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January 22, 2018 File No. 115157

Triton Engineering Services Limited
105 Queen Street West Unit 14
Fergus, ON N1M 1S6

Attn: **Christine Furlong, P.Eng.**
Project Manager

Ref: **Town of Erin, Urban Centre Wastewater Class EA**
Phase 1 & 2 Report

Dear Ms. Furlong:

We are pleased to present the "Phase 1 & 2 Report" for the Urban Centre Wastewater Servicing Schedule 'C' Municipal Class Environmental Assessment (UCWS EA).

This Report provides a general overview of the Environmental Assessment Process, and a summary of the Phase 1 and Phase 2 Environmental Assessment process for the wastewater servicing of the urban centres of Erin Village and Hillsburgh. The report summarizes the planning process spanning from the previously completed Servicing and Settlement Master Plan (SSMP) through to the conclusion of Phase 1 and Phase 2 of the UCWS EA.

Yours truly,

AINLEY & ASSOCIATES LIMITED

DRAFT

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Joe Mullan, P.Eng.
Project Manager

Town of Erin
Urban Centre Wastewater Servicing
Class Environmental Assessment

Phase 1 & 2 Report

Draft

January 2018

Urban Centre Wastewater Servicing Class Environmental Assessment

Phase 1 & 2 Report

Project No. 115157

Prepared for:
The Town of Erin

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1.0 Introduction

This Municipal Class Environmental Assessment (Class EA) is being undertaken to confirm the recommended general alternative solution for Wastewater Collection, Treatment and Disposal for Erin Village and Hillsburgh and then to identify and evaluate design alternatives and recommend a preferred alternative solution. The Class EA process will be documented in an Environmental Assessment Report. This Phase 1 and 2 Report presents an overview of the Study, provides an opportunity statement and confirms the recommended general solution. The report documents Phase 1 and 2 activities conducted to fulfill the requirements for a Schedule “C” Municipal Class Environmental Assessment, and include a discussion of both the methodology used and the technical analysis conducted. The public consultation process carried out as a part of the study has also been documented herein. Feedback arising from public consultation was integrated into the study findings; the specific feedback received on the study and the influence imparted on the course of the study is summarised in this report.

The Phase 1 & 2 report will form a part of the Environmental Study Report (ESR).

1.1 Purpose and Study Background

In 2014, the Town of Erin completed a Servicing and Settlement Master Plan (SSMP) to address servicing, planning and environmental issues within the Town. The study area for the SSMP included the Village of Erin and Hillsburgh as well as a portion of the surrounding rural lands. The SSMP considered servicing and planning alternatives for wastewater and identified a preferred wastewater servicing strategy for existing and future development in the study area. The SSMP was conducted in accordance with the requirements of the Municipal Class Environmental Assessment (Class EA), which is an approved process under Ontario’s Environmental Assessment Act and addressed Phase 1 & components of Phase 2 of the Class EA planning process.

The Urban Centre Wastewater Servicing Class Environmental Assessment (UCWS EA) is a continuation of the study, closing out Phase 2 of the study and initiating Phases 3 & 4 of the planning process to determine the preferred design alternative for wastewater collection, treatment and disposal. The study was initially envisaged as the planning process to accommodate wastewater servicing for the existing community and future growth up to a population of approximately 6,000. Through the updated analysis within the UCWS EA it has been determined that there is potential to grow the community to a residential population of approximately 14,600 people. The UCWS EA has therefore proceeded with planning for the community on this basis. The aforementioned SSMP concluded that the preferred solution for both communities is a municipal wastewater collection system conveying sewage to a single wastewater treatment plant located south east of the Village of Erin with treated effluent being discharged to the West Credit River. Within the UCWS EA, and as documented in this Phase 1 and 2 report, this recommendation has been confirmed.

This Class EA process follows the planning and design process for Schedule ‘C’ projects as described in the Municipal Class Environmental Assessment Document (October 2000 as amended in 2007, 2011 & 2015), published by the Municipal Engineer’s Association.

1.2 Study Objectives

The Class EA study outlines a problem or opportunity and identifies and evaluates potential solutions through examination of the benefits and drawbacks of each solution. The approach taken within the UCWS EA is described as follows:

1.1.1. Identify Alternative General Solutions (Phase 1 and 2)

Refinement of the problem through defining the extent of the service area including existing communities and future development areas, was undertaken. The development of a feasible set of alternatives is critical to ensuring a thorough evaluation prior to recommendation of a preferred solution. A comprehensive review of wastewater servicing alternatives was described in the SSMP, and has been refined as a part of this study. Confirmation of treated wastewater effluent conditions was undertaken to define a disposal solution for the wastewater. In addition, supplementary information pertaining to each alternative was identified, reviewed and documented within the findings of the study. A Public Information Centre and meetings with selected agencies were conducted to obtain essential stakeholder input.

1.1.2. Identify and Evaluate Alternative Designs (Phase 3 and 4)

Alternative design solutions will be developed for each component of the recommended general alternative solution during this stage of the study. Each of the alternative design solutions identified has associated technical, environmental, social, economic and cultural impacts. Within the evaluation, the impacts associated with each individual alternative will be identified and documented. Technical feasibility and potential constructability issues will be reviewed in the study through literature review and examination of their application in the context of the study area. A Public Information Centre and meetings with selected agencies will be conducted to obtain essential stakeholder input. The impacts associated with each alternative design concept will be assessed and evaluated to determine which solution has the least overall impact. After conducting a thorough evaluation of each alternative design, one preferred design solution will be presented to the public and ultimately recommended to the Town for implementation.

1.3 Related Documents and Projects

Several related studies were completed prior to the commencement of this Class EA Study. Each document was reviewed for pertinent information related to this project. They are described in brief in the following subsections.

1.3.1. Terms of Reference

The study is being conducted in accordance with the Terms of Reference as outlined in the Request for Proposal issued by the Town of Erin on December 25, 2015.

1.3.2. Town of Erin Official Plan

The Official Plan of the Town of Erin contains information pertaining to the Town's land use designations and policies for the physical development and redevelopment of the Town.

1.3.3. Zoning Bylaw

The Town of Erin's Zoning Bylaw (No. 07-67) provides detailed information to control the development of properties within the Town. The bylaw regulates many aspects of development, including the permitted uses of property, the location, size, and height of buildings, as well as parking and open space requirements.

1.3.4. Servicing and Settlement Master Plan (SSMP)

SSMP was developed by B.M.Ross and Associates Limited (2014) with the goal to develop appropriate strategies for community planning and municipal servicing, consistent with current provincial, county and municipal planning policies. The SSMP process followed the Master Plan approach, as defined in the Municipal Class Environmental Assessment (Class EA) document, dated October 2000 (as amended in 2007 and 2011). SSMP addresses the first two phases of the Class EA planning and design process, following Approach 1 of the Master Plan process.

1.3.5. Municipal Class EA Document

The Environmental Assessment Act codifies a planning process that requires the evaluation of potential environmental effects and benefits of a project before decisions are made about implementing the project. It applies to activities or projects of public agencies, and major commercial or business undertakings of non-public entities, if designated by regulation.

The Municipal Class EA document outlines the approach to planning water and wastewater servicing that the Town must follow, in order to comply with the Environmental Assessment Act, including the types of impacts that must be assessed and the need to consult with stakeholders and incorporate stakeholder input into the planning process.

1.4 Study Area

The Town of Erin is a predominately rural municipality, located in southeastern Wellington County. The Town is bordered to the east by the Town of Caledon, the Town of Halton Hills to the south, Guelph and Guelph/Eramosa Township to the west, and the Township of East Garafraxa to the north. Located within the Town boundaries are the headwaters for the West Credit River. Generally, the Town of Erin is characterized by undulating topography, numerous wetlands and woodland areas.

The study area for the UCWS Class EA was set out in the TOR. It includes the Village of Erin and Hillsburgh, as well as a portion of the surrounding rural area. Figure 1 overleaf shows the study area.

2.0 Environmental Assessment Process

This section describes the Environmental Assessment process and the specific requirements associated with this study.

2.1. Environmental Assessment Act

Ontario's Environmental Assessment Act (henceforth referred to as "the Act") was passed in 1975 and proclaimed in 1976. The Act requires proponents to examine and document the environmental effects that might result from major projects or activities. Municipal undertakings became subject to the Act in 1981.

The Act defines the environment broadly as:

- Air, land or water
- Plant and animal life, including man
- The social, economic and cultural conditions that influence the life of man or a community

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Figure 1 – Study Area

- Any building, structure, machine or other device or thing made by man
- Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirect from activities of man
- Any part or combination of the foregoing and the interrelationships between any two or more of them.

The purpose of the Act is the betterment of the people in the whole or any part of Ontario by providing for the protection, conservation and wise management of the environment in the Province (RSO1990, c. 18, s.2).

As set out in Section 5(3) of the Act, an EA document must include the following:

- A description of the purpose of the undertaking including:
  - The undertaking
  - The alternative methods of carrying out the undertaking
  - Alternatives to the undertaking
- A description of:
  - The environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking or alternatives to the undertaking
  - The effects that will be caused or that might reasonably be expected to be caused to the environment by the undertaking or alternatives to the undertaking
  - The actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking or alternatives to the undertaking
- An evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking

2.2. Principles of Environmental Planning

The Act sets a framework for a systematic, rational and replicable environmental planning process that is based on five key principles, as follows:

- **Consultation with affected parties -** Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.
- **Consideration of a reasonable range of alternatives -** Alternatives include functionally different solutions to the proposed undertaking and alternative methods of implementing the preferred solution. The “do nothing” alternative must also be considered.
- **Identification and consideration of the effects of each alternative on all aspects of the environment -** This includes the natural, social, cultural, technical, and economic environments.
- **Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects -** The evaluation shall increase in the level of detail as the study moves from the evaluation of alternatives to the proposed undertaking to the evaluation of alternative methods.

- **Provision of clean and complete documentation of the planning process followed -** This will allow traceability of decision-making with respect to the project. The planning process must be documented in such a way that it may be repeated with similar results.

2.3. Municipal Class Environmental Assessment

Class Environmental Assessments (EAs) were approved by the Minister of the Environment in 1987 for municipal projects having predictable and preventable impacts. The Class EA approach streamlines the planning and approvals process for municipal projects which have the following characteristics:

- Recurring
- Similar in nature
- Usually limited in scale
- Predictable range of environmental impacts
- Environmental impacts are responsive to mitigation

The Municipal Class Environmental Assessment document, prepared by the Municipal Engineers Association (MEA) (October 2000, as amended in 2007, and 2015), outlines the procedures to be followed to satisfy Class EA requirements for water, wastewater and road projects. The process includes five phases:

- Phase 1: Problem Definition
- Phase 2: Identification and Evaluation of Alternative Solutions to Determine a Preferred Solution
- Phase 3: Examination of Alternative Methods of Implementation of the Preferred Solution
- Phase 4: Documentation of the Planning, Design and Consultation Process
- Phase 5: Implementation and Monitoring.

Public and agency consultation are integral to the Class EA planning process. Projects subject to the Class EA process are classified into four possible “Schedules” depending on the degree of expected impacts. It is important to note that the Schedule assigned to a particular project is proponent-driven. For example, if a project has been designated as Schedule “A”, the proponent can decide to comply with the requirements of a Schedule “B” or “C” of the MEA process based on the magnitude of anticipated impacts or the special public and agency consultation requirements specific to that particular project.

For Schedule “B” and “C” projects the public has the opportunity to request additional investigation by filing a Part II Order Request to the Ministry of the Environment.

The Class EA process flowchart is provided in Figure 2.

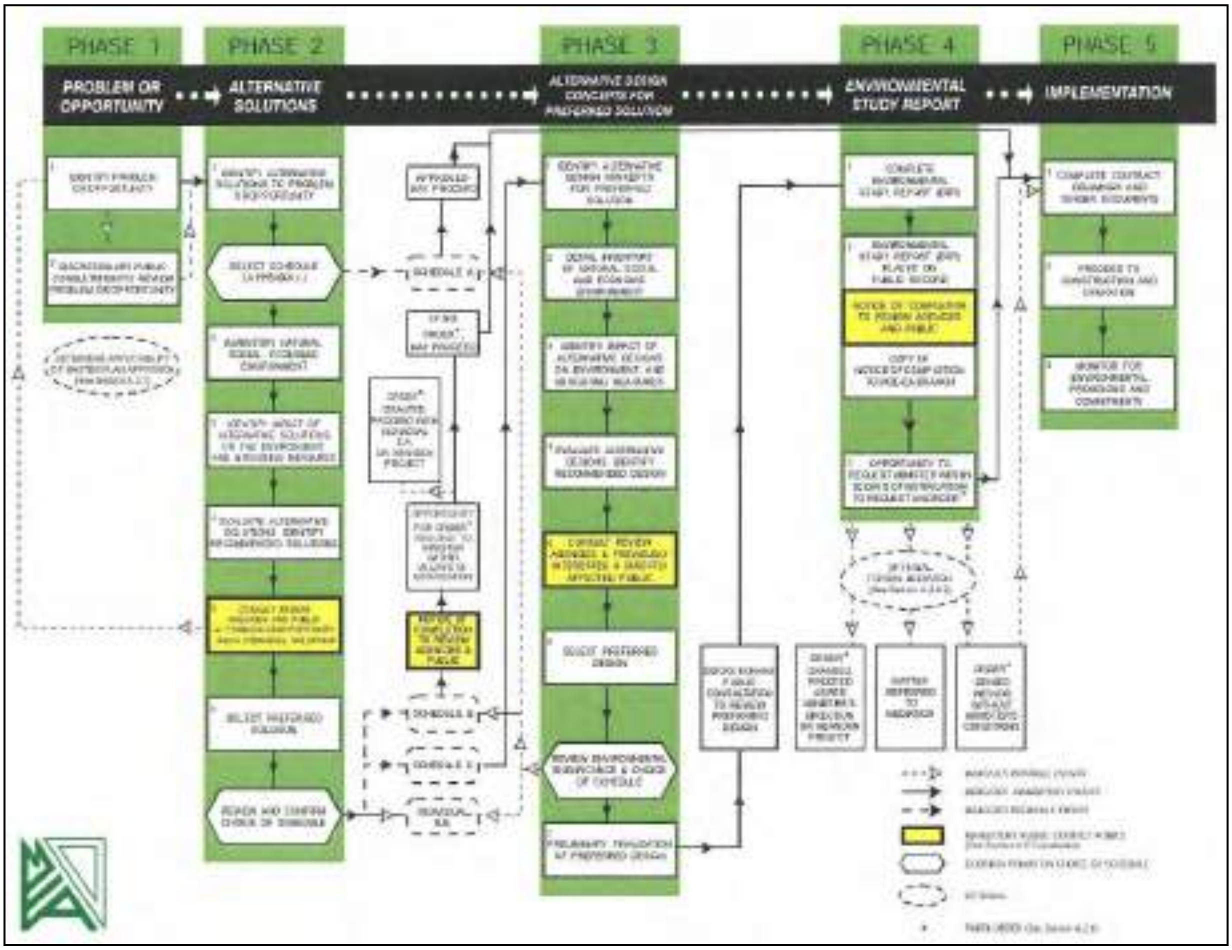


Figure 2 – Municipal Class EA Process

Schedule "A" Projects

Schedule "A" projects are minor, operation and maintenance activities and are pre-approved without the need for further assessment. Projects with this designation are typically limited in scale and have minimal adverse environmental impacts. An example of a Schedule "A" wastewater project is the establishment of a sewage collection system and all necessary works to connect the system to an existing sewage outlet, where it is required as a condition of approval on a site plan, consent plan of subdivision or plan of condominium approved under the Planning Act prior to construction. This type of project is pre-approved and the proponent may proceed without following the procedures set out in any other part of the Class EA process.

Schedule "A+" Projects

Schedule "A+" projects were introduced by MEA in 2007. Similar to Schedule "A", these projects are also pre-approved. However, the difference is that for Schedule "A+" projects, the public must be advised prior to project implementation. An example of a Schedule "A+" wastewater project would be the establishment, extension or enlargement of a sewage collection system and all necessary works to connect the system to an existing sewage or natural drainage outlet, provided all such facilities are in either an existing road allowance or an existing utility corridor, including the use of Trenchless Technology for water crossings.

Schedule "B" Projects

Schedule "B" projects generally include improvements and minor expansions to existing facilities where there is potential for some adverse environmental impacts. These projects require screening of alternatives for their environmental impacts and completion of Phases 1 and 2 of the Class EA planning process. If outstanding issues remain after the public review period, any party may request that the Minister of the Environment consider a Part II Order (also known as bumping-up the project) to elevate the project to a more stringent process (Schedule "C" or an Individual Environmental Assessment). Provided no significant impacts are identified and no requests for a Part II order are received, Schedule "B" projects are approved and may proceed directly to Phase 5: Implementation. An example of a Schedule "B" wastewater project would be the establishment, extension or enlargement of a sewage collection system and all works necessary to connect the system to an existing sewage outlet where such facilities are not in an existing road allowance or an existing utility corridor.

Schedule "C" Projects

Schedule "C" projects generally include the construction of new facilities and major expansions to existing facilities. These projects are typically more complex and have the potential for significant environmental effects. As a result, they proceed under full planning and documentation procedures and satisfy all five phases of the Class EA planning process. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 is the preparation of an Environmental Study Report which is filed for public review. Provided no significant impacts are identified and no requests for Part II Order or "bump-up" to an Individual Environmental Assessment are received, Schedule "C" projects are then approved and may proceed to Phase 5: Implementation. An example of a Schedule "C" wastewater project would be construction of a new sewage system, including the construction of treatment and an outfall to a receiving water body and/or a constructed wetland for treatment.

3.0 Existing Conditions

In the Town of Erin, wastewater is managed exclusively by private, on-site wastewater systems. Types of systems within the town include Class 4, Class 5 and Class 6 sewage systems. Class 4 sewage systems are the most common in the town and are typically composed of a two-compartment septic tank and a leaching bed. The septic tank collects the raw sewage and helps in settling and digestion. Class 5 systems use a holding tank for the retention of hauled sewage at the site where it is produced prior to its collection by a hauled sewage system. A number of Class 5 systems are located in the downtown area of Erin Village due to a lack of adequate space for a leaching bed. Class 6 systems are tertiary septic systems which include a filter to provide a higher level of treatment before the effluent reaches the leaching bed. The Class 6 systems are distributed throughout the Town where older Class 4 systems have failed. Within the Built Boundary of the settlement areas (Hillsburgh and Erin Village), private property investment and redevelopment is restrained by setbacks required for septic systems, small lot sizes, and the presence of private wells. Several areas have septic systems within the wellhead protection areas of municipal wells. Additionally, there are limited facilities in the area accepting septage from private systems for treatment.

The settlement areas (Erin Village and Hillsburgh) have been identified as areas of modest growth under the Places to Grow Act and by Wellington County population projections partly as a result of the wastewater servicing restrictions identified in the SSMP. While there is over 200 Ha of lands identified in the Town Official Plan for future development, these lands cannot be serviced with a municipal wastewater system within the 6,000 population limit identified in the SSMP wherein the existing population of over 4,500 would also be serviced. Credit Valley Conservation (CVC) has also indicated that future development should not occur on lots sized to include septic systems.

4.0 Servicing and Settlement Master Plan

4.1. Problem / Opportunities

The Town of Erin Official Plan highlights a community based process for completing a Servicing and Settlement Master Plant (SSMP) to address servicing, planning and environmental issues within the Town. B.M Ross was retained to develop the initial SSMP report. The first phase of this SSMP report, the Data Collection and Review Phase highlighted the information regarding community design, form and function, community planning, the environment and existing infrastructure. The information gathered was used to derive and identify the Problem/ Opportunity Statement for the SSMP. It was found from this information that the Town of Erin lacks a long term, comprehensive strategy for the provision of water and wastewater servicing in the Village of Erin and Hillsburgh. It was found that wastewater is treated by private on site wastewater treatment systems and there are limited facilities in the area accepting septage from private systems for treatment. The Village of Erin and Hillsburgh have been identified as areas of modest growth however the existing infrastructure is inadequate to meet future demands. There is limited stormwater management infrastructure as well as limited water servicing, which gives rise to the need to assess existing conditions and address the need for future development.

4.2. Community Planning Alternatives and Evaluation

The SSMP report defined information regarding community planning, form and function which led to the development of planning alternatives for the future of the Town. The four planning scenarios were:

Scenario 1: Planning based on municipal services for existing residents and future development in both Hillsburgh and Erin Village

Scenario 2: Planning based on providing municipal services for the existing residents and future developments in Erin Village only

Scenario 3: Planning based on providing municipal services for the existing residents and future developments in Hillsburgh only

Scenario 4: Planning based on no municipal wastewater services in the Town.

Each of the four identified scenarios were evaluated based on their social, economic and natural impacts as well as on the availability of municipal services

4.3. Assimilative Capacity Study

An Assimilative Capacity Study was completed by B.M Ross in 2014 to determine if the West Credit River had the capacity to accept treated wastewater effluent for various population scenarios. The investigation considered projected effluent discharge from 3,087 to 6,000 people. The analysis focused on the assimilative capacity of the river at the intersection with 10th Line. This location was the focus of the study since the CVC had a flow gauge at the site and a history of flow data had already been established. In addition, it was known that the river had a higher flow rate and background water quality in this location than potential alternative locations upstream of Erin Village or Hillsburgh. The flow history gathered by the CVC was used to develop the 7Q20 flow required for the assimilative capacity analysis.

The ACS concluded that surface water discharge would be viable for a service population up to 6,000 people, while not impacting aquatic life. The major limiting factor in the discharge potential was found to be the resulting phosphorus concentration. The West Credit River is a Policy 1 receiver, meaning that the water quality in the river exceeds the Provincial Water Quality Objectives. The Provincial guidelines state that: “In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objective”. With respect to phosphorus, this requirement dictates that the concentration must be kept at or below 0.03 mg/L. It was assumed within this analysis that the treated effluent from the proposed treatment facility would be 0.15 mg/L with a capacity of 2,610 m^3/d.

4.4. Sewage Collection and Wastewater Treatment and Disposal

As indicated in the Servicing and Settlement Master Plan Final Report (B.M Ross 2014), there are no municipally owned communal sewage systems servicing communities in the Town of Erin, however the Town is typically serviced by Class 4 and Class 6 individual private septic systems. There have been numerous studies investigating and identifying issues with this form of servicing. Studies have been conducted by Wellington-Dufferin-Guelph Health Unit in 1995, by the Ministry of Environment in 2005 and an existing Conditions Repot in 2011 by B.M Ross. These studies concluded that septic systems are contributing to nutrient loading in the groundwater and subsequently in the West Credit River. Other issues and constraints include lot sizing, age of systems and the inability to replace systems on the small lots.

It is noted that not all wastewater treatment plants located in the vicinity of Erin accept septage. Septage has several distinctive characteristics that can result in complications in the biological processes of a wastewater treatment plant if it is not designed to receive septage. Currently, septage is hauled to Collingwood or Hamilton which increases the cost of disposal. Given the servicing potential identified under the ACS of 6,000 people, and the large amounts of vacant developable land in both Hillsburgh and Erin Village, it is unlikely that growth will extend outside the existing urban boundary. Conceptual level planning was conducted to establish the feasibility of providing wastewater collection and treatment for the urban areas.

4.5. Sewage Collection System

The SSMP prepared by B.M Ross presented conceptual level planning related to sewage servicing for the Town of Erin. The intent was to establish a better understanding of the possible constraints and costs associated with sewage servicing. The concept presented was created on the basis that sewage would be conveyed from both Erin Village and Hillsburgh to a common wastewater treatment plant. A number of different conveyance systems were considered, with each systems advantages and disadvantages evaluated. For the purpose of a conceptual level design, a gravity sewer system with the series of pumping stations was utilized.

A conceptual gravity sewer plan was completed to confirm details on pipe layout, possible sewer routes, servicing boundaries and pumping station locations. It is noted that the majority of the communities would be serviced by gravity conveyance with the main sewage pumping station situated in the lower end of the Erin Village. The report selects the Elora Cataract Trail as the optimal route for the connection of Hillsburgh to Erin Village.

4.6. Conceptual Wastewater Treatment and Disposal

The SSMP provides a brief overview of available technologies at each level of treatment and proposes a series of potential treatment options for consideration under future planning processes. A preliminary investigation was conducted to confirm that a sewage treatment technology exists that is capable of producing the effluent quality suggested in the ACS. A conceptual WWTP using membrane filtration was developed in order to establish a better understanding of the costs associated with the provision of sewage servicing to the Town of Erin. The report concludes that a wastewater treatment facility, utilizing membrane filtration, would produce effluent of sufficient quality to maintain the health of the receiving stream. The conceptual membrane facility was determined to be an economically feasible alternative for the Town. In addition, it was established that the treatment facility should also incorporate septage unloading facilities and specialized treatment equipment as required to manage the additional loadings received from septic system pump-outs throughout the Town. It was noted that a review of alternative collection systems and sewage treatment technologies will be completed during Phase 3 of the Municipal Class EA.

4.7. Conceptual WWTP Location

Given the improved water quality and increased flow rate in the West Credit River, it was determined that the location of a future waste water treatment facility is better suited somewhere along the County Road 52 corridor between County Road 124 and Winston Churchill Boulevard.

The exact location of the proposed treatment facility will be established during Phase 3 of the Municipal Class EA.

5.0 Participation by Public, Review Agencies and Others

Public and agency consultation is mandatory during a master planning process under the requirements of the Class EA process. For this project, public and agency participation was integral to the development and evaluation of the servicing alternatives at different points in the planning process.

In order to establish a direct line of communication between the public and the project team, a project email address was established (erin.urban.classea@ainleygroup.com). The project email served as an avenue for interested parties to contact the project team with any questions or comments outside of the formal Public Information Centres (PIC).

The public, review agencies, and Aboriginal communities were contacted with two (2) different notices through Phase 1 and Phase 2 of the Class EA process. Notices were distributed directly to key contacts and through two local papers: The Wellington Advisor and Erin Advocate. Throughout the study, interested parties were encouraged to contact the project team through the project email for inclusion in a Notice List. All notices were sent directly to each person who requested inclusion in the Notice List.

The first notice, a Notice of Commencement, was sent out on April 13, 2016 to notify the public that the study was underway and to provide information on the study process. On April 14, 2016, a Terms of Reference was issued to establish an advisory committee comprised of interested public stakeholders. The advisory committee, henceforth referred to as the Public Liaison Committee (PLC), served as a sounding board for the project findings before they were released at the PIC and helped the project team determine the optimal formation of presentation materials for public release. In addition, the PLC provided key insight into potential gaps in the study analysis, resulting in the understanding that a more thorough analysis of the potential for a multi-treatment plant solution and the potential for subsurface discharge of treated effluent was required. The gaps identified were rectified through two additional technical memoranda: the Two Plant Alternative Technical Memorandum, and the Subsurface Disposal Alternative Technical Memorandum. These memoranda reaffirmed the general alternative selected through the SSMP that wastewater should be treated at a single site and discharge to the surface water.

During Phase 1 and Phase 2 of the UCWS EA, three PLC meetings were held. The PLC meetings were held on June 7th, 2016, November 24th, 2016, and June 7th, 2017. Minutes were taken at each PLC meeting and are included in ***Appendix A***. The purpose of the first PLC meeting was to introduce the Project and the team involved as well as to outline the functionality of the PLC and expectations of the participants. The second PLC meeting was called in order to review and discuss the findings from the technical studies that were completed to date, wherein the previously discussed gaps in the study were identified. The third PLC meeting was called to present and discuss the Subsurface Disposal Alternative Memorandum as well as the Two Treatment Plant Alternative Technical Memorandum and to invite comments on the format for the first PIC.

The second public notice was issued on June 8, 2017, directly following the third PLC meeting, informing the public about the first PIC. The Phase 1/Phase 2 PIC took place on June 22, 2017 from 6-9pm at the Erin Community Centre (Centre 2000). At the PIC an informal question and answer period was provided wherein a series of display boards were made available covering the project findings and the project team was available to answer any questions and take public comments. A formal presentation of the project findings was provided subsequently with an open-mic style question and answer period facilitated by Hardy Stevenson.

The comments and input received from the public were taken into consideration during the planning processes following the Phase 1 PIC. A Public Consultation Report was generated from the PIC discussion and is included in ***Appendix A.***

Throughout the study, the Credit Valley Conservation Authority and the MOECC were regularly consulted. All study findings presented to the PLC were first presented to representatives from the CVC and MOECC to ensure the study approach was consistent with the requirements of these agencies. Prior to the finalisation of all project reports, review was requested from the full set of project stakeholders listed in Table 1.

5.1 Core Management Team (CMT)

During the study a Core Management Team was formed of the following members:

- Mayor Allan Alls - Town of Erin
- Derek McCaughan (interim CAO) - Town of Erin
- Nathan Hyde (CAO) – Town of Erin
- Christine Furlong - Triton Engineering
- Gary Cousins - Wellington County
- Jen Dougherty - Credit Valley Conservation Authority
- Craig Fowler - MOECC
- Barbara Slattery - MOECC
- Dave Hardy - Hardy Stevenson
- Noah Brotman - Hardy Stevenson
- Joe Mullan - Ainley Group
- Gary Scott - Ainley Group
- Simon Glass - Ainley Group
- Ray Blackport - Blackport Hydrogeology
- Deborah Sinclair - Hutchinson Environmental
- Tara Roumeliotis - Hutchinson Environmental
- Neil Hutchinson - Hutchinson Environmental

During Phase 1/Phase 2 of the project the Core Management Team met to discuss the planning process on 5 occasions.

5.2 Public Liaison Committee (PLC)

During the study a Public Liaison Committee was formed of the following members:

- Mayor Allan Alls - Town of Erin
- Dave Doan – SeptTech Wastewater Group
- Jamie Cheyne - Heritage Committee and Economic Development, Erin Agricultural Society
- Derek McCaughan - Interim Chief Administrative Officer
- Nathan Hyde - Chief Administrative Officer
- Dianna Mckay - General public
- Jay Mowat - Environment Committee
- Justin Morrow - Copper Hills Development
- Linda Rosier - General public
- Lloyd Turbitt - Let's Get Hillsburgh Growing Committee
- Maurizio Rogato – Solmar Homes
- Melodie Rose - Riverwalk Trails Committee
- Nancy Shoemaker - Black, Shoemaker, Robinson and Donaldson Limited
- Roy Val - General public
- Valerie Bozanis - General public

Table 1 – List of Public Contacts and Review Agencies

Public & Review Agencies		
Provincial & Federal Agencies		
▪ Environment Canada - Environmental Protection Operations Division - Ontario Region	▪ Ministry of Economic Development, Employment and Infrastructure	▪ Ministries of Tourism - Culture & Sport
▪ Ministry of the Environment and Climate Change	▪ Ministry of Municipal Affairs and Housing	▪ Ministry of Natural Resources and Forestry
▪ Canadian Environmental Assessment Agency	▪ Ontario Clean Water Agency	▪ Ontario Ministry of Agriculture - Food and Rural Affairs
▪ Fisheries & Oceans Canada	▪ Ministry of Transportation - Corridor Management Section, West Region	
Local Government & Other Agencies		
▪ Wellington County Planning	▪ Town of Caledon	▪ SOLMAR Development Group
▪ Centre Wellington	▪ R.J. Burnside and Associates	▪ Milton
▪ Region of Peel	▪ Carson Reid Homes	▪ Dufferin County
▪ Wellington (East) Chamber of Commerce	▪ Region of Halton	▪ East Garafraxa
▪ Credit Valley Conservation Authority	▪ Fire Department Erin	▪ Guelph/ Eramosa
▪ Grand River Conservation Authority	▪ Upper Grand District Schoolboard	▪ Erin Village Business Improvement Association
Aboriginal Consultation		
▪ Ministry of Aboriginal Affairs	▪ Haudenosaunee Confederacy	▪ Six Nations of the Grand River Territory
▪ Aboriginal Affairs & Northern Development Canada Consultation Unit	▪ Mississauga of the New Credit First Nation	
Utilities		
▪ Rogers Communications Inc.	▪ Caneris	▪ Hydro One
▪ Bell Communications	▪ Internet Access Solutions	▪ Enbridge Gas
▪ Vianet (Zing) Networks Inc. Internet Services	▪ Primus	

6.0 Refinement of the Servicing and Settlement Master Plan

The SSMP undertook part of Phase 1 and part of Phase 2 of the Class Environmental Assessment process and the Town is now engaged in completing these two phases and moving on to complete Phase 3 and Phase 4 of the Class EA process. The study terms of reference require confirmation and refinement of the preferred solution (communal wastewater collection system) presented in the Servicing and Settlement Plan by B.M Ross and further investigation to review and select a preferred general solution.

6.1 Septic System Overview

The majority of properties within the Village of Erin and Hillsburgh are currently serviced by individual private septic systems. The Servicing and Settlement Master Plan (SSMP), completed by B.M. Ross in 2014, selected a communal wastewater collection system for both communities as the preferred alternative solution to deal with issues related to the private systems. A more detailed septic system survey was undertaken as part of the UCWS EA.

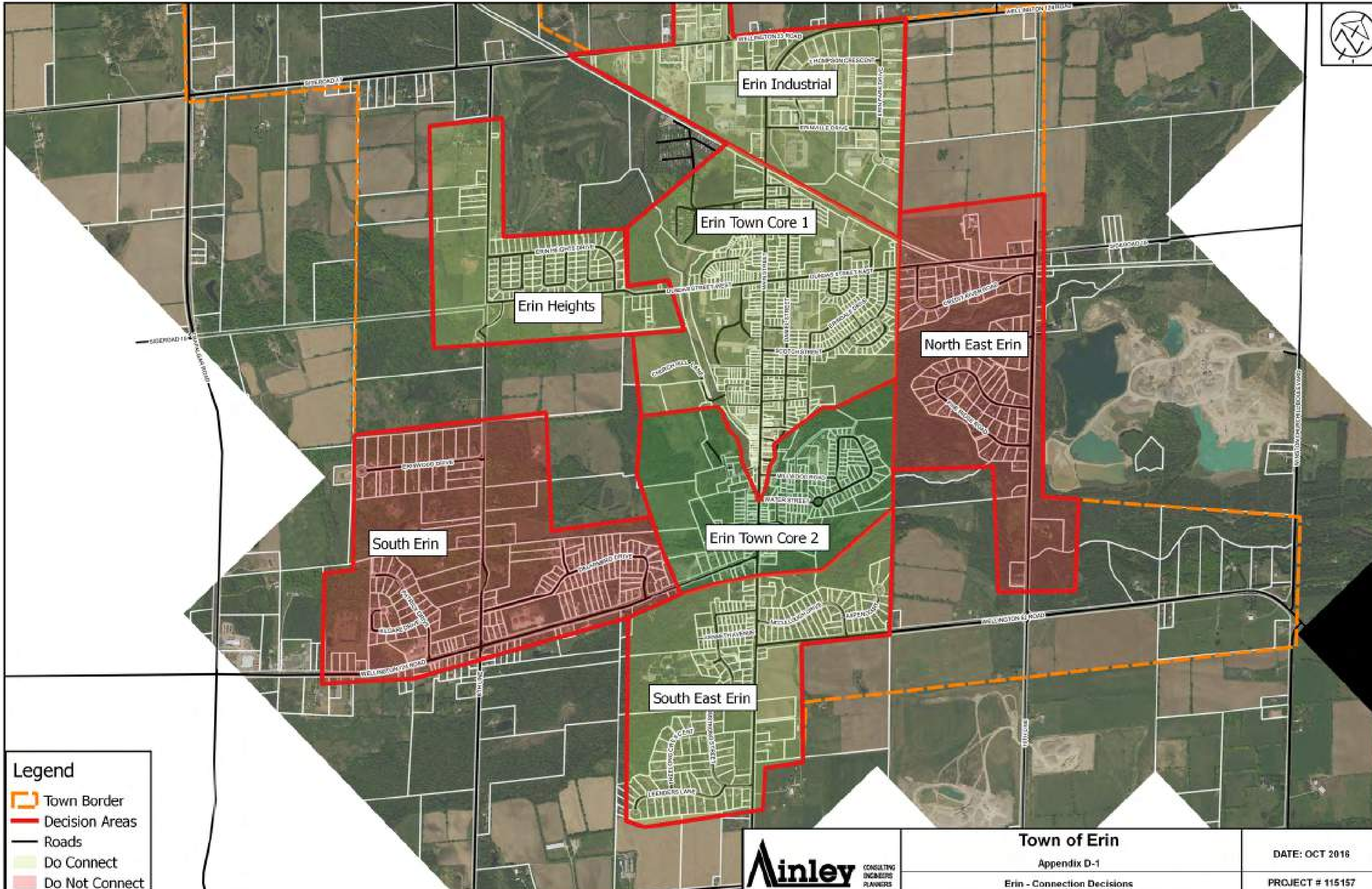
The Septic System survey provides an overview of the septic system information collected from the available existing sources and defines the recommended communal sewage servicing areas. The objective of this study was to conduct data analysis of the available septic tank data and present recommendations for servicing existing properties in the study area. The documents reviewed include:

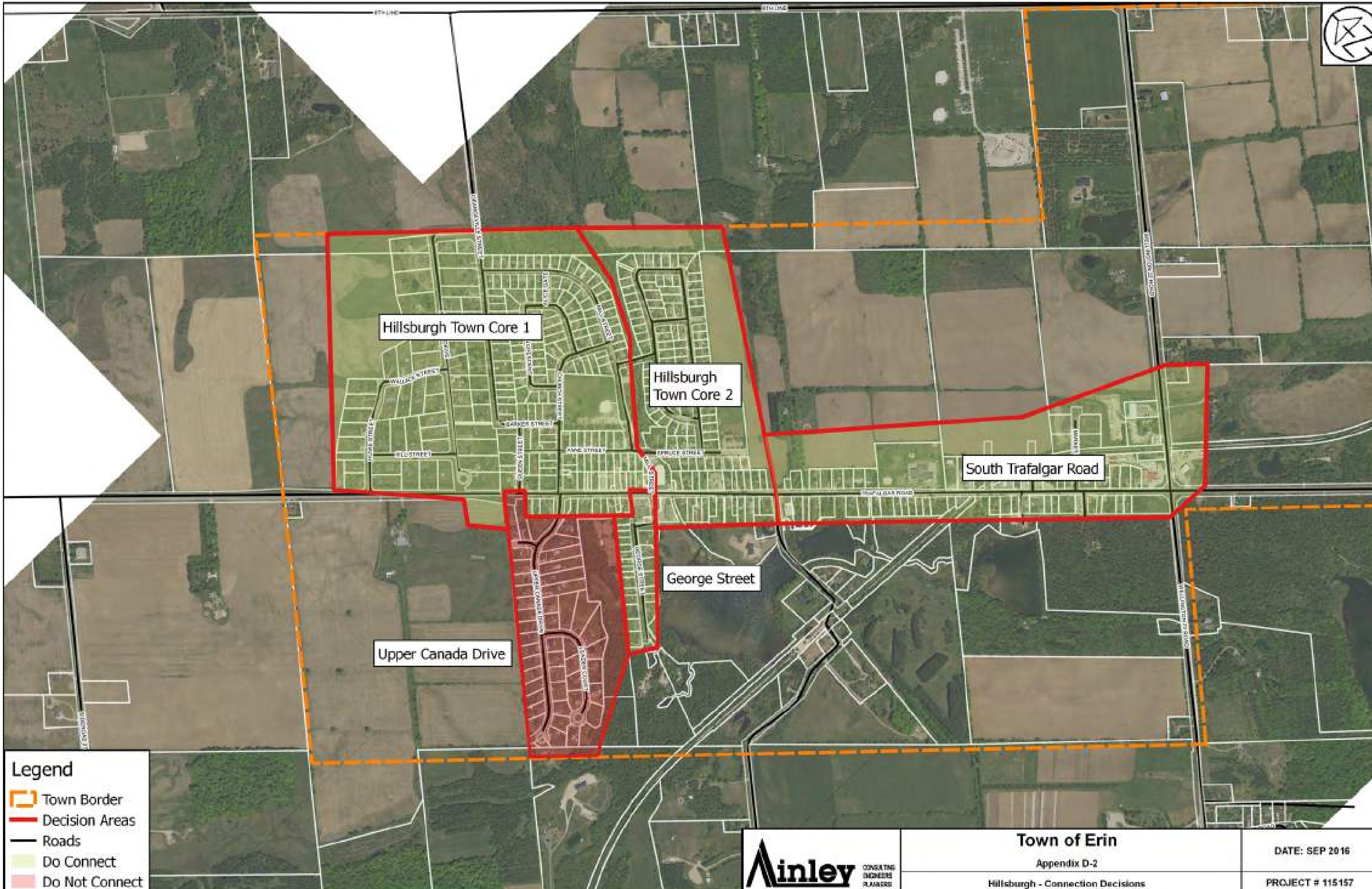
- Servicing and Settlement Master Plan
- Town of Erin Mandatory Septic Re-inspection Program
- Building Department Records
- GIS data
- Ontario Building Code
- Ministry of Environment and Climate Change guidelines
- Wellhead Protection Report

MOECC requires that wastewater collection systems be designed to service all lots within a specific service area consistent with the planning designation for the area. If an area is to be designated for servicing by a communal wastewater system, then the system must be designed to meet the capacity of all of the properties within this area. It is also noted that where a communal wastewater system is to be designed to service an area, Municipalities require all properties to be connected and to contribute their share of the capital and operating costs. Therefore, it is necessary to designate specific areas to be serviced by private wastewater systems or by a communal wastewater system. For the purposes of this study, Erin Village and Hillsburgh, were split into logical serviceable sections, defined as “decision areas”. Decision areas were derived from a combination of factors including location, local topography, drainage areas, proximity to sensitive receivers, and development consistency (lot sizes etc).

The documentation reviewed was further analyzed to define factors that determine whether a decision area to connect to a communal sewage system. These factors include lot size, septic tank size, septic system age, proximity to surface water, and proximity to well head protection areas. Based on the analysis of these factors, it was found that all decision areas in Erin except for Northeast Erin and part of South Erin should be connected to the proposed communal wastewater collection and treatment system. In Hillsburgh, all decision areas should be connected except for Upper Canada Drive. Figures 3 and 4 show the recommended service areas for Erin and Hillsburgh respectively.

A detailed technical memorandum on this overview can be found in ***Appendix B.***


Erin Industrial
Erin Town Core 1
Erin Heights
North East Erin
South Erin
Erin Town Core 2
South East Erin
Legend
Town Border
Decision Areas
Roads
Do Connect
Do Not Connect
Ainley
CONSULTING ENGINEERS PLANNERS
Town of Erin
Appendix D-1
Erin - Connection Decisions
DATE: OCT 2016
PROJECT # 115157


Hillsburgh Town Core 1
Hillsburgh Town Core 2
South Trafalgar Road
George Street
Upper Canada Drive
Legend
Town Border
Decision Areas
Roads
Do Connect
Do Not Connect
Ainley
CONSULTING ENGINEERS PLANNERS
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Hillsburgh - Connection Decisions
DATE: SEP 2016
PROJECT # 115157

6.2 System Capacity and Sewage Flows

A sewage capacity and sewage flows study was conducted to estimate wastewater flows from the urban areas of Erin Village and Hillsburgh. In order to establish wastewater flow projections a set of flow assumptions were developed on the basis of existing water use data, flow assumptions of similar communities, and MOECC Guidelines. For the existing community, the flow assumptions were applied to the known development existing in the communities at the time of this study with additional consideration for infill potential and some development intensification. For the future community, the study reviewed the development areas established within the Town's Official Plan and assumed the growth areas would be developed in accordance with the current planning. The same flow assumptions used for the existing community, outlined in Table 2, were applied to the development areas.

Table 2 – Flow assumptions for preliminary design

Residential Flow	290 L/c/d
Inflow and Infiltration	90 L/day/capita
School Flow	95 L/student/day
Industrial Flow	9 m^3/ha/d
Commercial Flow	28 m^3/ha/d

Based on a detailed assessment of the study area, it is estimate that the average day wastewater flow would be approximately 2,844 m^3/d based on a residential population of 4,616 persons. It is also determined that the new growth areas, as defined by the Town Official Plan, would contribute an estimated 4,328 m^3/d of wastewater flow, based on an additional residential population of 9,943 persons. The total estimated wastewater flow to fully develop the existing urban areas is 7,172 m^3/d. This represents a residential population of 14,559 persons. A summary of the flow projections is provided in Table 3.

Table 3 – Full Build Out ADF Flow Summary (m^3/d)

	All Development			Residential Development		
	Erin	Hillsburgh	Total	Erin	Hillsburgh	Total
Existing Community	2,244.1	599.4	2,843.5	1,225.5	528.6	1,754.1
Growth Areas	2,523.0	1,805.7	4,328.7	2,029.2	1,749.1	3,778.3
Total	4,767.1	2,405.1	7,172.2	3,254.7	2,277.7	5,532.4

A detailed technical memorandum on System Capacity and Sewage Flows can be found in ***Appendix C***.

6.3 Assimilative Capacity Study

A preliminary Assimilative Capacity Study (ACS) was completed by B.M. Ross in 2014 as part of the SSMP, to assess the feasibility of a wastewater treatment plant with surface water discharge to the West Credit River in the reach between 10th Line and Winston Churchill Blvd. The Assimilative Capacity Study, conducted by Hutchinson Environmental Sciences Ltd in 2017, provides an update to the Preliminary ACS. The Study includes:

Recent Water Quality Data Collected for the West Credit River at 10th Line

Monthly water quality sampled were collected and analyzed from the West credit River at 10th Line from May to September 2016. The water collected represented very good quality with low concentrations of suspended sediments and nutrient. The total phosphorus and un-ionized ammonia nitrogen concentrations were well below their PWQO values. Water quality data was collected from the West Credit River at Winston Churchill Blvd and compared to the data collected at 10th Line. It was found that the 75th percentile concentrations calculated for Winston Churchill Blvd were similar to the concentrations calculated for 10th Line.

An Updated 7Q20 Low Flow Statistic for the West Credit River at 10th Line

A flow gauging station was established at 10th Line in July 2013 by CVC. In an ideal situation, 10 years of data is recommended for the calculation of the 7Q20 statistic; at the conclusion of the initial ACS insufficient data was collected from this station to determine a reliable 7Q20 low flow statistic. The 7Q20 Low flow statistics for 10th Line was recalculated using updated water level and flow data from 8th and 10th Line between July 2013 and December 2015. The new 7Q20 flow statistic of 225L/s includes a 10% reduction to account for effects on climate change. The lowest flow was measured to be 305L/s during August. This was 80L/s greater than the calculated 7Q20 flow. The revised 7Q20 flow analysis report by the CVC is included in the ACS.

Mixing Zone Modelling (Using CORMIX) to Predict the Size and Shape of the Mixing Zone

The mixing zone modelling focused on ammonia as the potentially toxic component of the effluent. The first aspect of the assessment was the requirement that the undiluted effluent be non-acutely lethal at the point of discharge. This was simply determined based on the concentration of ammonia in the effluent which was found to be 2.1 mg/L. Therefore, a total ammonia effluent limit of 2.1 mg/L or less would meet the requirement. The second aspect of the assessment was the determination of the size and characteristics of the mixing zone for ammonia in the West Credit River. The size of the mixing zone is determined by modelling the physical mixing of the effluent with the river and then setting an ammonia limit for the effluent. The near-field mixing of the discharge from Erin WWTP into the West Credit River was modelled using CORMIX version 10.0. The results from the mixing zone model can be seen below:

Table 4 – Summary of CORMIX Mixing Zone Modelling Results

Parameter	Phase 1 Pipe Discharge	Phase 1 Multiport Diffuser	Full Buildout Multipoint Diffuser
Distance to meet PWQO (m downstream of outfall)	25m	100m	153m
Plume Width (10% of channel) below PWQO at distance in which plume encounters the opposite bank (representing the narrowest place for safe fish passage)	90%	40%	40%

Discharge Potential Based on Phosphorus Loading

The report confirms the discharge potential to the West Credit River on the basis of phosphorus concentration in the proposed WWTP effluent. The assimilation of phosphorus into the river was calculated on the basis of the estimated ADF of 7,172 m^3/d of treated effluent. It is assumed that Total Phosphorus (TP) is the limiting parameter for discharge of treated wastewater effluent to the West Credit River. The West Credit River has a TP concentration between 0.011-0.015 mg/L, which is well below the PWQO of 0.03 mg/L. Based on discussions with MOECC and CVC, and in order to protect cold water habitat and water quality, it is recommended to have a downstream TP concentration limit of 0.024 mg/L as well as adopt a ‘net zero’ increase in phosphorus loading between the pre-development and post development conditions for future development areas.

Based on the results from the Assimilative Capacity Study, it has been determined that the TP effluent limits from a Wastewater Treatment plant are 0.079 mg/L, to service existing communities and 0.046mg/L to service full build out of the Town Official Plan. The effluent limits for phosphorus are stringent but within the capacity of modern treatment technologies. ‘Best Available Technology’ will be considered in Phase 3 and 4 of this project that can meet the 0.046 mg/L effluent limit for phosphorus and maintain the 0.024 mg/L downstream concentration limit. Treatment technologies will be reviewed and recommended during Phase 3 of this Class EA.

Hydrodynamic, Far-Field Modelling (using QUAL2K) to Predict Downstream Concentrations of Oxygen, Temperature, Nitrate, and Ammonia

QUAL2K is a one dimensional river and stream water quality model used to assess the environmental impact of pollution discharges along rivers. The West Credit River was modelled from a point 100 m upstream of the 10th Line to a point approximately 40 m downstream of Winston Churchill Blvd, for a total river model length of 1.7 km and the model was used to predict the downstream concentrations of dissolved oxygen, pH temperature, CBOD, nitrate, and ammonia. Modelling was limited to the summer since water temperatures are high which results in increased speciation of ammonia to its unionized form. The summer low flow Phase 1 and Full Build Out scenarios resulted in un-ionized ammonia concentrations below the PWQO at all locations in the West Credit River.

It was found that the un-ionized ammonia concentrations declined with distance from the outfall and reached concentrations between 9.3 and 9.9 µg/L downstream of Winston Churchill Blvd., which is 1.5 km from the point of discharge. These concentrations are well below the PWQO.

The maximum nitrate concentration beyond the point of complete mixing was predicted to remain below the CWQG of 3 mg/L throughout the study area. Based on all of the ACS results, effluent limits were developed as shown in Table 5.

Table 5 – Effluent Limits for Proposed Erin WWTP

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 6.5-8.5	Within range of 6.5-8.5
Total Suspended Solids	5mg/L	5mg/L
Total Phosphorus	0.07mg/L	0.045 mg/L
Total Ammonia Nitrogen	1.2mg/L summer 2 mg/L winter	0.6mg/L summer 2 mg/L winter
Nitrate Nitrogen	5 mg/L	5 mg/L
E.coli	100cfu/100mL	100cfu/100mL
Dissolved Oxygen	4mg/L	4mg/L
5-day Carbonaceous Biochemical Oxygen Demand (CBOD5)	5 mg/L	5 mg/L

The ACS shows that a discharge at these concentrations will maintain West Credit River water quality downstream of the proposed outfall to PWQO/CWQG requirements.

A detailed Assimilative Capacity Study can be found in ***Appendix D.***

6.4 Two Treatment Plant Solution

The SSMP concluded that wastewater should be conveyed to a single location for treatment and discharge. At the outset of the UCWS EA the single plant solution was carried forward without additional analysis. Through the public consultation process, it was determined that a desire for a more thorough examination of the benefits and drawbacks of operating separate treatment systems for Erin Village and Hillsburgh existed in the community. The perception among some residents was that the capital costs and long term operational costs associated with pumping waste from Erin Village and Hillsburgh would outweigh the costs associated with establishing and operating two separate treatment facilities. As a result, the study team re-examined the potential for a multi-plant solution for the community.

In order to compare the single plant and multi-plant alternatives, an implementation plan was developed for comparative analysis to illustrate cost differences between each scenario. Implementation plans were developed for both alternatives and the capital and operating costs were developed for each alternative on the basis of full build out of the communities and for the existing communities alone.

The operating costs for each alternative were also compared based on budgets for various municipalities along with discussions with operating authorities. Operating cost components investigated for comparisons included personnel costs, consumables, and plant maintenance. The costs associated with each alternative were compared using a Net Present Value analysis. It was determined that individual collection and treatment systems for Erin Village and Hillsburgh would be 32% more expensive to operate and maintain as compared to one large system for the entire community.

The following table presents the cost to service full build out:

Table 6 – Cost Comparison of Alternatives for Servicing Full Buildout

Inflation Adjusted Cost	One Plant	Two Plants
Capital Cost	$60,669,310	$98,348,076
Operation and Maintenance Costs	$75,113,136	$100,118,368
Total	$135,782,445	$198,466,444
Present Value Cost	**$70,497,472**	**$104,250,255**

The following table presents the cost to service the existing community:

Table 7 – Cost Comparison of Alternatives for Servicing Existing Community

Inflation Adjusted Cost	One Plant	Two Plants
Capital Cost	$ 30,904,188	$42,910,949
Operation and Maintenance Costs	$31,707,382	$41,826,759
Total	$62,611,569	$84,737,708
Present Value Cost	**$36,810,320**	**$50,655,454**

Based on the NPV analysis conducted, it was determined that utilising a single plant is more economically feasible compared to individual collection systems for each Town. However, the calculations for NPV did not take into account the $5.0 million required for the cost of constructing a forcemain between Hillsburgh and Erin Village. However, the cost analysis clearly indicates that the two plant solution is more expensive even when the connection between the two communities is taken into account.

Based on the above results, it is recommended that the preferred alternative solution identified in the original SSMP with a single treatment plant discharging to the West Credit River south of Erin village, remains the preferred alternative.

A detailed report can be found in ***Appendix E***.

6.5 Viability of Subsurface Disposal

The use of subsurface disposal for treated effluent was examined as an alternative solution for servicing the communities of Erin Village and Hillsburgh. Subsurface disposal was evaluated as an alternative to, or in conjunction with, surface water discharge to the West Credit River, downstream of Erin Village. 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 identified that subsurface discharge was not fully addressed as a potentially viable component of the overall solution within the SSMP. While the SSMP did identify subsurface disposal as an alternative solution, it indicated that further consideration should be given during Phase 3.

Large Subsurface Disposal Systems (LSSDS) are a common effluent management practice throughout Ontario, however typically they are used for small single developments such as nursing homes, hotels, subdivisions and parks since they are designed for an average daily flow of 10-80m^3/d. The scale of the system needed for managing waste from an area the size of Erin Village or Hillsburgh is well beyond any system presently operating in Ontario.

It is noted that a plant discharging to surface water will require 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. In order to evaluate the range of potential solutions for subsurface disposal, three (3) alternative treatment and disposal strategies were considered:

- **Alternative 1:** Decentralised treatment and disposal systems servicing sewer decision areas established in the Septic System Survey technical memorandum.
- **Alternative 2:** Centralized 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:** Centralized treatment system for either Erin Village or Hillsburgh with a single disposal field suitable for subsurface disposal based on the hydrogeological overview of the study area

In order to evaluate the use of subsurface disposal within the Town of Erin, potential locations suitable for subsurface disposal were reviewed. Potential locations in the community are severely limited due to the extensive pattern of surface water drainage as well as the potential impact on drinking water supplies. After eliminating locations within 300m of surface waters, and within wellhead protection areas, a small number of suitable locations remained.

Based on the available disposal areas and a review of all three alternatives, it has been concluded that subsurface disposal alternatives are not viable for Erin Village. It was determined that not enough land was available to support Alternative 1. Alternative 2 and 3 had minimal cost advantage and added risk associated with disposal bed failure and the commitment to meet compliance limits downstream of the disposal field.

In contrast, for Hillsburgh it was found that all three alternatives were viable and there may be opportunity to incorporate subsurface disposal in the overall solution. Each alternative was evaluated economically for a comparative analysis; it was found that Alternative 3 was the least costly alternative for subsurface disposal at an estimated capital cost of $36,975,000. At full buildout, treatment and disposal costs 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).

Based on the comparative analysis, in terms of capital cost, there is no advantage for a separate treatment system in Hillsburgh using subsurface disposal. This solution is likely to cost between 10 – 20% more in terms of capital cost. In addition, the costs to operate two plants instead of one would likely be approximately 10% more in ongoing operation and maintenance. 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.

Based on the comparative analysis of costs, a single plant with surface water discharge servicing both the Erin Village and Hillsburgh provides a more economical solution for the Town. In addition, the operation and maintenance of two treatment plants would add significantly to the lifecycle cost of this alternative. It was concluded that subsurface disposal of treated wastewater effluent for the community of Hillsburgh offers no advantage over the preferred surface water discharge alternative established during the SSMP.

A detailed report can be found in ***Appendix F***.

7.0 Recommended Preferred General Alternative Solution

This Phase 1 and 2 Class EA Report has been prepared as part of the Town of Erin Urban Center Wastewater Servicing Environmental Assessment (UCWS EA) and presents an overview of the Servicing and Settlement Master Plan (SSMP) by summarizing the key findings followed by a review and refinement of the recommended preferred alternative identified in the SSMP.

In 2014, the Town of Erin completed a SSMP to address servicing, planning and environmental issues within the Town. The study area included the Village of Erin and Hillsburgh as well as a portion of the surrounding rural lands. The SSMP considered servicing and planning alternatives for wastewater and identified a preferred wastewater servicing strategy for existing and future development in the study area. The UCWS EA continues with a review of Phase 1 and Phase 2 activities to confirm the preferred general alternative for wastewater collection, treatment and disposal for the existing urban areas of the Village of Erin and Hillsburgh, and to accommodate future growth. The aforementioned SSMP concluded that the preferred solution for both communities is a municipal wastewater collection system conveying sewage to a single wastewater treatment plant located south east of the Village of Erin with treated effluent being discharged to the West Credit River. A system with a capacity of 2,610 m^3/d servicing a population of 6,000, based on a phosphorus discharge concentration of 0.15 mg/L; was recommended.

As part of the UCWS EA, a more detailed survey of existing septic systems was undertaken within the study area to refine the problem statement. Based on the analysis of the septic system information collected; proposed wastewater servicing areas in Erin Village and Hillsburgh were recommended as shown in Figures 3 and 4.

As part of the UCWS EA, an assessment of the anticipated wastewater flows was made from each of the recommended servicing areas within the existing communities. Anticipated wastewater flows were also assessed from future development areas as delineated within the Town Official Plan. The results of these flow assessments indicate that in order to fully service the existing communities of 4,616 persons, a wastewater flow of 2,844 m^3/d will be needed. It is also determined that in order to service new growth areas, as defined by the Town Official Plan, 4,328 m^3/d of wastewater flow will result from 9,943 persons. The total estimated wastewater flow resulting from the full build out service area will be 7,172 m^3/d. This services a residential population of 14,559 persons. Tables 8 and 9 below summarise the anticipated flows and populations respectively.

Table 8 – Full Build Out ADF Flow Summary (m^3/d)

	All Development			Residential Development		
	Erin	**Hillsburgh**	**Total**	**Erin**	**Hillsburgh**	**Total**
Existing Community	2,244.1	599.4	2,843.5	1,225.5	528.6	1,754.1
Growth Areas	2,523.0	1,805.7	4,328.7	2,029.2	1,749.1	3,778.3
Total	4,767.1	2,405.1	7,172.2	3,254.7	2,277.7	5,532.4

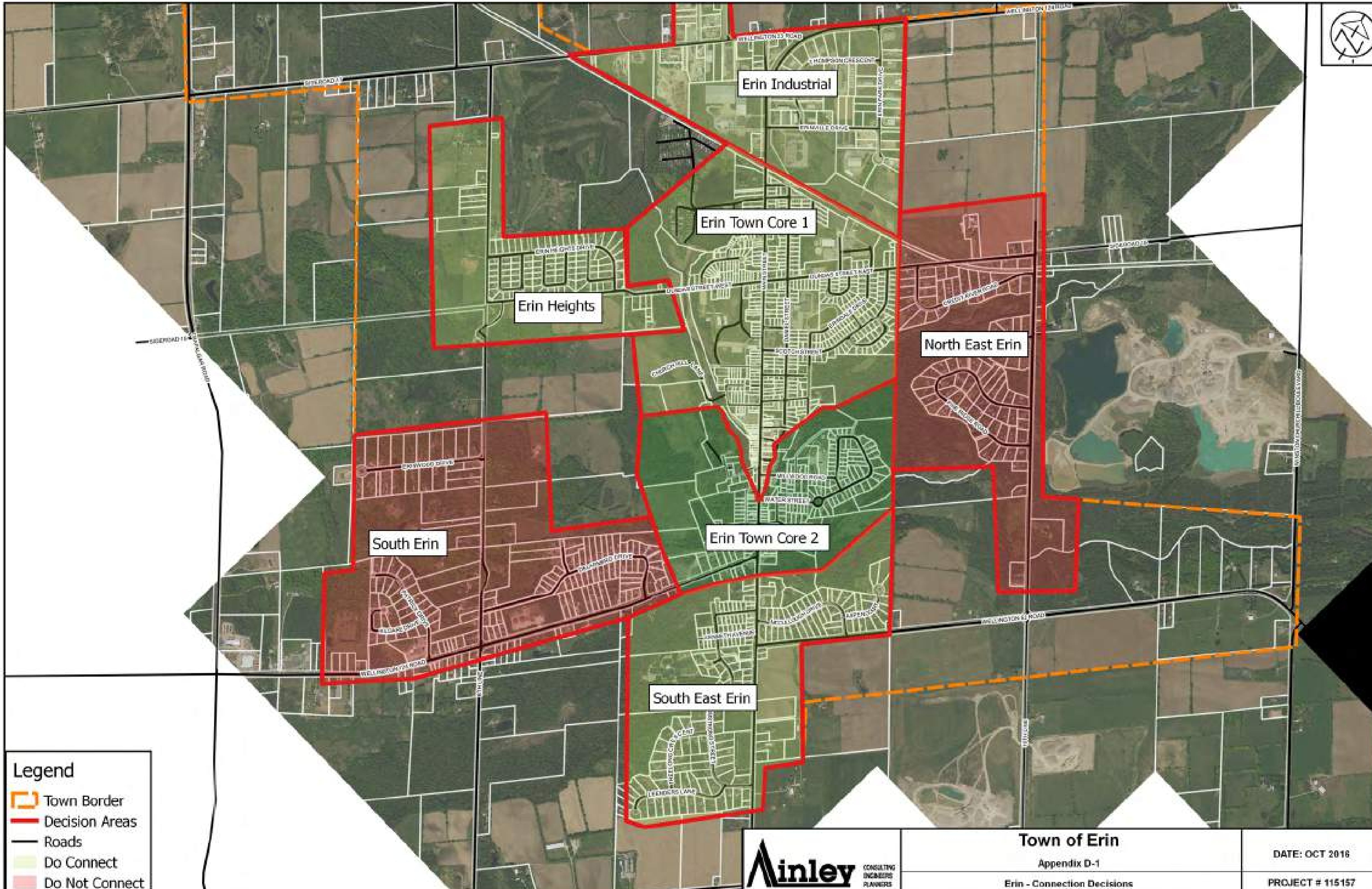
Table 9 – Full Build Out Population Summary

	Equivalent Population			Residential Population		
	Erin	**Hillsburgh**	**Total**	**Erin**	**Hillsburgh**	**Total**
Existing Community	5,905	1,577	7,482	3,225	1,391	4,616
Growth Areas	6,639	4,752	11,391	5,340	4,603	9,943
Total	12,544	6,329	18,873	8,565	5,994	14,559

Based on an updated 7Q20 baseline flow in the West Credit River, established by CVC and the wastewater flow required to service the full build out population, a revised Assimilative Capacity Study was undertaken as part of the UCWS EA.

In order to protect the water quality of the West Credit River, the ACS recommends establishment of a site specific downstream Total Phosphorus (TP) concentration of 0.024 mg/L to ensure that the Provincial Water Quality Objective of 0.03 mg/L is not exceeded. In order to further protect water quality, the ACS recommends that a target of 'net zero' increase in phosphorus loading be adopted for future development lands.

The results of the ACS indicate that the required full build out wastewater flow can be discharged to the West Credit River provided the effluent meets the limits indicated in Table 10. It was also confirmed that the effluent limits required to meet the full build out system capacity can be achieved through the application of "Best Available Technology".



Town of Erin

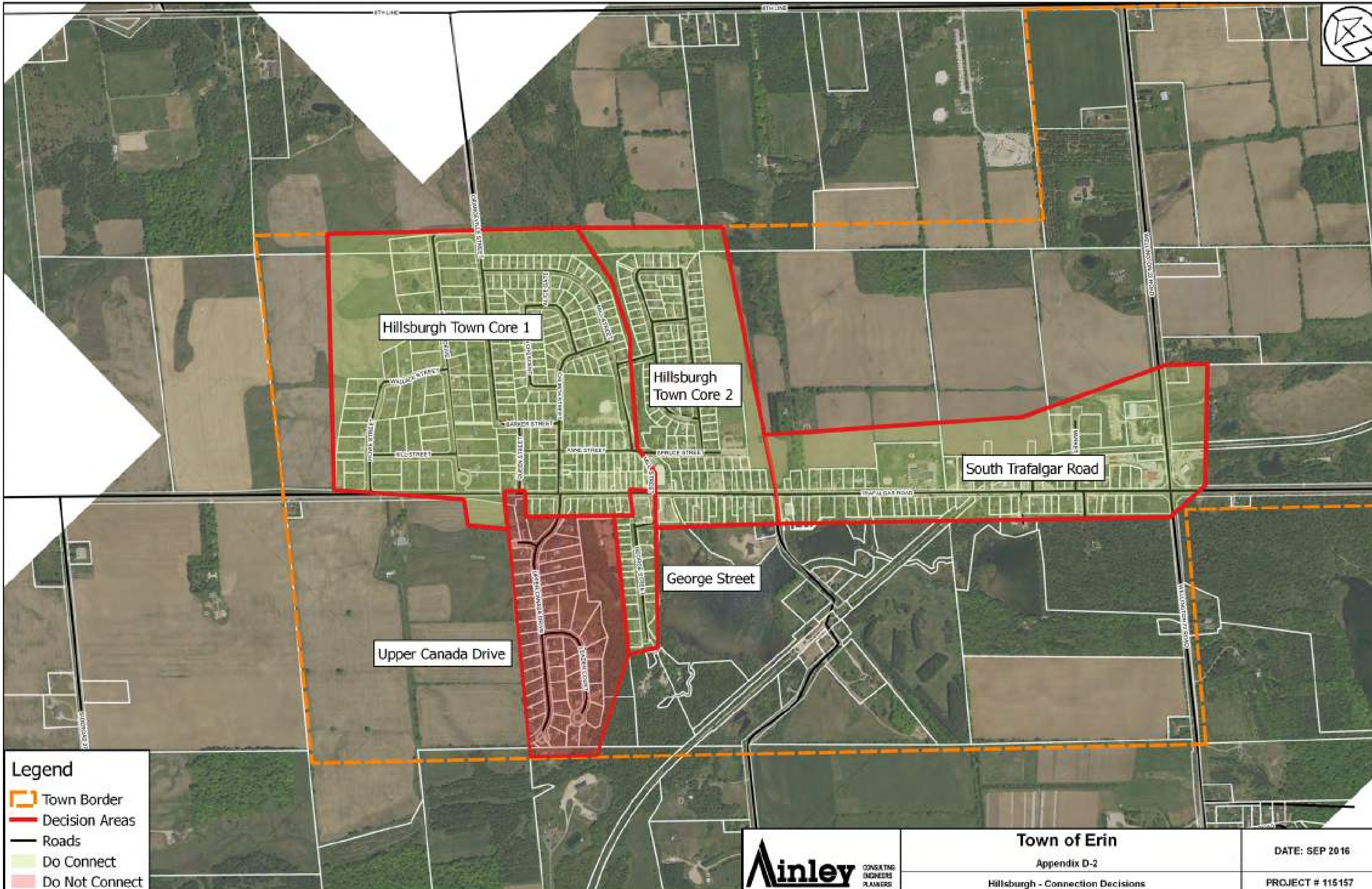
Appendix D-1

Erin - Connection Decisions

DATE: OCT 2016

PROJECT # 115157

Ainley CONSULTING ENGINEERS PLANNERS


Hillsburgh Town Core 1
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Town of Erin
Appendix D-2
Hillsburgh - Connection Decisions
DATE: SEP 2016
PROJECT # 115157

Table 10 – Effluent Limits for Proposed Erin WWTP

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 6.5-8.5	Within range of 6.5-8.5
Total Suspended Solids	5mg/L	5mg/L
Total Phosphorus	0.07mg/L	0.045 mg/L
Total Ammonia Nitrogen	1.2mg/L summer 2 mg/L winter	0.6mg/L summer 2 mg/L winter
Nitrate Nitrogen	5 mg/L	5 mg/L
E.coli	100cfu/100mL	100cfu/100mL
Dissolved Oxygen	4mg/L	4mg/L
5-day Carbonaceous Biochemical Oxygen Demand (CBOD5)	5 mg/L	5 mg/L

As part of the UCWS EA, further investigation was conducted into additional general alternative solutions. The first included a comparison of a two plant solution servicing Erin Village and Hillsburgh with separate discharges to the West Credit River with a single plant solution as recommended in the SSMP. This alternative was shown to be more costly and to require considerable cost and time to establish the viability of a second discharge to the River in Hillsburgh. The second alternative included a comparison of subsurface disposal alternatives with the single plant surface water disposal alternative. All of the subsurface alternatives considered were shown to be either non-viable of more costly than the single surface water discharge alternative. The alternative of a single treatment plant located south east of Erin and discharging to the West Credit River was confirmed as the preferred general alternative solution.

Based on the results of Phase 1 and Phase 2 of the UCWS EA, it is recommended that the preferred general alternative solution identified in the SSMP with a single treatment plant discharging into the West Credit River south east of Erin Village remain the preferred general alternative solution, with a revised capacity of 7,172 m^3/d servicing the full build out of the Town's present Official Plan and that the Town of Erin proceeds forward with Phase 3 of the Class EA with this recommended alternative solution.

Appendix A
Public Consultation Records

Listing of Contents

1.
Notice of Commencement

The Corporation of the Town of Erin

Urban Centre Wastewater Servicing

Class Environmental Assessment (Phases 3 & 4)

Notice of Study Commencement

In 2014 the Town of Erin completed a Servicing and Settlement Master Plan (SSMP) to address servicing, planning and environmental issues within the Town. The study area for the SSMP included the Village of Erin and Hillsburgh as well as a portion of the surrounding rural lands. The SSMP considered servicing and planning alternatives for wastewater and identified a preferred wastewater servicing strategy for existing and future development in the study area. The SSMP is available on the Town's website at http://www.erin.ca/town-hall/public-notices. The SSMP was conducted in accordance with the requirements of the Municipal Class Environmental Assessment (Class EA), which is an approved process under Ontario's Environmental Assessment Act and addressed Phase 1 & components of Phase 2 of the Class EA planning process.

The Town is now continuing with a review of Phase 2 and initiating Phases 3 & 4 of the Class EA Planning Process to determine the preferred design alternative for wastewater for the existing urban areas of the Village of Erin and Hillsburgh, and to accommodate future growth. The aforementioned SSMP concluded that the preferred solution for both communities is a municipal wastewater collection system conveying sewage to a single wastewater treatment plant located south east of the Village of Erin with treated effluent being discharged to the West Credit River. During this study, the SSMP's preferred solution will be refined and a preferred design concept for wastewater collection and treatment will be identified.

This Class EA process will follow the planning and design process for Schedule 'C' projects as described in the Municipal Class Environmental Assessment Document (October 2000 as amended in 2007, 2011 & 2015), published by the Municipal Engineer's Association.

The Town has retained the Ainley Group to complete and document the Class EA planning process and this Notice initiates the beginning of the Study. The Town recognizes that public consultation will be a key component of this Study and an extensive public consultation process will be arranged including the formation of a Public Liaison Committee, Public Information Centres, newspaper advertisements and updates to Council throughout the completion of the Class EA Study in order to seek input and comment.

The Town has created a project website at www.erin.ca/town-hall/wastewater-ea to make project information available to the public.

If you would like to be placed on the mailing list to receive all future notices relating to this Class EA please send your contact information to either of the Contacts listed below.

Dina Lundy
Town Clerk
Town of Erin
5684 Trafalgar Road
Hillsburgh, Ontario
N0B 1Z0
Tel: (519) 855-4407
Email: dina.lundy@erin.ca

Joe Mullan, P. Eng.
Project Manager
Ainley & Associates Limited
280 Pretty River Parkway
Collingwood, Ontario
L9Y 4J5
Phone: (705) 445-3451
Email: erin.urban.classea@ainleygroup.com

This notice issued April 13, 2016.

Comments and information regarding this project are being collected in accordance with the Municipal Freedom of Information and Protection of Privacy Act for the purpose of meeting environmental assessment requirements. With the exception of personal information, all comments received will become part of the public record.

2.
Media Release

TOWN OF ERIN
5684 Trafalgar Rd.
Hillsburgh, ON N0B 1T0
www.erin.ca

Office of the Mayor
Telephone: (519) 855-4407 Ext 232
Fax: (519) 855-4281
council@erin.ca

Media Release

On November 8th, 2016, Town Council received an update on the status of the Urban Centre Wastewater Servicing Class Environmental Assessment (Class EA) for Erin Village and Hillsburgh. The following are some of the key tasks that have been completed by the project team to date:

- Topographical surveys to support detailed analysis of the proposed sewage collection system
- Documentation and analysis of data related to the existing septic systems
- Updating of the West Credit River Assimilative Capacity Study (ACS) including assessment of river low flow conditions and field work and analysis to determine the amount and quality of effluent (treated sewage from a treatment plant) that can be safely discharged to the river
- Evaluation of potential wastewater flows from existing development and new growth areas

Council heard that the river has the capacity to accommodate treated effluent to service the majority of the existing urban centres of Erin and Hillsburgh; allow for a full build-out of Erin Village and Hillsburgh as provided within the existing Official Plan and limited septage servicing of our rural areas. This amount of sewage servicing would permit the urban centres to grow to a residential population of approximately 14,500 as well as accommodate institutional, commercial and industrial development.

This level of population/development growth is based strictly on an engineering/technical perspective related to the amount of treated wastewater effluent the West Credit River can accommodate. Currently, the Town of Erin and Wellington County Official Plans do not include this substantial increase in population. As a result, amendments to the Official Plans will be required if the Town wishes to grow beyond currently identified levels. The Official Plan amendment process requires public consultation with residents and other stakeholders and includes mandatory requirements for public notices and meetings.

“Although I campaigned on a platform of growth for the Town of Erin, the potential population increase identified by this EA process is significantly higher than Council expected” said Mayor Alls. “Council has committed to fully engaging the public through an Official Plan amendment process in 2017 to determine how large our community wishes to grow” he added.

Detailed information on the Urban Centre Wastewater Servicing Class EA can be found on the Town’s web page erin.ca. Queries regarding the wastewater servicing Class EA should be forwarded to the project email address at erin.urban.classea@ainleygroup.com.

3.
PLC Recruitment Ad and Terms of Reference

Town of Erin

Urban Centre Wastewater Servicing

Schedule C Municipal Class Environmental Assesment

Invitation to Join a Public Liaison Committee

Representatives of the local community are being sought to join the Public Liaison Committee (PLC) for the Town of Erin Urban Centre Wastewater Servicing EA.

The PLC is a non-political advisory committee that will provide advice and feedback at key milestones over the course of the Project.

An application questionaire, fact sheet, and the PLC terms of reference are available at:

www.erin.ca/town-hall/wastewater-ea/

Get involved!

Have your voice heard.

For more information, please contact:

Dina Lundy - Town Clerk

Email: dina.lundy@erin.ca

Mail: Dina Lundy
Town of Erin
5684Trafalgar Rd.
Hillsburgh, ON
N0B 1Z0

Town of Erin Urban Centre Wastewater Servicing
Schedule C Municipal Class Environmental Assessment

Public Liaison Committee TERMS OF REFERENCE

Project Background and Description

The Town of Erin (the "Town") is a rural lower-tier municipality located in southern Wellington County northwest of the Greater Toronto Area (GTA). The population of the Town is 11,830 spread out in 3900 households. It includes two urban centres, Erin Village and Hillsburgh.

The Town's Official Plan was originally approved by Wellington County on December 14, 2004. The Town completed a Servicing and Settlement Master Plan (SSMP) in September 2014, assisted by their consultant B.M. Ross and Associates Limited. This was completed as a Master Plan under the Municipal Class Environmental Assessment (Class EA) process and included water, wastewater, transportation and storm water management servicing. The SSMP followed Approach #1 of the Class EA Master Planning Process and by doing so, addressed Phases 1 and 2 of the Class EA process. Because the SSMP was done at a broad level of assessment, more detailed project-specific studies are required to fulfill the Class EA requirements.

The Town has made the decision to move forward with a municipal wastewater collection and treatment system as recommended in the SSMP. In order to advance to next steps, the Town is undertaking a Class EA - Urban Centre Wastewater Servicing Class Environmental Assessment (the "Project"). This Project involves continuing Phase 2 of a Class EA process and then, commencing and completing Phases 3 and 4.

The Project is classified as a Schedule C under the Municipal Class EA process. The Town will continue with Phase 2 of the Schedule C Project by reviewing and updating wastewater related studies completed as part of the Class EA Master Planning Process (Phases 1 and 2) and commence and complete Phases 3 and 4 of this Class EA process to complete an Environmental Study Report (ESR), which helps to determine the preferred design concept for wastewater servicing across the Town (including identification of the parts of the community that should be connected to the wastewater collection and treatment system).

The Town has retained a multi-disciplinary consultant team including the Ainley Group (project management), Hardy Stevenson and Associates Limited (environmental assessment coordination, public and stakeholder consultation, and communications), and Hutchinson Environmental Sciences Limited (water quality and assimilative capacity studies) to carry out this Project.

The Consultation Program will strive for strong two-way communication with Municipal Council, the general public, local businesses, interest groups, government review agencies (e.g. Ministry of Environment and Climate Change, Credit Valley Conservation Authority, etc.) and Aboriginal communities (where appropriate).

Part of the Consultation Program is to establish a Public Liaison Committee (PLC). PLCs are common in projects of this nature and it is an approach that has proven to be helpful for guiding many other similar projects. Through the PLCs, a cross section of key stakeholders will be engaged early on and in depth during the EA process. This will help address issues and discuss approaches prior to engaging the wider community. As well, this will allow for a detailed discussion of Project issues with a smaller group of stakeholders, while still allowing for a range of perspectives from across the community.

In addition to the PLC, the Consultation Program includes:

> *Core Management Team (CMT) Committee*, which includes Town of Erin and Triton Engineering Services Limited, Wellington County Planning Department, Blackport Hydrogeology, government review agencies, Ainley Group, Hardy Stevenson and Associates Limited, and Hutchinson Environmental Sciences Limited (not open to the general public);
>
> *Council Workshops*, which are intended for municipal councillors (although open to public, the general public will not participate in the discussion);
>
> *Public Information Centres (PICs)*, which are for the general public (CMT, PLC, and councillors are invited to attend);
>
> *Public Review of ESR*, which offers the stakeholders and government review agencies at least 30 calendar days to review the ESR and submit written comments via email, hand delivery, or regular mail within a given deadline; and
>
> *Written Submissions*, which will be opportunities to submit written feedback from the beginning of the Project to two weeks after the second PIC and as part of the public review period of the ESR.

Purpose of PLC

The PLC is a non-political advisory committee that will be established by the Town of Erin in accordance with these Terms of Reference (ToR). Members of this group are guided by these ToR.

The purpose of the PLC is to provide advice and feedback to the Town of Erin, the CMT, and the Project Team at key milestones over the course of the Project, including feedback on the following:

- Opportunity Statement for the project;
- Evaluation approach, including evaluation criteria, weighting factors and proposed methodology;
- Evaluation results;
- Anticipated impacts and mitigation measures;
- Communication and consultation activities and approach;
- Key documents completed in draft before they are released to the public; and
- Related project issues and items as may be identified as the project evolves.

All participating members will have an opportunity to be heard. By participating as members of the PLC, the members are not expected to waive their rights to the democratic process, and may continue to avail themselves of participation opportunities through delegations to Council, and / or providing written briefs. Any positions taken by individual members are without prejudice.

Membership

The PLC is structured to allow a full range of stakeholder opinions to be made available to the Town of Erin. Accordingly, the Town intends to have member representatives in the PLC, from the following groups:

Types of Groups	
General public (both Erin and Hillsburgh)	Economic Development Committee
Community interest groups	Environment and Sustainability Advisory Committee
Local businesses (includes Erin Village BIA and Let's Get Hillsburgh Growing Committee)	Environmental groups
Development community	Aggregate industry
Heritage Committee	Agricultural industry
Recreation and Culture Committee	

Recruiting

10-12 PLC members will be identified and recruited by the Town of Erin from the groups listed above. PLC membership positions will be advertised through ads in the Erin Advocate and Wellington Advertiser, Town's website and social media (Twitter and Facebook). The following criteria are recommended to assist with identifying and selecting community-at-large PLC representatives:

- Interest in water and wastewater servicing matters.
- Ability to attend meetings over a 24 month period.
- Ability to travel to attend meetings.
- Represent general public and / or represent one of the groups listed above.

See *end of this ToR* for the Application Form

Meetings

The PLC will be convened at key points in the project. Meetings are anticipated to be aligned with key study stages or as deemed necessary by the Project Team. Meetings will be held at the Town's offices, with the exact location to be confirmed. In order to adhere to the project schedule, the PLC meetings will take place as scheduled. If a participating member is not able to attend a meeting, he / she is encouraged to assign an alternate representative (see sections below on *Participating Members* about alternate representatives).

The Project Team will organize the meetings, including setting the dates, sending invitations, and providing the agendas and information related to the study process in advance of each meeting. Participants should review any reports and materials before the meetings as required. PLC meetings will be open to members of the public but only members of the PLC will be able to participate in the discussions.

Minutes

Minutes of meetings with the PLC will be taken by a member of the Project Team. Draft meeting minutes will be circulated to the PLC for suggested edits following each meeting. Members will have three business days to provide suggested edits (only information that was recorded erroneously or was incorrect will be incorporated – no new comments will be added); then, the minutes will be finalized (incorporating suggested edits, if applicable), re-circulated and posted on the project website.

Members and observers are not allowed to audio or video record the meeting without permission from the chair.

Roles and Responsibilities

As a member of the PLC, each participant will:

- Consider any matters, issues, or information referred to them by the Project Team relating to the Class EA, and provide advice and recommendations as requested;
- Liaise with the organization they represent (if applicable) and bring forward advice, issues, or comments from their organization to the PLC;
- Assign an alternate representative to attend a meeting(s) when absent from a meeting(s);
- Strive to operate in a consensus mode, where participants openly discuss views and opinions, and seek to develop common ground and narrow areas of disagreement to the best of their ability. It is not the purpose of the PLC to provide a single unified position to the Town;
- Ensure that the results of the PLC discussions are accurately recorded in the meeting minutes, or in additional reports that members may determine as needed;
- Receive project information available to the public and be invited to attend PICs; and
- Treat all members of the PLC with mutual respect and courtesy.

Project Team members will:

- Strive to provide accurate, understandable information to PLC members, such that they can contribute informed advice and recommendations;
- Ensure that appropriate Town staff (or other resource people) are present at discussions on specific issues or components of the planning process;
- Ensure that the advice and recommendations of the PLC are fully considered as part of the Class EA; and
- Be open, receptive, and give careful consideration to advice and ideas received from PLC members.

Structure of PLC

Chair: Meetings will be chaired and facilitated by Dave Hardy (with Hardy Stevenson and Associates Limited). The Chair will conduct PLC meetings in a timely and orderly manner and ensure that the meeting adheres to the agenda items. The Chair will help the PLC to provide advice through consensus where possible and will ensure that each member has an opportunity to provide their input and opinion.

Participating Members: Each PLC member will represent an independent interest. A member will be allowed to identify an alternate who may participate in the discussions so that if the member is unavailable, the member's interests can continue to be represented. It is the responsibility of the member to notify their alternate if they are unable to attend the meeting and that they are up-to-date on the Project. Members and their alternates are expected to share the meeting discussions with their respective organizations.

Observers: Observers (non-members) will not participate, ask questions or provide unsolicited comments unless the PLC Chair provides for this opportunity.

Reporting

The Project Team will prepare the meeting minutes for all PLC meetings. Draft versions will be circulated to the meeting participants for suggested edits (no additional comments could be added to the minutes after the meeting). They will then be finalized, re-circulated and posted on the project website. See section above on *Minutes* with additional information.

Decision Making

The PLC does not make decisions about the Class EA. It will be acting in an advisory capacity to the Project Team, and through the Project Team to the Town Council. However, from time to time the PLC may be asked to assist with decisions of an administrative matter, such as the time, date and location of meetings.

Transparency

All meeting records will be posted on the Town's website for review by Council and the general public.

TOWN OF ERIN | TRITON ENGINEERING SERVICES LIMITED Consulting Engineers | Ainley GROUP CONSULTING ENGINEERS PLANNERS | HARDY STEVENSON AND ASSOCIATES

Application Form

Name	
Address	
Telephone	
Email	
Affiliation	
Are you currently a member of any Town Board or Advisory Committee? If yes, which one(s)?	
Please list prior or current community involvement or experience within the Town of Erin including but not limited to participation in the Servicing and Settlement Master Plan (SSMP).	
Please list the skills or qualifications you would bring to this committee.	

Please list your reason(s) for seeking appointments to this Public Liaison Committee and other pertinent information you may deem helpful in considering your application.
Please list on this form any affiliation that you have, financial or otherwise, with a commercial or other industry interest and/or land ownership and if you think this might be perceived as biasing your participation in the Public Liaison Committee or a conflict of interest.

Please send your completed and signed forms to:

Dina Lundy (Town Clerk)

Email: dina.lundy@erin.ca

Mail to: Attn: Dina Lundy,
Town of Erin,
5684 Trafalgar Road,
Hillsburgh, ON N0B 1Z0.

Completed applications must be received by April 29, 2016.

Signature: ____________________________________ **Date:** ______________

All comments and information received from individuals, Public Liaison Committees and agencies regarding this Project are being collected to assist the Town of Erin in making a decision. All comments and feedback will be part of public record. In accordance with the *Ontario Freedom of Information and Protection of Privacy Act*, comments and feedback will not be associated with the respective individuals or groups by sharing the names, titles, contact information or personal information. This information will only be made public only with written consent from the individuals or groups, authorizing the disclosure of such information.

4.
Communications to the PLC

Simon Glass

From: Dina Lundy <Dina.Lundy@erin.ca>
Sent: May 31, 2016 12:50 PM
To: Allan Alls; Bruce Donaldson; Christine Furlong; Dave Doan; Dave Hardy; Don Fysh; Donna Revell - Alternate; Erik Mathisen; Gary Scott; Jamie Cheyne; Jay Mowat; Joe Mullan; Josie Wintersinger; Justin Morrow; Linda Rosier; Lloyd Turbitt (LGHG); Maurizio Rogato; Melodie Rose - Alternate; Noah Brotman; Roy Val; Valerie Bozanis
Subject: Public Liaison Committee - Appointments and First Meeting
Attachments: PLC Meeting #1 Agenda.docx

Hello all:

Thank you for putting your name forth to join the Public Liaison Committee for the Town's Urban Centre Wastewater Servicing EA. You will be recommended for appointment at our next meeting on June 7th. We expect all of you to be appointed to the committee (including the two names put forth as alternates). The first meeting for the Committee is also on **June 7th at 7PM at the Municipal Office (address below)**. We apologize for the short notice, and hope all of you can attend.

Attached you will find an Agenda for this meeting. Please let me know if you have any questions, and please rsvp if you can.

Thank you

Dina Lundy **Dipl.M.A, CMO**
Clerk, Town of Erin
5684 Trafalgar Rd
Hillsburgh, ON
519-855-4407 x233
Clerk's and Administration Department Webpage

Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: September 6, 2016 12:52 PM
To: Allan.Alls@erin.ca; abrucedonaldson@aol.com; dave@sep-tech.ca; gdfysh@gmail.com; revelld@hotmail.com; mensaerik@gmail.com; jamiecheyne01@gmail.com; jaymowat@sympatico.ca; wintersinger1947@gmail.com; justin@copperhilldevelopments.com; linda@conceptadvertising.com; lloyd.turbitt@sympatico.ca; mrogato@solmar.ca; melodie.rose.1@gmail.com; nancy@bsrd.com; sales@pangaeasciences.com; valerie.bozanis@gmail.com; bhalfpenny@killamproperties.com; dina.lundy@erin.ca
Cc: cfurlong@tritoneng.on.ca; Dave Hardy; Noah Brotman; Joe Mullan; Gary Scott
Subject: Town of Erin WW Class EA – PLC Update

Town of Erin WW Class EA – PLC Update

Welcome back from what we hope has been a relaxing and fun summer for everyone. This email provides a status update of the progress on the Erin Wastewater Servicing Class EA.

Throughout the summer our team has been hard at work on a number of technical studies that are key components of the Class EA process. Our primary focus has been on the following activities:

1. Completing the septic survey of systems in Erin.
2. Completing a detailed topographical survey of the study area
3. Identifying collection system alternatives
4. Identifying potential wastewater treatment plant sites
5. Completing a peer review of the 7Q20 flows in the West Credit River
6. Completing the Rhodamine WT dye study in order to determine hydrologic characteristics of the West Credit River that will be used in evaluating discharge options for the wastewater treatment facility.

At this time, we are pleased to report that the field work for these tasks have been completed and we are now analysing the new information, assessing potential sewage flows from the existing communities and analysing collection system alternatives.

The focus of the next Public Liaison Committee (PLC) meeting will be on providing you with updates and obtaining your comments about the revised CVC flow data and the assimilative capacity study. We will also look at the extent of the existing communities to be serviced and the potential service population. Your comments on these matters will also be important.

Once we have completed our associated technical memos on the septic systems, updated river flow and assimilative capacity, and collection system alternatives, the Core Management Team (CMT) will review and comment on the technical memos. The technical memos will remain in draft form through submission to Council, and to you as PLC members for comment. Thereafter, our team will prepare for the first Public Information Centre (PIC) still planned for November 2016. We will be reviewing PIC info with you before we finalize the PIC approach.

After receiving all comments through the PIC process, we will close out Phase 2 of the study which will define the extent of the service area including existing communities and areas for planned growth. As a heads up to future activities, starting next year we will start to define and analyse treatment processes and sites and effluent discharge alternatives. We encourage all questions and comments. If you have any further questions, please send a message to the project email address: erin.urban.classea@ainleygroup.com

Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: October 19, 2016 10:55 AM
To: [redacted]
Subject: Erin WW EA PLC Meeting #2 Notice

Hello to all, we hope you have had a great start to the fall season. This is a status update for all PLC members regarding the Erin Wastewater Servicing Class EA.

As you know, over the summer our team was able to undertake the field investigations for the completion of four project tasks: the Assimilative Capacity Study (ACS); the Septic System Survey; the System Capacity Study; and the evaluation of collection system alternatives. During September, our team has been hard at work analyzing the findings of the studies and completing technical memos for review by the project Core Management Team (CMT).

The CMT has now met once to review the findings and will meet again shortly to finalize the technical memos. Once approved by the CMT, the technical memos will be ready to be shared publicly. An informational update will first be presented in a session of Town Council on November 8, and then the following day the full studies will be available for download on the Town's project website.

The next PLC meeting is scheduled for Thursday November 24, 2016 from 7:00 p.m. to 9:00 p.m.

The topics for discussion will focus on:

1. The results of the Assimilative Capacity Study.
2. The results of the Septic System Survey.
3. The results of the System Capacity Study.
4. An overview of the collection system alternatives.
5. PLC advice regarding preparations for the first Public Information Centre.

We look forward to hearing from PLC members on these important studies. Once the technical memos have been shared with the PLC, if you have any questions or wish further clarification please send them to the project email address: erin.urban.classea@ainleygroup.com. Helpful questions of interest to PLC members will be brought forward at the PLC meeting so that all can hear the response.

Regards,

Dave Hardy

Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: November 14, 2016 5:04 PM
To: Dave Hardy
Cc: Noah Brotman
Subject: PLC Update

Hello to all PLC members,

This message is to inform you that the reports for the initial technical studies for the Erin Wastewater Servicing EA have been completed, reviewed by the CMT, presented to Council, and are now available for public review and comment.

On November 14, the following documents are now available on the project website:

- Technical memorandum on results of the Assimilative Capacity Study.
- Technical memorandum on results of the Septic System Survey, with recommendations for servicing existing area.
- Technical memorandum on System Capacity, with recommendations for servicing existing and new growth areas.
- West Credit River 7Q20 Update Report by CVC
- Presentation to Council from Nov. 8.

All of these documents can be found at http://www.erin.ca/town-hall/wastewater-ea

Please note that these technical memorandums are currently “Draft for Comments”. These documents will remain in draft form through the PLC meeting and the Public Information Centre now planned for January. The memorandums will be finalized only after receiving public comment.

These documents will be the focus of the conversation for the next PLC meeting #2, which is coming up on **November 24, 2016 from 7:00 p.m. – 9:00 p.m.**

We look forward to hearing from PLC members on these important studies. If you have any questions or wish further clarification please send them to the project email address: erin.urban.classea@ainleygroup.com. Helpful questions of interest to PLC members will be brought forward at the PLC meeting so that all can hear the response.

Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: January 20, 2017 12:24 PM
To: [redacted] Dave Hardy; Noah Brotman; Joe Mullan; Gary Scott
Subject: January PLC Update

Hello to all PLC members,

This message is a status update for Public Liaison Committee (PLC) members regarding the Erin Wastewater Servicing Class EA. There are two matters that the Project Team wants to update you on.

First, two members at the last PLC meeting asked for the Class EA study to consider an alternative treatment solution. The suggested solution differs from the preferred solution identified in the SSMP which is a single wastewater treatment plant discharging to the Credit River downstream of Erin for both Erin and Hillsburgh. Members of Transition Erin subsequently met with the Town and asked for consideration of a multiple plant solution with subsurface discharges.

In response, Ainley Group were asked by the Town to look at this issue and having done so, it is their opinion that the alternative of subsurface discharge may not have been looked at in sufficient detail during the SSMP. Ainley recommended an additional study to examine the viability of the suggested approach and their recommendation was approved by Council on January 17, 2017. A phased approach has been recommended that will address the suggested alternative at the conceptual/viability level, then report back to Council with a recommendation on whether to further evaluate the alternative. The study will take around one month to complete. Within this scope change, Council also approved an additional PLC meeting.

The second update to share is that due to this scope change, the Public Information Centre (PIC) meeting that had been originally planned for late January will be pushed back. This will allow the Project Team to work through the initial investigation, to report back to Council, and to reach agreement on how best to proceed. The new date for the PIC is not anticipated to have a significant impact on the current overall project timeline. Ainley will be proceeding with other aspects of the project that were planned for early January.

Prior to the PIC there will be a PLC meeting held to discuss the results of the proposed scope change investigation and to seek more detailed input in materials to be presented at the PIC. You will receive another update email once final dates have been set for the next PLC meeting and for the PIC.

We are happy to receive your questions and comments at any time. If you wish further clarification, please contact us through them to the project email address: erin.urban.classea@ainleygroup.com. Helpful questions of interest to PLC members and responses will be shared at the PLC meeting so that we can all participate in the dialogue.

Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: April 10, 2017 12:48 PM
To: Dave Hardy
Subject: PLC Update Email - April

Hello to all PLC members,

Here is a status update for Public Liaison Committee (PLC) members regarding the Erin Wastewater Servicing Class E A as of the end of March 2017.

At the request of some members of the PLC and with approval from council, the Project Team has been hard at work for the last few months investigating the viability of Large Subsurface Sewage Disposal Systems (LSSDS) around Erin and Hillsburgh to support a multiple plant solution as a possible alternative to the single wastewater treatment plant for both Erin and Hillsburgh. A phased approach to the LSSDS study had been recommended that would address the suggested alternative at the conceptual/viability level, then report back to Council with a recommendation on whether to further evaluate the alternative.

We are pleased to let you know that the Technical Memorandum examining the overall viability of this approach has been completed and has been sent to the Ministry of Environment and Climate Change (MOECC) and Credit Valley Conservation (CVC) for comment. We are hopeful of receiving comments by the end of April, at which point the document will be finalized, presented to Council and shared with you and made available for public comment.

Our next PLC meeting will be scheduled to allow for at least two weeks of review time after the LSSDS memo is release to ensure that you have adequate time to consider the findings. We expect that the PLC will occur around the first or second week of May. At that PLC meeting, there will be two areas of discussion: the technical memo on subsurface disposal; and the display boards that will be used at the Public Information Centre (PIC) in late May or early June.

We are happy to receive your questions and comments at any time. If you wish further clarification, please contact us through them to the project email address: erin.urban.classea@ainleygroup.com. Helpful questions of interest to PLC members and responses will be shared at the PLC meeting so that we can all participate in the dialogue.

Looking forward to our next meeting!

David R. Hardy R.P.P.
Principal
Hardy Stevenson and Associates Limited
364 Davenport Road
Toronto, Ontario
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Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: May 25, 2017 3:28 PM
To: erin.urban.classea@ainleygroup.com
Subject: PLC Update

Hello to all PLC members,

Here is a status update for Public Liaison Committee (PLC) members regarding the Erin Wastewater Servicing Class EA.

In the previous email update at the end of March, we informed you that the Technical Memorandum examining the viability of subsurface disposal of treated wastewater effluent had been completed and had been sent to the Ministry of Environment and Climate Change (MOECC) and Credit Valley Conservation (CVC) for comment. We are now able inform you that those comments have been received and the Memorandum was finalized and presented to Council on May 16, 2017.

To briefly summarize the responses from MOECC and CVC, MOECC found that:

> *"…there is no significant benefits in terms of capital costs for the inclusion of a subsurface disposal option in Hillsburgh, [and that] a detailed feasibility investigation will involve significant time, cost and uncertainties, which may further negate the option of subsurface disposal in 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 surface disposal with known constraints and risks exists."*

CVC found that:

> *"...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.*

Given the findings from the Technical Memorandum by Ainley Group and the support for those findings from both the MOECC and CVC, no further steps will be taken to assess the viability of the subsurface disposal approach in Hillsburgh.

The full memorandum can be found at:
http://www.erin.ca/uploads/userfiles/files/LSSDS%20Viability%20Report%20Final_compressed.pdf

We would also like to inform you that at the Erin Town Council meeting on May 2nd, a resolution was passed asking Ainley Group to prepare an additional Technical Memorandum on the feasibility of a surface water discharge for a wastewater treatment plant to service Hillsburgh specifically (a two plant solution). The study for that memo is currently under way and you will be updated once completed and MOECC and CVC have commented. At this time, the intention is to present this Technical Memorandum to Council on June 6, 2017.

Our **next PLC meeting will be held on June 8th at 7:00 PM – 9:00 PM**. At that meeting, we will discuss and address any final questions regarding the technical memorandum on subsurface disposal, a two plant solution and will have a chance to preview and comment on the display boards that will be used at the Public Information Centre (PIC) on June 22nd. Additional information on the PIC will be sent out at a later date.

Regards,

David R. Hardy R.P.P.
Principal
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364 Davenport Road
Toronto, Ontario
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Fax: (416) 944-0900

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Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: October 10, 2017 2:20 PM
To: Dave Hardy
Subject: Erin Wastewater EA - Fall PLC Update

Hello to all PLC members,

We hope everyone had a great summer and are continuing to enjoy the lovely start of fall. This email is to update members of the PLC on the progress that we have had over the last few months in the Erin Urban Centre Wastewater Servicing Class Environmental Assessment project.

The focus of the recent work has been in two key areas: background work for technical memoranda on design options for the wastewater treatment plant and the collection system; and conducting required natural sciences, heritage, and archaeological field investigations. The memoranda on design options for the wastewater treatment plant and collections systems have proceeded well and are expected to be completed in draft around mid November. When ready, the draft memos will be circulated to the Core Management Team for review and comment prior to circulation to the PLC. It is anticipated that there will be a PLC meeting to discuss the memos at some point in early December.

The other focus of our work in the last few months has been to prepare for the required geotechnical investigations. So far, preferred locations for borehole testing have been identified, landowners have been contacted, and the final preparations to start the field work have begun. During October 2017, as part of the Erin Urban Centre Wastewater Servicing Class Environmental Assessment project, boreholes will be drilled throughout Erin Village and Hillsburgh and along the Elora Cataract Trailway. The resulting Geotechnical Investigations Report will assist in defining potential environmental impacts from the project and will assist with costing alternative solutions that are being investigated.

If you have any questions for the Project Team about the current work please remember to send your emails to erin.urban.classea@ainleygroup.com. This will help us ensure that you get a timely answer from the right people, and that your comments and questions are properly documented for the purposes of the study.

Thank you,

Dave Hardy

David R. Hardy R.P.P.
Principal
Hardy Stevenson and Associates Limited
364 Davenport Road
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5.
PLC 1 – Meeting Notes

Public Liaison Committee Meeting #1 - Notes

PROJECT: Town of Erin: Urban Centre Wastewater Municipal Class Environmental Assessment (EA)

DATE: June 7, 2016

LOCATION: Town of Erin Municipal Office

TIME: 7:00 p.m. – 9:00 p.m.

ATTENDEES:

PLC members	Organization
Allan Alls	Mayor
Bruce Donaldson	Black, Shoemaker, Robinson and Donaldson Limited (Lawyer for Tavares Group)
Dave Doan	SeptTechWastewater Group
Don Fysh	Riverwalk trails committee and Rotary Club
Donna Revell	Let's Get Hillsburgh Growing Committee
Erik Mathisen	Urban Erin
Jamie Cheyne	Heritage Committee and Economic Development, Erin Agricultural Society
Jay Mowat	Environment Committee
Josie Wintersinger	General public, Former Erin Councilor
Justin Morrow	Copper Hills Development
Linda Rosier	General public
Lloyd Turbitt	Let's Get Hillsburgh Growing Committee
Maurizio Rogato	Solmar
Melodie Rose	Riverwalk trails committee
Nancy Shoemaker	Black, Shoemaker, Robinson and Donaldson Limited (Lawyer for Tavares Group)
Roy Val	General public
Valerie Bozanis	General public
Brian Halfpenny	Killam Properties / Stanley Park
Project Team	
Christine Furlong	Triton Engineering
Joe Mullan	Ainley
Gary Scott	Ainley
Dave Hardy	HSAL
Noah Brotman	HSAL

Public Liaison Committee Meeting #1 - Notes

MEETING PURPOSE: To introduce the Project and the Project Team and to outline how the PLC will function and what the expectations will be of participants.

MEETING AGENDA

1. **Welcome Remarks**

   Remarks by Mayor Alls

2. **Chair's Remarks**

   Explain the role of the Chair

   Describe what we hope to get out of this meeting

3. **Introductions**

   Public Liaison Committee (PLC)

   Project Team

4. **Review of the PLC Terms of Reference**

5. **Presentation – Part 1: Project Overview**

   Background and Context

   Project Goals and Approach

   Challenges and Opportunities

6. **Discussion – Part 1 – EA Process, Technical Issues**

7. **Presentation – Part 2: Consultation and Communications**

   Consultation Objectives

   Consultation and Communications Approaches

   Phases of the consultation program

8. **Discussion – Part 2 – Consultation and Communications**

9. **Next Meeting**

   October 2016

   Topics: Summary of Environmental Baseline and Wastewater System

10. **Adjournment**

Public Liaison Committee Meeting #1 - Notes

Welcome Remarks

The meeting started with a welcome from Mayor Allan Alls and an introduction from Dave Hardy (PLC Chair), providing a brief overview of the agenda for the first PLC meeting. The role of the PLC Chair was described, the agenda for the meeting was reviewed.

Introductions

PLC members were then asked to introduce themselves, as well as any organizations that they were there to represent. The Project Team was then introduced and the roles of each member were explained.

Review of PLC Terms of Reference

PLC members were walked through a review of the PLC Terms of Reference in order to ensure that everyone is clear on the responsibilities and requirements of taking part in the committee. PLC member were given an opportunity to ask questions about the PLC setup and how it would function.

PLC Questions

- Will all PLC member questions be captured?
    - Answer: Yes, all questions will be captured. However, the names of question askers will not be recorded in order to ensure privacy and that PLC member are able to comfortably ask questions and make comments.
- Will the notes be posted online?
    - Answer: Yes, all PLC meeting notes will be posted on the Town of Erin website in the 'Wastewater Environmental Assessment' section under the 'Town Hall' tab. We will get the notes out as quickly as possible after the meetings.
- Is this an official town committee?
    - Answer: Yes, it is an official committee and will be open to the public.
- Given that the closing date of the project is in 2018, how many PLC meetings will there be?
    - Answer: We are anticipating five PLC meetings.

- What would happen if we feel there is a need for more PLC meetings?
    - Answer: The number of meetings was generally determined by the requirements of the EA process. If more meetings are required due to circumstances of the process, we are able to add additional meetings. However, at this time we don't anticipate a need for additional meetings.
- How do we get in contact with the project team if we have questions?
    - Answer: A general project email has been set up for all project related emails. If you send a question through that, the project team will ensure that it gets to the right person for a response. The email address is: erin.urban.classea@ainleygroup.com

Following the question period, the Terms of Reference were accepted by all PLC members with no objections or issues.

Project Overview

Gary Scott (Ainley) gave a presentation providing an overview of the project, including:

- A review of the work completed to this point through the Erin Servicing and Settlement Master Plan (SSMP);
- Description of baseline conditions study work that has already been initiated;
- A summary of key high level consideration for the project as a whole;
- Highlights of the work plan, detailing the three phases of the project and the specific pieces of work that are intended to occur in each.
- An outline of the standard Municipal Class Environmental Assessment (Class EA) system and where this project currently sits in that process.

Following this presentation, PLC members were invited to ask questions regarding the overall project, technical considerations, the EA process,

PLC Questions

- What does "SPS" stand for?
    - Answer: Sewage pumping station.
- Has the assimilative capacity of the West Credit River been determined by the Credit Valley Conservation Authority (CVC)?

- Answer: Yes, the SSMP included a preliminary assimilative capacity study that was reviewed by the CVC and Ministry of Environment and Climate Change (MOECC). However, the study is being revisited to take a more detailed look in order to confirm the previous findings. As well, we are already working with the CVC and MOECC on this project and they are also bringing some new information to the table that they didn't have at the time when the SSMP was being done. An important part of the early steps of this project is the process of tweaking and adjusting the previous findings with the most up-to-date information before we go forward.

- Do you expect that effluent numbers have gone up or down since the SSMP?
  - Answer: Based on meetings with CVC and MOECC, it is the Project Team's understanding that the river low flow statistics are going to be close to the original numbers, but confirming this is important.
- Have flow rates changed since the SSMP?
  - Answer: The Conservation Authority has been collecting more flow data, so we do have their updated numbers on that.
- So our growth is determined by the allowable effluent levels?
  - Answer: Yes, that's correct. We will actually be looking at the maximum capacity of the river and working backwards. Also, we're considering that some of the septic systems in certain areas may not need to be serviced. We are revaluating effluent limits and growth numbers in light of that.
- Will the assimilative capacity number be public?
  - Answer: Once we finish the report, it will go to the Core Management Team (CMT) for comment, then to the PLC, then ultimately to the general public.
- Going through the CVC, when would the assimilative capacity number be made public?
  - Answer: We still have some work to do on this and are expecting PLC members to see the numbers at some time in September in advance of our next PLC meeting.

- Are you going to be looking at alternative methods like the small bore sewers? Are you considering alternative collection systems?
  - Answer: Yes, we will be considering a number of alternative technologies. As soon as we determine which properties are in or out of the collection system, we will start looking at the potential technical solutions. It may be a mix of potential solutions.
- Would it be helpful if we had an overview of the SSMP report? Would that help at all?
  - Answer: The feedback that we got coming into this is that the SSMP process took a long time and was a bit painful, so we would prefer to move forward rather than dwell on previous battles.
  - A PLC member commented that maybe the way to do it would be to bring forward an overview of the recommendations of the SSMP.
  - Answer: Actually there is already a brief overview provided in the Fact Sheet prepared for this project which can be found on the project webpage. The fact sheet is attached to these minutes as well.
- Once the assimilative capacity study has been completed, will there be an opportunity for public comment?
  - Answer: Yes there will be. The study will be seen first by the CMT, then the PLC, then general public. Comments from all will be considered.
- Does this project and this committee have a way to look at the impact on local businesses should the treatment plant be put in? Does this committee have a chance to look at what the impact would be?
  - Answer: That will come with the socio-economic effects study and will certainly be reviewed by the PLC when it has been completed. The project team will seek to acknowledge and mitigate the potential impacts, but large infrastructure projects of this kind are likely to require some road work down Main Street that would have impacts. We will be seeking advice from the PLC on how best to mitigate any negative impacts and to identify sensitive users.
- Is there going to be information made available to the PLC or the public about existing septic systems and potential replacements.

- Answer: That is actually something we are working on right now. We are trying to get an age profile and conditions profile together. That study is being done and should be ready by the fall.

- How are you doing that study?
  - Answer: We actually found a lot of information through the building department. We originally were going to have to go out and look at each system, but the information has been quite good, so it has shifted from an observational study to a more analytical one. We will also be looking for feedback from residents and local experts in reviewing the septic study.
  - A PLC member suggested that any time work is done on a septic system, there should be some kind of reporting to the town about conditions.
- Have hydrology reports been looked at to take into account the abundance of springs? Some properties will be dry, while others right across the street will have their sump pumps going all year round.
  - Answer: We will definitely take a look at that. Thank you for the suggestion.
- PLC members were asked if there are any opportunities that the project team should be sure to take advantage of?
  - A number of answers were given:
  - There are fantastic technologies out there. If we're looking for something to be proud of, there are a lot of interesting opportunities here in regards to cost recovery.
  - Ideally we would like to have a planning led approach. What we found in the SSMP was that the Erin Official Plan defined some growth areas that present some challenges and opportunities for the implementation of the wastewater system.
  - There is an existing divide between the preference of residents and the push for new growth. There is an opportunity here to discuss how best to grow and develop Erin.

Consultation and Communications

Dave Hardy provided an overview of the consultation and communications approach for the project, including discussing: consultation objectives; consultation and communications approaches; and outlining the phases of the consultation program.

PLC Questions

- There is an average of 5-6 months between meetings of this committee. That is a long time. Is there any way you could communicate with us between those meetings to keep updates going?
  - Answer: There are many ways to do that, including updates on the website and direct PLC member updates. What did you have in mind?
  - A PLC member pointed out that it will be difficult to give a well-informed opinion if we're only seeing details every few months. Even just doing a very advanced agenda with notes would give PLC member something to think about would be helpful. The PLC on the SSMP project basically ended up coming to meetings, listening to the consultant speak, and then everyone walked away. There was no dialogue. There was no engagement. There needs to be ample time to comment and we should consider more meetings.
  - Answer: We see this as an ongoing process that doesn't stop when we leave the room. If a report is released in September, the discussion is not cut off and the door is not closed on comments until the PLC have had their opportunity to provide feedback. That feedback is essential to our success and we would not proceed without it. Our goal will be to get reports and meeting agendas to the PLC as early as possible to allow for ample review time. As well, Council updates will be occurring once per month, so some of the information will be trickling out through them. We can ensure that any updates provided to Council will also be circulated to PLC members. Also, if there are any comments or questions, the project email address will remain open throughout the project.
- The CMT meetings that precede the PLC meetings, is there a reason why they're at the same time, or could they be a week or two before PLC meetings?
  - Answer: We will take a look as a team and see what can be done.

- If I email the project email address and get a detailed answer, how can we be sure that those answers will get out to other PLC members?
    - Answer: In other projects we have sent out answers to all PLC members, or maintained a questions section on the website.
- When we're looking at alternative systems, how will that work?
    - Answer: We will develop a set of evaluation criteria and rank each alternative against each other. We will need to talk to some of the vendors to get additional information, but we are familiar with many types of systems through previous experience. If you have any additional information or specific people to speak to we would love to hear it.
- Will the evaluation be traceable or subjective?
    - Answer: We strive to make it all traceable, but some factors do end up being subjective. Getting input from the PLC will be key here. We will probably end up needing a primer on evaluation methodology so that everyone understands how the decision making will work.
- Erin is a clean palette. We can do whatever we want. We should be open to considering non-standard methods that are progressive, innovative, and economically feasible. If it's just a big pipe tearing up roads, it will be too expensive.
    - Answer: That kind of issue will be covered in the next PLC meeting so there will certainly be an opportunity to discuss it.
- What experience do you have with communities that don't have any infrastructure? You've basically got a greenfield here.
    - Answer: Ainley has implemented the wastewater systems for both Wasaga Beach and Innisfil, which were both designed and developed from scratch with no sewer or water systems in place prior to the projects.
- PLC members were asked to suggest organizations that may be helpful in getting the word out to the people in the community. The following responses were given:
    - BIA; Rotary Club; various service groups; Agricultural Society; Optimists Club; Lions; Masons; and School.

  - The suggestion was made that some of these organizations might be interested in hearing about the project at one of their meetings.
- A PLC member pointed out that social media use is big in Erin, with Facebook tending to be the most popular forum. It was also suggested that the local radio station would be happy to provide regular project updates.
- A PLC member agreed that roadside signage for public events would be a very effective means of getting the word out.
- A PLC member pointed out that when we get down to alternatives and possibilities, there are mostly people around the table who are not experts on wastewater systems. At some point the project team might want to consider some educational materials or additional meetings where people can learn in more detail about some of the technical considerations.
- There is a general summary of wastewater collection and treatment technologies in the SSMP.
- A PLC member suggested that even sending out links to informational Youtube videos would be a helpful learning opportunity.
- A PLC member suggested having a glossary of terms and a list of acronyms available on the website.

Final Comments

- More information shared in advance and communicated in ways that the public can easily access would be great.
- Everyone's main concern is going to be cost. This is going to be a major issue. We *have* to afford it. If we don't do something quick, we won't have a Town of Erin. And people do want to see new ideas and not old stock.
- Mayor: One of the reasons we hired Ainley is that we felt they would be much more open to feedback and brining the community into the conversations.
- Happy to see there is a lot of public consultation because there are lot of people in Erin who are interested in this and want to have their voices heard.
- Many things for the SSMP were very last minute.
- We need to be *better* than other towns. We need to be forward thinking and innovative.

6.
PLC 2 – Meeting Notes

Public Liaison Committee Meeting #2 - Notes

PROJECT: Town of Erin: Urban Centre Wastewater
Municipal Class Environmental Assessment (EA)

DATE: November 24, 2016

LOCATION: Town of Erin Municipal Office

TIME: 7:00 p.m. – 9:00 p.m.

ATTENDEES:

PLC members	Organization
Allan Alls	Mayor
Dave Doan	SeptTechWastewater Group
Jamie Cheyne	Heritage Committee and Economic Development, Erin Agricultural Society
Derek McCaughan	Interim Chief Administrative Officer
Dianna Mckay	General public
Jay Mowat	Environment Committee
Justin Morrow	Copper Hills Development
Linda Rosier	General public
Lloyd Turbitt	Let's Get Hillsburgh Growing Committee
Maurizio Rogato	Solmar
Melodie Rose	Riverwalk trails committee
Nancy Shoemaker	Black, Shoemaker, Robinson and Donaldson Limited (Lawyer for Tavares Group)
Roy Val	General public
Valerie Bozanis	General public
Project Team	
Christine Furlong	Triton Engineering
Joe Mullan	Ainley Group
Gary Scott	Ainley Group
Neil Hutchinson	Hutchinson Environmental Sciences
Dave Hardy	HSAL
Noah Brotman	HSAL

Public Liaison Committee Meeting #2 - Notes

MEETING PURPOSE: To review and discuss findings from the technical studies that have been completed to date

MEETING AGENDA

1. **Welcome Remarks**

   Remarks by Mayor Alls

2. **Chair's Remarks**

   Welcome PLC members

   Review Agenda

3. **Assimilative Capacity Study**

   Presentation by Hutchinson Environmental Sciences

   Discussion of Findings and Implications for the Project

4. **Septic System Survey Results**

   Presentation by Ainley Group

   Discussion of Findings and Implications for the Project

5. **Flows and Service Population**

   Presentation by Ainley Group

   Discussion of Findings and Implications for the Project

6. **Next Steps**

7. **Adjournment**

Public Liaison Committee Meeting #2 - Notes

Welcome Remarks

The meeting started with a brief welcome from Mayor Allan Alls and an introduction from Dave Hardy (PLC Chair), providing a brief overview of the agenda for the second PLC meeting. It was noted that there was quite a bit of detailed material to go through together, so the meeting would be broken up into three presentations, with Q&A and discussion time following each presentation. As well, it was expressed that, if necessary, an additional PLC meeting could be arranged early in the new year to continue the discussion and to provide input for the Public Information Centre.

Introductions

The Project Team and PLC members were then asked to briefly introduce themselves, as well as any organizations that they were there to represent.

Project Update

Dave Hardy provided an update of the work completed over the summer since the last PLC meeting. The field studies were described, as well as the process to complete draft reports, receive comments from the Ministry of Environmental and Climate Change (MOECC) and from Credit Valley Conservation (CVC), and finalize the reports for public release. Mr. Hardy noted that MOECC and CVC have a large influence over decisions at this stage of the project.

Presentation: Assimilative Capacity Study

Neil Hutchinson (Hutchinson Environmental) presented the Assimilative Capacity Study (ACS). He stated that the purpose of the study is to understand how the river will deal with the treated effluent. He explained how the level of allowable effluent release would be influenced by factors such as the river's flow rate, flow volume, water quality and sensitive aquatic communities. The field studies undertaken during the summer were described in detail, including the involvement of CVC in the process.

The general findings were described, including, there is very good water quality in the river between 10th Line and Winston Churchill with a low concentration of nutrients and algae. Phosphorus, ammonia, and nitrites are critical elements to consider. The field studies completed below Erin Village show that the phosphorus level is low and well below Provincial standards.

The rhodamine dye test to determine river flow rate was explained. Water quality modelling using the CORMIX and QUAL2K models was explained. Allowable effluent concentration was explained.

ACS Q&A and Discussion

Q: The ACS from B.M. Ross was peer reviewed by Ray Blackport. Are we looking to have this study peer reviewed as well?

Ray Blackport is actually part of this project team and has been working with the CVC to help reach the low flow value.

Q: We have spent a lot of money on studies up to this point. How did we get from B.M. Ross's results to this?

One of the main differences between the findings from B.M. Ross and the new findings is that a higher concentration of effluent phosphorus in the river is now suggested.

Q: Does this phosphorus limit represent the "worst" possible scenario?

The limit indicated is the amount of phosphorus that the treatment facility will not be permitted to exceed.

Q: The 2014 Sewer Servicing Master Plan (SSMP) identified a 7Q20 of 210 and now you're saying 225. Could you explain the difference?

The project team explained that the "7Q20" is the 7-day lowest flow rate over a 20-year period. It was explained that the primary difference between the 7Q20 rates is the inclusion of two more years of flow rate data. B.M. Ross had to use projections and standard ratios, but a flow monitoring gauge placed at 10th Line has given real data and allowed for a more accurate projection.

A PLC member asked that this be made clear in the report and when presented to the community.

Q: How can the B.M. Ross report and this report both claim to use "best available technologies" if there are differences in effluent treatment levels? If the study results are going to allow growth to 15,000 people, that will be the headline of any public meeting.

Another PLC member responded that the cost to treat effluent is directly relatable to how many people the system serves. When people say best available technology there is still the question of what is economically achievable.

The project team added that best available technology changes with time. The last ten years has seen development of a number of new treatment technologies and a 0.07 effluent limit has become a common industry practice.

It was also noted that the effluent limits are only one part of the decision to grow the community. While the allowable effluent level and level of treatment set the potential limits of the overall population, the decision on how much to grow is a planning and strategic decision that rests in the Official Plan process that will occur outside the scope of this study.

Q: In 1991-1993 there were tests done on the West Credit River and the water quality was really bad, specifically regarding Pseudomonas bacteria. Has there ever been updated tests for this?

The PLC member indicated that CVC had provided her with the studies at the time and she would be happy to share. The project team responded that they would be happy to look at those studies if provided.

Q: During the 2014 SSMP process it was stated that Ontario communities recommend the assumption of a 10% reduction of flow because of climate change. Why would we not do 15% just to be on the conservative side?

The project team explained that the 7Q20 of 225 is a calculation done by CVC and the 7Q20 flow statistics is set by the MOECC and not by this team. As well, to give some context, the summer of 2016 was an extremely dry one and during that time the lowest flow recorded was 305, meaning that the 7Q20 of 225 calculated by the CVC is being conservative.

Q: Did we want to address the reduction in precipitation that the area has seen over the last few years? There has been an increasing number of heat advisories and 2016 was the hottest year ever.

Interestingly, the precipitation being low this year actually didn't manifest in a lower flow. In fact, there is a 20% increase in flow between 10th Line and Winston Churchill, indicating that local water springs are adding significantly to the river flow.

A PLC member suggested that the proposed expansion of the gravel pit in the area may have an impact on the water table and how that could impact flows may need to be considered.

Presentation: Septic System Survey

Gary Scott (Ainley Group) presented the results of the Septic System Survey. It was explained, when you design a communal sewage system for an area you don't design for what is currently there, but for what could potentially be built in the area as well. There is a need to account for all potential properties in the area.

The approach taken for the Septic System Survey was described. The approach taken was to define logical groupings of homes and businesses into servicing areas that would allow for decisions to be made based on the overall characteristics of the zone. For example, if a zone has numerous small properties that are unable to put in new septic tanks it would likely be recommended for inclusion in the wastewater system. However, an area with larger properties or undeveloped lots could stay on septic systems and perhaps have their zone connected at a later stage.

An example map of one zone was reviewed and the decision criteria used were briefly discussed. PLC members were invited to take time over the next few weeks to review the zone maps in the completed reports and to provide comments.

Q: Why would the age of a septic system be important? Shouldn't they be able to operate forever if properly maintained?

Septic systems can fail for a number of reasons. Even if maintained in very good working order, the concrete itself and the structural integrity of the tank can degrade over time. Disposal beds can become blocked over time. As well, not all septic systems are properly maintained.

Q: If a holding tank on Main St. breaks, what does the building code say about that? What do they replace it with?

The building code states that new holding tanks would not normally be allowed, however it would be allowed it if there are no other possible solutions.

Q: There was a mention made of nitrate concentrations being elevated at Winston Churchill Blvd. That was when they were dropping whey on the field. Would that have any effect on the nitrates?

This is a good and interesting question but we don't not enough about dairy wastes to respond at this time.

Q: You have prepared this detailed maps from the Town GIS. Are we able to access those?

We are not sure if the maps can be shared due to privacy concerns. We will look into whether the release of that information is possible.

Q: During the SSMP it was brought up that there might be two different ways of treating houses in town (some septic, some communal). This would create two classes of houses. There will be a question from people of "why aren't I a part of this?" and "how much will it cost to hook up this area?".

It is important that people understand that if a decision is made not to connect a zone to the communal system, that a compelling reason to connect the area has not been identified.

Q: There's some wonderful decentralized systems that we should be looking at before I can concur with the area recommendations.

The project team responded that the Terms of Reference for this project was to refine the servicing areas identified in the SSMP and to move on to the treatment approach. Reassessing the base findings of the SSMP was not a part of this project.

A PLC member stated that their understanding is that the mandate is for one facility for both communities and that this decision was no longer on the table.

A PLC member suggested that decentralized systems could deal with the industrial area or certain residential spots.

The project team stressed that we are now past that stage of decision and it is no longer in the scope of work to consider decentralized systems.

Q: You have indicated that you will be looking at alternatives in Phase 3. I assume we will be looking at decentralized systems at that point.

Phase 3 will focus on different treatment technologies that are options for a centralized treatment system. Decentralized systems will not be considered.

A PLC member noted that this was an issue for years in the SSMP and they said someone would look at alternative non-centralized systems. They said that someone would be looking at that in the EA study. But you seem to be under the assumption that this is settled.

The project team clarified that the SSMP concluded that there would be a single municipal treatment plant. The Terms of Reference for this team was to look at a centralized treatment system with collection and treatment alternatives. The CVC has said that the discharge for a centralized facility must be located between Winston Churchill Blvd. and 10th Line.

A PLC member asked to see the Terms of Reference and it was indicted that this could be put up on the project website.

The PLC member thought this meant alternative decentralized systems would be considered, rather than alternative technologies in a centralized system. At this point a conversation ensued between several PLC members and the project team to determine how this difference of understanding could have occurred. Ultimately it was identified that there was a misunderstanding of what was meant by “alternatives”.

Q: In the core area, were you able to figure out the density and average plot sizes?

Yes.

Q: Regarding the building code and outdated septic tanks, how would you know that a tank is out of code?

A PLC member responded that any septic tank installed before 2012 would be out of code.

The project team explained that if a landowner went to get a permit to replace the tank it would have to be brought up to the latest Building Code standard.

Q: What will happen if someone has spent money on a tertiary system or their septic system is working well?

When an EA is completed a municipality typically passes a bylaw that says everyone will have to connect. There can be phasing done but they eventually will have to a connect to a communal system.

Q: What is the current timeline for when all rural properties will need to have a mandatory septic inspection?

The regulation requiring that has been passed by the Town and they are now in the process of implementation and inspection for compliance are expected to occur over the next few years.

Presentation: Flows and Population Projections

Joe Mullan (Ainley Group) presented on flows and population projections. It is explained that part of the purpose of this study is to identify what effluent flow is possible given the river condition and treatment technology. The Official Plan process will be where the actual growth decisions are made. That process is separate and will be run by the Town and the County.

It was also explained that part of this teams mandate is to reevaluate, not redo Phase 2 before moving on to Phase 3 and 4, which is one of the key differences from the B.M. Ross report.

The current population and wastewater flows were presented. The potential populations that would be possible with various treatment levels were presented. The new growth areas of both Erin and Hillsburgh were described. Observations and preliminary recommendations were reviewed.

Q: If we build a facility for 10,000 people, could we still restrict growth and keep the population at 6,000? How would that impact the cost per person?

The result would be a much higher expense per person. There is some staging possible but there would be no reason to overbuild if you are not intending to grow.

Comment: Mayor Als commented that this is just technology. It has nothing to do with population levels the Town decides to achieve. The Town will be initiating a process to discuss population growth in 2017. The wastewater EA will not make the decision about how much we grow. Also, at this point we should really be starting to move beyond discussing the SSMP. Those decisions have been made and we need to move forward.

Comment: It would be helpful for the public meeting to come up with a simplified statement about the differences between the B.M. Ross study and this study in order to help differentiate.

Q: In order to achieve full buildout, we have to go with the best technology. Does anyone have any idea of the cost per year to service that?

That is a topic that we will be getting to in the new year.

A PLC member suggested that if we got to the public meeting and say that 15,000 people can now be accommodated then the first question will be how much will that cost. It will be viewed as suspicious if we don't have a number.

The project team responded that we are currently in the middle of the process and there is quite a bit more study to be done before we get to costing.

Q: Is the PIC in January premature if we don't have all the info?

One of the key focuses for the team on this project is to communicate with the public and to provide information in a timely and easy to understand way. We are going to be doing the PIC at this time so that we can familiarize people with what is happening early in the process. This will give people time to think about things, learn more about the process, and take the time to discuss and understand. If we just save everything up for a single meeting at the end it will be very challenging for people to engage and provide meaningful input. We are planning a second PIC at which costs and technologies will be discussed.

Q: Has this taken into account septage? Now septage must be sent to Collingwood so this could be a source of revenue.

Yes, septage has been taken into account and the treatment plant should be able to treat septage over and above the limit shown here.

Q: After treating septage would there still be biosolids to deal with? Has technology gotten to a point where there are beneficial uses for the biosolids?

There will be a biosolids management aspect to this and there are currently beneficial uses for biosolids. That is an aspect that will be considered later in the process, however the scale of the plant might mean that not enough biosolids are produced to provide a notable benefit.

Final Comments

PLC members were asked to provide final comments about their thoughts on the overall process

- It would be helpful to really make the point that planning is not done by pipe. You should show at the PIC how planning decisions are made.
- Much of this material will need to be made more easily digestible for the public.
- I applaud this team for this process. It is going much better than last time.
- I am still really concerned about what you'll do in terms of alternate technologies. If what you're saying is that the only option is a single treatment plant, then I am disappointed. There are plenty of other technologies that should be considered. I was at those B.M. Ross meetings and it was very clear that alternative technologies would be considered.
- Looking forward to see where we're going next because that is the guts of this process.
- Not being an engineer, I agree that it is disappointing that decentralized approaches are not going to be considered.
- I would like to see a little more study on the quality of the River.
- We should look at alternatives that cost less and are decentralized.
- People will be most interested in costs and what it means for development.
- I believe we could get Council to revise the Terms of Reference and look at two treatment plants.
- Why would the public want to look at alternative systems? Wouldn't the centralized system be the most economic way of doing this?

- This is going well and there has been lots of good discussion.
- There has been lots of great work done by the project team. This is a public process and people should engage with it and present other options to the team if they feel certain ideas have not had enough consideration.
- If I do some research and find some technologies I will send to the project team for their consideration.

7.
PLC 3 – Meeting Notes

Public Liaison Committee Meeting #3 - Notes

PROJECT: Town of Erin: Urban Centre Wastewater Municipal Class Environmental Assessment (EA)

DATE: June 7, 2017

LOCATION: Town of Erin Municipal Office

TIME: 7:00 p.m. – 9:00 p.m.

ATTENDEES:

PLC members	Organization
Allan Alls	Mayor
Valerie Bozanis	General public
Nathan Hyde	Chief Administrative Officer
Deanna McKay	General public
Jay Mowat	Environment and Sustainability Advisory Committee
Linda Rosier	General public
Lloyd Turbitt	Let's Get Hillsburgh Growing Committee
Maurizio Rogato	Solmar
Melodie Rose	Riverwalk trails committee
Nancy Shoemaker	Black, Shoemaker, Robinson and Donaldson Limited (Planner for Tavares Group)
Roy Val	General public
Project Team	
Christine Furlong	Triton Engineering
Joe Mullan	Ainley Group
Gary Scott	Ainley Group
Neil Hutchinson	Hutchinson Environmental Sciences
Deborah Sinclair	Hutchinson Environmental Sciences
Dave Hardy	Hardy Stevenson and Associates Limited
Noah Brotman	Hardy Stevenson and Associates Limited

Public Liaison Committee Meeting #3 - Notes

MEETING PURPOSE: To review and discuss findings from the technical studies that have been completed to date and to provide a preview of the Public Information Centre in June.

MEETING AGENDA

1. **Welcome Remarks**

   Remarks by Mayor Alls

2. **Chair's Remarks**

   Welcome PLC members

   Review Agenda

3. **Subsurface Disposal Alternative Technical Memo**

   Discussion of Findings and Implications for the Project

4. **Hillsburgh Surface Water Disposal Alternative Technical Memo**

   Discussion of Findings and Implications for the Project

5. **Preview of Public Information Centre**

6. **Next Steps**

7. **Adjournment**

Public Liaison Committee Meeting #3 - Notes

Welcome Remarks

The meeting started with a brief welcome from Mayor Allan Alls and an introduction from Dave Hardy (PLC Chair), providing a brief overview of the agenda for the third PLC meeting.

It was noted that there was quite a bit of detailed material to go through together, so the meeting would be broken up into three presentations, with Q&A and discussion time following each presentation. The first presentation was on the results of the study of the subsurface disposal alternative with a presentation by Gary Scott. The second topic focused on the investigation of a potential second treatment plant in Hillsburgh with a presentation by Joe Mullan. The third topic was a discussion about the upcoming Public Information Centre led by Dave Hardy.

Introductions

The Project Team and PLC members briefly introduced themselves, mentioning the organizations that they were there to represent. Nathan Hyde, the new CAO for the Town of Erin, was introduced to the PLC.

Presentation: Subsurface Disposal Alternative

Gary Scott presented the results of the investigation into a subsurface disposal alternative. The presentation started with a brief review of the background of the study, noting that it was the result of a request/suggestion made by PLC members. Following that request, Ainley Group met with members of Transition Erin to better understand their concerns. This resulted in taking a closer look at the Servicing and Settlement Master Plan (SSMP), from which Ainley determined that the possibility of subsurface disposal had not been adequately addressed in that study. The SSMP acknowledged the possibility but had left it as a recommendation for investigation in Phase 3. In order to be able to satisfactorily close out the Class EA, Ainley felt that it was important to investigate that alternative.

Once approved by Council, a study was undertaken to determine the viability of subsurface disposal. A technical memo was completed that looked at: government regulations on subsurface disposal; other locations in Ontario where comparable systems had been used; a calculation of the land area that would be required; a study of which areas in Erin could use subsurface disposal considering environmental constraints; a consideration of alternatives in Erin Village and Hillsburgh to consider viability; and, a general project of potential costs.

Gary then provide a few highlights of identified considerations that should be taken into account when considering the viability of subsurface disposal:

Government regulations

- Wastewater systems over $10m^3/d$ falls under MOECC jurisdiction and would require environmental compliance approval.
- Subsurface system effluent treatment requirements could be almost equivalent to the requirements of a surface water system.

- The systems being considered for Erin Village and Hillsburgh would need to meet this standard.
- The technical memo discusses and conceptually outlines the effluent requirements.
- It is noted that to fully define those effluent requirements there would need to be extensive hydrogeological and geological studies that could take years to do.
- The MOECC is generally getting stricter about requirements as they are increasingly of the opinion that the ground would be getting saturated with nitrates and phosphorus.
- Regulations on subsurface disposal could tighten in the future.

Other locations in Ontario

- Subsurface disposal is fairly common for rural subdivisions and facilities.
- Most subsurface systems are in situations where the developer/owner actually owns the land it is put on.
- In Erin, it would be imposing the system on private owners, which could cause a number of issues.
- An investigation was done into one specific system nearby that is already having issues leading to bed replacement. It was also noted that the cost per house of that system was around $21,000.
- If Erin were to do this, it would be the biggest system in Ontario.

Examination of land area

- Size of disposal beds required were calculated using MOECC guidelines.
- A service area of 58 hectares would be required to serve Erin Village and Hillsburgh.
- Due to a history of failure of these disposal beds, MOECC has been asking for additional disposal bed capacity.
- Erin Village and Hillsburgh have variable and undulating topographies with a lot of surface water drainage. Since any subsurface discharge requires a setback from surface water, this creates some limitations on potential locations for disposal beds.
- MOECC considers a 300m buffer as reasonable, with indications that they may increase the required buffer area in the future.

At this point Gary shared and explained the map of potential areas in Erin Village and Hillsburgh that could allow for subsurface disposal. It was shown that the possible areas are somewhat limited and that there would be a number of challenges for siting any subsurface disposal systems.

A general review of cost estimates for the various subsurface alternatives were described.

Given the findings in the Subsurface Disposal Alternative Technical Memo, both the MOECC and CVC recommended that subsurface disposal not be investigated further.

Subsurface Disposal Alternative Q&A and Discussion

Q: What is the equivalent number of households that would produce 80m^3/d of waste?

That would be the equivalent of around 80 homes. An explanation was provided of the usual waste numbers for standard homes.

Q: So the operation at Centre 2000 could service 70 to 80 homes?

Yes, though the system there has been having problems and they have had to add additional disposal bed capacity. If that were to occur on a full town scale in would be very problematic.

Q: I am aware of a subsurface system in the town of Mono and MOECC has required them to have a water source next to the system in case anything goes wrong.

We looked into that system in the report and noted that they have been having issues.

The project team would like to clarify that MOECC did not require a water source to be located next to the system. Since there was nowhere for the system to discharge to surface water, discharging into the ground was the only alternative.

Presentation: Two Treatment Plant Alternative Technical Memo

Joe Mullan presented the results of the investigation into the possibility of a second treatment plant and an additional surface water discharge site in Hillsburgh. It was noted that this alternative was not heavily discussed in the SSMP and that Council felt it was best to complete all the due diligence and investigate this option.

The SSMP collected and evaluated water quality and flow data on the West Credit River from Hillsburgh to south of Erin Village. From this data a discharge location was identified with support from MOECC and CVC and the study was then closed. At the start of this project, Ainley reviewed the data collected in the SSMP and found that there was not enough data to complete an Assimilative Capacity Study for discharge in Hillsburgh in order to understand the flows.

In order to collect the data required to properly determine the 7Q20 for the Hillsburgh area of the river, flow and water quality data would be required for at least 10 years of monitoring in order to meet MOECC and CVC data standards. Undertaking this investigation would mean a significant delay for the implementation of a communal wastewater system and would cost around $500,000. Most importantly, there would be no guarantees that the study would reach a positive result, meaning that 10 years of studies could be done and then the result could be that effluent discharge would not be allowed at that location.

High-level cost considerations comparing two plants versus one were then reviewed. Overall, the two-plant solution would end up costing more than a single treatment facility.

Due to the time, cost, and uncertainty of being able to implement a second treatment plant with MOECC and CVC approval, it is recommended to proceed with a one-plant solution.

Subsurface Disposal Alternative Q&A and Discussion

Q: I would like to see the cost numbers in today's dollars. How can the $60 million be the cost for just the one treatment plant?

That is the cost of the treatment plant for full buildout. It can be phased along the way to coincide with the actual population growth called for in the Official Plan.

Q: Is there somewhere where we have seen the number of properties that this effects?

We can express costs by the numbers per lot, but at this stage we usually look at it in terms of the number of people to be served by the system.

Q: People at the PIC are going to be asking about costs. How will that be addressed?

We will be making it clear that considering specific costs at this point is getting ahead of things in the process of the study. That is a topic for the next stage and we will assure everyone that we recognize that this is the topic of greatest concern for most residents and it will be covered in detail in the next PIC in November.

It will also be important to point out that the number of people for full buildout is being determined by Official Plan decisions. Those growth targets will have an impact on the associated costs for current residents.

Q: When we talk about two plants, are we talking about two surface plants? Did you consider the possibility of surface disposal in Erin Village with subsurface disposal in Hillsburgh?

Yes, we are talking about two surface plants. We did investigate the possibility of surface disposal in Erin Village with subsurface disposal in Hillsburgh and it was concluded that it would be a 12% increase in cost to do subsurface in Hillsburgh over piping into a single treatment plant in Erin Village.

Q: If you present these numbers at the PIC, shouldn't you include the costs of both the plant and the piping? This does not include the piping.

Good point. Collection system alternatives have not yet been evaluated and are going to be looked at in Phase 3 of the Class EA. For the next PIC, we should be able to present total costs including the plant and piping.

Q: There was some discussion of using the Cataract Trail as a possible avenue for connecting the sewage systems of the two villages. Has there been any further investigation into this?

There have been initial discussions with the CVC and they have indicated that they are open to considering this but nothing has proceeded on that topic yet.

Q: Are both of these reports on the Town's website?

The subsurface study is currently up on the Project's website. The treatment plant alternative memo will be up shortly.

Comment: People had a strong reaction about the cost numbers at the PIC for the SSMP. I suggest that the messaging be very carefully thought through with how the costs are presented to people because that has potential to scuttle the whole project?

Great point. We are very much aware of that concern and will be thinking carefully about how everything is presented.

Q: Is there a way to talk about the potential for Provincial and Federal funding to perhaps soften the blow for people?

Mayor Alls responded that it would be premature to discuss that possibility, but that he has had some initial conversations and would be following up with Provincial and Federal governments.

Q: Operational costs are estimated over how long? And is that listed in 2016 dollars or does it take into account inflation over time?

Those operational costs are for fifty years and are in 2016 dollars without inflation.

Comment: We will definitely want the collection costs to be included in this.

The collection costs will be included when we get into that topic at the next PLC and PIC.

Public Information Centre Preview

Joe Mullan started with an overview of the PIC and how it will be set up. The date, time, and location were discussed, with PLC members sharing thoughts about how best to structure the meeting. The format of the PIC was described, starting with an informal opportunity to see the display boards and speak with the Project Team, a formal presentation, and then a question and answer period for visitors to ask questions and share their thoughts. A description of the display boards was provided including what technical material will be presented.

Feedback provided by PLC members is depicted below, along with responses from the Project Team:

Comment: This is a commuting town and 6pm might be a bit early to start.

We are flexible on the timing and can start the presentation later if needed.

Comment: Sixty display boards is a lot of content and I recommend that you lower that number to something more manageable.

We will look into reducing the number of boards where possible.

Comment: The arena might be the wrong space. We have never had 250 people show up for anything at the SSMP. There is a lot of echo and I would recommend doing it

somewhere else.

Thank you for the comment. At this point we are committed to the location, but will have an audio system there that will reduce echo as much as possible.

Comment: Maybe some consideration should be given to a more open house format with less of a focus on a formal presentation. Presentations can get complex or boring. Q&A periods can become an opportunity for people to grandstand and maybe isn't needed.

Thank you for your comment. We will consider that possibility.

Comment: The Project Team should be easily identifiable.

A Project Team members will have name tags for easy identification.

Comment: If you were to use a projector for the boards instead of printing they could be much larger and more people would be able to see them at once.

We will be using a projector for the presentation, but for the boards that would mean that people could only see one slide at a time and might not focus on the topics that most concern them.

Comment: I think that you could get a lot of traction with people if you can show images of what the actual treatment plant would look like.

Comment: Lots of people won't be able to understand the language being used. You need to do as much as you can to make the language easily understood by everyone.

This is definitely a focus for us. It will need to be a careful balance between helping people understand through simple language and using technical accurate terms to avoid later confusion.

Comment: Who will chair the Q&A?

Dave Hardy will be the chair.

Comment: We have had bad experiences with outside facilitators. Tricky to have someone from outside the town to do this. You should consider having someone from the Town do it.

Comment: One of the major questions you will face is that the SSMP estimated river capacity at 6000 people and now you're saying it can be 14,500. There needs to be a simple and succinct answer to how this is possible.

Thank you for the comment. We will do our best to explain to people how our improved understanding of the flows and water quality of the river, as well as using best available treatment technology.

Comment: I didn't realize that there was an actual Phase 4 to this process. It would be good if one of the boards said what the next two phases are and what they will be dealing with.

Need to be clear on that.

Comment: What's the presentation going to be? Is it simply going to be a reiteration of the boards? Some of the best presentation we've had have not had any words in the display. There's pictures to connect with what you're saying, but there's no need for words in the PowerPoint. The words are already on the display boards, there is no need for them in the presentation.

Comment: You've got to try to dumb it down. No disrespect to anyone, but they just want to come and easily understand, and you have maybe fifteen minutes before they lose interest.

Comment: I suggest that you keep the presentation to 30 minutes with a one hour Q&A period. At the SSMP the presentation went for over an hour and it annoyed everyone.

We will consider shifting time from the presentation to display board meeting and greet at the start of the event so that people can speak directly with the Project Team for more time.

Comment: The Q&A should be documented somehow.

We will be taking detailed notes and there will be a PIC consultation report produced.

Comment: If we advertise the meeting we might want to have it say why it's happening and what people will get out of the meeting.

The Mayor responded that this was a great idea and that he would write a piece for the newspapers to publish.

Final Comments

PLC members were asked to provide final comments on the overall process

- Strongly suggest to cut down the number of display boards.
- Council should look to senior levels of government for funding and to work with developers to make it affordable for the average person.
- This is very important and pertinent material and we want it to be received positively by the public. So pictures, and bullet points, and simple language will be important.
- The two reports discussed today were very helpful and answered a lot of our questions.
- I think that there is a lot of misinformation in the community about this. I don't think that the website and the information coming out of Council has told the story well. I think that people will have a lot of misconceptions and they're going to take small pieces of what you're presenting and they're going to run with it. Be ready to correct a lot of misconceptions.

8.
PIC 1 – Project Backgrounder

June 13th, 2017

Backgrounder

Wastewater Public Information Centre

- The Class Environmental Assessment (Class EA) process for wastewater projects in Ontario is a five phased process. The Settlement Servicing Master Plan (SSMP) completed Phase 1 (problem definition) and part of Phase 2 which identifies the recommended overall general alternative solution to the problem. For the past year the team has been busy closing out Phase 2.

- The focus of the work by the consultants over the last year has been to study the conditions of the West Credit River in order to determine whether it can support a municipal wastewater system for the existing community and to allow for future growth. It has been found that the river can support growth up to a population above 14,500 which is in line with the present Official Plan growth allocations. As well recommendations have been made as to what areas should be serviced by the municipal system to support the existing community and potential growth areas.

- Following the June 22nd Public Information Centre (PIC) meeting and subject to comments received, the team will move forward with Phase 3. Phase 3 looks at more detailed design alternatives for the recommended general alternative identified in Phase 2. They will be looking at what type of sewage collection system the Town should have and what type of treatment the Town should have for the treatment plant. The preferred location of the plant and the discharge location to the river and the location of any pumping stations, will all be developed in the coming months and presented at the next Public Information Centre.

- Financial impacts from the recommended preferred solution will be available at the next meeting in the fall.

- The target for completion of the project is anticipated to be Spring – 2018.

For more information: Nathan Hyde, CAO – Town of Erin. 519.855.4407.

Nathan.Hyde@Erin.ca.

9.
PIC 1 – Media Advisory

June 13th, 2017

MEDIA ADVISORY

What: Public Information Centre to discuss the Town's Wastewater Servicing Environmental Assessment that is currently underway

When: June 22nd, doors open at 6:00pm with an opportunity for informal questions and answers. Formal presentation begins at 7:30pm, to be followed by a formal question and answer period at 8:00pm.

Where: Centre 2000 Community Centre (on the ice rink), 14 Boland Drive, Erin, ON.

Details: This is an opportunity for the media and community to learn more about the current Wastewater study and ask the Project Team questions. Residents will have an opportunity to ask detailed questions about the work completed thus far, and learn what steps are left to be completed. The work currently underway is the latest step in a process that started years ago with the development of the Settlement and Servicing Master Plan (SSMP) and is now continuing with the present team to complete the Class Environmental Assessment process.

For more information: Nathan Hyde, CAO – Town of Erin. 519.855.4407.
Nathan.Hyde@Erin.ca.

10.
PIC 1 – Presentation Boards

Public Information Centre

WELCOME

Town of Erin – Urban Centre

Wastewater Servicing Class EA

TOWN OF ERIN

Class Environmental Assessment Phases 3 & 4

Ainley GROUP CONSULTING ENGINEERS PLANNERS

Date: June 22, 2017

Presentation Agenda

1. Welcome and Introductions
2. Meeting Courtesies
3. Purpose of PIC & Project Background
4. Refresher on the Servicing and Settlement Master Plan (SSMP)
5. Update on Assimilative Capacity Study (ACS) and confirmed effluent objectives for the discharge to the West Credit River at 10th Line;
6. Overview of the existing Septic System Review and identified areas that should be connected to the Municipal Wastewater system;
7. Overview of the Potential Populations and Wastewater Flows for each Community, based on updated ACS and new effluent criteria;
8. Overview of the Assessment for Two Wastewater Treatment Plant discharge locations;
9. Overview of the Assessment for Large Subsurface Disposal Systems.
10. Next Steps & Schedule

Project Team

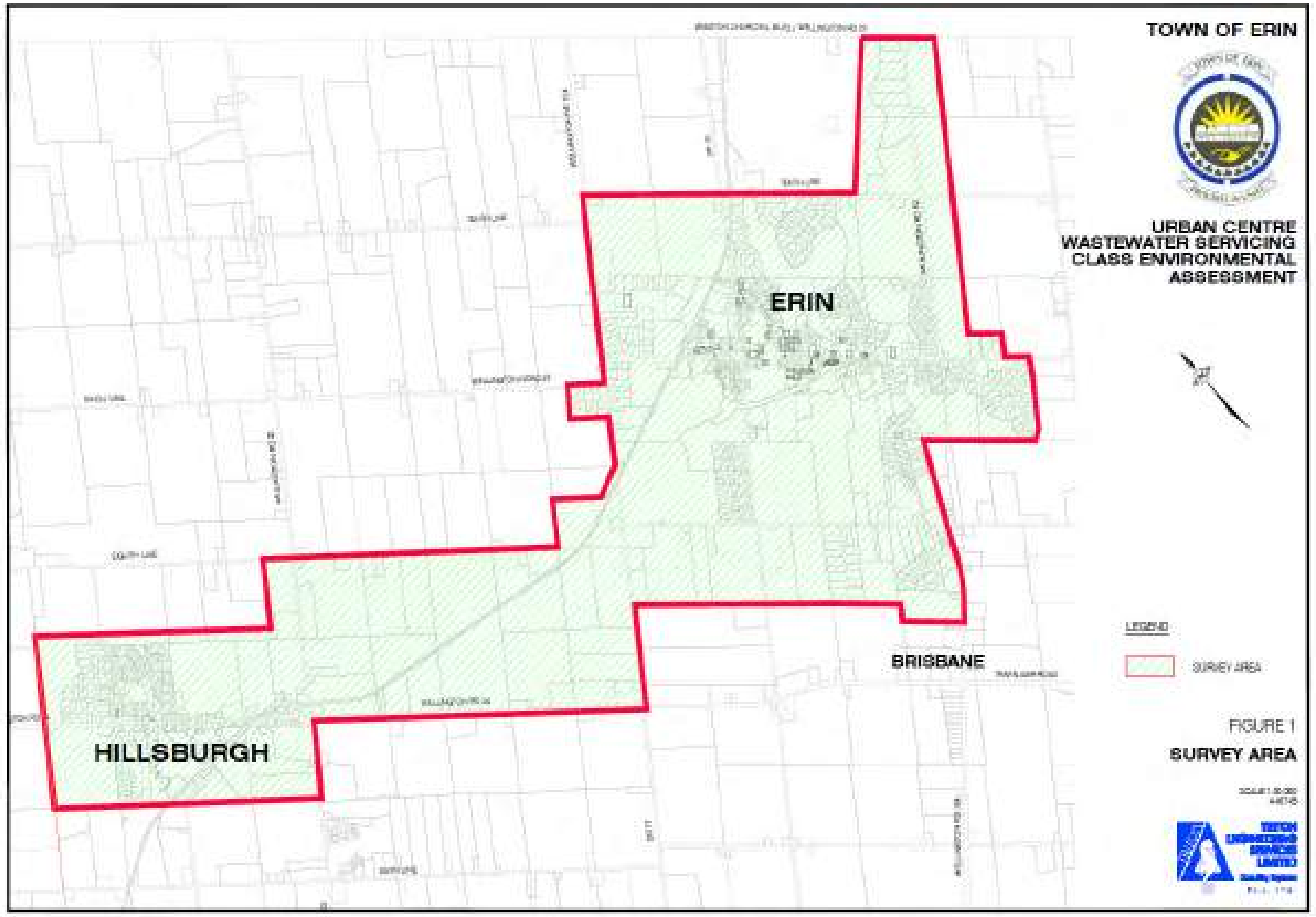
Triton Engineering Services Limited, Consulting Engineers	Christine Furlong	Town's Project Manager
Ainley Group, Consulting Engineers Planners	Joe Mullan	Overall Project Manager
	Gary Scott	Technical Team Lead
	Simon Glass	Technical Support
Hardy Stevenson and Associates	Dave Hardy	Consultation Lead
	Noah Brotman	Consultation Support
Hutchinson Environmental Sciences Ltd	Neil Hutchinson	Natural Sciences Advisor
	Deborah Sinclair	Senior Aquatic Scientist

Meeting Courtesies

- Speaking
- Listening
- Jargon
- Note taking
- All views welcome
- Polite language
- Sharing time
- Speak into the microphone
- Safety

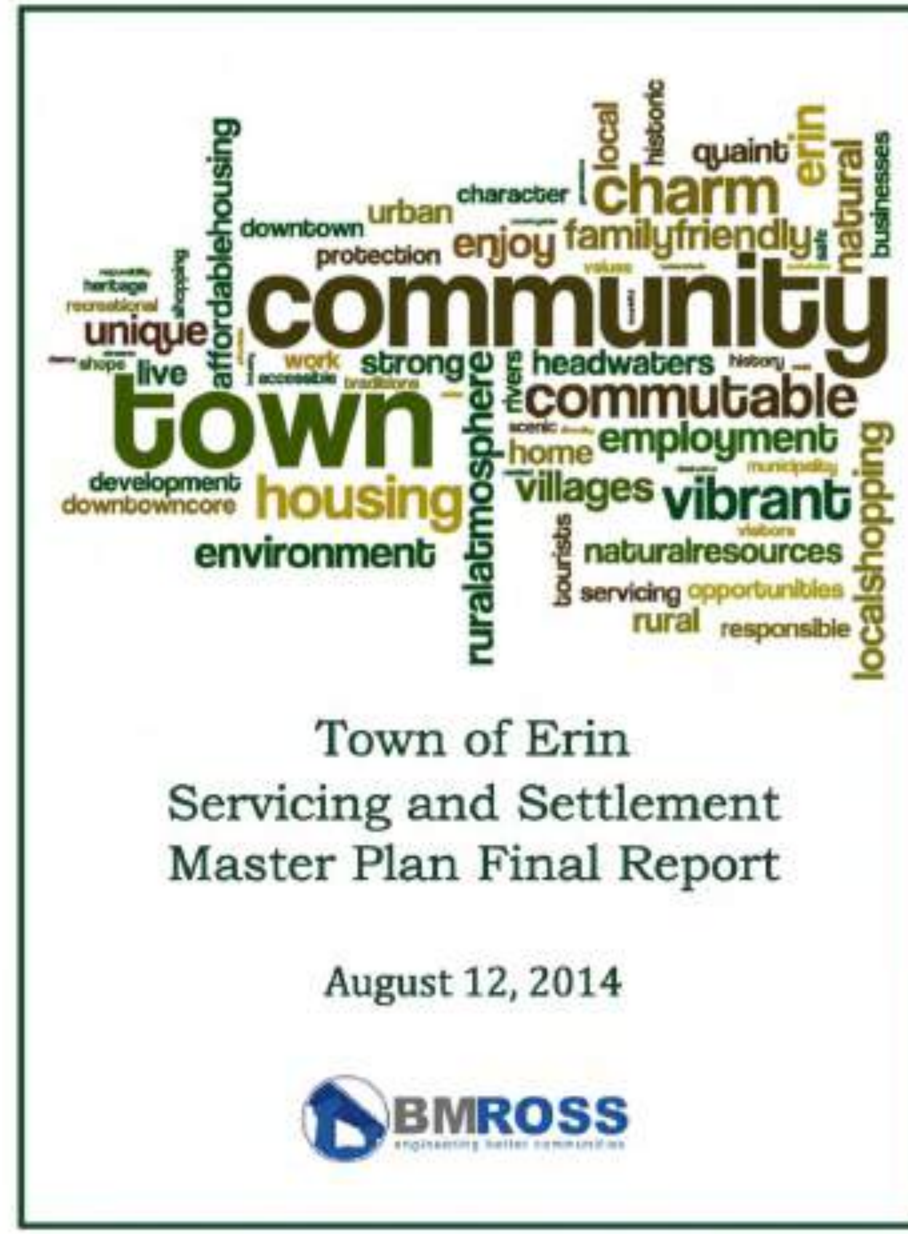
Purpose of today's Public Information Centre (PIC)

- To provide an overview of the Urban Centre Wastewater Servicing EA
- To outline changes since the SSMP was completed in 2014
- To present project findings and receive comments on the various Technical Reports, completed to date
- To highlight next steps and the proposed schedule



Servicing and Settlement Master Plan (SSMP)

- In 2014 B.M. Ross completed the Servicing and Settlement Master Plan (SSMP). The SSMP completed Phase 1 and part of Phase 2 of the Class Environmental Assessment process.
- SSMP concluded that the Town should proceed with planning for a municipal wastewater system for both communities.
- SSMP identified a Preferred alternative as a single Wastewater Treatment Plant with effluent discharge to the West Credit River, between 10th Line and Winston Churchill Boulevard.
- SSMP identified a potential buildout population of 6,000



Town of Erin
Servicing and Settlement Master Plan Final Report

August 12, 2014

BMROSS

Assimilative Capacity Study (ACS) Update

- The Assimilative Capacity Study (ACS) identifies how much treated wastewater can be safely discharged to the West Credit River at 10^{th} Line.
- An ACS was completed by CVC, as part of the SSMP in 2014.
- A key component of the ACS is the determination of the 7Q20 flow rate. The 7Q20 flow rate is the lowest 7-day average flow in a 20 year period.
- The 7Q20 is used to assess the effect of effluent discharge to the river under low flow conditions.
- In 2016, CVC updated the 7Q20 value for the West Credit River at the 10^{th} Line and identified a value of 225 Litres/second. The SSMP identified a 7Q20 of 202 Litres/second
- Water quality and potential effects on species in the river are core concerns and the ACS helps to ensure that appropriate treatment limits are set.

Assimilative Capacity Study (ACS) Update

- The baseline water quality in the West Credit River was measured through sampling at 10th Line
- At this location, the water quality in the river is very good
- One of the key water quality parameters for treatment is the level of Total Phosphorus (TP) in the river and in the effluent.
- The level of TP in the river is 0.016 mg/L, well below the Provincial Water Quality Objective (PWQO) of 0.03 mg/L.
- This study is recommending a downstream Site Specific Water Quality Objective (SSWQO) of 0.024 mg/L TP (well below 0.03 mg/L):
- Based on the above, we can increase the TP in the river from 0.016 mg/L to 0.024 mg/L

Recommended Effluent Limits for WWTP to meet Provincial Water Quality Guidelines in West Credit River

- The recommended effluent limits will reduce nutrient levels to minimise the impact on the river.
- The proposed Total Phosphorus (TP) limit of 0.045 mg/L will ensure the TP in the river will be below the objective of 0.024 mg/L, even at full buildout.
- The recommended effluent limits have been reviewed by MOECC and CVC and their comments have been addressed.

Parameter	**Full Build Out Effluent Limit**
pH	Within range of 7 – 8.6
Total Suspended Solids	5 mg/L
Total Phosphorus	**0.045 mg/L**
Total Ammonia Nitrogen	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

Septic System Review and Determination of Service Areas

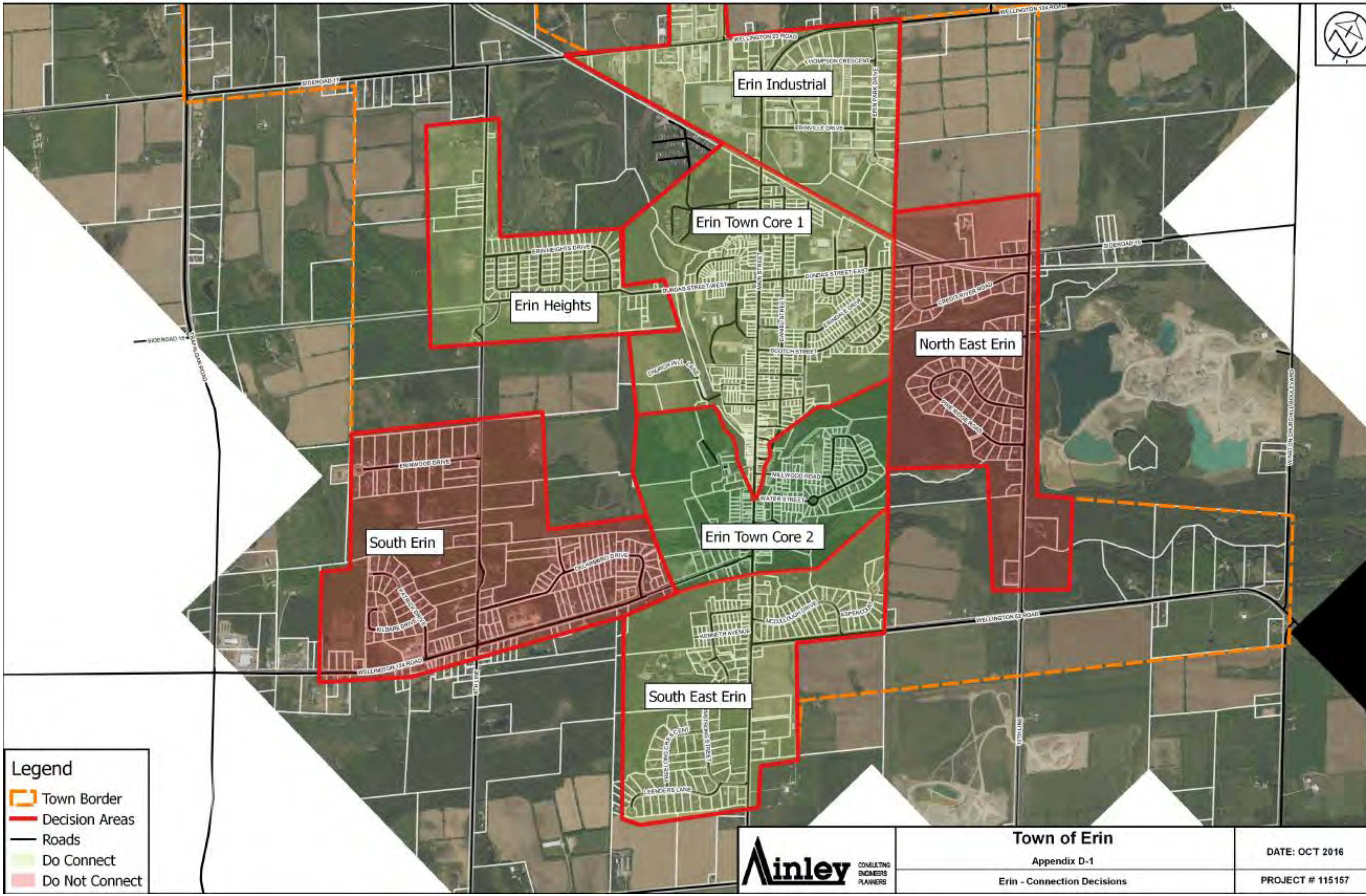
- There is a long history of concern over the number and concentration of septic systems in Erin Village and Hillsburgh.
- In 1995, a study by the Health Unit identified that properties in some areas of Erin Village close to the river were increasing the potential for contamination and that many were too small to comply with standards
- A 2005 MOECC septic investigation for Erin Village determined that septic systems in the community were a contributor to nutrients in the West Credit River
- The 2014 SSMP recommended that most of the core areas of Erin Village and Hillsburgh be serviced by a communal sewage system.

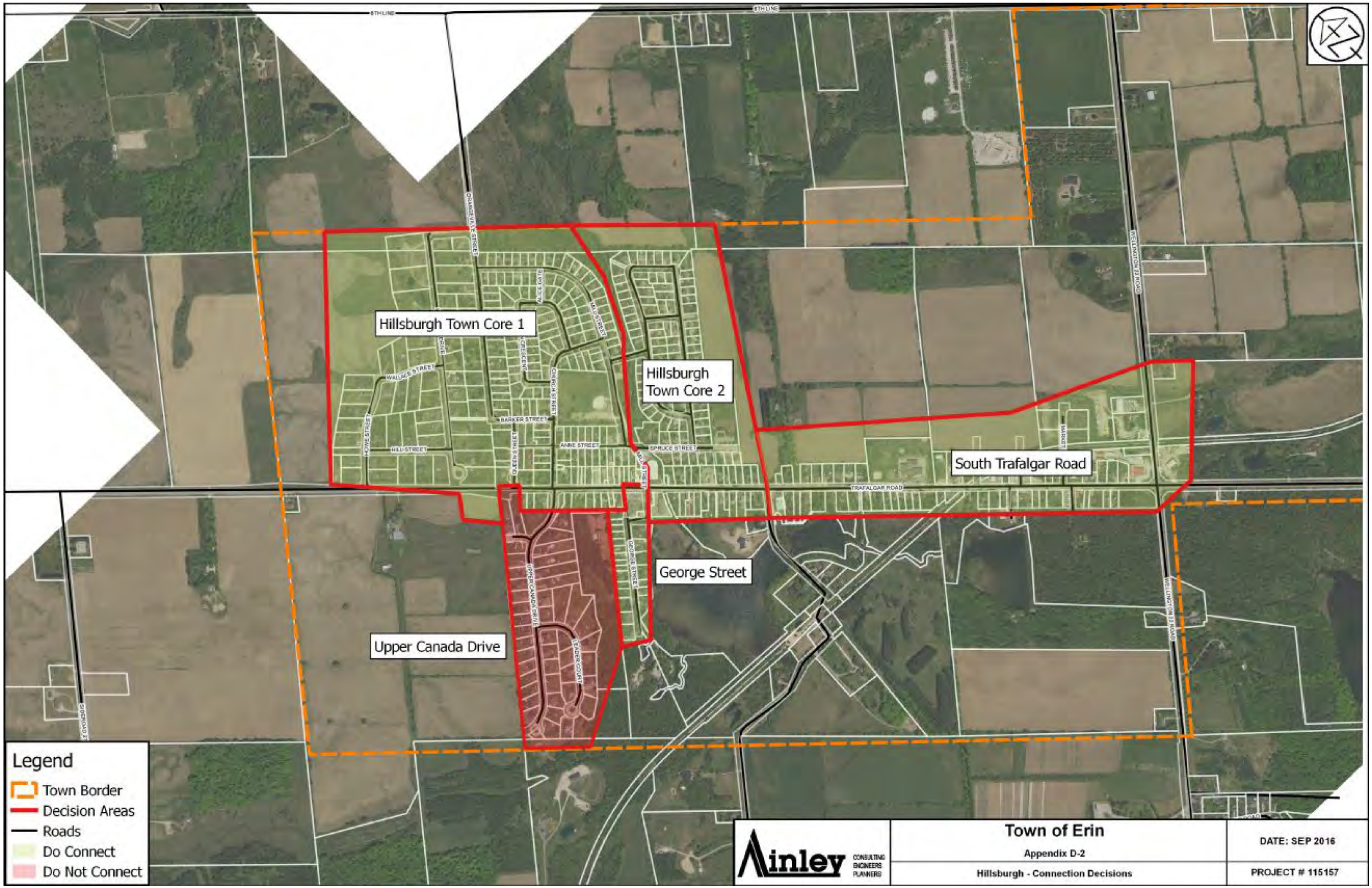
Septic System Review and Determination of Service Areas

A comprehensive review of existing septic systems was completed and it was determined that:

- Based on the current Building Code, the lot size must be approximately 1,400 m^2 (15,000 ft^2 or 0.35 acre) for a traditional septic system, to meet compliance requirements.
- Approximately 51% of the lots in the study area are less than 1,400 m^2 and in some areas, over 80% of the lots are less than 1,400 m^2.
- Many of the existing septic tanks are undersized based on the current Building Code requirements
- Depending on the area, average septic tank age ranges from 11-40 years
- Following slides shown the areas being recommended for inclusion or exclusion from a Municipal Wastewater system, based on the existing septic system review.

Town of Erin – Urban Centre Wastewater Servicing

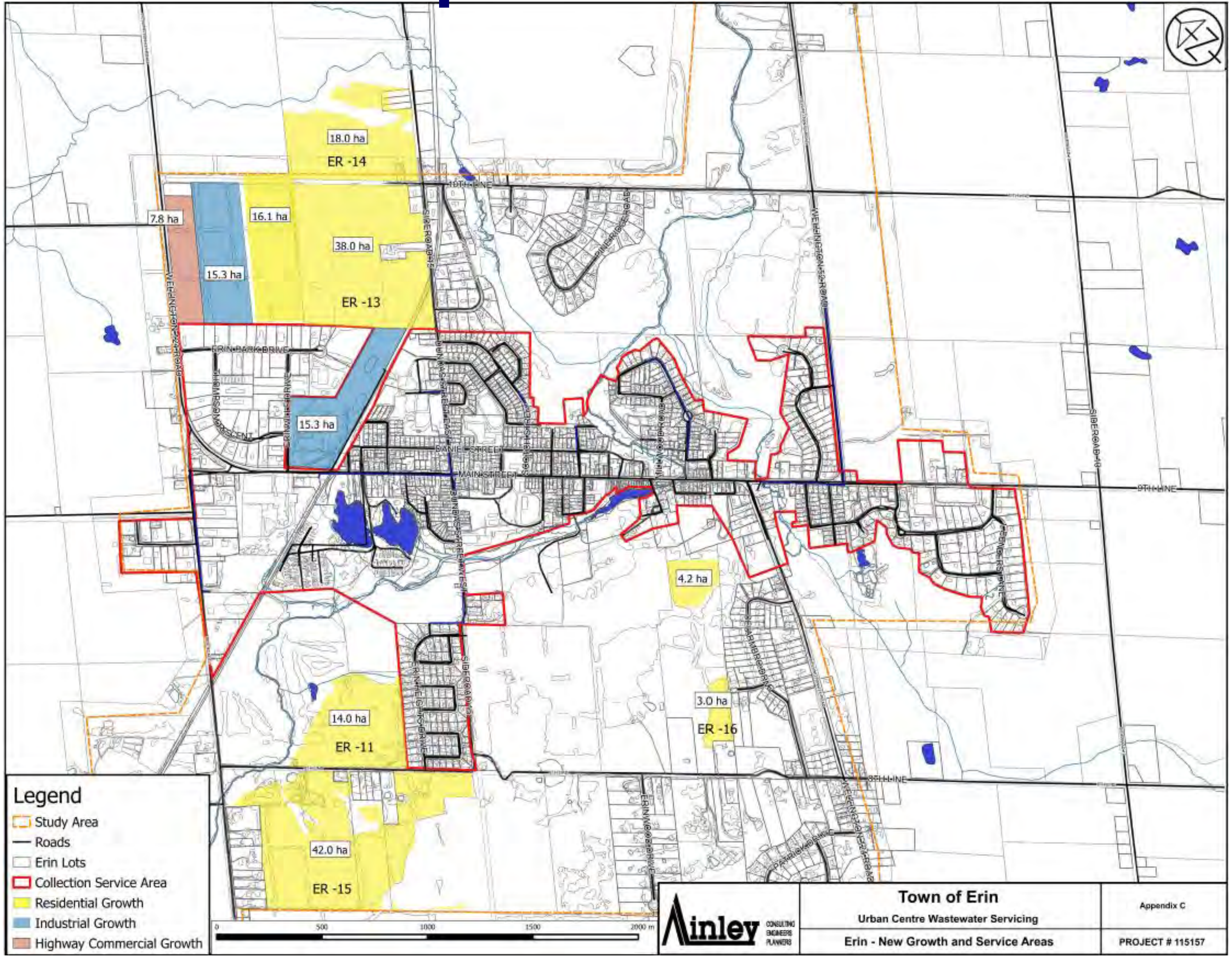



Hillsburgh Town Core 1
Hillsburgh Town Core 2
South Trafalgar Road
George Street
Upper Canada Drive
Legend
Town Border
Decision Areas
Roads
Do Connect
Do Not Connect
Ainley CONSULTING ENGINEERS PLANNERS
Town of Erin
Appendix D-2
Hillsburgh - Connection Decisions
DATE: SEP 2016
PROJECT # 115157

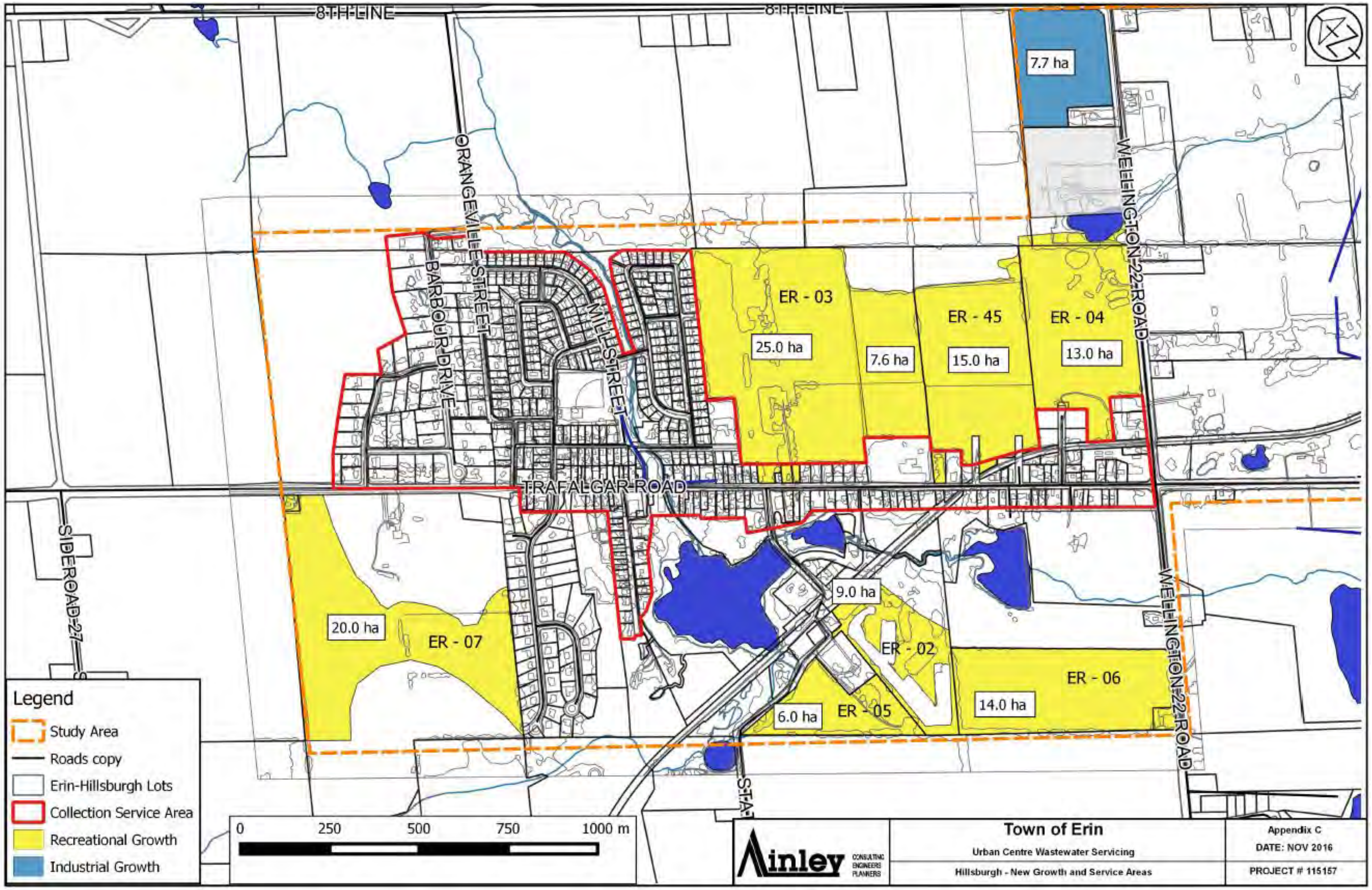
Population and Flow Projections

- The SSMP established a servicing limit of 6,000 persons
- Based on the use "Best Available Technology" at the Wastewater Treatment Plant, the updated ACS and the new effluent criteria, we have the potential to service a higher population
- The Town of Erin Official Plan (OP) has identified 267.3 Ha (660 acres) of land available for residential, commercial and industrial growth in the Town.
- We have determined that full buildout of these growth areas, would add an additional 9,943 residents to the existing population of 4,616 residents, giving a total full build out potential population of 14,559.
- However; the future population of the Town will be determined through an Official Plan review process and not through this Class EA.

Potential Development areas in Erin Village



Potential Development areas in Hillsburgh



Population and Flow Projections

Potential Full Buildout Residential Population			
	Erin	Hillsburgh	Total
Existing Community	3,225	1,391	4,616
Growth Areas	5,340	4,603	9,943
Total	8,565	5,994	14,559

Potential Full Buildout Flow Projection (m^3/d)			
	Erin	Hillsburgh	Total
Existing Community	2,244.1	599.4	2,843.5
Growth Areas	2,523.0	1,805.7	4,328.7
Total	4,767.1	2,405.1	7,172.2

Note: Actual Populations for Erin & Hillsburgh will be determined through Town's Official Plan update

Why has “Potential” Serviced Population increased from 6,000 in SSMP to 14,559 in current Class EA

There are a number of key difference between the assumptions made in the SSMP and in this Class EA as noted below:

Design Assumptions	Servicing and Settlement Master Plan (SSMP)	Urban Centre Wastewater Servicing EA
Total Phosphorus level in the treated sewage	0.15 mg/L	0.045 mg/L
Total Phosphorus in the river after mixing with the treated effluent	0.03 mg/L	0.024 mg/L
7Q20 Flow within the West Credit River as identified in Assimilative Capacity Study	202 Litres per second	225 Litres per second
Per-capita contribution of sewage (Litres per-person per day)	435 L/p/d	380 L/p/d
Resulting Potential Sewage flow	2,610 m^3/day	7,172 m^3/day
Resulting Potential Population	6,000	14,559

Alternative with Two Treatment Plants & Two Surface Discharge Locations

- The SSMP looked at a range of Alternatives including a two Treatment Plant solution but with a single surface water discharge south of Erin Village.
- This alternative (two plants with a single surface water discharge) was eliminated during the SSMP based on cost.
- A two plant solution based on two separate discharges to surface water was not seriously considered in the SSMP and this has been questioned by members of the Public Liaison Committee.
- At the May 2, 2017 Council Meeting, Council passed a resolution requesting this Alternative be reviewed.

Potential River Discharge Through Hillsburgh

- There is currently insufficient water quality or flow data to complete an Assimilative Capacity Study (ACS) to define effluent limits for a surface discharge through Hillsburgh
- No additional water quality or flow data has been collected, for the river through Hillsburgh, since the completion of the SSMP in 2014
- Based on the limited data currently available, it cannot be determined if the river, through Hillsburgh, could support a Treatment Plant discharge
- To complete an Assimilative Capacity Study would require collection of flow & quality data for up to 10 years and could cost in excess of $500,000, with no guarantee that a surface discharge would be approved near Hillsburgh

Two Treatment Plants Cost Comparison

The cost comparison between two Treatment Plants with two surface discharges versus a single Treatment Plant with one surface discharge are:

- A single Treatment Plant is 27% less expensive than a two Treatment Plants (with two discharges), for servicing the existing community
- A single Treatment Plant is 32% less expensive than a two Treatment Plants (with two discharges), for servicing full build-out of the OP

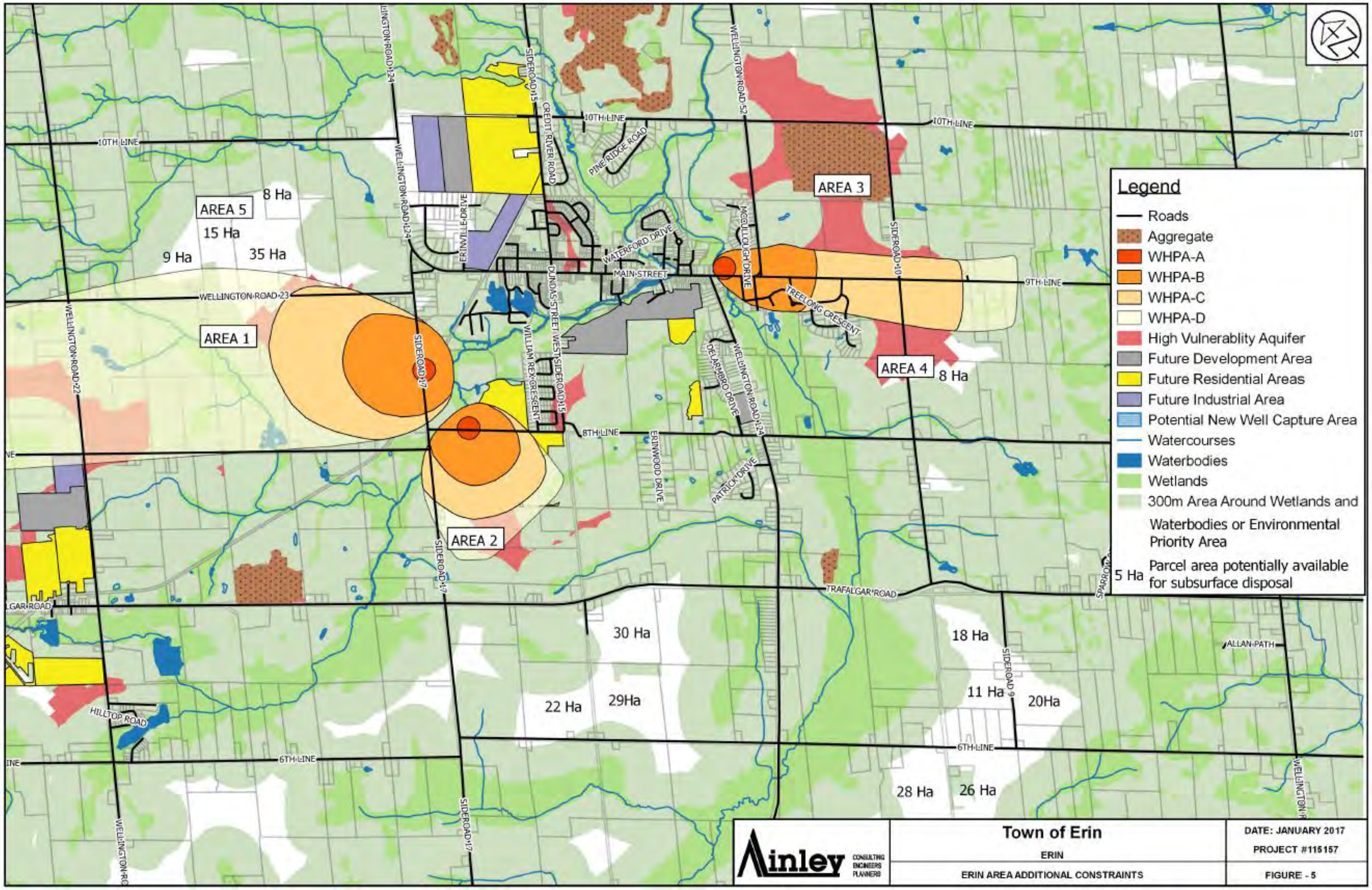
Through the work completed to date we have already demonstrated that a single Treatment Plant discharging to the West Credit River south of Erin Village, can support full build out of the Town Official Plan.

It is therefore recommended that the single Treatment Plant alternative be carried forward for more detailed evaluation in Phase 3 of the Class EA

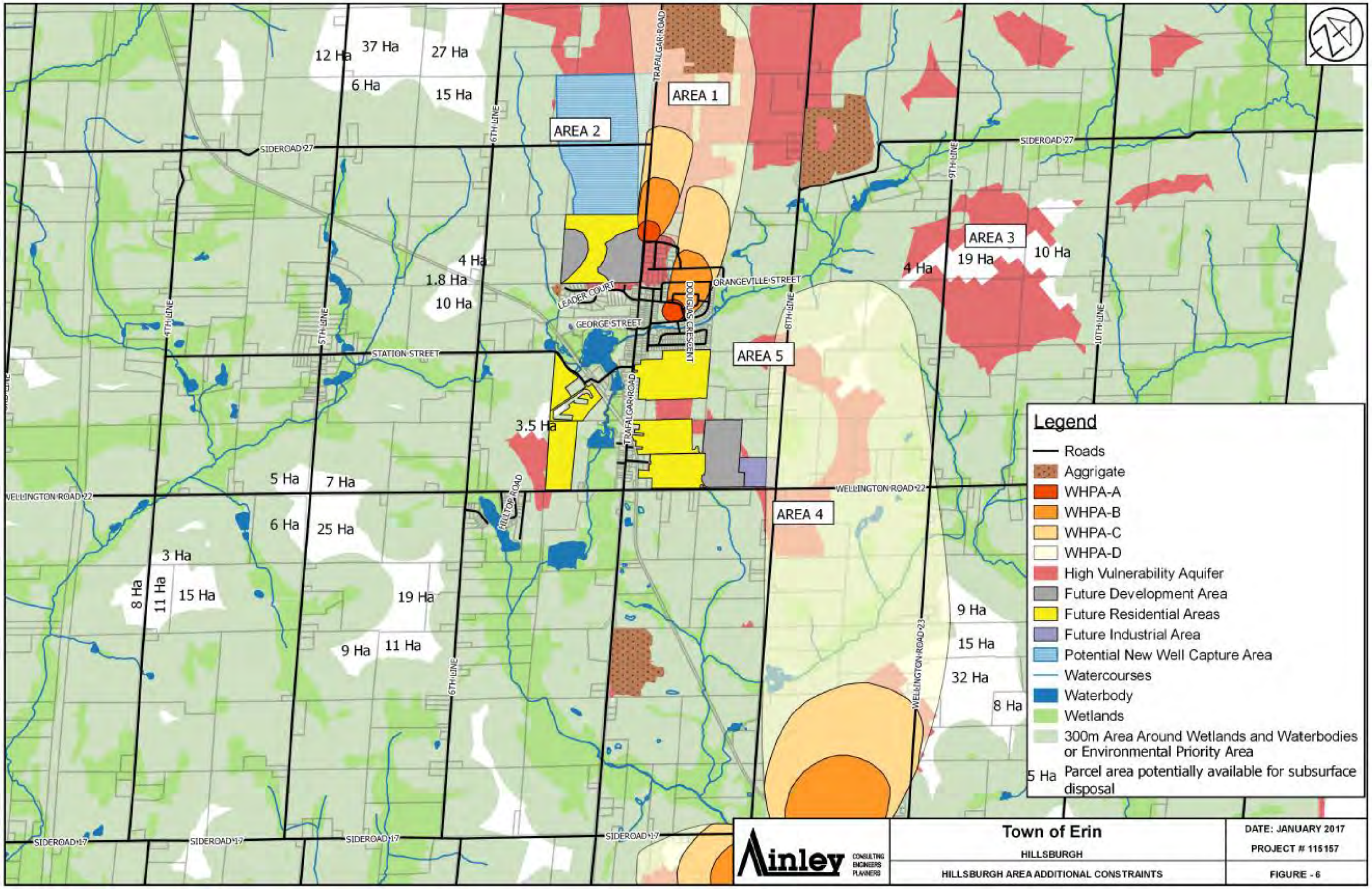
Discharge of Effluent to the Subsurface

- Upon review of the SSMP, it was determined that the issue of subsurface disposal need to be examined further
- Our evaluation of utilizing Subsurface Areas, included a review of legislative guidelines, geotechnical/ hydrogeological conditions, groundwater quality, land requirements and environmental constraints
- Conceptual level design requirements to support each community were determined as a basis for site selection and preliminary system costing
- Land requirements were established for the disposal fields to fully service Erin Village and Hillsburgh
- The potential for subsurface disposal in Erin and Hillsburgh was found to be highly constrained by surface water features, hydrogeological conditions, existing development, protection zones for existing drinking water wells, and woodland areas (see following slides)

Subsurface Disposal - Constrained Areas around Erin



Subsurface Disposal - Constrained Areas around Hillsburgh



Subsurface Disposal Challenges

- Subsurface disposal systems are highly sensitive to treatment upsets
- Short term treatment process failures will often result in plugging of the tile beds over time and contingency measures would be required
- Potential areas for subsurface disposal in Erin and Hillsburgh are limited due to environmental constraints
- The level of treatment required at a Treatment Plant is very similar to what is required for surface water disposal
- Extensive field investigations would be required to support the design and approval of subsurface disposal areas
- At this time the Town does not own lands suitable for subsurface disposal of effluent and limited lands are available making land purchase problematic

Subsurface Disposal Alternative Summary

- The opportunity for multiple or single disposal fields for each community is limited by topography, environmental constraints and available lands
- Capital cost estimates for a multiple Treatment Plants solution with subsurface discharges are 10-20% more expensive than a single Treatment Plant solution
- There would also be additional lifecycle costs for the operation & maintenance of the systems, due to the use of multiple facilities
- Extensive site-specific investigation is required to obtain approval for the use of subsurface disposal at significant cost to the Town
- It is concluded that the use of subsurface discharge for a multi-plant solution is **non-viable for Erin** due to existing constraints and **non-competitive for Hillsburgh** due to the higher capital and operating costs

Next Steps and Proposed Schedule

- Receive Public and Agency Comments until July 6, 2017.
- Provide an update to Council on Class EA progress in July, 2017.
- Proceed with Phase 3 activities looking at design alternatives.
- Host Public Information (PIC) Centre No. 2 in November 2017 to seek public input on the alternatives for the Collection System and Treatment System.
- Proceed to Phase 4 and prepare the Environmental Study Report (ESR) anticipated for February 2018.
- Initiate a 30 Day Public Review period in March 2018.

YOUR COMMENTS ARE IMPORTANT TO US

Please complete a Comment Sheet or take one home with you.

Comment Sheets may be placed in the comment box or returned to the study team by Email or regular Mail to:

Ms. Christine Furlong, P. Eng.
Project Coordinator, Town of Erin
Triton Engineering
Email: cfurlong@triton.on.ca
105 Queen St W – Unit 14
Fergus, ON
N1M 1S6

Mr. Joe Mullan, P. Eng.
President & CEO
Ainley Group
Email: erin.urban.classea@ainleygroup.com
195 County Court Boulevard, Suite 300
Brampton, ON
L6W 4P7

We would appreciate receiving your comments by July 6, 2017

11.
PIC 1 – Consultation Report

Public Information Centre – Consultation Report

PROJECT:	Town of Erin: Urban Centre Wastewater Municipal Class Environmental Assessment (EA)
DATE:	June 22, 2017
LOCATION:	Erin Community Centre / Centre 2000
TIME:	6:00 p.m. – 9:00 p.m.

These notes summarize the Public Information Centre event held on June 22, 2017 at the Erin Community Centre / Centre 2000.

This consultation report includes: attendance numbers; the agenda for the event; a description of the format and content presented; a summary of questions and comments received from the public; and copies of both the display boards and the PowerPoint presentation used at the event.

Please note that this record of comments includes comments from direct conversations, questions asked and answers received from the Q&A session, and comments submitted to the Project email address following the event. The summary of comments is not meant to be exhaustive and is not verbatim. Names of visitors have not been associated with comments made in order to protect privacy.

PIC Agenda

6:00 p.m.	Doors open
	Display boards can be viewed by public
	Project Team available to public for informal discussion and questions
7:30 p.m.	Presentation by Project Team
8:00 p.m.	Q&A Period
9:00 p.m.	PIC Concludes

Attendance

In total, 62 people attended the PIC event.

Visitors were invited to arrive at 6:00 p.m. for an opportunity to see the display boards and to have informal conversations with the Project Team. The majority of visitors arrived between 6:00 p.m. and 6:45 p.m., taking the time to review the boards and ask questions.

Event Goals

The primary purpose of this event was to share information with members of the public about the Erin Urban Centre Wastewater Servicing Class EA in order to give a better understanding of the project and the implications for the Town of Erin community.

The specific goals of this PIC were to:

- Introduce the project to residents who may not be familiar;
- Inform residents about the findings from the technical studies completed to date;
- Describe the process up to this point and explain why certain decisions have been made;
- Give residents an opportunity to ask questions of the Project Team;
- To hear back from the community about their thoughts and concerns for the project.

The desired outcome of the event was that community members would have all of the information that they may have been seeking about the Project, and that their concerns and questions have been appropriately addressed. It was also generally important for residents to become familiar with the Project Team and to feel comfortable to get in touch in the future if they have any questions or concerns.

Display Board Viewing

The PIC started at 6:00 p.m. and arriving visitors had an opportunity to see the display boards that were set up around the space and to have informal conversations with the Project Team. The boards provided an overview of the project up to this point as well as sharing the highlights of the technical studies that have been completed. Members of the Project Team were available to discuss the project and to answer questions on a one-on-one basis.

A copy of all display boards can be found in Appendix A of this report.

The following is a summary of questions asked of Project Team members and comments from visitors during the viewing of display boards.

- A visitor asked for an explanation of the Servicing Area Map, wondering why proposed but currently undeveloped areas weren't being depicted. A Project Team member explained that the map they were looking at was showing existing areas to be serviced and that a different display board had information about potential growth areas.
- A visitor expressed concern about the amount of growth that could happen.
- A visitor asserted that the community did not want this growth and expressed frustration that the Town was continuing to spend money to study something that people don't want.
- A visitor stated that this Project was very important for the future of the community and that both residential and commercial growth had been needed for years. They said that it was time to get on with it already and that the community was ready for growth.

- A visitor asked about whether the population projections included commercial and industrial growth. They stated that they were very concerned about ensuring that there was job growth for the community because that is what would keep people in town for the long term. Too many young people had moved away for better job prospects, so ensuring employment growth should be a top priority for the town. A Project Team member explained that the wastewater flow numbers did include commercial and industrial flows.
- Three visitors discussed what new residential growth would ultimately look like. The discussion included locations for development, design and aesthetics, and what kind of population density would make sense for the area.
- A visitor expressed how important having this conversation was for the future of the Town.
- A visitor said that it would be important to keep communications open with residents so that they understand the process and can have their voices heard.
- A visitor asked about what the impact would be on the West Credit River after full buildout. A Project Team member explained the impacts on water quality and what it would mean for aquatic species in the river.
- A visitor asked for more details on how the serviced population had increased between the SSMP and the Class EA and on how the 7Q20 statistic had been calculated and updated. A Project Team Member explained the details.
- A visitor asked for more details on the water quality results from Hillsburgh and potential influences on it. A Project Team Member explained potential influences on water quality and how any influence of existing septic systems could not be conclusively determined from existing data and that long-term monitoring (after any plant was built) would be required to establish this.
- A member of the Press asked for details on how the ACS was conducted and the numbers derived. Project Team Members explained this.
- A visitor provided Project Team Members with their experience in alternative sewage treatment technologies in Sechelt, BC.
- A visitor asked about the treatment technology that would be used. A Project Team member provided a general explanation of common treatment technologies but explained that the specific technology to be used had not yet be determined for this project.
- Two visitors asked about the overall growth decision process and how the wastewater Class EA fits into it. A Project Team member explained that the three major pieces that would need to be completed the wastewater Class Environmental Assessment, the completion of the water supply Class Environmental Assessment, and the updating of the Official Plan. It was pointed out that while the wastewater and water supply issues would determine the technical limits on potential growth, the decision on actually how much to grow would be made through the Official Plan process.

- A visitor expressed concern about what areas would be serviced and how that decision would be made. The visitor predicted that all of the community would inevitably want to connect to the communal system and that allowances should be made for that.
- A visitor stated that they were very happy with the amount of information and the availability of the Project Team to respond to questions.
- A visitor said that they were very optimistic about what this project could mean for the future of Erin.

Presentation Introduction

At 7:30 p.m. the formal presentation began.

Dave Hardy welcomed visitors and thanked them for coming out to spend the evening learning a bit more about the Project. The agenda for the presentation was reviewed. Dave then introduced the members of the Project Team. Finally, Dave reviewed a set of meeting courtesies that both visitors and the Project Team were asked to keep in mind in order to ensure that the meeting stayed focused, easy to understand, civil, and inclusive.

Main Presentation

Joe Mullan provided the formal presentation and covered the following topics:

1. Purpose of PIC & Project Background
2. Refresher on the Servicing and Settlement Master Plan (SSMP)
3. Update on Assimilative Capacity Study (ACS) and confirmed effluent objectives for the discharge to the West Credit River at 10th Line;
4. Overview of the existing Septic System Review and identified areas that should be connected to the Municipal Wastewater system;
5. Overview of the Potential Populations and Wastewater Flows for each Community, based on updated ACS and new effluent criteria;
6. Overview of the Assessment for Two Wastewater Treatment Plant discharge locations;
7. Overview of the Assessment for Large Subsurface Disposal Systems.
8. Next Steps & Schedule

A copy of the PowerPoint presentation slides can be found in Appendix B of this report.

Q&A Session

The following summarizes all questions from the public and answers by the Project Team.

Q: You collected a lot of information on the septic systems in Erin and Hillsburgh. I'm wondering if you could have just done a water quality test of the river before it gets to Hillsburgh and then after it leaves the town. Wouldn't that have told you what pollutants are coming from the town itself?

That could be done, but it would take quite a bit of additional testing to determine the water quality at those locations. While that testing might be able to show a higher level of pollutants in Hillsburgh, it wouldn't definitively show the source of that pollution. We did not take measurements from the river around Hillsburgh. That data is from the MOECC and CVC. We followed the SSMP which identified downstream of Erin Village as the preferred discharge location. Our testing focused on the most likely place that the disposal of effluents would be allowed.

Q: In terms of water consumption, it looks like you are saying it is 385 litres per capita per day. Given all the water saving technology that exists today I think that number is very high. The numbers in Victoria are more in the 140-150 range. If you just drop that number from 380 to 200 you could cut the size of the treatment system in half. Water is not inexpensive here. This really should be factored in, especially in new dwellings. The numbers we are using for subdivision use is 75 litres per dwelling per day.

We realize that we selected a water consumption number that was high and conservative. The number we quoted was based on the gravity collection system alternative and included an allowance for infiltration. We looked at the average drinking water consumption levels in Erin and it was around 160 litres per dwelling per day. We then bumped up those numbers significantly because with a new wastewater system consumption levels may go up and we wouldn't want to undersize. If the facility is developed and we find that the actual numbers are different then the plant would be able to service additional people.

Q: What population density did you use to calculate the overall population?

All of the growth numbers came from the County. We used their density estimate of 45 persons per hectare.

Q: The SSMP said that the maximum number of individuals that can be handled by the river is 6000. Now you have said that it can handle up to 14,500. And you have said that you have taken conservative numbers. How many people can the plant actually handle?

It is important to remember that this study is only one part of the process. We are looking at what is technically possible given the river conditions and available technology. The actual decision on how much growth will occur will be made through the Official Plan process.

In regards to how many people the treatment facility could handle, that is variable based on the size of the facility and the treatment technology. There is not yet a specific system design or treatment technology identified for this project. We were asked to study whether it is possible to provide wastewater treatment for Erin Village and Hillsburgh up to the full buildout population currently stated in the Official Plan. We are saying that it's possible.

Q: What if the County comes back and says that they want to put 25,000 people in Erin. Will the treatment plant be able to handle that?

Given our understanding of the river and with current treatment technology, no, the treatment plant could not handle 25,000 people in Erin.

Q: I am on the Environmental Sustainability Committee in Erin and in January we asked if we could expand the scope of the study and the Town put aside $30,000 for the expanded study. Two weeks later we were already hearing that subsurface disposal was not possible. Then we sent a letter in February and didn't get a response back until June. Could you explain what happened?

We first met with you in January to discuss the possibility of subsurface disposal as an alternative to a centralized treatment system. The gentleman you brought along did not have experience with wastewater systems in Ontario, where regulations are much stricter. Following that meeting we went back to the SSMP and determined that the whole issue of subsurface disposal had not been fully examined. We then went to Council for approval to complete that investigation. Over the next few months the study was completed and we have now confirmed that subsurface disposal would not be a viable alternative for the community.

Q: Do you know why the 7Q20 flow rate increased given that 2016 was a drought year?

We worked with Credit Valley Conservation (CVC) to get this information. The 7Q20 low flow statistic was derived by comparing flow between water gauges located at 8th Line and 10th Line. In 2013, CVC put a new water gauge in at 10th Line and we now have two more years of data to derive the 7Q20 than they did previously. CVC were able to statistically compare the flow from the two flow stations to better estimate the 7Q20. Interestingly, it was found that the lowest flow rate measured during the 2016 summer drought was still higher than the 7Q20 (the 7 day low flow rate over a period of the last 20 years).

Q: You keep talking about phosphorus but there's a lot of other things that you need to be sure you're cleaning up. One of the latest things being found as environmental contaminant is prescription drugs that go through our bodies and cosmetics.

We have not specifically addressed either of those contaminants at this stage of this study. This issue has come up over the last ten years all over the world and, so far, there have not been standards developed yet to address this. I know that this is not a great answer, but the sewage treatment facility would be able to remove some of these contaminants from the water. New standards and treatment approaches could be added in future years as any risks are identified and an approach for treating those contaminants becomes standardized.

Q: You mentioned that the treatment plant would be between 10th Line and Winston Churchill Road. Do you have a specific area in mind of where it would be built?

That is a good question, but it is a matter that will to be discussed further in Phase 3 of this project. We have started that process and we will soon be starting to talk to land owners and to evaluate potential sites.

Q: There is a spot near 10th Line where lots of people fill water bottles and take water directly from the river and kids fish and swim.

Thank you for that information. The ACS identified a site at Winston Churchill Blvd. where people take water from a spring adjacent to the river but we were not aware of any Site at 10th Line. This is very important info. [The commenter later provided a map of the specific location through email.]

Q: There's a gravel pit that is going to be expanding towards Bush Street. So you'll have a sewage treatment facility on one corner and a gravel pit on the other. That's got to affect groundwater.

The wastewater treatment plant would not impact groundwater. By design it would not leak and would not impact groundwater and regulations are in place to ensure that it never does. Thank you for letting us know about the gravel pit location being moved. That is important information.

Q: One of the major issues is the sequencing of what you're going to do. You don't currently have a collection system or a treatment plant. It's kind of a chicken or egg scenario. Which will come first, the treatment or the collection?

The staging and phasing of implementation is an issue that is will be looked at in Phase 3. We will certainly be looking at how phasing will effect both costs and project timelines.

Q: In the SSMP, the price tag presented was very high. I hope that every resident here understands that the cost will be on them and it won't come from any grant scenario. The community has to know that cost number as soon as possible.

Actually, there have already been initial conversations going on between your Council and higher levels of government about funding. A key thing to recognize is that the Federal and Provincial governments have both said that they would not provide grants for any projects that aren't fully studied and planned. The process we are going through now is one of the key steps in that direction. Completing this work is a significant required step for getting funding for implementation.

Q: There hasn't been any conversation about whether rural residents will have to pay for a portion of the system even though they won't be connected. Could you comment on other places in Ontario and what they have done?

In Ontario the full cost of financing water and wastewater services is bourn by the actual customers. Rural residents who are not going to be connected will not be required to pay for the wastewater system.

Comment Forms and Email Submissions

The following comments and questions were submitted either through the available comment forms at the PIC or through the project email following the event. Answers to the questions have been provided by the Project Team.

Q: I am concerned about the natural ecosystems once development begins and our population increases. Will development occur with this in mind? Or will Erin end up looking like Brampton or Mississauga?

The form of any future development is not a topic that was considered within this wastewater Class environmental assessment. However, under the Official Plan process it is within the Town's ability to set guidelines for any new development in a way that fits with the existing community.

Comment: I think that a big pipe single treatment facility is the best solution rather than continuing with septic systems, doing subsurface disposal, or making a second treatment plant in Hillsburgh.

Comment: I agree that there are a significant number homes in the old village of Erin that have lot sizes that are inadequate for private sewage disposal systems. The Province has historically funded community improvement projects like this and should step up to help Erin too. The Town should be seeking upper tier financial assistance.

Comment: An expansion of the Town's municipal water supply should be considered in conjunction with or prior to the provision of a sanitary sewer system in Erin. A full sanitary sewer system in Erin as outlined by the Consultant is not viable without expansion to the water system.

Comment: There are a number of relatively new subdivisions in the Town that are on large lots and have modern private sewage systems. The consultant seems to advocate for some of these subdivisions to be connected to the sewer system while others won't be. Some of those properties shouldn't need to connect and they would bear the financial cost in a seemingly unfair way.

Comment: It seems to me that the only way the project will proceed is properly identifying the properties that are of sufficient size and nature where a private sewage system is viable and not including those properties in the service area. The serviced area should be limited to the undersized lots and new development.

Comment: Hillsburgh is in need of an expanded water supply system. Erin has many small lots needing sanitary sewers. It appears to me that these two urban centres have different priorities.

Comment: We live in the area and have our own well and septic system that was approved in 2017. I am not in favour of hooking up to the proposed plan for our area.

TOWN OF
ERIN

Town of Erin – Urban Centre
Wastewater Municipal Class Environmental Assessment

Public Information Centre

Thursday, June 22, 2017

Comment Form

Name:

Email:

Given what you have heard tonight, do you have any thoughts or comments that you would like to share with the Project Team about the Study?

WE LIVE AT THE AREA, NINTH LINE & ARMSTRONG ST.
HAVING OUR OWN WELL AND SEPTIC SYSTEM
WITH 5/8 ACRE LOT - THE SEPTIC SYSTEM APPROVED
IN 2017
I AM NOT IN FAVOUR OF HOOKING UP TO THE
PROPOSED PLAN FOR OUR AREA

As the Town moves into the next phase of the study, what questions and concerns will most be on the mind of residents or interested parties (that Team needs to focus on)?

For more information on the *Town of Erin Urban Centre Wastewater Municipal Class Environmental Assessment*, please visit: www.erin.ca/town-hall/wastewater-ea

Comments and questions can also be submitted directly to the Project email at: erin.urban.classea@ainleygroup.com

Simon Glass

From: [redacted]
Sent: June 26, 2017 8:00 AM
To: erin.urban.classea
Subject: Erin EA

Subject: Town of Erin's EA

There is no doubt in my mind that there are a significant number of homes in the old village of Erin that have lot sizes that are totally inadequate for private sewage disposal systems. The Province should recognize this and it has historically funded community improvements in Ontario to address these issues.

It seems to me that an expansion of the Town's municipal water supply would be considered either in conjunction with or prior to the provision of a sanitary sewer system in Erin. It seems to me that the Town should be seeking upper tier financial assistance to expand the current water system and the primary drivers would be protection of our only source of domestic water (ground water). A full sanitary sewer system in Erin as outlined by the Consultant is not very viable without expansions to the water system.

The Consultant refers to a Health Dept (1995) study of private septic systems in Erin. As I recall this study paints a dark picture of the situation in Erin and the criteria for minimum lot size is totally different from what the Consultant is currently using. (1400 square metres) This 1995 study (as I recall) had no legal basis for the minimum lot size that it referenced and it is out of date today. if the intent was to present a dark picture for funding purposes, then I guess it serves that purpose.

There are a number of relatively new residential subdivisions in the Town that are on large lots and have modern sewage systems. These subdivisions seem to be classified differently and the rationale seems inconsistent. The consultant seems to advocate for certain of these subdivisions to be sewered while others are classified as not needing sewers. Both the 1995 study and the current mapping by the consultant seems to indicate certain large residential lots are needing sewers and they would bear the financial cost of that in a seemingly unfair way.

When the study references OBC standards, this seems to be somewhat if an irritant. In the case of septic tanks, the industry phased out the smaller tanks. Labelling smaller tanks as inadequate does not take into account the advances made with low volume toilets and energy efficient clothes washing machines that use considerably less water.

It seems to me that the only way the project will proceed is properly identifying the properties that are of sufficient size and nature where a private sewage system is viable forever. These properties should be eliminated from the serviced area. The serviced area should be limited to the undersized lots and new development. That way there would be the most likely opportunity for upper tier funding and I am sure that developers would be quite able to afford a municipal treatment plant provided their projects have sufficient numbers and density.

Our Town Council has a difficult task in that the town has 2 major centres. In my opinion these two centres have some similarities and some differences. Hillsburgh does not have a well developed municipal water system as is found in the old village of Erin. In Hillsburgh there are many community buildings still serviced by private wells. Hillsburgh is in dire need of a expanded water system. On the other hand In the old village of

Erin there seems to be many small lots needing sanitary sewers. It appears to me that these two urban centres have different priorities.

Simon Glass

From: [redacted]
Sent: June 26, 2017 1:21 PM
To: erin.urban.classea@ainleygroup.com
Subject: Water in Erin, ON
Attachments: Winston Churchill.JPG

Hi there,

I attended the public information night on June 22 at the Erin Centre 2000 and mentioned that people have been known to take water from a river that cuts across Winston Churchill just north of Wellington Road 50. I was asked to identify the spot where people have been taking water. I've attached the area and marked the exact spot for your information. I hope you find this useful and investigate the spot before any decisions are made regarding the water treatment plant.

Many thanks,
[redacted]

Ministry of Tourism,
Culture and Sport

Heritage Program Unit
Programs and Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7
Tel: 416 314 7145
Fax: 416 212 1802

Ministère du Tourisme,
de la Culture et du Sport

Unité des programmes patrimoine
Direction des programmes et des services
401, rue Bay, Bureau 1700
Toronto ON M7A 0A7
Tél: 416 314 7145
Téléc: 416 212 1802

Ontario

June 20, 2016 (EMAIL ONLY)

Joe Mullan, P. Eng.
Ainley & Associates Limited
280 Pretty River Parkway
Collingwood, ON L9Y 4J5
E: mullan@ainleygroup.co

RE:	**MTCS file #:**	**0004911**
	Proponent:	**The Corporation of the Town of Erin**
	Subject:	**Notice of Commencement, Municipal Class Environmental Assessment Urban Centre Wastewater Servicing**
	Location:	**Town of Erin, County of Wellington, Ontario**

Dear Joe Mullan:

Thank you for providing the Ministry of Tourism, Culture and Sport (MTCS) with the Notice of Commencement for your project. MTCS's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage, which includes:

- Archaeological resources, including land-based and marine;
- Built heritage resources, including bridges and monuments; and,
- Cultural heritage landscapes.

Under the EA process, the proponent is required to determine a project's potential impact on cultural heritage resources. The recommendations below are for a Schedule C Municipal Class EA project, as described in the notice of study commencement. If any municipal bridges may be impacted by this project, we can provide additional screening documentation as formulated by the Municipal Engineers Association in consultation with MTCS.

While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Aboriginal communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Aboriginal communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Archaeological Resources
Your EA project may impact archaeological resources and you should screen the project with the MTCS *Criteria for Evaluating Archaeological Potential* to determine if an archaeological assessment is needed. MTCS archaeological sites data are available at *archaeology@ontario.ca*. If your EA project area exhibits archaeological potential, then an archaeological assessment (AA) should be undertaken by an archaeologist licenced under the *OHA*, who is responsible for submitting the report directly to MTCS for review.

Built Heritage and Cultural Heritage Landscapes
The MTCS *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* should be completed to help determine whether your EA project may impact cultural heritage resources. The Clerks for the Town of Erin and County of Wellington can provide information on property registered or designated under the *Ontario Heritage Act*. Municipal Heritage Planners can also provide information that will assist you in completing the checklist

If potential or known heritage resources exist, MTCS recommends that a Heritage Impact Assessment (HIA), prepared by a qualified consultant, should be completed to assess potential project impacts. Our Ministry's *Info Sheet #5: Heritage Impact Assessments and Conservation Plans* outlines the scope of HIAs. Please send the HIA to MTCS for review, and make it available to local organizations or individuals who have expressed interest in review.

Environmental Assessment Reporting
All technical heritage studies and their recommendations are to be addressed and incorporated into EA projects. Please advise MTCS whether any technical heritage studies will be completed for your EA project, and provide them to MTCS before issuing a Notice of Completion. If your screening has identified no known or potential cultural heritage resources, or no impacts to these resources, please include the completed checklists and supporting documentation in the EA report or file.

Thank-you for consulting MTCS on this project: please continue to do so through the EA process, and contact me for any questions or clarification.

Sincerely,

Joseph Muller, RPP/MCIP
Heritage Planner
Joseph.Muller@Ontario.ca

Copied to: Dina Lundy, Town Clerk, Town of Erin

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. MTCS makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MTCS be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Please notify MTCS if archaeological resources are impacted by EA project work. All activities impacting archaeological resources must cease immediately, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists.

If human remains are encountered, all activities must cease immediately and the local police as well as the Cemeteries Regulation Unit of the Ministry of Government and Consumer Services must be contacted. In situations where human remains are associated with archaeological resources, MTCS should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

June 2, 2014 Project No. 1212

Town of Erin Municipal Office
5684 Trafalgar Rd.
Hillsburgh, Ontario
N0B 1Z0

Sent via email only

Attention: Mayor Maieron and Members of Council

Re: Settlement Servicing Master Plan Options
Draft Plan of Subdivision 23T-95001
Erin Heights Golf Course
Part of Lot 19, Registrar's Compiled Plan 686 (Village of Erin) Town of Erin
5525 8th Line and 17th Sideroad

I have been retained by the owner of the Erin Heights Golf Course with respect to the proposed residential development for this property. The owner of this property, Jim Holmes, has been involved in the issue of municipal services for Erin since 1992.

In 1992, the first proposal for a Draft Plan of Subdivision to create 350 residential units was presented to Town Council. In 2001 a revised plan for 173 units was presented to Council. Over the years revised plans were submitted with various servicing options proposed. The owner was advised to wait for the pending outcome of a search for a sewage treatment servicing solution for the Village of Erin.

The Erin Heights Golf Course property is located within the Erin Urban Area as shown on Schedule A-2 of the Town of Erin Official Plan. The subject property is designated as "Residential" where future residential is proposed on the property. In addition, the subject property is located within the Built Boundary as identified by Places to Grow. The current use of the property is a golf course which means that agricultural land will not be required to be taken out of production in order for this property to be developed for residential. This is consistent with the Provincial Policy Statement 2014.

The owner of the Erin Heights Golf Course property intends to pursue the existing Draft Plan of Subdivision application at the appropriate time when a servicing solution for Erin becomes evident.

In December 1995 Triton Engineering Services Limited completed the "West Credit River Assimilative Capacity – Supplementary Report" on behalf of the Town of Erin. On page 13 of this report, it is indicated that the addition of a WPCP serving an expanded population in the Village of Erin will reduce the existing urban contribution of E.coli to the West Credit River from septic systems for every month of the year. In addition, with the construction of a WPCP for Erin the potential future impact of phosphorous plumes from faulty septic systems will be arrested. On page 14 the report states that, despite the increase in population in Erin, the nitrate nitrogen addition to the West Credit River would be reduced with the elimination of individual septic systems. This would reduce the overall loadings from the Village of Erin to the West Credit River.

Now that the Assimilative Capacity Study has been updated and has confirmed that approximately 500 additional homes can be accommodated, there are a number of decision points to be made by Council once various scenarios have been costed and evaluated.

Given the potential impacts to the West Credit River of the existing septic systems in the Erin Urban Area, as identified in 1995, a Sewage Treatment Plan that includes both the existing and future population of Erin for 6,000 residents appears to be a prudent option.

Please provide me with notice of any meetings related to this process. The owner of the Erin Heights Golf Course would like to ensure that adequate sewage treatment plant capacity is allocated to allow for the residential development of their property.

Yours truly,

Astrid Clos, RPP, MCIP

cc: Jim Holmes, Erin Heights Golf Course
Matt Pearson, B. M. ROSS and Associates Limited

ASTRID J. CLOS
PLANNING CONSULTANTS

January 21, 2016 Project No. 1212

Town of Erin Municipal Office
5684 Trafalgar Rd.
Hillsburgh, Ontario
N0B 1Z0

Sent via email only

Attention: Mayor Allan Alls and Members of Council

Re: Settlement Servicing Master Plan EA
Draft Plan of Subdivision 23T-95001
Erin Heights Golf Course
Part of Lot 19, Registrar's Compiled Plan 686 (Village of Erin) Town of Erin
5525 8th Line and 17th Sideroad

Further to my letter to Council dated June 2, 2014 which is appended, I have been retained by the owner of the Erin Heights Golf Course with respect to the proposed residential development for this property. The owner of this property, Jim Holmes, has been involved in the issue of municipal services for Erin since 1992.

The Erin Heights Golf Course property is located within the Erin Urban Area as shown on Schedule A-2 of the Town of Erin Official Plan. The subject property is designated as "Residential" where future residential is proposed on the property. In addition, the subject property is located within the Built Boundary as identified by Places to Grow. The current use of the property is a golf course which means that agricultural land will not be required to be taken out of production in order for this property to be developed for residential. This is consistent with the Provincial Policy Statement 2014. **Please include the Erin Heights Golf Course property in any mapping and for servicing consideration for residential development.**

In 1992, the first proposal for a Draft Plan of Subdivision to create 350 residential units was presented to Town Council. In 2001 a revised plan for 173 units was presented to Council. Over the years revised plans were submitted with various servicing options proposed. The owner of the Erin Heights Golf Course property intends to pursue the existing Draft Plan of Subdivision application at the appropriate time when a servicing solution for Erin becomes evident.

Please provide me with notice of any meetings and the release of any reports related to this process.

Yours truly,

Astrid Clos, RPP, MCIP

cc: Jim Holmes, Erin Heights Golf Course
Kathryn Ironmonger, CAO, Town of Erin
Gary Cousins, County of Wellington

423 Woolwich Street, Suite 201, Guelph, Ontario, N1H 3X3
Phone (519) 836-7526 Fax (519) 836-9568 Email astrid.clos@ajcplanning.ca

12.
General Public Communication Records

Simon Glass

From: [redacted]
Sent: June 23, 2017 10:27 AM
To: Simon Glass; erin.urban.classea@ainleygroup.com
Cc: [redacted]
Subject: RE: Town of Erin Urban Centre Wastewater Servicing - Public Information Centre 1

Thank you Simon.

Regards,

[redacted]

[redacted]
Planning Consultants
423 Woolwich Street
Suite 201
Guelph, Ontario
N1H 3X3

[redacted]

[redacted]

From: Simon Glass [mailto:glass@ainleygroup.com]
Sent: Friday, June 23, 2017 8:49 AM
[redacted]
Subject: RE: Town of Erin Urban Centre Wastewater Servicing - Public Information Centre 1

Hi [redacted]

As discussed at the PIC we have received your email and we have been sure to include the golf course lands within our assessment of future flows/population.

I'll file your letters in our project communications folder for documentation within the ESR.

Regards,

Simon Glass, E.I.T.
Ainley
www.ainleygroup.com

glass@ainleygroup.com
Tel: (905) 452-5172 x 220
Cell: (289) 654-2865
Fax: (905) 595-6701

[redacted]
Sent: June 22, 2017 11:35 AM
To: Simon Glass; erin.urban.classea@ainleygroup.com
[redacted]
Subject: RE: Town of Erin Urban Centre Wastewater Servicing - Public Information Centre 1

Hi Simon,

Thank you for providing notice of the PIC this evening. We will be attending.

I have attached letters previously provided to Council regarding the Erin Heights Golf Course lands which are designated Residential and are within the Erin Urban Boundary and abut the existing Erin Heights residential subdivision. Municipal water is available to the Erin Heights Golf Course lands.

Given the small size of the abutting Erin Heights residential lots, municipal sanitary services will need to be extended to this area as a priority over areas with larger lots. This would bring municipal services to the doorstep of the Erin Heights Golf Course property making this property cost effective to service.

Please ensure that the Erin Heights Golf Course lands are included in the consideration for fully serviced land within the this EA process.

Could you also please ensure that the attached letters become part of the public input record related to this EA.

These lands which are within the Erin Urban Area were mistakenly excluded in earlier phases of the study. **Could you please confirm that the Erin Heights Golf Course lands are included within the study area for consideration for full urban services.**

Thanks very much.

Regards,

[redacted]

[redacted]

[redacted]

[redacted]

From: Simon Glass [mailto:glass@ainleygroup.com]
Sent: Thursday, June 08, 2017 11:31 AM
To: erin.urban.classea@ainleygroup.com
Subject: Town of Erin Urban Centre Wastewater Servicing - Public Information Centre 1

Hello,

This letter is to inform you about the upcoming Public Information Centre (PIC) for the Town of Erin Urban Centre Wastewater Servicing Class Environmental Assessment (Class EA). The PIC will be held on June 22, 2017 at the Erin Community Centre (Centre 2000). The doors will be open at 6.00 pm. For full details about the event, please see the attached notice.

We appreciate your ongoing interest in the project and look forward to meeting with you and discussing the project at the PIC.

Regards,

Simon Glass, E.I.T.
Ainley
www.ainleygroup.com

glass@ainleygroup.com
Tel: (905) 452-5172 x 220
Cell: (289) 654-2865
Fax: (905) 595-6701

Simon Glass

From: Dave Hardy <davehardy@hardystevenson.com>
Sent: May 25, 2017 3:28 PM
To: erin.urban.classea@ainleygroup.com
Subject: PLC Update

Hello to all PLC members,

Here is a status update for Public Liaison Committee (PLC) members regarding the Erin Wastewater Servicing Class EA.

In the previous email update at the end of March, we informed you that the Technical Memorandum examining the viability of subsurface disposal of treated wastewater effluent had been completed and had been sent to the Ministry of Environment and Climate Change (MOECC) and Credit Valley Conservation (CVC) for comment. We are now able inform you that those comments have been received and the Memorandum was finalized and presented to Council on May 16, 2017.

To briefly summarize the responses from MOECC and CVC, MOECC found that:

> *"…there is no significant benefits in terms of capital costs for the inclusion of a subsurface disposal option in Hillsburgh, [and that] a detailed feasibility investigation will involve significant time, cost and uncertainties, which may further negate the option of subsurface disposal in 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 surface disposal with known constraints and risks exists."*

CVC found that:

> *"...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.*

Given the findings from the Technical Memorandum by Ainley Group and the support for those findings from both the MOECC and CVC, no further steps will be taken to assess the viability of the subsurface disposal approach in Hillsburgh.

The full memorandum can be found at:
http://www.erin.ca/uploads/userfiles/files/LSSDS%20Viability%20Report%20Final_compressed.pdf

We would also like to inform you that at the Erin Town Council meeting on May 2nd, a resolution was passed asking Ainley Group to prepare an additional Technical Memorandum on the feasibility of a surface water discharge for a wastewater treatment plant to service Hillsburgh specifically (a two plant solution). The study for that memo is currently under way and you will be updated once completed and MOECC and CVC have commented. At this time, the intention is to present this Technical Memorandum to Council on June 6, 2017.

Our **next PLC meeting will be held on June 8th at 7:00 PM – 9:00 PM**. At that meeting, we will discuss and address any final questions regarding the technical memorandum on subsurface disposal, a two plant solution and will have a chance to preview and comment on the display boards that will be used at the Public Information Centre (PIC) on June 22nd. Additional information on the PIC will be sent out at a later date.

Regards,

David R. Hardy R.P.P.
Principal
Hardy Stevenson and Associates Limited
364 Davenport Road
Toronto, Ontario
M5R 1K6

Cell: (416) 358-9881
Telephone: (416) 944-8444 x 222
Toll Free: 1-877-267-7794
Fax: (416) 944-0900

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Simon Glass

From: Simon Glass
Sent: October 19, 2017 10:00 AM
To: Simon Glass
Subject: FW: Beaver traps and dams at 10th line Erin

-----Original Message-----
[redacted]
Sent: August 10, 2016 4:41 PM
[redacted]
Subject: Beaver traps and dams

To - Allan Alls, Mayor, Councillors - John Brennan, Jeff Duncan, Matt Sammut, Rob Smith and Bob Morris

Four weeks ago, Bob orris called me regarding setting traps for the beavers in order to move them to another area. At that time I told Mr.
Morris that I would like to discuss the matter with him and I suggested meeting with him at his office. He told me he would contact the people involved and they would come to my property to discuss it. I spoke with him again on August 9th and was told, once more, they would come to my property to discuss it. My property is Pt. of the West 1/2 of Lot 13 concession 11 - with the West Credit River as its South border and consists of 7.3 acres. I have lived on this property for 32 years. The beavers have never been an aggrevation or a nuisance to me. They enjoy their natural habitat. Under no circumstances and to be perfectly clear I will not give permission to set traps on my property to remove the beavers and/or their dams - their natural habitat, to the Credit Valley Conservation Authority, The Town of Erin, or any other Agency or Organization,

[redacted]

Simon Glass

From: Simon Glass
Sent: October 19, 2017 10:20 AM
To: Simon Glass
Subject: FW: Beaver damat 10th Line stream gauge, Erin

From: Morris, Bob
Sent: August 18, 2016 10:02 AM
To: James Boyle; sales@pangaeasciences.com; pafflora@sympatico.ca; jan.kulhay@gmail.com
Cc: council@erin.ca.-.allan.alls; "councillors - john brennan, jeff duncan, matt sammut, rob smith, derek.mccaughan"@erin.ca; Mereu, Tim; Martin-Downs, Deborah; Kuntz, Tim; Gupta, Neelam; Sinnige, John; Dougherty, Jennifer; Marray, Liam
Subject: Beaver damat 10th Line stream gauge, Erin

August 17, 2016

Dear [redacted] and others present at the site meeting:

Thank you [redacted] for hosting the site meeting on August 15 parties to discuss the beaver dam and related matters and for inviting other interested parties. I am writing to summarize our discussions and recommended actions.

BACKGROUND

In early July I was informed by Tim Kuntz, our CVC Water Resources Specialist responsible for operations of our flow gauges that the backwater of a beaver dam was interfering with the accurate collection and analysis of flow data at the 10th Line Erin gauge. The data collected at this gauge is very important in determining the assimilative capacity or dilution of effluent from a proposed wastewater treatment plant (WWTP) for Erin. In addition the information is used for flood forecasting, the assessment of low flows and a range of other ecological conditions such as maintenance of the sensitive brook trout fishery of the West Credit River.
When initially contacted you expressed to CVC and others at the Town that you did not want the beavers trapped or the dam removed but agreed to a site visit to investigate conditions and a range of options. In attendance were other landowners [redacted] in the area and including [redacted] mother of the landowner on the opposite bank to yours, where the beaver dam is located and the local councillor, Mr. Matt Sammut. I am also copying others you notified of your position including the Mayor, Allan Alls and Councillors John Brennan, Jeff Duncan and Rob Smith.

CVC Water Resources staff and I met with you all on site and discussed a broader range of issues in the area, but the purpose of my visit and continued communications will remain on the beaver dam. This situation is somewhat unique in that in that generally CVC has no issues with beavers and their dams as part of the natural ecology of the Credit River and that any beaver management decisions, including to leave them alone, reside with the landowners and the Ministry of Natural Resources and Forestry policies regulating such wildlife. I also noted that beaver dams do not generally have the same negative impacts that many manmade dams do. Beavers and brook trout evolved together and their dams are more temporary and often "rough" enough or with side channels that allow for fish passage. Nevertheless CVC feels that reinstating flow conditions for the stream gauge for the purposes of protecting the water quality of the West Credit River with accurate assimilative capacity studies and long term monitoring outweighs not mitigating or removing the dam.

I was also asked whether beaver dams would affect the assimilative capacity of the river and would have to be controlled in the future for the operation of the WWTP. In short the answer was that there are no anticipated effects on assimilative capacity except possibly minor effects on the extent of a dilution mixing zone, given only flow velocities change as they vary along any given reach, but that the actual volume of discharge does not change for dilution purposes. Beaver control may be exercised on lands secured for the WWTP if the proposed outfall is back-flooded.

My observations of the beaver dam and adjacent river reaches suggests that there is no evidence of the dam directly supporting a lodge in the back water, unless much further upstream of 10th line that was not accessed. In addition the dam had a lot of cedar that is used for dam building but is not a preferred food source. There is little evidence of feeding (debarked sticks) or caches of the poplar/aspen trees cut in the area but some evidence of them perhaps crossing the road and taking it upstream where other dams have been reported. I suspect the lodge(s) or bank dens are upstream and that there may be a good chance the dam inspected may not be as important to the beaver colony and may be abandoned if damaged by floods. It should also be noted that the dam is close to its maximum height before it spills into a wider adjacent floodplain that would require much more work by the beavers to build up and maintain.

I also assessed the reach for two options, the first being to encourage the beavers to relocate their dam a little further downstream where the backwater effect could be eliminated at the gauge site. Unfortunately the river gradient flattens out below the existing dam such that relocation would have to be significantly further downstream and would not likely be successful. The second option would be installing submerged pipes at the base of the dam to drain the backwaters and encourage the beavers to abandon the dam as they are unable to stop the leakage unless they can hear and plug the escaping water. The depth downstream of the dam is quite shallow such that only small pipes could be fully submerged and there would not be enough capacity in these pipes to prevent backwaters at moderate and higher flows such that stream gauge readings would still be compromised. Nevertheless this option might help drain the backwaters at low flows and encourage the beavers to abandon this dam.

RECOMMENDATIONS

Given that these dam modifications investigated could have a limited chance of success and that the landowner(s) at this time are opposed to disturbing the beavers, CVC will respect your decision as a landowner. CVC would like permission to continue to monitor beaver activity and the condition of the dam, particularly following the first rain event that occurred Tuesday August 16, following our low water conditions this year and until after next spring's freshet. In the meantime, CVC staff may attempt to re-calibrate the flow gauge readings with the backwater but this is challenging unless dam conditions stabilize. Furthermore alternate gauge locations may be discussed but at this time seem very limited. Hopefully we can revisit options in the future if for example the dam is breached or abandoned or a better appreciation for the value of the flow data is accepted.

OTHER ISSUES

While on site we discussed a number of other topics including older water quality studies, ongoing assimilative capacity studies, population growth in Erin, and two aggregate operations in the vicinity. Regarding these issues, other CVC staff should be consulted including Jennifer Dougherty, Manager, Water Quality Protection on the assimilative capacity and Liam Marray, Manager, Planning Ecology on other planning matters such as aggregate operations. CVC can provide advice on these matters but the ultimate responsibilities are with the Provincial Ministries or the municipality and its consultants.

Aside from your general concern for the river, you expressed concerns that the proposed effluent might contaminate your well that is located between your house and the river and is 22 ft deep. I am recommending that Councillor Sammut request a response from the Town's consultants on this matter and then CVC's experts could be asked to comment on any such assessment provided.

Another request made of the landowners present, that the Town should address, assuming the dye test to assess the mixing zone has been delayed, is that the landowners be personally informed of when the consultants will conduct this test. Likewise the Councillor could request this of the Town's consultants. I also assured all that there are no toxic or other negative ecological impacts associated with the dye.

A specific request was also made to track down a letter sent by [redacted] to Brian Kristy at out Terra Cotta Conservation Area regarding concerns about the potential negative effects such as debris and erosion on the West Credit River from the new Halton Sand and Gravel operation off Bush St. in Erin. This letter has been forwarded to Liam Marray, who will consider its contents and provide a reply to [redacted]

I would like to personally thank all stakeholders in this situation for their interest in the West Credit River, beaver ecology and the value of collecting flow data for its protection and management and am confident a reasonable solution will emerge with continued cooperation and exchange of information.

Thank you.

Robert Morris
Watershed Specialist | Credit Valley Conservation
905.670.1615 ext 379 | C: 647.309.5104 | 1.800.668.5557
bmorris@creditvalleyca.ca | creditvalleyca.ca

Simon Glass

From: Simon Glass
Sent: August 24, 2016 10:30 AM
To: [redacted]
Cc: Tara Roumeliotis (tara@environmentalsciences.ca); Deborah Sinclair (Deborah.Sinclair@environmentalsciences.ca); Christine Furlong (cfurlong@tritoneng.on.ca); noahbrotman@hardystevenson.com; Gary Scott
Subject: 116091 - West Credit River Dye Study Update

Hello,

Please be informed that the previously postponed dye testing in the West Credit River will now take place tomorrow, Thursday, August 25, 2016 from approximately 9:30 am to 5:00 pm.

As a reminder, Town of Erin is currently undertaking a Class Environmental Assessment for Urban Centre Wastewater Servicing for the communities of Hillsburgh and Erin Village. As part of this study, Hutchinson Environmental Sciences Ltd. (HESL) will be conducting a Rhodamine WT dye study on the West Credit River to determine hydrologic characteristics of the river in the vicinity of 10th Line and Winston Churchill Boulevard. The results of this testing will assist the project team in evaluating discharge options for a wastewater treatment facility.

Rhodamine WT dye is the preferred dye tracer for use in hydrologic studies. At the concentrations to be used in this study, it is non-toxic to humans and aquatic life. The dye tracer will cause the water in the West Credit River to have a pink coloration at the site of injection (10th Line and Winston Churchill Boulevard). This effect will become diluted and much less distinct with distance from the study site (e.g., by 1.5 km downstream, at Winston Churchill Boulevard and Shaws Creek Road, respectively). The dye will no longer be visible approximately six hours after being placed in the river. Credit River Conservation and the Ministry of Environment and Climate Change are both aware of the testing program.

Deborah Sinclair and Tara Roumeliotis of HESL will be conducting the dye testing.

Regards,

Simon Glass, E.I.T.
Ainley
www.ainleygroup.com

glass@ainleygroup.com
Tel: (905) 595-6862
Cell: (289) 654-2865

Welcome back from what we hope has been a relaxing and fun summer for everyone. This email provides a status update of the progress on the Erin Wastewater Servicing Class EA.

Throughout the summer our team has been hard at work on a number of technical studies that are key components of the Class EA process. Our primary focus has been on the following activities:

1. Completing the septic survey of systems in Erin.
2. Completing a detailed topographical survey of the study area
3. Identifying collection system alternatives
4. Identifying potential wastewater treatment plant sites
5. Completing a peer review of the 7Q20 flows in the West Credit River
6. Completing the Rhodamine WT dye study in order to determine hydrologic characteristics of the West Credit River that will be used in evaluating discharge options for the wastewater treatment facility.

At this time, we are pleased to report that the field work for these tasks have been completed and we are now analysing the new information, assessing potential sewage flows from the existing communities and analysing collection system alternatives.

The focus of the next Public Liaison Committee (PLC) meeting will be on providing you with updates and obtaining your comments about the revised CVC flow data and the assimilative capacity study. We will also look at the extent of the existing communities to be serviced and the potential service population. Your comments on these matters will also be important.

Once we have completed our associated technical memos on the septic systems, updated river flow and assimilative capacity, and collection system alternatives, the Core Management Team (CMT) will review and comment on the technical memos. The technical memos will remain in draft form through submission to Council, and to you as PLC members for comment. Thereafter, our team will prepare for the first Public Information Centre (PIC) still planned for November 2016. We will be reviewing PIC info with you before we finalize the PIC approach.

After receiving all comments through the PIC process, we will close out Phase 2 of the study which will define the extent of the service area including existing communities and areas for planned growth. As a heads up to future activities, starting next year we will start to define and analyse treatment processes and sites and effluent discharge alternatives. We encourage all questions and comments. If you have any further questions, please send a message to the project email address: erin.urban.classea@ainleygroup.com

Simon Glass

From: [redacted]
Sent: August 30, 2016 6:11 PM
To: erin.urban.classea@ainleygroup.com
Cc: allan.alls@erin.ca
Subject: Erin EA

Hi...

I am a member of the public liaison committee. In the last meeting we discussed a number of areas where we need more information and updates. The next meeting is coming up quickly in October and I was wondering when we could expect the following information:

1.When can we expect to see the updated CVC flow data and assimilative capacity number?

2.Any informational materials that would help us understand the technologies or any links to youtube videos that would better inform us (requested at the last meeting).

3. An idea of what is going to be discussed at the next meeting or any reports that you will present to us.Remember, we all represent various communities and need to take the information to them prior to the next meeting.

4. Even a general update on your progress to date would be helpful in advance of the next meeting. There has been little communication since the last meeting and a few of us are wondering what is going on. An all member email on progress would be helpful. I would suggest an email that addresses items brought up in the minutes of the last meeting would be a good idea.

[redacted]
Erin Environment and Sustainability Committee.

Simon Glass

From: Simon Glass
Sent: October 19, 2017 2:29 PM
To: Simon Glass
Subject: FW: PLC Questions -- Jay Mowat

Responses in red:

From: [redacted]
Sent: November 22, 2016 4:00 PM
To: erin.urban.classea@ainleygroup.com
Subject: PLC Questions

Here is a list of questions I would like to discuss at the PLC meeting on Thursday:

1. Two years ago, BM Ross suggested that the West Credit could handle waste from some 6000 people. Now Ainsley is suggesting that the number is 14,559 - nearly 2.5 times higher than the figure quoted by BM Ross.

How did Ainsley come up with a number nearly 2.5 times higher than BM Ross using basically the same data? Could you explain the differences between the BM Ross study and the Ainsley study. The differences are not clear in the documents.

The largest difference between the Ainley assessment and the BM Ross assessment of the future population is the level of treatment assumed at the treatment facility. The BM Ross report assumed a non-compliance effluent concentration of 0.15 mg/L phosphorus whereas Ainley is suggesting that using "Best Available Technology" a 0.045 mg/L phosphorus concentration in the effluent can be achieved. This factor alone represents 0.15/0.045 = 3.33 times the volume that can be discharged between the BM Ross Study and the present Class EA.

2. You've allowed for a 10% reduction in water flow in the West Credit due to climate change Given that a potential sewage treatment plant will last for decades, shouldn't you be allowing for a much greater reduction in water flow due to climate change perhaps as great as 20%. The 10% reduction in flow due to climate change for the ACS is the same assumption that was made for both the current and the previous ACS. This is the number that CVC and MOECC are comfortable with.

3. The Ainsley report suggests a number of areas in Hillsburgh and Erin don't need to be connected to a treatment facility basically because of larger lot sizes. In the past, there was worry that this would create two classes of housing which would have a negative effect on some property values. The excluded areas don't seem to be that large in number. Will Ainsley also provide data on an option to include all housing in the Erin and Hillsburgh village areas. Ainley was unable to determine adequate justification for the connection of properties in the areas which were excluded. This is an issue that will likely invite some public comment and this may have to be taken into consideration.

4. In the minutes of the May 30, 2016 ACS Pre-consultantion meeting, the following was recorded:

"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."

and

"MOECC noted that they would prefer to not be involved in the whole ACS process, but would rather just review the finalized ACS report."

Ainsley's suggestion that the river can handle 14,559 residents seems a significant departure from BM Ross. Can Ainsley outline any discussions with MOECC (and the CVC for that matter) that would indicate support for the much larger ASC number? The ACS is only one component of the change in in suggested service population. As noted above, by far the largest contributing factor is the level of treatment technology. The ACS results are not substantially different from the previous results, however our team also developed a Site Specific Water Quality Objective for phosphorus in the river to further protect the river. Discussions with MOECC indicated that the Class EA team should consider whether it is appropriate to assume going from 0.016 mg/l in the river all the way up to the PWQO of 0.03 mg/l. Our team considered this and has suggested that the Class EA be based on going to no higher than 0.024 mg/l. This is our Site Specific Water Quality Objective. This is outlined in an appendix to the ACS.

Also, is there any chance that either the MOECC or the CVC will reject the new ASC report? While MOECC and CVC have participated in the study, they retain their approval rights. The completed reports to date are now being sent to these agencies for their official review. We anticipate receiving comments before the Public Information Centre.

Thanks for your consideration. See you Thursday.

[redacted]

Simon Glass

From: Simon Glass
Sent: October 19, 2017 2:19 PM
To: Simon Glass
Subject: FW: PLC Questions

From: [redacted]
Sent: November 22, 2016 4:00 PM
To: erin.urban.classea@ainleygroup.com
Subject: PLC Questions

Here is a list of questions I would like to discuss at the PLC meeting on Thursday:

1. Two years ago, BM Ross suggested that the West Credit could handle waste from some 6000 people. Now Ainsley is suggesting that the number is 14,559 - nearly 2.5 times higher than the figure quoted by BM Ross.

How did Ainsley come up with a number nearly 2.5 times higher than BM Ross using basically the same data? Could you explain the differences between the BM Ross study and the Ainsley study. The differences are not clear in the documents.

2. You've allowed for a 10% reduction in water flow in the West Credit due to climate change Given that a potential sewage treatment plant will last for decades, shouldn't you be allowing for a much greater reduction in water flow due to climate change perhaps as great as 20%.

3. The Ainsley report suggests a number of areas in Hillsburgh and Erin don't need to be connected to a treatment facility basically because of larger lot sizes. In the past, there was worry that this would create two classes of housing which would have a negative effect on some property values. The excluded areas don't seem to be that large in number. Will Ainsley also provide data on an option to include all housing in the Erin and Hillsburgh village areas.

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and

"MOECC noted that they would prefer to not be involved in the whole ACS process, but would rather just review the finalized ACS report."

Ainsley's suggestion that the river can handle 14,559 residents seems a significant departure from BM Ross. Can Ainsley outline any discussions with MOECC (and the CVC for that matter) that would indicate support for the much larger ASC number?

Also, is there any chance that either the MOECC or the CVC will reject the new ASC report?

Thanks for your consideration. See you Thursday.

Simon Glass

From: [redacted]
Sent: December 6, 2016 9:20 AM
To: Gary Scott
Cc: 'Christine Furlong'; garyc@wellington.ca; Derek.McCaughan@erin.ca; Simon Glass; Joe Mullan
Subject: RE: Erin Wastewater Environmental Assessment

Dear sir,

Thank you for your response to my inquiry on behalf of my client. We will review the development potential of my client's lands with Wellington County planning staff as our background studies proceed.

Nonetheless, the proposed level of servicing for the lands within the Environmental Assessment is a critical part of any planning approval process required moving forward. Please keep us advised as to how the subject lands are proposed to be serviced as the study moves forward.

Regards,

[redacted]

[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: Monday, November 28, 2016 11:36 AM
[redacted]
Cc: Christine Furlong; 'garyc@wellington.ca'; Derek.McCaughan@erin.ca; Simon Glass; Joe Mullan
Subject: FW: Erin Wastewater Environmental Assessment

Thank you for your email in connection with the Erin Wastewater Class EA.
The information presented to Council was a summary of our Sewage Flow and Capacity Technical Memorandum which is available on the Town website. The purpose of this Technical Memorandum was to establish the required capacity of a communal wastewater to service existing developed areas of Erin and Hillsburgh and to establish the required capacity to service all of the lands presently allocated to growth under the Town Official Plan. The lands designated for growth were agreed with Wellington Planning Department.
The suggested ultimate servicing capacity of a communal wastewater system is still subject to review by the public and relevant agencies. The Class EA is anticipated to be completed in April of 2018. While the completion of the Class EA for Wastewater identifies the potential for servicing by a communal wastewater system, any decisions regarding future servicing will still be subject to all of the relevant planning approvals.

For any discussion on planning issues related to the lands you reference, we would refer you to Wellington County Planning Department.

Gary Scott
scott@ainleygroup.com

Tel: (905) 595- 6859
Cell: (905) 767-1284

[redacted]
Sent: November 25, 2016 10:47 AM
To: erin.urban.classea@ainleygroup.com
Cc: 'Dina Lundy'; 'Gary Cousins'; [redacted]
Subject: Erin Wastewater Environmental Assessment

Dear Mr. J Mullan,

I represent Mr. [redacted] who is the owner of the former Chambers property, consisting of Part of the West Half of Lot 14, Concession 9, Town of Erin. The lands are located within the Erin Urban Area boundary, and are designated a combination of Residential, Greenlands and Core Greenlands in the Town of Erin Official Plan. My client is currently undertaking environmental and engineering studies of the property to support a development application on the site.

I have reviewed the Urban Centre Wastewater servicing brief presented to Council on November 8th, 2016. The subject property is located partially within the area identified as South Erin in the septic system survey which formed part of the study. South Erin was further recommended to not be connected to the future wastewater collection system. On the map of New Growth Areas (attached) in the brief part of the property is identified as a residential growth area (ER-16). A portion of the remainder of the property may be included in the new growth area of 4.2ha also identified in this area but that is not clear from the mapping.

The owner is examining development options for his entire holding. The level of servicing to be considered by the Town for the entire property is an essential part of that examination.

Can you please provide further information on how the entire holding is intended to be dealt with in the wastewater study? Please contact me if you have any questions related to the property.

Regards,

[redacted]

[redacted]

Simon Glass

From: [redacted]
Sent: August 10, 2016 10:59 AM
To: Gary Scott
Cc: Simon Glass; Noah Brotman; Christine Furlong; Joe Mullan; Dina Lundy; Deborah Sinclair
Subject: RE: Erin Wastewater Class EA

Gary,

Thank you for your email.

I will wait for information once its available.

Thanks again,

[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: Monday, August 08, 2016 9:51 PM
[redacted]
Cc: Simon Glass; Noah Brotman; Christine Furlong; Joe Mullan; Dina Lundy; Deborah Sinclair
Subject: RE: Erin Wastewater Class EA

Sorry [redacted] we have not been able to clarify MOECC position on something and cannot confirm this aspect of the ACS work plan. We would certainly like to get this compleded and provided to the Core Management Team (CMT) in the near future and are working towards this. Meanwhile aspects of the ACS workplan are proceeding and we will be doing dye testing in the river on Monday Aug 15 2016. This should be on the project website and adjacent landowners should be informed (Im presuming including you).
We understand your interest! We are nearing completion of assessing existing septic systems and working on comparing alternative collections systems for the existing community. This will all come together in the next two months.
We do give project updates for monthly Council meetings and the PLC committee will be able to review materials after review by the Core Management Team.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

[redacted]
Sent: August-08-16 11:32 AM
To: Gary Scott
Cc: Simon Glass; Noah Brotman; Christine Furlong; Joe Mullan; Dina Lundy
Subject: RE: Erin Wastewater Class EA

Gary,

Just following up to my request below.

Thank you,

[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: Monday, August 01, 2016 9:20 AM
[redacted]
Cc: Simon Glass; Noah Brotman; Christine Furlong; Joe Mullan; Dina Lundy
Subject: RE: Erin Wastewater Class EA

Let me see where we are tomorrow. I'll get back to you shortly.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

[redacted]
Sent: August-01-16 9:16 AM
To: Gary Scott
Cc: Simon Glass; Noah Brotman; Christine Furlong; Joe Mullan; Dina Lundy
Subject: Re: Erin Wastewater Class EA

Gary,

Hope all is well.

Further your correspondence below, I am writing to see if there is an update on submitting the ACS Work Plan update?

We at Solmar have a keen interest in this work and therefore would like the opportunity to review the same.

Please let me know.

Thank you,

[redacted]
SOLMAR DEVELOPMENT CORP.
www.solmar.ca

From: Gary Scott
Sent: Monday, July 18, 2016 11:47 AM
[redacted]
Cc: Simon Glass; Noah Brotman; Christine Furlong; Joe Mullan; Dina Lundy
Subject: Erin Wastewater Class EA

[redacted]
Apologoes for delay in responding to your request for our ACS workplan. Joe and I have been on vacation. Work plans included in our proposal were preliminary. We did develop an ACS work plan and have met with MOECC and CVC and we are now working on elements of that plan. We still have an ongoing discussion we need to complete with MOECC. We anticipate completing this soon and submitting an update on the ACS to our core management team at the next meeting.

For these deliverables the team has established a protocol wherein they will be presented to our Core Management Team and then will go to Council and then provided to the PLC for discussion/input.

Gary Scott, M. Sc., P. Eng.
Vice President, Water Business

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Simon Glass

From: Simon Glass
Sent: October 19, 2017 11:56 AM
To: Simon Glass
Subject: FW: FW: Erin: Assimilative capacity

From: Slattery, Barbara (MOECC) [mailto:barbara.slattery@ontario.ca]
Sent: October-14-16 8:26 AM
[redacted]
Cc: Christine Furlong; Gary Scott; Dougherty, Jennifer; Neil Hutchinson (Neil.Hutchinson@environmentalsciences.ca)
Subject: RE: FW: Erin: Assimilative capacity

[redacted]

The following is provided as a response to your email:

With respect to the use of a 10% reduction to account for climate change, the rationale used by both B.M. Ross and the current consulting team is reasonable and is consistent with what other municipalities are using. In the absence of having a better understanding of climate change at this scale, and utilizing the "precautionary approach" a 10% reduction is a reasonable estimation rather than completely discounting climate change impacts. Obtaining flow data over the last few years is reflective of climate (and climate change) that is being experienced in streams presently. Accounting for an additional 10% reduction in flow is a conservative and reasonable approach.

The 10% reduction value has remained because of the timescales that are involved. A two year window is not a sufficient enough window to make conclusions on how flow values will change. It is possible in the future that more information will be available that will allow for further refinement of climate change impacts.

I understand that you have also posed questions to both the consultants and to the CVC so they will also be providing you with their responses.

Thank you,

Barb Slattery, EA/Planning Coordinator
Ministry of the Environment and Climate Change
West Central Region
(905) 521-7864

[redacted]
Sent: October 12, 2016 5:05 PM
To: Slattery, Barbara (MOECC)
Subject: Re: FW: Erin: Assimilative capacity

Hello Barb Slattery,

Thank you so much for you're informative, thoughtful, and quick response. The Concerned Erin Citizens very much appreciate it!!

I just have a few follow up questions regarding this quote "the work being done is using a 10% reduction in water availability to account for climate change which has been deemed to be reasonable":

It is true that BP Ross used a 10% reduction in water availability to account for climate change in calculating their assimilative capacity figures during the SSMP back in 2014. But have current studies carried out by Ainley Group and Triton Engineering this past year also adopted this 10% figure? Why has the figure stayed the same? How is this figure calculated? Is it based on west credit river flow reductions?

Also, what are the timeframes for this anticipated 10% reduction in water flow (5 years....50 years)?

Lastly, how does the Credit Conservation Authority fit into the picture in determining assimilative capacity?

Again, thank you very much in advance!! Very Sincerely,[redacted]

On Wed, Oct 12, 2016 at 12:22 PM, Slattery, Barbara (MOECC) <barbara.slattery@ontario.ca> wrote:

Hello[redacted]

We have prepared the following in response to your email. However, please understand that there is no requirement in the Class EA process to undertake an assimilative capacity study. It has become our practice to have them completed by any municipality that is undertaking an EA for a new plant or existing plant expansion, we feel that is how feasibility and acceptable impact to the surface water receiver can be demonstrated. The assimilative capacity study also determines the effluent quality that will need to be achieved which in turn, serves as the starting point for the design of the treatment facility.

Once a proponent completes the assimilative capacity study, MOECC staff review the study and comment on methodology, breadth of actual data used in the model, the assumptions of the model in order to determine whether it is reasonable to accept the conclusions so that the next phases of the EA can continue.

Here are our responses to the questions in your email:

1. The MOECC evaluates point source discharges to surface water bodies primarily by using two documents: 1. *Deriving Receiving-Water based, Point Source Effluent Requirements for Ontario Waters*, MOEE July 1994; and 2. *Water Management – Policies, Guidelines, and Provincial Water Quality Objectives*, MOEE July 1994. These documents do not provide a lot of information on how to conduct an ACS, but do provide water management policies that guide the process. Generally, an

ACS will evaluate the type of discharge and waterbody, flow analysis of the receiver, examine background water quality, characterize effluent parameters of concern, assess mixing (mass balance/mixing zone), and determine waste assimilation capacity. All of this together forms the ACS and is used in a site specific context to determine impacts to environment, habitat, sensitive species, etc. The MOECC works with the environmental firms to ensure the water management policies/guidelines/legislation are being followed, any assumptions are appropriate, and the conclusions of the study are reasonable. The process is not entirely prescriptive as professional judgement is used both from the MOECC and the consultants and the scope of MOEC review is specific to water quality and quantity considerations.

2. Climate change models are generally done on a large scale and are difficult to apply on small scale. There are multiple climate change models that can provide a range in temperature/precipitation outputs which confounds the application of results. T he work being done is using a 10% reduction in water availability to account for climate change which has been deemed to be reasonable, but at this time, there are no guidance or tools available to incorporate climate change models. As was mentioned, the past summer was very dry and summer flows were very low. The empirical data collected by the monitoring program is representative of climate change so the benefits of modelling are diminished.

3. The guidance documents that the ministry uses for evaluating discharges is attached to this email. However, there isn't a set of standards (outside the PWQOs or CWQGs) or models used by the ministry. There are models, particular to predicting mixing, available commercially to consultants that are more common than others, but the ministry doesn't develop or endorse any specific model whether it be for climate impacts or for effluent mixing.

For further information on the study and the EA in general, please consider contacting either Ms Christine Furlong of Triton Engineering, acting on behalf of the Town, or Mr. Gary Scott of Ainley Group, consultant for the job.

Best regards,

Barb Slattery, EA/Planning Coordinator

Ministry of the Environment and Climate Change

West Central Region

(905) 521-7864

From: Fowler, Craig (MOECC)
Sent: October 12, 2016 10:40 AM
To: Slattery, Barbara (MOECC); Odom, Paul (MOECC)
Subject: RE: Erin: Assimilative capacity

Hi Barb,

I think it would be beneficial for the CEC to contact the Town (and their consultants) for additional info on how the ACS is being completed. In terms of responses to the three questions I see (and numbered below) I offer the following:

1. The MOECC evaluates point source discharges to surface water bodies primarily by using two documents: 1. *Deriving Receiving-Water based, Point Source Effluent Requirements for Ontario Waters*, MOEE July 1994; and 2. *Water Management – Policies, Guidelines, and Provincial Water Quality Objectives*, MOEE July 1994. These documents do not provide a lot of information on how to conduct an ACS, but do provide water management policies that guide the process. Generally, an ACS will evaluate the type of discharge and waterbody, flow analysis of the receiver, examine background water quality, characterize effluent parameters of concern, assess mixing (mass balance/mixing zone), and determine waste assimilation capacity. All of this together forms the ACS and is used in a site specific context to determine impacts to environment, habitat, sensitive species, etc. The MOECC works with the environmental firms to ensure the water management policies/guidelines/legislation are being followed, any assumptions are appropriate, and the conclusions of the study are reasonable. The process is not entirely prescriptive as professional judgement is used both from the MOECC and the consultants and the scope of my review is specific to water quality and quantity considerations.

2. Climate change models are generally done on the large scale and are difficult to apply on small scale. There are multiple climate change models that can provide a range in temperature/precipitation outputs which confounds the application of results. I believe BM Ross used a 10% reduction in water availability to account for climate change which was deemed to be reasonable at the time, but there are no guidance or tools available to incorporate climate change models. As was mentioned, the past summer was very dry and summer flows were very low. The empirical data collected by the monitoring program is representative of climate change so the benefits of modelling are diminished.

3. I've attached the guidance documents that the ministry uses for evaluating discharges, but there isn't a set of standards (outside the PWQOs or CWQGs) or models used by the ministry. There are models, particular to predicting mixing, available commercially to consultants that are more common than others, but to my knowledge the ministry doesn't develop or endorse any specific model whether it be for climate impacts or for effluent mixing.

Craig Fowler, M.Sc.| Surface Water Specialist | Technical Support Section| Ministry of the Environment and Climate Change| 119 King St. West, 12th Floor, Hamilton, Ontario, L8P 4Y7 | ph: 905-521-7823 | fax: 905-521-7820 | craig.fowler2@ontario.ca

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From: Slattery, Barbara (MOECC)
Sent: October 12, 2016 8:48 AM
To: Fowler, Craig (MOECC); Odom, Paul (MOECC)
Subject: FW: Erin: Assimilative capacity

Gents, could you please help me with a response to this gentlemen as I can't think of a nice "definition/explanation" of how we assess ACS in lay terms. I also intend to suggest that he may wish to contact Triton to have it explained.

Thank you

[redacted]
Sent: October 10, 2016 4:18 PM
To: Slattery, Barbara (MOECC)
Subject: Erin: Assimilative capacity

Hello Barbara Slattery,

I am a member of Concerned Erin Citizens (CEC). It is a ratepayer association in the town of Erin which champions issues ranging from economic to environmental.

Our town has decided it wants a municipal wastewater collection and treatment system and is currently undertaking a Schedule C- Municipal Class EA. Effluent from the future wastewater plant will flow into the west credit river. Last summer Hutchinson Environmental Sciences Limited and the Credit Valley Conservation Authority (CVC) carried out assimilative capacity studies. These studies will determine discharge limits for the treated effluent and servicing limits for our town, ultimately dictating how large our town can grow.

Assimilative capacity studies have been undertaken several times in Erin's past, most recently in 2014 during the servicing and settlement master plan- the precursor to our current EA. However, given that the west credit river was at a record low this past summer and that this past summer was the hottest on record, we at the CEC hope that the very latest climate change

models/projections will ensure the assimilative capacity is lowered from its 2014 figure to reflect new realities.

The CEC is very interested in knowing exactly how the MOECC fits into the picture in determining assimilative capacity. 1. How does the MOECC work with the environmental firms hired by the town and the CVC?

2. Which climate change models have been referenced in determining the assimilative capacity?

3. Is it possible you could provide us with your set of standards/models which you use in determining assimilative capacity?

Any help and information you can provide us with would be greatly appreciated!!!

Very Sincerely, [redacted]

Simon Glass

From: Gary Scott
Sent: April 10, 2017 1:51 PM
[redacted]
Cc: Joe Mullan; Simon Glass; 'Noah Brotman'; 'Christine Furlong'
Subject: RE: sub-surface discharge/ inter-rural w/w pipe connections

[redacted] with respect, there are likely hundreds if not thousands of examples of subsurface disposal systems throughout the Province servicing rural facilities such as schools, highway service stations, recreation facilities, parks, rural subdivisions etc and we simply don't have the resources, budget or need to list them.
The Stayner Sewage Pumping Station forcemain is likely around 5 km long and discharges into a Wasaga Beach sewer. From where it flows to another SPS and is pumped again to the Wastewater Treatment System. Again we not aware of all or even many of the sewage systems that convey sewage between communities and don't necessarily need to know this to complete our evaluation of alternatives foe Erin and Hillsburgh.

Gary Scott
scott@ainleygroup.com
Tel: (905) 452- 5172 ext 202
Cell: (905) 767-1284

[redacted]
Sent: April-10-17 11:56 AM
To: Gary Scott
Cc: Joe Mullan; Simon Glass; 'Noah Brotman'; 'Christine Furlong'
Subject: RE: sub-surface discharge/ inter-rural w/w pipe connections

Thanks Gary..

Re. **Inter-community wastewater connections** (excluding the "Big Pipe" scenarios that pump to Lake Ontario – that require an extremely large population to cover cost);

1. What is the distance for Stayner's wastewater to travel to Wasaga beach? How many pumping stations were required?
2. Any other inter-community arrangements in moving wastewater from one development to one that has available wastewater servicing? (i.e Rockwood > Guelph)?

Re **Sub-surface discharge**: You had mentioned in our conversation of a number of communities who had implemented sub-surface discharge .. all I am asking is a listing of these communities - other than Pine Meadows (between Belwood and Fergus). I can wait for such a list if, as I understand, this info will be incorporated in Ainley's report re subsurface discharge.

Thanks
[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: April-10-17 11:19 AM
[redacted]

Cc: Joe Mullan; Simon Glass; Noah Brotman; Christine Furlong
Subject: RE: sub-surface discharge/ inter-rural w/w pipe connections

Thanks for reminder [redacted]
We are not really in a position to comment in detail on these project solutions. We have used a couple of examples we are more familiar with in our subsurface disposal technical memo which is under review and hopefully will be presented to Council and PLC in the coming month.

We will respond directly to the letter from Transition Erin as soon as we are through the review process of our technical memo.

An example of a rural community being connectd to another rural community would be the Stayner connection to Wasaga Beach. With the planned growth in Stayner it was found to be more advantageous to decommission the Stayner lagoons and pump all flow to Wasaga Beach for treatment in one larger facility. An example of a big pipe solution connection to a larger system would be King City where all the septics were replaced by a communal system discharging into the York Durham Sewage System. From King City, Newmarket, Aurora Richmond Hill, Vaughan all the sewage is pumped all the way to Pickering for treatment in the Duffins Creek WWTP.

Gary Scott
scott@ainleygroup.com
Tel: (905) 452- 5172 ext 202
Cell: (905) 767-1284

[redacted]
Sent: April-10-17 11:01 AM
To: Gary Scott; Joe Mullan
Subject: RE: sub-surface discharge/ inter-rural w/w pipe connections

Dear Joe and Gary,

Never did receive a response to the below questions posed back in January?

Please advise when responses might be forthcoming.

Thanks

[redacted]

[redacted]
Sent: January-20-17 5:13 PM
To: 'Gary Scott'; 'mullan@ainleygroup.com'
Subject: sub-surface discharge/ inter-rural w/w pipe connections

Dear Joe and Gary,

Thanks for the time afforded me after your delegation to council this week.

Just to follow up on our side-bar conversation on sub-surface discharge, you had mentioned several examples of communities who have employed this method. I recall you mentioned the Pines Meadow development in Belwood is one: (195 homes/65 ac, located very close to the Grand River and Irvine Creek .. curious why they had chosen sub-surface with water so close by and located merely 7 km from Fergus's full servicing capabilities)

You had mentioned a number of other examples, can you confirm some additional examples?

You also cited several examples of rural communities currently connected to wastewater by a big pipe to a larger rural community (aside from Rockwood). Can you confirm those examples as well?

Thanks

[redacted]

Think Green. Read the screen

Simon Glass

From: Allan Alls <Allan.Alls@erin.ca>
Sent: August 22, 2017 2:29 PM
To: [redacted]Noah Brotman
Cc: Dave Hardy; Nathan Hyde
Subject: RE: Emailing - Erin PLC 3 Notes Final(1).pdf

[redacted]

Unforunately Dina is away this week on holidays but both Nathan and I don't recall asking for this. Prior to agenda items going on the Council agenda Nathan, Dina, and myself review for accuracy and content.
Al

[redacted]
Sent: August-17-17 4:19 PM
To: 'Noah Brotman'; Allan Alls
Cc: 'Dave Hardy'; Nathan Hyde
Subject: RE: Emailing - Erin PLC 3 Notes Final(1).pdf

Thanks Noah, .. and to Mayor Alls.

But waiting 2 months to comment on the minutes is somewhat unreasonable for anyone to remember the various questions and responses and is certainly not in compliance to the Terms of Reference as outlined below.

The PIC and PLC minutes are quite separate events. I can perhaps appreciate the Town's request to review the PIC meeting. I am not clear why there was a need for the minutes of the PLC#3 to be reviewed by the Town in advance of the committee members?

Not a big deal, but if this is to be the trend for the future PIC meetings, I believe the Terms of Reference ought to stipulate this and the corresponding justification for the change. Will we now need to wait 2 months for the draft minutes so that the Town can review/edit? I propose this subject be added to the agenda for PLC #4 meeting.

Question for Mayor Alls: Could you weigh in on why the Town felt the need to review the minutes of PLC#3 when it did not for the previous 2 PLC meeting minutes and why it took 2 months to do so?

Thank you,
[redacted]

From: Noah Brotman [mailto:noahbrotman@hardystevenson.com]
Sent: August-17-17 1:56 PM
[redacted]
Cc: Dave Hardy
Subject: RE: Emailing - Erin PLC 3 Notes Final(1).pdf

Hi Roy,

The Town requested that they would have the opportunity to review notes before being posted or sent out. This has slightly changed the timing of how we approach getting comments back, but we are certainly still accepting suggested edits on the notes and will incorporate the feedback provided where appropriate.

Regards,

Noah Brotman
Urban Environmental Planner
Hardy Stevenson and Associates Limited
364 Davenport Road
Toronto, ON
M5R 1K6
T (416) 944-8444 ext. 226
Toll Free 1 (877) 267-7794
Email: noahbrotman@hardystevenson.com
Web: www.hardystevenson.com
Twitter: twitter.com/HardyStevenson

[redacted]
Sent: Thursday, August 17, 2017 1:51 PM
To: Noah Brotman <noahbrotman@hardystevenson.com>
Cc: Dave Hardy <davehardy@hardystevenson.com>
Subject: RE: Emailing - Erin PLC 3 Notes Final(1).pdf

Thanks Noah...

In reviewing the Terms pf Reference:

Minutes
Minutes of meetings with the PLC will be taken by a member of the Project Team. Draft meeting minutes will be circulated to the PLC for suggested edits following each meeting. Members will have three business days to provide suggested edits (only information that was recorded erroneously or was incorrect will be incorporated – no new comments will be added); then, the minutes will be finalized (incorporating suggested edits, if applicable), re-circulated and posted on the project website.

Noah, I'm a little confused. Why were the members (who attended) not given the opportunity review prior to being posted? The minutes of PIC#3 would have been published shortly after the June 7th meeting, and only became public on August 4th as part of the Council Agenda and posted on the Town's web site shortly after the august 8th Council meeting?

Thanks
[redacted]

From: Noah Brotman [mailto:noahbrotman@hardystevenson.com]
Sent: August-17-17 12:56 PM
[redacted]
Cc: Dave Hardy
Subject: Re: Emailing - Erin PLC 3 Notes Final(1).pdf

Hi [redacted]

The Town had asked us to wait on circulating the notes for both the PLC meeting and the PIC until they had a chance to review and comment. It had been my intention to send along the reports to PLC members earlier this week but I was pulled away by other matters. Will be sending out to all PLC members shortly.

Thanks,

Noah Brotman
Urban Environmental Planner
Hardy Stevenson and Associates Limited
364 Davenport Road
Toronto, ON
M5R 1K6
T (416) 944-8444 ext. 226
Toll Free 1 (877) 267-7794
Email: noahbrotman@hardystevenson.com
Web: www.hardystevenson.com
Twitter: twitter.com/HardyStevenson

[redacted]
Sent: August-16-17 1:31 PM
To: 'Dave Hardy'
Cc: 'Joe Mullan'
Subject: FW: Emailing - Erin PLC 3 Notes Final(1).pdf

Attention: Dave

In last week's Council meeting, the minutes of PLC#3 meeting was part of the agenda package and subsequently posted thereafter on the Town's web site.

I was under the impression the minutes would first be circulated to those who attended for comment, then thereafter a final coy emailed to the PLC members. Not clear members received the attached .. … not sure each member would check the website.

Perhaps sending out the "Public Information Centre – Consultation Report" to each of the members would be also a good thing.

Thank you
[redacted]

Simon Glass

From: Simon Glass
Sent: October 19, 2017 2:29 PM
To: Simon Glass
Subject: FW: PLC questions Response to [redacted]

Responses in red.

From: Neil Hutchinson [mailto:Neil.Hutchinson@environmentalsciences.ca]
Sent: November-23-16 12:08 PM
To: Gary Scott; Christine Furlong; Allan Alls (Allan.Alls@erin.ca); Derek.McCaughan@erin.ca; Joe Mullan; Dave Hardy; Noah Brotman; Deborah Sinclair
Subject: RE: PLC questions Response to Roy Val

Thanks Gary – see comments below on A1 – also some of the HESL responses below do not reflect the edits I sent earlier today

Wrt: B4 The CVC recommended 7Q20 value has been increased. The Ainley team recommended downstream phosphorus concentration in the river has been reduced. Both of these combined, reduce the potential for the serviced population.

- This is not accurate - increasing the 7Q20 will increase the serviced population (allows more effluent). Reducing the recommended downstream, P concentration will reduce the allowable effluent, all else being equal

B5 – precipitation /climate – see earlier email where IO provided measured values to show that flow was > 7Q20 in 2016
HESL Response: Please see CVC response to your similar question posed to them: Precipitation was noticeably lower than average this year, however, the minimum streamflows measured at 10th Line by HESL field crews in 2016 were 381 L/sec (July 27), 370 L/sec (Aug. 25 and 305 L/sec (September 28). These are well above the 7Q20 value of 225 L/sec.

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: Wednesday, November 23, 2016 11:25 AM
To: Christine Furlong (cfurlong@tritoneng.on.ca) <cfurlong@tritoneng.on.ca>; Allan Alls (Allan.Alls@erin.ca) <Allan.Alls@erin.ca>; Derek.McCaughan@erin.ca; Joe Mullan <mullan@ainleygroup.com>; Dave Hardy <davehardy@hardystevenson.com>; Noah Brotman <noahbrotman@hardystevenson.com>; Neil Hutchinson <Neil.Hutchinson@environmentalsciences.ca>; Deborah Sinclair <Deborah.Sinclair@environmentalsciences.ca>
Subject: RE: PLC questions Response to [redacted]

Questions received from [redacted] with suggested response in red. We may want to get a response out before the meeting. Please send me any suggested changes. We can also discuss this afternoon if necessary.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

To the Ainley group:

I, along with some of my neighbours, have reviewed the technical memorandums on Septic and Flow, available on the Town's web site. We have listed below a number of questions in advance of the Liaison meeting on the 24th. Some questions perhaps can be answered quickly and before the meeting by return, others I assume can be discussed at the meeting, and still some other questions may be a bit early in the process.

It was mentioned the requested glossary of terms and acronyms would be made available on the website ..... I was unable to locate them on the Town's website. We are working on this and will post it as soon as we can.

Thank you

[redacted]

Resident and Liaison committee member

A. Questions to the November 2016 Ainley's Technical Memorandum Septic System Overview draft for comments.

1. The West Credit River, a Policy 1 stream, has a Total Phosphorus (TP) concentration of between 0.011 – 0.015 mg/L well below the Provincial Water Quality Objective (PWQO) of 0.03 mg/L. Is it safe to say there is no evidence currently of septic leakage in the Village of Erin even with some septic systems as old as 60 years? The use of septic systems does have an impact on groundwater phosphorus and nitrate concentrations and groundwater does flow to the river. In addition, septic systems in several areas in Erin are close to the river. The minimum required distance from a surface water to a leaching bed in Ontario is 15m. Concern over this has been expressed in previous reports. The extent to which this impact influences the background phosphorus and nitrate concentrations in the river is an unknown and it is difficult to separate phosphorus and nitrate inputs from septic systems from other sources such as agriculture.. It has been noted that the Phosphorus concentration has not changed significantly over the years, however, this may be due to a steady state being achieved. It can also be stated that phosphorus levels do not appear to be compromising the Policy 1 status of the river. Nitrate concentrations are also elevated in the river at Winston Churchill Blvd. (CVC 2011) and are increasing.

2. Is there a statutory/legal requirement to have homes connect to wastewater if they are greater than 1400 m2 (0.342 acre) and already on municipal water? If there are homes on the street that are less than 1400, would other properties meeting the building code be required to connect? In our septic system report we suggest 1400 m2 as one of our decision criteria to suggest whether an area should be "in or out". This was the lot size used in the SSMP for a similar purpose. We reviewed this considering the average percolation rates we found in the applications for approval of septic systems in Erin, required setbacks from property lines and average house size. Using the calculations outlined in the building code this is likely the approximate lot size that would be needed to comply with the code. The 1400 m2 is not a regulated number. To comply with the code each individual property needs to perform the necessary code compliance calculations for their own property. Our suggested approach is to make a decision on an area by area basis and so we have selected 1400 m2 as one of the basis for this. We are suggesting that if there is sufficient rationale for an area to be connected, all properties within the area will be required to connect. It's understood lots greater than 2,784 m2 (0.688 acre) with their own water well and septic system are considered in in compliance to the building code. The SSMP states "Under current standards, properties must be at least 1,400 m2 to accommodate a septic system and observe the required setbacks. Another 20% of the properties do not have sufficient space for both a septic system and a private well (or are between 1,401 m2 and 2,787 m2 in size)." It may be possible for a septic system and well to be on the same 2,788 m2 lot and meet the requirements however, it should be noted that, a 15 m setback is required between the well location and the tile bed and as such blanket approval of lots with an area of 2,788 m2 with a well is not advisable. Compliance with the building code would need to be conducted on a case by case basis to ensure adequate setbacks and approval.

3. Ainley's Technical Memorandum states there are 1851 properties in Erin and Hillsburgh .. does this number include industrial properties as well, or only residential properties? Yes. This is a gross lot count based on the Town's GIS database, all property types are included.

4. There are "140 properties within the wellhead protection plan that have septic systems that require a 5-year maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07." Of the 140 properties, how many are in Erin and how many in Hillsburgh? How many of the 140 properties are not in compliance to the building code? 114 properties in Erin and 25 properties in Hillsburgh fall within a WHPA with a vulnerability score of 10. These properties will require the 5-year maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07. Based on our rationalisation that lots < 1400 m2 may not be in compliance with the building code, approximately 90 of these properties may not be in compliance. It should be noted that compliance with the building code and proximity to the wellhead protection area are separate rationalisations for connection to the communal system that are not inherently linked.

5. How many properties in Erin and properties in Hillsburgh that are less the 1400m2 are not currently on municipal water? There are properties within Erin and Hillsburgh that are currently serviced by private wells which have been included in the proposed service area.

6. For the 17% of properties with undersized septic tanks, what is the approx. cost to replace a septic tank in order to ensure compliance to the building code? This would depend on the size determined by the calculations in the building code. A 1,000 gallon tank may cost around $1,500 and a 1,500 gallon tank around $2,200 plus installation and removal of old tank which may double this cost, however, based on the recommended solution adopted in the SSMP, the mandate of this phase of the Class EA is not to examine upgrade costs for private systems. Are there any Erin and Hillsburgh properties that are >1400 m2 where the septic tank is less than the 3600 litres (792 gallons) required by the building code? There are a few properties within our database with a property size > 1400 m2 and a septic tank < 3600 L. These instances are limited but do exist within the data set.

7. For the 26% of properties with at risk leaching beds and tank effluent levels, is Ainley familiar with the newer technologies to remediate these situations, can they be considered a possible solution? Yes we are familiar with the wide range of tertiary treatment systems, however, based on the recommended solution adopted in the SSMP, the mandate of this phase of the Class EA is not to examine alternative solutions based on private systems.

8. The report states Erin's oldest septic tank is 62 years (Dundas East). Has Ainley performed an inspection of a system of that vintage? What were the findings? We are not in a position to answer this question. We would however, comment that Septic system components fail for many reasons. Tanks can fail structurally or through failure to maintain them and empty solids at regular intervals. More often, leaching beds fail through plugging with solids, inadequate percolation rates, high groundwater levels, higher than capacity water use etc. The likelyhood of failures increases with age. During our study we were able to find a considerable amount of data on the existing septic systems from Building Department records. This data was considered far more accurate and reliable than information we could have gathered from a field inspection of each system. Analysis of this data combined with the recommendation to make a decision on an area by area basis, combined with the use of general decision criteria led to our suggested servicing area for the communal system.

9. Is Ainley familiar with the advanced septic systems that are designed to be used in lots less than 1400 m2.. ref: Ontario Rural Wastewater Centre at the University of Guelph?. Generally yes. This Centre conducts a wide range of research on private sewage systems and septage treatment, however, based on

the recommended solution adopted in the SSMP, the mandate of this phase of the Class EA is not to examine alternative solutions based on private systems.

10. South East Erin sector is dominated by a Well Head Protect Area (WHPA) of the Bel-Erin Well, considered a Groundwater Under Direct Influence (GUDI) of surface water, but this well is inoperative. The current drilling at Kenneth /9th is expected have a much smaller WHPA footprint, if successful. Will this change your recommendation to service this sector? We understand that the proposed well is anticipated to have a smaller wellhead protection area, however, our philosophy is to progress the study using current day information. It is possible that future well drilling results could affect the service area decisions.

11. North East Erin Sector with 95 properties is considered Rural Residential and not within the urban boundary. Similarly, South Erin Sector, 69 of the 163 properties lie outside of the urban boundary. The SSMP study was limited to the urban area of both villages with the preliminary suggestion to service all 4500 people. The current report suggests we not service 46 lots in urban Hillsburgh and 94 lots (163-69) in urban Erin. (approximate 400 of the 4500 population). Why were rural residential properties included in the Request for Proposal (RFP) for the "Urban Centre wastewater Class EA"? North East Erin is correctly identified as lying outside of the Urban Boundary. It was included in the study area and it has been determined that these properties will not be included in the communal system. We are working within the Study Area Boundary defined in the Terms of Reference of the Class EA.

12. The existing communal septic systems at Centre 2000 (Erin High School and Erin Community Centre), Stanley Park mobile homes and the St. John Brebeuf Catholic School were included in the flow calculation study. Will the cost to decommission these systems be identified and the cost to connect to a municipal system be estimated? Yes. Similarly, what is the approx. cost to the individual property owners to decommission their septic systems and connect to a municipal wastewater system? Ainley is working on a Technical Memoramdum On Alternative Wastewater Collection Systems. This will identify all costs to convey sewage from the proposed service areas (not including growth areas) to a treatment plant site. The work is at an advanced stage, however it cannot be finalised until there is reasonable agreement on the areas to be serviced. Costs will be identified for the collection system and for connection for each alternative. It is anticiapted this will be completed and released after the upcoming public consultation process.

13. It's assumed the following terms are used interchangeably: "properties", "lots" and "households". We will review our reports and clarify, however they are not necessarily interchangeable. The SSMP stated for 2016; 1090 households in Erin and 460 households in Hillsburgh within the urban area . So taking away the 69 and 95 properties outside of the urban area from the 1259 properties in Ainley's report would result in the same 1090 households reported in the SSMP. Similar results for Hillsburgh. Please then confirm the difference of 80 properties in Erin and 8 properties in Hillsburgh that are not accounted for in the various sectors studied when Ainley refers to a total 1339 in Erin and 512 in Hillsburgh? "Total properties" within the village of Erin and Hillsburgh includes both industrial and commercial properties. We will conduct a final check on property numbers after receiving all comments.

	Ainley's count				
Erin	**1339**	total lots		total undersized lots	
Core 1		521	86%	448	
Core 2		174	61%	106	
South Erin		**163**	**2%**	**3**	**no connection; 69 rural lots**
Erin Heights		115	38%	44	
SE Erin		191	24%	46	

N.E Erin		95	0%	0	No connection; 95 rural lots	
Total		**1259**		**647**		**51%**
Hillsburgh	**512**					
Core 1		230	63%	145		
Core 2		126	85%	107		
Upper Canada		**46**	**0%**	**0**	**no connection**	
George St		24	67%	16		
S. Trafalgar		78	42%	33		
Total		**504**		**301**		**60%**
Total	**1851**	**1763**	Diff: 88			

B. Questions to the November 2016 Ainley's Technical Memorandum System Capacity and Sewage Flows draft for comments.

1. The 2014 SSMP conclusion was restated by Ainley as follows: population of Erin and Hillsburgh at a total serviceable population of **6,000** was based Average Daily Flow (**ADF) of 435 L/c/d** a wastewater **flow of 2,610 m3/d** discharging to the West Credit River at an **effluent phosphorus concentration of 0.15 mg/**l to achieve a downstream phosphorus concentration in the West Credit River of **0.03 mg/l** corresponding to the Provincial Water Quality Objective for Phosphorus. Why did Ainley refer to the non-compliance objective of 0.15 mg/l phosphorous and not the MOE proposed objective of 1.0 mg/L which were used to calculate the 6000? (note 6000 is related to the above bolded factors; changing any will affect the total population calculation). The non-compliance limit of 0.15 mg/l was used during the SSMP in the determination of the total population of 6,000, not the objective concentration of 0.10 mg/l.

2. Ainley reports "the 2,610 m3/d discharge potential identified in the SSMP associated with a downstream phosphorus concentration of 0.03 mg/L can no longer be achieved at a wastewater effluent concentration of 0.15 mg/L". Cannot be achieved for what reason? Mandated by the CVC , MOECC .. if so why the change within 2 years? What has changed? In their calculations, BMRoss (2014) used an effluent flow rate of 2610 m^3/d and an TP concentration of 0.15 mg/L coupled with monthly 7Q20 flow values (which were not always the lowest 7Q20 value) to calculate resulting downstream TP concentrations. Using the updated 7Q20 flow statistic of 225 L/s, and an effluent concentration of 0.15 mg/L, only 2,268 m^3/d of wastewater flow can be treated and meet a downstream phosphorus concentration of 0.03 mg/L. Any flow beyond 2268 m3/day would cause the river to exceed the PWQO of 0.03 mg/L during low flow conditions, in contravention of MOECC Policy 1 for Surface Water Quality Management.

3. Ainley confirmed the CVC reports the West Credit river now has a flow rate of 225 litres per second and that this flow rate includes a 10% Climate Change adjustment. In 2014, the CVC reported a flow rate of 202 litres per second. Could the West Credit's s flow rate have increased by 20% in the last two years? (in spite of the beaver dam down river from the CVC flow metre). Has CVC's criterion to calculate flow changed since 2014? The revised 7Q20 estimate reflects more data and additional analysis and should not be interpreted as an increase in flow over a 2 year period. A flow gauging station was established at 10th Line in July 2013 by Credit Valley Conservation (CVC). A minimum of 10 years of data is required at a flow station to calculate a 7Q20 flow statistic. Flows measured at this gauge were used by CVC to develop a flow transposition factor between the 8th Line (1983 – present) and the 10th Line flow data (2013-present). The preliminary ACS (BMRoss 2014) used 7Q20 flows for 10th Line as

determined by CVC using a transposition factor based on stream flows collected for four months (July to October) in 2013 at 10th Line. Additional flow data have been collected since the preliminary ACS to refine the transposition factor used to calculate the 7Q20. In 2016, CVC recalculated the 7Q20 low flow statistic for 10th Line, using data from July 2013 to December 2015. The new 7Q20 flow statistic for 10th Line of 225 L/s is now based on a transposition factor based on 2.5 years of flow data for 10th Line, instead of only 4 months. The revised 7Q20 flow also includes the 10% adjustment for climate change. The revised 7Q20 flow of 225 L/sec is 10% higher that the value of 202 L/sec that was calculated previously.

Please also see CVC's response your similar question posed to them.

4. Why did the MOECC and the CVC request updates to the work completed in the SSMP including revisiting the 7Q20 flow values and re-evaluating the assimilative capacity of the West Credit River? With the admitted low flows of the W. Credit (by the CVC) over the last 2 years, how did the updated 7Q20 flow data, along with a more stringent effluent objective, translate into a substantially higher serviceable population? The intent of the preliminary ACS was to assess the feasibility of a wastewater treatment plant (WWTP) with surface water discharge to the West Credit River in the reach between 10th Line and Winston Churchill Blvd. The preliminary ACS demonstrated that this was feasible but recommended that the next phases of the EA should include a review of dissolved oxygen and temperature impacts, and potential for effluent storage. In their review of the 2014 ACS the MOECC confirmed (letter from Ms. Barbara Slattery dated October 31, 2015 to Ms. Christine Furlong, Triton Engineering) that the original ACS be updated to include:

- Mixing zone analysis to include both the lateral and longitudinal plume dimensions;
- Hydrodynamic modelling to predict dissolved oxygen and temperature;
- Worse-case flow scenario should be September (i.e. month with lowest flow); and
- Update ACS to incorporate additional streamflow data (finalize 7Q20 estimate).

The CVC recommended 7Q20 value has been increased. The Ainley team recommended downstream phosphorus concentration in the river has been reduced. Both of these combined, reduce the potential for the serviced population. The Ainley team has also identified the potential to achieve effluent limits more in line with available treatment technologies. This demonstrates that, while still providing for the projected 7Q20 and protecting the river to a higher level, it is still possible to service all of the existing population and new growth areas on the Town Official Plan.

www.farmzone.com reported for Peel North, 662 mm of precipitation in 2014, 604 mm in 2015 and 514 mm in 2016. http://app.toronto.ca/tpha/heatStats.html reports 2016 had 22 Heat Alert days, 8 were Extreme Heat Alerts, in 2015 there were 12, with 4 Extreme Heat Alerts, while 2014 merely had one Heat Alert. Would the downward trend in precipitation along with the increase in the number of heat advisories over the last 3 years not suggest a lower flow rate? Please see CVC response to similar question posed to them: Precipitation was noticeably lower than average this year, however, the yearly minimum streamflow measured in 2016 is consistent with (slightly higher than) the average yearly minimum streamflow measured over the past 33 years recorded at the Water Survey of Canada gauge at 8th Line.

5. The Rhodamine Dye test was completed this August at the request of the MOE/CVC in 2014. The test was initiated downstream from the beaver dam, with the installed Flow Meter located further upstream some 100 meters on the west side of 10th line. Is the data generated from this test relevant with respect to calculating the assimilative capacity of the river if the discharge point would be located at 10th line? As I understand, "CVC staff may attempt to re-calibrate the flow gauge readings with the backwater but this is challenging unless the beaver dam conditions stabilize". The purpose of the dye study was to determine the "time of travel" of the river as input into the water quality models. Some factors that influence the time of travel include: obstructions (e.g. dams, large woody debris), river gradient, substrate composition, river meander characteristics, river shape, and

vegetation. The stream characterization completed on June 10th determined that these characteristics are fairly consistent between 10th Line and Winston Churchill. The dye study determined that the velocities were similar between 10th Line and Winston Churchill, confirming this interpretation. Therefore the data generated from the dye study is relevant with respect to assessing the effects of a discharge at 10th Line. The recommended preferred location for the outfall has not yet been determined.

6. Why was the MOE/CVC in 2014 recommending that because of the reduced flow at 10th Line, the optimum discharge point would need to be closer to Winston Churchill? A preferred discharge point has not yet been selected. It is likely alternative discharge locations will include a point closer to Winston Churchill.

7. With input from the CVC/MOE in 2014, why did the SSMP assume a downstream phosphorus concentration of 0.03 mg/L after mixing with the wastewater effluent, and now both agencies think it is "appropriate to recommend that a downstream Site Specific Water Quality Objective (SSWQO) for a Total Phosphorous of 0.024 mg/L be adopted to protect the cold water habitat and water quality in the West Credit River"? Does the difference between 0.03 and 0.024 actually affect the temperature of the water, noting that the following statement; "effect of changing the trophic status of the river on brook trout and other aquatic life in the West Credit River is not well understood at this time". What is the incremental cost increase to reach this higher level of protection for the lower limit of 0.024 down river? The intent of the preliminary ACS was to assess the feasibility of a wastewater treatment plant (WWTP) with surface water discharge to the West Credit River in the reach between 10th Line and Winston Churchill Blvd. The preliminary ACS demonstrated that this was feasible. The PWQO of 0.03 mg/L represents a two-fold increase over the current 75th percentile TP (0.015 mg/L) concentration and a change in trophic status from oligotrophic to mesotrophic in the West Credit River between 10th Line and Winston Churchill Boulevard. CVC has designated the West Credit River downstream of 10th Line as a cold-water aquatic community due to the presence of brook trout. 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 2011). The effect of doubling the TP concentration, thus changing the trophic status of the river, on brook trout and other aquatic life in the West Credit River is not well understood but detrimental changes would include increased growth of algae attached to bottom substrate (periphyton) which impairs habitat for fish spawning and benthic invertebrates and increased dissolved oxygen concentrations during the day and decreased concentrations at night in response to increased algal respiration which would stress aquatic life. A cautionary approach to establishing a target downstream TP concentration for the purposes of defining the flow and treatment limits was therefore recommended to protect aquatic life. This is the recommendation of the consulting team and not necessarily that of MOECC or CVC although these agencies were party to the discussion. There is no connection between this decision and temperature if the water.

Costs to treat the wastewater are more related to the effuent limit to be achieved through the treatment process rather than the decision on the downstream phosphorus level. The downstream phosphorus level affects the numbers of people who can be serviced.

8. If the Preferred Solution for the current EA for the Hillsburgh dam/pond (Triton) is to bring the West Credit river back to a "meandering stream" by decommissioning the dam/draining the pond, would this affect the flow and/or the velocity of the river? Would this affect the Assimilative Capacity of the river? How will it affect the Assimilative capacity? The Class EA for the Hillsburgh dam is incomplete and as a result, it is premature to comment on the impact the various alternatives may have on the West Credit River at this time. However, the assimilative capacity of the river is being assessed at a significant distance downstream of the Hillsburgh dam. Between the Hillsburgh dam and the reach of the river where CVC has indicated that a WWTP discharge should occur (between the 10th Line and Winston Churchill Blvd.), there are several dams and several tributaries that contribute to flow in the river. These

river features downstream of the Hillsburgh dam will not change with the implementation of the possible alternatives under consideration for the Hillsburgh dam. It is anticipated that there will be no impact on the assimilative capacity of the river or the flow velocity in the reach of the river, where a WWTP discharge is proposed, resulting from the status quo or potential configuration changes at the dam in Hillsburgh.

9. Will the wastewater EA review the impact of a failing 100 year old dam(s) upstream in the village of Erin and if necessary include the cost to remediate? Has Ainley requested the report completed several years ago as to the integrity of all the dams in town?

The impact of constructing/modifying/repairing/removing dams in the West Credit River watershed would typically be assessed on a case by case basis when such a project involving a dam is initiated. As with the Hillsburgh dam, an environmental assessment, as mandated by Provincial regulations, would need to be completed to identify and assess viable alternatives to address the problem/opportunity identified for the specific dam in question. Assessing the impact of all the dams in the West Credit River watershed on the assimilative capacity of the river, in the reach of the river where CVC has indicated that a WWTP discharge should occur, is beyond the scope of the wastewater Class EA.

10. Will the wastewater EA take in consideration the net effect of adjacent and (potentially) approaching aggregate pits given the fact there are several springs entering the West Credit from the direction of the pits ? The regulation of aggregate pits falls under the jurisdiction of various government approval agencies. Typically, detailed technical studies are required for the approval of aggregate sites in order to protect existing natural features in the area of the proposed pit. However, it is important to know that the studies completed to date for the wastewater Class EA have been undertaken under existing environmental conditions including the operation of the existing aggregate pits.

11. With input from the CVC/MOE in 2014, the MOE proposed a Total Phosphorous of 0.1mg/L to generate a flow of 2610 m3/d equal to a serviceable population of 6000 (SSMP). Why is the new phosphorous proposal reduced to 0.07 mg/L to allow for a higher discharge volume and therefore the larger serviceable population? In the last 2 years, has the MOECC official changed the discharge criteria for phosphorous? Can the cost to reach the lower objective be quantified? The SSMP recommended an effluent limit of 0.15 mg/l for TP, not 0.1 mg/l. The Ainley team has indicated that the limit of technology for TP removal through wastewater treatment plants is substantially lower than was considered in the SSMP. In fact it is possible to achieve the effluent limit of 0.045 mg/l needed to service full build out of the town official plan including growth. There is no fixed MOECC discharge criteria for TP. This would be a site secific consideration based on the treatment technologies adopted for each treatment plant.

There is certainly a cost increase to achieve higher levels of TP removal and these will be considered in Phase 3 of the Class EA

12. Will the incremental increase in costs be estimated to reduce the phosphorous levels in the discharge from 0.10 to 0.07, 0.07 to 0.05 and 0.05 to 0.046? Can the calculation include the per capita cost increases based on the various projected populations for each discharge objective? Yes this will be addressed in Phase 3 of the Class EA based on agreed phasing for the project.

13. With the maximum 7,172 m3/day of flow from a population of 14,559 people equal to a ADF of 493 L/day for each person assumes Best Available Technology (BAT)…a.k.a. Gravity fed collection sewers and includes infiltration of ground water. What percent of infiltration is incorporated in the flow? If a small bore collection system is put in place, what is the net effect on the serviceable population? Our capacity analysis to date has been based on a gravity sewer solution which represents the lowest serviced population scenario due to the inclusion of inflow and infiltration (I&I). Should other collection system alternatives be selected it may be possible to service additional population through elimination of I&I flows. The flows allocated for I&I are shown in our report.

14. The population at full build out of 14,599 (18,873 including equivalent population), means almost doubling Erin's population and more than tripling Hillsburgh's. If a treatment facility is considered for Hillsburgh would a new Assimilative Capacity Study be required? Is it a fair assumption to believe a south Hillsburgh wastewater plant would not effect a wastewater facility some 10 km south in south Erin? A centralised treatment system for both communities has been selected as the preferred alternative from the SSMP. Phase 3 of the Class EA will focus on selecting a preferred site in the area South of Erin as identified in the SSMP.

15. In real life conditions, would 250 L/day per person not be more realistic? The lower this number, the more can be serviced.

For the purposes of planning in the absence of actual flow data, conservative estimates are used to ensure that the wastewater system is adequate for the projected service population. As actual flow data is obtained through system operation, the serviceable population may change. Municipalities are required to report their System Reserve Capacity" to MOECC on an ongoing basis and they must demonstrate that sufficient capacity is available prior to approving new connections.

16. The total population in the Town of Erin (Advocate 11/16/20016) is 12,300, the two villages at 4500 and the rural population at 7,800. Has the rural septage for 7,800 people been addressed and included in the ACS as part of the reserved capacity? The capacity for septage treatment will be addressed within the design of the treatment facility and ultimately has very minimal impact on flow volumes at the facility.

17. With the projected increase in serviceable populations, will this Wastewater EA address the municipal water requirements - both feasibility and costing - in order to offer full servicing to all? Currently, there are 1010 water connections (+110 potential to connect) in Erin and 280 connections (230 potential to connect). Could water availability be a rate determining factor for the amount of growth for both villages? The SSMP stated another $2.7million to connect all existing residents (table 7-15) and another $4.5 million to connect 1500 of new growth (table 7-16). The Urban Centre Wastewater Servicing Class EA addresses wastewater servicing and the Urban Centre Water Servicing Class EA addresses water servicing. The revised populations from the wastewater Class EA will be taken into account in the water Class EA. The water Class EA is on-going and it is premature to comment on the impact the recently released population projections will have on the alternatives available to the Town to address water supply issues for the urban centres.

18. Given the information gathered to date, with respect to the technical possibilities to increase our population and which of the existing areas that ought to be serviced, at what point can the Town/Council decide to procced to a Performance-Based Class Environmental Assessment (MOECC correspondence of June 19, 2013 to Infrastructure Ontario)? At what point would Council propose how much growth and where growth is preferred? Or will Ainley, only after completing phase 4 of the EA, prescribe how much growth and where? Subject to public input over the next two months, it is expected that this Class EA will be completed based on servicing the two communities up to full build out of the present official plan. It is expected that a parallel planning process will be undertaken in the coming year to consider growth levels. This Class EA will not allocate capacity to growth areas other than those established through the planning process.

19. The SSMP was governed by a Terms of Reference available to the public. Is there a Terms of Reference published and publically available for the current EA? Should it be listed on the web site? There is a Terms of Reference for the study.

20. It appears the ACS used in the SSMP 2014 was in fact peer reviewed and agreed upon - i.e. 6000 people [ref. Advertiser 11/18/2016]. With a substantially larger population that can now be

serviced, will the current ACS be peer-reviewed by the CVC, MOECC, and/or an outside engineering firm? The CVC and MOECC will be reviewing the ACS update.

21. Regarding the below chart:
- Why is Total Suspended solids actually higher in the new guidelines (from 3 on 2014 to 5 mg/l in 2016) ?
- Why is Total Ammonia actually higher in the new guidelines (from 0.4 on 2014 to 2.0 mg/l in 2016) ?

	West credit River: Policy One Receiver Erin MOE Aug 27, 2014 Proposed Treatment Objectives	MOE ~1995 Objectives	**Credit River: Policy T** Orangeville comparis Objectives	Actuals
pH	<7 and >8.6	6.8 -7.6		
Total Suspended Solids mg/L	3	10	5	7.5
Total Phosphorous mg/L	**0.1**	**0.3**	**0.4**	**0.5**
Total Ammonia mg/L	0.4	2	2	3
Total Kjeldahl Nitrogen mg/l	6	3		
Nitrate Nitrogen mg/L	5	10	10	2.5
E.coli organisms/100 mls	100	100	150	?
Dissolved oxygen mg/L	5 minimum	2		
BOD 5 mg/l	3.6	5	5	?
temperature	17	8 to 16		

From BMRoss' SSMP: 2014

From Ainley: 201

Table 6-1: Effluent Quality Criteria (Current Study) Objectives and non-compliance

Design Values	Treatment Objective	Non-Compliance objective	Stage 1	Full buil
Effluent Flow (m3/d)	**2610**	**2610**	**3380**	**717**
Total Suspended Solids (mg/L)	3	10	5	
Total Phosphorous (mg/L)	0.1	0.15	0.07	0.04
Total Ammonia (mg/L)	0.4	2	1.3	0.
			2	
Nitrate Nitrogen (mg/L)	5	6	5	
E. coli (cfu/100 mL)	100	100	100	10
Dissolved Oxygen (mg/L)	5 (min)	4 min.	4	
BOD_5 (mg/L)	4	8	5	

The Ainley 2016 values presented above and the HESL 2016 values are effluent limits suggested by our team and subject to review by MOECC. The TSS limit of 5 mg/L is recommended and is lower than the effluent limit proposed by BMRoss (2014) of 10 mg/L mainly due to the more strict level proposed for Total Phosphorus. The total ammonia limit of 1.3 mg/L was derived based on receiver characteristics presented in HESL 2016, and is less than the BMRoss (2014) limit of 2 mg/L. The effluent limits for these two parameters are therefore more stringent than the BMRoss values.

Simon Glass

From: Gary Scott
Sent: November 22, 2016 11:31 AM
To: Neil Hutchinson; Deborah Sinclair; Tara Roumeliotis; Christine Furlong
Cc: Joe Mullan; Simon Glass
Subject: FW: PLC questions

Neil/Deborah or Tara can you please do a draft response to the questions in yellow.
Christine can you please do a draft resonse to the items in pink.
We have nearly finished other answers and will compile and send to team for comments before responding to [redacted]

Gary Scott
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To the Ainley group:

I, along with some of my neighbours, have reviewed the technical memorandums on Septic and Flow, available on the Town's web site. We have listed below a number of questions in advance of the Liaison meeting on the 24th. Some questions perhaps can be answered quickly and before the meeting by return, others I assume can be discussed at the meeting, and still some other questions may be a bit early in the process.

It was mentioned the requested glossary of terms and acronyms would be made available on the website .... I was unable to locate them on the Town's website.

Thank you

[redacted]

Resident and Liaison committee member

A. Questions to the November 2016 Ainley's Technical Memorandum <u>Septic System</u> Overview draft for comments.

1. The West Credit River, a Policy 1 stream, has a Total Phosphorus (TP) concentration of between 0.011 – 0.015 mg/L well below the Provincial Water Quality Objective (PWQO) of 0.03 mg/L. Is it safe to say there is no evidence currently of septic leakage in the Village of Erin even with some septic systems as old as 60 years?

2. Is there a statutory/legal requirement to have homes connect to wastewater if they are greater than 1400 m2 (0.342 acre) and already on municipal water? If there are homes on the street that are less than 1400, would other properties meeting the building code be required to connect? It's understood lots greater than 2,784 m2 (0.688 acre) with their own water well and septic system are considered in in compliance to the building code.

3. Ainley's Technical Memorandum states there are 1851 properties in Erin and Hillsburgh .. does this number include industrial properties as well, or only residential properties?

4. There are “140 properties within the wellhead protection plan that have septic systems that require a 5-year maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07.” Of the 140 properties, how many are in Erin and how many in Hillsburgh? How many of the 140 properties are not in compliance to the building code?

5. How many properties in Erin and properties in Hillsburgh that are less the 1400m2 are not currently on municipal water?

6. For the 17% of properties with undersized septic tanks, what is the approx. cost to replace a septic tank in order to ensure compliance to the building code? Are there any Erin and Hillsburgh properties that are >1400 m2 where the septic tank is less than the 3600 litres (792 gallons) required by the building code?

7. For the 26% of properties with at risk leaching beds and tank effluent levels, is Ainley familiar with the newer technologies to remediate these situations, can they be considered a possible solution?

8. The report states Erin’s oldest septic tank is 62 years (Dundas East). Has Ainley performed an inspection of a system of that vintage? What were the findings?

9. Is Ainley familiar with the advanced septic systems that are designed to be used in lots less than 1400 m2.. ref: Ontario Rural Wastewater Centre at the University of Guelph?.

10. South East Erin sector is dominated by a Well Head Protect Area (WHPA) of the Bel-Erin Well, considered a Groundwater Under Direct Influence (GUDI) of surface water, but this well is inoperative. The current drilling at Kenneth /9th is expected have a much smaller WHPA footprint, if successful. Will this change your recommendation to service this sector?

11. North East Erin Sector with 95 properties is considered Rural Residential and not within the urban boundary. Similarly, South Erin Sector, 69 of the 163 properties lie outside of the urban boundary. The SSMP study was limited to the urban area of both villages with the preliminary suggestion to service all 4500 people. The current report suggests we not service 46 lots in urban Hillsburgh and 94 lots (163-69) in urban Erin. (approximate 400 of the 4500 population). Why were rural residential properties included in the Request for Proposal (RFP) for the “Urban Centre wastewater Class EA”?

12. The existing communal septic systems at Centre 2000 (Erin High School and Erin Community Centre), Stanley Park mobile homes and the St. John Brebeuf Catholic School were included in the flow calculation study. Will the cost to decommission these systems be identified and the cost to connect to a municipal system be estimated? Similarly, what is the approx. cost to the individual property owners to decommission their septic systems and connect to a municipal wastewater system?

13. It’s assumed the following terms are used interchangeably: “properties”, “lots” and “households”. The SSMP stated for 2016; 1090 households in Erin and 460 households in Hillsburgh within the urban area . So taking away the 69 and 95 properties outside of the urban area from the 1259 properties in Ainley’s report would result in the same 1090 households reported in the SSMP. Similar results for Hillsburgh. Please then confirm the difference of 80 properties in Erin and 8 properties in Hillsburgh that are not accounted for in the various sectors studied when Ainley refers to a total 1339 in Erin and 512 in Hillsburgh?

Ainley's count

Erin	**1339**	total lots		total undersized lots	
Core 1		521	86%	448	
Core 2		174	61%	106	
South Erin		**163**	**2%**	**3**	**no connection; 69 rural lots**
Erin Heights		115	38%	44	
SE Erin		191	24%	46	
N.E Erin		**95**	**0%**	0	**No connection; 95 rural lots**
Total		**1259**		**647**	**51%**
Hillsburgh	**512**				
Core 1		230	63%	145	
Core 2		126	85%	107	
Upper Canada		**46**	**0%**	**0**	**no connection**
George St		24	67%	16	
S. Trafalgar		78	42%	33	
Total		**504**		**301**	**60%**
Total	**1851**	**1763**	Diff: 88		

B. Questions to the November 2016 Ainley's Technical Memorandum System Capacity and Sewage Flows draft for comments.

1. The 2014 SSMP conclusion was restated by Ainley as follows: population of Erin and Hillsburgh at a total serviceable population of **6,000** was based Average Daily Flow (**ADF) of 435 L/c/d** a wastewater **flow of 2,610 m3/d** discharging to the West Credit River at an **effluent phosphorus concentration of 0.15 mg/l** to achieve a downstream phosphorus concentration in the West Credit River of **0.03 mg/l** corresponding to the Provincial Water Quality Objective for Phosphorus. Why did Ainley refer to the non-compliance objective of 0.15 mg/l phosphorous and not the MOE proposed objective of 1.0 mg/L which were used to calculate the 6000? (note 6000 is related to the above bolded factors; changing any will affect the total population calculation).

2. Ainley reports "the 2,610 m3/d discharge potential identified in the SSMP associated with a downstream phosphorus concentration of 0.03 mg/L can no longer be achieved at a wastewater effluent concentration of 0.15 mg/L". Cannot be achieved for what reason? Mandated by the CVC , MOECC .. if so why the change within 2 years? What has changed?

3. Ainley confirmed the CVC reports the West Credit river now has a flow rate of 225 litres per second and that this flow rate includes a 10% Climate Change adjustment. In 2014, the CVC reported a flow rate of 202 litres per second. Could the West Credit's s flow rate have increased by 20% in the last two years? (in spite of the beaver dam down river from the CVC flow metre). Has CVC's criterion to calculate flow changed since 2014?

4. Why did the MOECC and the CVC request updates to the work completed in the SSMP including revisiting the 7Q20 flow values and re-evaluating the assimilative capacity of the West Credit River? With the admitted low flows of the W. Credit (by the CVC) over the last 2 years, how did the updated 7Q20 flow data, along with a more stringent effluent objective, translate into a substantially higher serviceable population?

5. www.farmzone.com reported for Peel North, 662 mm of precipitation in 2014, 604 mm in 2015 and 514 mm in 2016. http://app.toronto.ca/tpha/heatStats.html reports 2016 had 22 Heat Alert days, 8 were Extreme Heat Alerts, in 2015 there were 12, with 4 Extreme Heat Alerts, while 2014 merely had one Heat Alert. Would the downward trend in precipitation along with the increase in the number of heat advisories over the last 3 years not suggest a lower flow rate?

6. The Rhodamine Dye test was completed this August at the request of the MOE/CVC in 2014. The test was initiated downstream from the beaver dam, with the installed Flow Meter located further upstream some 100 meters on the west side of 10th line. Is the data generated from this test relevant with respect to calculating the assimilative capacity of the river if the discharge point would be located at 10th line? As I understand, "CVC staff may attempt to re-calibrate the flow gauge readings with the backwater but this is challenging unless the beaver dam conditions stabilize".

7. Why was the MOE/CVC in 2014 recommending that because of the reduced flow at 10th Line, the optimum discharge point would need to be closer to Winston Churchill? A preferred discharge point has not yet been selected. It is likely alternative discharge locations will include a point closer to Winston Churchill.

8. With input from the CVC/MOE in 2014, why did the SSMP assume a downstream phosphorus concentration of 0.03 mg/L after mixing with the wastewater effluent, and now both agencies think it is "appropriate to recommend that a downstream Site Specific Water Quality Objective (SSWQO) for a Total Phosphorous of 0.024 mg/L be adopted to protect the cold water habitat and water quality in the West Credit River"? Does the difference between 0.03 and 0.024 actually affect the temperature of the water, noting that the following statement; "effect of changing the trophic status of the river on brook trout and other aquatic life in the West Credit River is not well understood at this time". What is the incremental cost increase to reach this higher level of protection for the lower limit of 0.024 down river?

9. If the Preferred Solution for the current EA for the Hillsburgh dam/pond (Triton) is to bring the West Credit river back to a "meandering stream" by decommissioning the dam/draining the pond, would this affect the flow and/or the velocity of the river? Would this affect the Assimilative Capacity of the river? How will it affect the Assimilative capacity?

10. Will the wastewater EA review the impact of a failing 100 year old dam(s) upstream in the village of Erin and if necessary include the cost to remediate? Has Ainley requested the report completed several years ago as to the integrity of all the dams in town?

11. Will the wastewater EA take in consideration the net effect of adjacent and (potentially) approaching aggregate pits given the fact there are several springs entering the West Credit from the direction of the pits ? Im presuming that approval of any pits would not be allowed to affect base flow in the river???

12. With input from the CVC/MOE in 2014, the MOE proposed a Total Phosphorous of 0.1mg/L to generate a flow of 2610 m3/d equal to a serviceable population of 6000 (SSMP). Why is the new phosphorous proposal reduced to 0.07 mg/L to allow for a higher discharge volume and therefore the larger serviceable population? In the last 2 years, has the MOECC official changed the discharge criteria for phosphorous? Can the cost to reach the lower objective be quantified?

13. Will the incremental increase in costs be estimated to reduce the phosphorous levels in the discharge from 0.10 to 0.07, 0.07 to 0.05 and 0.05 to 0.046? Can the calculation include the per capita cost increases based on the various projected populations for each discharge objective?

14. With the maximum 7,172 m3/day of flow from a population of 14,559 people equal to a ADF of 493 L/day for each person assumes Best Available Technology (BAT)...a.k.a. Gravity fed collection sewers and includes infiltration of ground water. What percent of infiltration is incorporated in the flow? If a small bore collection system is put in place, what is the net effect on the serviceable population?

15. The population at full build out of 14,599 (18,873 including equivalent population), means almost doubling Erin's population and more than tripling Hillsburgh's. If a treatment facility is considered for Hillsburgh would a new Assimilative Capacity Study be required? Is it a fair assumption to believe a south Hillsburgh wastewater plant would not effect a wastewater facility some 10 km south in south Erin?

16. In real life conditions, would 250 L/day per person not be more realistic? The lower this number, the more can be serviced.

17. The total population in the Town of Erin (Advocate 11/16/20016) is 12,300, the two villages at 4500 and the rural population at 7,800. Has the rural septage for 7,800 people been addressed and included in the ACS as part of the reserved capacity?

18. With the projected increase in serviceable populations, will this Wastewater EA address the municipal water requirements - both feasibility and costing - in order to offer full servicing to all? Currently, there are 1010 water connections (+110 potential to connect) in Erin and 280 connections (230 potential to connect). Could water availability be a rate determining factor for the amount of growth for both villages? The SSMP stated another $2.7million to connect all existing residents (table 7-15) and another $4.5 million to connect 1500 of new growth (table 7-16).

19. Given the information gathered to date, with respect to the technical possibilities to increase our population and which of the existing areas that ought to be serviced, at what point can the Town/Council decide to procced to a Performance-Based Class Environmental Assessment (MOECC correspondence of June 19, 2013 to Infrastructure Ontario)? At what point would Council propose how much growth and where growth is preferred? Or will Ainley, only after completing phase 4 of the EA, prescribe how much growth and where?

20. The SSMP was governed by a Terms of Reference available to the public. Is there a Terms of Reference published and publically available for the current EA? Should it be listed on the web site?

21. It appears the ACS used in the SSMP 2014 was in fact peer reviewed and agreed upon - i.e. 6000 people [ref. Advertiser 11/18/2016]. With a substantially larger population that can now be serviced, will the current ACS be peer-reviewed by the CVC, MOECC, and/or an outside engineering firm?

22. Regarding the below chart:
    - Why is Total Suspended solids actually higher in the new guidelines   (from 3 on 2014 to 5 mg/l in 2016) ?
    - Why is Total Ammonia actually higher in the new guidelines   (from 0.4 on 2014 to 2.0 mg/l in 2016) ?

West credit River: Policy One Receiver		**Credit River: Policy T**	
Erin		Orangeville comparis	
MOE Aug 27, 2014	MOE ~1995		
Proposed			
Treatment			
Objectives	Objectives	Objectives	Actuals

pH	<7 and >8.6	6.8 -7.6		
Total Suspended Solids mg/L	3	10	5	7.5
Total Phosphorous mg/L	**0.1**	**0.3**	**0.4**	**0.5**
Total Ammonia mg/L	0.4	2	2	3
Total Kjeldahl Nitrogen mg/l	6	3		
Nitrate Nitrogen mg/L	5	10	10	2.5
E.coli organisms/100 mls	100	100	150	?
Dissolved oxygen mg/L	5 minimum	2		
BOD 5 mg/l	3.6	5	5	?
temperature	17	8 to 16		

From BMRoss' SSMP: 2014

From Ainley: 201

Table 6-1: Effluent Quality Criteria (Current Study) Objectives and non-compliance

Design Values				Stage 1	Full buil
Effluent Flow (m3/d)		**2610**	**2610**	**3380**	**717**
	Treatment Objective		Non-Compliance objective		
Total Suspended Solids (mg/L)	3		10	5	
Total Phosphorous (mg/L)	0.1		0.15	0.07	0.04
Total Ammonia (mg/L)	0.4		2	1.3	0.
				2	
Nitrate Nitrogen (mg/L)	5		6	5	
E. coli (cfu/100 mL)	100		100	100	10
Dissolved Oxygen (mg/L)	5 (min)		4 min.	4	
BOD_5 (mg/L)	4		8	5	

Simon Glass

From: Gary Scott
Sent: October 17, 2016 12:15 PM
To: [redacted]
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; Derek.McCaughan@erin.ca
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

[redacted] further to your email today, on this particular issue we do understand your concerns re the beaver dams and other issues related to the ACS and we do hope to be able to answer your concerns in our reports. We have preliminary ACS results but we do not yet have Hutchinson's report. We do hope you understand that where we have not completed our work and researched issues, we are not in a position to respond.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

From: [redacted]
Sent: August-10-16 2:21 PM
To: Gary Scott
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; 'Council'
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

Thank you Gary for your quick response re the Rhodamine test. I remain interested in receiving Hutchinson's response to the question posed below, whether the presence of beaver dams in the area will affect the outcome of tracking river flow with the rhodamine dye.

In the meantime, could you respond to the question regarding beaver dams and flow rates from a 7Q20 perspective. Would the data be biased, or is there a correction added to the calculation? Would the assimilative capacity of the river at the point of discharge not be affected by the presence of beavers dams up-stream as well as down-stream? Would this mean that once we are discharging effluent, we will need to prevent beavers in settling on the river, preventing dams?

In last night's council meeting, the mayor suggested there were no longer beavers on-site. As it turns out, when I took the attached photos yesterday, my dog did give chase to what was surely a beaver.

I look forward to your response(s).

Thanks
[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: August-10-16 1:44 PM
[redacted]
Cc: Simon Glass; Joe Mullan; Noah Brotman; Christine Furlong
Subject: RE: 7Q20 and Rhodmine tracing study of the West Credit

Thank you [redacted]

We have passed this along to Hutchinson staff who are doing the dye study and we will consider the effect of this before we start.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

From: Simon Glass
Sent: August-10-16 10:23 AM
To: Gary Scott; Jatin Singh
Cc: Christine Furlong (cfurlong@tritoneng.on.ca); Joe Mullan; noahbrotman@hardystevenson.com
Subject: FW: 7Q20 and Rhodmine tracing study of the West Credit

FYI

Regards,

Simon Glass, E.I.T.

www.ainleygroup.com

glass@ainleygroup.com
Tel: (905) 595-6862
Cell: (289) 654-2865

[redacted]
Sent: August 9, 2016 4:07 PM
To: erin.urban.classea@ainleygroup.com
Cc: 'Council'
Subject: 7Q20 and Rhodmine tracing study of the West Credit

To the Ainley Group re Erin's Wastewater EA

Dear Sirs,

I understand that the 7Q20 memo was received from the CVC as per your monthly report dated July 27, 2016 for the month of June.

I have attached photos of the West Credit at 10th line... based on the beaver activity this year and the subsequent lower flow, could you confirm if the data collected to calculate the 7Q20 took into consideration this year's beaver activity. From the attached, the river is substantially higher without much velocity.

Moreover, I understand later this month a rhodamine tracing dye study will be performed. With the existing beaver dams on the east and west side of 10th, will the results of such a study be an accurate indication of river flow?

Look forward to your response.

Thank you

[redacted]
Erin Resident & Member of the Liaison committee

Simon Glass

From: Gary Scott
Sent: October 17, 2016 12:25 PM
To: [redacted]
Cc: Jatin Singh; noahbrotman@hardystevenson.com; Joe Mullan; Christine Furlong; Simon Glass
Subject: RE: Hillsburgh Pond/Station Street Dam EA, effect on Assimilative capacity and the wastewater EA/ septage disposal.

[redacted]

With these other issues that you raised we responded as below. As noted, we are still working on the ACS report and still not in a position to address your issue. Likewise with septage we have calculated loads of septage from various alternatives and will be evaluating these are part of Phase 3 of the Class EA. Our main objectives at this time remain closing out Phase 2 issue. We have to address all of the components of the Class EA as a step by step process and that is our main focus.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

From: Gary Scott
Sent: July-19-16 8:21 PM
[redacted]
Cc: Jatin Singh; noahbrotman@hardystevenson.com; Joe Mullan; 'Christine Furlong'; Simon Glass
Subject: RE: Hillsburgh Pond/Station Street Dam EA, effect on Assimilative capacity and the wastewater EA/ septage disposal.

[redacted]

With respect to your emails below we offer the following response:

1 The Class EA for the Hillsburgh dam is incomplete and as a result, it is premature to comment on the impact the various alternatives may have on the assimilative capacity of the West Credit River at this time.
2 We understand that septage from private sewage systems throughout Erin is handled by private haulers who use existing Wastewater Treatment Plants that accept septage. The issue of Septage will be addressed within the Class EA.

Thanks for your input.

Gary Scott, M. Sc., P. Eng.
Technical Lead Erin Wastewater Class EA

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Brampton, ON L6W 3W8

scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

[redacted]
Sent: July 18, 2016 4:09 PM
To: erin.urban.classea@ainleygroup.com
Subject: RE: Hillsburgh Pond/Station Street Dam EA, effect on Assimilative capacity and the wastewater EA/ septage disposal.

To the Ainley Group,

I addition to the below inquiry of June 29th, could someone at Ainley confirm how/where Erin's pumped septage is disposed of ?

Can Erin's septage be processed at wastewater plants that are operating at below design capacity, like the Nobleton plant?

Thanks
[redacted]
Liaison Committee member

[redacted]
Sent: June-29-16 4:17 PM
To: 'erin.urban.classea@ainleygroup.com'
Cc: 'Council'
Subject: Hillsburgh Pond/Station Street Dam EA, effect on Assimilative capacity and the wastewater EA

To the Ainley group,

As directed by David in our first Liaison committee meeting, any questions should be directed generically to the above email for distribution.

In conversation with some folks in town, the subject of the Hillsburgh Pond and Station Street Dam surfaced with respect to the Assimilative Capacity of the West Credit at the south-east corner of town. Although unlikely, but if the Preferred Solution for the current EA for the Dam/pond was to bring the W. Credit back to a "meandering stream", would this not affect the flow and/or the velocity of the river, thereby affecting the AC? Will those agencies (CVC, MOECC) responsible for the oversight of the EA for the Dam and the EA for wastewater monitor these variables jointly and collectively? If I'm not mistaken, the option to revert to its natural state is more costly than to remediate.

That said, I believe there may be a recent report on file that addresses the structural integrity of the various dams in the Town of Erin. Will the wastewater EA address the unlikely (but possible) event if one of the dams breached or malfunctioned. I assume the EA will address and quantify the costs to upgrade these dams where needed. As I understand some of the dams are privately owned which may complicate matters.

Be interested in your initial thoughts...

Simon Glass

From: [redacted]
Sent: October 18, 2016 1:12 PM
To: Gary Scott
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; Derek.McCaughan@erin.ca; Jatin Singh; 'Council'
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

Thanks Gary
Much appreciated.
[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: October-18-16 12:55 PM
To: [redacted]
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; Derek.McCaughan@erin.ca; Jatin Singh; 'Council'
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

[redacted]
I think the answering of questions from individual members likely requires further discussion at the next meeting just to clarify everyone is ok with that. I'll leave that to Dave and Noah.
Hutchinson just presented preliminary results. No report. Its due end of month. I'll remind them to capture this issue.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

[redacted]
Sent: October-18-16 12:51 PM
To: Gary Scott
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; Derek.McCaughan@erin.ca; Jatin Singh; 'Council'
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

Gary,

Thank you for re-sending your responses of July 19.

Since the ACS was already presented to the CMT on October 3, I just wondered if the presence or absence of the Hillsburgh dam and/or beaver dams or breached dams in the village would actually affect the river flow, volume or velocity and if these issues can affect the current preliminary assimilative capacity (population number) of the river at point of discharge?

Could the Hutchinson's report (Rhodamine tracing flow study) once received affect the preliminary ACS?

I would still be interested to know if Ainley intends to capture the Q&A of the PLC members in between meetings.

Thanks
[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: October-17-16 12:15 PM
[redacted]
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; Derek.McCaughan@erin.ca
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

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Tel: (905) 595- 6859
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[redacted]
Sent: August-10-16 2:21 PM
To: Gary Scott
Cc: Simon Glass; Joe Mullan; 'Noah Brotman'; 'Christine Furlong'; 'Council'
Subject: RE: 7Q20 and Rhodamine tracing study of the West Credit

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I look forward to your response(s).

Thanks
[redacted]

From: Gary Scott [mailto:scott@ainleygroup.com]
Sent: August-10-16 1:44 PM
[redacted]

Cc: Simon Glass; Joe Mullan; Noah Brotman; Christine Furlong
Subject: RE: 7Q20 and Rhodmine tracing study of the West Credit

Thank you [redacted]
We have passed this along to Hutchinson staff who are doing the dye study and we will consider the effect of this before we start.

Gary Scott
scott@ainleygroup.com
Tel: (905) 595- 6859
Cell: (905) 767-1284

From: Simon Glass
Sent: August-10-16 10:23 AM
To: Gary Scott; Jatin Singh
Cc: Christine Furlong (cfurlong@tritoneng.on.ca); Joe Mullan; noahbrotman@hardystevenson.com
Subject: FW: 7Q20 and Rhodmine tracing study of the West Credit

FYI

Regards,

Simon Glass, E.I.T.

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[redacted]
Sent: August 9, 2016 4:07 PM
To: erin.urban.classea@ainleygroup.com
Cc: 'Council'
Subject: 7Q20 and Rhodmine tracing study of the West Credit

To the Ainley Group re Erin's Wastewater EA

Dear Sirs,

I understand that the 7Q20 memo was received from the CVC as per your monthly report dated July 27, 2016 for the month of June.

I have attached photos of the West Credit at 10th line... based on the beaver activity this year and the subsequent lower flow, could you confirm if the data collected to calculate the 7Q20 took into consideration this year's beaver activity. From the attached, the river is substantially higher without much velocity.

Moreover, I understand later this month a rhodamine tracing dye study will be performed. With the existing beaver dams on the east and west side of 10th, will the results of such a study be an accurate indication of river flow?

Look forward to your response.

Thank you

[redacted]

Erin Resident & Member of the Liaison committee

Appendix B
Septic System Survey

Town of Erin

Urban Centre Wastewater Servicing
Class Environmental Assessment

Technical Memorandum
Septic System Overview
Final

October 2017

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
Septic System Overview

Project No. 115157

Prepared for:
The Town of Erin

Prepared By:

Jay Foster, E.I.T

Prepared By:

Gary Scott, M.Sc., P.Eng.

Ainley Group
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1.0 Introduction

This Report has been prepared in support of the Town of Erin Urban Centre Wastewater Servicing Environmental Assessment (UCWWS EA). The majority of properties within the Village of Erin and Hillsburgh are currently serviced by individual private septic systems. The Servicing and Settlement Master Plan (SSMP), completed by B.M. Ross in 2014, selected a communal wastewater collection system for both communities as the preferred alternative solution to deal with issues related to the private systems. The SSMP undertook part of Phase 1 and part of Phase 2 of the Class Environmental Assessment process and the Town is now engaged in completing these two phases and moving on to complete Phase 3 and Phase 4 of the Class EA process.

In order to complete the Class EA process, the Town is seeking to develop a more complete understanding of the existing septic systems in order to clearly define the extent of the planned communal sewage service area. The results of this Technical Memorandum will also assist with the selection of the most appropriate collection system by identifying accurate cost estimates for property owners.

This Technical Memorandum provides an overview of the septic system information collected from all available existing sources and defines the communal sewage service areas and provides rationale for connecting or not connecting each area to a communal collection and treatment system based upon analysis of the available data.

1.1 Objectives

The objective of this memorandum is to review available Septic Tank data, conduct any necessary field work and conduct data analysis and present recommendations for servicing existing properties in the study area.

1.2 Existing Information

Several studies/documents were used to prepare this memorandum. Each of these documents was reviewed for pertinent information related to this project. These documents include (a) Servicing and Settlement Master Plan, (b) Town of Erin Mandatory Septic Re-inspection Program, (c) Building Department Records, (d) GIS data. Relevant codes and standards governing wastewater for private systems including the Ontario Building Code and the Ministry of Environment and Climate Change (MOECC) guidelines were also relied on to develop this report. Information used from these studies/documents is summarised in the following subsections.

1.2.1 Servicing and Settlement Master Plan (SSMP)

In August 2014, BM Ross published the Town of Erin Servicing and Settlement Master Plan (SSMP) Final Report. The SSMP provides a brief overview of the current state of septic systems within the study area and summarises three previously completed reports relevant to the study. In summary, the SSMP found that there are no municipally owned communal sewage systems in Erin. They are generally serviced with Class 4 individual private septic systems, with a smaller portion of Class 6 systems and the commercial areas being serviced by holding tanks. Since 1999, the Town of Erin Building Department has required a permit for any work installing or repairing septic systems, resulting in 484 permits issued for new septic systems and 209 for replacement or alteration from 1999-2014. There are a few shared proprietary septic systems; Centre 2000 in Erin that services the Erin High School and Erin Community Centre. Also The Stanley Park mobile home development and the St. John Brebeuf Catholic School each have their own respective proprietary systems.

There had been past studies done on the septic systems in Erin before BM Ross completed the SSMP. In 1995 the Wellington-Dufferin-Guelph Health Unit performed the Village of Erin Private Sewage System Survey. This helped define the problem for the Class EA because the results indicated that several sewage disposal systems in downtown and on the south end of Main Street are in close proximity to West Credit River, increasing potential for pollution. It also found that many lots in the Village have inadequate space for septic tank replacement that would meet today's design standards under the Ontario Building Code.

The MOECC & West Central Region Technical Support Section Water Unit determined in their 2005 Town of Erin Septic Investigation that septic systems within the Town are a contributor of nutrients to the west branch of the Credit River; however, the impact to receiver was low in 2005. They recommended that older areas of Erin be investigated, as the risk of septic nutrient impact might be higher due to the deterioration of the septic systems.

Lastly, in 2011, there was an Existing Conditions Report for the Erin SSMP Environmental Component to investigate the impact that septic systems had on the West Credit River. It found that the existing municipal water supply wells showed no apparent impact from septic systems and that there was only a slight increase in nitrate concentration over time in the river, downstream of Erin. It also revealed that chloride and mass loading in the West Credit River have increased considerably over the last 20-30 years. Phosphorous levels also have increased over time; however these increases appear to reflect changes in surface runoff rather than impacts from septic systems. In general the report found that there are relatively higher urban impacts (including septic systems) on the reaches of two tributaries, immediately adjacent to Erin when compared to the main branch of the West Credit River. The report further explains that to properly determine the overall sensitivity of the environmental features, functions and linkages within Erin, the results from this report must be combined with other component studies.

The SSMP Final Report also outlines the issues and constraints that the current septic system will face in the future. The report determined that many septic systems in Erin are over 30 years old, while the general lifespan of a septic system is 20-25 years old. This indicates that most systems are in need of being replaced in the immediate future and data shows that only 6 out of approximately 1500 systems within the urban settlements of Erin and Hillsburgh have been replaced since 2004. The need for septic replacement is imminent and the SSMP reports that 54% of properties in Erin and 55% of in Hillsburgh are presently not large enough for a replacement septic and tile bed under the Ontario Building Code.

1.2.2 Septic Re-Inspection Program – WSP Canada 2015 Annual Report

In 2015 WSP conducted a septic re-inspection evaluation on 113 properties in the Town of Erin. This program aims to protect water resources by inspecting septic systems within highly vulnerable municipal well head protection areas every 5 years to ensure that they are operating safely and being maintained. This program was based on the *Draft Source Protection Plan for the Grand River* (March 12th, 2015), which was introduced so that highly vulnerable systems cease to be or never become a significant threat to the water quality in municipal wells.

Following the inspection, 17 of the 113 septic systems were issued remedial action letters based on varying risk factors that were observed. The seven risk factors include: tank size, tank compartments, tank condition, effluent level, leaching bed condition, drinking water source distance, and distance to surface water. Of the 17 remedial action notices, 8 were due to the volume of solids (effluent level) being above the limit or unknown, which requires the tank to be pumped out and 9 were issued to address structural issues such as: missing/cracked/inaccessible lids, inlet or outlet pipe obstruction, and not being watertight. No other remedial action letters were issued, however, the majority (99%) of the inspected septic systems had two or less of the seven risk factors named above. The following is a breakdown of the results for each risk factor:

- Septic Systems with a Tank Size risk: 17%
- Septic Systems with a Tank Compartment risk: 10%
- Septic Systems with a Tank Condition risk: 12%
- Septic Systems with an Effluent Level risk: 17%
- Septic Systems with a Leaching Bed Condition risk: 9%
- Septic Systems with a Drinking Water Source Distance risk: 1%
- Septic Systems with a Distance to Surface Water risk: 1%

1.2.1 Building Department Records (Town of Erin)

As part of this Class EA, in order to further analyse the condition and compliance aspects of the existing septic systems in Erin and Hillsburgh, historical data was obtained from the Town of Erin's Building Department. These records included specific addresses, legal descriptions, owner information, well type and available septic information including: type, tank size, and filter bed size.

The Building Department also provided copies of individual septic related records that included lot property location surveys, septic installation/alteration permits, inspection records, for approximately 1,200 properties in Erin and Hillsburgh. Although the actual data provided by these records was incomplete for each individual property, it was useful in analysing the systems and identifying the approximate age of septic systems throughout each area of Hillsburgh and Erin.

1.2.2 Site Inspections

Also as part of this Class EA, a general site survey was undertaken throughout the Village of Erin and Hillsburgh to verify a sample of septic system records and to identify servicing issues for the main areas of the communities. The results of this survey will be used to identify the cost to connect existing systems to the planned communal collection system.

1.2.3 GIS Data (Town of Erin)

The Town of Erin GIS database provided a property fabric for all lots within the urban boundary. Included in the database was a listing of Parcel ID numbers, Roll Numbers, and lot areas which were attached to spatial reference points. The property area was used as a measure to determine if sufficient space is available for a replacement septic system. The Roll Numbers were used to link existing building department records to the location of the property.

1.2.4 Ontario Building Code

The construction and installation of small individual septic systems (<10,000 L/d) up to a daily design sewage flow of 10,000 litres per day is regulated under the Ontario Building Code (OBC). The OBC regulates the design, construction, operation and maintenance of on-site septic systems for most single family homes, through Part 8 of Division B of the Building Code (O. Reg.350/06) made under the Building Code Act, 1992.

Per Ontario Building Code (Clause 8.2.2.3), the minimum working capacity of a septic tank shall be the greater of 3,600 L and (a) in residential occupancies, twice the daily design sanitary sewage flow or (b) in non-residential occupancies, three times the daily design sanitary sewage flows.

1.2.5 Ministry of Environment and Climate Change (MOECC)

All sewage works with a design capacity in excess of 10,000 L/d, including subsurface disposal systems, are subject to the requirements of Section 53 of the Ontario Water Resources Act (OWRA) administered by the MOECC. Subsurface disposal systems with a design capacity in excess of 10,000L/d are referred to as large subsurface sewage disposal systems (LSSDS). The LSSDS is mainly comprised of two components, a pre-treatment process (i.e., a septic tank or other treatment processes facilities) followed by a soil component (e.g. drain field).

For LSSDS, the working capacity of the septic tank(s) should provide a minimum of 24-hours retention at design peak daily flow. If the LSSDS is proposed to service dry industry, commercial facilities, institutional development, restaurants, office buildings or a larger residential development, it will be necessary to assess both the sewage quality and flow characteristics.

There are some types of wastewater that may not be suitable to be treated with a LSSDS. These may include wastewater from automatic car washes, garage facilities, or some agricultural uses such as egg washing. LSSDS for these types of sewage may require complicated pre-treatment or this type of wastewater may not be suitable for subsurface disposal.

Secondary aerobic biological treatment processes (other than primary septic tanks) for lowering concentrations of BOD and TSS in the effluent are recommended for LSSDS. For flows not substantially larger than 10,000 L/d, the designer should consider the use of pre-engineered (package) aerobic biological treatment units.

The size of LSSDS drain field interface surface may also preclude the use of gravity flow to the drain fields. Part 8 of Division B of the Building Code mandates effluent distribution through dosing for any sewage system having more than 150 m (490 feet) length of distribution pipe. Typically, all LSSDS's fall within this category and should be dosed appropriately.

Evaluation of existing systems was conducted for compliance with MOECC.

2.0 Data Analysis

2.1 Septic System Database

A database was created using the available septic information in order to analyze and to help make decisions on whether certain areas of Erin and Hillsburgh required connection to a communal collection system or whether they should be left to continue using their current septic system. This database combined the data made available through the Town of Erin Building Department Records and the GIS data. This database was used in conjunction with the information and recommendations provided by the SSMP, WSP Canada 2015 Annual Report, Ontario Building Code, and the MOECC to decide whether connection to a communal system for each area of Erin and Hillsburgh was necessary.

2.2 Defining Collection Decision Areas

In deciding whether existing private septic systems can remain as private systems or should be incorporated into a proposed communal system, it is desirable to define "servicing areas" and to decide on an area by area basis as outlined in the SSMP. Constructing a communal wastewater system to service only those systems with proven non-compliance or poor performance issues, while allowing individual lots on the same street or within the same area to remain on private systems, is not a valid approach for the following reasons:

- MOECC will require that wastewater collection systems be designed to service all lots within a specific service area consistent with the planning designation for the area. If an area is to be designated for servicing by a communal wastewater system, then the system must be designed to meet the capacity of all of the properties within this area
- Typically, where a communal wastewater system is to be designed to service an area, Municipalities require all properties to be connected and to contribute their share of the capital and operating costs

For the above reasons, it is necessary to designate specific areas to be serviced by private wastewater systems or by a communal wastewater system. For the purposes of this study, therefore, Erin and Hillsburgh, was split into logical serviceable sections, defined as "decision areas". Decision areas were derived from a combination of factors including location, local topography, drainage areas, proximity to sensitive receivers, and development consistency (lot sizes etc). The decision areas of each of the two communities each have their own unique challenges to be taken into account when planning wastewater collection options.

Having defined the “decision areas”, the analysis of existing private systems provides the rationale for whether each area is to be serviced by a communal wastewater system or to continue to be serviced by private wastewater systems.

The decision areas identified are outlined in Table 1.

Table 1 - Collection System Decision Areas in Erin and Hillsburgh

Decision Area Name	Location	Rationale
Erin Industrial Area	North of the Elora Cataract Trailway South of Sideroad 17 Pioneer Drive is included	Primarily industrial and commercial area Natural drainage to the south Contains communal septic system for recreation centre
Erin Town Core 1	South of the Elora Cataract Trailway North of Water St West of Creditview River Road East of Erin Heights Drive	Primarily residential area Consistent lot sizing and building age Several drainage challenges along the river Contains areas of institutional/commercial development
Erin Town Core 2	North of the West Credit River South of Water St A small portion of Highway 124 is included	Primarily residential area Natural drainage area terminating at the West Credit River Consistent lot sizing and building age Contains areas of commercial development
South Erin	Properties along Wellington 124 and Along 8th Line.	Primarily residential area Consistently large lot sizing and newer building age

Erin Heights	Properties along Erin Heights Drive and Sideroad 15	Uniform development Consistent lot sizing and building age Drainage towards river (NE) Separated from Town Core areas by the West Credit River
South East Erin	Bounded by Wellington 124 Road and the south east study area boundary.	Primarily new development with large lot size Natural drainage towards the northwest
North East Erin	Properties along 10^{th} Line including Pine Ridge Road and Credit River Road.	Primarily residential area Consistently large lot sizing and newer building age
Hillsburgh Town Core 1	North of Mill Street East of Trafalgar Road Bounded by north study areas boundary	Primarily Residential Natural drainage towards south end of the decision area Primarily medium sized lots with consistent building age, with larger lots in the North end Contains areas of commercial development
Hillsburgh Town Core 2	North of Station Street South of Mill Street East of Trafalgar Road	Primarily Residential Natural drainage towards west end of the decision area Primarily medium sized lots with consistent building age Contains areas of commercial development
Upper Canada Drive	Properties along Upper Canada Drive and Leader Court	Residential area Single development with

		consistent age and large lot sizes Drainage splits NE and SW creating two drainage areas
George Street	Properties along George Street	Consistent development age and lot sizes Drainage to the west
South Trafalgar Road	Properties along Trafalgar Road south of Station Street	Mixed residential and commercial development Consistent building age Drainage to the south

The drawings in Appendix A provide a visual representation of the collection decision areas in Erin and Hillsburgh.

2.3 GIS Data

The Town of Erin GIS database provided a property fabric for all lots within the urban boundary. Included in the database was a listing of Parcel ID numbers, Roll Numbers, and lot areas which were attached to spatial reference points. The property area was used as a measure to determine if sufficient space is available for a replacement septic system. The GIS data was also used to link existing building department records to the location of the property.

The Ontario Building Code states that a lot must be at least 1,400 m^2 to accommodate a septic system replacement. In an analysis of the property lot sizes, it was found that 49% of Erin properties and 58% of Hillsburgh properties are below 1,400m^2, which excludes them from replacing their septic systems in the future, as shown in Table 2.

Table 2 - Town of Erin Properties <1,400m^2

	Total Properties	Properties <1,400m^2	% Properties < 1,400m2
Erin	1339	650	**49%**
Hillsburgh	512	295	**58%**
Total	1851	945	**51%**

Properties less than 1,400m^2 in Town of Erin and Hillsburgh are shown in Appendix B.

2.4 Building Department Data

The data received from the Town of Erin's Building Depart provided information on existing systems. The Ontario Building code states that a septic system must have a minimum working capacity of 3,600L. The building department provided tank sizes for 548 properties in Erin and 266 in Hillsburgh, representing 44% of properties, as can be seen in Table 3.

Table 3 - Town of Erin Septic Tank Sizes

	Total Property Information Available	Tanks < 3,600L	% Tanks < 3,600L
Erin	548	75	**14%**
Hillsburgh	266	49	**18%**
Total	814	124	**15%**

Within that data, 14% and 18% of septic tanks are below the OBC specified 3,600L limit in Erin and Hillsburgh respectively.

A cross section of the septic records was analyzed from each street in Erin and Hillsburgh to determine the septic system age specific to each individual decision area. To be conservative, the highest septic age found on each street was used to represent the age of each respective street. Table 4 shows the average maximum age of the streets within each decision area.

Table 4 - Average Septic System Ages

Decision Area	Average Max Age (yrs)
Erin	
South East Erin	26
Erin Industrial Area	31
North East Erin	no septic records
South Erin	23
Erin Town Core 1	39
Erin Town Core 2	40
Erin Heights	32
Hillsburgh	
Hillsburgh Town Core 1	33
Hillsburgh Town Core 2	37
Upper Canada Drive	11
George Street	29
South Trafalgar Road	35

2.5 Well Head Protection Program

In December of 2015, the Source Protection Plan (SPP) for the Credit Valley/Toronto and Region/Central Lake (CTC) Source Protection Region in Ontario came into effect to protect current and future sources of municipal drinking water from significant threats. As part of the SPP, the Well Head Protection Program has come into effect and has defined well protection areas within Ontario. There are varying sizes of land that are considered protected for each well and their size depends on the length of time necessary for a contaminant to reach the wellhead by means of ground water. The *Clean Water Act* (2006) required that a circle of 100 metres in diameter be provided around each municipal well. The wellhead protection program uses this as their first protection area for each well (WHPA-A), the second is a representation of 2 years of contaminant travel time (WHPA-B), the third is 5 years of travel time(WHPA-C), the fourth is 25 years(WHPA-D), and the last refers to wells in direct influence of surface water(WHPA-E).

Severity of risk is highest within the first protection area delineation of 100m diameter surrounding the well and tends to decrease as the radius gets larger from WHPA-B to WHPA-D. The SPP also assigns vulnerability scores (1-10) to land within the wellhead protection areas based on the vulnerability of the source water area and the hazard rating of the potential threat. The SPP indicates that establishment, operation, or maintenance of septic systems within the WHPA-A will require a maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07. The report must outline the actions taken in the previous year to achieve outcomes of the source protection policy. According to the SSMP, the maintenance program should be a 5 year mandatory septic system inspection. Septic systems within WHPA-B will have their Environmental Compliance Approvals established or under review to ensure it they do not become a significant threat (vulnerability score = 10) in the near future. However, if the vulnerability score within WHPA-B is currently 10, then the same rules that apply to septic systems within WHPA-A, also apply to WHPA-B.

Hillsburgh has 2 wells within its boundary and Erin has 3, all of which have a risk of contamination from septic systems. Appendices C-1 and C-2 show that in Erin, 13 properties are within a WHPA-A and Appendix C-3 show that there are 25 properties within a WHPA-A in Hillsburgh. In addition, in Appendix C-1 it can be seen that Erin has 102 properties within a WHPA-B that has a vulnerability score of 10, which means that operation, or maintenance of those septic systems requires an inspection program. In total there are 140 properties within the wellhead protection plan that have septic systems that require a 5-year maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07.

Although a vulnerability score of 10 is considered significant threat, a score of 8 indicates that that land's risk is close to being a significant threat to municipal water quality. Since the age of the systems within the areas with a vulnerability score of 8 are past the typical septic system life span of 20-25 years, the integrity of the systems will begin to break down in the immediate future and the risk of contamination will increase, which causes the vulnerability score to rise. In Erin, there are two areas in which there is vulnerability score of 8; a WHPA-C in the south end of Erin and a WHPA-B on the west side of Erin, shown in Appendices C-1 and C-2, respectively. In Hillsburgh, both WHPA-B have a vulnerability score of 8 and they contain 84 properties, as can be seen in Appendix C-3. Table 5 provides a breakdown of the wellhead protection areas and how they affect both Erin and Hillsburgh.

Table 5 - Well Head Protection Data

Well Head Protection Area Type	Erin		Hillsburgh		Total	
	Lots with VS=10	Lots with VS=8	Lots with VS=10	Lots with VS=8	Lots with VS=10	Lots with VS=8
WHPA-A	13	0	25	0	38	0
WHPA-B	101	1	0	84	101	85
WHPA-C	0	23	0	0	0	23
TOTAL	114	24	25	84	**139**	**108**

*VS: Vulnerability Score

2.6 Gap Analysis

A gap analysis was performed to identify properties with missing septic system information.

2.6.1 Unaccounted Information

Septic system information for 1,590 lots within Erin and Hillsburgh was available which accounts for 86% of the 1,851 lots in the urban area of Hillsburgh and Erin. A gap analysis of the available data is shown on Table 6.

Table 6 - Gap Analysis of Available Information

Data	Total		Erin		Hillsburgh	
	# of Lots	% of Properties	# of Lots	% of Properties	# of Lots	% of Properties
Total Lots	1851	100%	1339	100%	512	100%
GIS Data	1851	100%	1339	100%	512	100%
Data from Building Dept.	1590	86%	1088	81%	502	98%
Tank Size	814	44%	548	41%	266	52%
Septic Age	1236	67%	740	55%	496	97%
Type of Septic System	861	47%	575	43%	286	56%

2.6.2 Potential Methods of Unaccounted Information Procurement

To obtain data on Septic Type, Septic Age and Septic Size, a full investigation into each individual septic permit that the Building Department is necessary. There are approximately 1200 entries that have varying historical and incomplete permit information.

A physical survey of each individual property would be necessary to obtain 100% of the septic data. Since it is unlikely that property owners would have detailed information on the extent of their disposal beds or tanks, the collection of this data would involve extensive field work. While it was originally envisaged that most data would need to be collected in the field, the actual data collected from the building department has likely more accurate and useful than information that could be collected from property owners.

For this reason, it is suggested that the information available from the sources outlined in this study be considered sufficient to decide whether each area becomes part of the communal wastewater system or remains as privately serviced.

3.0 Overview of Collection Decision Areas

Using the information presented in this report, rationale was made for the properties of each decision area to either be connected to the future wastewater collection system or to continue with private servicing.

3.1 Wastewater Collection System Rationale

3.1.1 Erin

Erin has been divided into 7 decision areas for wastewater. This section of the report will focus on each area individually and provide rationale as to whether it should be connected to a communal system based on the information provided in Section 2.

Erin Industrial

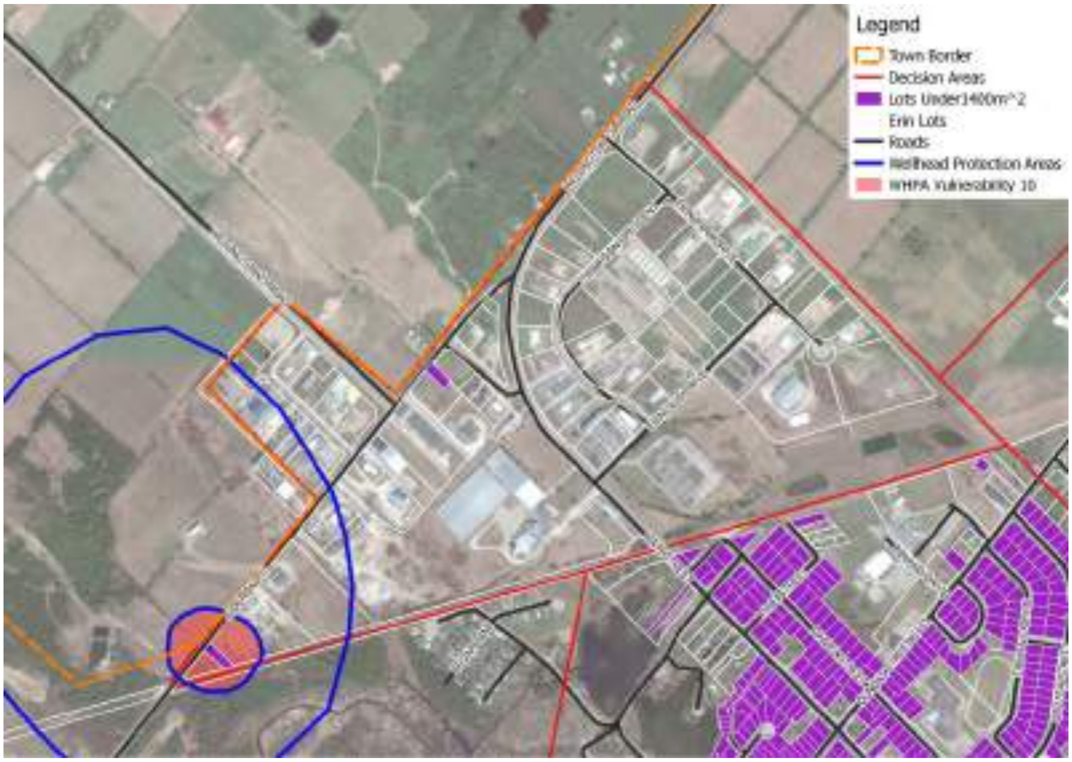


Figure 1 - Erin Industrial

The Erin Industrial area is made up of characteristically large commercial buildings and following a visual inspection, almost no signs of existing septic systems were found. This means that the vast majority of these lots may be using a holding tank or another type of wastewater system that may not comply with the Ontario Building Code.

Based the information provided by the Building Department and on flow calculations, the majority of the lots in this decision area could potentially exceed 10,000L/d. Therefore, the septic systems will likely have to comply with MOECC and not OBC as mentioned in section 1.2.5.

In reviewing the business profile of the area it is apparent that certain properties may have replaced or altered their septic systems due to a change in business operation. It is also apparent that lot sizes presently may not support expansion of some businesses to their full potential. From the available septic records, Table 7 presents the average age of systems within this decision area. The majority of the systems in Erin Industrial are also likely past their typical useful lifespan.

Table 7 - Septic Age within Erin Industrial Area

Street	Approximate Septic Age (yrs)
Erin Park Drive/Erinville Drive	27
Side Road 17	25
Shamrock Road	44
Thompson Crescent	29
Average Age	**31**

Since the majority of the septic systems in this area may not conform to the MOECC guidelines and, the average age of the septic systems may be close to end of their useful lifespan, it is recommended that the Erin Industrial area be connected to the proposed communal wastewater collection and treatment system.

Erin Town Core 1

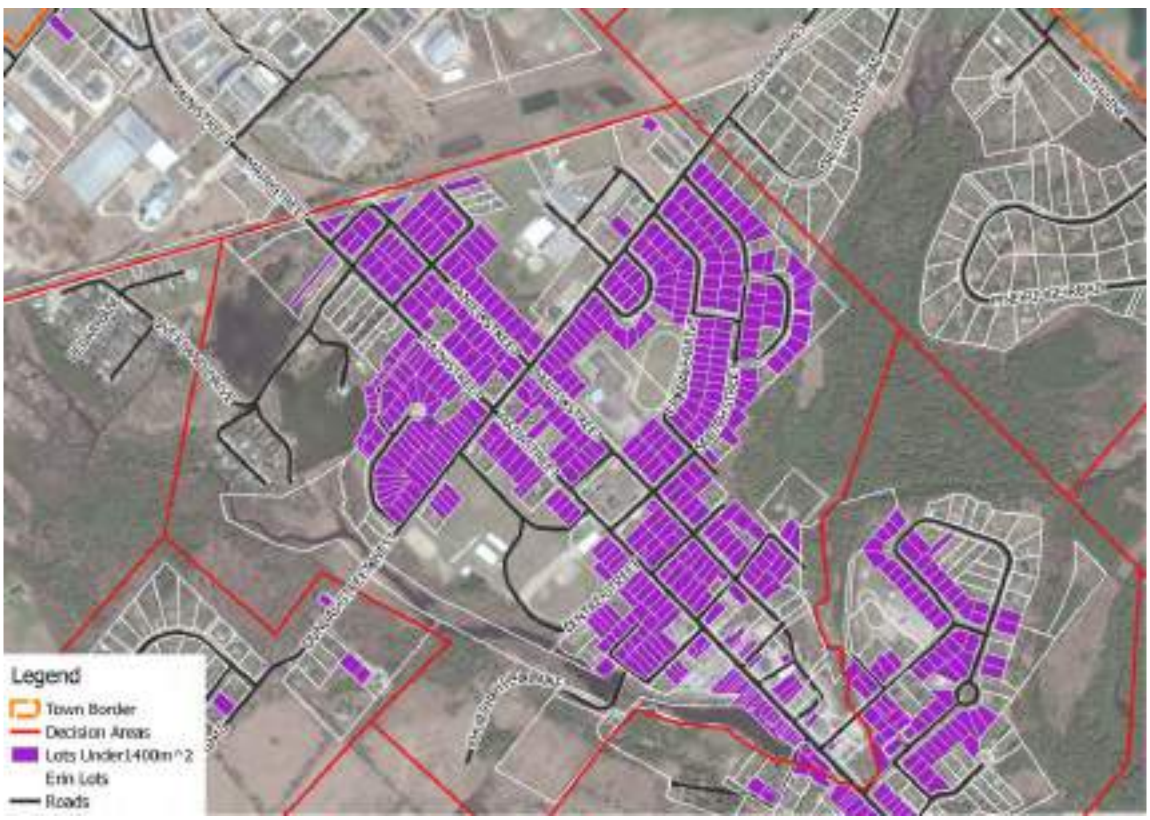


Figure 2 - Erin Town Core 1

The Erin Town Core 1 area contains 521 of the 1,339 lots that are located in Erin, which is the largest decision area in Erin. Of the 521 properties, 449 (86%) are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is available for 228 lots. Of those lots, 22% have septic systems with a tank that is below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC. Within the available septic tank size data, the following streets in Erin Town Core 1 have the highest number of non-compliance sized tanks: Tomwell Cres. (58%), Scotch St. (60%), Erindale Dr. (40%). A portion of properties on the Main St of Erin are using holding tanks as their current septic system. This type of septic system is also in violation of section 8.2.2.3 of the OBC.

Table 8 shows that the average age of the septic systems in this decision area is 39 years old, with the oldest streets being Dundas St E, Main St and Daniel St, which are 55+ years old. A portion of the properties on those streets may have since been replaced or altered their septic systems due to disrepair.

Table 8 - Septic Age within Erin Town Core 1

Street	Approximate Septic Age (yrs)
Daniel Street	56
Ross/Lorne Street	29
Spring Street	39
Pine Street	33
May Street	34
Dundas Street East	62
Tomwell Crescent	44
Centre Street	31
Scotch Street	48
English Street	12
Erindale Drive	44
Erinlea Crescent	27
Church Street/Wheelock St.	44
Church Boulevard	32
Carberry Road	33
Sunnyside Drive	29
Dundas Street West	44
Main Street	64
Average Age	**39**

There are no lots within Erin Town Core 1 that fall within the wellhead protection areas, however, the east and west boundaries of this decision area are in close proximity to the West Credit River and the topography indicates that the decision area drains towards those boundaries. If septic systems are deficient and leaking, they will potentially drain into the West Credit River. Due to the majority of the lots being undersized, the old age of the existing septic systems and the high number of tanks being undersized, this area should be connected to the proposed communal wastewater collection and treatment system.

Erin Town Core 2

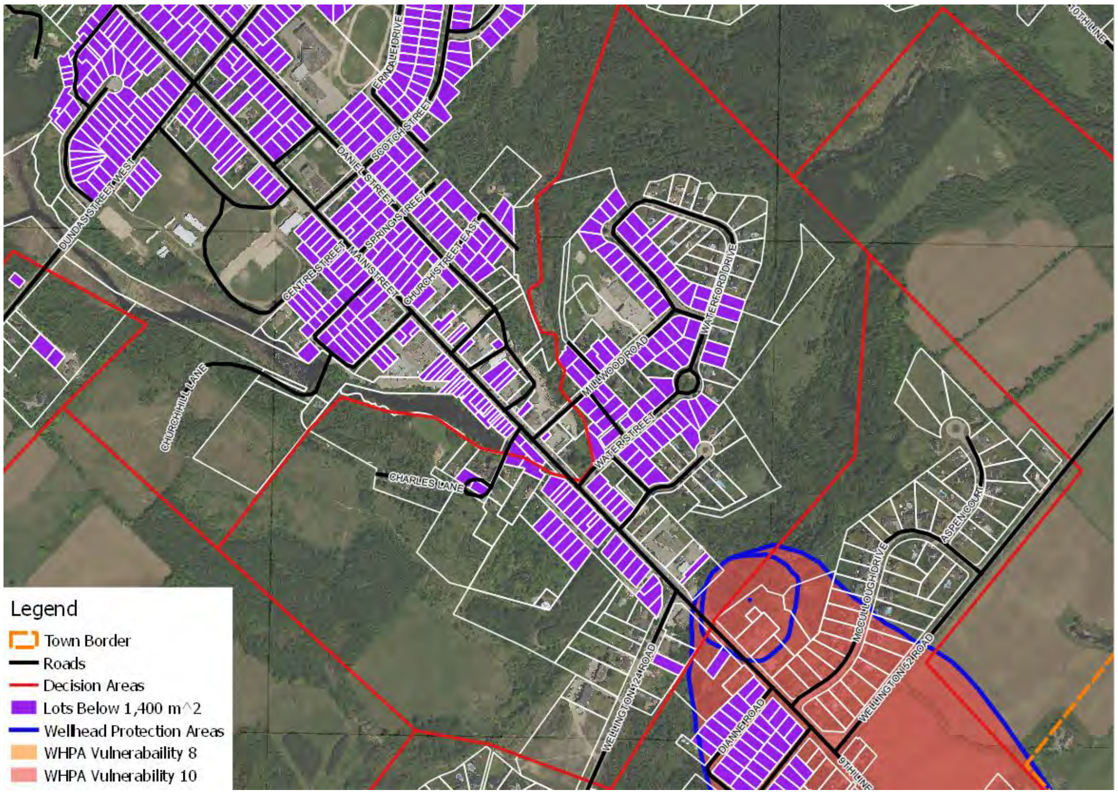


Figure 3 - Erin Town Core 2

The Erin Town Core 2 area contains 174 of the 1,339 lots that are located in Erin. Of these properties, 61% are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is available for 71 lots. Of those lots, 18% have septic systems with a tank that is below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC. Within the available septic tank size data, the following streets in Erin Town Core 2 have the most non-compliance sized tanks: Waterford/Water Dr. (26%) and Scotch St. (43%). A portion of properties on the Main St of Erin are still using holding tanks as their current septic system. This type of septic system is also in violation of section 8.2.2.3 of the OBC.

Table 9 shows that the average age of the septic systems in this decision area is 42 years old, with the oldest streets being Charles St, William St, Waterford/Water Dr, and Millwood Dr, which are 45+ years old. A portion of the properties on those streets may have since replaced or altered their septic systems due to disrepair.

Table 9 - Septic Age within Erin Town Core 2

Street	Approximate Septic Age (yrs)
Waterford/Water Drive	49
Millwood Road	46
Young Street	29
Lions Park Avenue/Hillsview St	34
William Street	51
Charles Street	57
Wellington Road 124	29
Main Street	28
Average Age	**40**

There are 2 lots on the most southern point of Erin Town Core 2 that is within a WHPA-A with vulnerability score of 10 and 1 lot within a WHPA-B with a VS of 10. These lots require a maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07. The report must outline the actions taken in the previous year to achieve outcomes of the source protection policy. According to the SSMP, the maintenance program should be a 5 year mandatory septic system inspection.

The west boundary of this decision area is in close proximity to the West Credit River and east side is in close proximity to a tributary. The topography indicates that the decision area drains towards those boundaries. If septic systems are deficient and leaking, they will potentially drain into the surrounding river.

Due to the majority of the lots being undersized, the old age of the existing septic systems and the high number of undersized septic tanks, this area should be connected to the proposed communal wastewater collection and treatment system.

South Erin

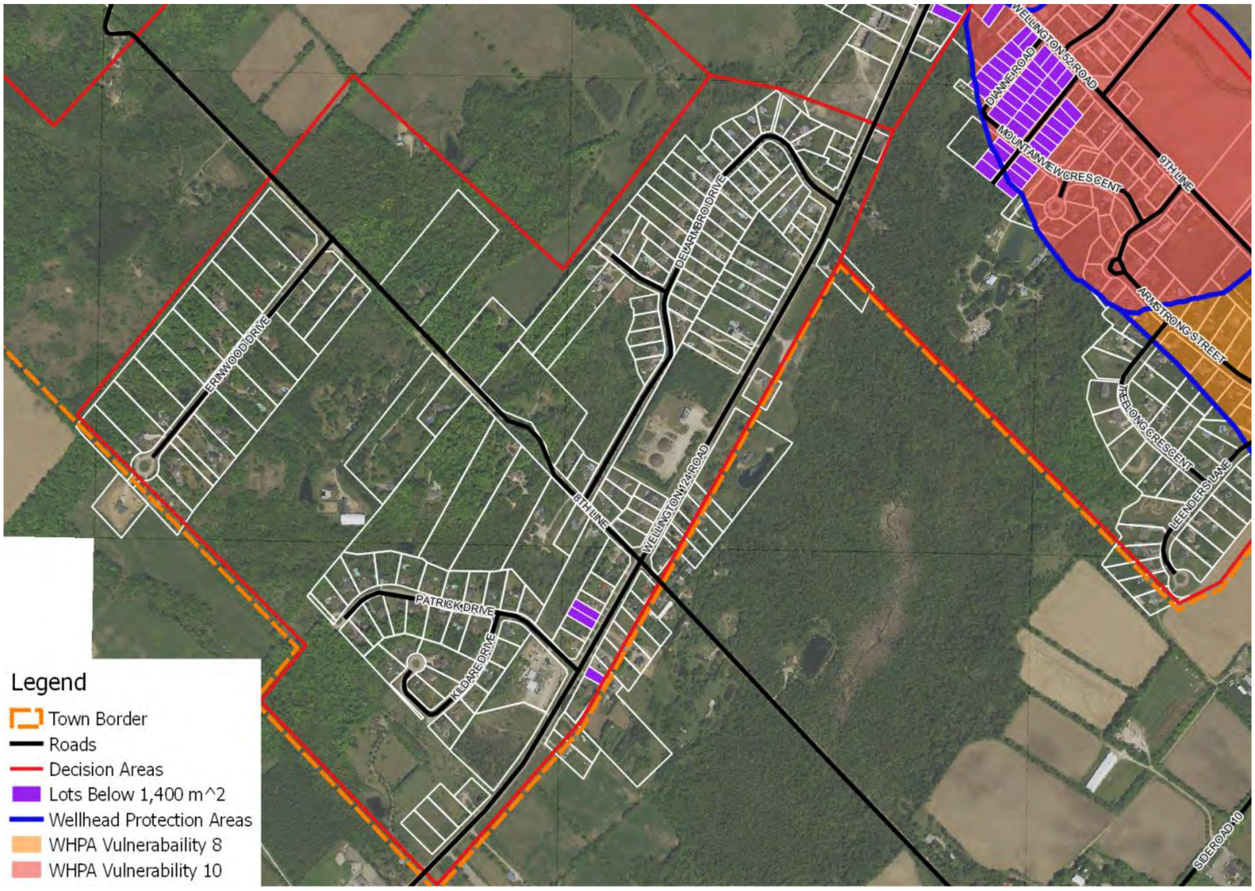


Figure 4 - South Erin

The South Erin decision area contains 163 of the 1,339 lots that are located in Erin. Of these lots, only 2% are below the minimum of 1,400m^2 lot area for septic replacement.

The building department data accounts for only 37 lots (20%) within this decision area.

The septic tank size data is available for only 20 lots. Of those lots, 15% (3 tanks) have septic systems with a tank that are below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC. These non-compliant septic tanks are all on Wellington Road 24.

Table 10 indicates that South Erin is a comparatively new area with an average septic system age of 19 years. Within the Building Department septic records, 8th Line, Erinwood Drive, and Patrick Drive were unavailable.

Table 10 - Septic Age within South Erin

Street	Approximate Septic Age (yrs)
Wellington Road 124	29
Delarmbro Drive	16
8th Line	no permit info
Forest Ridge Road	12
Erinwood Drive	no permit info
Patrick Drive	no permit info
Average Age	**19**

Due to the low number of lots below 1,400m^2 and the relatively young age of the majority of the lots, the recommendation is not to connect this area to the communal wastewater collection and treatment system.

Erin Heights

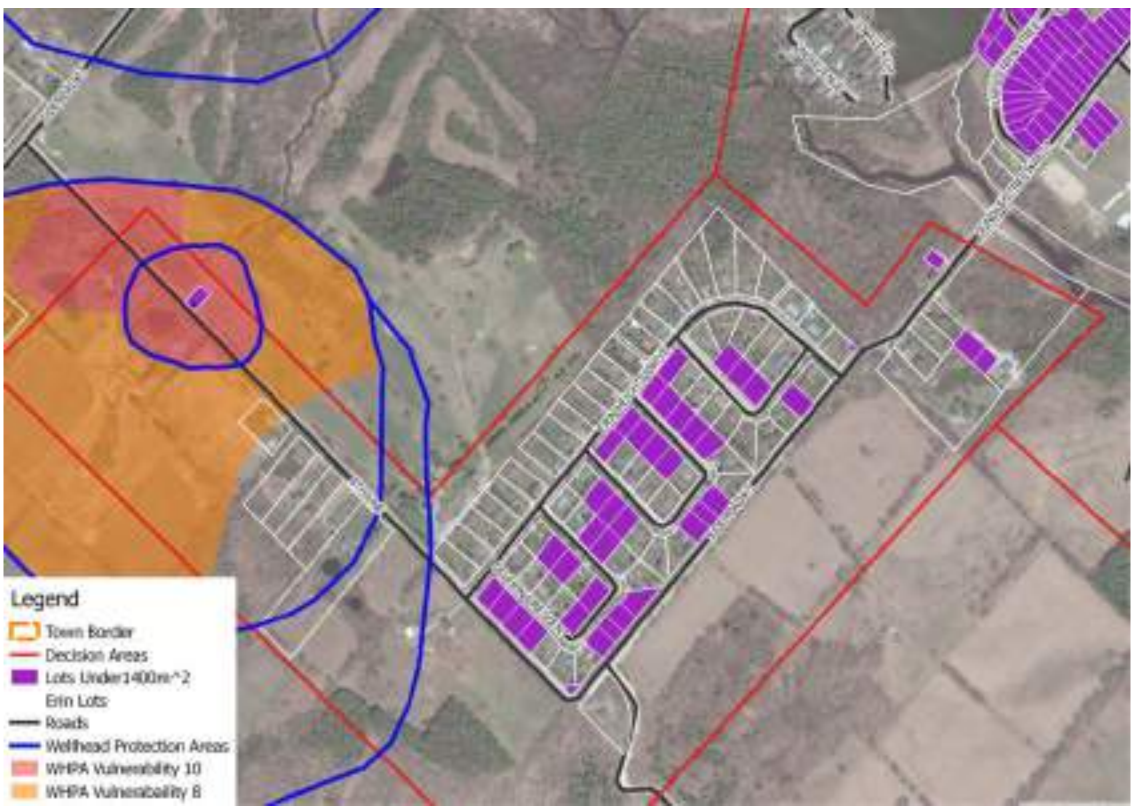


Figure 5 - Erin Heights

The Erin Heights decision area contains 115 of the 1,339 lots that are located in Erin. Of these lots, 38% are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is available for 45 lots. Of those lots, only 2% have septic systems with a tank that are below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC.

There is 1 lot on 8th Line within the Erin Heights that is within a WHPA-A with vulnerability score of 10 which requires an inspection program to support its operation and maintenance under the SPP. In addition there is 1 lot within a WHPA-B with a vulnerability score of 8, increasing the probability that operation and maintenance will require an inspection program under the SPP.

Table 11 shows that the average age of the septic systems in the decision area is 29 years old, with the oldest streets being 40+ years old: Erin Heights Dr, William Rex Cres, and Delerin Cres.

Table 11 - Septic Age within Erin Heights

Street	Approximate Septic Age (yrs)
Erin Heights Drive	40
William Rex Crescent	41
Wesley Crescent	38
Delerin Crescent	41
Dundas Street West	30
8th Line	3
Average Age	**29**

The northeast boundary of this decision area is in close proximity to the West Credit River. The topography indicates that the decision area drains towards that boundary and if septic systems are deficient and leaking, they will potentially drain into the surrounding river.

Due to the high number of undersized lots and the septic ages likely approaching the end of their useful life, it is recommended that this area should be connected to the proposed communal wastewater collection and treatment system.

South East Erin

Figure 6 - South East Erin

The South East Erin decision area contains 191 of the 1,339 lots that are located in Erin. Of these lots, 24% are below the minimum 1,400m^2 lot area for septic replacement. The undersized lots are all located primarily on Dianne Rd, Kenneth Ave, and Mountain View Cres.

The septic tank size data is available for 127 lots. Of those lots, only 4% have septic systems with a tank that are below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC.

There are 86 lots within the South East Erin decision area with vulnerability score of 10, five (5) of these lots land within WHPA-A and 81 of these lots land in a WHPA-B. These lots require a maintenance program to be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07. The report must outline the actions taken in the previous year to achieve outcomes of the source protection policy. According the SSMP, the maintenance program should be a 5 year mandatory septic system inspection.

There are also 20 lots that fall within a WHPA-C that has a vulnerability score of 8. The lots with a vulnerability score of 8 are close to a score of 10 and as the age of the septic systems increases, so does their risk of contaminating the groundwater, which increases the vulnerability score of the wellhead protection area that they fall under. This will result in these lots becoming a vulnerability of 10 and inciting the mandatory maintenance and reporting program mentioned above.

Table 12 shows that the average age of the septic systems in the decision area is 27 years old. There are four streets that still have substantial remaining life for their septic systems: Treelong Cres, Leenders Ln and Armstrong St, and Aspen Ct.

Table 12 - Septic Age within South East Erin

Street	Approximate Septic Age (yrs)
Dianne Road	25
9th Line	47
Mountain View Cres.	29
Garden Court	29
Kenneth Avenue	59
Armstrong Street	11
Leenders Lane	11
Aspen Court	18
McCullough Drive	21
Wellington Road 52	32
Treelong Crescent	10
Average Age	**27**

The lots within a wellhead protection area with a vulnerability score of 8 and 10 should be connected to the proposed communal wastewater collection and treatment system. These lots are located on the following streets: 9th Line, Dianne Rd, Kenneth Ave, Mountain View Cres, Armstrong St, Treelong Cres, Leenders Ln, Wellington Road 52. The remaining streets; McCullough Dr and Aspen Ct, have 21 and 11 year old septic systems, however it is anticipated that they would require to be connected to a communal system at some point in the future.

The northwest boundary of this decision area is in close proximity to a tributary of the West Credit River. The topography indicates that the decision area drains towards that boundary. More specifically, if the septic systems on McCullough Dr are deficient and leaking, they will potentially drain into the nearby tributary.

It is recommended to connect this entire area to a communal wastewater system. However this could be re-evaluated following the completion of the ongoing water system Class EA.

North East Erin

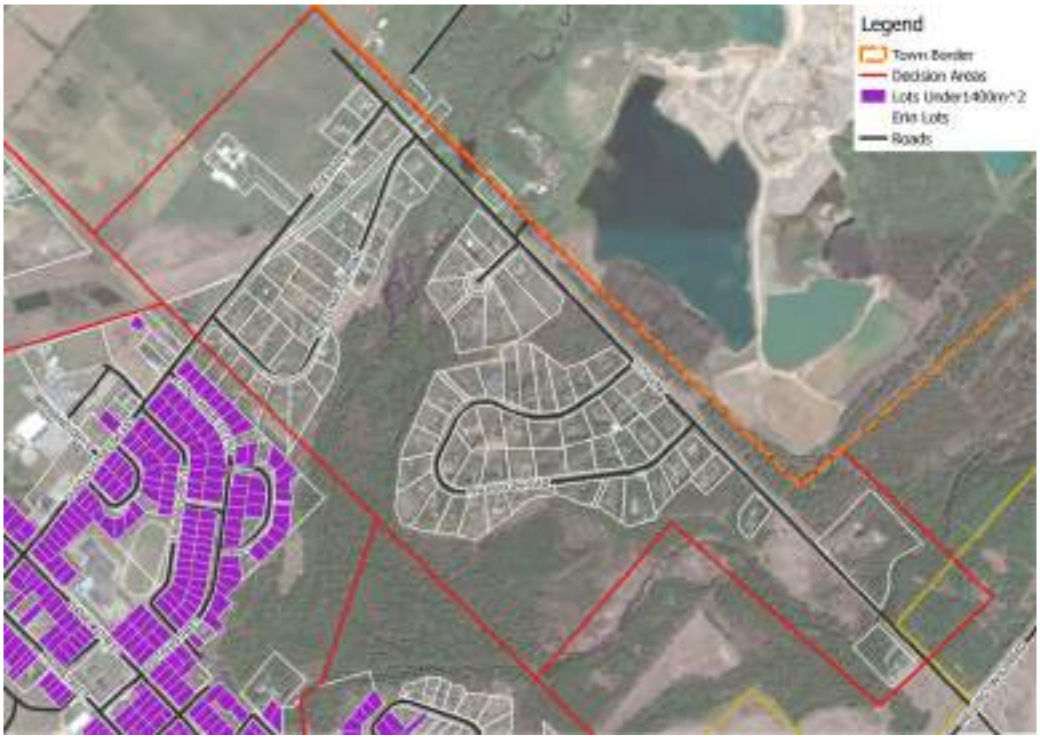


Figure 7 - North East Erin

The North East Erin decision area contains 95 of the 1,339 lots that are located in Erin. The building department data accounts for only 33 lots (20%) within this decision area. None of those lots are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is available for 31 lots. None of those septic systems has a tank that is below 3,600L in working capacity.

There are no lots within this area that fall within well head protection areas.

The Building Department records had no data regarding the age of the septic systems in this area.

The West Credit River runs through the south end of this decision area and the topography indicates that it drains towards the river. If the septic tanks in this decision area were to become deficient and leak, they could potentially contaminate into the West Credit River. However, since these lots were only recently developed, that is unlikely to occur in the near future.

It is recommended that this area not be connected to the proposed communal wastewater collection and treatment system in the immediate future.

3.1.2 Hillsburgh

Hillsburgh has been split into 5 decision areas regarding wastewater collection.

Hillsburgh Town Core 1

Figure 8 - Hillsburgh Town Core 1

The Hillsburgh Town Core 1 area contains 230 of the 512 lots that are located in Hillsburgh, which is the largest decision area in Hillsburgh. Of the 230 properties, 63% are below the minimum 1,400m^2 lot area for septic replacement. Most of the undersized lots are located south of Orangeville Street, with majority of lots on Mill St., Ellen Cres., Anne St., and Church St. being below 1,400m^2.

The septic tank size data is available for 227 lots. Of those lots, 36% have septic systems with a tank that are below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC. Within the available septic tank size data, the following streets in Hillsburgh Town Core 1 have the most non-compliance sized tanks: Ellen Cres/Alice Gate (94%) and Mill St. (50%).

There are 25 lots within the Hillsburgh Town Core 1 that land within a WHPA-A with vulnerability score of 10. The majority of lots within the two WHPA-A within Hillsburgh Town Core 1 are on Church St and Howe St. The SPP requires these lots to have a maintenance program be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07. The report must outline the actions taken in the previous year to achieve outcomes of the source protection policy. According the SSMP, the maintenance program should be a 5 year mandatory septic system inspection.

There are also 83 lots that fall within a WHPA-B that has a vulnerability score of 8. As can be seen in Appendix C-3, the WHPA-B with vulnerability score of 8 encompasses large portions of lots on Barbour Dr., Orangeville St., Ellen Cr., and Wallace St. These lots are close to a score of 10 and as the age of the septic systems increases, so does their risk of contaminating the groundwater, which would increase the vulnerability score of the wellhead protection area. This will cause the vulnerability scores to reach 10, which will incite the mandatory maintenance and reporting program mentioned above.

Table 13 shows that the average age of the septic systems in the decision area is 33 years old, with the oldest streets being Ellen Cres/Alice Gate, Church St and Trafalgar Rd, which are 45+ years old.

Table 13 - Septic Age within Hillsburgh Town Core 1

Street	Approximate Septic Age (yrs)
Barbour Drive	22
Hill Street	20
Wallace Street	19
Howe Street	23
Anne Street	31
Mill Street	44
Ellen Crescent/Alice Gate	46
Orangeville Street	40
Queen Street	33
Barker Street	23
Church Street	47
Trafalgar Road	45
Average Age	**33**

There is a tributary that runs through the south east section of this decision area, along Mill St. The topography indicates that the decision area drains towards that tributary and if septic systems are deficient and leaking, this could potentially increase the risk of contamination to the surface water.

Due to the majority of the lots being undersized, a high number of undersized septic tanks, a large portion of the area being in wellhead protection areas with vulnerability scores of 8 and 10, the close proximity to nearby surface water and the old age of the septic systems, it is recommended that this area be connected to the proposed communal wastewater collection and treatment system.

Hillsburgh Town Core 2

Figure 9 - Hillsburgh Town Core 2

The Hillsburgh Town Core 2 area contains 126 of the 512 lots that are located in Hillsburgh. Of the 126 properties, 85% are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is available for 61 lots. Of those lots, 3% have septic systems with a tank that are below 3,600L in working capacity, which violates section 8.2.2.3 of the OBC.

There are no lots within Hillsburgh Town Core 2 that fall within the wellhead protection areas.

Table 14 shows that the average age of the decision area is 37 years old.

Table 14 - Septic Age within Hillsburgh Town Core 2

Street	Approximate Septic Age (yrs)
Douglas Crescent/Currie Drive	39
Spruce Street	39
Trafalgar Road	32
Average Age	**37**

There is a tributary that runs in close proximity to northwest section of this decision area, along Mill St. The topography indicates that the decision area drains towards that tributary and if septic systems are deficient and leaking, they will potentially contaminate it. There is also a small lake located in close proximity to the south west border of this decision area that also has potential for contamination due to deficient septic systems.

Due to the majority of the lots being undersized, the close proximity to surface water and the old age of the septic systems, it is recommended that this area be connected to the proposed communal wastewater collection and treatment system.

Upper Canada Drive

Figure 10 - Upper Canada Drive

The Upper Canada Drive area contains 46 of the 512 lots that are located in Hillsburgh. Of the 126 properties, none are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is complete for this area and no lot has septic systems with a tank that are below 3,600L in working capacity. There are also no lots within Hillsburgh Town Core 2 that fall within the wellhead protection areas.

Table 15 shows that the average age of the septic systems in the decision area is 11 years.

Table 15 - Septic Age within Upper Canada Drive

Street	Approximate Septic Age (yrs)
Upper Canada Drive/McMurchy Ln	11
Leader Court	10
Average Age	**11**

There is a creek that runs through the north end of this decision area, along Trafalgar Rd and across Upper Canada Dr. The topography indicates that the decision area drains towards that creek and if septic systems are deficient and leaking, they will potentially contaminate it.

There appears to be no issues with the septic systems within this area of Hillsburgh. It is not recommended to be connected to a communal collection system.

George Street

Figure 11 - George Street

The George Street area contains 24 of the 512 lots that are located in Hillsburgh. Of the 24 properties, 67% are below the minimum 1,400m^2 lot area for septic replacement.

The septic tank size data is available for 10 lots. None of those lots have septic systems with a tank that are below 3,600L in working capacity.

There are no lots in this area that fall under a wellhead protection area. Table 16 shows that the average age of the decision area is 29 years old.

Table 16 - Septic Age within George Street

Street	Approximate Septic Age (yrs)
George Street	29
Average	**29**

There is a creek that runs through the north end of this decision area, behind the Hillsburgh library and across George St. The topography indicates that the decision area drains towards that creek and if septic systems are deficient and leaking, they will potentially contaminate it. There is also a small lake located in close proximity to the east border of this decision area that also has potential for contamination due to deficient septic systems.

Due to the majority of the lots being undersized, the close proximity to surface water and the high average age of the septic systems, it is recommended that this decision area be connected to the proposed wastewater collection and treatment system.

South Trafalgar Road

Figure 12 - South Trafalgar Road

The South Trafalgar Road area contains 78 of the 512 lots that are located in Hillsburgh. Of the 78 properties, 35% are below the minimum 1,400m^2 lot area for septic replacement. The majority of those lots are on Trafalgar Rd, with 42% being below 1,400m^2.

The septic tank size data is available for 23 lots. Of those lots, 1 has a septic system with a tank that is below 3,600L in working capacity.

There are no lots in this area that fall under a wellhead protection area.

Table 17 shows that the average age of the septic systems within this decision area is 29 years old.

Table 17 - Septic Age within South Trafalgar Road

Street	Approximate Septic Age (yrs)
Trafalgar Road	50
Station Street	28
Market Street	28
Average	**35**

There is a creek that runs in close proximity to the northwest end of this decision area. The topography indicates that the properties in the northwest end of this decision area drain towards that creek and if septic systems are deficient and leaking, they will potentially contaminate it. There are also a two small lakes located in close proximity to the southwest border of this decision area. These lakes and the creek connecting them also have potential for contamination due to deficient septic systems.

Due to the high number of undersized lots, the close proximity to surface water and the old age of the systems, this area should be connected to the proposed communal wastewater collection and treatment system.

4.0 Conclusion

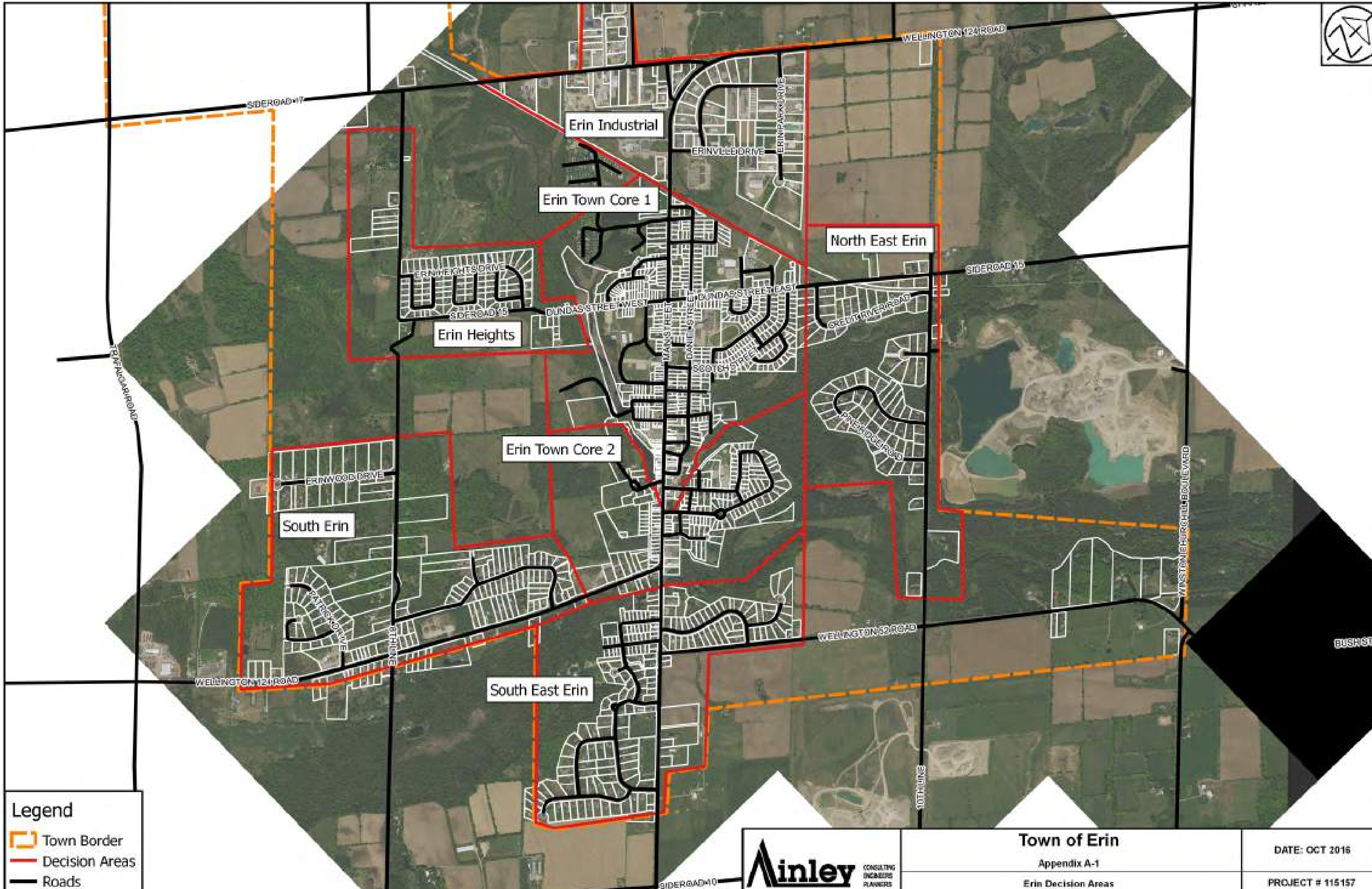
This report has been prepared in support of the Town of Erin Urban Centre Wastewater Servicing Environmental Assessment (UCWWS EA). The majority of properties within the Village of Erin and Hillsburgh are currently serviced by individual private septic systems and this septic system study was carried out to develop a more complete understanding of the existing septic systems to more clearly define the extent of the communal sewage service area. To accomplish this, Erin and Hillsburgh properties were split into separate decision areas based upon property location, local topography, drainage areas, proximity to sensitive receivers, and development consistency. The decision areas in Erin include: Erin Industrial, North East Erin, Erin Town Core 1, Erin Town Core 2, South East Erin, South Erin, and Erin Heights. Hillsburgh decision areas include: Hillsburgh Town Core 1, Hillsburgh Town Core 2, South Trafalgar Road, George Street and Upper Canada Drive. A visual representation of the decision areas can be found in Appendix A.

To determine which decision areas should be connected to the proposed communal wastewater collection and treatment system several studies/documents were analyzed, including: Servicing and Settlement Master Plan, Town of Erin Mandatory Septic Re-inspection Program, Building Department Records, GIS data, CVC Source Protection Plan(SPP), the Ontario Building Code and MOECC guidelines. These documents were analysed to define a number of determining factors for a decision area to connect to a communal sewage system, which include: lot size, septic tank size, septic system age, proximity to surface water and proximity to wellhead protection areas as defined in the SPP. A property lot size lower than 1,400m^2 is considered unable to accommodate a replacement septic system. The typical septic system life is 20-25 years according to the SSMP. If a septic tank is smaller than 3,600L and the property produces less than 10,000 L of sewage per day, it is not in compliance with the Ontario Building Code. If the property produces greater than 10,000 L of sewage per day then the working capacity of the septic tank(s) should provide minimum 24-hours retention at design peak daily flow according to MOECC guidelines. Lastly, if a property is within a wellhead protection area that has a vulnerability score of 10, the SPP requires a maintenance program be created and an annual report to be submitted to the MOECC equivalent to Section 65 of O.Reg. 287/07. The report must outline the actions taken in the previous year to achieve outcomes of the source protection policy. According the SSMP, the maintenance program should be a 5 year mandatory septic system inspection.

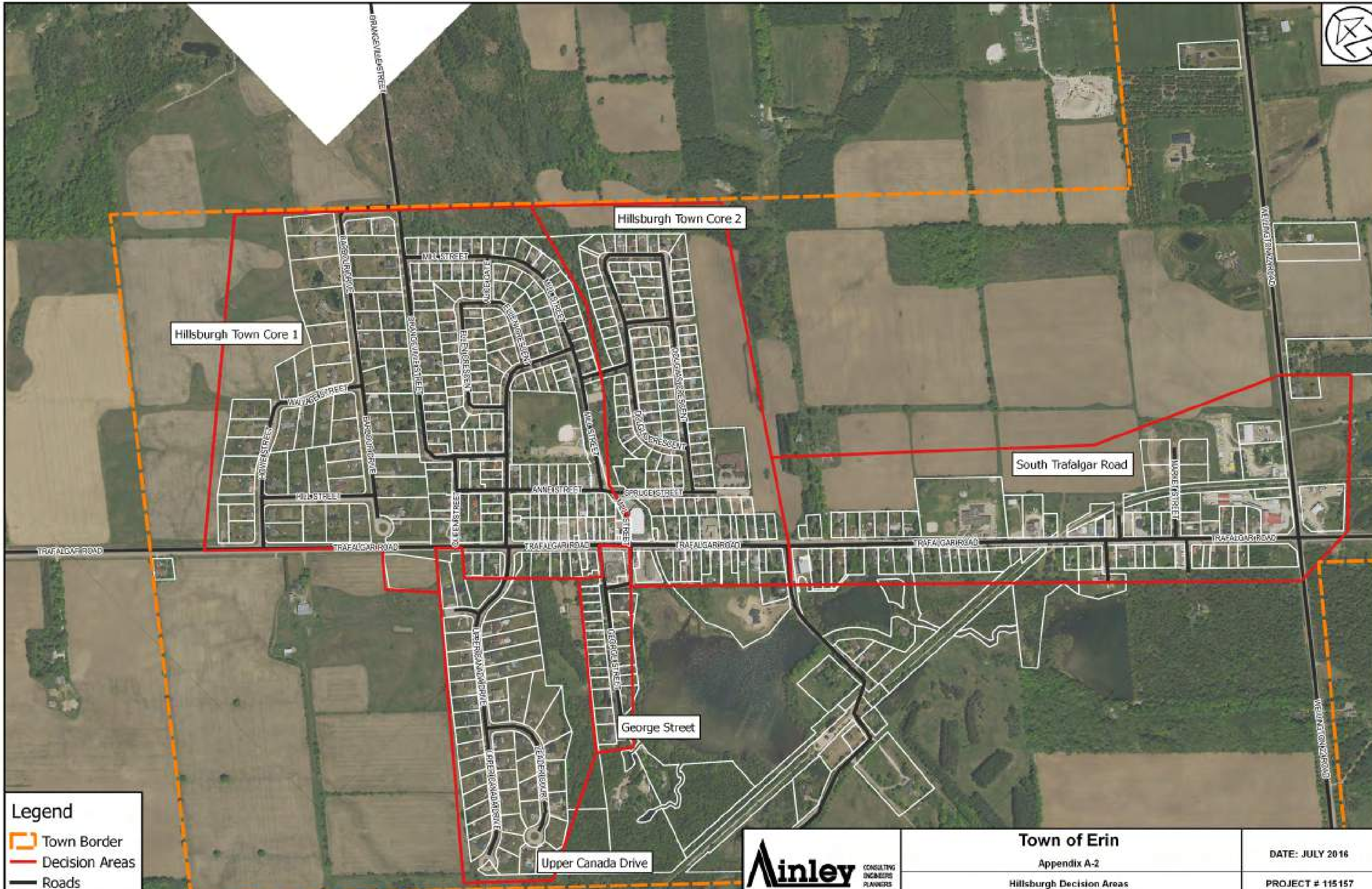
Based on the analysis of the four determining factors it was found that all decision areas in Erin except for Northeast Erin and part of South Erin should be connected to the proposed communal wastewater collection and treatment system, as shown in Appendix D1. In Hillsburgh, all decision areas should be connected except for Upper Canada Drive as shown in Appendix D2. In addition to the four determining factors that were used to decide which areas are to be connected, it should also be recognized that both communities have a high density of septic systems many of which are in close proximity to surface waters.

Appendix - A

Decision Areas



Erin Industrial
Erin Town Core 1
North East Erin
Erin Heights
Erin Town Core 2
South Erin
South East Erin
WELLINGTON 124 ROAD
SIDEROAD 17
SIDEROAD 15
DUNDAS STREET WEST
DUNDAS STREET EAST
ERINVILLE DRIVE
ERIN PARK DRIVE
ERIN HEIGHTS DRIVE
MAIN STREET
SCOTCH STREET
CREDIT RIVER ROAD
ERINWOOD DRIVE
TRAFALGAR ROAD
WELLINGTON 52 ROAD
10TH LINE
8TH LINE
WINSTON CHURCHILL BOULEVARD
SIDEROAD 10
Legend
Town Border
Decision Areas
Roads
Ainley
CONSULTING ENGINEERS PLANNERS
Town of Erin
Appendix A-1
Erin Decision Areas
DATE: OCT 2016
PROJECT # 115157



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Town of Erin

Appendix A-2

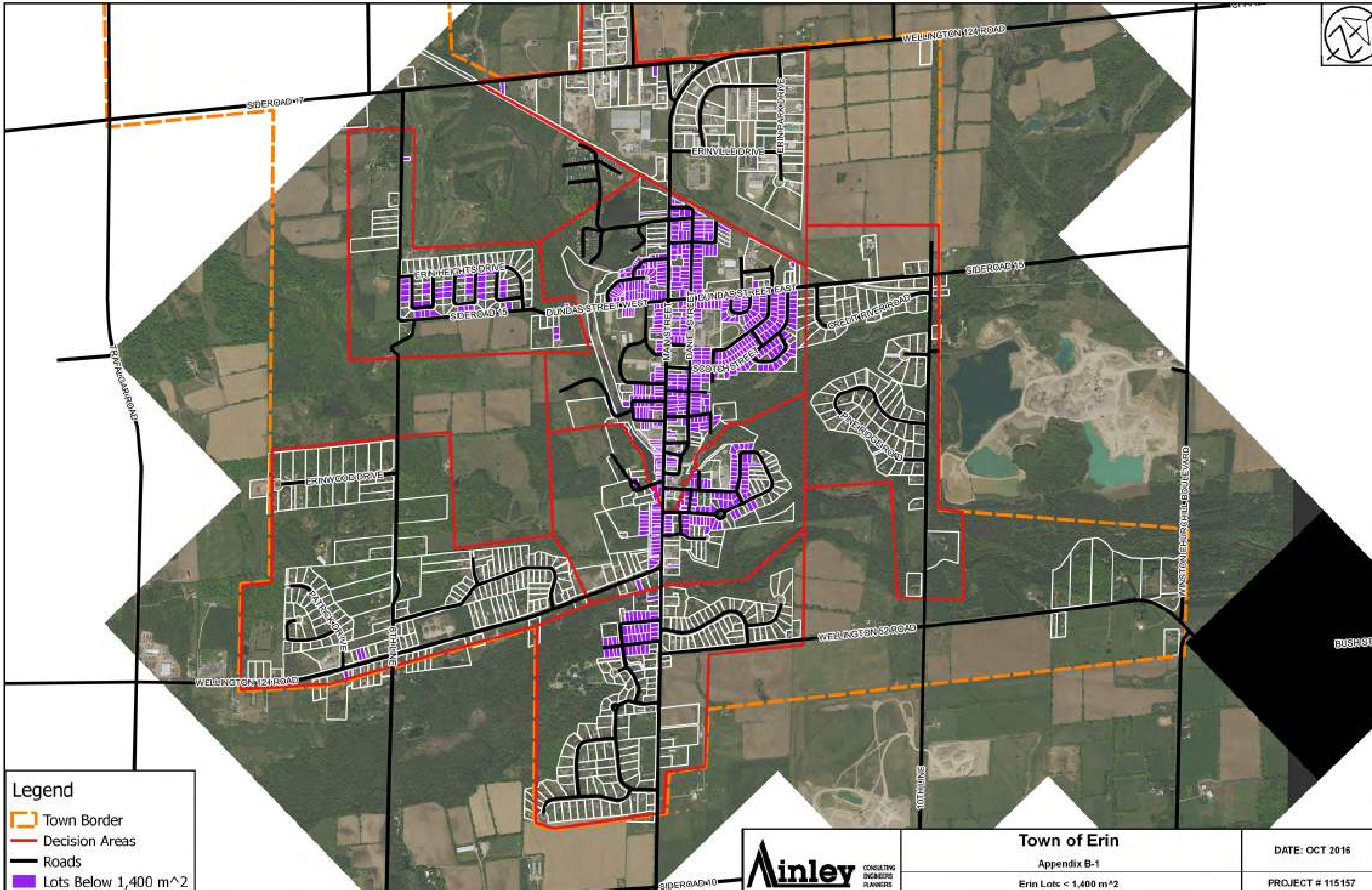
Hillsburgh Decision Areas

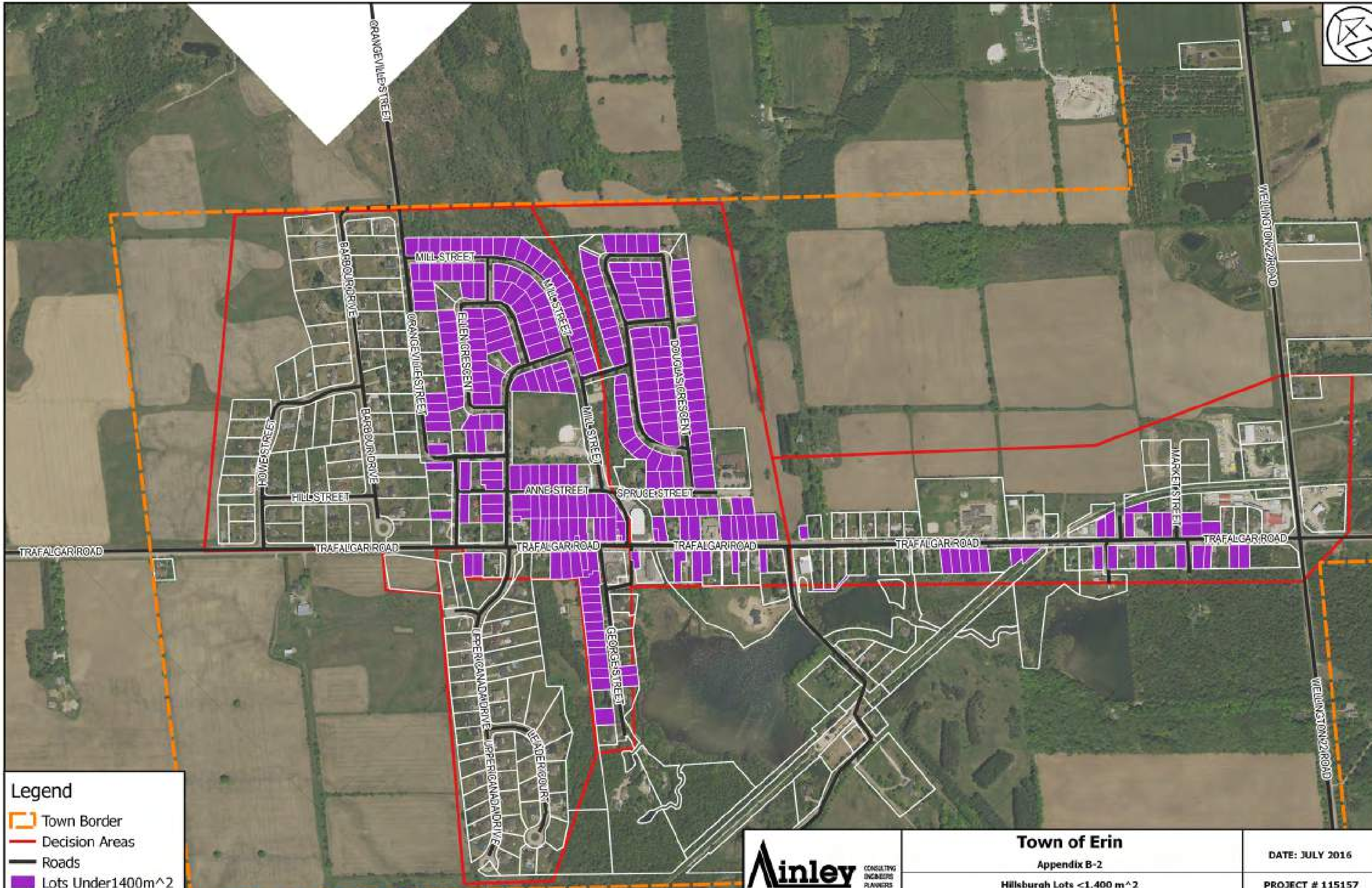
DATE: JULY 2016

PROJECT # 115157

Appendix - B

Lots Below 1,400m²


SIDEROAD 17
WELLINGTON 124 ROAD
ERINVILLE DRIVE
ERIN PARK DRIVE
ERIN HEIGHTS DRIVE
SIDEROAD 15
DUNDAS STREET WEST
DUNDAS STREET EAST
MAIN STREET
DANIEL STREET
SCOTCH STREET
CREDIT RIVER ROAD
SIDEROAD 15
PINE RIDGE ROAD
TRAFALGAR ROAD
ERINWOOD DRIVE
PATRICK DRIVE
9TH LINE
WELLINGTON 124 ROAD
WELLINGTON 52 ROAD
WINSTON CHURCHILL BOULEVARD
BUSH STR
10TH LINE
SIDEROAD 10
Legend
Town Border
Decision Areas
Roads
Lots Below 1,400 m^2
Ainley
CONSULTING ENGINEERS PLANNERS
Town of Erin
Appendix B-1
Erin Lots < 1,400 m^2
DATE: OCT 2016
PROJECT # 115157



Town of Erin

Appendix B-2

Hillsburgh Lots <1,400 m^2

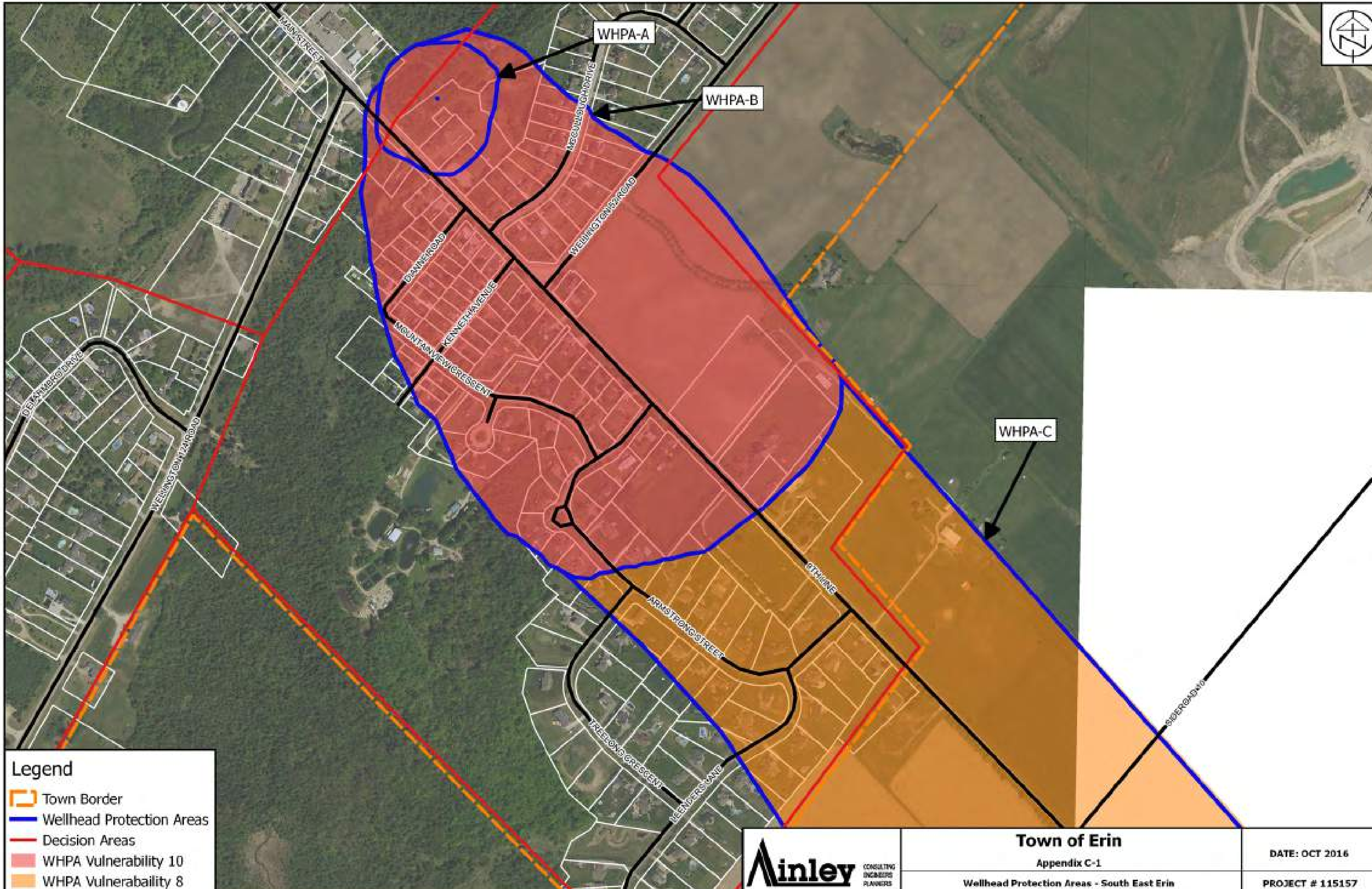
DATE: JULY 2016

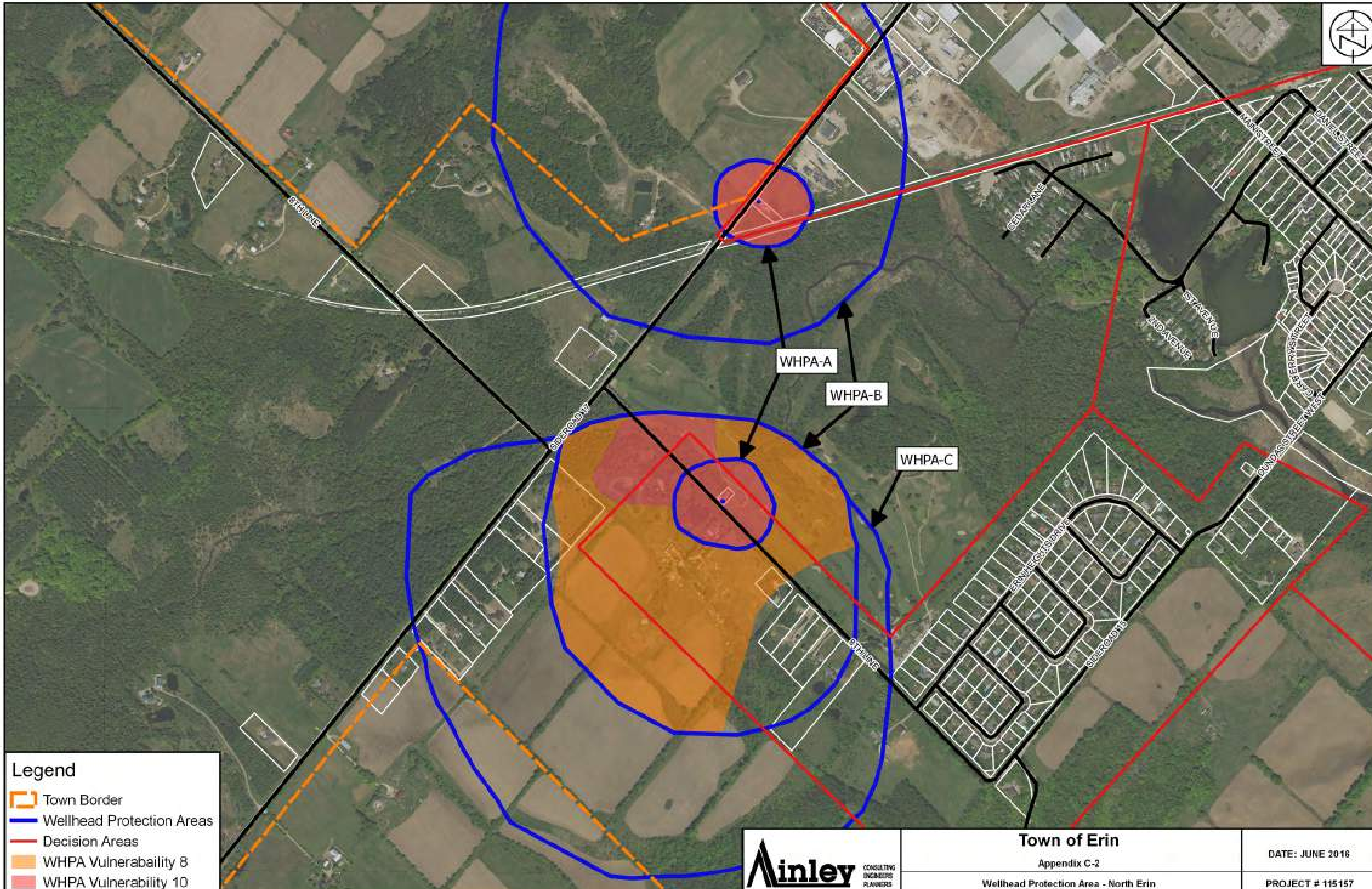
PROJECT # 115157

Ainley CONSULTING ENGINEERS PLANNERS

Appendix - C

Wellhead Protection Areas


WHPA-A
WHPA-B
WHPA-C
MAIN STREET
WELLINGTON ROAD
DIANNE ROAD
KENNETH AVENUE
MOUNTAINVIEW CRESCENT
ARMSTRONG STREET
8TH LINE
SIDEROAD 10
WELLINGTON 24 ROAD
Legend
Town Border
Wellhead Protection Areas
Decision Areas
WHPA Vulnerability 10
WHPA Vulnerabaility 8
Ainley
CONSULTING ENGINEERS PLANNERS
Town of Erin
Appendix C-1
Wellhead Protection Areas - South East Erin
DATE: OCT 2016
PROJECT # 115157


WHPA-A
WHPA-B
WHPA-C
8TH LINE
MAIN STREET
1ST AVENUE
2ND AVENUE
DUNDAS STREET WEST
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Wellhead Protection Areas
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WHPA Vulnerabaility 8
WHPA Vulnerability 10
Ainley
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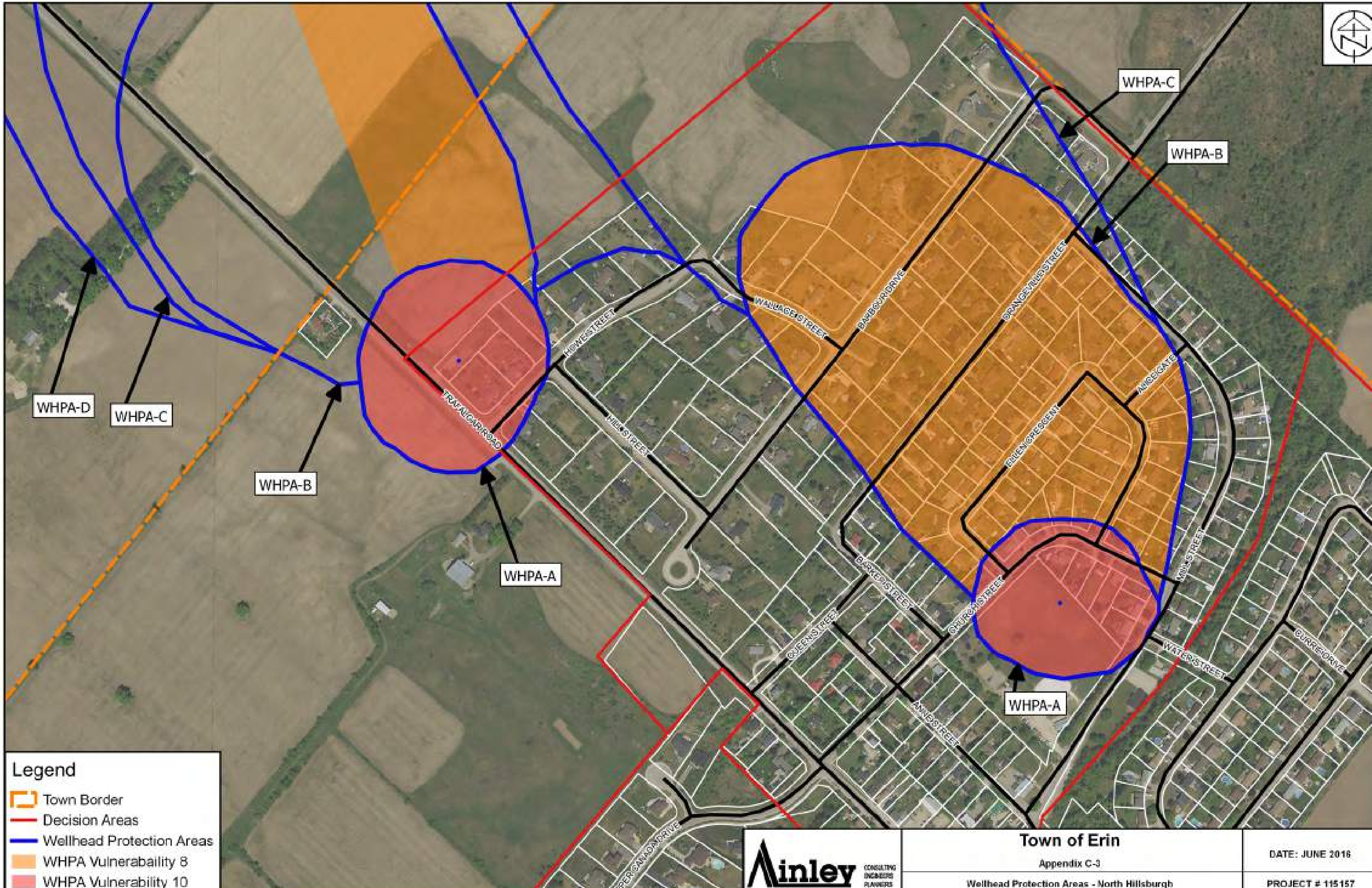
Town of Erin
Appendix C-2
Wellhead Protection Area - North Erin
DATE: JUNE 2016
PROJECT # 115157



Ainley CONSULTING ENGINEERS PLANNERS

Town of Erin

Appendix C-3

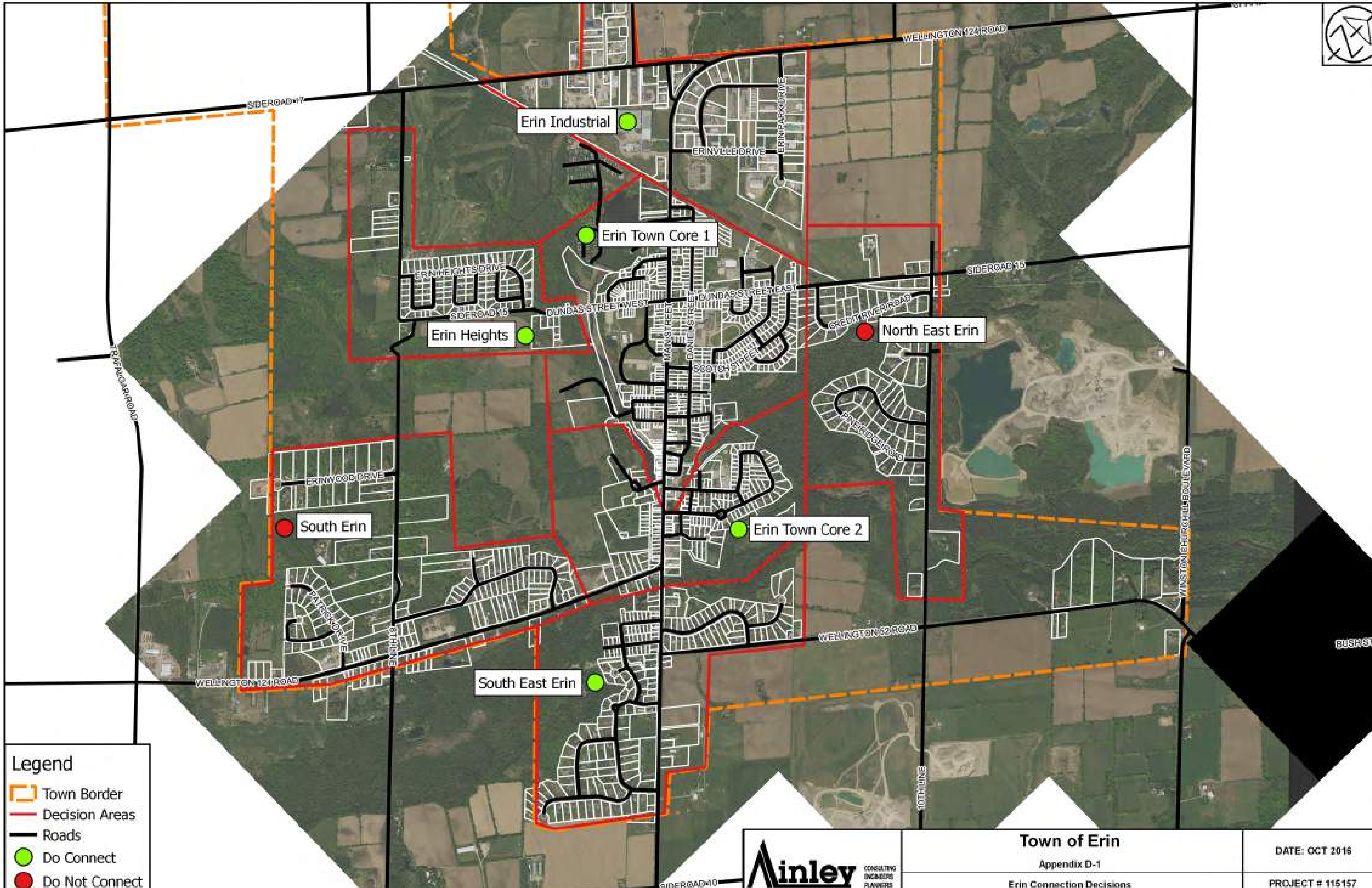
Wellhead Protection Areas - North Hillsburgh

DATE: JUNE 2016

PROJECT # 115157

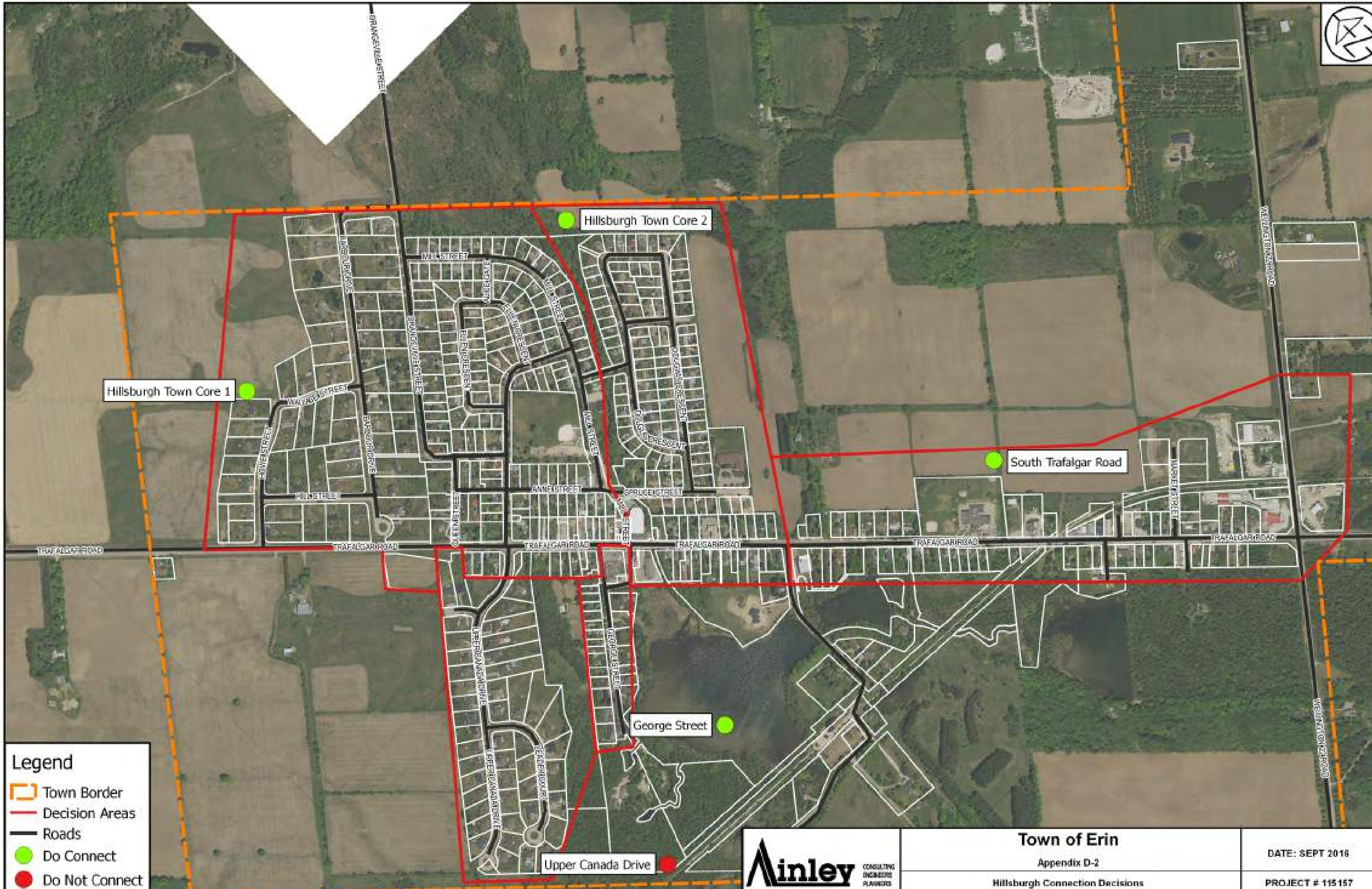
Appendix - D

Wastewater Collection Connection Decisions



Ainley CONSULTING ENGINEERS PLANNERS

Town of Erin	DATE: OCT 2016
Appendix D-1	
Erin Connection Decisions	PROJECT # 115157



Hillsburgh Town Core 2
Hillsburgh Town Core 1
South Trafalgar Road
George Street
Upper Canada Drive
TRAFALGAR ROAD
MILL STREET
ANNE STREET
SPRUCE STREET
GEORGE STREET
Legend
Town Border
Decision Areas
Roads
Do Connect
Do Not Connect
Ainley
CONSULTING ENGINEERS PLANNERS
Town of Erin
Appendix D-2
Hillsburgh Connection Decisions
DATE: SEPT 2016
PROJECT # 115157

Appendix C
System Capacity and Sewage Flows

Town of Erin

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
System Capacity and Sewage Flows
Final

November 2016

CONSULTING ENGINEERS & PLANNERS

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
System Capacity and Sewage Flows

Project No. 115157

Prepared for:
The Town of Erin

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Checked by:

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1.0 Introduction

This Technical Memorandum has been prepared in support of the Town of Erin Urban Centre Wastewater Servicing Environmental Assessment (UCWWS EA). The majority of properties within the Village of Erin and Hillsburgh are currently serviced by individual private septic systems. The Servicing and Settlement Master Plan (SSMP), completed by B.M. Ross in 2014, selected a communal wastewater collection system for both communities as the preferred alternative solution to deal with issues related to the private systems. The SSMP undertook part of Phase 1 and part of Phase 2 of the Class Environmental Assessment process and the Town is now engaged in completing these two phases and moving on to complete Phase 3 and Phase 4 of the Class EA process.

This Technical Memorandum outlines the flow volumes anticipated from each area that has been recommended for connection to the future communal sanitary collection system for the Town. The areas recommended for inclusion or exclusion for the wastewater system are shown in ***Appendix A***. Further, this report will outline the potential discharge volume to the West Credit River on the basis of the revised assimilative capacity report and outlines the amount of growth that the overall system could potentially accommodate.

2.0 Objectives

The objectives of this Technical Memorandum are as follows:

- Identify sanitary sewer flow volumes for each area within the existing urban area of Erin and Hillsburgh.
- Confirm the discharge potential to the West Credit River.
- Establish growth potential for the Town based on the proposed servicing limits for the communal wastewater system.

3.0 SSMP Overview of Flows and Discharge

In 2013, B. M. Ross conducted an Assimilative Capacity Study (ACS) of the West Credit River. The study investigated the impact on the river, as an effluent receiver, under three discharge scenarios: existing population of Erin (3,087 people), existing population of Erin and Hillsburgh (4,481 people), and a Future Population Scenario of 6,000 people. For the purpose of this summary, the impact on the receiver under the "Future Population Scenario" will be discussed.

The report assumed an average water usage rate of 345 litres/capita/day (L/c/d) combined with an inflow and infiltration rate of 90 L/c/d for a total of 435 L/c/d. On the basis of a future population of 6,000 residents the estimated Average Daily Flow (ADF) at 435 L/c/d was therefore 2,610 m^3/d. The ACS reviewed the impact of the discharge on the river at treatment parameter objective concentrations and non-compliance concentrations (summarized in Table 1 below).

Table 1 – SSMP Effluent Parameters

Parameter	Objective	Non-Compliance
TSS (mg/L)	3.0	10
Total Phosphorus (mg/L)	0.1	0.15
Total Ammonia (mg/L)	0.4	2.0
Nitrate-Nitrogen	5	6
TKN (mg/L)	-	3
BOD_5	3.6	7.5

The impact of each parameter on the river was evaluated on a month-by-month basis using monthly 7Q20 flow values developed for the report. Of the parameters considered at the assumed discharge of 2,610 m^3/d, the only concern was a slight exceedance for total nitrate nitrogen compliance limit during the month of February. This assessment was completed on the basis of increasing the phosphorus concentration in the West Credit River up to a limit of 0.03 mg/L corresponding to the Provincial Water Quality Objective (PWQO).

The result of the SSMP was an identified servicing capability of 6,000 persons including the existing population and new growth. While the SSMP identified an existing population of 4,481 persons within the proposed service area, no detailed flow contributions were presented and there was no discussion on “equivalent population” representing flows from institutional, commercial and industrial areas.

3.1 ACS Update Results

As part of this phase of the Class EA process, the Ministry of Environment and Climate Change (MOECC) and the Credit Valley Conservation (CVC) Authority requested updates to the work completed in the SSMP including revisiting the 7Q20 flow values and reevaluating the assimilative capacity of the West Credit River based on updated 7Q20 flows and recommended effluent objective and compliance concentrations of the key effluent parameters. The updated ACS also provides an analysis of all other parameters including dissolved oxygen. The updated ACS is provided as a separate report and the results incorporated into this Technical Memorandum which calculates flow and capacity based on the updated 7Q20 flow.

While the effluent discharge to the West Credit River will be required to meet a full range of compliance limits for various discharge parameters in order to secure MOECC approval, for the purpose of this Technical Memorandum, phosphorus concentration is assumed to be the parameter that limits the amount of treated wastewater effluent that can be discharged to the river. The West Credit River is defined as a Policy 1 stream for management of surface water quality as it has a Total Phosphorus (TP) concentration of between 0.011 – 0.015 mg/L, well below the PWQO of 0.03 mg/L and will have to be managed to remain below the PWQO. While the SSMP assumed a downstream phosphorus concentration of 0.03 mg/L after mixing with the wastewater effluent, discussions with MOECC and CVC throughout the ACS update established that it would be inappropriate to model the wastewater discharge to this limit. Based on this, Hutchinson Environmental Sciences Ltd (HESL) was requested to identify an appropriate downstream phosphorus concentration to ensure that the river remained a Policy 1 receiver while maintaining the appropriate level of water quality. ***Appendix B*** contains HESL’s memorandum titled "Recommended Downstream TP Target for West Credit River at Winston Churchill Blvd" which recommends a "Site Specific Target" for Phosphorus downstream of the proposed effluent discharge.

Based on this analysis, it is recommended that a downstream Site Specific Water Quality Objective (SSWQO) of 0.024 mg/L TP be adopted to protect the cold water habitat and water quality in the West Credit River, consistent with Environment Canada and Canada Council of Ministers of the Environment (CCME) guidance. This target aims to maintain the current trophic status of the river. A higher water quality objective is not recommended as the effect of changing the trophic status of the river on brook trout and other aquatic life in the West Credit River is not well understood at this time.

Targeting a fully mixed West Credit River phosphorus concentration of 0.024 mg/L, a range of wastewater effluent scenarios were modeled as outlined in Table 2.

Table 2 – Updated ACS Effluent Discharge Potential (River Concentration 0.024 mg/L)

Effluent Phosphorus Concentration (mg/L)	Discharge Potential (m^3/d)
0.15 mg/L	1,234
0.1 mg/L	2,050
0.07 mg/L	3,380
0.05 mg/L	5,982
0.046 mg/L	7,172

It is noted that the 2,610 m^3/d discharge potential identified in the SSMP associated with a downstream phosphorus concentration of 0.03 mg/L can no longer be achieved at a wastewater effluent concentration of 0.15 mg/L.

4.0 Wastewater Flow Design Basis

4.1 Flows from Existing Developed Communities

In recent years it has been recognized, through changes to the plumbing code and additional efforts to reduce water use; that the wastewater flow rates historically used in Ontario for design of wastewater systems, are high and could result in unnecessary infrastructure spending. More typically, wastewater system capacities are being designed based on lower actual flows. While Erin does not have wastewater flow data available, data for municipal water usage exists and provides a guide for estimating wastewater flow. The current MOECC guidelines for sewage works design suggest a design value of 450 L/c/d for the sizing of wastewater systems. In light of existing water use data, our approach is geared towards optimizing system design by determining a flow estimation value which reflects the actual water use in the existing communities.

The majority of Erin and Hillsburgh planned wastewater service area is presently serviced by municipal water. The water taking records from 2013-2015 were obtained from the Town and the monthly total water demand for this period is summarized in Figure 1. The 3-year average shows the trend of increased water usage during the summer months typically associated with warm weather activities such as lawn/garden watering, car washing, driveway washing, etc. Normally, the increased water usage in the summer is not reflected in increased wastewater flows to municipal systems during that period. Typically a baseline water usage rate exists throughout the year for in-home use including laundry, showers, flushing, dishwashing, etc. and this is reflected in a relatively constant wastewater flow throughout the year.

For Erin, based on the average monthly water usage rates, the baseline overall water usage rate was determined to be 29,500 m^3/month (average of 9 months less June, July, August) which equates to approximately 215 L/c/d considering an existing water service population of approximately 4450 residents. Further, the water taking records reflect the volume of water pumped into the distribution system, not necessarily the volume of water use by residents/businesses/industry in the serviced communities. Typically, water distribution systems have a portion of distributed water unaccounted for through system leaks and operational uses. An efficient system may still have unaccounted for water of up to 10% of distributed water in this manner. Based on this analysis, we can realistically conclude that the Erin per capita wastewater generation rate may be approximately 195 L/c/d. For the purposes of this study it is suggested that a 50% safety factor be used for design over and above this baseflow. It is therefore proposed to use a residential wastewater generation rate of 290 L/c/d. This generation rate is exclusive of flow generated through inflow and infiltration (I&I) sources.

The proposed residential wastewater generation rate is around the mid-range of design standards used by various locations within southern Ontario. Several example locations and their respective rates are outlined in Table 3. Although this will be a completely new wastewater system, the existing residential water use pattern is well established and wastewater flow rates towards the lower end of the range may not be realized. It is therefore prudent to allow for a higher rate of 290 L/c/d.

Table 3 – Sewage Generation Assumptions, Southern Ontario

Design Standard	Residential Flow Rate
City of Barrie	225 L/c/d
Region of Halton	275 L/c/d
Region of Peel	303 L/c/d
Region of Waterloo	350 L/c/d
MOECC (design guidelines)	450 L/c/d

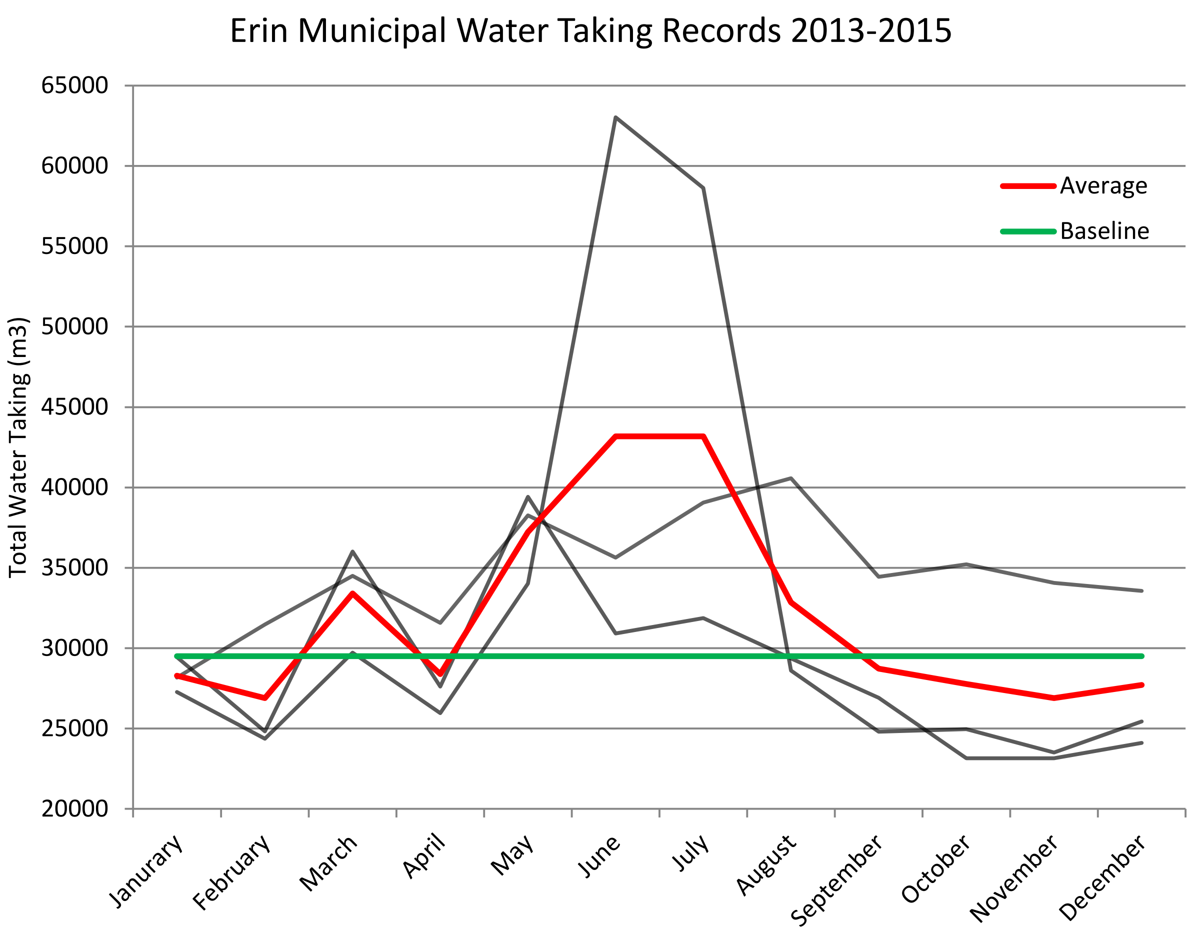


Figure 1 – Erin Municipal Water Taking Records

Table 4 outlines the assumptions used to generate the estimated average daily flow for residential, institutional, commercial and industrial flows as well as inflow and infiltration from the existing properties in Erin.

Table 4 – Flow assumptions for preliminary design

Residential Flow	290 L/c/d
Inflow and Infiltration	90 L/day/capita
School Flow	95 L/student/day
Industrial Flow	9 m^3/ha/d
Commercial Flow	28 m^3/ha/d

The industrial flow assumption has been revised down to 9 m^3/ha/day (from the MOECC standard 28 m^3/ha/day), in light of existing water use data from 2013-2016. This flow allocation is representative of "dry" industries. Future proposals for industrial developments in Erin would likely need to look at the total allocation to industrial/commercial and will also need to look at the nature of the discharge in terms of its effect on treatment and discharge to the West Credit River.

The inflow and infiltration assumption is based on the MOECC design guidelines.

The volume of wastewater generation from the existing developed communities of Erin and Hillsburgh was calculated on an area by area basis using the property database developed for the Septic System Report for those areas recommended to be connected to the communal wastewater system and using the per capita flows established herein. The database includes existing properties serviced by private sewage systems within the communities.

In addition to flows from existing serviced properties, the recommended areas for communal wastewater servicing may also be expected to generate wastewater flows from vacant lots (infill) and from intensification of development on existing serviced lots.

Average daily flows and peak flows were calculated by area. Peak flows were also determined for each community and for both communities combined. Peak flows were calculated using the Harmon Peaking Factor calculation.

4.2 Wastewater Flows from Future Planned Growth Areas

Growth areas are designated in the Town's Official Plan (OP). These areas were confirmed with the County of Wellington and are illustrated in ***Appendix C.*** Also based on discussions with the County of Wellington, the assumed density of residential development is 16 units/ hectare and 2.8 persons per unit. Residential populations are therefore based on this density. Flow contributions from institutional/commercial/industrial growth areas expressed as an equivalent population are determined by calculating the flows based on the flow assumptions in Table 4 and then dividing by the per capita flow contribution of 380 L/C/D. The growth areas considered within the analysis are listed in Table 5 below:

Table 5 – New Growth Areas and Equivalent Population

Identification	Designation	Area (Ha)	Equivalent Population
ER-11	Erin - Residential	14	627
ER-13	Erin - Residential	38	1,702
ER-14	Erin - Residential	18	806
ER-15	Erin - Residential	42	1,882
ER-16	Erin - Residential	3	135
Ind.	Erin - Residential	4.2	188
Ind.	Erin – Industrial	15.3	362
Ind.	Erin – Industrial	15.3	362
Ind.	Erin – Commercial	7.8	575
Erin - Total		157.6	6,639
ER-02	Hillsburgh - Residential	9	403
ER-03	Hillsburgh - Residential	25	1120
ER-04	Hillsburgh - Residential	13	583

ER-05	Hillsburgh - Residential	6	269
ER-06	Hillsburgh - Residential	14	627
ER-07	Hillsburgh - Residential	20	896
ER-45	Hillsburgh - Residential	15	672
Ind.	Hillsburgh – Industrial	7.7	182
Hillsburgh Total		109.7	4,752
Total		267.3	11,391

5.0 Wastewater Flows from Proposed Communal System

5.1 Servicing Existing Developed Communities

The extent of the proposed communal wastewater service area for the existing communities has been identified in the Septic System Survey Technical Memorandum and that technical memorandum includes the rationale for inclusion or exclusion of various sections of the communities on an area by area basis. The results of the study indicate that the entire urban areas of both Erin Village and Hillsburgh should be included in the communal service area except for North East Erin, South Erin, and Upper Canada Drive. The boundaries of the proposed wastewater communal system servicing existing developed communities, are shown in ***Appendix A.*** This Technical Memorandum addresses the flow estimate from only those areas recommended to be in the communal wastewater system.

This section addresses the total wastewater flows from all of the existing developed areas recommended to be serviced by the communal wastewater system. The detailed flow determinations on an area by area basis are shown in ***Appendix D*** for Erin and ***Appendix E*** for Hillsburgh.

In determining wastewater flows from existing developed urban areas it is necessary to determine the flow from existing serviced lots and also to determine the flows from infill development of undeveloped lots. It is also prudent to consider the possibility of intensification as the change from private wastewater systems to communal sewage systems provides the opportunity for properties, especially in downtown core areas, to construct larger commercial properties. For this reason, this Technical Memorandum addresses flows for the proposed existing area in terms of these three components (Existing Lots, Infill Lots and Intensification).

In addition, it is prudent to consider the full build out of existing areas (Existing Lots, Infill Lots and Intensification) when allocating system capacity to the existing communities.

On the basis of the flow assumptions presented in Section 4.0 Wastewater Design Flow Basis, and the detailed area by area flow calculations shown in ***Appendix D*** and ***Appendix E***, the anticipated flow from existing serviced lots in the proposed collection area is presented in Table 6. The ADF flow estimate represents the average daily flow while Peak Day Flow Estimate represents the peak daily flow expected for a gravity system experiencing Inflow and Infiltration. While other collection system alternatives will be considered to eliminate or reduce Inflow and Infiltration, this memorandum considers the worst case in order to establish a minimum potential system capacity.

Table 6 – Sanitary Collection System Flow Estimation – Existing Developed Lots

Location	Equivalent Population[2]	Residential Population	ADF Flow Estimate (m^3/d)	Peak Day Flow Estimate (m^3/d)
Erin	4,852	2,943	1,844	6,006
Hillsburgh	1,513	1,327	575	2,113
Total	6,365	4,270	2,419	7,610[1]

[1] Peak Day Estimates are calculated using the Harmon Peaking Factor and therefore the peak day estimates for each location do not sum to the total.

[2] Equivalent Population (EP) represents Residential Population plus institutional/commercial/industrial wastewater flow sources expressed as the equivalent number of residents, while Residential Population represents the "actual" population exclusive of institutional/commercial/industrial wastewater flows.

It is noted that while the SSMP used an existing population of 4,481, it is not clear whether this represented an equivalent population or simply the existing residential population. None-the-less the estimated equivalent population from the proposed existing communal serviced area is 6,365 which is significantly more than the existing residential population.

It is also noted that the latest available estimated existing residential population of the two urban areas is 4,415 (C N Watson and County Planning). The residential population shown in Table 6 represents the estimated population for the proposed service area while the C N Watson and County Planning estimate is based on the whole urban areas population.

As noted, vacant lots throughout both Erin and Hillsburgh were tallied under the assumption that these lots would be allocated capacity for connection to the proposed sanitary system. The lot tally was conducted using Google Earth images. Vacant lots within industrial areas were assumed to be reserved for industrial development, likewise for residential and commercial areas. The equivalent population and estimated flow rates for the infill lots is presented in Table 7.

Table 7 – Sanitary Collection System Flow Estimation - Infill

Location	Equivalent Population	Residential Population	ADF Flow Estimate (m^3/d)	Peak Day Flow Estimate[1] (m^3/d)
Erin	720	125	273.5	903
Hillsburgh	26	26	10	33
Total	746	151	283.5	935

[1] Peaking Factor assumed to be 3.3 based on the existing population

As the existing communities are on private septic systems it has been difficult for property owners to add to the existing development on their existing lots. There is typically insufficient space to increase the wastewater disposal bed size on most lots. When the communities are serviced with a communal wastewater system, some amount of intensification will likely occur in the core areas where there will be increased opportunity for more commercial activity. For this reason, it is prudent to assume rates of intensification for various areas of Erin and Hillsburgh under the assumption that the communities will further develop on the communal wastewater system. This assumption will help ensure that the design of the proposed system will allow for a moderate amount of intensification to occur without impacting the performance of the system. The equivalent population and estimated flow rates for intensification is presented in Table 8.

Table 8 – Sanitary Collection System Flow Estimation - Intensification

Location	Equivalent Population	Residential Population	ADF Flow Estimate (m^3/d)	Peak Day Flow Estimate (m^3/d)
Erin	333	157	126.6	417.8
Hillsburgh	38	38	14.4	47.5
Total	371	195	141	465.3

[1] Peaking Factor assumed to be 3.3 based on the existing population

Considering the total flow estimate from the existing lots, infill lots and intensification, Table 9 summarizes the total equivalent population and Table 10 summarizes the total estimated wastewater flow needed to service the existing developed areas. It is also noted that the expected residential population for build out of these the existing areas proposed for servicing is 4,616.

Table 9 – Equivalent Population Summary, Servicing Existing Areas

	Existing Equivalent Population	Infill Population	Intensification Population	Total Equivalent Population
Erin	4,852	720	333	5,905
Hillsburgh	1,513	26	38	1,577
Total	6,365	746	371	7,482

Table 10 – ADF Flow Summary, Servicing Existing Areas

	Existing Flow m^3/d	Infill Flow m^3/d	Intensification Flow m^3/d	Total ADF Flow m^3/d
Erin	1,844	273.5	126.6	2,244.1
Hillsburgh	575	10	14.4	599.4
Total	2,419	283.5	141	2,843.5

5.2 Servicing Future Planned Growth Areas

The total potential growth for the communities based on available land designated in the OP as shown in Table 5 is summarized in Table 11. The per capita wastewater flow assumptions outlined in Table 4 were applied to planned growth areas and equivalent populations to establish projected wastewater flows from these areas.

Table 11 – New Growth Areas, Equivalent Population and ADF Estimate

Identification	Designation	Equivalent Population	ADF Estimate (m^3/d)
ER-11	Erin - Residential	627	238.3
ER-13	Erin - Residential	1,702	646.9
ER-14	Erin - Residential	806	306.4
ER-15	Erin - Residential	1,882	715.0
ER-16	Erin - Residential	135	51.1
Ind.	Erin - Residential	188	71.5
Ind.	Erin – Industrial	362	137.7
Ind.	Erin – Industrial	362	137.7
Ind.	Erin - Commercial	575	218.4
Erin - Total		6,639	2,523
ER-02	Hillsburgh - Residential	403	153.2
ER-03	Hillsburgh - Residential	1120	425.6
ER-04	Hillsburgh - Residential	583	221.3
ER-05	Hillsburgh - Residential	269	102.1
ER-06	Hillsburgh - Residential	627	238.3
ER-07	Hillsburgh - Residential	896	340.5
ER-45	Hillsburgh - Residential	672	255.4
Ind.	Hillsburgh – Industrial	182	69.3
Hillsburgh Total		4,752	1805.7
Total		11,391	4,328.7

Table 12 – Sanitary Collection System Flow Estimation – New Growth Areas

Location	Equivalent Population	Residential Population	ADF Flow Estimate (m^3/d)	Peak Day Flow Estimate[1] (m^3/d)
Erin	6,639	5,340	2,523.0	7,316
Hillsburgh	4,752	4,603	1,805.7	5,237
Total	11,391	9,943	4,328.7	12,553

[1] Peaking Factor assumed to be 2.9 based on the total growth population

5.3 Full Build Out Wastewater Flow

Full Build out wastewater flow represents the total estimated wastewater flow that would be generated from the existing developed areas of Erin and Hillsburgh and the total wastewater flow from all planned growth areas identified in the Official Plan. Table 13 shows the full build out flows and Table 14 shows the estimated equivalent population and estimated residential population that would need to be serviced to achieve full build out of the Official Plan. While Equivalent Population includes an allowance for institutional, commercial and industrial flows, the Residential Population represents the actual estimated serviced population. The “Existing Community” in both Table 13 and Table 14 includes infill and intensification.

Table 13 – Full Build Out ADF Flow Summary (m^3/d)

	All Development			Residential Development		
	Erin	Hillsburgh	Total	Erin	Hillsburgh	Total
Existing Community	2,244.1	599.4	2,843.5	1,225.5	528.6	1,754.1
Growth Areas	2,523.0	1,805.7	4,328.7	2,029.2	1,749.1	3,778.3
Total	4,767.1	2,405.1	7,172.2	3,254.7	2,277.7	5,532.4

Table 14 – Full Build Out Population Summary

	Equivalent Population			Residential Population		
	Erin	Hillsburgh	Total	Erin	Hillsburgh	Total
Existing Community	5,905	1,577	7,482	3,225	1,391	4,616
Growth Areas	6,639	4,752	11,391	5,340	4,603	9,943
Total	12,544	6,329	18,873	8,565	5,994	14,559

6.0 Balancing Estimated Wastewater Flows and Effluent Discharge Potential

6.1 Effluent Discharge Scenarios

Using the Updated ACS Effluent Discharge Potential shown in Table 2, the total equivalent population under each phosphorus effluent concentration scenario is outlined in Table 15. The TP effluent discharge concentrations of 0.15 mg/l (used in the SSMP) and 0.10 mg/l have no longer been included because they do not allow the existing community to be serviced.

Equivalent populations are derived from the ADF flows and the per capita flow contribution of 380 L/c/d which is associated with a gravity sewer system and includes an allowance for inflow and infiltration. The residential populations are derived from the previously calculated residential population from the existing areas plus the residential populations from the growth areas at 45 persons per hectare.

Table 15 – Equivalent Population for Discharge Scenario (River Concentration 0.024 mg/L)

Servicing Limits For Flow and TP Discharge Concentration Limits	TP Effluent Discharge Concentration (mg/L)	Equivalent Population Potential	Residential Population	ADF (m^3/d)
Fully Service Existing Community	0.079	7,482	4,616	2,844
Potential Stage 1 Servicing	0.07	8,895	6,029	3,380
Potential Stage 2 Servicing	0.05	15,742	12,876	5,982
Potential Stage 3 Servicing (Full Build Out)	0.046	18,873	14,559	7,172

To service the existing community including infill and intensification would require a wastewater treatment plant to achieve a TP effluent discharge concentration of 0.079 mg/l.

To achieve full build out of the Official Plan (O.P.) including all of the designated growth areas, would require a wastewater treatment plant to achieve a TP effluent discharge concentration of 0.046 mg/l.

The Stage 1, Stage 2 and Stage 3 servicing options are discussed below.

6.2 Treatment Technology Limits for Phosphorus Removal

For the purposes of this Technical Memorandum, it is assumed that meeting the discharge limits for phosphorus into the West Credit River will be the most critical treatment parameter limiting system capacity. As outlined in Section 3 of this Technical Memorandum, it is recommended to adopt a downstream phosphorus concentration of 0.024 mg/l to protect water quality in the river. Phosphorus effluent concentrations from the proposed treatment plant that maintains this downstream level of phosphorus, will therefore dictate the flow that can be discharged and dictate the capacity of the system. Based on this, treatment technologies adopted for phosphorus removal in the treatment plant, will likewise dictate the capacity of the system.

Treatment technologies and overall project phasing will be considered in more detail during Phase 3 and 4 of the Class EA as an implementation plan is developed. Having established the wastewater flows and discharge limits needed to meet full build out of the Official Plan, it is necessary to identify whether it is practical to achieve these limits using available treatment technologies.

Treatment of municipal wastewaters using primary, secondary and tertiary treatment, can reliably achieve an effluent phosphorus concentration below 0.1 mg/l. A range of treatment alternatives including biological phosphorus removal, chemical addition and sand filtration has been used for many decades to achieve this level of removal. In addition to these traditional methods used to remove phosphorus, there are several technologies available that can achieve an effluent concentration below 0.03 mg/l. While at present, 0.03 mg/l may be considered the limit that can reliably be achieved by best available technologies, MOECC appears to have adopted a cautious approach to approval of treatment systems at this limit. While it is considered that the effluent concentration of 0.046 mg/l needed to meet full build out conditions, can be achieved through application of best available technology, it is likely necessary to adopt a staged approach to achieving this limit in order to satisfy MOECC that it can be reliably achieved.

It is therefore suggested that a staged approach could be adopted to achieve full build out condition. This approach would use best available technology combined with a process of treatment plant rerating based on operational results. It should also be noted that, while MOECC issue an approval based on compliance limits, they also set operational objectives to ensure that treatment plants reliably meet their compliance limits. For example, a compliance limit of 0.1 mg/l may also have an objective of 0.08 mg/l that the plant needs to meet.

While phasing will be considered in more detail during Phase 3 and 4 of the Class EA, the following is staging plan is suggested to illustrate the potential for servicing at various Effluent Limits.

6.3 Stage 1 – Effluent Phosphorus Limit 0.07 mg/L

A phosphorus effluent compliance limit of 0.07 mg/L with an operational objective of 0.05 mg/l would provide for the following:

- Equivalent service population limit of 8,895
- Existing lots, infill and intensification can be serviced with 1,413 equivalent population still available for new growth
- Actual residential population could increase to 6,029
- The treatment plant could be operated to demonstrate reliable performance under 0.05 mg/l sufficient to apply for rating to meet Stage 2 limits

6.4 Stage 2 – Effluent Phosphorus Limit 0.05 mg/L

A phosphorus effluent compliance limit of 0.05 mg/L with an operational objective of 0.04 mg/l would provide for the following:

- Equivalent service population limit is 15,742
- Existing lots, infill and intensification can be serviced with 8,260 equivalent population still available for new growth
- Actual residential population could increase to 12,876
- The treatment plant could be operated to demonstrate reliable performance under 0.04 mg/l sufficient to apply for rating to meet full build out limits

6.5 Stage 3 – Effluent Phosphorus Limit 0.046 mg/L

A phosphorus effluent compliance limit of 0.046 mg/L with an operational objective of 0.04 mg/l representative of full build out of the Official Plan, would provide for the following:

- Equivalent service population limit is 18,873
- Existing lots, infill and intensification can be serviced and still allow for 11,391 equivalent population meeting full development of all new growth areas
- Actual residential population could increase to 14,559

7.0 Conclusions and Recommendations

The Servicing and Settlement Master Plan (SSMP) identified an existing communal wastewater serviced population of Erin and Hillsburgh at 4,481 people and a potential future total population of 6,000 based on an estimated wastewater Average Daily Flow (ADF) of 435 L/c/d resulting in a wastewater flow of 2,610 m^3/d discharging to the West Credit River at an effluent phosphorus concentration of 0.15 mg/l to achieve a downstream phosphorus concentration in the West Credit River of 0.03 mg/l corresponding to the Provincial Water Quality Objective for Phosphorus.

The objective of this Technical Memorandum is to:

- More accurately identify predicted wastewater flows from the existing urban areas of Erin and Hillsburgh and from planned growth areas in both of these communities;
- Confirm the discharge potential to the West Credit River based on an updated Assimilative Capacity Study and to confirm the potential to service the urban areas of Erin and Hillsburgh with a communal wastewater system based on the ability to meet discharge limits to the river.

This Technical Memorandum concludes the following:

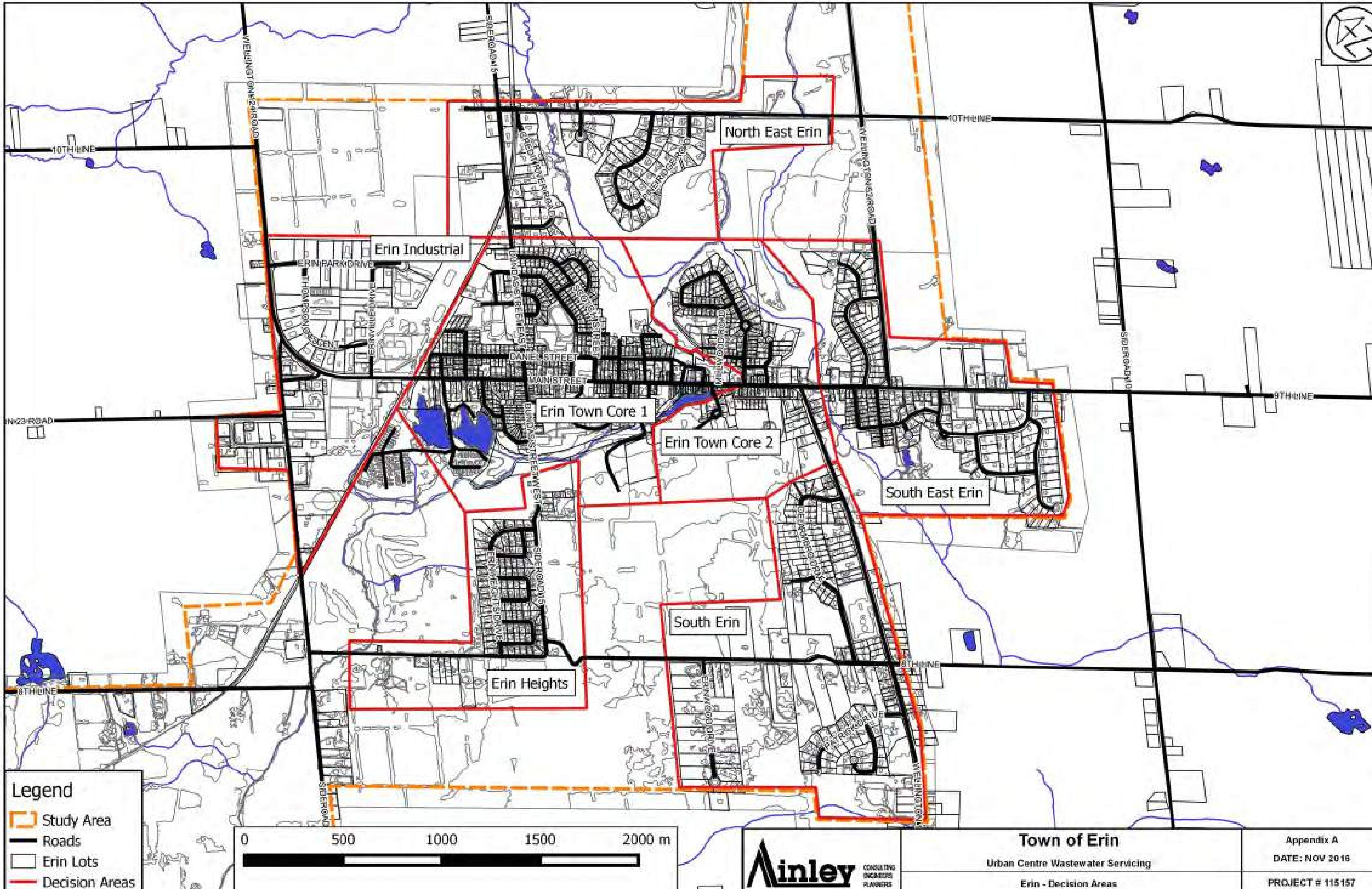
- The SSMP does not represent a realistic wastewater system capacity scenario based on either downstream phosphorus limits in the West Credit River or based on available wastewater treatment technologies for effluent discharge;
- Whereas the SSMP recommended a downstream TP of 0.03 mg/l; a Site Specific Water Quality Objective (SSWQO) of 0.024 mg/l is a more appropriate downstream TP concentration for the West Credit River, in order to protect the cold water habitat and water quality in this Policy 1 receiver;
- To further protect water quality it is recommended that a target of "net zero" increase in phosphorus loading be adopted, such that the cumulative phosphorus loading from municipal wastewater effluent and stormwater runoff must not increase between the pre-development and post-development condition;
- Whereas the SSMP recommended use of an average daily flow of 435 L/c/d; given the level of municipal water consumption in Erin and Hillsburgh, 380 L/c/d is a more appropriate per capita flow contribution for wastewater;
- Whereas the SSMP identified a wastewater flow of 2,610 m3/d to service a population of 6,000; this Technical Memorandum establishes the wastewater flows necessary to service both existing communities and to service all growth areas defined in the Town Official Plan (OP);
- Based on a detailed assessment of the wastewater servicing requirements, the following wastewater flows would result:
    - To fully service Existing Communities with infill growth 2,844 m^3/d
    - To service New Growth Areas Defined in Town Official Plan 4,328 m^3/d
    - Resulting in a total estimated wastewater flow 7,172 m^3/d
- Servicing the existing communities and new growth areas would result in the following residential populations:
    - To fully service Existing Communities with infill growth 4,616 persons
    - To service New Growth Areas Defined in Town Official Plan 9,943 persons
    - Resulting in a total residential population 14,559 persons
- This Technical Memorandum assumes that TP is the limiting parameter for discharge of treated effluent to the West Credit River;
- This Technical Memorandum assumes that the collection system will be a gravity system and makes allowance for inflow and infiltration into the sewers;

- Based on the results of the Assimilative Capacity Study, the following TP effluent Limits would need to be met from a Wastewater Treatment Plant to service the existing communities and new growth:
    - To fully service Existing Communities with infill growth 0.079 mg/l
    - To service Full Build Out of the Town Official Plan 0.046 mg/l
- Treatment technologies will be reviewed and recommended during Phase 3 of this Class EA, however, it is considered that Best Available Technology for phosphorus removal can meet an effluent limit required to achieve full build out of the Town Official Plan;
- It is suggested that the Town of Erin should target a future TP effluent limit of 0.046 mg/l to meet the requirements of full build out of the Town OP;
- It is recognized that additional operating experience with available technologies may need to be demonstrated in order to secure approval from MOECC for an effluent limit of 0.046 mg/l and a staged approach may be necessary in order to achieve this approval in future;
- While it is recommended that a SSWQO of 0.024 mg/l be established to protect water quality in the river, it is recommended that water quality be monitored through phased implementation of wastewater servicing. A relaxation of the SSWQO from 0.024 mg/l to 0.025 mg/l would mean that a treated effluent limit of 0.05 mg/l could achieve full build out of the Town Official Plan;
- While this Technical Memorandum addresses wastewater servicing requirements to meet full build out of the Town OP, it does not address the municipal water requirements to meet full build out of the OP.

Based on the results of this study and the ACS, it is concluded that the Town of Erin can implement a communal wastewater system for the Village of Erin and for Hillsburgh that meets the wastewater servicing requirements of the existing communities including infill and intensification of these areas and can also service all new growth areas identified in the Town Official Plan while protecting water quality in the West Credit River and utilizing “Best Available Technology” for phosphorus removal.

Appendix - A

Decision Areas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Erin Town Core 1
Erin Town Core 2
South East Erin
South Erin
Erin Heights
10TH LINE
9TH LINE
8TH LINE
MAIN STREET
DANIEL STREET
ERIN PARK DRIVE
THOMPSON CRESCENT
Legend
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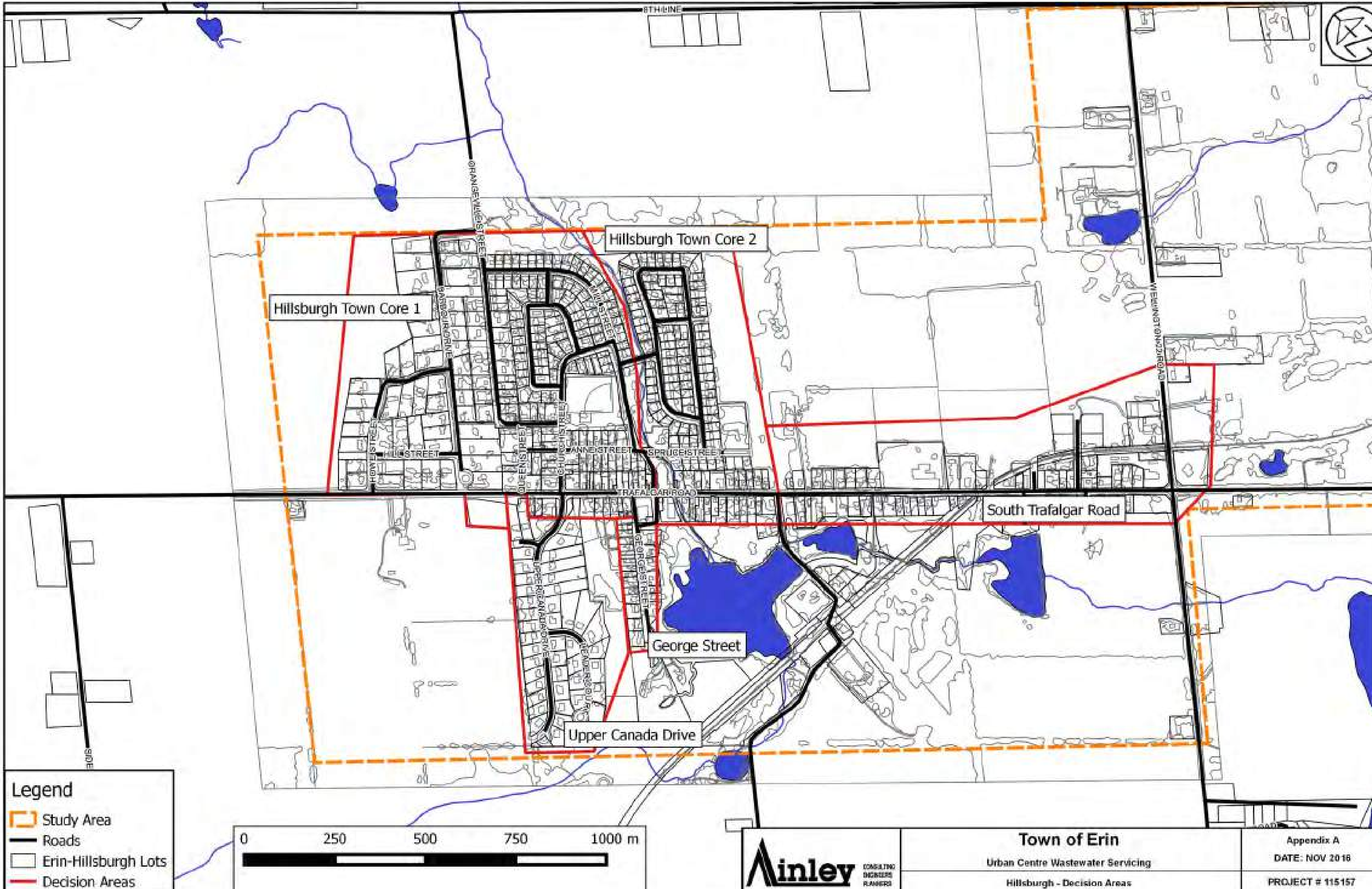
CONSULTING ENGINEERS PLANNERS
Town of Erin
Urban Centre Wastewater Servicing
Erin - Decision Areas
Appendix A
DATE: NOV 2016
PROJECT # 115157



Hillsburgh Town Core 2
Hillsburgh Town Core 1
South Trafalgar Road
George Street
Upper Canada Drive
8TH LINE
HILL STREET
ANNE STREET
SPRUCE STREET
TRAFALGAR ROAD
Legend
Study Area
Roads
Erin-Hillsburgh Lots
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CONSULTING ENGINEERS PLANNERS
Town of Erin
Urban Centre Wastewater Servicing
Hillsburgh - Decision Areas
Appendix A
DATE: NOV 2016
PROJECT # 115157

Appendix - B

Hutchinson Environmental

Water Quality Memo

Memorandum

Date: **October 20, 2016**

To: **Gary Scott, Ainley Group**

From: **Deborah Sinclair, Neil Hutchinson and Tara Roumeliotis**

Re: **J160005 – Recommended Downstream TP Target for West Credit River at Winston Churchill Blvd.**

The Town of Erin (Town) is currently completing a Schedule C Class EA for a proposed Waste Water Treatment Plant (WWTP) to service the existing population and proposed new growth in Erin and Hillsburgh. The proposed phasing of the plant will eventually accommodate Full Build Out of the Town's official plan with additional capacity for growth. Ainley Group (consultants for the Town) requested that Hutchinson Environmental Sciences Ltd (HESL) recommend a downstream water quality target for Total Phosphorus (TP) for the West Credit River at Winston Churchill Blvd. as input to determining the effluent flow and treatment limits for the proposed WWTP.

The Ontario Ministry of the Environment and Climate Change (MOECC) provides guidance on the management of surface water and groundwater quality and quantity for the Province of Ontario. They have established a Provincial Water Quality Objective (PWQO) of 0.03 mg/L for Ontario rivers and Policy 1 for management of surface water quality which states *"In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives. Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed …"*.

This memo provides information and a rationale to support a permissible lowering of water quality in the West Credit River from discharge of treated municipal waste water from the proposed Erin WWTP.

TP Concentrations in West Credit River at 10th Line and Winston Churchill Blvd.

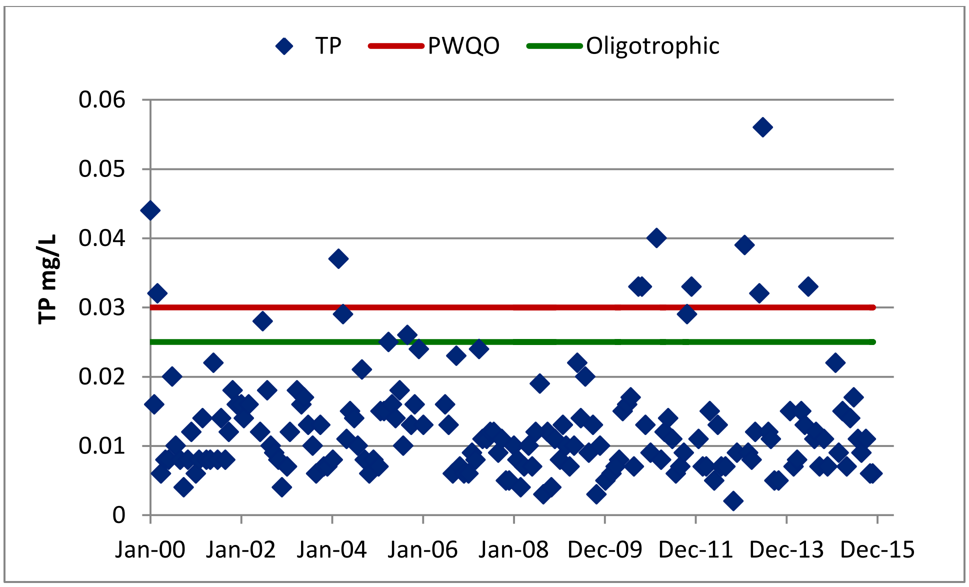
Total phosphorus (TP) concentrations in the West Credit River have been monitored as part of the Ministry of the Environment and Climate Change's (MOECC) Provincial Water Quality Monitoring Network (PWQMN) at Winston Churchill Boulevard since 1975 (station 6007601502). The median (2005 - 2015) and 75th percentile TP concentrations (0.011 mg/L and 0.015 mg/L) are well below the Provincial Water

Quality Objective[1] (PWQO) of 0.03 mg/L. Concentrations are stable; with no apparent increasing or decreasing trend over time (Figure 1).

TP measurements were also collected from the West Credit River upstream of Winston Churchill at 10th Line by Credit Valley Conservation (CVC) in 2007 and 2008 (CVC 2011) and by HESL in 2016 (unpublished data). The median and 75th percentile TP concentrations at 10th Line were also well below the PWQO at 0.014 mg/L and 0.016 mg/L, respectively (based on 15 measurements). The lower TP concentrations, and hence better water quality, at Winston Churchill is due to groundwater discharge to the river between the two stations (CVC 2011).

In 2016, HESL collected chlorophyll "*a*" samples from 10th Line on five occasions. Concentrations ranged from 0.598 µg/L to 3.91 µg/L, with a median of 2.63 µg/L.

Figure 1 Total Phosphorus concentrations measured (2000-2015) in the West Credit River at Winston Churchill Blvd. (PWQMN station 6007601502)



Trophic Status of West Credit River and Implications

Total phosphorus is the key limiting nutrient in plant and algal growth in freshwater systems. Increases in total phosphorus concentrations often results in increased algal biomass (e.g. Dodds et al., 1997). Phosphorus concentrations are therefore commonly used to classify lakes and rivers according to their nutrient ("trophic") status[2] (e.g. oligotrophic, mesotrophic, and eutrophic). Generally oligotrophic systems have low nutrients, low algal biomass, high water clarity, and can support a cold-water fishery. Eutrophic

[1] *The PWQO are numerical and narrative criteria that serve as chemical and physical indicators representing a satisfactory level for surface waters (i.e. lakes and rivers) and where it discharges to the surface, the groundwater of the province of Ontario. The PWQO are set at a level of water quality, which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water (MOEC 1994a).*

[2] *Trophic status – the availability of growth limiting nutrients (Smith et al. 1999) such as total phosphorus or nitrogen.*

systems are nutrient enriched (high nutrient concentrations), have high algal biomass, can have frequent algal blooms, and wide swings in dissolved oxygen (with potential for conditions of no oxygen (anoxia)). Mesotrophic systems have intermediate characteristics (Dodds et al., 1998).

The trophic status classification of the West Credit River between the 10th Line and Winston Churchill Blvd. is oligotrophic using the spot TP data from 10th Line, the long-term PWQMN data and the recent chlorophyll "*a*" data from 10th Line. The oligotrophic classification is based on a trophic status system developed for temperate streams by Dodds et al. (1998; Table 1).

Table 1 Trophic classification boundaries for streams (based on Dodds et al., 1998)

Trophic Level	TP (mg/L)	Suspended Chlorophyll *a* (µg/L)
Oligotrophic	<0.025	<10
Mesotrophic	0.025-0.075	10-30
Eutrophic	>0.075	>30

The West Credit River discharges to the Credit River downstream of Belfountain. The median and 75th percentile (2005-2014) TP concentrations of the Credit River downstream of Belfountain, at Highway 10 (PWQMN station 06007605202) are 0.031 mg/L and 0.052 mg/L respectively; above the PWQO of 0.03 mg/L.

The MOECC provides guidance on the management of surface water and groundwater quality and quantity for the Province of Ontario. In their document: *Policies, Guidelines and Provincial Water Quality Objectives of the Ministry of Environment and Energy (MOE 1994a)* two policies relate to the protection of water quality:

> Policy 1 – *In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives. Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed …"*
>
> Policy 2 - Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

The West Credit River at Erin is therefore managed under MOECC Policy 1 which allows some degradation of water quality, but flows into the main trunk of the river downstream of Belfountain which is managed under Policy 2 such that no additional degradation is allowed and remediation measures are encouraged. The discharge of effluent from the proposed Erin WWTP must not, therefore, contribute to any additional degradation of the main Credit River downstream.

For the purposes of the Schedule C Class EA, the MOECC stated (Paul Odom, October 3, 2016 Core Management Team Meeting) that the MOECC Policies are guidance statements, and that the Town of Erin may not increase the TP concentration in the West Credit River beyond the PWQO of 0.03 mg/L.

They did note, however, that if the Town of Erin discharge were to increase total phosphorus concentrations in the river to 0.03 mg/L that there would be no remaining assimilation capacity to accommodate other dischargers on this reach of the river or downstream, such as industrial dischargers or other municipalities, or to accommodate stormwater runoff. We note that the MOECC guidance does not encourage dischargers to discharge up to the PWQO, but states "… *some lowering of water quality is permissible in these areas…".* Therefore, MOECC suggested that the study team recommend a downstream objective and rationale for total phosphorus for consideration by MOECC. The downstream objective, because it differs from the MOECC generic PWQO of 0.03 mg/L, would be considered a Site Specific Water Quality Objective (CCME 2003).

The PWQO of 0.03 mg/L represents a two-fold increase over the current 75th percentile TP (0.015 mg/L) concentration and a change in trophic status from oligotrophic to mesotrophic in the West Credit River between 10th Line and Winston Churchill Boulevard. CVC has designated the West Credit River downstream of 10th Line as a cold-water aquatic community due to the presence of brook trout. 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 2011) and the longest contiguous brook trout habitat in the Credit River watershed is the West Credit River between Erin and Belfountain. The effect of doubling the TP concentration, thus changing the trophic status of the river, on brook trout and other aquatic life in the West Credit River is not well understood but detrimental changes would include increased growth of algae attached to bottom substrate (periphyton) which impairs habitat for fish spawning and benthic invertebrates and increased dissolved oxygen concentrations during the day and decreased concentrations at night in response to increased algal respiration which would stress aquatic life. A cautionary approach to establishing a target downstream TP concentration for the purposes of defining the flow and treatment limits is therefore recommended to protect aquatic life.

The following sections review available guidance to develop a downstream phosphorus objective for the West Credit River that will protect the cold water fishery. We then recommend an effluent TP limit that will meet the objective in the river at the projected effluent flows.

Environment Canada Framework for Managing Phosphorus

Environment Canada (2004) has developed a guidance framework for managing phosphorus concentrations in fresh water systems that is consistent with Canada Council of Ministers of the Environment (CCME) guideline development principles, but permits site-specific management of phosphorus. It was published as part of their *Ecosystem Health: Science-based Solutions* series which is dedicated to the dissemination of information and tools for monitoring, assessing and reporting on ecosystem health to support Canadians in making sound decisions (Environment Canada 2004). The guidance recommends a trigger approach to setting and establishing thresholds for TP concentrations. The framework steps include:

- Set ecosystem goals and objectives (enhance, protect, or restore)
- Define reference/baseline conditions
- Select trigger ranges
- Determine current TP concentrations
- Compare current concentrations and concentrations predicted from an undertaking to the trigger range

- Compare current concentrations and concentrations predicted from an undertaking to the baseline

In this case, the goal is to protect the sensitive brook trout population and maintain a healthy diverse aquatic system, while servicing existing development in Erin Village and Hillsburgh and allowing for new growth in the Town. The reference/baseline conditions in the river are well understood, and in this case represent the current concentrations of total phosphorus, which have not shown any increasing/decreasing trend in the last 15 years.

The Canadian Council of Ministers of the Environment (CCME 2003, p.15) provides the following guidance on setting Site Specific Water Quality Objectives (SSWQOs):

> *Two distinct strategies are commonly used to establish WQOs in Canada, including the antidegradation strategy and the use protection strategy. For water bodies with aquatic resources of national or regional significance, the WQOs are established to avoid degradation of existing water quality. For other water bodies, the WQOs are established to protect the designated uses of the aquatic ecosystem. As long as the designated water uses are protected, some degradation of existing water quality may be acceptable in these water bodies, provided that all reasonable and preventative measures are taken to protect water quality conditions.*

The brook trout population in the West Credit River is of regional significance and the West Credit River is the only portion of the Credit River sustaining Policy 1 oligotrophic waters. Therefore the Site Specific Water Quality Objective should be focused on “antidegradation” to maintain the oligotrophic status of the river.

CCME (2003) identifies four methods for developing a SSWQO; the background concentration procedure, recalculation procedure, water effect ratio procedure, and the resident species procedure. The “background concentration procedure” is appropriate for the West Credit River. *“In the background concentration procedure, the natural background concentrations of a contaminant in water …are determined and these levels are used to define acceptable water quality conditions at the site under consideration. Its use is based on the premise that surface water systems with superior water quality (i.e., relative to the Canadian WQGs) should not be degraded. This approach has been used most commonly to define WQOs for relatively pristine water bodies, including several river systems in Canada (e.g., Dunn 1989; MacDonald and Smith 1990). It has also been used in somewhat contaminated water bodies, such as Burrard Inlet (Nijman and Swain 1989).”* (CCME 2003, p. 19). We used three approaches to define the background concentration and resultant SSWQO for the West Credit River.

Although the natural background concentrations of total phosphorus in the West Credit River are not known, current concentrations are low and exceptional for Southern Ontario and are a reasonable approximation of natural background levels. The background concentration procedure uses the upper limit of the natural background concentration of a contaminant to define acceptable water quality conditions (CCME 2003). In this case the “natural” background concentration is the current stable TP concentration of the receiver, prior to the input from the WWTP. The two examples provided to determine the upper limit are the mean concentration plus two standard deviations and the 90th percentile concentration. For the West Credit River at Winston Churchill Blvd. these values are 0.030 mg/L (mean = 0.012 mg/L, standard deviation = 0.009 mg/L) and 0.024 mg/L respectively. Since the data are highly variable (2 x standard deviation is greater than the mean) this approach is not protective of water quality.

Using the 90th percentile approach to establish the upper limit of the background concentration of 0.024 mg/L is recommended, and recognizes the oligotrophic nature of the receiver.

Therefore, use of the background concentration procedure for derivation of the SSWQO will define the natural background concentration of the West Credit River as the 75th percentile total phosphorus concentration (=0.016 mg/L) with the upper limit defined by the 90th percentile concentration of 0.024 mg/L.

A trigger range is defined as a "desired concentration range for phosphorus; if the upper limit of the range is exceeded, that indicates ***a potential*** environmental problem, and therefore **"triggers" further investigation**. The internationally-accepted Organization for Economic Co-operation and Development (OECD) trophic status values are the recommended trigger ranges (Table 2) for Canadian lakes and rivers (CCME 2004). These trophic values were originally established for lakes and reservoirs (Environment Canada 2004), which is why they differ slightly than those presented in Table 1. Rivers can, however, sustain higher loads of TP than lakes before any observable changes in community composition and biomass (Smith et al. 1999): TP is flushed through the system before it can be taken up and utilized by aquatic plants. Therefore, the United States Environmental Protection Agency (USEPA) has adopted trophic classification for rivers based on the Dodds et al. values (Table 1), which are higher than the OECD values.

Table 2 Recommended trigger ranges for Canadian Lakes and Rivers (CCME 2004)

Trophic Status	TP concentration (µg/L)
Ultra-oligotrophic	< 4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	>100

We recommend using the Dodds et al (1998) trigger ranges as they have specifically been established for rivers in temperate sites. The oligotrophic trophic range is <0.025 mg/L TP (Table 1); therefore a downstream concentration over 0.024 mg/L TP would indicate a potential shift to mesotrophic classification and trigger further investigation.

In addition to the trigger ranges, the Environment Canada guidance also recommends comparing predicted concentrations to baseline conditions, and notes that *"up to a 50% increase in phosphorus concentrations above the baseline level is deemed acceptable"…"If a 50% increase from baseline is not observed, then there is considered a low risk of adverse effects….if the increase is greater than 50%, the risk of observable effects is considered to be high and further assessment is recommended*" (Environment Canada 2004). We established a natural background 75th percentile concentration of 0.016 mg/L in the West Credit River at Erin. A 50% increase above this results in a trigger concentration of 0.024 mg/L.

Use of the Environment Canada guidance of a 50% increase above background supports a total phosphorus concentration of 0.024 mg/L as an upper range to protect the oligotrophic waters of the West Credit River.

We therefore recommend a value of 0.024 mg/L as the SSWQO for total phosphorus in the West Credit River.

Conclusions and Recommendations

We therefore recommend that a downstream SSWQO of 0.024 mg/L TP be adopted to protect the cold water habitat and water quality in the West Credit River, consistent with Environment Canada and CCME guidance. This will maintain the current trophic status of the river. A higher water quality objective is not recommended as the effect of changing the trophic status of the river on brook trout and other aquatic life in the West Credit River is not well understood at this time.

Water quality objectives are developed as guidelines and not as enforced regulatory standards. They are conservative, in that the best scientific information concludes that aquatic life will be protected at concentrations below the objective but this does not mean that the ecosystem will necessarily be impaired if concentrations increase above the objective. Therefore, Environment Canada (2004) states that, if total phosphorus concentrations increase to the SSWQO, the management response is investigation to determine if the changes have been harmful or if further increases can be sustained. This provides the opportunity for adaptive management of discharge from the proposed WWTP at Erin.

During Phase 1 of the WWTP, we recommend that the Town implement a receiver monitoring program for the West Credit River to determine the resultant phosphorus concentration in the river and assess any effects of increased TP loadings on water quality and aquatic communities (e.g. algal, benthos and fish). Effluent monitoring is also required to confirm that the lower effluent limits and objectives required to accommodate future growth can be met. The findings from these monitoring studies can:

a) inform a future application to rerate the Erin WWTP to accommodate a higher wastewater flow at a lower effluent TP concentration if monitoring shows that the plant can be operated at a lower effluent limit,

b) inform a decision to maintain the downstream West Credit River TP objective at 0.024 mg/L at Full Build Out or if it can be relaxed to 0.027 mg/L with no threat to aquatic life to accomodate either a higher population or a higher effluent limit.

Phosphorus Control for New Development

Wastewater discharge will not be the only source of total phosphorus to the West Credit River as the Town of Erin is serviced and grows. New development, infill and intensification of development will increase impervious services in Erin and Hillsburgh, leading to increased runoff of stormwater which will contain phosphorus and other pollutants. Growing recognition of non-point source pollution by urban runoff has lead to increased demands for management of stormwater quality, as well as quantity. New development in the Lake Simcoe and Nottawasaga River watersheds and in the City of Oakville, for example, must set a target of “net zero” increase in phosphorus loading, such that the cumulative phosphorus loading from municipal wastewater effluent and stormwater runoff must not increase between the pre-development and post-development condition. Jennifer Dougherty, of Credit Valley Conservation stated that this was typically required for cases where the receiving waters were Policy 2 but that this would not be required for Erin[3]. Nevertheless, the sensitivity of the West Credit River at Erin may stimulate requests for phosphorus abatement from stormwater as Erin and Hillsburgh are built out.

Decommissioning of septic systems upon completion of the Erin WWTP will reduce one source of phosphorus (and nitrate) loading to the watershed. Development and redevelopment can reduce phosphorus loading in storm water through implementation of improved stormwater management (Best Management Practices) for older areas and Low Impact Development Techniques, particularly infiltration of runoff for new development. Infiltration techniques reduce surface runoff volume, remove particulates and suspended solids from runoff (including particulate phosphorus), encourage adsorption of phosphorus onto mineral surfaces in soils and cool the runoff, all of which will protect the cold water habitat in the West Credit River and help offset the discharge form the new WWTP.

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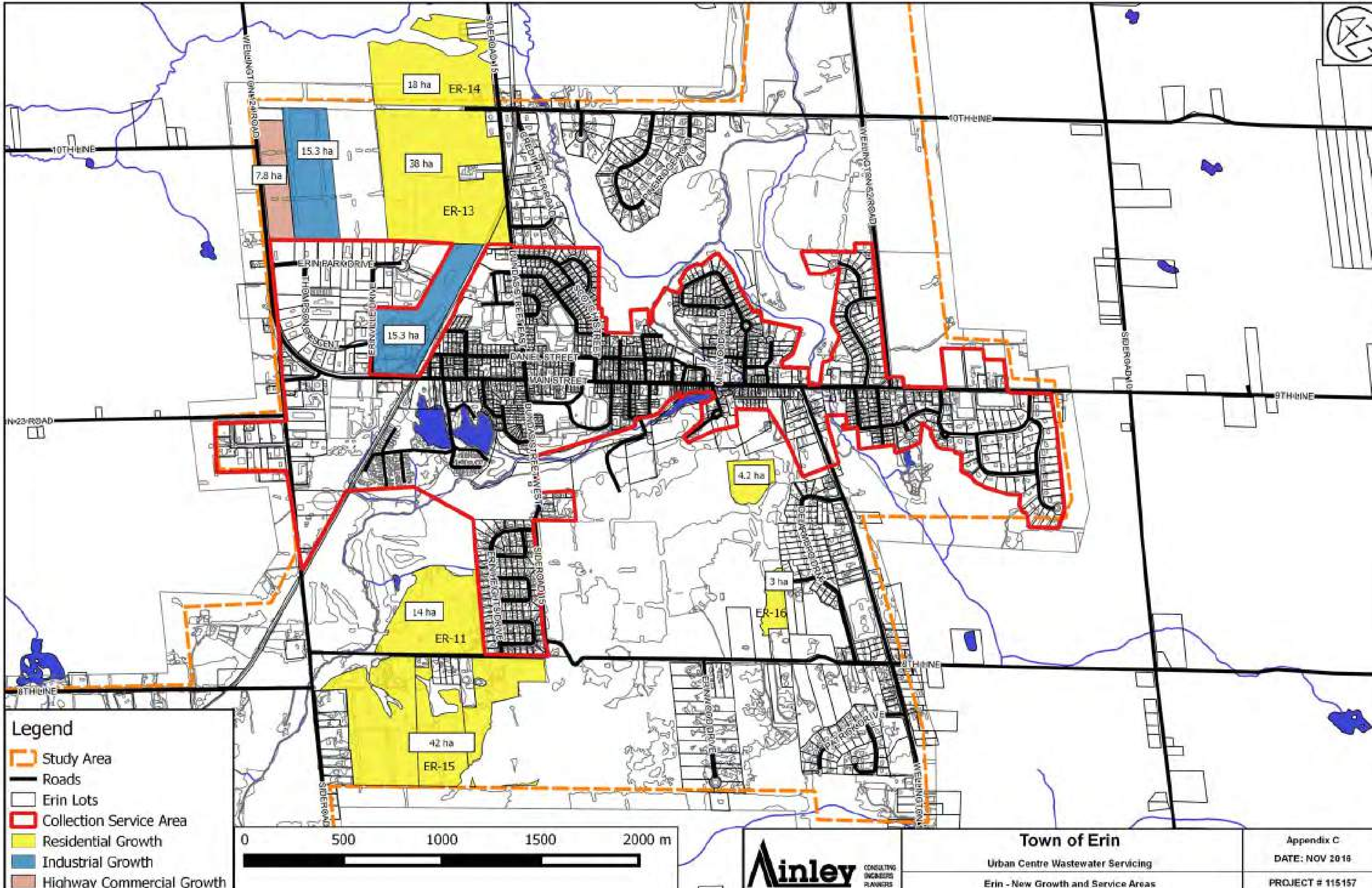
Appendix - C
New Growth Areas



Ainley CONSULTING ENGINEERS PLANNERS

Town of Erin

Urban Centre Wastewater Servicing

Erin - New Growth and Service Areas

Appendix C

DATE: NOV 2016

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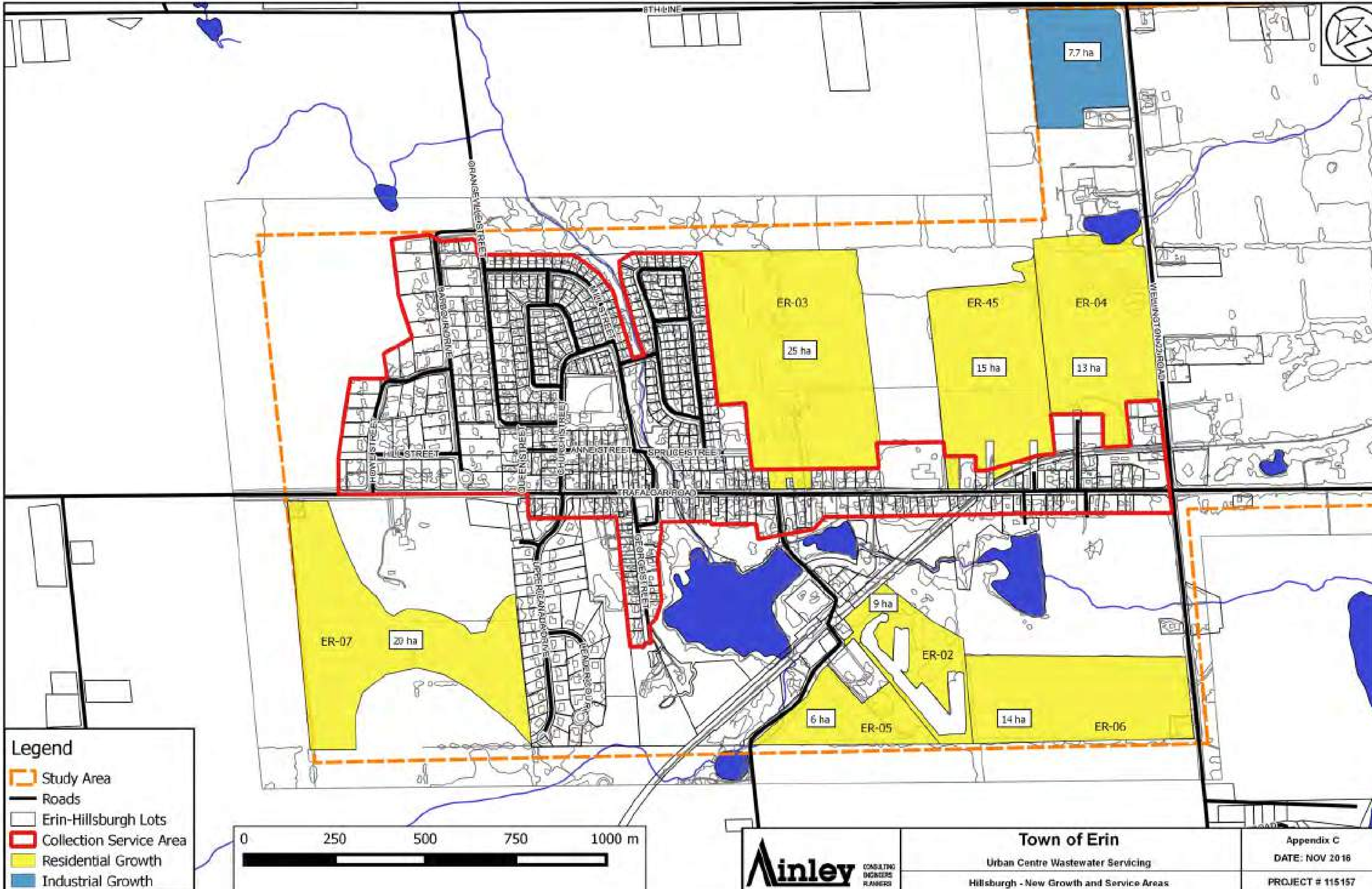
8TH LINE
ORANGEVILLE STREET
BARBOUR DRIVE
HOWE STREET
HILL STREET
QUEEN STREET
CHURCH STREET
ANNE STREET
SPRUCE STREET
TRAFALGAR ROAD
GEORGE STREET
WELLINGTON 22 ROAD
ER-03
25 ha
ER-45
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ER-04
13 ha
7.7 ha
ER-07
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ER-02
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ER-05
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ER-06
Legend
Study Area
Roads
Erin-Hillsburgh Lots
Collection Service Area
Residential Growth
Industrial Growth
0
250
500
750
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Ainley
CONSULTING ENGINEERS PLANNERS
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Appendix - D

Erin Wastewater Flow Detail

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1.0 Erin Wastewater Flow by Area

1.1 Industrial Area

The industrial area in Erin is located at the north end of the town and consists of 87 individual lots primarily located along Thompson Crescent, Erinville Drive, Erin Park Drive, and Pioneer Drive. Based on the Town's GIS database, the total combined area of the industrial lots is approximately 72.4 Ha. The current MOECC design standard for sewage flow estimation of industrial areas is 28 m^3/Ha•d. Using the MOECC standard, an estimated 2,026 m^3/d of average day sewage flow would be generated from this area at full buildout. At this time, a number of lots remain vacant and the estimated flow from the established industry is 1,297 m^3/d, shown in Table D1.

Table D1 - Industrial Area Flow Summary, Pre-modification

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Industrial	52	47.0	1,297	3,891

Existing water use data from June 2013 to June 2016 was reviewed for the industrial area. Assuming the maximum yearly consumption of each site, the existing industry uses approximately 84 m^3/d suggesting that the design estimations are much too high and are resulting in an over estimation of actual flows. The *maximum* flow from an industrial property in Erin over the time reviewed was 19.4 m^3/d, in contrast the *average* flow estimate based on MOECC guidelines is 19.5 m^3/d. While the estimates may be excessive for the current use of the area, it is possible that establishing a sanitary network in the town may attract more water intensive industries or will change the habits of the existing users. It is suggested that a compromise between the existing data and design projections be met, the result is shown in Table D2.

In addition to the established industry, a significant amount of land in this area has been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table D2 - Industrial Area Flow Summary, Post-modification

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Industrial – Current Day	52	37.0	334	1,002
Industrial – Infill	35	25.2	227	681
Industrial – Intensification (20%)	-	-	67	201
Industrial – New Growth Areas	-	30.6	275.4	826.2
Commercial – New Growth Areas	-	7.8	215.0	655.2
Residential – New Growth Areas	608	38	647	1,941
Total	995	138.6	1,765.4	5,306.4

1.2 Erin Town Core 1

The area designated as Erin Town Core 1 comprises the majority of the village and is primarily residential and downtown commercial development. The area is bounded at the north end by Elora Cataract Trail and on the south end by the West Credit River. The area has 518 individual lots, including 2 schools, and 32 commercial properties. Based on the Town's GIS database the combined area of the commercial properties is approximately 2.5 Ha. The current MOECC design standard for sewage flow estimation of commercial areas is 28 m^3/Ha•d. Using the MOECC standard, an estimated 70 m^3/d of average day sewage flow would be generated from the commercial portion of this area. For schools, an assumed flow rate of 95 L/student/day is taken. The two schools within this area have a total of 950 students combining for an estimated flow of 90.2 m^3/day. The remaining lots (residential units) combine for an average day flow of 478.1 m^3/d, shown in Table D3.

In addition to the established development, a few hectares of land in this area have been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh. As communities grow it is typical for some amount of intensification to occur in the core areas, for this reason we have assumed a 10% allowance for intensification.

Table D3 – Erin Town Core 1, Flow Summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Residential	484	60.3	478.1	1,769
Commercial	32	2.5	69.0	324.7
Institutional	2	7.7	90.2	333.7
Residential – Infill	30	-	29.6	110.0
Residential – Intensification (10%)	52[1]	-	51.8	191.7
Total	669	71.5	718.7	2,756.1

[1] Equivalent lots.

1.3 Erin Town Core 2

The area designated as Erin Town Core 2 is at the south end of the town and primarily consists of residential development. The area is bounded at the north end the West Credit River and on the south end by Wellington 124 Rd. The area has 161 individual lots, including 3 commercial properties and 1 school. Based on the Town's GIS database the combined area of the commercial properties is approximately 0.95 Ha. Using the MOECC standard, an estimated 26.6 m^3/d of average day sewage flow would be generated from the commercial portion of this area. For schools, an assumed flow rate of 95 L/student/day is taken. The school within this area has 220 students combining for an estimated flow of 20.9 m^3/day. The remaining lots (residential units) combine for an average day flow of 154.4 m^3/d, shown in Table D4.

In addition to the established development, a few acres of land in this area have been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table D4 - Erin Town Core 2, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Flow Estimate (m^3/d)
Residential	157	18.7	154.4	601.1
Commercial	3	0.95	26.6	98.4
Institutional	1	0.94	20.9	83
Residential – Intensification (5%)	8[1]	-	7.8	27
Residential - Infill	6	-	6.0	23.7
Total	175	20.6	215.7	833.2

[1] Equivalent lots.

1.4 South East Erin

The area designated as South East Erin is a primarily residential area with limited commercial properties and covers the properties in Erin along 9th Line south of Wellington 124 Rd. There are 191 lots in this area, 186 of which are single residence lots, 2 commercial lots, as well as a farm, and a cemetery. The total average day flow estimate for the area is 186.3 m^3/d, shown in Table D5.

In addition to the established development, a few acres of land in this area have been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table D5 – South East Erin, Flow Summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Flow Estimate (m^3/d)
Residential	186	50.0	186.3	721.1
Commercial	2	0.4	11.2	43.7
Residential - Infill	11	-	10.9	36
Total	199	50.4	208.4	800.8

1.5 South Erin

The area designated as South Erin is a residential area with a larger average lot size than the surrounding community. There are 176 lots in this area, primarily along Wellington Road 124. The total average day flow estimate for the area is 173.9 m^3/d, shown in Table D6.

In addition to the established development, a few acres of land in this area have been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table D6 – South Erin, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Flow Estimate (m^3/d)
Residential	176	97.6	173.9	694.5
Residential – Growth	118	7.4	126	378
Total	294	105	299.9	1,072.5

1.6 North East Erin

The area designated as North East Erin is a residential area with a larger average lot size than the surrounding community. There are 91 lots in this area, primarily along Credit River Road and Pine Ridge Road. The total average day flow estimate for the area is 89.9 m^3/d, shown in Table D7.

In addition to the established development, a large plot of land in this area has been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table D7 – North East Erin, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Flow Estimate (m^3/d)
Residential	91	44.1	89.9	370.5
Residential – Growth	288	18	306.4	919.3
Total	379	62.1	396.3	1,289.8

1.7 Erin Heights

The Erin Heights area is a residential subdivision which is separated from the downtown by the West Credit River. There are 114 lots within the area, all of which are single residence properties. The total average day flow estimate for the area is 112.6 m^3/d, shown in Table D8.

Two large sections of land have been identified for potential future growth in this area. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table D8 – Erin Heights, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Flow Estimate (m^3/d)
Residential	114	17.7	112.6	451.5
Residential - Growth	896	56	953.3	2,860
Total	1,010	73.7	1,065.9	3,311.5

1.8 Overland Drive

The Overland Drive area is a residential subdivision which is separated from the downtown by a small body of water. There are 98 lots within the area, all of which are single residence properties. The total average day flow estimate for the area is 96.8 m^3/d, shown in Table D9. There is no GIS data for the properties in this location so the total lot area is unknown.

Table D9 – Overland Drive, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Flow Estimate (m^3/d)
Residential	98	-	96.8	397.7

1.9 Erin Summary

Table D10 – Summary of Erin Decision Area Flows

Decision Area	Equivalent Population [Build-out]	Existing ADF Estimate (m^3/d)	Build-out ADF Estimate (m^3/d)
Industrial Area	1,653 [4,655]	628	1,765.4
Erin Town Core 1	1,891 [1,891]	718.7	718.7
Erin Town Core 2	568 [568]	215.7	215.7
South East Erin	548 [548]	208.4	208.4
South Erin	458 [789]	173.9	299.9
North East Erin	237 [1,042]	89.9	396.3
Erin Heights	296 [2,805]	112.6	1,065.9
Overland Drive	255 [255]	96.8	96.8
Total	5,906 [12,554]	2,244	4,767.1

Appendix - E

Hillsburgh Wastewater Flow Detail

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1.0 Hillsburgh Wastewater Flow

1.1 Hillsburgh Town Core 1 and 2

The areas designated as Hillsburgh Town Core 1 and 2 comprise the majority of the village and are primarily residential development, however this area also has the majority of the commercial properties in the town. In total, these areas are bounded at the north end by Howe St., Trafalgar road on the west and on the south end by Douglas Cres. The area has 356 individual lots, including 11 commercial properties. Based on the Town's GIS database the combined area of the commercial properties is approximately 1.4 Ha. Using the MOECC standard, an estimated 39.2 m^3/d of average day sewage flow would be generated from the commercial portion of this area. The remaining lots (residential units) combine for an average day flow of 369.57 m^3/d, shown in Table E1.

In addition to the established development, a significant amount of land in this area has been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table E1 – Hillsburgh Town Core 1 and 2, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Residential	344	56.4	367.2	1,469
Commercial	11	1.4	39.2	155.6
Residential – Infill	10	-	9.9	32.7
Residential – Growth	720	45	766	2,298
Total	1,085	102.8	1,182.3	3,955.3

1.2 George Street

George Street is a short residential street on the south side of Trafalgar Road. In total, there are 27 properties, 26 residential properties, and 1 commercial property. Based on the Town's GIS database the area of the commercial property is approximately 0.3 Ha. Using the MOECC standard, an estimated 2.8 m^3/d of average day sewage flow would be generated from the commercial property in this area. The remaining lots (residential units) combine for an average day flow of 25.7 m^3/d.

In addition to the established development, a significant amount of land in this area has been identified for future growth. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table E2 – George Street, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Residential	26	2.3	25.7	101.6
Commercial	1	0.3	8.4	33.2
Total	27	2.6	34.1	134.8

1.3 South Trafalgar Road

The South Trafalgar Road area has a total of 74 lots and includes the village's local public school. The residential lots in this area combine for an average day flow of 92.4 m^3/d. A summary of the sewage generation for the area is provided in Table E3.

There is a significant amount of land that has been allocated for future growth in this area. Maps have been provided in ***Appendix B*** showing the location of the growth areas and the type of development specified in the Town's Official Plan for Erin and Hillsburgh.

Table E3 – South Trafalgar Road, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Residential	73	74.8	75.1	286.9
Institutional	1	2.3	11.4	46.8
Residential – Intensification (20%)	-	-	14.4	50.5
Residential – Growth	896	56	973.1	2,860
Industrial - Growth	-	7.7	69.3	207.9
Total	970	141	1,143.3	3,452.1

1.4 Upper Canada Drive

The Upper Canada Drive area has a total of 46 residential lots. Through the Septic System Survey this area has been selected for exclusion from the ultimate sanitary system. The residential lots in this area combine for an average day flow of 45.4 m^3/d. A summary of the sewage generation for the area is provided in Table E4.

Table E4 – Upper Canada Drive, flow summary

Development Type	Number of Lots	Lot Area (Ha)	ADF Estimate (m^3/d)	Peak Day Estimate (m^3/d)
Residential	46	12.9	45.4	191.9

1.5 Hillsburgh Summary

Table E5 – Summary of Hillsburgh Decision Area Flows

Decision Area	Equivalent Population [Build-out]	Existing ADF Estimate (m^3/d)	Build-out ADF Estimate (m^3/d)
Hillsburgh Town Core 1 & 2	1,140 [3,111]	433.4	1,182.3
George Street	90 [90]	34.1	34.1
South Trafalgar Road	228 [3,009]	86.5	1,143.3
Upper Canada Drive	119 [119]	45.4	45.4
Total	1,577 [6,329]	599.4	2,405.1

Appendix D
Assimilative Capacity Study

Hutchinson
Environmental Sciences Ltd.

West Credit River Assimilative Capacity Study

Final Report – December 2017 Update

Prepared for: Ainley Group.
Job #: J160005

December 6, 2017

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

December 6, 2017 HESL Job #: J160005

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

Dear Mr. Mullan:

Re: Assimilative Capacity Study for West Credit River – Final Report – December 2017 Update

We are pleased to submit the final assimilative capacity study final report in support of the Class Environmental Assessment (Class EA) for a communal wastewater and collection system for the Village of Erin and Hillsburgh. We have summarized baseline data on water quality and flow and used the 7Q20 flow value derived by Credit Valley Conservation (CVC) to model effluent limits and flows using CORMIX to estimate near field mixing and QUAL2K to estimate far field assimilation processes. The effluent limits recommended will meet all required water quality objectives in the West Credit River and the mixing zone characteristics modelled meet the regulatory requirements of the MOECC. We have also presented several alternative designs for the effluent outfall itself to accommodate efficient mixing in the near field under Phase 1 and Full Build Out effluent flows. The final report (issued March 2017) incorporated comments received from CVC on the November 2016 draft report. This updated final report incorporates comments received from MOECC on the March 2017 final report. MOECC and CVC comments are provided in Appendix H. Appendix H also contains a Mussel Survey completed in 2017 of the West Credit River in response to MOECC comments.

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.

Deborah L. Sinclair, M.A.Sc.
Deborah.sinclair@environmentalsciences.ca

Signatures

Report Prepared by:

Deborah Sinclair, M.A.Sc.
Senior Aquatic Scientist

Tara Roumeliotis, M.Sc. P.Eng.
Senior Environmental Engineer

Report Reviewed by:

Neil Hutchinson, Ph.D.
President

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Appendices

1. Introduction

The Town of Erin is currently completing a Class Environmental Assessment (Class EA) for a communal wastewater and collection system for the Village of Erin and Hillsburgh. A Servicing and Settlement Master Plan (SSMP), by B.M.Ross in 2014, 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). The Town is now engaged in completing Phase 1 and Phase 2 of the EA and moving on to complete Phase 3 and Phase 4.

A preliminary Assimilative Capacity Study (ACS) was completed by B.M.Ross (2014) as part of the SSMP. The intent of the preliminary ACS was to assess the feasibility of a wastewater treatment plant (WWTP) with surface water discharge to the West Credit River in the reach between 10th Line and Winston Churchill Blvd. The preliminary ACS demonstrated this was feasible but recommended that the next phases of the EA should include a review of dissolved oxygen and temperature impacts, and potential for effluent storage. The Ontario Ministry of the Environment and Climate Change (MOECC) confirmed that the original ACS be updated to include hydrodynamic modelling and additional stream flow information collected since the ACS was completed.

This ACS report provides an update to the preliminary ACS completed as part of the SSMP to include:

- Recent (2016) water quality data collected for the West Credit River at 10th Line;
- An updated 7Q20 low flow statistic for the West Credit River at 10th Line;
- Mixing zone modelling (using CORMIX) to predict the size and shape of the mixing zone; and
- Hydrodynamic, far-field modelling (using QUAL2K) to predict downstream concentrations of oxygen, temperature, nitrate, and ammonia.

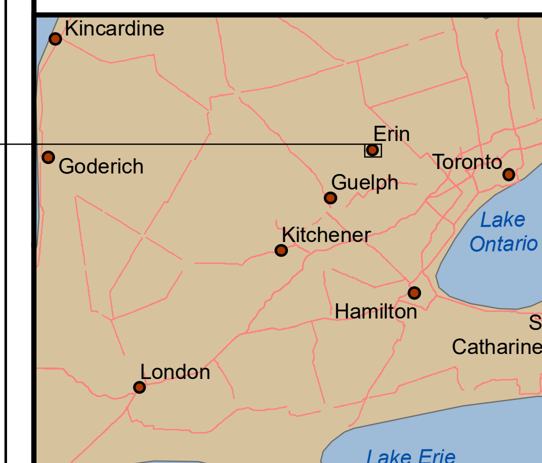
1.1 Study Area

The study area for the ACS is presented on Figure 1. Generally it follows the West Credit River and extends just upstream and downstream of 10th Line and Winston Churchill Blvd., respectively. A large aggregate pit is located to the north-west, and Wellington Road 52 is located to the south-east, along with some residential properties. The study area is located downstream of the Village of Erin.

CVC completed an extensive Existing Conditions Report (CVC 2011) as part of the SSMP, which summarized the hydrogeology, hydrology, geomorphology, aquatic ecology (fish and benthos), water quality, and hydraulics in the study area. Much of the information used for the preliminary ACS was collected from this report, as it provides an excellent baseline of the natural environment in the study area. The West Credit River downstream of 10th Line has been designated as a cold-water aquatic community due to the presence of brook trout. 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 2011) and the longest contiguous brook trout habitat in the Credit River watershed is the West Credit River between Erin and Belfountain.

Figure 1:
Site Location

Stream
Road
Study Area
Waterbody



N
0 125 250 500 750 1,000 m

Prepared by: Eric Dilligeard
Data Source: LIO, HESL, Esri Imagery.
Coordinate System: NAD 1983 UTM Zone 17N

Project Lead: Tara Roumeliotis and Deborah Sinclair
Project: Town of Erin Class EA Wastewater Servicing. Assimilative Capacity Study
Project#: 160005

November 2016

Hutchinson Environmental Sciences Ltd.

2. Background

In 2014, B. M. Ross completed an ACS of the West Credit River. The study investigated the impact of three discharge scenarios on the West Credit River: existing population of Erin (3,087 people), existing population of Erin and Hillsburgh (4,481 people), and a future population scenario of 6,000 people. The impact of the WWTP discharge on the West Credit River was estimated using a mass-balance approach with monthly 75th percentile background water quality and monthly 7Q20 flows. Background water quality was based on the long-term Provincial Water Quality Monitoring Network (PWQMN) station located at Winston Churchill Blvd. (station 06007601502). The monthly 7Q20 estimates were calculated by CVC and included a 10% reduction factor for climate change.

B.M.Ross used the effluent objectives and limits outlined in Table 1, and a maximum effluent flow rate of 2,610 m^3/d, and predicted that water quality in the West Credit River met all Provincial Water Quality Objectives (PWQO) with the exception of total phosphorus in September. Total phosphorus concentrations were predicted at 0.0308 mg/L, just slightly above the PWQO of 0.03 mg/L. The report concluded that a surface water discharge with an average daily discharge rate of 2,610 m^3/d (6,000 people) would not negatively impact the stream. The report recommended that dissolved oxygen modelling, thermal impacts, and effluent storage be investigated as part of future stages of the EA (B.M.Ross 2014).

Table 1 Effluent Quality Criteria Proposed by B.M.Ross (2014)

Parameter	Treatment Objectives	Non-Compliance
pH	<7 and >8.6[a]	<7 and >8.6 [a]
Total Suspended Solids (mg/L)	3.0	10
Total Phosphorus (mg/L)	0.1	0.15
Total Ammonia (mg/L)	0.4	2.0
Total Kjeldahl Nitrogen (mg/L)		3.0
Nitrate Nitrogen (mg/L)	5	6
E. coli (org/100 mL)	100	100
Dissolved Oxygen (mg/L)	5 (min)	4 (min)
BOD5 (mg/L)	3.6	7.5
Temperature	17	<8 and >19 [b]

Note: a – this has been interpreted as pH >7 and <8.6; b – this has been interpreted as temperature >8 and <19.

The Ontario Ministry of the Environment and Climate Change (MOECC) confirmed (letter from Ms. Barbara Slattery dated October 31, 2015 to Ms. Christine Furlong, Triton Engineering) that the original ACS be updated to include:

- Mixing zone analysis to include both the lateral and longitudinal plume dimensions;
- Hydrodynamic modelling to predict dissolved oxygen and temperature;

- Worse-case flow scenario should be September (i.e. month with lowest flow); and
- Update ACS to incorporate additional streamflow data (finalize 7Q20 estimate).

HESL used these comments from the CVC and MOECC to prepare an updated work plan (HESL: memo to B. Slattery et al. May 2 2016) for the ACS for review and final approval by the study team.

2.1 Pre-Consultation Meeting with MOECC and CVC

On May 30, 2016, HESL, Ainley Group and Triton Engineering attended a pre-consultation meeting with the MOECC and CVC. The purpose of the meeting was to review the updated ACS work plan with MOCC and CVC and discuss any questions or concerns with the proposed approach (modelling, field investigations and analyses). The group approved the ACS work plan with the following modifications:

1. Water quality modelling will be completed for a 10th Line discharge, as the most conservative location. The West Credit River at Winston Churchill Blvd. is characterized by higher flows and higher water quality than 10th Line as a result of groundwater discharge between the two sites.
2. The dye study and water quality modelling would extend downstream of the study area (i.e. Winston Churchill Blvd.) to capture Winston Churchill Blvd. as a potential discharge location.
3. Stream flow would be measured at Winston Churchill Blvd. to compare with measurements collected at 10th Line.

Minutes from the meeting are presented in Appendix A.

2.2 Policies

Ontario's Ministry of Environment and Climate Change (MOECC) have established policies and guidelines that direct the discharge requirements for waste water treatment plants (WWTPs) in the province. In "*Water Management* Policies*, Guidelines and Provincial Water Quality Objectives of the Ministry of Environment and Energy"* (MOE 1994a) the MOE provides direction on the management of surface water and groundwater quality and quantity for the Province of Ontario. The two policies that relate to the determination of WWTP discharges limits are:

> Policy 1 – In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives.
>
> Policy 2 - Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

The PWQO (Provincial Water Quality Objectives) are numerical and narrative criteria that serve as chemical and physical indicators representing a satisfactory level for surface waters (i.e. lakes and rivers) and where it discharges to the surface, the groundwater of the Province of Ontario. The PWQO are set at a level of water quality, which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water (MOE 1994a).

In Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters (MOE 1994b), the MOECC provides guidance with regard to the requirements for point-source discharges and the procedures for determining effluent limits. For continuous discharges to streams and rivers, the 7Q20 low-flow statistic is used as a basic design flow to determine the assimilative capacity. The 7Q20 flow represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate streamflow to properly dilute the point discharge. The 75th percentile concentration is used to determine background water quality when developing receiver-based effluent limits, and is to reflect the existing conditions of the receiver. The 75th percentile background concentrations are also used to determine the Policy status for each of the contaminants expected in the effluent. The following presents MOECC guidance for effluent limits based on receiver Policy Status.

- For Policy 1 receivers, an evaluation is made as to what treatment or other measure is required to maintain water quality at or above the PWQO. Although some lowering of the water quality is permissible, violation of the PWQO is not allowed.
- For Policy 2 receivers no further lowering of water quality is permitted, and all reasonable and practical measures to improve water quality shall be undertaken (MOECC 1994b).

2.3 7Q20 statistic

A Water Survey of Canada (WSC) gauge located in the West Credit River at 8th Line provides a long-term (1983 - present) record of flow. Due to differences in geological conditions between the catchment area of this station and the WWTP study area (i.e., West Credit River between 10th Line and Winston Churchill Blvd.), flows from 8th Line could not be pro-rated for catchment size at 10th Line for the preliminary ACS (B.M.Ross 2014).

A flow gauging station was established at 10th Line in July 2013 by Credit Valley Conservation (CVC). Insufficient data has been collected from this station to determine a reliable 7Q20 low flow statistic; a minimum of 10 years of data are required. Flows measured at this gauge, however, were used by CVC to develop a flow transposition factor between the 8th Line and the 10th Line data. The preliminary ACS used 7Q20 flows for 10th Line as determined by CVC using a transposition factor based on stream flows collected from July to October 2013 at 10th Line. Additional flow data have been collected since the preliminary ACS to refine the transposition factor. In 2016, CVC recalculated the 7Q20 low flow statistic for 10th Line, using data from July 2013 to December 2015 (Appendix B). The new 7Q20 flow statistic for 10th Line of 225 L/s includes a 10% reduction to account for effects on climate change.

3. Approach and Methods

The preliminary ACS (B.M.Ross 2014) used water quality data from the Provincial Water Quality Monitoring Network (PWQMN) station located on the West Credit River at Winston Churchill Blvd. (PWQMN 06007601502) as input to their ACS. This station is located in the study area and has a long-term record of water quality (1975-2015). The updated ACS, however, draws on water quality information collected from the 10th Line, upstream of Winston Churchill Blvd., which was contained in the Existing Conditions Report (CVC 2011), and updated with new data collected as part of this study. Groundwater discharge between the 10th Line and Winston Churchill Blvd. results in improved water quality downstream and so provides a more conservative estimate of background water quality.

A CORMIX water quality model was used to determine the size and shape of the effluent plume and water quality in the mixing zone. Oxygen and temperature modelling of the discharge in the River, as requested by the MOECC and CVC and recommended in the preliminary ACS, was completed using the QUAL2K model. The QUAL2K model was also used to predict the influence of assimilation processes beyond the mixing zone on downstream concentrations of ammonia and nitrate. The QUAL2K model requires a large amount of site-specific physical, chemical and biological information to accurately simulate the effect of the effluent on the receiver. The data to complete the modelling was assembled from the background data and updated with data from the current water quality, quantity and detailed field studies conducted in the summer of 2016. The additional field studies were undertaken as inputs into the ACS included:

- Diurnal Oxygen Surveys - used as input into the QUAL2K model and to determine if oxygen is a limiting factor at night when photosynthesis is low and respiration is high
- Physical Attributes Survey – to define and characterize distinct reaches in the West Credit River within the study area for input into the hydrodynamic model
- Dye Tracer Study – to calculate time of travel and longitudinal dispersion of effluent as input to the Qual2K model

The methods used for the field investigations and ACS are outlined in the following sections.

3.1 Confounding Factors

In early July 2016 the CVC became aware of backwater effects at their 10th Line flow gauge caused by a beaver dam located approximately 20 m downstream of 10th Line. The time of construction of the dam is unknown, but CVC believes that water levels (and hence calculated flows) at 10th Line from approximately May 20, 2016 were impacted by downstream beaver dams (Tim Hurts, CVC personal communication). The presence of beaver dams downstream of the water level gauge at 10th Line caused the pooling of water and flooding of banks upstream of 10th Line. As a result, accurate flow measurements could not be calculated from the CVC gauge from ~ May 2016 onwards.

The presence of the beaver dams should not influence the water quality data collected by HESL in 2016. Water samples were collected at 10th Line from May to July 2016. In August and September 2016 the sampling station was moved 75 m downstream of 10th Line, outside of any influence of the beaver activity. In May, June, and July, stream flows were measured just upstream of 10th Line at the CVC flow gauge. Flows measured during this period may include influence (e.g. backwater effects) from beaver dams located downstream. In August and September, stream flows were measured ~ 75m downstream of 10th Line, to avoid interference from the beaver dam.

A dye tracer study was conducted on August 25, 2016 (Section 3.5). The dye was injected approximately 75 m downstream of 10th Line, downstream of the influence of the beaver dam. The presence of the beaver dam at 10th Line did not influence the dye study, as the study was conducted well outside of its influence.

3.2 Water Quality

Monthly water quality samples were collected from the West Credit River at 10th Line (Figure 2) from May to September 2016 on:

- May 27, 2016

- June 29, 2016
- July 27, 2016
- August 25, 2016
- September 28, 2016

Water samples were collected 75 m downstream of 10th Line during August 25 and September 28 sampling events to avoid the influence of the beaver dam.

During each sampling event grab samples were collected from the centre of the watercourse for analysis of:

- 5-day and ultimate carbonaceous biochemical oxygen demand (CBOD5 and CBODu),
- total phosphorus (TP),
- orthophosphate (PO_4),
- total dissolved phosphorus (TDP)
- total Kjeldahl nitrogen (TKN),
- nitrate (NO3) and nitrite (NO2),
- total ammonia nitrogen (TAN),
- total suspended solids (TSS),
- chlorophyll *a*,
- volatile suspended solids (VSS), and
- chloride (September 2016 sampling event only).

After sample collection, water samples were stored in laboratory-provided coolers containing ice packs and shipped to ALS in Waterloo, Ontario for analysis. Field measurements of pH, dissolved oxygen (DO; mg/L and % saturation), temperature (°C) and specific conductivity (µS/cm) were collected with a water quality multi-parameter meter (YSI 600 QS). Field pH and temperature were used to calculate un-ionized ammonia using the equation from Appendix A of MOE's document "Water Management" (MOE 1994).

The relationships between these variables are used by the QUAL2K model to predict far-field water quality.

3.2.1 Diurnal DO Surveys

Three dissolved oxygen (DO) loggers (Optical Dissolved Oxygen Loggers, HOBO Model U26-001) were installed in the West Credit River at three locations: 10th Line, Winston Churchill Blvd., and the mid-point between the two stations on June 10, 2016 (Figure 2). The DO loggers were calibrated prior to deployment, and programmed to measure dissolved oxygen (mg/L) and temperature (ºC) every 0.5 hours. The loggers were retrieved on August 25, 2016; the logger between the two stations was likely vandalized and was not retrieved. A DO logger was also installed 75 m downstream of 10th Line from August 25 to September 28, 2016 to assess dissolved oxygen concentrations downstream of 10th Line. The dissolved oxygen measurements were used as input into the QUAL2K model (Section 3.7), and to assess aquatic habitat conditions in the West Credit River.

Figure 2:
Monitoring Locations in
West Credit River Study Area

- Monitoring Site
- PWQMN Station 06007601502
- CVC Flow Station
- HESL DO Logger
- HESL Flow Station
- HESL Water Quality
- Stream
- Road

N

0 25 50 100 150 200 m

Prepared by: Eric Dilligeard
Data Source: LIO, HESL, Esri Imagery.
Coordinate System: NAD 1983 UTM Zone 17N

Project Lead: Tara Roumeliotis and Deborah Sinclair
Project: Town of Erin Class EA Wastewater Servicing. Assimilative Capacity Study
Project#: 160005

November 2016

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3.3 Stream flow

Stream flow was measured at 10th Line and Winston Churchill Blvd. (Figure 2) during each sampling event[1] using an OTT MF Pro brand flow meter. From May to July stream flows were measured just upstream of 10th Line at the CVC flow gauge. Flows measured during this period may include influence (e.g. backwater effects) from the beaver dams located downstream. The August and September flows were measured ~ 75 m downstream of 10th Line to avoid interference from the beaver dam.

Stream velocity was measured at a minimum of 10 points across the stream cross-section. At points where the water depth was less than 0.5 m, the water velocity was measured at 0.6 of the water depth. Where water depths were greater the 0.5 m the velocity was measured at 0.2 and 0.8 of the depth and the mean of these values computed. The area-velocity method was used to calculate stream discharge. Manual streamflow measurements are generally accurate to within 6-19% (Harmel et al. 2006) of the actual flow in the watercourse, with lower flows being less accurate.

3.4 Stream Characterization

On June 10, 2016 a detailed field reconnaissance of the West Credit River between 10th Line and Winston Churchill Blvd. was carried out by HESL scientists. The purpose of the reconnaissance was to develop a better understanding of the proposed receiving environment, identify potential influences on water quality and the assimilation process, and to define and characterize distinct sections (also known as reaches) of the river for the purpose of informing the 1-dimensional river model, QUAL2K.

The QUAL2K model requires spatial segmentation of the river into a series of reaches, which are sections of similar hydrogeometric characteristics, (i.e., depth, cross sectional area, bank slopes, channel slopes, average velocity and average flow), channel pattern, bed materials, bank composition, and influence of riparian and in-stream vegetation on flow. HESL scientists surveyed the longitudinal slope of the river and the left and right bank slopes at eight locations within the study area. In addition, the field reconnaissance made note of any of the following items:

- human contact points
- upstream inputs or modifiers that may affect assimilation such as tile drains or impoundments
- inputs or structures downstream of the discharge such as tributaries, tile drains or impoundments
- Substrate type
- In-stream vegetation (macrophyte growth)
- Large woody debris
- Riparian vegetation
- Tree canopy and percent of shading

HESL field notes from the reconnaissance are attached in Appendix C.

In addition to the reconnaissance conducted by HESL, fluvial geomorphologists from Palmer Environmental Consulting Group (PECG) carried out a comprehensive stream assessment of the West Credit River study

[1] *Stream flow was not measured at Winston Churchill Blvd. during the May27, 2016 event.*

area between 10th Line and 80 m downstream of Winston Churchill Blvd. on June 29, 2016. Although the focus of PECG's assessment was evaluating potential outfall locations, (to be reported in Phase 3 and 4 of the EA), their study observations on channel morphology, bed and bank materials, and existing erosion sites were incorporated into the physical attributes survey results of HESL.

3.5 Dye Tracer Study

Tracer testing was conducted on August 25, 2016 under a low flow of 0.37 m^3/s, as measured by HESL staff on the day of the tracer test at a location approximately 75 m downstream of 10th Line and outside of the influence of the beaver dam. Data gathered during the tracer tests were used to calculate time of travel, velocity, and longitudinal dispersion for use in the far-field 1-dimensional river model (QUAL2K) of the West Credit River and to provide a one-time calibration of the model using the flow and velocity conditions on that date.

Rhodamine WT dye, a fluorescent xanthene dye that is pink in colour, was used as the tracer for the study. Rhodamine WT dye was chosen because it is a stable, non-toxic, and chemically non-reactive dye that is easily measured in the field. The substance is non-carcinogenic, and is safe if it comes into contact with skin. Rhodamine WT dye tracers are also very robust over a variety of different flow regimes.

A slug injection tracer test was carried out whereby a known amount of tracer was added to West Credit River approximately 75 m downstream of 10th Line (Figure 3). This injection location was selected because it was downstream of the zone of influence from the beaver dam near 10th Line.

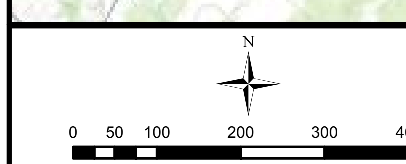
Fluorometers (YSI 600 OMS instruments equipped with Rhodamine WT optical sensors) were placed in the West Credit River at five locations downstream of the tracer injection site, as follows:

- Fluorometer 1 at 105 m downstream of the injection point;
- Fluorometer 2 at 486 m downstream of the injection point;
- Fluorometer 3 at 1,373 m downstream of the injection point;
- Fluorometer 4 at 1,687 m downstream of the injection point; and
- Fluorometer 5 at 2,827 m downstream of the injection point (Figure 3);

The fluorometers were equipped with an optical sensor to determine the concentration of Rhodamine WT in the water, in units of µg/L (ppb), and were set up to collect one measurement every 10 seconds for the duration of the test. The fluorometers were capable of measuring concentrations of Rhodamine WT with a resolution of 0.1 ppb. The Rhodamine WT optical sensors were calibrated in the field on a 2-point scale that included 0 ppb and 100 ppb Rhodamine WT. The 100 ppb solution was mixed in the field from a 20% Rhodamine WT dye solution, which was obtained from a national supplier.

Figure 3:
Dye Tracer Study,
Fluorometer Locations

- Fluorometer Station
- Injection Point
- Stream
- Road



Prepared by: Eric Dilligeard
Data Source: LIO, HESL, Esri Imagery.
Coordinate System: NAD 1983 UTM Zone 17N

Project Lead: Tara Roumeliotis and Deborah Sinclair
Project: Town of Erin Class EA Wastewater Servicing. Assimilative Capacity Study
Project#: 160005

November 2016

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To begin the slug injection tracer test, a certain volume of Rhodamine WT 20% dye solution was mixed into a bucket containing 10 L of water collected from the West Credit River. The volume of tracer required was estimated by applying the following empirical equation by Kilpatrick (1989):

$$V_s = 3.79 \times 10^{-5} \frac{QL}{v} C_p \qquad \text{Equation (1)}$$

where Vs is the volume of Rhodamine WT 20% dye, in mL;

Q is the flow rate of the West Credit River, in ft^3/s;

L is the length of the measurement reach, in ft;

v is the mean-stream velocity, in ft/s; and

Cp is the peak concentration at the sampling site, in µg/L.

Equation 1 was used to determine the amount of Rhodamine WT 20% dye needed, such that the peak tracer concentration detected at the furthest fluorometer (about 2.8 km downstream) would be detectable by the fluorometer. The 10L bucket containing the Rhodamine WT 20% mixture was then quickly emptied across the width of the river to simulate an instantaneous injection. The time of the injection was recorded. Photograph 1 shows this instantaneous injection, Photograph 2 shows the West Credit River looking downstream of the injection point approximately 10 seconds after the instantaneous injection, and Photograph 3 shows the West Credit River approximately 1 minute after the instantaneous injection. The "parabolic-shaped" velocity profile which is the result of stream velocities that are higher through the centre of the river, and slower along the banks is clearly shown in Photograph 3.

Photograph 1. Rhodamine WT slug test dye injection on the West Credit River (Photo credit: Christine Furlong, Triton Engineering Services Limited)

Photograph 2. Rhodamine WT Dye Plume Approximately 10 seconds after Slug (Instantaneous) Injection

Photograph 3. Rhodamine WT Dye Plume Approximately 1 minute after Slug (Instantaneous) Injection.

The measured Rhodamine WT concentrations versus time were graphed for each of the fluorometer stations, with the time axis, (the x-axis), beginning at the recorded time of the slug injection, as illustrated in the following theoretical example (Figure 4).

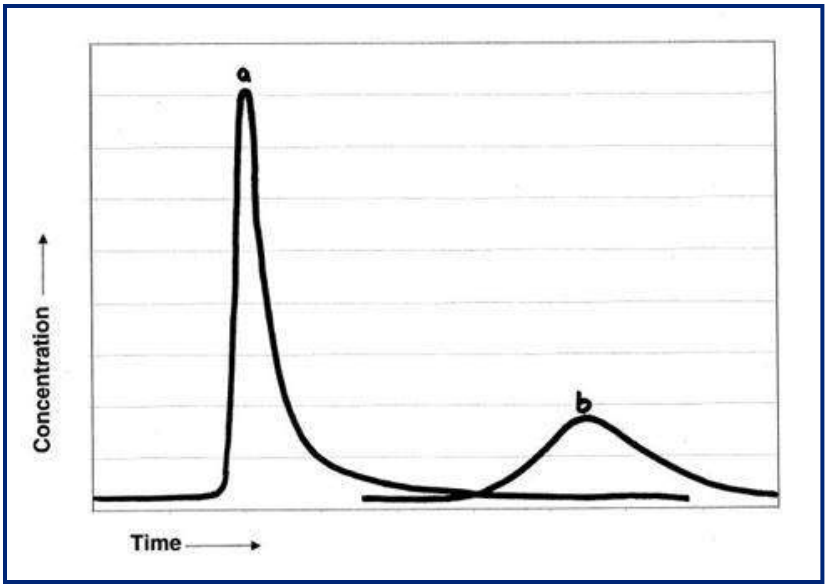


Figure 4. Example Graph of Rhodamine WT Concentration Versus Time for a Slug Injection Test

Figure 4 shows that the fluorometer closest to the injection point (i.e., line a in the figure) would exhibit a tracer peak that was higher and seen sooner than the peak at the other fluorometer station located further downstream (i.e., line b in the figure). The time of travel and longitudinal dispersion were computed by comparing the peak Rhodamine WT concentrations and the time between the slug injection and the peak.

The travel time ($\bar{t}$) between the dye injection point and a given fluorometer station was calculated by the following equation:

$$\bar{t} = \frac{\sum_{i=0}^{n-1}(c_i t_i + c_{i+1} t_{i+1})(t_{i+1} - t_i)}{\sum_{i=0}^{n-1}(c_i + c_{i+1})(t_{i+1} - t_i)}$$ Equation (2)

where ci is the Rhodamine WT concentration at a given time, in µg/L;

ti is the corresponding time, in minutes elapsed since the time of injection; and

n is the number of data points collected by the fluorometer.

The temporal variance (s_t^2) was calculated from the data collected at each fluorometer by the following equation:

$$s_t^2 = \frac{\sum_{i=0}^{n-1}(c_i t_i^2 + c_{i+1}t_{i+1}^2)(t_{i+1} - t_i)}{\sum_{i=0}^{n-1}(c_i + c_{i+1})(t_{i+1} - t_i)}$$ Equation (3)

The mean velocity (U) between two fluorometer stations was calculated by the following equation:

$$U = \frac{x_2 - x_1}{\overline{t_2} - \overline{t_1}}$$ Equation (4)

where x is the distance between the dye injection point and the fluorometer, in m.

The longitudinal dispersion coefficient (E) between two stations was calculated by:

$$E = \frac{U^2(s_{t2}^2 - s_{t1}^2)}{2(\overline{t_2} - \overline{t_1})}$$ Equation (5)

The calculated times of travel, mean velocities, and dispersion coefficient values between each of the five fluorometer locations were input into the QUAL2K model for the West Credit River.

3.6 Mass Balance Modelling

The potential volume of treated effluent flows from the proposed Erin WWTP are limited by total phosphorus concentrations with respect to both treatment technology limits for TP removal in wastewater and fully mixed TP concentrations in the West Credit River. A mass balance model was used to back-calculate allowable maximum effluent flows based on a range of potential effluent TP concentrations and fully mixed TP concentrations in the river, assuming homogenous concentrations across the river cross-section.

Although there are several processes leading to loss of phosphorus from the water column of a river over the course of a year, these are balanced out by resuspension such that on average, phosphorus is not retained in a river system. The West Credit River was therefore assumed to not act as a net sink for TP and TP was assumed to behave as a conservative parameter. Modelling these processes is difficult using an un-calibrated water quality model and lacking an existing discharge where assimilation processes could be observed in the field. A mass balance model of phosphorus loadings to the West Credit River was therefore used as a conservative estimate of the likely total phosphorus concentrations under a variety of effluent limits.

Determination of the water quality in the West Credit River, at the point of complete and homogenous mixing between the WWTP effluent and the river, was achieved by solving the following mass-balance equation for $C_{d/s}$:

$$Q_{u/s}C_{u/s} + Q_{WWTP}C_{WWTP} = (Q_{u/s} + Q_{WWTP})C_{d/s}$$ (Equation 6)

Where:

$Q_{u/s}$ is the upstream flow in the West Credit River, prior to the proposed WWTP discharge;

$C_{u/s}$ is the upstream West Credit River concentration for the parameter of interest;

Q_{WWTP} is the Erin WWTP effluent flow;

C_{WWTP} is the Erin WWTP effluent concentration for the parameter of interest; and

$C_{d/s}$ is the fully mixed downstream concentration in the West Credit River for the parameter of interest.

The mass balance model does not assume any mixing zone – it is based on the fully mixed river concentrations and treats phosphorus as a conservative parameter – one which does not undergo any assimilation reactions after discharge.

Equation 6 was re-arranged to solve for Q_{WWTP} in order to determine the maximum possible effluent flows under a variety of TP effluent concentrations (Table 2), while maintaining TP concentration in the West Credit River at the site-specific objective of 0.024 mg/L (Appendix D).

$$Q_{WWTP} = \frac{Q_{u/s}(C_{d/s} - C_{u/s})}{C_{WWTP} - C_{d/s}} \qquad \text{(Equation 7)}$$

HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m^3/d and a Full Build Out flow of 7,172 m^3/d for the complete assimilation modelling exercise based on the results of the TP mass balance modelling. These model results are detailed in Section 4.5.

Table 2. Mass Balance Modelling Inputs – Total Phosphorus

Parameter	Value	Rationale
Upstream West Credit River flow ($Q_{u/s}$)	0.225 m^3/s	The 7Q20 value, as calculated by Credit Valley Conservation (*Update of Low Flow Assessment (7Q20) for the West Credit River Assimilative Capacity Study (Erin SSMP),* CVC, June 2016).
Upstream West Credit River TP concentration ($C_{u/s}$)	0.016 mg/L	75th percentile concentrations of HESL (2016) and CVC (2007 & 2008) water quality data collected at 10th Line (15 data points)
WWTP effluent TP concentration (C_{WWTP})	0.15 to 0.04 mg/L	Effluent TP concentrations were varied from 0.15 mg/L (the effluent limit concentration proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*) to 0.04 mg/L (approaching the current limit of treatment technology)
Downstream West Credit River TP concentration ($C_{d/s}$)	0.024 mg/L	Recommended downstream maximum TP concentration based on Environment Canada and CCME guidance. (See Appendix D for additional details).

Mass balance modelling of total ammonia nitrogen (TAN) and nitrate were also completed as a "starting point" in determining effluent limits for these parameters (Equation 6) using the Phase 1 and Full Build Out effluent flows which were derived from the TP mass balance modelling (Equation 7) (Table 3). Since nitrification of TAN (and the generation of nitrate) in the West Credit River would be expected given that the river is well oxygenated (Section 3.1.3), these parameters were further modelled using the far-field longitudinal river model QUAL2K, which accounts for nitrification as well as denitrification. The QUAL2K modelling is discussed in Section 2.5. For the mass balance modelling of TAN, a mass balance to determine downstream temperature and pH was also carried out, and these downstream values then used to calculate fully mixed un-ionized ammonia concentrations.

Table 3. Mass Balance Modelling Inputs – Total Ammonia Nitrogen and Nitrate

Parameter	Value	Rationale
Upstream West Credit River flow ($Q_{u/s}$)	0.225 m³/s	The 7Q20 value, as calculated by Credit Valley Conservation (*Update of Low Flow Assessment (7Q20) for the West Credit River Assimilative Capacity Study (Erin SSMP),* CVC, June 2016).
Upstream West Credit River concentration for parameter of interest ($C_{u/s}$)	• TAN – 0.055 mg/L • (Temperature – 21.18°C; pH – 8.21)* • Nitrate – 1.9 mg/L	• TAN and nitrate - 75th percentile concentrations of HESL (2016) and CVC (2007 & 2008) water quality data collected at 10th Line (15 data points). • Temperature – 75th percentile of August 2016 HESL temperature logger measurements at 10th Line • pH - 75th percentile of CVC hydrolab data (June and Aug 2008)
WWTP effluent concentration for parameter of interest (C_{WWTP})	• TAN – 0.6 to 1.2 mg/L • Nitrate – 5 to 6 mg/L • (Temperature 19°C; pH – 8.6)*	• Effluent TAN concentrations were varied from 1.2 mg/L (from email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits [Appendix E]) to 0.06 mg/L (the Full Build Out TAN concentration required to meet the PWQO of 0.0164 mg/L for un-ionized ammonia at fully mixed downstream). • Temperature – as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*. • pH – as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*. • Effluent nitrate concentrations were varied from 5 to 6 mg/L, the effluent objective and limit concentrations proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*.
WWTP effluent flow (Q_{WWTP})	Phase 1 – 0.039 m³/s Full Build Out – 0.083 m³/s	From results of the TP mass balance modelling, HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m³/d (0.039 m³/s) and a Full Build Out flow of 7,172 m³/d (0.083 m³/s).

Mass balance modelling of chloride was completed using the Phase 1 and Full Build Out effluent flows (as derived from the TP mass balance modelling) to determine fully mixed, downstream chloride concentrations in the West Credit River. Chloride is a conservative parameter, whose concentrations would be expected to reduce through dilution only. As such, using a mass balance model to predict fully mixed chloride concentrations in the river was most appropriate in examining chloride concentrations in the receiver.

Table 4. Mass Balance Modelling Inputs – Chloride

Parameter	Value	Rationale
Upstream West Credit River flow ($Q_{u/s}$)	0.225 m^3/s	The 7Q20 value, as calculated by Credit Valley Conservation (*Update of Low Flow Assessment (7Q20) for the West Credit River Assimilative Capacity Study (Erin SSMP),* CVC, June 2016).
Upstream West Credit River concentration for chloride ($C_{u/s}$)	48.9 mg/L	75th percentile concentrations of HESL (2016) and CVC (2007 & 2008) water quality data collected at 10th Line (11 data points).
WWTP effluent concentration for chloride (C_{WWTP})	534 and 396 mg/L	Predicted maximum and average effluent chloride concentrations (Appendix D)
WWTP effluent flow (Q_{WWTP})	Phase 1 – 0.039 m^3/s Full Build Out – 0.083 m^3/s	From results of the TP mass balance modelling, HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m^3/d (0.039 m^3/s) and a Full Build Out flow of 7,172 m^3/d (0.083 m^3/s).

3.7 Far-Field Water Quality Modelling (QUAL2K)

QUAL2K is a one-dimensional (1-D) river and stream water quality model, supported by the United States Environmental Protection Agency (US EPA), which is typically used to assess the environmental impact of pollution discharges along rivers. A wide range of water quality parameters and chemical and biological pollutants within the river can be modelled, including temperature, pH, dissolved oxygen (DO), carbonaceous biochemical oxygen demand (CBOD), nitrogen species, phosphorus species, and suspended solids.

Since QUAL2K is a 1-D model, the model assumes that all point source inputs (such as the outfall from the WWTF) are instantaneously mixed laterally and vertically at each particular point in the river. Variation in each water quality parameter modeled occurs only longitudinally (in the x-direction along the length of the river), and is computed as water is transported out of each reach and into the next. The QUAL2K model is known as a far-field model since its water quality predictions apply beyond the point in which the effluent is fully mixed with the river, also known as the far-field. Near-field modelling to the point of complete mixing was carried out using the CORMIX mixing zone model, Section 3.8; however, it is important to note that the QUAL2K model takes into account a larger variety of water quality and physical parameters and processes and thus is both more complex and more precise regarding the fate of pollutants in the river than the mixing zone model, CORMIX.

The outfall for the WWTP is proposed between 10th Line and Winston Churchill Blvd. Thus the West Credit River was modeled using QUAL2K from a point approximately 100 m upstream of the 10th Line to a point approximately 40 m downstream of Winston Churchill Blvd., for a total river model length of about 1.7 km. This 1.7 km stretch was sub-divided into smaller sections called “reaches”, which are sections of the river with similar geomorphologic characteristics (Section 3.4) based on our physical attributes survey, to create an accurate simulation of the river for the model. A total of 6 reaches were identified for the model, denoted as Reach 0 through Reach 5, where Reach 0 is located upstream of 10th Line (Section 4.3, Figure 9).

3.7.1 Model Input

The main input parameters for the QUAL2K model are summarized in Table 5.

The far-field modelling was limited to the summer scenario since it is the most critical season due to increased water temperatures which result in increased speciation of ammonia to its un-ionized form. As such, summer temperatures are reflected in the model inputs.

Table 5. Model Input Parameters for QUAL2K Far-field Assimilation Modelling

Parameter	Value	Rationale
Receiving Water Characteristics (West Credit River at 10th Line)		
pH	8.21	• The 75th percentile of CVC hydrolab data (June and Aug 2008) • Note that 75th percentile of HESL 2016 and CVC (2007-2008) point measurements was 8.11
Water temperature	21.18 ºC	• The 75th percentile of August 2016 HESL temperature logger measurements at 10th Line • Note that the 75th percentile summer temperature (June through August 2016) from the HESL temperature logger was 20.66ºC
Dissolved oxygen	7.72 mg/L	• 25th percentile August 2016 HESL DO logger at 10th Line • 7.93 mg/L – 25% June to August 2016 HESL DO logger
Conductivity	613 µS/cm	• 75th percentile from CVC hydrolab data (June and Aug 2008) • Note that 75th percentile of HESL 2016 and CVC (2007-2008) point measurements was 600 µS/cm
Nutrients	TAN: 0.055 mg/L Nitrate-N: 1.90 mg/L	• 75 percentile of HESL (2016) and CVC (2007 & 2008) data collected at 10th Line (15 data points)

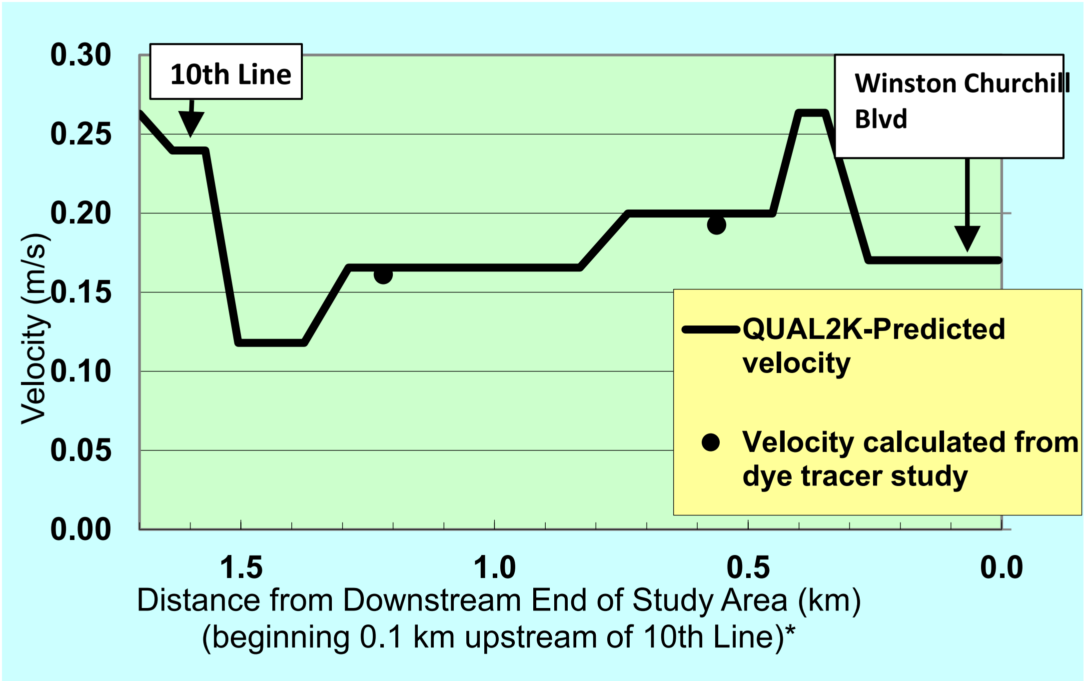
Parameter	Value	Rationale
	TKN: 0.590 mg/L TP: 0.016 mg/L Inorganic P: 0.0081 mg/L Organic P = TP-InorgP Organic N = TKN-TAN	• Organic phosphorus and Inorganic phosphorus – based on 75th percentile of HESL (2016) data collected at 10th Line (5 data points)
Inorganic Solids (ISS)	ISS= TSS-VSS TSS: 3.2 mg/L VSS: <3 mg/L	• 75th percentile of HESL 2016 data collected at 10th Line (5 data points). Did not use CVC data because TSS had high detection limit of 10 mg/L and no VSS data.
$cBOD_{fast}$	2.70 mg/L	• 75th percentile of HESL 2016 cBODu collected at 10th Line (5 data points)
Chlorophyll a	2.72 µg/L	• 75th percentile of HESL 2016 data collected at 10th Line (5 data points)
Alkalinity	281 mg/L	• From May 2011 report by CVC, Aquafor Beech Inc, and Blackport Hydrogeology Inc.: *Erin Servicing and Settlement Master Plan, Phase 1 – Environmental Component – Existing Conditions Report.*
E. coli	160 cfu/100 mL	• CVC 2007-2008 (10 points)
Flow	0.225 m^3/s	• 7Q20 flow at 10th Line, from CVC 2016 report: *Update of Low Flow Assessment (7Q20) for the West Credit River Assimilative Capacity Study (Erin SSMP)* • Accounts for climate change (subtracted 10% from 7Q20 flow)
Manning's n	0.035 – 0.045	• Initially based on June 10, 2016 field reconnaissance, refined through calibration with river velocities computed from dye tracer study
Bottom Algae coverage	15% to 40%	• Based on the June 10, 2016 field reconnaissance
Channel slope	0.0008 to 0.003	• From June 10, 2016 survey, averaged within each reach, refined through calibration with river velocities computed from dye tracer study
Bank slope	0.17 to 0.66	• From June 10, 2016 survey
Air Temperature	21.9°C to 29.7°C	• From Environment Canada's Historic Climate Data records for August 25, 2016 for Georgetown WWTP
Dew Point Temperature	17.7°C to 22.2°C	• From Environment Canada's Historic Climate Data records for August 25, 2016 for Georgetown WWTP
Wind speed	2 m/s	• Recommended for conservative design conditions
Shade	20% to 53%	• From June 10, 2016 survey, averaged within each reach
Effluent Characteristics (Proposed Erin WWTP)		
Flow rate	Phase 1 – 0.039 m^3/s Full Build Out – 0.083 m^3/s	• From results of the TP mass balance modelling, HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m^3/d (0.039 m^3/s) and a Full Build Out flow of 7,172 m^3/d (0.083 m^3/s).

Parameter	Value	Rationale
TAN	Phase 1 – 1.2 mg/L (summer); 2 mg/L (winter) Full Build Out – 0.6 mg/L (summer); 2 mg/L (winter)	• Phase 1 - From email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits (Appendix E), confirmed through mass balance modelling. • Full Build Out - From mass balance modelling: TAN concentration required to meet the PWQO of 0.0164 mg/L for un-ionized ammonia nitrogen at fully mixed downstream.
Temperature	19°C	• Maximum value, as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*.
pH	8.6	• Maximum value, as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*.
Nitrate-N	5 mg/L	• As proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*, confirmed value through mass balance modelling.
TP	Phase 1 – 0.07 mg/L Full Build Out – 0.045 mg/L	• From mass balance modelling, TP effluent concentrations relating to desired effluent flows.
cBOD	5 mg/L	• From email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits (Appendix E).
Dissolved oxygen	4 mg/L	• From email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits (Appendix E), and as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*.
Conductivity	1,000 µS/cm	• Based on measured effluent conductivity from existing WWTPs in southern Ontario (Simcoe WPCP, Delhi WPCP).
TSS	5 mg/L	• From email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits (Appendix E).
E.coli	100 CFU/100 mL	• From email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits (Appendix E), and as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*.
Model Parameters		

Parameter	Value	Rationale
CBOD oxidation rate	2 /d	Set near mid-point of range (0 to 5/d). The West Credit River does not have a high background CBOD concentration; however, oxidation of CBOD requires DO, and therefore to be conservative in our estimates of DO sag concentration in the study area, we set the CBOD oxidation rate at the mid-point of the range instead of at the low end.
Organic nitrogen - hydrolysis	0.1 /d	Conservative estimate. Set at low end of range (0 to 5/d).
Organic nitrogen – settling velocity	0.1 /d	Conservative estimate. Set at low end of range (0 to 2/d).
Nitrification rate	5/d	Set near mid-point of range (0 to 10/d). Literature review of similar streams indicates range of 0.2 to 9/d (EPA 1985). Note that nitrification is at its maximum at pH=8.5 and temperatures between 25 and 35 deg C and is high in shallow streams, thus medium to high rates would be expected for West Credit River. Further downstream TAN concentrations derived by mass balance (Section 4.5) conservatively assume zero nitrification, so the QUAL2K model nitrification rate provides a more realistic scenario.
Denitrification	0.1 /d	Set at low end of range (0 to 2/d). High rates of denitrification would not be expected in the West Credit River study area since it is well oxygenated with low CBOD.
Organic P - hydrolysis Rate	0.1 /d	Conservative estimate. Set at low end of range (0 to 15/d).
Reaeration Model	Tsivoglou-Neal	Default model selection in QUAL2K.

Although no point source currently exists within the West Credit River study area with which to calibrate and validate the water quality predictions of the QUAL2K model, the hydraulic component of the model was calibrated using the river velocities calculated from the dye tracer study conducted on August 25, 2016 (Section 3.3) and the river flow measured on that same day at a location approximately 75 m downstream of 10th Line (and outside the influence of the beaver dam). Manning's n values and channel slopes were varied in order to calibrate the hydraulic model results to those computed from the dye tracer study.

The precision of the hydraulic predictions from the QUAL2K model calibration are presented graphically in Figure 5, where the dye tracer study (i.e., field-calculated) velocities are plotted against the model-predicted velocities. Note that the river velocities computed from the dye tracer study are plotted at the mid-point location between fluorometer stations. The average velocity in the study area, computed through the dye tracer study results, was 0.17 m/s. The QUAL2K average velocity in the study area was 0.177 m/s. Thus the hydraulic results from the QUAL2K model calibrated well to the field results and the model was deemed to be acceptable for use in predicting far-field water quality.



*QUAL2K model calculates using a descending distance from the upstream-most point in the study area. In this case, the model begins at 1.7 km (which corresponds to 100 m upstream of 10th Line) and ends at 0 km (which corresponds to 40 m downstream of Winston Churchill Blvd.).

Figure 5. QUAL2K Velocity Calibration Results

3.8 Mixing Zone Modelling (CORMIX)

The receiver (i.e., West Credit River) water quality must be maintained within PWQO except for the volume of water within the mixing zone. From *Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters* (MOE, 1994b), the mixing zone is defined two ways:

- The volume of water contiguous to the discharge in which the effluent undergoes physical mixing with the receiver such that dilution by mixing is the dominant process reducing effluent concentrations in the water; or
- The volume of water contiguous to the discharge in which concentrations of effluent parameters exceed their respective PWQOs.

The mixing zone model provided information on effluent plume behaviour and pollutant concentrations in the near-field mixing zone. The mixing zone model focused on the physical component of modelling, where assimilation processes were dominated by mixing and dilution of the effluent with the receiving waters. (Note that in order to model assimilation of pollutants by the complex physical, chemical and biological processes in a river system beyond the point of complete mixing, the far-field water quality model QUAL2K was applied, as detailed in Section 3.7).

The mixing zone modelling focussed on ammonia as the potentially toxic component of the effluent that is assimilated by a) dilution in the near field area through initial mixing with the river and b) nitrification, the biological conversion of ammonia to nitrate. There were two aspects to the assessment of ammonia:

- The requirement that undiluted effluent be non-acutely lethal at the point of discharge. This was calculated without the need for an assimilation model and is based solely on the toxicity of ammonia in the effluent; and
- The determination of the size and characteristics of the mixing zone for ammonia in the West Credit River since this is the volume of water in which concentrations will exceed the PWQO of 0.0164 mg/L of un-ionized ammonia nitrogen (MOE, 1994). The mixing zone is allowed under MOECC surface water quality Policy 5 (MOE, 1994). The size of the mixing zone is determined by modelling the physical mixing of effluent with the river and then setting an ammonia limit for the effluent which will maintain the un-ionized ammonia concentration below the PWQO outside of the mixing zone. For a smaller receiver such as West Credit River, this limit will be lower than that required to maintain non-lethal effluent.

The near-field mixing of the proposed Erin WWTP discharge with the West Credit River was hydrodynamically modeled using CORMIX Version 10.0. CORMIX is a software system developed by Cornell University for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies. The model classifies the discharge configuration into generic flow classifications and then assembles and executes a sequence of sub-models to simulate the hydrodynamic behaviour of the discharge, calculating the plume trajectory, dilution and maximum centerline concentration. CORMIX was used to predict water quality up to and including the point of complete mixing between the effluent and the West Credit River. Downstream of the point of complete mixing, the QUAL2K model was used to predict water quality in the West Credit River, as discussed in Section 3.7.

The basis of the CORMIX model is a flow classification system. The model classifies the discharge configuration into generic flow classifications based on dimensionless length scales (Gomm, 1999). Once the flow has been classified, the model assembles and executes a sequence of sub-models to simulate the hydrodynamic behaviour of the discharge, and calculates the plume trajectory, dilution and maximum centerline concentration. CORMIX uses these different sub-models to predict mixing in both the near-field region and far-field region from the discharge point. The terminology “near-field” and “far-field” in the internal CORMIX usage have no relation to the point of complete mixing – the near-field region refers to the region where the initial jet characteristics, including momentum flux and buoyancy flux, and outfall geometry govern the plume mixing. The “far-field” region is representative of where conditions existing in the ambient environment (such as density current buoyant spreading and passive diffusion within the West Credit River) govern the trajectory and dilution of the plume. The distance to the boundary between the near-field to far-field regions depends on the model input parameters as determined by river characteristics and the scenario modelled (i.e. effluent flow, discharge configuration).

The CORMIX model output displays the predicted centerline concentration moving downstream from the outfall location. The centreline concentration is the maximum concentration and the corresponding x, y and z co-ordinates are returned in the model output (x – longitudinal distance downstream; y – across river width; z – river depth). To compute concentrations laterally outward from the centerline concentration at any given longitudinal point (i.e., x is constant, varying y), the following formula was used:

$$C(n) = C_c e^{-\left(\frac{n}{b}\right)^2} \quad \text{(Equation 8)}$$

Where:

C(n) is the lateral concentration;

C_c is the centreline concentration;

n is the y co-ordinate position measured transversely away from the centreline concentration position y-coordinate; and

b is the plume half-width and the longitudinal position of interest.

Note that this formula can only be applied to the "far-field" predictions of the CORMIX model, which were those areas of the mixing zone governed by buoyant spreading and passive diffusion.

The Erin WWTP discharge to the West Credit River for Phase 1 flows was modeled using CORMIX3, a subsystem which is used for buoyant surface discharges, and schematized as a round pipe located at the water surface level. The Phase 1 flows were also modelled using the CORMIX2 subsystem for multi-port discharges, schematized as a buried 5 m long multi-port diffuser running parallel to the south bank of the West Credit River, with vertical ports located along the river bed. The Full Build Out flows were modelled using the same CORMIX2 system for multi-port discharges.

3.8.1 Model Inputs

Table 6 presents the CORMIX model inputs. Note that the CORMIX model could not be calibrated or validated because no point source currently exists. The rationales for each of the inputs are provided immediately following the table.

Table 6. CORMIX Model Inputs – Total Ammonia Nitrogen

Input Parameter	Effluent Flows		
	Phase 1 – single pipe	Phase 1 – multi-port diffuser	Full Build Out - multi-port diffuser
Effluent Worksheet:			
Conservative/non-conservative pollutant	Non-conservative		
Decay rate (1/d) if non-conservative	5	5	
Discharge Concentration (mg/L)	1.2	0.6	
Discharge excess concentration (mg/L)	1.145	0.545	
Effluent flow rate (m^3/s)	0.039	0.083	
Effluent temperature (°C)	19.0		
Ambient Worksheet:			
Average channel depth (m)	0.4		
Depth at discharge (m)	0.3	0.4	

Input Parameter	Effluent Flows		
	Phase 1 – single pipe	Phase 1 – multi-port diffuser	Full Build Out - multi-port diffuser
Wind speed 2 m above water surface (m/s)	2		
Ambient West Credit River flow rate (m^3/s)	0.225		
Ambient Concentration (mg/L)	0.055		
Bounded width (m)	11		
Bounded appearance	Highly irregular		
Manning's n	0.035		
Ambient temperature (°C)	21.18		
Ambient pH	8.21		
Discharge Worksheet (CORMIX3):			
Discharge bank (looking downstream)	Right	n/a	n/a
Discharge configuration	Flush with bank	n/a	n/a
Horizontal angle (degrees)	90 (pipe enters perpendicular to bank)	n/a	n/a
Discharge pipe diameter (m)	0.2	n/a	n/a
Bottom depth invert (m)	0.2	n/a	n/a
Discharge Worksheet (CORMIX2):			
Discharge bank (looking downstream)	n/a	Right	
Diffuser length (m)	n/a	5	
Distance from bank (m)	n/a	0.5	
Port height above river bottom (m)	n/a	0	
Port diameter (m)	n/a	0.05	
Contraction ratio	n/a	1	
Total # of ports	n/a	10	15
Alignment angle (degrees)	n/a	0 (diffuser is parallel to current)	
Vertical angle of port discharge (degrees)	n/a	90 (vertical, pointing upward)	
Mixing Zone Worksheet:			
PWQO (in mg/L)	0.0164[A]		
Excess concentration for the WQS (mg/L)	0.215		0.195

Notes: A – PWQO for un-ionized ammonia nitrogen; n/a – not applicable

Effluent Worksheet

Parameters may be modeled as either conservative (concentrations are reduced by physical mixing and dilution only) or non-conservative (concentrations are reduced by biological assimilation processes). TAN was modeled as a non-conservative parameter with a rate of decay of 5/d. This is the same nitrification rate used in the QUAL2K model. A literature review of similar streams indicated a range of 0.2 to 9/d (EPA 1985). Note that nitrification is at its maximum at a pH of 8.5, temperatures between 25 and 35°C and in shallow streams, thus medium to high rates would be expected for the West Credit River. TAN concentrations derived for downstream fully mixed by mass balance (Section 3.6) conservatively assumed zero nitrification, so the nitrification rate of 5/d provides a more realistic scenario.

The discharge excess concentration refers to the excess concentration of the effluent above background (i.e., West Credit River at 10th Line) concentrations. The 75th percentile background TAN concentration was 0.055 mg/L (calculated from HESL 2016 and CVC 2007 and 2008 data). For Phase 1 effluent flows, the summer TAN effluent limit is proposed at 1.2 mg/L and for Full Build Out, the TAN summer effluent limit is 0.6 mg/L. Therefore, the discharge excess concentration for Phase 1 was 1.145 mg/L (i.e., 1.2 mg/L – 0.055 mg/L) and for Full Build Out was 0.545 mg/L (i.e., 0.6 mg/L – 0.055 mg/L).

The discharge flows were from results of the TP mass balance modelling: HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m^3/d (0.039 m^3/s) and a Full Build Out flow of 7,172 m^3/d (0.083 m^3/s).

The effluent temperature was the maximum summer value, as proposed in the B.M. Ross 2014 report, *West Credit River Assimilative Capacity Study*.

Ambient Worksheet

The West Credit River flow was assigned the 7Q20 value of 0.225 m^3/s, calculated by CVC (Appendix B). This 7Q20 value includes a 10% reduction as an estimate of future climate change on low flow.

Inputs for the bounded width, and the depth at discharge in the West Credit River near 10th Line were based on measurements collected during the 2016 field events. For the river geometry, CORMIX requires that the cross-section of the river be “schematized” as a rectangular channel. The average depth dimension was calculated based on the depth measurements made 75 m downstream of 10th Line (and outside of the influence of the beaver dam). The depth at discharge was set at 0.3 m for the pipe discharge (Phase 1) since the pipe would be originating from the bank and therefore be a smaller depth than the average depth in the river. For the multi-port diffuser discharge, the depth was set to the full average depth of 0.4 m since the diffuser was modelled as resting on the river bottom.

A wind speed of 2 m/s was used for all scenarios. In the absence of field data, this is the velocity recommended by CORMIX for conservative design conditions.

Manning’s n (describing channel roughness and friction) was set at 0.035 based on hydraulic model calibration completed for the QUAL2K model (Section 3.7). The bounded appearance of “highly irregular” was set based on field observations of the local sinuosity of the river.

The ambient temperature of 21.18°C was the 75th percentile of August 2016 HESL temperature logger measurements at 10th Line.

Discharge Worksheet

Under the “discharge” worksheet, the discharge bank location is the location of the nearest bank to the outfall when facing downstream[2] in the direction of the river flow. For the Erin WWTP outfall, this would be the right bank (i.e., south bank).

For the Phase 1 single pipe discharge scenario:

- The discharge was modelled as being flush with the bank, rather than protruding or co-flowing.
- The horizontal angle was the angle of the discharge channel centreline with respect to the direction of river flow. Since the channel enters perpendicular to the bank, the angle was set to 90°.
- The pipe diameter of 0.2 m and bottom depth invert of pipe of 0.2 m were set based on model runs to minimize the size of the mixing zone.

For the Phase 1 and Full Build Out multi-port diffuser scenarios:

- The diffuser length were set to 5 m, oriented parallel to the bank and river current (i.e., an alignment angle of 0°), at a distance of 0.5 m from the bank. This configuration was set based on model runs to minimize the size of the mixing zone, while allowing for fish passage along the bank opposite to the diffuser.
- The diffuser ports were located along the river bed, oriented vertically upward (i.e., a vertical angle of 90°), with port diameters of 0.05 m. We have proposed 10 ports for the Phase 1 discharge and 15 ports for the Full Build Out discharge. (Therefore five ports would be “closed off” for Phase 1 flows and “opened up” for Full Build Out flows). Recommended pipe discharge velocities are within the range of 3 m/s to 8 m/s (Doneker, 2007). The number of ports and their diameter were based on velocity calculations, and while the resulting velocities at Phase 1 and Full Build Out were on the low end of this range, these smaller velocities prevent the plume from quickly spreading across the width of the river, thereby allowing for fish passage. Detailed modeling of discharge port configuration will be carried out in subsequent project stages.
- The contraction ratio represents the “roundedness” of the discharge port. A ratio of 1 was used to represent a well-rounded port.

Mixing Zone Worksheet

Mixing zone modelling requires calculation of the “excess concentration” for the water quality standard over the upstream (background) concentration, or the amount of additional concentration that could be added to the background concentration to maintain the total concentration below the PWQO.

There is no PWQO for TAN but the PWQO for un-ionized ammonia is 0.0164 mg/L. As such, the maximum excess concentration for TAN in order to remain below the PWQO for un-ionized ammonia was determined by back-calculating TAN from an un-ionized ammonia concentration of 0.0164 mg/L using downstream,

[2] *Note that, conventionally-speaking, bank direction is typically assigned as standing facing upstream. CORMIX assumes facing a downstream direction when assigning bank direction.*

fully mixed pH and temperature values that were derived by mass balance for Phase 1 and Full Build Out flows, and subtracting the upstream TAN concentration of 0.055 mg/L from this concentration (Table 7).

Table 7. Calculated Downstream River pH and Temperature and Maximum Excess Concentration of Total Ammonia Nitrogen in the Effluent, for CORMIX Input

Parameter	Phase 1 (0.039 m^3/s)	Full Build Out (0.083 m^3/s)	Rationale
Upstream West Credit River pH and Temperature	pH – 8.21 Temperature – 21.18°C		• The 75th percentile of CVC hydrolab data (June and Aug 2008) • The 75th percentile of August 2016 HESL temperature logger measurements at 10th Line
WWTP pH and Temperature	pH – 8.6 Temperature – 19°C		• Maximum values, as proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*.
Resulting Downstream pH and Temperature	pH – 8.27 Temperature – 20.86°C	pH – 8.32 Temperature – 20.59°C	• By mass balance
Maximum TAN allowable to meet PWQO for un-ionized ammonia at downstream pH and temperature	0.27 mg/L	0.25 mg/L	• Calculated using equation given in *Water Management* (MOE 1994)
Excess TAN concentration over background	0.215 mg/L	0.195 mg/L	• Subtraction of maximum effluent TAN concentration (row above) from 0.055 mg/L (upstream river TAN concentration)

4. Results

4.1 Water Quality

Water quality results are presented in Table 8. Water quality measurements collected at 10th Line confirmed our understanding of baseline conditions for the West Credit River. In 2016, water quality at 10th Line was very good with low concentrations of suspended sediment (TSS), and nutrients (e.g. nitrate, TKN, TP, and ammonia). Total phosphorus (TP), and un-ionized ammonia nitrogen (UI-TAN) concentrations were well below their PWQO values of 0.03 and 0.0164 mg/L respectively; indicating Policy 1 status for these parameters. Dissolved oxygen concentrations were above the PWQO (temperature dependant), indicating a well oxygenated system. Chloride levels were below the chronic long-term Canadian Water Quality Guideline (CWQG) of 120 mg/L and the acute toxicity guideline of 640 mg/L.

Water samples were also collected at 10th Line in 2007 and 2008 (CVC 2011). This water quality data was used to characterize background water quality to inform the ACS. Water quality from 2016 was similar to water quality data measured in 2007 and 2008 (CVC 2011; Table 8), which the exception of TSS. The detection limit for TSS in 2007 and 2008 (<10 mg/L) was higher than the detection limit (<2 mg/L) and TSS concentrations in 2016, therefore comparisons between these results cannot be made. The 2007, 2008, and 2016 data were used to compute the 75th percentile concentrations for the ACS modelling (as per MOECC guidance, Section 1.4). Due to the differences in TSS detection limits between sampling years, only the 2016 TSS data was used to ensure that background concentrations were not overestimated.

Water quality data collected from the West Credit River at Winston Churchill Blvd. (PWQMN station 06007601502) from 2000-2014 was compared to data collected at 10th Line for 2007, 2008, and 2016. The 75th percentile concentrations computed for Winston Churchill Blvd., are for the most part, similar or lower than the 75th percentile concentrations calculated for 10th Line. The lower concentrations of nutrients at Winston Churchill Blvd. has been attributed (CVC 2011) to the input of groundwater between these two stations. The 10th Line statistics (e.g. 75th percentile, median and average values) are based on 5-15 sampling points collected over 3 years (2007, 2008, and 2016), while the Winston Churchill Blvd. statistics are based on 144-164 sampling points over 14 years (2000-2014). Although the statistics calculated for 10th Line are based on a reduced dataset as compared to Winston Churchill Blvd., the 75th percentile concentrations are more conservative (higher predicted background) than those calculated for Winston Churchill Blvd., and therefore were used as inputs into the water quality models (as recommended by CVC and MOECC).

Table 8. Water Quality of West Credit River

Location	Date	Source	VSS	TSS	TAN	Ul-TAN	NO_3-N	NO_2-N	TKN	PO_4	TDP	TP	cBOD	cBODu	Chl a (µg/L)	Cl^-
	PWQO/CWQG					0.02	3	0.06				0.030				120
	27-May-16	HESL	<3	4.8	<0.020	0.0006	1.50	<0.01	0.72	<0.003	0.0059	0.0136	<2	3	3.91	-
	29-Jun-16	HESL	<3	2.4	<0.020	0.0002	1.42	<0.01	0.58	<0.003	0.0062	0.0155	<2	<2	1.97	-
	27-Jul-16	HESL	<3	3.2	0.027	0.0006	1.27	<0.01	0.53	<0.003	0.0113	0.0162	<2	2.7	2.63	-
	25-Aug-16*	HESL	<3	2.0	0.023	0.0016	1.27	<0.01	0.35	<0.003	0.0081	0.0103	<2	<2	2.72	-
	28-Sep-16*	HESL	<3	2.0	<0.020	0.0009	1.58	<0.01	0.39	0.0035	0.0060	0.0088	<2	<2	0.598	50.7
	31-Oct-07	CVC	-	<10	0.030	0.001	2.4	-	0.5	-	-	0.007	<2	-	-	42
	26-Sep-07	CVC	-	<10	0.150	0.011	0.8	-	0.6	-	-	0.030	<2	-	-	23
	26-Nov-07	CVC	-	<10	0.090	0.000	2.3	-	0.4	-	-	0.009	<2	-	-	41
10th Line	31-Jan-08	CVC	-	<10	0.070	0.001	2.3	-	0.6	-	-	0.003	<2	-	-	51
	26-Mar-08	CVC	-	<10	0.050	0.000	2.0	-	0.5	-	-	0.014	<2	-	-	52
	29-Apr-08	CVC	-	<10	0.060	0.002	1.5	-	0.5	-	-	0.007	<2	-	-	46
	25-Jun-08	CVC	-	<10	0.010	0.001	1.3	-	0.5	-	-	0.011	<2	-	-	40
	27-Aug-08	CVC	-	<10	0.010	0.000	1.8	-	0.6	-	-	0.015	<2	-	-	47
	30-Sep-08	CVC	-	<10	0.030	0.001	1.7	-	0.5	-	-	0.02	<2	-	-	43
	05-Nov-08	CVC	-	<10	0.030	0.001	1.8	-	0.4	-	-	0.02	<2	-	-	38
	75%		3	3.2	0.055	0.0010	1.9	0.010	0.59	0.003	0.008	0.016	2	2.7	2.72	48.9
	median		3	2.4	0.030	0.001	1.58	0.010	0.50	0.003	0.006	0.014	2	2	2.63	43.0
	n		5	5	15	15	15	5	15	5	5	15	15	5	5	11
Winston Churchill Blvd. (2000-2014)	75%		-	4.0	0.019	0.0003	2.11	0.009	0.43	0.0025	-	0.015	1.0	-	-	-
	median		-	2.3	0.011	0.0002	1.72	0.007	0.36	0.0011	-	0.011	0.6	-	-	-
	n		-	158	164	144	163	164	164	164	-	164	156	-	-	-

*Notes: all values in mg/L unless note;, *water samples collected 75 m downstream of 10th Line; "–" not sampled*

4.1.1 Dissolved Oxygen and Temperature

Diurnal DO and temperature records (June 10 to August 25, 2016) for the West Credit River at 10th Line and Winston Churchill Blvd. are presented on Figures 6 and 7. Dissolved oxygen conditions in the West Credit River were excellent during this period. Concentrations ranged from 6.71 to 12.98 mg/L at 10th Line, and 7.44 to 12.44 mg/L at Winston Churchill Blvd., well above the PWQO of 6 mg/L for water temperatures of 10 ºC or more (Figures 6 and 7). Nighttime maxima for dissolved oxygen indicated supersaturated conditions. Minimum dissolved oxygen concentrations were slightly higher, and maximum concentrations were slightly lower at Winston Churchill Blvd. (Table 9) than 10th Line, indicating lower diurnal fluctuations in dissolved oxygen. Groundwater discharge in this reach reduced the temperature (Table 9) which would increase dissolved oxygen minima.

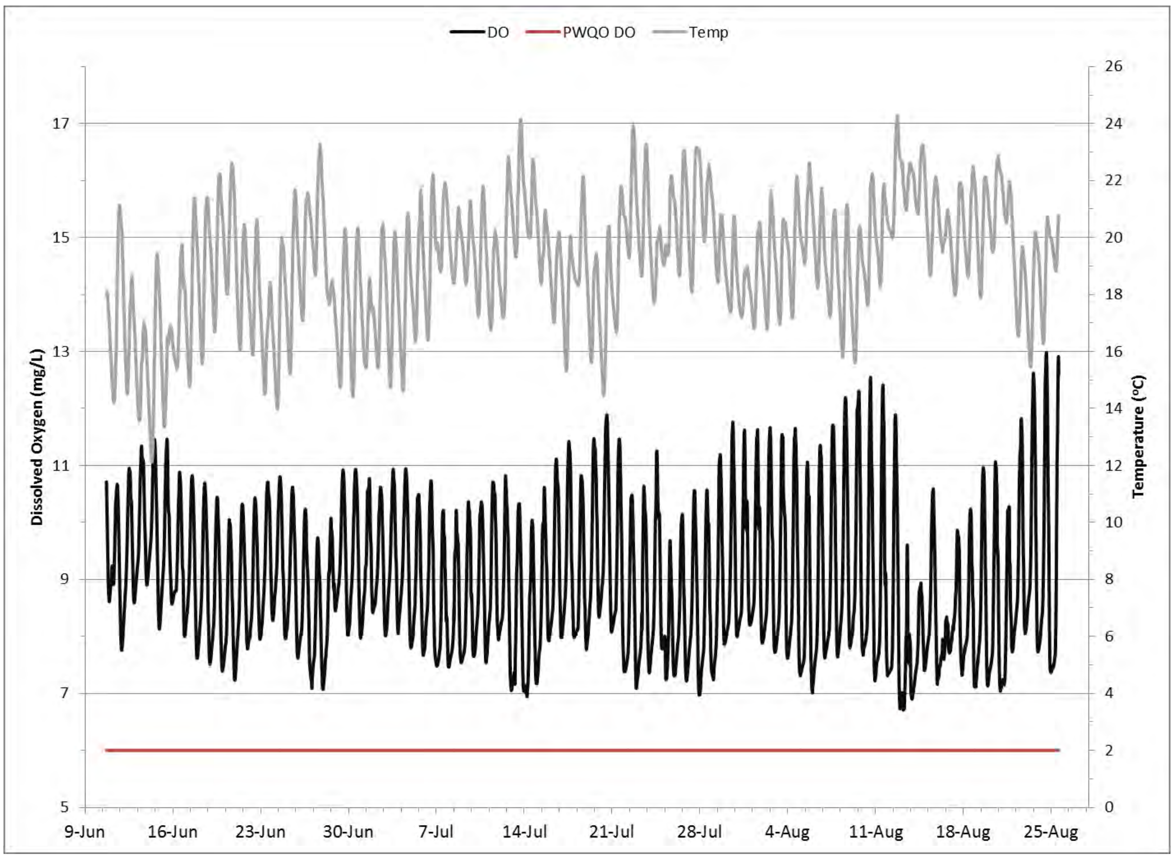


Figure 6 Continuous Dissolved Oxygen and Temperature measurements in the West Credit River at 10th Line (June 10 to August 25 2016)

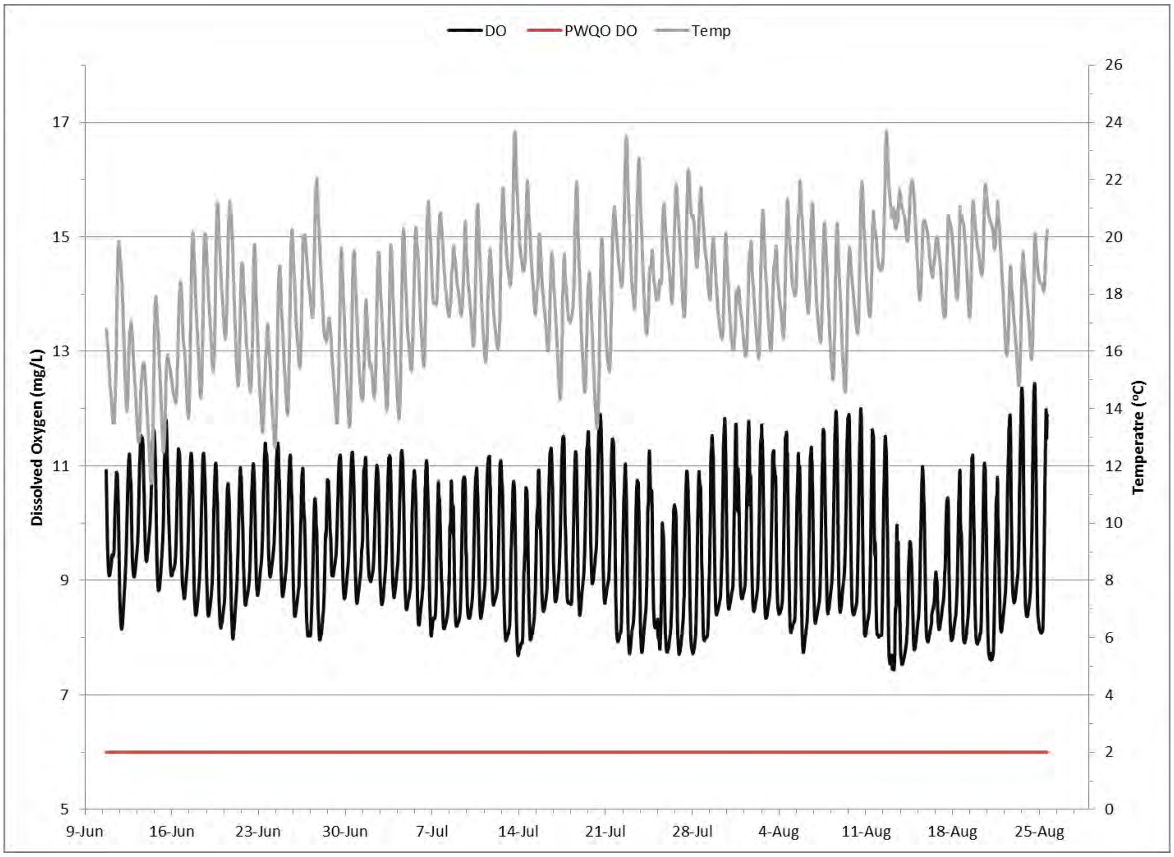


Figure 7 Continuous Dissolved Oxygen and Temperature measurements in the West Credit River at Winston Churchill Blvd. (June 10 to August 25 2016)

Twenty fifth (25th) percentile dissolved oxygen concentrations were calculated (Table 9) for each location as input into the QUAL2K model. Twenty fifth percentile concentrations calculated for 10th Line were lower than those calculated for Winston Churchill Blvd., were and thus a conservative estimate of upstream dissolved oxygen conditions for the ACS.

Table 9 Minima, Maxima, and 25th Percentile Dissolved Oxygen Concentrations (mg/L)

	10th Line			Winston Churchill Blvd.		
	Min	Max	25%	Min	Max	25%
June	7.07	11.46	8.28	7.96	11.81	8.89
Jul	6.94	11.89	7.96	7.69	11.90	8.48
Aug	6.71	12.98	7.72	7.44	12.44	8.29
All Data	6.71	12.98	7.93	7.44	12.44	8.5

Water temperatures ranged from 12.12 to 24.28ºC at 10th Line, and 11.38 to 23.70ºC at Winston Churchill Blvd. The maximum water temperatures were below 26 ºC; below CVC's absolute maximum threshold for coldwater habitat. Minimum and maximum water temperatures were slightly lower at Winston Churchill Blvd. than 10th Line (Table 10). The lower water temperatures at Winston Churchill Blvd are likely from groundwater input cooling the water between the two stations. Seventy-fifth (75th) percentile water temperatures were calculated (Table 8) as input into the QUAL2K model. Seventy-fifth (75th) percentile water temperatures calculated for 10th Line were higher than those calculated for Winston Churchill Blvd., and thus are a conservative estimate of upstream water temperatures for the ACS.

Table 10 Minima, Maxima, and 75th Percentile Water Temperatures (ºC)

	10th Line			Winston Churchill Blvd.		
	Min	Max	75%	Min	Max	75%
June	12.12	23.28	19.66	11.38	22.04	18.18
Jul	14.46	24.16	20.66	13.32	23.68	19.53
Aug	15.46	24.28	21.18	14.58	23.70	20.26
All Data	12.12	24.28	20.66	11.38	23.70	19.58

Dissolved oxygen conditions downstream of 10th Line were monitored in September 2016 (Table 11 and Figure 8). Concentrations were well above the PWQO of 6 mg/L for a water temperature of 10 ºC with a minimum concentration of 7.57 mg/L and maximum concentration of 13.27 mg/L. The diurnal fluctuations in dissolved oxygen decreased around September 7, 2016. At the same time, water temperatures in the river began to show an overall cooling. Minimum and minimum temperatures during this period were 10.08 and 22.36 ºC respectively (Table 11).

Table 11 Summary of Dissolved Oxygen and Water Temperatures 75 m downstream of 10th Line

	DO			PWQO - DO	Temp		
	Min	Max	25%		Min	Max	75%
September	7.57	13.27	8.77	6	10.08	22.36	18.6

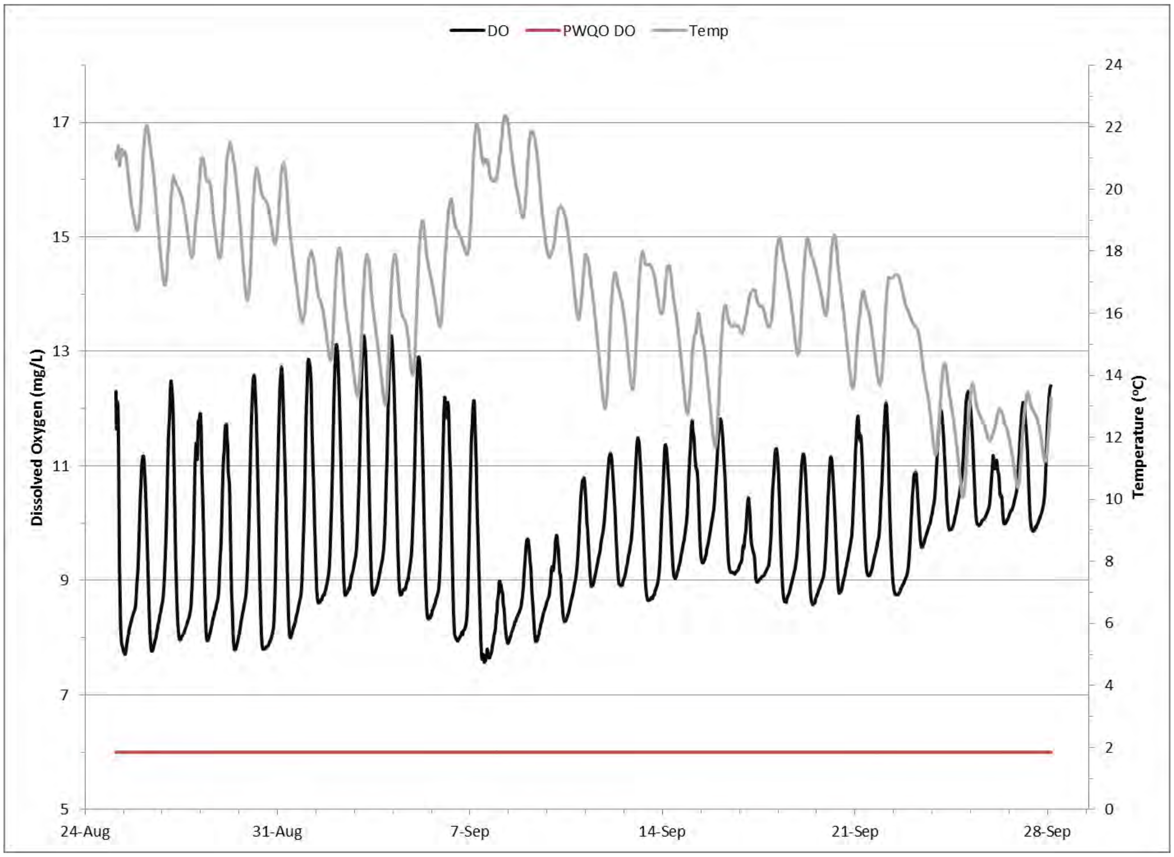


Figure 8 Continuous Dissolved Oxygen and Temperature measured in the West Credit River ~75 m 10th Line (August 25 to September 28, 2016)

4.2 Stream flow

Stream flow was highest in May and decreased throughout the summer months. Flows measured in May, June and July may have been influenced by backwater effects from downstream beaver dam (Table 12). 10th Line flows were greater than the calculated 7Q20 of 225 L/s during each sampling event. The lowest flow of 305 L/s was measured during the August sampling event (downstream of the beaver dam) and was 80 L/s greater than the calculated 7Q20 flow. An increase in flows of 9 to 32% was observed between 10th Line and Winston Churchill Blvd. likely as a result of groundwater inputs.

Table 12 Measured Stream Flows (L/s) in West Credit River

Station	27-May-16	29-Jun-16	27-Jul-16	25-Aug-16	28-Sep-16
10th Line	830 [a]	437 [a]	381 [a]	370 [b]	305 [b]
Winston	N/M	475	502	450	369
% increase	-	9%	32%	22%	21%

Notes: a - downstream beaver dams potentially influencing flow conditions; b – flow measured 75 m downstream of 10th Line; N/M – not measured.

4.3 Stream Characterization

On June 10, 2016 a detailed reconnaissance of the West Credit River study area was undertaken, from 10th Line to Winston Churchill Blvd. A detailed figure showing the river characteristics, distinguishing features such as woody debris, tributary inputs, man-made dams, and the locations of reach breaks (for QUAL2K modelling) was created (Figure 9).

The study area of the West Credit River exhibits an irregular meander pattern. The West Credit River has a relatively moderate trapezoidal cross-section with gentle to steep banks and a bankfull width between approximately 8 m and 12 m within the study area. On the date of the reconnaissance and at all HESL field events (monthly between June and September 2016), the river was easily wadeable.

The water clarity was good, with the river bottom visible. The substrate of the West Credit River in the study area was characterized by fine sediment with some cobbles and rocks. The ratio of fines to rocks/cobbles changed back and forth moving downstream from 10th Line toward Winston Churchill Blvd., but the same combination of substrate was always present (Photograph 4 and 5). A riffle section was noted about 300 m upstream of Winston Churchill Blvd., which was denoted as Reach 5 (Figure 9 and Photograph 6).

The banks were lined with vegetation including tall grasses, shrubs and coniferous trees. Emergent macrophytes were noted along some banks. Bank erosion (under-cutting) was also visible along some bank sections. Beyond the bank vegetation, forest consisting of both coniferous and deciduous trees, lined the north and south banks of river, with the exception of a couple of manicured lawns (residential properties) that were visible on the south river bank.

Fallen woody debris altered the river flow in several sections of the West Credit River study area, as identified on Figure 9 (Photograph 7). In some cases, especially in Reach 3 and Reach 4, the woody debris was thick enough that the river could not be walked. While the woody debris was generally naturally occurring as the result of fallen trees in a dynamic system, beaver dams utilizing the fallen woody debris were noted upstream of 10th Line and about 40 m downstream of 10th Line (Photograph 8). (The beaver dam is discussed in Section 3.1).

Occasional growths of submerged aquatic macrophytes were observed in the West Credit River; however, they were not observed in abundance throughout the study area. Attached algae (periphyton) was noted on some cobbles and rocks (Photograph 5).

Man-made dams created out of cobbles were noted at three locations in the study area (Figure 9, Photograph 9). In some cases the dams had been breached in the centre and in all cases the river water level was near the top or above the man-made dam and was not notably altering flows.

Figure 9:
West Credit River Study
Area Characterization

Intake Pipe
Man-made Dam
Culvert
Tributary Input
Stream
Road
Large Woody Debris
Reach

N

0 25 50 100 150 200 m

Prepared by: Eric Dilligeard
Data Source: LIO, HESL, Esri Imagery.
Coordinate System: NAD 1983 UTM Zone 17N

Project Lead: Tara Roumeliotis and Deborah Sinclair
Project: Town of Erin Class EA Wastewater Servicing. Assimilative Capacity Study
Project#: 160005

November 2016

Hutchinson
Environmental Sciences Ltd.

Three small tributary inputs to the study area were observed on the north bank of the river, in Reach 4 and 5 (Photograph 10). Flows were observed to be low and their influence was captured in the measured increase in flow between 10th Line and Winston Churchill Blvd. (Table 12). The flow contribution from these small tributaries did not have a notable impact on the total flow in the river.

An intake pipe located on the north bank and a culvert located on the south bank were observed, both in Reach 5 in the vicinity of the residential properties. At the time of the reconnaissance, the intake pipe was not drawing water and there was no discharge from the culvert.

The bridge crossings at 10th Line (Photograph 11) and Winston Churchill Blvd. (Photograph 12) represent the only potential human contact points in the West Credit River study area, with the exception of the residences located along the north and south banks in the latter half of the study area. The area near the West Credit River at Winston Churchill Blvd. appears to be a well-visited location and groundwater was flowing from riverbank seeps and drainage pipes to the river (Photograph 13).

Photograph 4. River substrate is mostly fine sediments with few cobbles near 10th Line

Photograph 5. River substrate is fines with cobbles near Winston Churchill Blvd. Note the periphyton on the cobbles

Photograph 6. Riffle section within the West Credit River study area, looking upstream

Photograph 7. Woody debris within the West Credit River study area

Photograph 8. The beaver dam located approximately 40 m downstream of 10th Line, looking upstream

Photograph 9. Breached man made dam within West Credit River study area, looking upstream

Photograph 10. Small tributary entering north bank of West Credit River

Photograph 11. Bridge located at 10th Line, looking downstream

Photograph 12. East side of culvert located at Winston Churchill Blvd., looking upstream

Photograph 13. Groundwater seep at Winston Churchill Blvd

4.4 Dye Tracer Study

Tracer testing was conducted in the West Credit River between 10th Line and Shaws Creek Road (downstream of Winston Churchill Blvd.) on August 25, 2016. The volume of Rhodamine WT 20% dye added to the 10 L bucket of West Credit River water was determined to be 455 mL based on Equation 1.

Figure 10 presents the Rhodamine WT concentration over time, as recorded at each of the fluorometer stations during the slug injection tracer test.

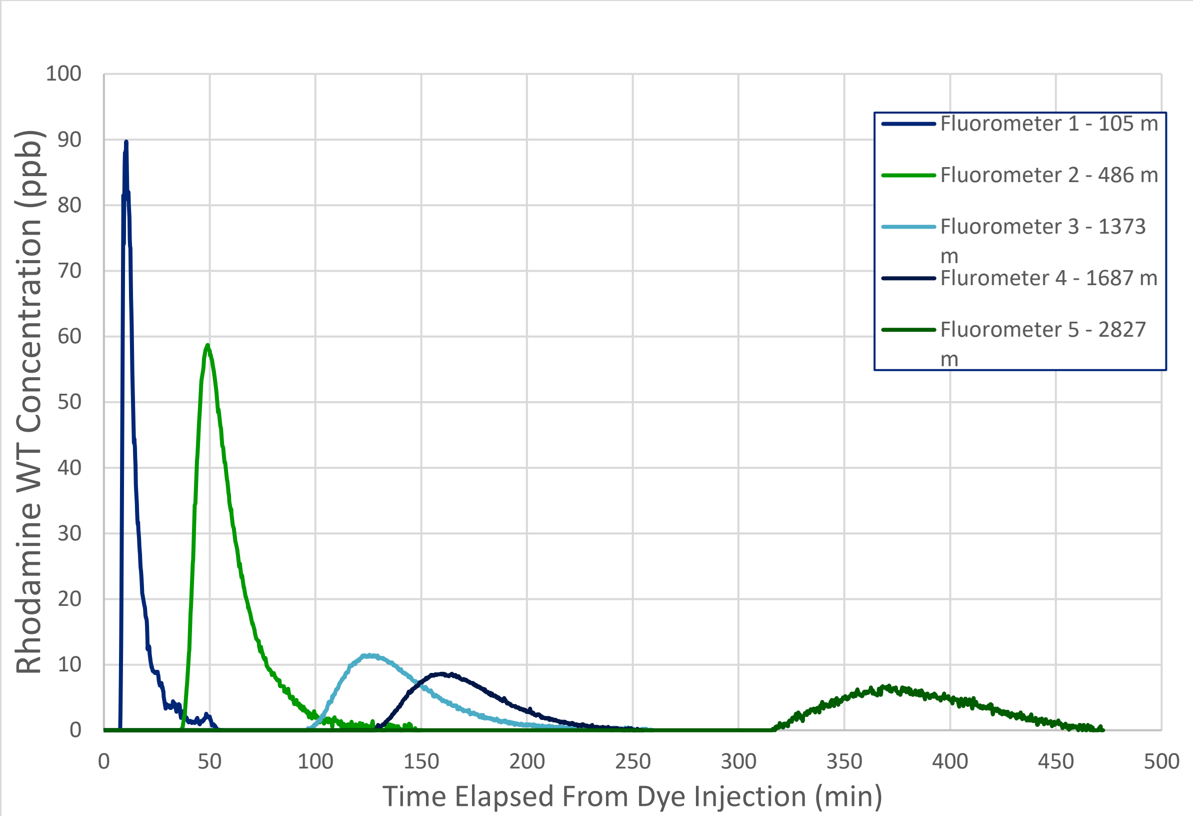


Figure 10 Slug Injection Test Results

The data obtained from the slug injection tests showed that dye dispersion in West Credit River behaved in the expected manner (as per Figure 10) and could therefore be used to determine the time of travel between the dye injection point and each fluorometer station. Data are presented as total travel time (in minutes, Table 13), average velocity (in m/s) between each fluorometer station (Table 14), and longitudinal dispersion (in m^2/min) between each fluorometer station (Table 15).

Table 13. Travel Time Between Fluorometer Stations

Fluorometer	Time of Travel (min)
1 (105 m)	16
2 (486 m)	59
3 (1,373 m)	140
4 (1,687 m)	171
5 (2,827 m)	382

Table 14. West Credit River Velocity (m/s) between Fluorometer Stations

Upstream Fluorometer	Downstream Fluorometer				
	Fluorometer 1	Fluorometer 2	Fluorometer 3	Fluorometer 4	Fluorometer 5
Fluorometer 1	x	0.15	0.17	0.17	0.12
Fluorometer 2	x	x	0.18	0.18	0.12
Fluorometer 3	x	x	x	0.17	0.10
Fluorometer 4	x	x	x	x	0.09
Fluorometer 5	x	x	x	x	x

*Table should be read as the dispersion between the upstream fluorometer (list in 1st column) and the next fluorometer of interest, by reading along the appropriate row.

Table 15. West Credit River Longitudinal Dispersion (m^2/min) between Fluorometer Stations

Upstream Fluorometer	Downstream Fluorometer				
	Fluorometer 1	Fluorometer 2	Fluorometer 3	Fluorometer 4	Fluorometer 5
Fluorometer 1	x	51	139	164	184
Fluorometer 2	x	x	203	222	194
Fluorometer 3	x	x	x	264	158
Fluorometer 4	x	x	x	x	135
Fluorometer 5	x	x	x	x	x

*Table should be read as the velocity between the upstream fluorometer (list in 1st column) and the next flurometer of interest, by reading along the appropriate row.

The average West Credit River velocity for the August 25, 2016 slug injection test was calculated as 0.17 m/s between 10th Line and Winston Churchill Blvd. (Table 14). The data also show that the river moves more slowly downstream of Winston Churchill Blvd., toward Shaws Creek Road.

4.5 Mass Balance Modelling – Total Phosphorus, Total Ammonia Nitrogen and Nitrate

The treated effluent flows from the proposed Erin WWTP are limited by total phosphorus concentrations with respect to both treatment technology limits for TP removal in wastewater and the need to maintain fully mixed TP concentrations in the West Credit River within their site-specific water quality objective of 0.024

mg/L (Appendix D). A mass balance model was used to back-calculate maximum effluent flows based on varying effluent TP concentrations, 7Q20 low flows in the West Credit River, and a fully mixed downstream TP concentrations of 0.024 mg/L in the river (Table 16).

Table 16. Maximum WWTP Effluent Flows Corresponding to Effluent TP Concentrations and a Downstream TP Concentration of 0.024 mg/L

Effluent Total Phosphorus Concentration (mg/L)	Maximum WWTP Effluent Flow (m^3/d)
0.15	1,234
0.1	2,046
0.07	3,380
0.05	5,982
0.045	7,406

Based on the results of the TP mass balance modelling, HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m^3/s and a Full Build Out flow of 7,172 m^3/s corresponding to effluent total phosphorus concentrations of 0.07 and 0.046 mg/L respectively.

Using these Phase 1 and Full Build Out effluent flows, mass balance modelling of TAN and nitrate were carried out to determine appropriate WWTP effluent limits for these parameters. The resulting effluent limits were then confirmed using the far-field QUAL2K model, and in the case of TAN, the near-field (mixing zone) CORMIX model.

The TAN mass balance results are presented in Table 17. The corresponding un-ionized ammonia concentrations were computed using the fully mixed downstream pH and temperature (see Table 6 for particulars on downstream mass balance of pH and temperature), and compared against the PWQO of 0.0164 mg/L un-ionized ammonia nitrogen (Table 18).

Table 17. Fully Mixed Downstream Total Ammonia Nitrogen Concentration (mg/L) for Varying Effluent Concentrations, at Phase 1 and Full Build Out Effluent Flows

Effluent Flow (m3/d)	Effluent Concentration			
	TAN=1.2 mg/L	TAN=1.0 mg/L	TAN=0.8 mg/L	TAN=0.6 mg/L
Phase 1 – 3,381	0.22	0.20	0.17	0.14
Full Build Out – 7,172	0.36	0.31	0.26	0.20

Table 18. Fully Mixed Downstream Un-ionized Ammonia Concentration (mg/L) for Varying Effluent TAN Concentrations, at Phase 1 and Full Build Out Effluent Flows

Effluent Flow (m^3/d)	Effluent Concentration			
	TAN=1.2 mg/L	TAN=1.0 mg/L	TAN=0.8 mg/L	TAN=0.6 mg/L
Phase 1 – 3,381	0.016	0.014	0.012	0.010
Full Build Out – 7,172	***0.028***	***0.024***	***0.020***	0.016

Note: Bold and italicized concentrations represent an exceedance of the PWQO for un-ionized ammonia

As shown in Tables 17 and 18, effluent TAN concentrations were varied from 1.2 mg/L to 0.6 mg/L. At a summer TAN concentration of 1.2 mg/L, which was initially based on email correspondence dated October 3, 2016 from the MOECC providing guidance on effluent limits (Appendix E), un-ionized ammonia concentrations were below the PWQO at fully mixed Phase 1 effluent flows; however, at Full Build Out flows, the PWQO was exceeded. The effluent TAN concentration was decreased until, at a concentration of 0.6 mg/L, the PWQO was met.

As such, summer TAN effluent concentrations of 1.2 mg/L (Phase 1) and 0.6 mg/L (Full Build Out) were carried forward for further examination in the QUAL2K and CORMIX models.

Of note, winter effluent TAN concentrations (of 2 mg/L at both Phase 1 and Full Build Out flows) were also checked to determine the corresponding concentration of un-ionized ammonia. Since speciation of ammonia to its un-ionized state is driven by increasing temperature and pH, un-ionized ammonia at winter temperatures is rarely of concern. In this case, the Phase 1 and Full Build Out flows corresponded with winter un-ionized ammonia concentrations of 0.003 mg/L and 0.006 mg/L, respectively, assuming a water temperature of 4°C. Therefore, the winter effluent TAN concentrations are acceptable.

The nitrate mass balance results are presented in Table 19.

Table 19. Fully Mixed Downstream Nitrate-N Concentration (mg/L) for Varying Effluent Concentrations, at Phase 1 and Full Build Out Effluent Flows

Effluent Flow (m^3/d)	Effluent Concentration	
	Nitrate=6 mg/L	Nitrate=5 mg/L
Phase 1 – 3,381	2.51	2.36
Full Build Out – 7,172	3.00	2.74

At effluent nitrate-N concentrations of 5 and 6 mg/L (which were the effluent objective and limit concentrations proposed in the B.M. Ross, 2014, *West Credit River Assimilative Capacity Study*), the fully mixed downstream nitrate-N concentrations were at or below the CWQG of 3 mg/L nitrate-N for both the Phase 1 and Full Build Out effluent flows. However, nitrification (which would increase the nitrate concentrations in the river) is expected in the West Credit River which is not accounted for in the mass balance model. Given that the effluent nitrate concentration of 6 mg/L results in a fully mixed downstream concentration that is at the CWQG of 3 mg/L, this does not leave any room for the generation of additional nitrate through nitrification. As such, the lower effluent nitrate-N concentration of 5 mg/L was carried forward for further examination in QUAL2K. QUAL2K modelling confirmed that a nitrate concentration of 5 mg/L at Full Build Out flows would maintain the downstream mixed nitrate concentration below the CWQG of 3 mg/L.

4.6 Mass Balance Modelling – Chloride

The current chloride concentrations in the West Credit River are generally low (75th percentile concentration of 48.9 mg/L) and do not vary greatly (median = 43 mg/L). The highest values (50 and 51 mg/L) were observed in January and March, consistent with road salt influence while other potential influences include water softeners and septic systems.

The maximum WWTP effluent chloride concentration was estimated to be 534 mg/L, with average and minimum concentrations of 396 mg/L and 200 mg/L respectively (Appendix D). Predicted chloride levels in the Erin WWTP effluent were developed using data from communities with similar drinking water characteristics to Erin, including the Town of Orangeville, Elora (Wellington County), Arthur (Wellington County) and Mount Forest (Wellington County). Average WWTP effluent average chloride concentrations for these communities was found to be between 197 to 500 mg/L. Maximum WWTP effluent chloride concentrations for these communities ranged between 274 to 713 mg/L. The predicted chloride concentrations in the Erin WWTP effluent was calculated by taking the average of the chloride concentrations in the effluent from the other WWTPs (Appendix D).

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.

Table 20. Fully Mixed Downstream Chloride Concentrations (mg/L) for Varying Effluent Concentrations, at Phase 1 and Full Build Out Effluent Flows

Effluent Flow (m^3/d)	Effluent Concentration	
	Chloride- 534 mg/L	Chloride – 396 mg/L
Phase 1 – 3,381	121	100
Full Build Out – 7,172	180	142

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.

A mussel survey was completed in the WCR from 10th Line to Shaw's Creek Road on October 3, 2017 by Natural Resource Solutions Inc. (NSRI Inc.; Appendix H). The mussel survey was in response to MOECC's comment regarding the projected effect of increased chloride concentrations in the WCR on species at risk (SAR) mussels (Appendix H). The survey found no SAR mussels within the surveyed reach, or review of background information for the WCR. Based on the investigation, the increase in chloride concentrations would not result in impacts to SAR mussels (NSRI 2017 – Appendix H).

4.7 Far-Field Water Quality Modelling (QUAL2K)

Downstream, far-field concentrations of dissolved oxygen, nitrate and un-ionized ammonia, as predicted by the QUAL2K model, were of particular interest. The far-field model results for these parameters are presented in the following sub-sections. All QUAL2K water quality output data can be found in Appendix F. The actual WWTP discharge location has not yet been determined; however, for the purposes of the running the QUAL2K model, the discharge was simulated as entering the West Credit River at 10th Line. This is considered a conservative location since it has been established that water quality in the West Credit River study area improves moving downstream to Winston Churchill Blvd. The choice of the preferred location will also consider the specific ecological sensitivities within this reach of river and factors such as access or cost.

4.7.1 Dissolved Oxygen Far-Field Modelling Results

For the Phase 1 summer low flow scenario, dissolved oxygen concentrations were predicted to decrease by approximately 1 mg/L to a minimum concentration of 6.73 mg/L at a distance approximately 700 m to 1 km downstream of the simulated WWTP discharge location and then begin recovering (Figure 11). 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.

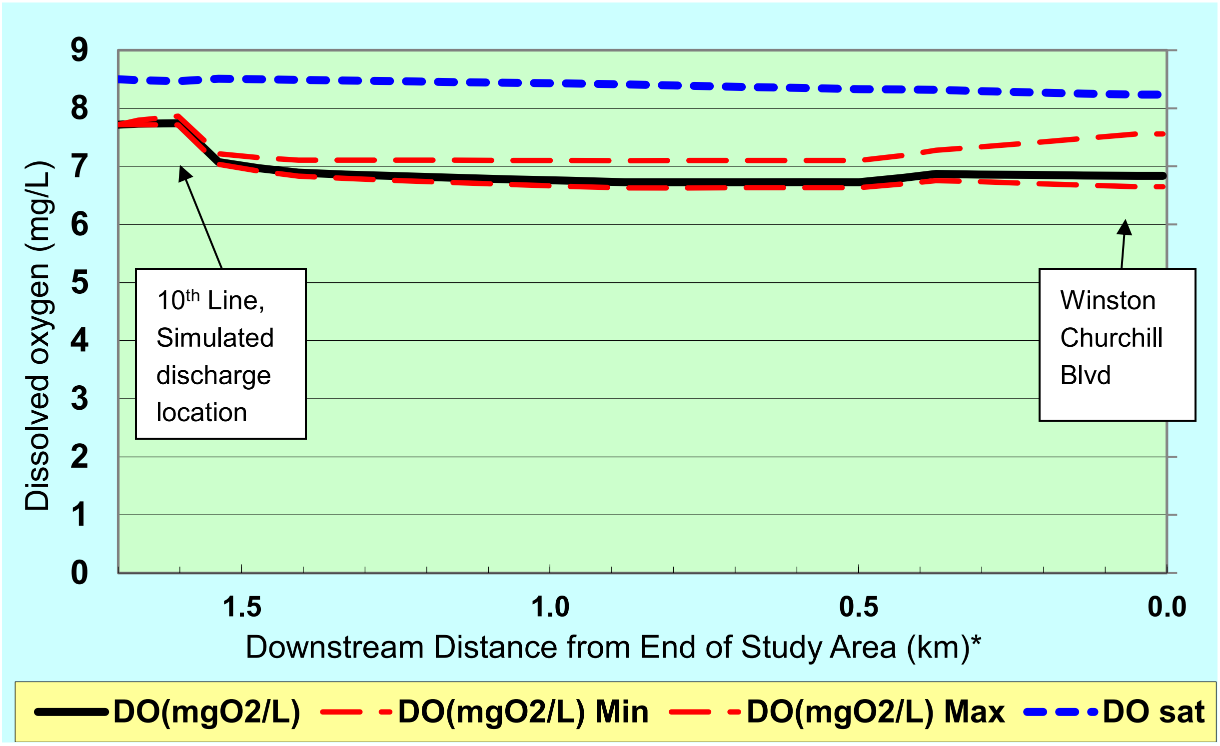


Figure 11. Phase 1: Dissolved Oxygen in the West Credit River Predicted by QUAL2K for Low Summer flow and 5 mg/L Effluent cBOD

*Note: *QUAL2K model calculates using a descending distance from the upstream-most point in the study area. In this case, the model begins at 1.7 km (which corresponds to 100 m upstream of 10th Line) and ends at 0 km (which corresponds to 40 m downstream of Winston Churchill Blvd.).*

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 simulated WWTP discharge location and then begin recovering (Figure 12). 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.

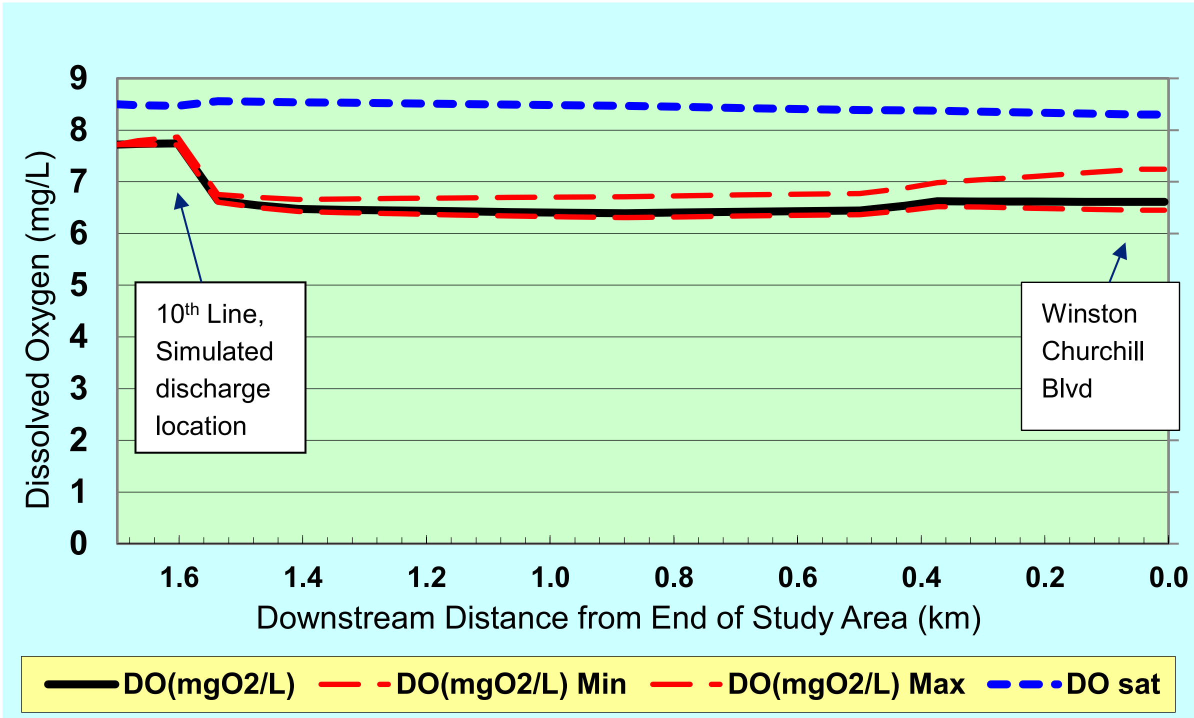


Figure 12. Full Build Out: Dissolved Oxygen in the West Credit River Predicted by QUAL2K for Low Summer flow and 5 mg/L Effluent cBOD

4.7.2 Un-ionized Ammonia Far-Field Modelling Results

For the Phase 1 summer low flow scenario, the maximum un-ionized ammonia concentration beyond the point of complete mixing was predicted at 16.1 µg/L for 1.2 mg/L effluent ammonia (Figure 13), which is below the PWQO of 16.4 µg/L. Un-ionized ammonia concentrations declined to 9.3 µg/L at the downstream edge of the study area.

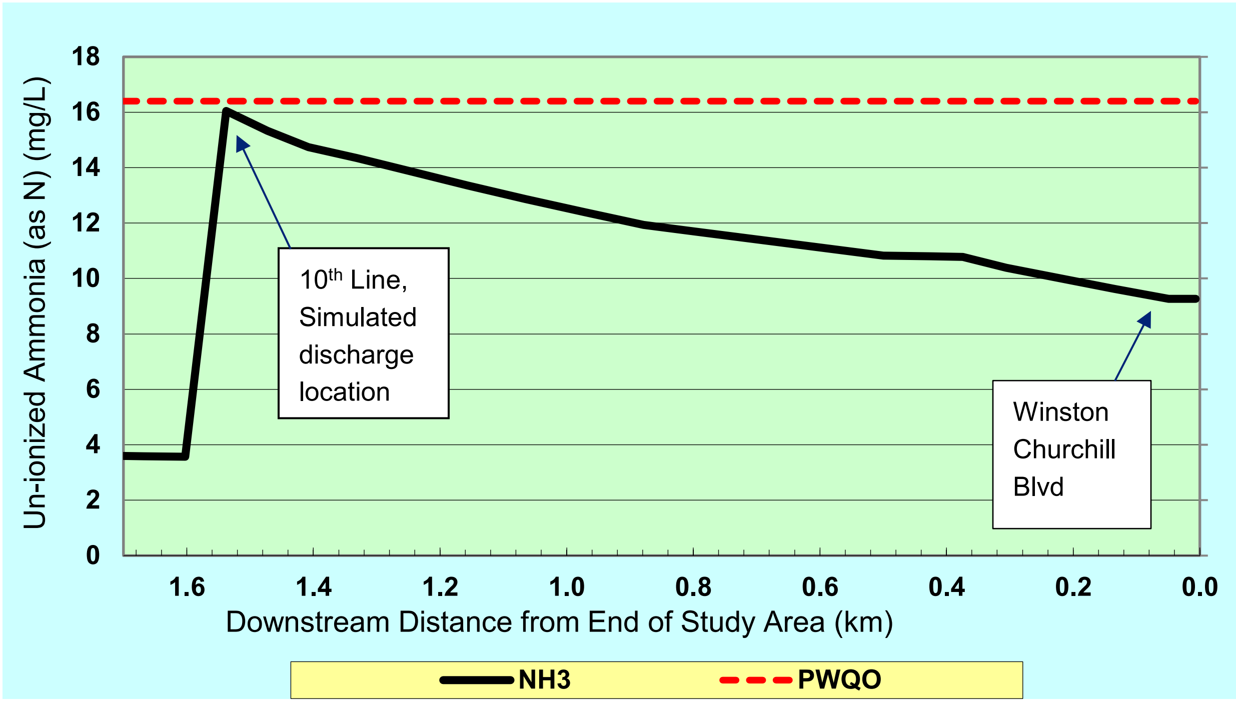


Figure 13. Phase 1: Un-ionized Ammonia in the West Credit River Predicted by QUAL2K for Low Summer flow and 1.2 mg/L Effluent TAN

For the Full Build Out summer low flow scenario, the maximum un-ionized ammonia concentration beyond the point of complete mixing was predicted at 16.1 µg/L for 0.6 mg/L effluent ammonia (Figure 14), which is below the PWQO of 16.4 µg/L. Un-ionized ammonia concentrations declined to 9.9 µg/L at the downstream edge of the study area.

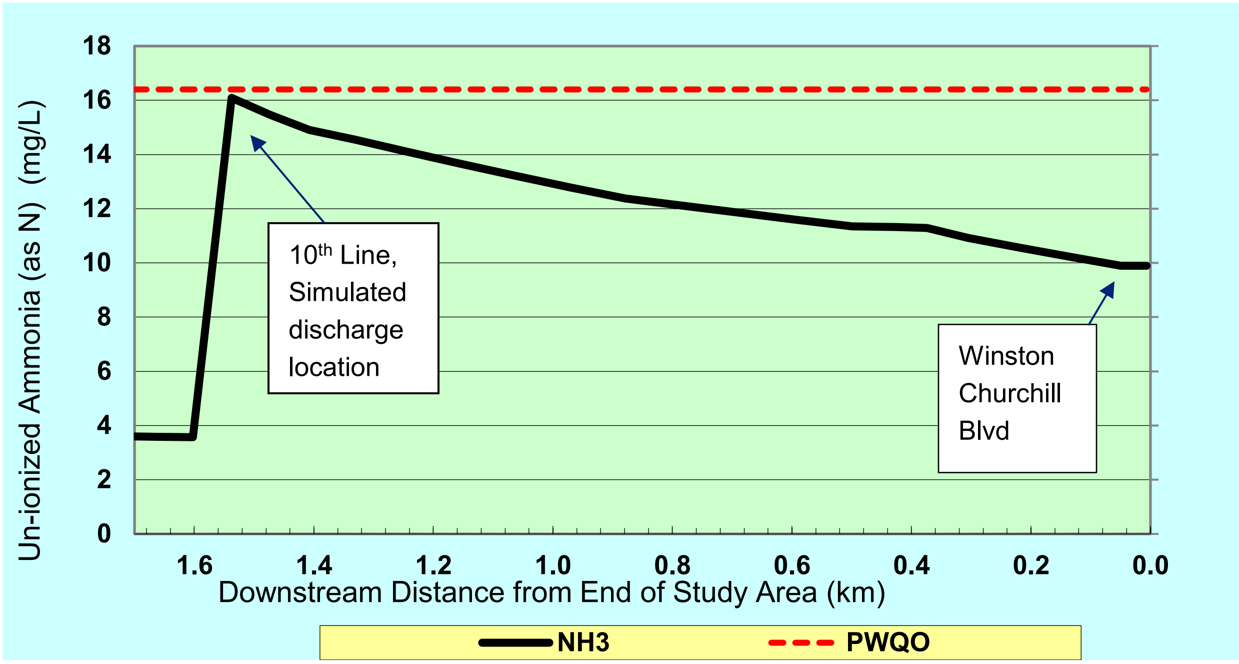


Figure 14. Full Build Out: Un-ionized Ammonia in the West Credit River Predicted by QUAL2K for Low Summer flow and 0.6 mg/L Effluent TAN

4.7.1 Nitrate Far-Field Modelling Results

For the Phase 1 summer low flow scenario, the maximum nitrate concentration beyond the point of complete mixing was predicted to remain below the CWQG of 3 mg/L, with a maximum concentration of approximately 2.4 mg/L (Figure 15).

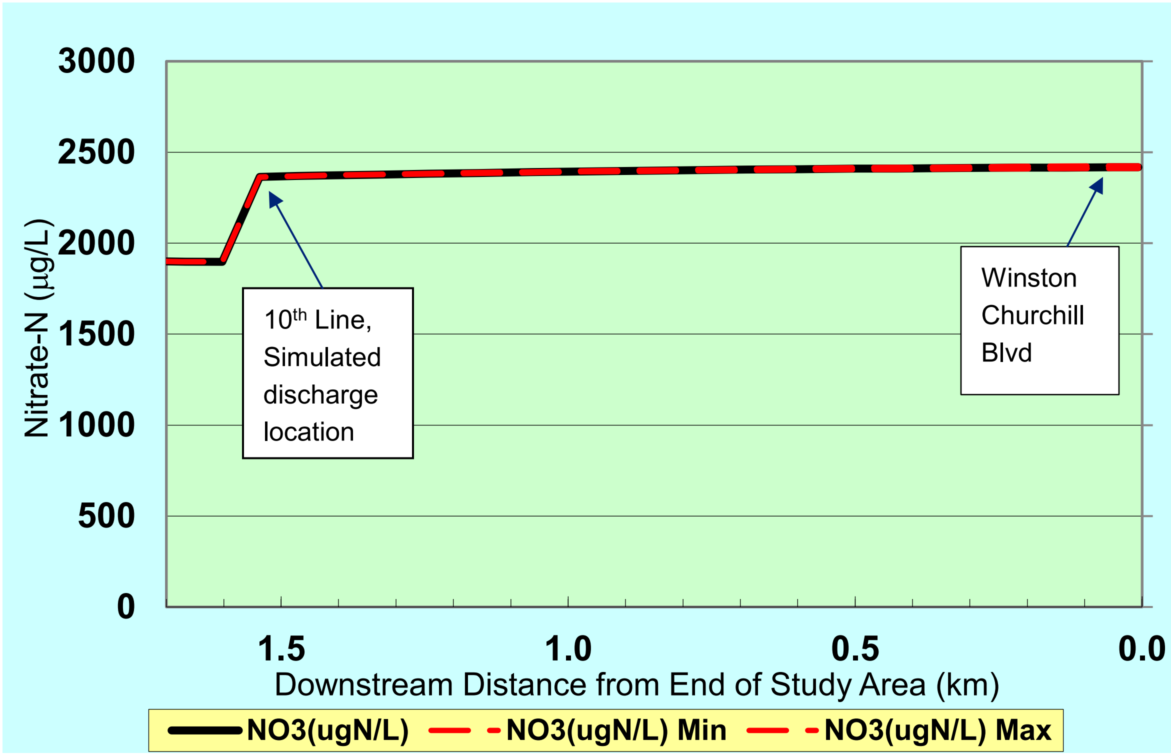


Figure 15. Phase 1: Nitrate-N in the West Credit River Predicted by QUAL2K for Low Summer flow and 5 mg/L Effluent Nitrate-N

For the Full Build Out summer low flow scenario, the maximum nitrate concentration beyond the point of complete mixing was predicted to remain below the CWQG of 3 mg/L, with a maximum concentration of approximately 2.8 mg/L (Figure 16).

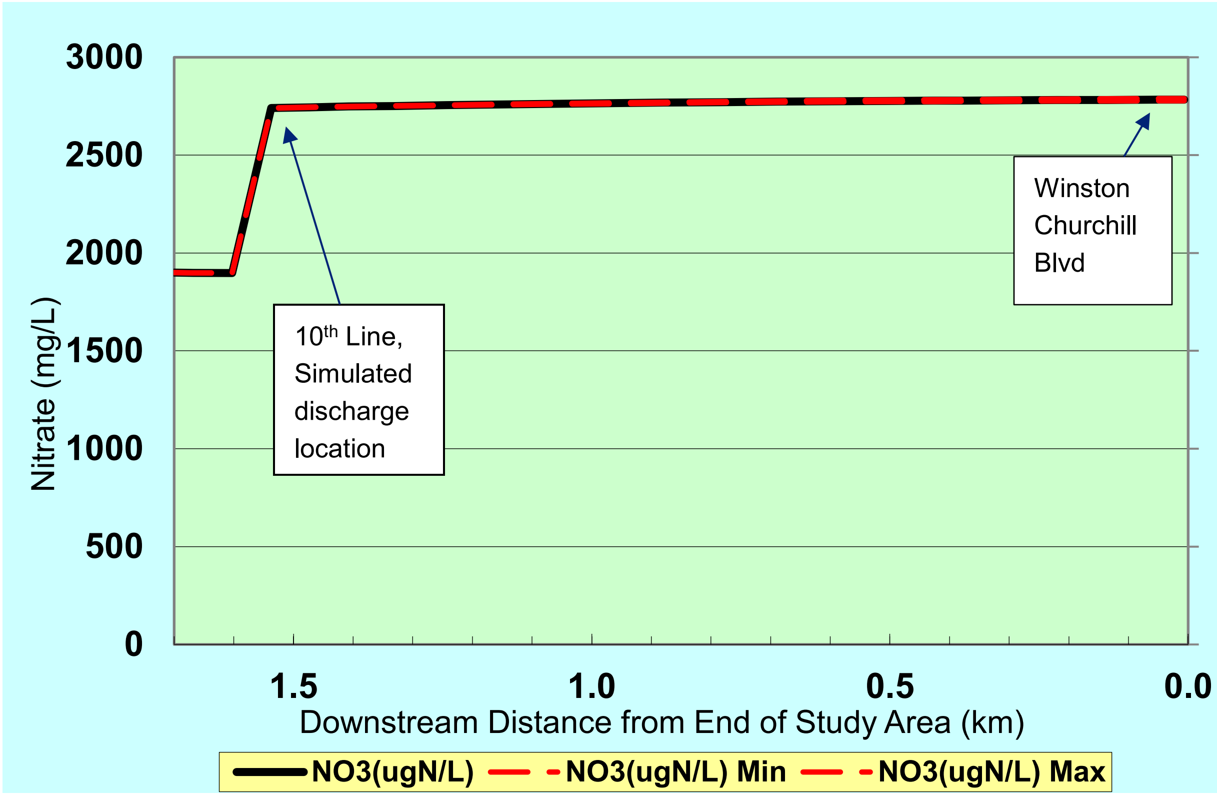


Figure 16. Full Build Out: Nitrate-N in the West Credit River Predicted by QUAL2K for Low Summer flow and 5 mg/L Effluent Nitrate-N

4.7.2 Summary of Far-Field Modelling

The summer low flow Phase 1 and Full Build Out scenarios resulted in dissolved oxygen concentrations above the PWQO at all locations in the West Credit River downstream of the point of complete mixing (Table 21).

Table 21. Overview of QUAL2K Modelling Results for Dissolved Oxygen

Development Phase (Effluent Flow)	CBOD Concentration (mg/L)	Minimum West Credit River Dissolved Oxygen Concentration and Location
Phase 1 (3,380 m^3/d)	5	6.73 mg/L at 0.7 to 1 km
Full Build Out (7,172 m^3/d)		6.39 mg/L at 0.7 km

The summer low flow Phase 1 and Full Build Out scenarios resulted in un-ionized ammonia concentrations below the PWQO at all locations in the West Credit River (Table 22), downstream of the point of complete mixing. The un-ionized ammonia concentrations declined with distance from the outfall and reached concentrations between 9.3 and 9.9 µg/L at the downstream end of the study area (i.e., Winston Churchill Blvd.), 1.5 km from the point of discharge (Table 22). These concentrations are well below the PWQO.

Table 22. Overview of QUAL2K Modelling Results for Un-ionized Ammonia

Development Phase (Effluent Flow)	**Effluent Total Ammonia Concentration (mg/L)**	**West Credit River NH_3 Concentration:**	
		Maximum after discharge (assuming complete mixing, µg/L)	At 1.5 km downstream of outfall (µg/L)
Phase 1 (3,380 m^3/d)	1.2	16.1	9.3
Full Build Out (7,172 m^3/d)	0.6	16.1	9.9

For nitrate-N in both the Phase 1 and Full Build Out summer low flow scenario, the maximum nitrate concentration beyond the point of complete mixing was predicted to remain below the CWQG of 3 mg/L throughout the study area.

Given that the maximum summer water temperature for the WWTP effluent of 19°C 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.

4.8 Mixing Zone Modelling (CORMIX)

The mixing zone modelling focussed on ammonia as the potentially toxic component of the effluent that is assimilated by a) dilution in the near field area through initial mixing with the creek and b) nitrification, the biological conversion of ammonia to nitrate. There were two aspects to the assessment of ammonia:

- The requirement that undiluted effluent be non-acutely lethal at the point of discharge; and
- The determination of the size and characteristics of the mixing zone for ammonia in the West Credit River.

These two assessment aspects are detailed below.

4.8.1 Effluent characteristics - Non-lethal Effluent Requirement

The MOECC requires that all effluent discharging to surface waters be non-acutely lethal at the end of the pipe. This requires an effluent concentration of 0.27 mg/L or less of un-ionized ammonia (NH_3) as a conservative estimate of the lethal threshold[3]. An effluent pH of 8.6 and temperature of 19°C, were used to estimate un-ionized ammonia concentrations based on recommendations made by B.M Ross (2014). The maximum effluent total ammonia concentration (corresponding to 0.27 mg/L of un-ionized ammonia) was calculated to be 2.1 mg/L. Thus, a total ammonia effluent limit of 2.1 mg/L or less would meet the requirement for non-lethality during the summer discharge period.

4.8.2 Near-Field (Mixing Zone) Model Results – Phase 1

At a Phase 1 effluent flow of 0.039 m^3/s, with the outfall modelled as a pipe discharge at the level of the water surface, pointing perpendicular to the water surface, CORMIX predicted that the plume would immediately attach to the near bank. Mixing was dominated by the initial momentum of the effluent discharge, causing spreading towards the far bank of the river. Following this initial momentum, the cross flow of the West Credit River began to dominate, bending the plume toward the downstream bank. The plume then began to spread laterally (buoyant spreading) while being advected downstream. In the final mixing region, ambient was the predominant mixing process and the plume grew in the vertical and horizontal directions.

The CORMIX model predicted that the plume will encounter the opposite bank at a distance 24 m downstream of the outfall, meet the PWQO of 0.0164 mg/L at 25 m downstream, and become fully mixed at 39 m downstream. Note that although the plume contacts the opposite bank prior to meeting the PWQO, the plume is not homogenously mixed at this point and therefore there is width available for safe passage of aquatic species. Ammonia concentrations laterally across the river at 24 m were computed using Equation 8 to determine the width of the plume that met PWQO at this point (Table 23). The centreline concentration presented in the CORMIX prediction file was located along the nearest river bank.

[3] *The MOECC does not provide formal documented guidance on what levels of un-ionized ammonia are considered acutely toxic. We therefore consulted EPA (2009) which recommends 5 mg/L ammonia nitrogen as a criterion for acute toxicity at pH 8 and 25ºC or, that the average not exceed 4.5 mg/L over any 4 day period. Total ammonia concentrations of 5 and 4.5 mg/L correspond to un-ionized concentrations of 0.27 and 0.24 mg/L respectively at pH 8 and 25ºC. USEPA. 2009. DRAFT 2009 UPDATE AQUATIC LIFE AMBIENT WATER QUALITY CRITERIA FOR AMMONIA – FRESHWATER EPA 822-D-09-001. December 2009. Environment Canada (2009) provide a median LC50 of 0.481 mg/L unionized ammonia (NH_3) for rainbow trout and 1.16 mg/L for the most sensitive daphnid (water flea) species tested. An effluent concentration of 0.27 mg/L or less (as derived using EPA (2009) is therefore a conservative estimate of a concentration that would assure no acute toxicity to test organisms. Environment Canada/Health Canada (2001) Canadian Environmental Protection Act. Ammonia in the Aquatic Environment – Priority Substances List Assessment Report. February 2001. TD195.A44P74 2000.*

Table 23. Total Ammonia Nitrogen Concentrations Laterally Across River at 24 m Downstream (Location where Plume Encounters Opposite Bank) for Phase 1 Pipe Design

Lateral Distance from Centerline Concentration (m)	Total Ammonia Nitrogen Concentration (mg/L)
1	0.269
2	0.264
3	0.256
4	0.244
5	0.231
6	0.215
7	0.199
8	0.182
9	0.166
10	0.150
11	0.134

From Tables 17 and 18, the PWQO for un-ionized ammonia at Phase 1 flows was met at a TAN concentration of 0.27 mg/L. Thus, from Table 23, the PWQO was met at a distance of 1 m from the closest bank (i.e., the location of the centerline concentration). Therefore, there is about 10% of the width of the river available for fish passage.

The Phase 1 flows were also modelled as discharged from a 5 m long diffuser located parallel to the south bank of the river, with 10 ports opening vertically upward. (The Full Build Out flows were modelled as a diffuser discharge, which is discussed further below. Therefore, for consistency, the Phase 1 flows were also modelled as a diffuser discharge).

With the diffuser design, the CORMIX model predicted that the plume will encounter the opposite bank at a distance 72 m downstream of the outfall, meet the PWQO of 0.0164 mg/L at 100 m downstream, and become fully mixed at 121 m downstream. The low velocities from the individual diffuser ports result in less jet momentum spreading the plume across the width of the river. Therefore, there is less initial mixing with river water and the plume requires a larger downstream distance to meet PWQO.

Ammonia concentrations laterally across the river at 72 m downstream were computed using Equation 8 to determine the width of the plume that met PWQO at this point (Table 24). The centreline concentration presented in the CORMIX prediction file was located along the nearest river bank.

Table 24. Total Ammonia Nitrogen Concentrations Laterally Across River at 72 m Downstream (Location where Plume Encounters Opposite Bank) for Phase 1 Diffuser Design

Lateral Distance from Centerline Concentration (m)	Total Ammonia Nitrogen Concentration (mg/L)
1	0.323
2	0.316
3	0.306
4	0.292
5	0.275
6	0.256
7	0.235
8	0.214
9	0.193
10	0.173
11	0.154

For the Phase 1 diffuser scenario at 72 m downstream, the PWQO was met at a distance of 6.5 m from the closest bank (i.e., the location of the centerline concentration). Therefore, there is about 40% of the width of the river available for fish passage.

4.8.3 Near-Field (Mixing Zone) Model Results – Full Build Out

At a Full Build Out effluent flow of 0.083 m^3/s, and the outfall modelled as a pipe discharge at the level of the water surface, pointing perpendicular to the water surface, CORMIX could not predict the downstream mixing with any degree of certainty because the momentum of the Full Build Out effluent flow in comparison to the 7Q20 West Credit River flow resulted in numerous hydraulic jumps in the vicinity of the outfall. Further, the momentum of the discharge caused the plume to spread very quickly across the width of the river (i.e., within a few meters downstream), thus blocking any means of fish passage around the outfall. For these reasons, a multi-port diffuser was designed and modelled. The diffuser was identical in design to the one described above for the Phase 1 discharge, with the exception that there were 5 additional ports (for 15 ports total).

The CORMIX model predicted that the plume will encounter the opposite bank at a distance 42 m downstream of the outfall, meet the PWQO of 0.0164 mg/L at 152 m downstream, and become fully mixed at 187 m downstream. Since the exit velocity of the discharge from the multi-port diffusers is higher for Full Build Out flows than Phase 1 flows, the additional momentum causes the opposite bank to be encountered more quickly than for the Phase 1 scenario (42 m versus 72 m downstream). However, this opposite bank interaction limits the amount of mixing that can occur, resulting in a longer downstream distance to meet the PWQO.

Ammonia concentrations laterally across the river at 42 m downstream were computed using Equation 8 to determine the width of the plume that met PWQO at this point (Table 25). The centreline concentration presented in the CORMIX prediction file was located along the nearest river bank.

Table 25. Total Ammonia Nitrogen Concentrations Laterally Across River at 42 m Downstream (Location where Plume Encounters Opposite Bank) for Full Build Out Diffuser Design

Lateral Distance from Centerline Concentration (m)	Total Ammonia Nitrogen Concentration (mg/L)
1	0.329
2	0.322
3	0.311
4	0.297
5	0.279
6	0.260
7	0.239
8	0.218
9	0.196
10	0.176
11	0.157

For the Full Build Out diffuser scenario at 42 m downstream, the PWQO is met at a distance of 6.5 m from the closest bank (i.e., the location of the centerline concentration). Therefore, there is about 40% of the width of the river available for fish passage.

A 2-d figure showing a top view (i.e., "bird's eye view") of the plume created by the multi-port diffuser at Full Build Out effluent flows is presented in Figure 17. The red-shaded regions (which hug the southern bank) represent areas with the highest TAN concentrations.

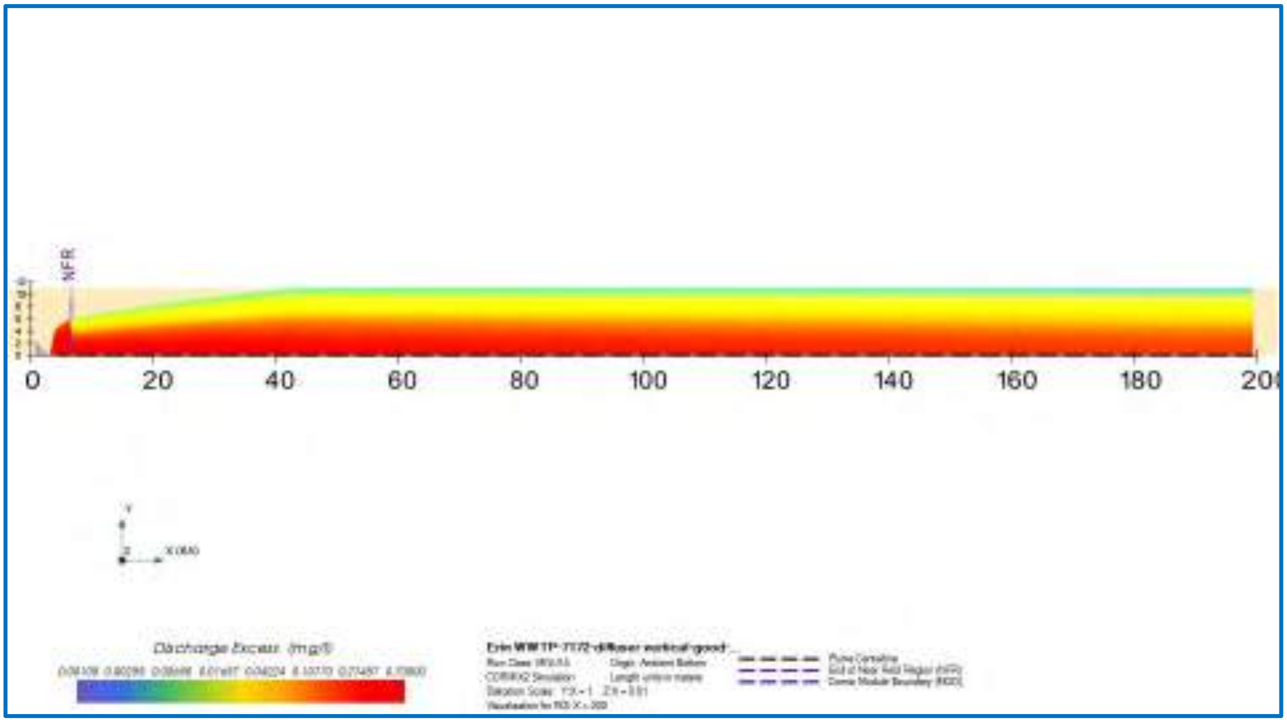


Figure 17. Top View of Full Build Out Discharge Plume for Summer Low River Flow and 0.7 mg/L Effluent Ammonia

4.8.4 Summary of Near-Field CORMIX Modelling

The Phase 1 effluent flow of 0.039 m^3/s was modelled as a pipe discharge at the level of the water surface, pointing perpendicular to the water surface, and also as a multi-port diffuser from a 5 m long diffuser located parallel to the south bank of the river, with 10 ports opening vertically upward. The Full Build Out effluent flow of 0.083 m^3/s was modelled as a multi-port diffuser only, with 15 ports.

The mixing zone results are presented below. CORMIX output results are presented in Appendix G.

Table 26. Summary of CORMIX Mixing Zone Modelling Results

Parameter	Phase 1 Pipe Discharge	Phase 1 Multiport Diffuser	Full Build Out Multiport Diffuser
Distance to Meet PWQO (m downstream of outfall)	25 m	100 m	152 m
Plume Width (% of channel) below PWQO at distance in which plume encounters the opposite bank (representing the narrowest place for safe fish passage)	90%	40%	40%

It is recommended that a detailed design of the outfall pipe or diffuser be carried out prior to construction activities. For example, a staged outfall, with a pipe at bank for Phase 1 and the multiport diffuser for Phase 2 would provide for optimum effluent dispersion, based on results to date.

5. Summary and Recommended Erin WWTP Effluent Limits

This ACS report provides an update to the preliminary ACS completed as part of Class Environmental Assessment (Class EA) for a communal wastewater and collection system for the Villages of Erin and Hillsburgh. It includes:

- Recent (2016) water quality data collected for the West Credit River at 10th Line;
- An updated 7Q20 low flow statistic for the West Credit River at 10th Line;
- Mixing zone modelling (using CORMIX) to predict the size and shape of the mixing zone; and
- Hydrodynamic, far-field modelling (using QUAL2K) to predict downstream concentrations of oxygen, temperature, nitrate, and ammonia; and
- Effluent limit recommendations to meet PWQOs in the West Credit River;

<u>Water Quality</u>
In 2016 water quality at 10th Line was very good with low concentrations of suspended sediments and nutrients (e.g. nitrate, TKN, TP, and ammonia). Total phosphorus, and un-ionized ammonia nitrogen concentrations were well below their PWQO values of 0.03 and 0.0164 mg/L respectively; indicating Policy 1 status for these parameters. Dissolved oxygen concentrations were above the PWQO (temperature dependant), indicting a well oxygenated system. Water quality data collected from the West Credit River at Winston Churchill Blvd. was compared to data collected at 10th Line. The 75th percentile concentrations computed for Winston Churchill Blvd., are for the most part, similar or lower than the 75th percentile concentrations calculated for 10th Line, due to the likely input of groundwater between to two stations.

<u>Low Flow Analysis</u>
CVC recalculated the 7Q20 low flow statistic for 10th Line, using water level and flow data from 8th and 10th Line for July 2013 to December 2015 (Appendix B). The new 7Q20 flow statistic for 10th Line of 225 L/s includes a 10% reduction to account for effects on climate change. Spot flows were measured monthly by HESL from May to September 2016. The lowest flow of 305 L/s was measured during the August sampling event (downstream of the beaver dam) and was 80 L/s greater than the calculated 7Q20 flow.

<u>Site characterization</u>
The study area of the West Credit River, between 10th Line and Winston Churchill Blvd. exhibits an irregular meander pattern. The river is easily wadeable with gentle to steep banks and a bankfull width between approximately 8 m and 12 m within the study area. The water clarity is good, with the river bottom visible. The substrate of the West Credit River in the study area is characterized by fine sediment with some cobbles and rocks. The ratio of fines to rocks/cobbles changed back and forth moving downstream from 10th Line toward Winston Churchill Blvd. The banks are lined with vegetation including tall grasses, shrubs and coniferous trees. Emergent macrophytes were noted along some banks. Bank erosion (under-cutting) was

also visible along some bank sections. Fallen woody debris altered the river flow in several sections of the West Credit River study area.

Dye tracer testing

Tracer testing was conducted on August 25, 2016 under a low flow of 0.37 m^3/s. Based on the dye tracer results, the average velocity in the West Credit River in the study area was calculated to be 0.17 m/s on the day of the tracer test, which was used to hydraulically calibrate the far-field QUAL2K model.

Mass balance modelling

The treated effluent flows from the proposed Erin WWTP are limited by total phosphorus concentrations with respect to both treatment technology limits for TP removal in wastewater and fully mixed TP concentrations in the West Credit River. A mass balance model was used to back-calculate maximum effluent flows based on varying effluent TP concentrations, 7Q20 low flows in the West Credit River, and a fully mixed downstream TP concentrations of 0.024 mg/L in the river. Based on the results of the TP mass balance modelling, HESL was directed by Ainley Group to carry forward a Phase 1 WWTP effluent flow of 3,380 m^3/s and a Full Build Out flow of 7,172 m^3/s, based on an effluent TP concentration of 0.07 mg/L (Phase 1) and 0.046 mg/L (Full Build Out).

Mass balance modelling of total ammonia nitrogen (TAN) and nitrate were also completed as a "starting point" in determining effluent limits for these parameters using the Phase 1 and Full Build Out effluent flows which were derived from the TP mass balance modelling. The mass balance modelling found that at summer temperatures, a TAN concentration of 1.2 mg/L (Phase 1) and 0.6 mg/L (Full Build Out) resulted in fully mixed downstream TAN concentrations that equated to un-ionized ammonia concentrations that were below the PWQO for un-ionized ammonia.

Winter effluent TAN concentrations (of 2 mg/L at both Phase 1 and Full Build Out flows) were also checked to determine the corresponding concentration of un-ionized ammonia. Since speciation of ammonia to its un-ionized state is driven by increasing temperature and pH, un-ionized ammonia at winter temperatures is rarely of concern. In this case, the Phase 1 and Full Build Out flows corresponded with winter un-ionized ammonia concentrations of 0.003 mg/L and 0.006 mg/L, respectively, assuming a water temperature of 4°C. Therefore, the winter effluent TAN concentrations are acceptable.

From the mass balance modelling, the resulting downstream fully mixed chloride concentrations in the West Credit River were 121 mg/L and 180 mg/L at Phase 1 and Full Build Out Effluent 7Q20 flows, respectively. Both fully mixed concentrations were above the chronic CWQG of 120 mg/L, but below the acute CWQG of 640 mg/L and not likely to impair aquatic life.

Far-field (QUAL2K) Modelling

QUAL2K is a one-dimensional (1-D) river and stream water quality model, supported by the United States Environmental Protection Agency (US EPA), which is typically used to assess the environmental impact of pollution discharges along rivers. A wide range of water quality parameters and chemical and biological pollutants within the river can be modelled, including temperature, pH, dissolved oxygen (DO), carbonaceous biochemical oxygen demand (CBOD), nitrogen species, phosphorus species, and suspended solids. The QUAL2K model is known as a far-field model since its water quality predictions apply beyond the point in which the effluent is fully mixed with the river, also known as the far-field.

We limited the far-field modelling to the summer scenario since it is the most critical season due to increased water temperatures which result in increased speciation of ammonia to its un-ionized form.

The summer low flow Phase 1 and Full Build Out scenarios resulted in un-ionized ammonia concentrations below the PWQO at all locations in the West Credit River, downstream of the point of complete mixing.

The un-ionized ammonia concentrations declined with distance from the outfall and reached concentrations between 9.3 and 9.9 µg/L at the downstream end of the study area (i.e., Winston Churchill Blvd.), 1.5 km from the point of discharge (Table 22). These concentrations are well below the PWQO.

For nitrate-N in both the Phase 1 and Full Build Out summer low flow scenario, the maximum nitrate concentration beyond the point of complete mixing was predicted to remain below the CWQG of 3 mg/L throughout the study area.

Mixing Zone (CORMIX) Modelling

The mixing zone modelling focussed on ammonia as the potentially toxic component of the effluent. There were two aspects to the assessment of ammonia:

- The requirement that undiluted effluent be non-acutely lethal at the point of discharge. This was calculated without the need for an assimilation model and is based solely on the toxicity of ammonia in the effluent; and
- The determination of the size and characteristics of the mixing zone for ammonia in the West Credit River since this is the volume of water in which concentrations will exceed the PWQO of 0.0164 mg/L of un-ionized ammonia nitrogen (MOE, 1994). The mixing zone is allowed under MOECC surface water quality Policy 5 (MOE, 1994). The size of the mixing zone is determined by modelling the physical mixing of effluent with the river and then setting an ammonia limit for the effluent which will maintain the un-ionized ammonia concentration below the PWQO outside of the mixing zone. For a smaller receiver such as West Credit River, this limit will be lower than that required to maintain non-lethal effluent.

At an effluent pH of 8.6 and temperature of 19°C, [based on recommendations made by B M Ross [2014]), the maximum effluent total ammonia concentration (corresponding to 0.27 mg/L of un-ionized ammonia) was calculated to be 2.1 mg/L. Thus, 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 near-field mixing of the proposed Erin WWTP discharge with the West Credit River was hydrodynamically modeled using CORMIX Version 10.0. The Erin WWTP discharge to the West Credit River for Phase 1 flows was modeled using CORMIX3, a subsystem which is used for buoyant surface discharges, and schematized as a round pipe located at the water surface level. The Phase 1 flows were also modelled using the CORMIX2 subsystem for multi-port discharges, schematized as a buried 5 m long multi-port diffuser running parallel to the south bank of the West Credit River, with vertical ports located along the river bed. The Full Build Out flows were modelled using the same CORMIX2 system for multi-port discharges.

The mixing zone results are presented below.

Table 27. Summary of CORMIX Mixing Zone Modelling Results

Parameter	Phase 1 Pipe Discharge	Phase 1 Multiport Diffuser	Full Build Out Multiport Diffuser
Distance to Meet PWQO (m downstream of outfall)	25 m	100 m	153 m
Plume Width (% of channel) below PWQO at distance in which plume encounters the opposite bank (representing the narrowest place for safe fish passage)	90%	40%	40%

It is recommended that a detailed design of the outfall pipe or diffuser be carried out prior to construction activities.

Recommended Erin WWTP Effluent Limits

Based on the results of the ACS, including mass balance modelling, mixing zone modelling, and far-field modelling, the following effluent limits and loadings are recommended for adoption at the proposed Erin WWTP (Table 28 and 29) for Stage 1 (effluent flow of 3,380 m^3/d) and Full Build Out (effluent flow of 7,172 m^3/d). Ainley Group have developed effluent objectives (Table 28) to ensure these effluent limits can be met (in draft). The ACS shows that a discharge at these concentrations and loads, will maintain West Credit River water quality downstream of the proposed outfall the PWQO/CWQG requirements.

Table 28. Proposed Erin WWTP Effluent Objectives and Limits

	Objectives	Limits	
Parameter	Stage 1[a] and Full Build Out[b]	Stage 1[a]	Full Build Out[b]
TSS	3 mg/L	5 mg/L	
TP	0.03 mg/L	0.07 mg/L	0.045 mg/L
TAN - May 15 to October 15	0.3 mg/L	1.2 mg/L	0.60 mg/L
TAN - October 16 to May 14	1 mg/L	2 mg/L	
NO_3-N	4 mg/L	5 mg/L	
DO	5 mg/L	4 mg/L	
$CBOD_5$	3 mg/L	5 mg/L	
pH	6.5 - 8	6.5 – 8.5	
E. coli	100 cfu/100 mL		

Notes: a - at effluent flow of 3,380 m^3/d, b - effluent flow of 7,172 m^3/d

Table 29 Proposed Erin WWTP Effluent Loading Objectives and Limits (in kg/yr)

	Objectives		Limits	
Parameter	Stage 1[a]	Full Build Out[b]	Stage 1[a]	Full Build Out[b]
TSS	3,701	7,853	6,169	13,089
TP	37	79	86	118
TAN - May 15 to October 15	370	785	1,480	1,571
TAN - October 16 to May 14	1,234	2,618	2,467	5,236
NO_3-N	4,935	10,471	6,169	13,089

Notes: a – based on effluent flow of 3,380 m^3/d, b – at effluent flow of 7,172 m^3/d

6. References

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Appendix A. Pre-Consultation Meeting Minutes

Hutchinson
Environmental Sciences Ltd.

Suite 202 – 501 Krug Street, Kitchener, ON N2B 1L3 │ 519-576-1711

Memorandum

Date: **May 2, 2016**

To: **Barbara Slattery and Craig Fowler (Ministry of Environment and Climate Change), Jennifer Dougherty and Tim Mereu (Credit Valley Conservation)**

From: **Deborah Sinclair, Tara Roumeliotis, Neil Hutchinson**

Cc: **Gary Scott and Joe Mullan (Ainley Group), Christine Furlong (Triton Engineering)**

Re: **J160005 – Town of Erin Class EA – Assimilative Capacity Study Update Work Plan**

This memorandum provides an outline of the assimilative capacity study (ACS) update work plan to be completed as part of Phases 1 and 2 of the Town of Erin Class EA.

1. Background and General Approach to Updating the ACS

The intent of the ACS completed as part of the Servicing and Settlement Master Plan (SSMP) was to assess the feasibility of a wastewater treatment facility (WWTF) with surface water discharge to the West Credit River in the reach between 10th Line and Winston Churchill. The preliminary ACS (by B.M. Ross and Associates) demonstrated this was viable; however recommended that the next phases of the EA should include a review of dissolved oxygen and temperature impacts, and potential for effluent storage. The Ontario Ministry of the Environment and Climate Change (MOECC) concurred (in a letter from Ms. Barbara Slattery dated October 31, 2015 to Ms. Furlong, Triton Engineering) that the original ACS be updated to include hydrodynamic modeling and additional stream flow information collected since the preliminary ACS was completed.

The SSMP identified a general area (along Wellington County Road 52, between 10th Line and Winston Churchill Boulevard) for the location of a wastewater treatment plant (WWTP). As part of the next phases of the EA, the ACS will be updated/refined and detailed modeling (mixing zone model and hydrodynamic far-field model) will be completed for three potential outfall locations. The models will be used to predict water temperature, dissolved oxygen, and nutrient loads in the receiver under a range of WWTP discharge scenarios (e.g. low flow, effluent storage and seasonal discharge). The flow rate and discharge criteria used for the modeling will be finalized in consultation with MOECC, Credit Valley Conservation (CVC) and the Town of Erin.

CORMIX will be used to complete the mixing zone modelling of the WWTP effluent and the West Credit River under a variety of flow scenarios. Oxygen and temperature modelling of the discharge in the River, as requested by the MOECC and CVC and recommended in the preliminary ACS, will be completed using the U.S. EPA's QUAL2K model. The QUAL2K model requires a large number of site-specific physical, chemical and biological information to accurately simulate the effect of the effluent on the receiver. The data to complete the modeling will be assembled from the background data and updated with current water quality, quantity and detailed field studies.

Completion of the ACS Update will occur in two-phases in order to provide the EA team (i.e., Town of Erin, Triton Engineering, Ainley Group) with a reasonable estimate of recommended WWTP effluent limits as soon as possible, as follows:

1) A draft ACS Update report will be completed by late spring/early summer. This report will include the updated 7Q20 and water quality data and use estimates in the modelling work where site specific data has not yet been collected. Draft WWTP effluent limits will be calculated and provided; and
2) A final ACS Update report will be completed in the fall. This report will incorporated the summer field investigations and an updated 7Q20 as modelling inputs and to complement the understanding of receiver water quality and quantity. Effluent limits will be finalized based on the site-specific information.

The following tasks will be completed as part of the full ACS update:

1. Review of preliminary ACS
2. Update to water quality and quantity statistics
3. Pre-consultation meeting with MOECC, CVC and the Town of Erin
4. Field investigations including survey of physical attributes of the West Credit River in the study area, water quality sampling, and a dye tracer study
5. Mixing zone modelling (CORMIX) and Far-field modelling (QUAL2K)
6. Derivation of WWTP effluent limits
7. Reporting and Presentations
8. Follow up meetings with MOECC, CVC and the Town of Erin

These tasks are detailed in the sections below.

2. Task 1 – Review Preliminary ACS

The Preliminary ACS completed by B.M. Ross and Associates (2014) will be reviewed to confirm the approach, water quality parameters modeled, 7Q20 derivation, model assumptions, modeling results, and proposed effluent limits.

3. Task 2 - Update Water Quality and Quantity Statistics

The preliminary ACS used water quality data from the Provincial Water Quality Monitoring Network (PWQMN) station located on the West Credit River at Winston Churchill Boulevard (PWQMN 06007601502) as input to the modeling work. This station is located in the study area and has a long-term record of water quality (1975-2015). We will update the monthly water quality summary statistics for this site to include the 2013 through 2015 data. Water quality parameters for the analysis will include 5-day biochemical oxygen demand (BOD_5), dissolved oxygen, Total Kjeldahl Nitrogen (TKN), total ammonia, un-ionized ammonia, nitrite, nitrate, total phosphorus, total suspended solids, pH, temperature, and *Escherichia coli*. Data will be assessed against the most current applicable Provincial Water Quality Objectives (PWQO; MOE 1994a) and Canadian Water Quality Guidelines (CWQG; CCME 2012) to confirm the policy status of the West Credit River at Winston Churchill Boulevard.

Effluent discharge to any receiver requires the determination that the receiver can effectively assimilate or dilute the effluent. In Ontario streams and rivers, the 7Q20 low-flow statistic is used as a basic design flow to determine the assimilative capacity of a stream or river. The 7Q20 flow represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate streamflow to properly dilute the point discharge.

A Water Survey of Canada (WSC) gauge located in the West Credit River 8th Line provides a long-term (1983 - present) record of flow. Due to differences in geological conditions between the catchment area of this station and the WWTP study area (i.e., West Credit River between 10th Line and Winston Churchill Boulevard), flows could not be pro-rated for the preliminary ACS (BM Ross 2014). Rather, a new gauging station was established at 10th Line in 2013 to develop a flow transposition factor between the 8th Line and the 10th Line. The 7Q20 flows for 10th Line were determined using this factor. CVC have recalculated the transposition factor using the most recent flow data from 8th Line and 10th Line (e.g. 2013 - 2015), and derived updated monthly 7Q20 statistics for 10th Line. CVC will provide this updated 7Q20 data to Hutchinson Environmental Sciences Ltd. (HESL) in spring 2016 for review and use in the draft ACS update. (This 7Q20 will also be reviewed by Blackport Hydrogeology Inc. and the MOECC). CVC will provide a second updated 7Q20 to HESL in fall 2016 (after the low flow period) for use in the final ACS update. The final updated 7Q20 flow statistic should consider the effects on climate change on low flows.

4. Task 3 – Pre-consultation Meeting with MOECC, CVC and the Town

It has been our experience that early and frequent consultation with regulatory agencies encourages successful approval of ACSs by providing agencies the opportunity to review HESL's approach in advance so that refinements can be made. We propose to schedule a pre-consultation meeting after CVC and MOECC have had an opportunity to review this work plan. The purpose of the meeting will be to discuss any questions or concerns with the proposed work plan (including modeling approach, field investigations, and analyses) to ensure that all aspects of the study are adequately addressed.

5. Task 4 – Field Investigations

CVC completed an extensive Existing Condition Report (CVC 2011) as part of the SSMP, which summarized the existing hydrogeology, hydrology, geomorphology, aquatic ecology (fish and benthos), water quality, and hydraulics in the study area. Much of the information used for the preliminary ACS was collected from this report, as it provides an excellent baseline of the natural environment in the study area.

The updated ACS will draw on information contained in CVC's report, and update it with new information collected as part of the next phases of the EA. In particular, water quality and quantity, aquatic ecology (fish and benthos), terrestrial, and geomorphological investigations and inventories will be used to as inputs to the ACS and/or as part of the impact assessment.

The additional investigations required as part of the ACS as input into the models are described below.

5.1 Physical Attributes

The QUAL2K model requires a spatial segmentation of the receiving stream into a series of constant hydrogeometric characteristics, (i.e. depth, cross sectional area, average velocity and average flow). A good understanding of the physical environment is therefore necessary prior to undertaking the modeling exercise. A comprehensive stream assessment of West Credit River will be undertaken by fluvial geomorphologists and aquatic scientists. The primary objective of the investigation is to define and characterize distinct reaches in the West Credit River (within the study area, between 10th Line and Winston Churchill Boulevard) for input into the hydrodynamic model.

Specific reaches will be defined by their characteristic channel pattern, gradient, dimensions, bed material, and bank composition, as well as riparian and aquatic vegetation and in-stream obstructions (e.g., large woody debris). Developing a detailed image of the study area, both within the mixing zone (near-field) and beyond the point of complete mixing of the effluent and River (far-field), is important to provide a better understanding of the receiving environment and other potential influences on water quality and the assimilation process.

5.2 Water Quality

To simulate downstream water quality, the QUAL2K model requires 5-day and ultimate carbonaceous biochemical oxygen demand ($CBOD_5$ and $CBOD_u$), dissolved oxygen (DO), total phosphorus (TP), orthophosphate, inorganic phosphorus, organic phosphorus, Total Kjeldahl nitrogen (TKN), nitrate (NO_3), nitrite (NO_2), total ammonia, total suspended solids (TSS), chlorophyll *a*, and volatile suspended solids (VSS) concentrations. The relationships and reactions between these variables are used by the model to predict far-field water quality. Monthly water quality sampling in the West Credit River at Winston Churchill Boulevard during low flow conditions (May to September) for these parameters will be undertaken to provide a baseline upon which to use for the model. Some of these parameters (i.e., CBODu, orthophosphate, inorganic phosphorus, organic phosphorus, chlorophyll *a* and VSS) are not routinely collected under the PWQMN program and are required for the QUAL2K model. Therefore, the water quality sampling proposed will build a small dataset with which to use for the modelling.

Diurnal oxygen (DO) surveys will be conducted in the West Credit River during summer low-flow conditions (June through September) to determine baseline oxygen conditions in the river, and determine if oxygen is a limiting factor at night when photosynthesis is low and respiration is high. Optical dissolved oxygen probes (HOBO brand) will be deployed at three locations in the West Credit River between 10th Line and Winston Churchill Boulevard. The probes will measure dissolved oxygen and temperature, which will be used as input into the QUAL2K model, and to assess aquatic habitat conditions in the West Credit River at several different locations.

5.3 Dye Study

A dye study under low flow summer conditions will be conducted in the West Credit River to calculate time of travel and longitudinal dispersion, an input requirement into the QUAL2K model. A slug injection test, where a known amount of tracer is instantaneously injected into the river, will be completed at the preferred discharge location. Fluorometers (YSI 600 OMS instruments equipped with Rhodamine WT optical sensors) will be placed in the river at three locations downstream of the proposed discharge location. Rhodamine WT dye, a fluorescent pink xanthene dye, will be used as the tracer for the study. Rhodamine WT dye is a stable, non-toxic, and chemically unreactive dye that is easily measured in the field. The substance is non-carcinogenic, and is safe if it comes into contact with skin. Results of the dye study (i.e., time of travel and dispersion) will be used an input variables into the QUAL2K model.

6. Task 5 – Modeling

6.1 CORMIX

CORMIX is a mixing zone model developed by Cornell University for the analysis, prediction, and design of aqueous pollutant discharges into diverse water bodies. The model simulates the hydrodynamic behaviour of the effluent discharge and calculates the plume trajectory, dilution and maximum centerline concentration in the river. CORMIX will be used to predict water quality up to and including the point of complete mixing between the WWTP effluent and West Credit River.

The CORMIX model will be created with the measurements collected during the field investigations and all available water quality data (i.e., PWQMN and CVC). The CORMIX model will examine total ammonia nitrogen (with un-ionized ammonia concentrations calculated from field pH and temperature) and TP in order to determine concentrations of these parameters between the outfall and the point of complete mixing. The MOECC and CVC will be consulted to determine if any additional parameters should be modelled within the mixing zone. A mixing zone model will be built for three candidate outfall sites. Various outfall configurations (i.e., co-flowing, protruding, etc.) will be modelled to determine the configuration which results in optimal mixing.

6.2 QUAL2K

QUAL2K is a one-dimensional (1-D) river and stream water quality model, supported by the United States Environmental Protection Agency (US EPA), which is typically used to assess the environmental impact of discharges along rivers. A wide range of water quality parameters and chemical and biological pollutants can be modeled, including temperature, pH, DO (including the sag point location), CBOD, nitrogen species, phosphorus species, and suspended solids. QUAL2K assumes instantaneous complete mixing and as such, will be used to predict water quality in the West Credit River beyond the point of complete mixing (i.e., far-field water quality).

The QUAL2K model will be created with the measurements and water quality data collected from the PWQMN Station, CVC monitoring data, and field investigations outlined above. Similar to the CORMIX modelling, the QUAL2K model will be built and run for three different discharge locations on the West Credit River and under a variety of river flows, including the 7Q20 flow.

7. Task 6 – Derivation of WWTP Effluent Limits

The Ontario Ministry of the Environment and Climate Change (MOECC) have three documents that direct the discharge requirements for waste water treatment plants (WWTP). In *Policies, Guidelines and Provincial Water Quality Objectives of the Ministry of Environment and Energy* (MOE 1994a) the MOE provides direction on the management of surface water and groundwater quality and quantity for the Province of Ontario. In *Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters* (MOE 1994b), the MOE provides guidance with regard to the requirements for point-source discharges and the procedures for determining effluent requirements for an Environmental Compliance Approval (ECA). In the Guideline F-5 Series *Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters* (MOE 1994c), the levels of treatment required are described, along with guidance on deriving effluent limits (concentrations and loading).

For the Erin WWTP, effluent limits will be derived from the results of the ACS, and the loading limits will be based on these effluent limits and the design average daily flow for the plant. The MOECC have recommended that best available treatment technology economically achievable (BATEA) be used in the WWTP design. The effluent limits will be cross-referenced with BATEA levels of treatment to determine the feasibility of the recommended effluent limits before they are proposed. The recommended WWTP effluent limits will be verified in writing with the MOECC, CVC and the Town.

8. Task 7 – Reporting and Presentations

A draft ACS Update report will be completed by late spring/early summer. Draft WWTP effluent limits will be provided in this report. A final ACS Update report will be completed in the fall and will include finalized effluent limits based on the site-specific information collected in summer 2016.

A Public Information Centre (PIC) will also be held in conjunction with the completed ACS update report.

9. Task 8 – Follow up Meetings with MOECC, CVC and the Town

A meeting with MOECC, CVC and the Town of Erin will be held after the final effluent limits are calculated and prior to submission of the final ACS Update report in order to discuss agency comments and/or questions regarding the limits. Additional meetings with MOECC, CVC and the Town of Erin will be held as required.

10. Schedule

The tasks to complete the ACS Update are scheduled as follows (Table 1).

Table 1. Schedule for ACS Update, Town of Erin Class EA

Task	Start	End
Review Preliminary Assimilation Capacity Study	1-Apr-16	15-Apr-16
Collect and review CVC 7Q20 and PWQMN data	12-Apr-16	25-Apr-16
Meeting with MOECC and CVC re: work plan	25-Apr-16	29-Apr-16
Derivation of preliminary effluent limits (modeling)	29-Apr-16	12-May-16
Draft Effluent Objectives and Limits	13-May-16	18-May-16
Draft ACS Update report	19-May-16	29-May-16
Field investigations for model inputs and calibration	1-May-16	30-Sep-16
Update ACS model with field data, update draft report	1-Oct-16	31-Oct-16
Meeting with MOECC and CVC re: effluent limits	1-Nov-16	16-Nov-16
Final Reporting – ACS Update	16-Nov-16	1-Dec-16

11. References

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Ontario Ministry of the Environment (MOE). 1994c. *Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters;* Guideline F-5 Series

Appendix B. Update of Low Flow Assessment (7Q20) for the West Credit River Assimilative Capacity Study - CVC 2016

CREDIT VALLEY CONSERVATION

Watershed Management

To:	**John Sinnige, Sr. Manager, Water Resources and Flood Risk**	**Date:**	**June 13, 2016**
From:	**Alex Pluchik, Hydrologist**	**Subject:**	**Update of Low Flow Assessment ($7Q_{20}$) for the West Credit River Assimilative Capacity Study (Erin SSMP)**
Cc:	**Neelam Gupta, Manager, Hydrology and Hydraulics**	**Our File:**	**Erin SSMP - ACS**
Cc:	**Jennifer Dougherty, Manager, Water Quality Protection**		

Introduction

This memo summarizes the revision of $7Q_{20}$ values for the West Credit River at 10^{th} line to support the update of the West Credit River assimilative capacity study. The initial assessment was completed at the end of 2013 in support of the Town of Erin Servicing and Settlement Master Plan (SSMP) study and was based on stream flows for the period from July to October 2013 at 10^{th} Line. A similar approach was used to update the $7Q_{20}$ values based on stream flows for the period from July 2013 to end of 2015 (refer to Memo from March 14, 2016). The present memo finalizes the results of $7Q_{20}$ value assessment for the West Credit River at 10^{th} line.

The location of the streamflow stations and proposed location of the WWTP effluent discharge are shown in Figure 1.

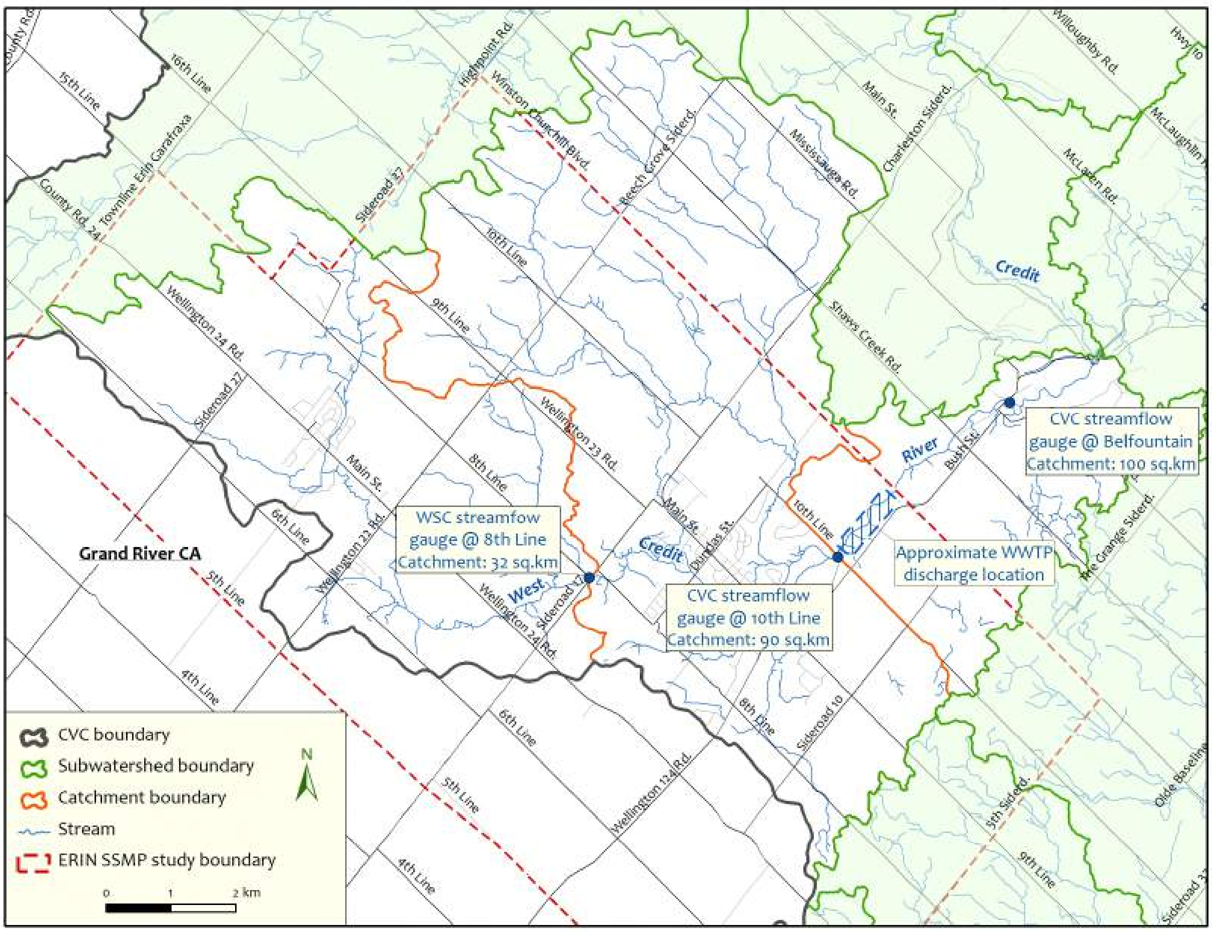


Figure 1: West Credit River watershed relative to the Assimilative Capacity Study limits for the Erin SSMP

Low Flow Analysis

The following methodology was applied to update the $7Q_{20}$ values for the West Credit River at 10^{th} line:

1. Mean daily flow series of the West Credit River at 8^{th} Line (WSC gauge, 1984-2015) were converted to the 7-day mean flows (7-day moving average).
2. Lowest 7-day mean flows for each year of record were collected for the Water Year (October 1-September 30), Summer (July-September), Fall-Winter-Spring (October-June) and for each month of year.
3. Mean daily flow series of the West Credit River at Belfountain (CVC gauge, 2002-2015) were converted to the 7-day mean flows (7-day moving average).
4. Lowest 7-day mean flows for each year of record were collected for the Water Year (October 1-September 30) and Summer (July-September).
5. The CVC real-time streamflow gauge at 10^{th} Line became active and fully operational at the end of July 2013. The development of a rating curve started at the same time. Since then, CVC field staff has measured 20 discharges (16 of them were used for the building of rating curve). The lowest discharges were measured at the end of July 2015; however the 2015 low flows were significantly higher than the low flows of summers 1995-2003 (excepting 1997), 2007 and 2012.

   Continuous water level data (15-min intervals) were converted to a continuous flow record using a rating curve fit equation (Shifted Power Law) developed in the WISKI module SKED (refer to Appendix, Figure A.1).

6. Mean daily and 7-day mean (moving average) flow series for the West Credit River at 10^{th} Line were produced using TSM module of WISKI. 7-day mean flows at the 8^{th} Line (WSC gauge) were paired with corresponding flows at the 10^{th} Line (CVC gauge) for the period of July 2013 – November 2015. These series were sorted by the ratio of 10^{th} Line flows to 8^{th} Line flows in ascending order. To remove outliers, values that lie outside of a band around the mean with a width of two standard deviations were not included for drawing the scatter graph and performing the regression analysis (refer to Appendix A, Figure A.2).
7. Similarly, 7-day mean flows at the Belfountain CVC gauge were paired with corresponding flows at the 10^{th} Line (CVC gauge) for the period of July 2013 – November 2015. These series were sorted by the ratio of Belfountain flows to 10^{th} Line flows in ascending order. Data that was obviously affected by freezing of the CVC Belfountain station were removed. Then values that lie outside of a band around the mean with a width of two standard deviations were not included for drawing the scatter graph and performing the regression analysis (refer to Appendix A, Figure A.3).
8. A regression analysis was executed to explore the relationships between streamflows at 8^{th} Line and 10^{th} Line and also Belfountain and 10^{th} Line. A linear trendline forced to intercept at nil was chosen as the best fit to observed data for both relations (refer to Appendix A, Figures A.2 and A.3). The quality of the regression equations was examined using the following indices: standard deviation of the criterion variable and standard error of estimate, coefficient of determination and F-test. Both regressions were deemed to be significant

given that the computed F-test is greater than F value extracted from the F values distribution table (level of significance = 0.05).

9. The low-flow frequency analysis was performed using the “Low Flow Frequency Analysis Package – LFA” (Environment Canada, September 1988). The program methodology is based on the Gumbel III distribution. This distribution has been recommended by Environment Canada as the best fit for extreme value analysis of low flows in the streams of South Ontario (Condie, Cheng, "Low Flow Frequency Analysis”, 1987). Also, the LFA application includes the Cunnane plotting-position formula for estimation the empirical exceedance probability.

10. The low-flow frequency analysis of the West Credit River at 8th Line data was performed for two data sets: 1984-2015 and 2002-2015. Also, the 7-day minimum flows of the West Credit River at Belfountain were processed for period of 2002-2015. The results of calculations ($7Q_{20}$ values) are presented in the Table 1 below and in the Appendix A, Table A.1 and Figures A.4, A.5 and A.6 (Gumbel III and Cunnane frequency curves).

Table 1: $7Q_{20}$ stream flows for the West Credit River gauges of WSC and CVC (Water Year: Oct 1-Sep 30)

Station location/name	Data Set Period	$7Q_{20}$ (m^3/sec)	$7Q_{20}$ Ratio for 8th Line
8th Line (WSC)	1984-2015	0.123	
8th Line (WSC)	2002-2015	0.172	1.4
Belfountain (CVC)	2002-2015	0.428	

The significant difference between the $7Q_{20}$ values at 8th Line for the different periods (almost 40%) can be explained by the length of analysed data sets. The driest year of the 2002-2015 data set (2003) is positioned at 7th place in 1984-2015 data set, i.e. the 6 years with smallest 7-day minimum flows observed at the 8th Line gauge (flow record from 1981 to 2015) were not measured in the Belfountain gauge (flow record from 2002 to 2015).

11. $7Q_{20}$ values for the West Credit River at 10th Line were computed for period of 2002-2015 using described above two regression equations (one - based on 8th Line data set, second - based on Belfountain gauge data) and are presented in the Table 2 below.

Table 2: 7Q20 stream flows of the West Credit River at 10th line (2002-2015)

Station	$7Q_{20}$ by LFA (m^3/sec)	$7Q_{20}$ at 10th Line by Regression Equation (m^3/sec)	Difference (%)
8th Line (WSC)	0.172	0.350	2.8
Belfountain (CVC)	0.428	0.360	

Comparison of results, which are very close (difference is less than 3%), verifies accuracy of methodology used to calculate streamflow at 10th Line.

12. $7Q_{20}$ values for the West Credit River at 10th Line were computed using the results of the low-flow frequency analysis of 8th Line data for period 1984-2015 and described above regression equation between streamflows at 8th Line and 10th Line (refer to Appendix A, Table A.1). Using this time period, a water year $7Q_{20}$ of 0.250 m^3/sec was calculated, which is very similar to the water year $7Q_{20}$ of 0.246 m^3/sec calculated in the March 2016 memo.

Review of Results

1. A slight increase was found between the $7Q_{20}$ values for the West Credit River at 10th Line computed for Water Year, Summer Season and September and provided in present and previous memos: 1.9%, 5.2% and 5.5 % respectively (refer to Appendix A, Table A.1). However, for the rest of year the $7Q_{20}$ increase is varying from 10% (August and Fall-Winter-Spring Season) to 19% (November, December and May). This increase can be clarified by using more statistically valid approach of selecting data for performing the regression analysis (refer to paragraphs 6 and 7). It allowed developing new linear regression equation between 7-day streamflows at 8th Line and 10th Line. Accuracy of this approach was verified by using streamflow data of Belfountain gauge (refer to paragraph 11).
2. The $7Q_{20}$ values calculated for the West Credit River at 10th Line in the previous memos have included a climate change impact factor. Therefore, the calculated value of $7Q_{20}$ was reduced by 10%. For consistency results the same approach was used to **update the $7Q_{20}$ value for the Water Year at 10th Line, which equals to 0.225 m^3/sec (Table A.1)**, i.e. deviation from the March 2015 value is less than 2%.

APPENDIX A

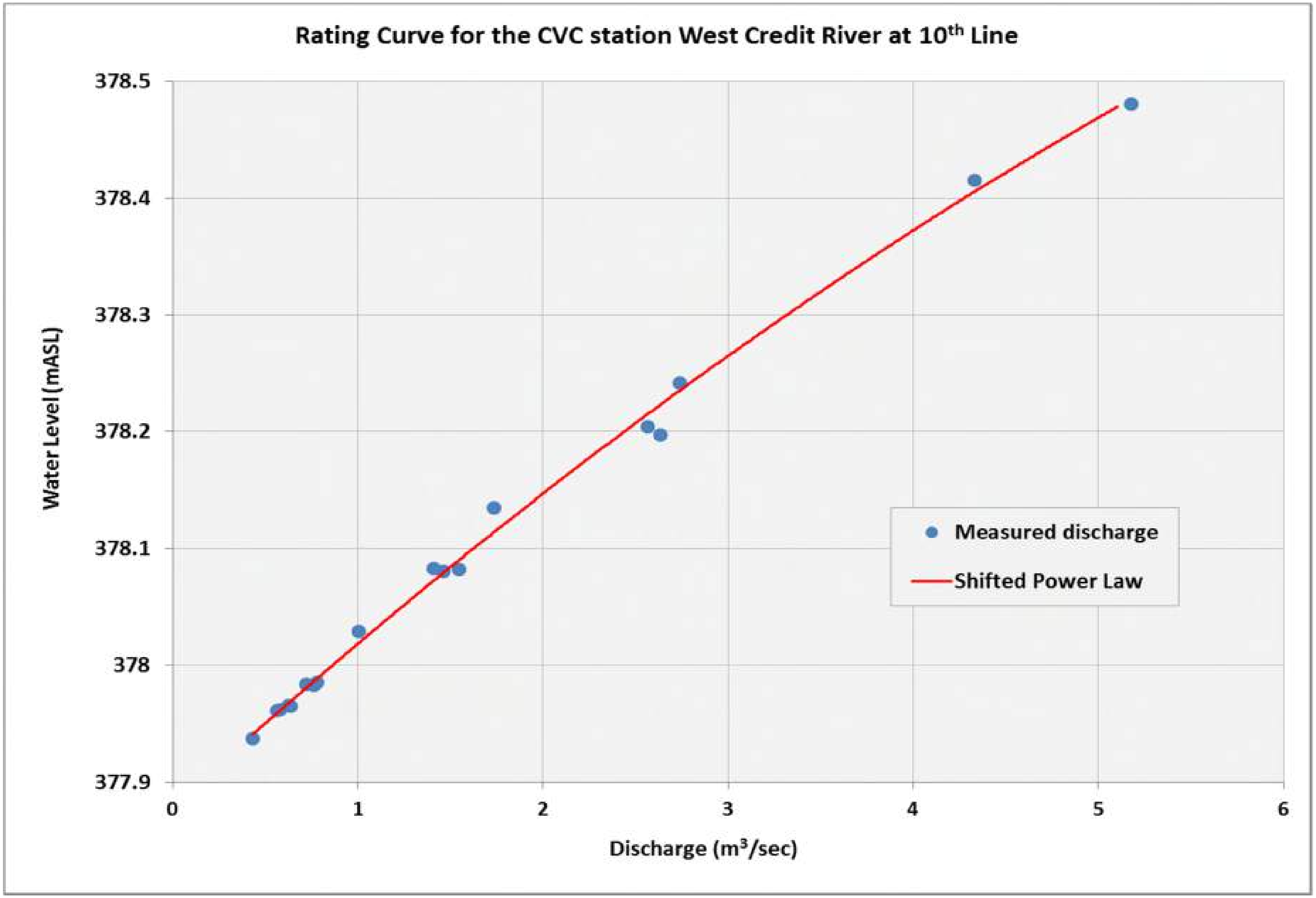


Figure A.1 Rating Curve for the CVC station West Credit River at 10th Line

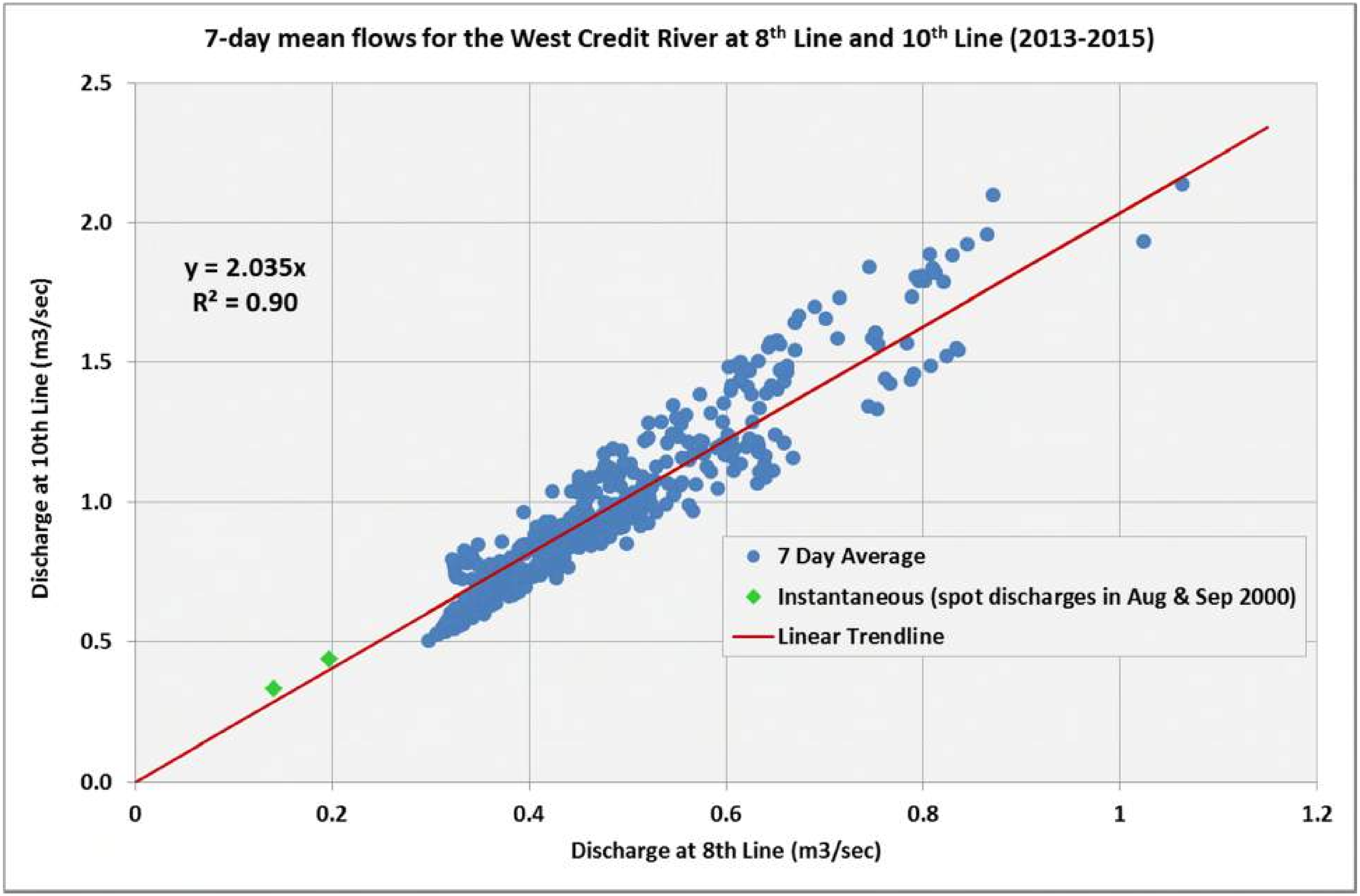


Figure A.2 Scatter graph of 7-day mean flows for the West Credit River at 8 th Line and 10th Line (July 2013 - November 2015)

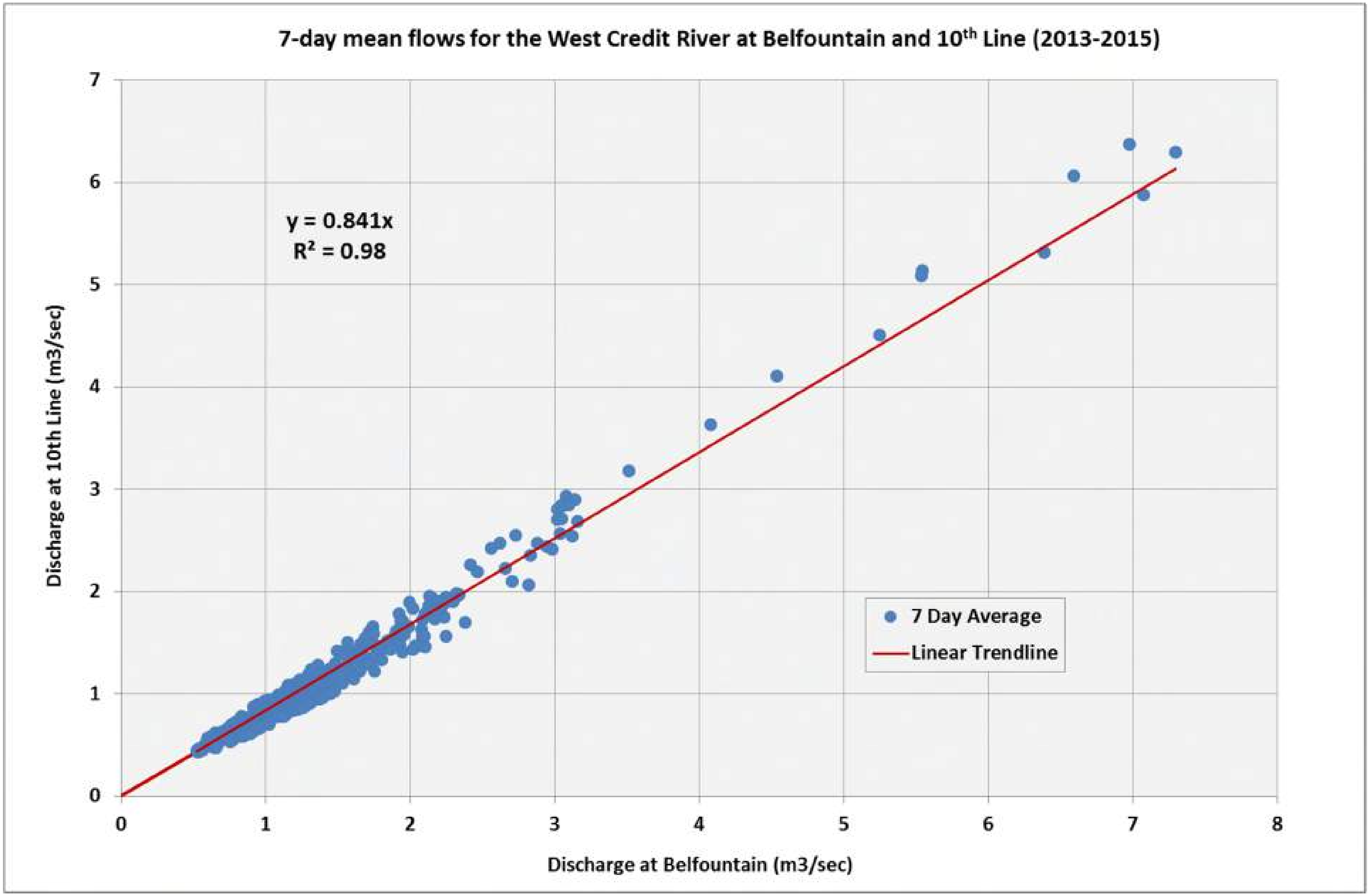


Figure A.3 Scatter graph of 7-day mean flows for the West Credit River at Belfountain and 10 th Line (July 2013 - November 2015)

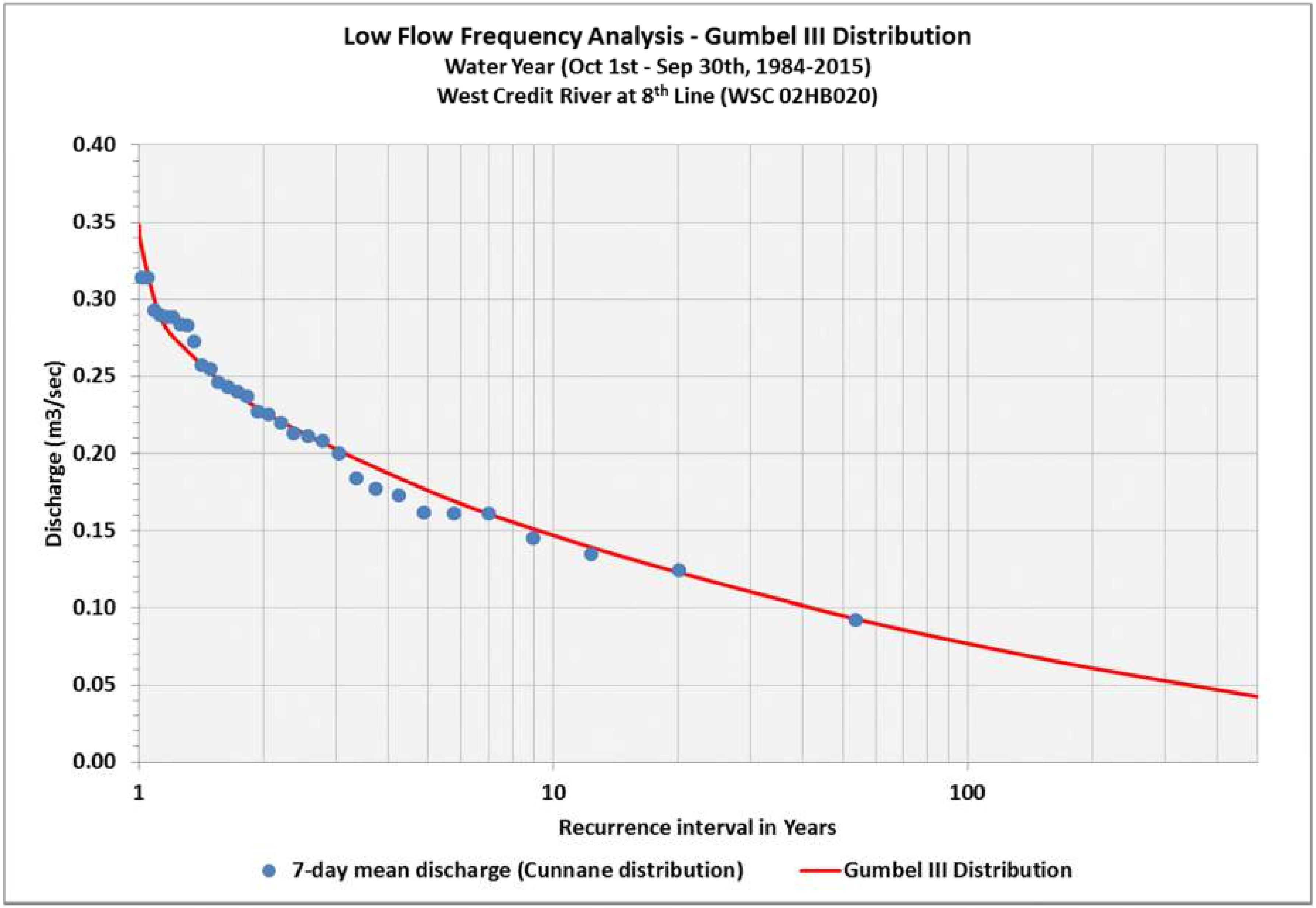


Figure A.4 **Gumbel III and Cunnane frequency distributions of minimum 7-day discharges for the West Credit River at 8 th Line (WSC gauge 02HB020) for Water Year (1984-2015)**

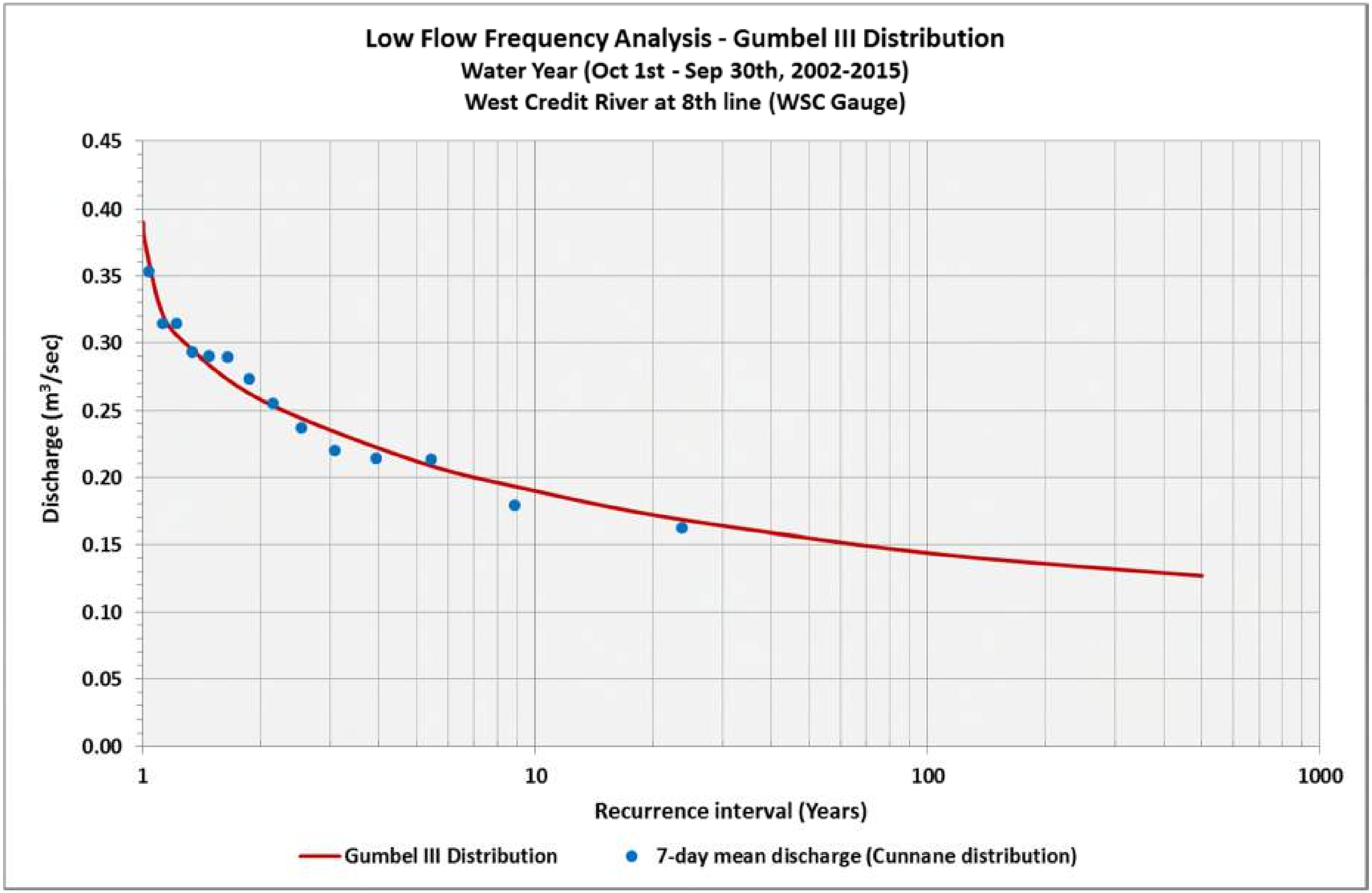


Figure A.5 Gumbel III and Cunnane frequency distributions of minimum 7-day discharges for the West Credit River at 8 th Line (WSC gauge 02HB020) for Water Year (2002-2015)

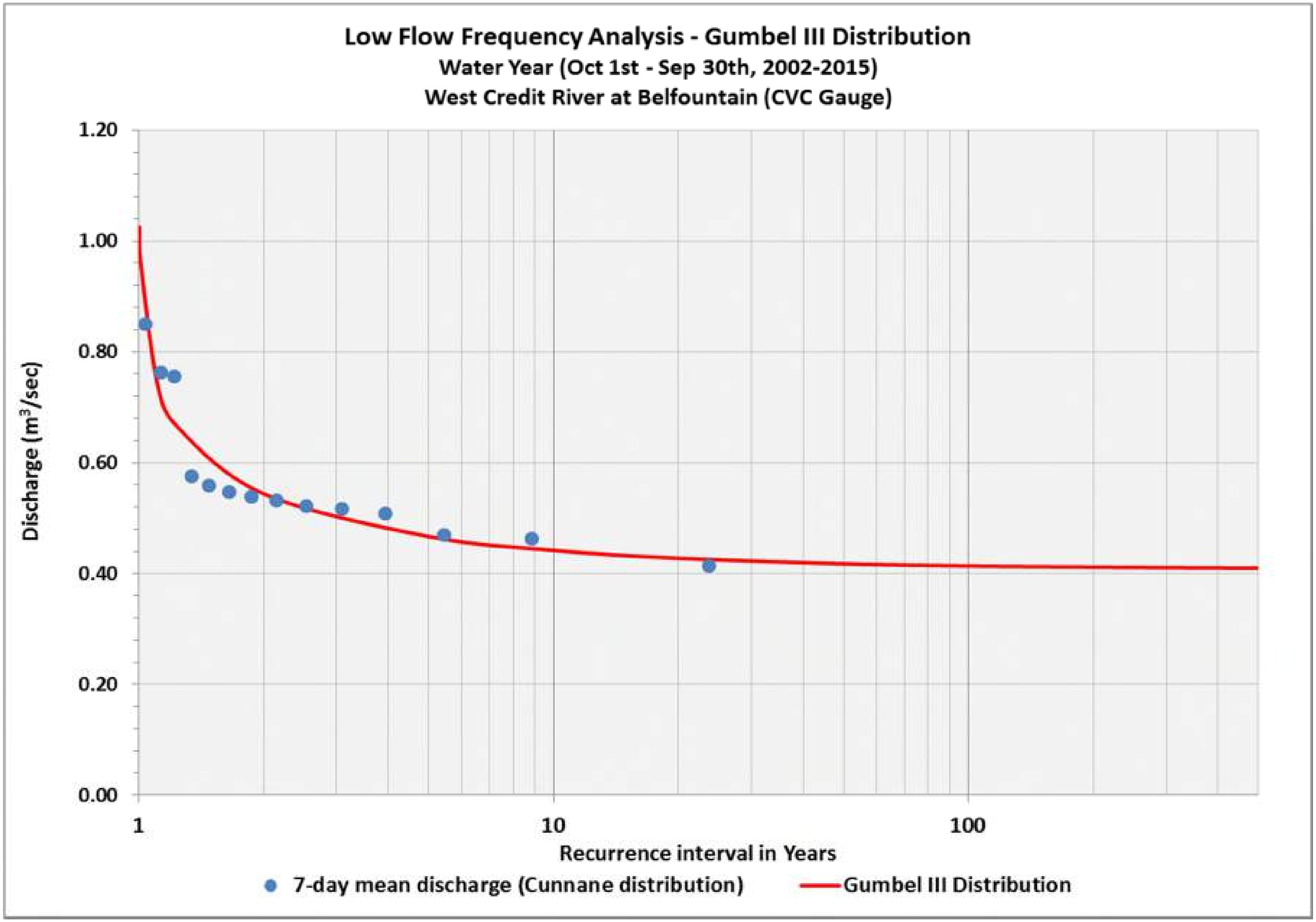


Figure A.6 Gumbel III and Cunnane frequency distributions of minimum 7-day discharges for the West Credit River at Belfountain (CVC gauge) for Water Year (2002-2015)

Table A.1 7Q20 monthly, seasonal and Water Year flows for the West Credit River at 8th Line and 10th Line (m^3/sec) - June 2016

Site/ Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Summer Min (Jul-Sep)	Fall-Winter-Spring Min (Oct-Jun)	Water Year Min (Oct 1-Sep 30)	Including 10% CC factor
8th Line (WSC Gauge)*	0.185	0.251	0.253	0.204	0.195	0.253	0.310	0.227	0.167	0.174	0.150	0.133	**0.132**	**0.151**	**0.123**	**0.111**
10th Line (CVC Gauge)**	0.376	0.511	0.515	0.415	0.397	0.515	0.631	0.462	0.340	0.354	0.305	0.271	**0.269**	**0.307**	**0.250**	**0.225**
Difference (%) ***	16.1	19.2	19.1	17.8	17.1	19.1	16.8	18.9	13.6	14.7	10.2	5.5	5.2	10.4	1.9	1.9

Notes:

* 7Q_{20} low flows (monthly, seasonal and yearly values) at 8th Line were estimated by frequency analysis of long-term streamflow data of the WSC gauge (1984-2015).

** 7Q_{20} low flows (monthly, seasonal and yearly values) at 10th Line were estimated by linear trendline equation defining relationship between streamflows at 8th Line and 10th Line. The ratio of 10th Line flow to 8th Line flow equal to 2.035.

*** Difference between present 7Q20 values (Jun 2016) and 7Q20 values from the March 14th Memo, calculated for the West Credit at 10th Line.

Table A.2 7Q20 monthly, seasonal and Water Year flows for the West Credit River at 8th Line and 10th Line (m3/sec) - March 2016

Site/ Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Summer Min (Jul-Sep)	Fall-Winter-Spring Min (Oct-Jun)	Water Year Min (Oct 1-Sep 30)	Including 10% CC factor
8th Line (WSC Gauge)	0.185	0.251	0.253	0.204	0.195	0.253	0.310	0.227	0.167	0.174	0.150	0.133	**0.132**	**0.151**	**0.123**	**0.111**
10th Line (CVC Gauge)	0.316	0.413	0.416	0.341	0.329	0.416	0.525	0.375	0.294	0.302	0.274	0.256	**0.255**	**0.275**	**0.246**	**0.221**
Ratio (10th Line/ 8thLine)	1.7	1.6	1.6	1.7	1.7	1.6	1.7	1.7	1.8	1.7	1.8	1.9	**1.9**	**1.8**	**2.0**	**2.0**

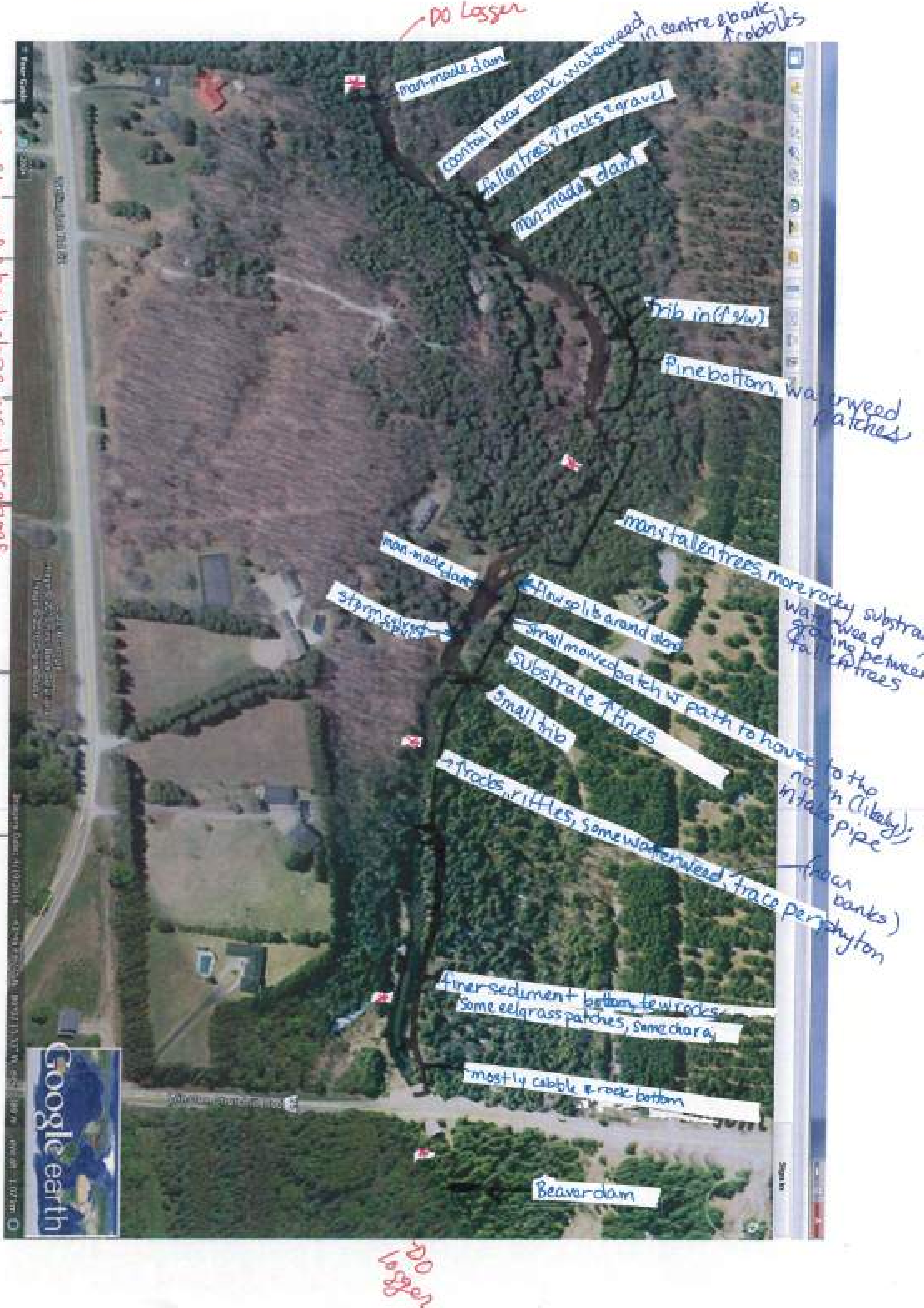
Appendix C. Physical Attributes Survey Field Notes

★ = channel & bankslope msmt locations.

General notes:

• Bottom is fine sediment w/ some cobbles & rocks. A ratio of fines to rocks/cobbles changes back & forth as you move downstream.

(over)



DO Logger
man-made dam
coontail near bank, waterweed in centre & bank
& cobbles
fallen trees & rocks & gravel
man-made dam
trib in (↑s/w)
Pine bottom, waterweed patches
many fallen trees, more rocky substrate
waterweed growing between fallen trees
man-made dam
flow splits around dam
storm culvert
small mowed patch w path to house to the north (likely), intake pipe
Substrate ↑ fines
small trib
→ rocks, riffles, some waterweed, trace periphyton (near banks)
finer sediment bottom, few rocks, some eelgrass patches, some chara,
mostly cobble & rock bottom
Beaver dam
DO Logger
* = Channel & bank slope msmt locations
Google earth

Appendix D. Downstream TP Target Memorandum and Predicted Effluent Chloride Concentrations

Hutchinson
Environmental Sciences Ltd.

Suite 202 – 501 Krug Street, Kitchener, ON N2B 1L3 │ 519-576-1711

Memorandum

Date: **October 20, 2016**

To: **Gary Scott, Ainley Group**

From: **Deborah Sinclair, Neil Hutchinson and Tara Roumeliotis**

Re: **J160005 – Recommended Downstream TP Target for West Credit River at Winston Churchill Blvd.**

The Town of Erin (Town) is currently completing a Schedule C Class EA for a proposed Waste Water Treatment Plant (WWTP) to service the existing population and proposed new growth in Erin and Hillsburgh. The proposed phasing of the plant will eventually accommodate Full Build Out of the Town's official plan with additional capacity for growth. Ainley Group (consultants for the Town) requested that Hutchinson Environmental Sciences Ltd (HESL) recommend a downstream water quality target for Total Phosphorus (TP) for the West Credit River at Winston Churchill Blvd. as input to determining the effluent flow and treatment limits for the proposed WWTP.

The Ontario Ministry of the Environment and Climate Change (MOECC) provides guidance on the management of surface water and groundwater quality and quantity for the Province of Ontario. They have established a Provincial Water Quality Objective (PWQO) of 0.03 mg/L for Ontario rivers and Policy 1 for management of surface water quality which states *"In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives. Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed …"*.

This memo provides information and a rationale to support a permissible lowering of water quality in the West Credit River from discharge of treated municipal waste water from the proposed Erin WWTP.

TP Concentrations in West Credit River at 10th Line and Winston Churchill Blvd.

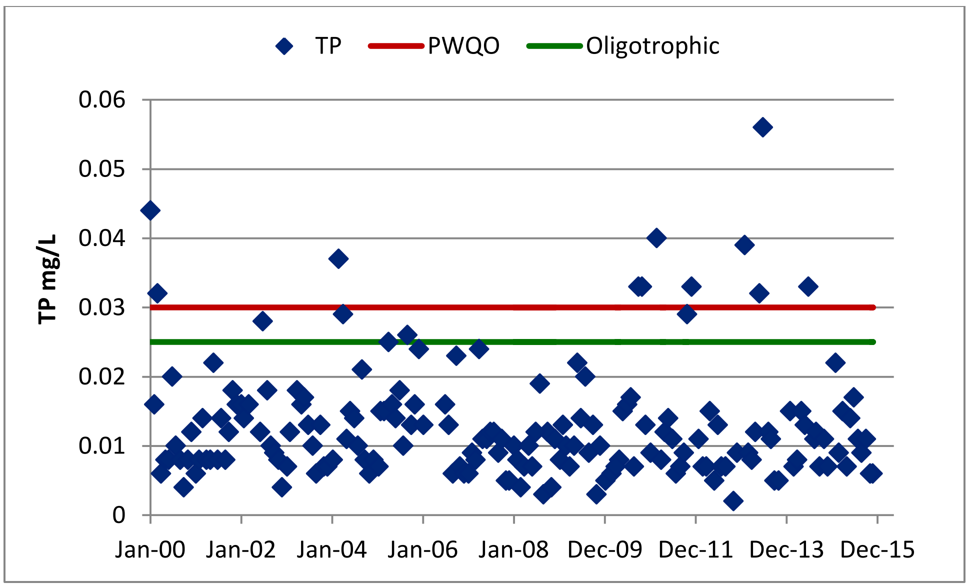
Total phosphorus (TP) concentrations in the West Credit River have been monitored as part of the Ministry of the Environment and Climate Change's (MOECC) Provincial Water Quality Monitoring Network (PWQMN) at Winston Churchill Boulevard since 1975 (station 6007601502). The median (2005 - 2015) and 75th percentile TP concentrations (0.011 mg/L and 0.015 mg/L) are well below the Provincial Water

Quality Objective[1] (PWQO) of 0.03 mg/L. Concentrations are stable; with no apparent increasing or decreasing trend over time (Figure 1).

TP measurements were also collected from the West Credit River upstream of Winston Churchill at 10th Line by Credit Valley Conservation (CVC) in 2007 and 2008 (CVC 2011) and by HESL in 2016 (unpublished data). The median and 75th percentile TP concentrations at 10th Line were also well below the PWQO at 0.014 mg/L and 0.016 mg/L, respectively (based on 15 measurements). The lower TP concentrations, and hence better water quality, at Winston Churchill is due to groundwater discharge to the river between the two stations (CVC 2011).

In 2016, HESL collected chlorophyll "*a*" samples from 10th Line on five occasions. Concentrations ranged from 0.598 µg/L to 3.91 µg/L, with a median of 2.63 µg/L.

Figure 1 Total Phosphorus concentrations measured (2000-2015) in the West Credit River at Winston Churchill Blvd. (PWQMN station 6007601502)



Trophic Status of West Credit River and Implications

Total phosphorus is the key limiting nutrient in plant and algal growth in freshwater systems. Increases in total phosphorus concentrations often results in increased algal biomass (e.g. Dodds et al., 1997). Phosphorus concentrations are therefore commonly used to classify lakes and rivers according to their nutrient ("trophic") status[2] (e.g. oligotrophic, mesotrophic, and eutrophic). Generally oligotrophic systems have low nutrients, low algal biomass, high water clarity, and can support a cold-water fishery. Eutrophic

[1] *The PWQO are numerical and narrative criteria that serve as chemical and physical indicators representing a satisfactory level for surface waters (i.e. lakes and rivers) and where it discharges to the surface, the groundwater of the province of Ontario. The PWQO are set at a level of water quality, which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water (MOEC 1994a).*

[2] *Trophic status – the availability of growth limiting nutrients (Smith et al. 1999) such as total phosphorus or nitrogen.*

systems are nutrient enriched (high nutrient concentrations), have high algal biomass, can have frequent algal blooms, and wide swings in dissolved oxygen (with potential for conditions of no oxygen (anoxia)). Mesotrophic systems have intermediate characteristics (Dodds et al., 1998).

The trophic status classification of the West Credit River between the 10th Line and Winston Churchill Blvd. is oligotrophic using the spot TP data from 10th Line, the long-term PWQMN data and the recent chlorophyll "*a*" data from 10th Line. The oligotrophic classification is based on a trophic status system developed for temperate streams by Dodds et al. (1998; Table 1).

Table 1 Trophic classification boundaries for streams (based on Dodds et al., 1998)

Trophic Level	TP (mg/L)	Suspended Chlorophyll *a* (μg/L)
Oligotrophic	<0.025	<10
Mesotrophic	0.025-0.075	10-30
Eutrophic	>0.075	>30

The West Credit River discharges to the Credit River downstream of Belfountain. The median and 75th percentile (2005-2014) TP concentrations of the Credit River downstream of Belfountain, at Highway 10 (PWQMN station 06007605202) are 0.031 mg/L and 0.052 mg/L respectively; above the PWQO of 0.03 mg/L.

The MOECC provides guidance on the management of surface water and groundwater quality and quantity for the Province of Ontario. In their document: *Policies, Guidelines and Provincial Water Quality Objectives of the Ministry of Environment and Energy (MOE 1994a)* two policies relate to the protection of water quality:

> Policy 1 – *In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives. Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed …"*
>
> Policy 2 - Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

The West Credit River at Erin is therefore managed under MOECC Policy 1 which allows some degradation of water quality, but flows into the main trunk of the river downstream of Belfountain which is managed under Policy 2 such that no additional degradation is allowed and remediation measures are encouraged. The discharge of effluent from the proposed Erin WWTP must not, therefore, contribute to any additional degradation of the main Credit River downstream.

For the purposes of the Schedule C Class EA, the MOECC stated (Paul Odom, October 3, 2016 Core Management Team Meeting) that the MOECC Policies are guidance statements, and that the Town of Erin may not increase the TP concentration in the West Credit River beyond the PWQO of 0.03 mg/L.

They did note, however, that if the Town of Erin discharge were to increase total phosphorus concentrations in the river to 0.03 mg/L that there would be no remaining assimilation capacity to accommodate other dischargers on this reach of the river or downstream, such as industrial dischargers or other municipalities, or to accommodate stormwater runoff. We note that the MOECC guidance does not encourage dischargers to discharge up to the PWQO, but states "… *some lowering of water quality is permissible in these areas…".* Therefore, MOECC suggested that the study team recommend a downstream objective and rationale for total phosphorus for consideration by MOECC. The downstream objective, because it differs from the MOECC generic PWQO of 0.03 mg/L, would be considered a Site Specific Water Quality Objective (CCME 2003).

The PWQO of 0.03 mg/L represents a two-fold increase over the current 75th percentile TP (0.015 mg/L) concentration and a change in trophic status from oligotrophic to mesotrophic in the West Credit River between 10th Line and Winston Churchill Boulevard. CVC has designated the West Credit River downstream of 10th Line as a cold-water aquatic community due to the presence of brook trout. 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 2011) and the longest contiguous brook trout habitat in the Credit River watershed is the West Credit River between Erin and Belfountain. The effect of doubling the TP concentration, thus changing the trophic status of the river, on brook trout and other aquatic life in the West Credit River is not well understood but detrimental changes would include increased growth of algae attached to bottom substrate (periphyton) which impairs habitat for fish spawning and benthic invertebrates and increased dissolved oxygen concentrations during the day and decreased concentrations at night in response to increased algal respiration which would stress aquatic life. A cautionary approach to establishing a target downstream TP concentration for the purposes of defining the flow and treatment limits is therefore recommended to protect aquatic life.

The following sections review available guidance to develop a downstream phosphorus objective for the West Credit River that will protect the cold water fishery. We then recommend an effluent TP limit that will meet the objective in the river at the projected effluent flows.

Environment Canada Framework for Managing Phosphorus

Environment Canada (2004) has developed a guidance framework for managing phosphorus concentrations in fresh water systems that is consistent with Canada Council of Ministers of the Environment (CCME) guideline development principles, but permits site-specific management of phosphorus. It was published as part of their *Ecosystem Health: Science-based Solutions* series which is dedicated to the dissemination of information and tools for monitoring, assessing and reporting on ecosystem health to support Canadians in making sound decisions (Environment Canada 2004). The guidance recommends a trigger approach to setting and establishing thresholds for TP concentrations. The framework steps include:

- Set ecosystem goals and objectives (enhance, protect, or restore)
- Define reference/baseline conditions
- Select trigger ranges
- Determine current TP concentrations
- Compare current concentrations and concentrations predicted from an undertaking to the trigger range

- Compare current concentrations and concentrations predicted from an undertaking to the baseline

In this case, the goal is to protect the sensitive brook trout population and maintain a healthy diverse aquatic system, while servicing existing development in Erin Village and Hillsburgh and allowing for new growth in the Town. The reference/baseline conditions in the river are well understood, and in this case represent the current concentrations of total phosphorus, which have not shown any increasing/decreasing trend in the last 15 years.

The Canadian Council of Ministers of the Environment (CCME 2003, p.15) provides the following guidance on setting Site Specific Water Quality Objectives (SSWQOs):

> *Two distinct strategies are commonly used to establish WQOs in Canada, including the antidegradation strategy and the use protection strategy. For water bodies with aquatic resources of national or regional significance, the WQOs are established to avoid degradation of existing water quality. For other water bodies, the WQOs are established to protect the designated uses of the aquatic ecosystem. As long as the designated water uses are protected, some degradation of existing water quality may be acceptable in these water bodies, provided that all reasonable and preventative measures are taken to protect water quality conditions.*

The brook trout population in the West Credit River is of regional significance and the West Credit River is the only portion of the Credit River sustaining Policy 1 oligotrophic waters. Therefore the Site Specific Water Quality Objective should be focused on "antidegradation" to maintain the oligotrophic status of the river.

CCME (2003) identifies four methods for developing a SSWQO; the background concentration procedure, recalculation procedure, water effect ratio procedure, and the resident species procedure. The "background concentration procedure" is appropriate for the West Credit River. *"In the background concentration procedure, the natural background concentrations of a contaminant in water …are determined and these levels are used to define acceptable water quality conditions at the site under consideration. Its use is based on the premise that surface water systems with superior water quality (i.e., relative to the Canadian WQGs) should not be degraded. This approach has been used most commonly to define WQOs for relatively pristine water bodies, including several river systems in Canada (e.g., Dunn 1989; MacDonald and Smith 1990). It has also been used in somewhat contaminated water bodies, such as Burrard Inlet (Nijman and Swain 1989)."* (CCME 2003, p. 19). We used three approaches to define the background concentration and resultant SSWQO for the West Credit River.

Although the natural background concentrations of total phosphorus in the West Credit River are not known, current concentrations are low and exceptional for Southern Ontario and are a reasonable approximation of natural background levels. The background concentration procedure uses the upper limit of the natural background concentration of a contaminant to define acceptable water quality conditions (CCME 2003). In this case the "natural" background concentration is the current stable TP concentration of the receiver, prior to the input from the WWTP. The two examples provided to determine the upper limit are the mean concentration plus two standard deviations and the 90th percentile concentration. For the West Credit River at Winston Churchill Blvd. these values are 0.030 mg/L (mean = 0.012 mg/L, standard deviation = 0.009 mg/L) and 0.024 mg/L respectively. Since the data are highly variable (2 x standard deviation is greater than the mean) this approach is not protective of water quality.

Using the 90th percentile approach to establish the upper limit of the background concentration of 0.024 mg/L is recommended, and recognizes the oligotrophic nature of the receiver.

Therefore, use of the background concentration procedure for derivation of the SSWQO will define the natural background concentration of the West Credit River as the 75th percentile total phosphorus concentration (=0.016 mg/L) with the upper limit defined by the 90th percentile concentration of 0.024 mg/L.

A trigger range is defined as a "desired concentration range for phosphorus; if the upper limit of the range is exceeded, that indicates ***a potential*** environmental problem, and therefore **"triggers" further investigation**. The internationally-accepted Organization for Economic Co-operation and Development (OECD) trophic status values are the recommended trigger ranges (Table 2) for Canadian lakes and rivers (CCME 2004). These trophic values were originally established for lakes and reservoirs (Environment Canada 2004), which is why they differ slightly than those presented in Table 1. Rivers can, however, sustain higher loads of TP than lakes before any observable changes in community composition and biomass (Smith et al. 1999): TP is flushed through the system before it can be taken up and utilized by aquatic plants. Therefore, the United States Environmental Protection Agency (USEPA) has adopted trophic classification for rivers based on the Dodds et al. values (Table 1), which are higher than the OECD values.

Table 2 Recommended trigger ranges for Canadian Lakes and Rivers (CCME 2004)

Trophic Status	TP concentration (µg/L)
Ultra-oligotrophic	< 4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	>100

We recommend using the Dodds et al (1998) trigger ranges as they have specifically been established for rivers in temperate sites. The oligotrophic trophic range is <0.025 mg/L TP (Table 1); therefore a downstream concentration over 0.024 mg/L TP would indicate a potential shift to mesotrophic classification and trigger further investigation.

In addition to the trigger ranges, the Environment Canada guidance also recommends comparing predicted concentrations to baseline conditions, and notes that *"up to a 50% increase in phosphorus concentrations above the baseline level is deemed acceptable"…"If a 50% increase from baseline is not observed, then there is considered a low risk of adverse effects….if the increase is greater than 50%, the risk of observable effects is considered to be high and further assessment is recommended*" (Environment Canada 2004). We established a natural background 75th percentile concentration of 0.016 mg/L in the West Credit River at Erin. A 50% increase above this results in a trigger concentration of 0.024 mg/L.

Use of the Environment Canada guidance of a 50% increase above background supports a total phosphorus concentration of 0.024 mg/L as an upper range to protect the oligotrophic waters of the West Credit River.

We therefore recommend a value of 0.024 mg/L as the SSWQO for total phosphorus in the West Credit River.

Conclusions and Recommendations

We therefore recommend that a downstream SSWQO of 0.024 mg/L TP be adopted to protect the cold water habitat and water quality in the West Credit River, consistent with Environment Canada and CCME guidance. This will maintain the current trophic status of the river. A higher water quality objective is not recommended as the effect of changing the trophic status of the river on brook trout and other aquatic life in the West Credit River is not well understood at this time.

Water quality objectives are developed as guidelines and not as enforced regulatory standards. They are conservative, in that the best scientific information concludes that aquatic life will be protected at concentrations below the objective but this does not mean that the ecosystem will necessarily be impaired if concentrations increase above the objective. Therefore, Environment Canada (2004) states that, if total phosphorus concentrations increase to the SSWQO, the management response is investigation to determine if the changes have been harmful or if further increases can be sustained. This provides the opportunity for adaptive management of discharge from the proposed WWTP at Erin.

During Phase 1 of the WWTP, we recommend that the Town implement a receiver monitoring program for the West Credit River to determine the resultant phosphorus concentration in the river and assess any effects of increased TP loadings on water quality and aquatic communities (e.g. algal, benthos and fish). Effluent monitoring is also required to confirm that the lower effluent limits and objectives required to accommodate future growth can be met. The findings from these monitoring studies can:

a) inform a future application to rerate the Erin WWTP to accommodate a higher wastewater flow at a lower effluent TP concentration if monitoring shows that the plant can be operated at a lower effluent limit,

b) inform a decision to maintain the downstream West Credit River TP objective at 0.024 mg/L at Full Build Out or if it can be relaxed to 0.027 mg/L with no threat to aquatic life to accommodate either a higher population or a higher effluent limit.

Phosphorus Control for New Development

Wastewater discharge will not be the only source of total phosphorus to the West Credit River as the Town of Erin is serviced and grows. New development, infill and intensification of development will increase impervious services in Erin and Hillsburgh, leading to increased runoff of stormwater which will contain phosphorus and other pollutants. Growing recognition of non-point source pollution by urban runoff has led to increased demands for management of stormwater quality, as well as quantity. New development in the Lake Simcoe and Nottawasaga River watersheds and in the City of Oakville, for example, must set a target of "net zero" increase in phosphorus loading, such that the cumulative phosphorus loading from municipal wastewater effluent and stormwater runoff must not increase between the pre-development and post-development condition. Jennifer Dougherty, of Credit Valley Conservation stated that this was typically required for cases where the receiving waters were Policy 2 but that this would not be required for Erin[3]. Nevertheless, the sensitivity of the West Credit River at Erin may stimulate requests for phosphorus abatement from stormwater as Erin and Hillsburgh are built out.

Decommissioning of septic systems upon completion of the Erin WWTP will reduce one source of phosphorus (and nitrate) loading to the watershed. Development and redevelopment can reduce phosphorus loading in storm water through implementation of improved stormwater management (Best Management Practices) for older areas and Low Impact Development Techniques, particularly infiltration of runoff for new development. Infiltration techniques reduce surface runoff volume, remove particulates and suspended solids from runoff (including particulate phosphorus), encourage adsorption of phosphorus onto mineral surfaces in soils and cool the runoff, all of which will protect the cold water habitat in the West Credit River and help offset the discharge form the new WWTP.

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[3] *October 3, 2016 Core Management Team Meeting)*

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Town of Erin

Urban Centre Wastewater Servicing

Class Environmental Assessment

Phases 3 and 4

Technical Memorandum

Predicted Chloride Levels in Future Erin WWTP Effluent

March 2017

Ainley GROUP
CONSULTING ENGINEERS & PLANNERS

Urban Centre Wastewater Servicing Class Environmental Assessment Phases 3 & 4

Project No. 115157

Prepared for:
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Hutchinson Environmental Sciences Ltd.

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VP Water Business

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1.0 Predicted Chloride Levels

Predicted chloride levels in the Erin WWTP Effluent were developed using data from communities with similar drinking water characteristics to Erin. The hard groundwater sources for Erin drinking water result in consumers using water softeners which add chlorides to the water. The communities in the table below also have high hardness levels in the drinking water and a high incidence of softener use. These communities also already have data on chlorides in their wastewater effluent allowing a comparison to be made with Erin drinking water hardness and a prediction to be made on future WWTP effluent chloride levels.

Parameter	Orangeville	Elora	Arthur	Mount Forest	Erin
Average Hardness in raw drinking water	360 mg/L	400-500 mg/L	345 mg/L	270-300 mg/L	300-400 mg/L
WWTP Effluent Average Chlorides	492.60 mg/L (2012-2016)	500 mg/L (2014-2015)	394.2 mg/L (2010)	197.25 mg/L (2012-2014)	**396 mg/L**
WWTP Effluent Max Chlorides	650 mg/L (2012-2016)	713 mg/L (2014-2015)	499 mg/L (2010)	274 mg/L (2012-2014)	**534 mg/L**
WWTP Effluent Min Chlorides	409 mg/L (2012-2016)	104 mg/L (2014-2015)	272 mg/L (2010)	13.1 mg/L (2012-2014)	**200 mg/L**

On average water hardness in raw drinking water in the Town of Erin ranges from 300-400 mg/L. Data was collected from nearby communities with similar hardness in drinking water including the Town of Orangeville, Elora (Wellington County), Arthur (Wellington County) and Mount Forest (Wellington County).

The hardness level of raw drinking water for these communities was found to between 270-500 mg/L. WWTP effluent average chloride concentrations for these communities was found to be between 197.25 -500 mg/L. WWTP effluent maximum chloride concentrations for these communities was found to be between 274 -713 mg/L.

Whereas the hardness level of drinking water in Erin is within the range of these other communities, there is no real corelation between the hardness and the effluent chloride levels because the % of consumers using softeners also varies and is unknown. For this reason, the predicted chloride concentration in the Erin WWTP effluent was calculated by taking the average of the chloride concentrations in the effluent from the other treatment plants.

Appendix E. Email Correspondence from MOECC on Effluent Limits

Tara Roumeliotis

From:	Christine Furlong <cfurlong@tritoneng.on.ca>
Sent:	October-03-16 3:21 PM
To:	scott@ainleygroup.com
Cc:	Simon Glass (glass@ainleygroup.com); 'jdougherty@creditvalleyca.ca'; Noah Brotman (noahbrotman@hardystevenson.com); mullan@ainleygroup.com; Neil Hutchinson; 'garyc@wellington.ca'; Dave Hardy (davehardy@hardystevenson.com); Deborah Sinclair; Tara Roumeliotis; 'Ray Blackport (blackport_hydrogeology@rogers.com)'; Barb Slattery
Subject:	FW: Comments on Today's meeting
Attachments:	1160-9ESQPY-14.pdf

Hello Gary

Barb Slattery has provided some comments from MOECC on effluent quality for the Town of Erin WWTP discharge based on the Environmental Compliance Approval (ECA) for the Orangeville WWTP.

Attached is the Orangeville ECA in its entirety from the Access Environment portal.

Christine Furlong, P. Eng

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From: Slattery, Barbara (MOECC) [mailto:barbara.slattery@ontario.ca]
Sent: October-03-16 2:59 PM
To: Christine Furlong
Subject: Comments on Today's meeting

Hello Christine, would you be so kind as to distribute this email to the rest of the group. As I noted, Paul and Craig wanted to make some comments on Table 4 on page 3 of the slide deck. Here they are:

Using the Orangeville WPCP ECA (2014) for comparison – a plant which discharges to the headwaters of the Credit. Orangeville is currently upgrading (summer 2018 completion) and has current and future numbers (we have used Objective/Limit notation in the following)

a) pH – is this actually meaning pH to be *between* 7 & 8.6. Achieving this is hightly desireable given that this is prime trout rearing habitat. (Orangeville is 6-9.5)
b) TSS – While this is not a PWQO parameter, it it can be designed for 3mg/l, the limit should be 5mg/l (Orangeville is 5/7.5 upgrading to 4/5). The issue is reducing to the maximum extent possible the discharge of solids material to the pools and substrates of one of GTA's prime spawning/rearing habitats.
c) TAN – With an objective of 0.4mg/l, they have proposed a limit of 2mg/l. This difference is likely driven by variations during winter conditions. Limits of 1.3 mg/l (May-October) and 2.0mg/L (November-April) should be readily achievable with a design of 0.4.
d) TKN at 3 mg/l and NO_3 at 5/6 mg/l are OK
e) E Coli at 100 are OK
f) D.O. in the effluent is OK at 5/4 (minimum values)
g) If BOD_5 is $tBOD_5$, OK. If it is $cBOD_5$, the limit should be 5. (Orangeville is 5/7.5 going to 4/5). Most modern facilities achieve $cBOD_5$ <2 (MDL) for most of their analyses (barring upset/spill).
h) Temperature: we presume the values quoted are <17°C objective and 8-19°C limit. Temperature is almost impossible to control within a WPCP; however, influent is usually fairly consistent. In the future, the ministry's review engineer will decide if temperature should be tabulated. Obviously the lower the temperature, the better for both the cold water species and ammonia dissociation.

Thank you

Barb Slattery, EA/Planning Coordinator
Ministry of the Environment and Climate Change
West Central Region
(905) 521-7864

Appendix F. QUAL2K Output Data

Constituent (Average) Summary - Phase 1 Flows (3380 m3/d)

Tributary Label	Reach Lal	x(km)	cond (umhos)	DO(mgO2/L)	ODf (mgO2	No(ugN/L)	NH4(ugN/L)	NO3(ugN/L)	Po (ugP/L)	Inorg P (ugP/L)	ritus (mgD	Pathogen	Alk	pH	TP	TKN	NH3
main	Mainstem	1.70	613.00	7.72	2.78	535.00	55.00	1900.00	7.90	8.10	0.00	160.00	281.00	8.21	18.72	609.58	3.60
		1.67	613.00	7.73	2.76	533.68	53.89	1898.82	7.70	8.07	0.00	149.99	280.99	8.21	18.45	606.83	3.58
		1.60	613.00	7.74	2.74	532.36	52.80	1897.63	7.51	8.05	0.00	140.87	280.99	8.22	18.19	604.10	3.57
		1.54	670.17	7.08	3.01	702.63	212.36	2363.31	11.29	12.00	0.01	121.98	286.68	8.28	25.48	930.79	16.05
		1.47	670.17	6.98	2.97	701.09	205.69	2368.20	11.09	11.98	0.01	114.09	286.63	8.27	25.24	922.34	15.33
		1.41	670.17	6.90	2.93	699.64	199.70	2372.46	10.91	11.96	0.01	107.53	286.58	8.26	25.01	914.68	14.74
		1.33	670.17	6.87	2.90	698.31	194.85	2375.53	10.74	11.94	0.01	102.58	286.55	8.26	24.79	908.31	14.35
		1.24	670.17	6.84	2.86	696.52	188.47	2379.49	10.51	11.92	0.01	96.57	286.50	8.26	24.50	899.88	13.85
		1.16	670.17	6.82	2.82	694.73	182.28	2383.28	10.29	11.89	0.02	91.16	286.46	8.25	24.22	891.64	13.36
		1.07	670.17	6.79	2.78	692.83	175.88	2387.11	10.06	11.86	0.02	85.93	286.41	8.25	23.92	883.07	12.87
		0.97	670.17	6.77	2.73	690.93	169.68	2390.75	9.83	11.84	0.02	81.19	286.37	8.25	23.63	874.71	12.40
		0.88	670.17	6.75	2.69	689.03	163.67	2394.20	9.61	11.81	0.02	76.89	286.32	8.24	23.34	866.54	11.93
		0.78	670.17	6.75	2.66	687.36	158.76	2396.94	9.42	11.78	0.03	72.84	286.29	8.24	23.10	859.74	11.66
		0.69	670.17	6.75	2.62	685.69	153.95	2399.58	9.24	11.76	0.03	69.20	286.25	8.24	22.86	853.04	11.38
		0.59	670.17	6.75	2.59	684.02	149.24	2402.11	9.06	11.74	0.03	65.89	286.22	8.24	22.62	846.45	11.10
		0.50	670.17	6.75	2.55	682.35	144.64	2404.55	8.88	11.71	0.03	62.87	286.19	8.24	22.39	839.96	10.82
		0.43	670.17	6.82	2.54	681.69	142.01	2405.18	8.79	11.69	0.03	61.67	286.17	8.25	22.26	836.56	10.81
		0.37	670.17	6.89	2.52	681.02	139.42	2405.78	8.70	11.67	0.04	60.51	286.15	8.25	22.14	833.21	10.78
		0.31	670.17	6.88	2.49	679.24	133.73	2407.31	8.48	11.62	0.04	57.38	286.12	8.25	21.84	825.50	10.39
		0.22	670.17	6.88	2.45	677.45	128.18	2408.70	8.27	11.58	0.04	54.50	286.08	8.25	21.55	817.91	10.00
		0.13	670.17	6.87	2.42	675.66	122.82	2409.94	8.06	11.53	0.05	51.84	286.05	8.25	21.27	810.52	9.63
		0.05	670.17	6.86	2.38	673.87	117.66	2411.02	7.86	11.49	0.05	49.38	286.01	8.24	20.99	803.33	9.27
	Terminus	0.01	670.17	6.86	2.38	673.87	117.66	2411.02	7.86	11.49	0.05	49.38	286.01	8.24	20.99	803.33	9.27

Constituent (Average) Summary - Full Build Out Flows (7172 m3/d)

Tributary Label	Reach Lal	x(km)	cond (umhos)	DO(mgO2/L)	ODf (mgO2	No(ugN/L)	NH4(ugN/L)	NO3(ugN/L)	Po (ugP/L)	Inorg P (ugP/L)	ritus (mgD	Pathogen	Alk	pH	TP	TKN	NH3
main	Mainstem	1.70	613.00	7.72	2.78	535.00	55.00	1900.00	7.90	8.10	0.00	160.00	281.00	8.21	18.72	609.58	3.60
		1.67	613.00	7.73	2.76	533.68	53.89	1898.82	7.70	8.07	0.00	149.99	280.99	8.21	18.45	606.83	3.58
		1.60	613.00	7.74	2.74	532.36	52.80	1897.63	7.51	8.05	0.00	140.87	280.99	8.22	18.19	604.10	3.57
		1.54	717.29	6.64	3.29	844.69	192.74	2738.99	11.31	11.92	0.01	118.57	291.44	8.34	25.12	1051.02	16.09
		1.47	717.29	6.55	3.24	843.01	187.46	2742.67	11.14	11.91	0.01	111.31	291.40	8.33	24.91	1043.87	15.46
		1.41	717.29	6.49	3.20	841.42	182.66	2745.90	10.98	11.89	0.01	105.21	291.37	8.32	24.71	1037.31	14.91
		1.33	717.29	6.48	3.17	839.94	178.73	2748.16	10.83	11.87	0.01	100.57	291.34	8.32	24.52	1031.74	14.56
		1.24	717.29	6.46	3.13	838.01	173.71	2750.99	10.63	11.85	0.01	95.09	291.30	8.31	24.27	1024.59	14.10
		1.16	717.29	6.45	3.09	836.08	168.82	2753.69	10.43	11.83	0.01	90.13	291.26	8.31	24.02	1017.57	13.67
		1.07	717.29	6.44	3.05	834.02	163.74	2756.42	10.23	11.81	0.02	85.32	291.22	8.31	23.77	1010.24	13.23
		0.97	717.29	6.43	3.00	831.97	158.80	2759.02	10.03	11.78	0.02	80.95	291.18	8.30	23.52	1003.05	12.79
		0.88	717.29	6.42	2.96	829.92	153.99	2761.48	9.84	11.76	0.02	76.97	291.15	8.30	23.27	995.99	12.38
		0.78	717.29	6.44	2.92	828.13	150.06	2763.41	9.67	11.74	0.02	73.17	291.12	8.30	23.06	990.09	12.11
		0.69	717.29	6.45	2.89	826.33	146.19	2765.26	9.50	11.72	0.02	69.74	291.09	8.30	22.85	984.26	11.86
		0.59	717.29	6.47	2.85	824.53	142.39	2767.05	9.34	11.70	0.02	66.63	291.06	8.29	22.65	978.49	11.60
		0.50	717.29	6.48	2.82	822.74	138.65	2768.76	9.18	11.68	0.03	63.79	291.03	8.29	22.44	972.79	11.35
		0.43	717.29	6.57	2.80	822.00	136.51	2769.10	9.10	11.66	0.03	62.69	291.01	8.30	22.33	969.83	11.32
		0.37	717.29	6.66	2.79	821.26	134.38	2769.42	9.02	11.64	0.03	61.63	291.00	8.30	22.23	966.89	11.28
		0.31	717.29	6.66	2.75	819.28	129.63	2770.28	8.82	11.60	0.03	58.66	290.97	8.30	21.97	959.96	10.92
		0.22	717.29	6.65	2.71	817.30	125.01	2771.03	8.63	11.57	0.04	55.94	290.94	8.30	21.71	953.18	10.57
		0.13	717.29	6.65	2.68	815.32	120.53	2771.66	8.45	11.53	0.04	53.43	290.91	8.30	21.46	946.54	10.23
		0.05	717.29	6.65	2.64	813.34	116.19	2772.18	8.27	11.49	0.04	51.11	290.88	8.29	21.21	940.04	9.89
	Terminus	0.01	717.29	6.65	2.64	813.34	116.19	2772.18	8.27	11.49	0.04	51.11	290.88	8.29	21.21	940.04	9.89

Appendix G. CORMIX Output Data

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CORMIX3 PREDICTION FILE:
333333333333333333333333333333333333333333333333333333333333333333333333333333333
                       CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX3: Buoyant Surface Discharges
                             CORMIX Version 10.0GT
                        HYDRO3 Version 10.0.0.0 July 2016
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CASE DESCRIPTION
 Site name/label:   West Credit River
 Design case:       Erin WWTP - 3380
 FILE NAME:         C:\...rin EA\CORMIX\Erin WWTP-3380 bank-good-update.prd
 Time stamp:        03/14/2017--12:43:54

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     11.00  AS    =      4.40  QA    =      0.23  ICHREG= 2
 HA    =      0.40  HD    =      0.30
 UA    =      0.051 F     =      0.130 USTAR =0.6529E-02
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.9542

DISCHARGE PARAMETERS (metric units)
 BANK  =  RIGHT     DISTB =      0.00  Configuration: flush_discharge
 SIGMA =     90.00  HDO   =      0.30  SLOPE =    0.00 deg.
 Circular discharge pipe:
 D0    =      0.200 A0    =      0.031
 Dimensions of equivalent rectangular discharge:
 B0    =      0.157 H0    =      0.200 A0    =0.3142E-01  AR    =      1.273
 U0    =      1.241 Q0    =      0.039       =0.3900E-01
 RHO0  =  998.4062  DRHO0 =-.4520E+00  GP0   =-.4442E-02
 C0    =0.1145E+01  CUNITS=  mg/l
 IPOLL =  2         KS    =0.0000E+00  KD    =0.5787E-04

FLUX VARIABLES (metric units)
 Q0    =0.3900E-01  M0    =0.4841E-01  J0    =-.1732E-03
 Associated length scales (meters)
 LQ    =      0.18  LM    =  99999.00  Lm    =      4.30  Lb    =      0.00
 LQ2D  =      0.10  LM2D  =  99999.00  Lm2D  =     61.72

NON-DIMENSIONAL PARAMETERS
 FR0   =  99999.00  FRCH  =  99999.00  R     =     24.28

FLOW CLASSIFICATION
 333333333333333333333333333333333333333333
 3  Flow class (CORMIX3)      =    SA2    3
 3  Applicable layer depth HS =     0.30  3
 3  Limiting Dilution S =QA/Q0=     6.77  3
 333333333333333333333333333333333333333333

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.1145E+01  CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  1         CSTD  =0.2150E+00
 REGMZ =  0
 XINT  =   1500.00  XMAX  =   1500.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the WATER SURFACE and at center of discharge
      channel/outlet:      0.00 m  from the RIGHT bank/shore.
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Erin WWTP-3380-diffuser vertical-good-side-update.prd

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CORMIX2 PREDICTION FILE:
222222222222222222222222222222222222222222222222222222222222222222222222222222222
222222222222
                    CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 10.0GT
                      HYDRO2 Version 10.0.0.0 July 2016
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CASE DESCRIPTION
 Site name/label:   West Credit River
 Design case:       Erin WWTP - 3380
 FILE NAME:         C:\... WWTP-3380-diffuser vertical-good-side-update.prd
 Time stamp:        03/14/2017--12:49:17

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     11.00  AS    =      4.40  QA    =      0.23  ICHREG= 3
 HA    =      0.40  HD    =      0.40
 UA    =      0.051 F     =      0.130 USTAR =0.6529E-02
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.9542

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= alternating_parallel
 BANK  =  RIGHT     DISTB =      0.00  YB1   =      0.50  YB2   =      0.50
 LD    =      5.00  NOPEN =   10       SPAC  =      0.56
 D0    =      0.050 A0    =      0.002 H0    =      0.00  SUB0  =      0.40
 D0INP =      0.050 CR0   =      1.000
 Nozzle/port arrangement:   near_vertical_discharge
 GAMMA =      0.00  THETA =     90.00  SIGMA =      0.00  BETA  =     90.00
 U0    =      1.986 Q0    =      0.039 Q0A   =0.3900E-01
 RHO0  =  998.4062  DRHO0 =-.4520E+00  GP0   =-.4442E-02
 C0    =0.1145E+01  CUNITS=  mg/l
 IPOLL =  2         KS    =0.0000E+00  KD    =0.5787E-04

DIFFUSER PARAMETERS WITH IMAGE EFFECTS (metric units)
 The bank/shore proximity effect is accounted for by the following flow
 variables and definitions of length scales and parameters.
 LD    =      5.00  Q0    =      0.078 Q0A    =0.3900E-01

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.3120E-01  m0    =0.1549E-01  j0    =-.3465E-04  SIGNJ0=     -1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.016 lM    =     14.54  lm    =     11.85
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.7800E-01  M0    =0.7746E-01  J0    =-.1732E-03
 Associated 3-d length scales (meters)
 LQ    =      0.04  LM    =     11.16  Lm    =      7.70  Lb    =      2.59
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    475.55  FRD0  =    133.27  R     =     38.84  PL    =  140.00
 (slot)             (port/nozzle)


FLOW CLASSIFICATION
 222222222222222222222222222222222222222222
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                Erin WWTP-3380-diffuser vertical-good-side-update.prd
 2  Flow class (CORMIX2)      =    MNU14  2
 2  Applicable layer depth HS =     0.40  2
 2  Limiting Dilution S =QA/Q0=     3.88  2
 222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.1145E+01  CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  1         CSTD  =0.2150E+00
 REGMZ =  0
 XINT  =    200.00  XMAX  =    200.00

X-Y-Z COORDINATE SYSTEM:
  because of bank/shore proximity, the ORIGIN is located directly
   at the RIGHT bank/shore.
  the bank/shore acts as a plane of symmetry for the predicted
  plume geometry.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 100 display intervals per module
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BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.00     1.0 0.114E+01   0.00     2.50     1.986
.00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
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BEGIN MOD234: UNSTABLE RECIRCULATION REGION OVER LAYER DEPTH

 The MIXING of this alternating diffuser is somewhat REDUCED
   due to its PARALLEL ALIGNMENT.
 INITIAL LOCAL VERTICAL INSTABILITY REGION:
   Bulk dilution (S =   1.41) occurs in a limited region (horizontal extent
   =    3.00 m) surrounding the discharge location.

  Control volume inflow:
       X        Y       Z        S       C       BV       BH         TT
      0.00     0.00    0.00     1.0 0.114E+01   0.00     2.50   .00000E+00

  Control volume outflow:
       X        Y       Z        S       C       BV       BH         TT
      3.00     0.00    0.20     1.4 0.810E+00   0.40     1.00   .00000E+00

END OF MOD234: UNSTABLE RECIRCULATION REGION OVER LAYER DEPTH
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BEGIN MOD234a: UPSTREAM SPREADING AFTER NEAR-FIELD INSTABILITY

 UPSTREAM INTRUSION PROPERTIES:
        Upstream intrusion length               =       0.26 m
        X-position of upstream stagnation point =       2.74 m
        Thickness in intrusion region           =       0.40 m
        Half-width at downstream end            =       2.86 m
        Thickness at downstream end             =       0.38 m

  Control volume inflow:
       X        Y       Z        S       C       BV       BH        TT
      3.00     0.00    0.20     1.4 0.810E+00   0.40     1.00   .00000E+00

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       ZU       ZL
TT
      2.74     0.00    0.00  9999.9 0.000E+00   0.00     0.00    0.00     0.00
.28011E+02
      2.77     0.00    0.00     3.1 0.365E+00   0.40     0.41    0.40     0.00
.00000E+00
      2.94     0.00    0.00     1.5 0.783E+00   0.40     0.98    0.40     0.00
.00000E+00
      3.11     0.00    0.00     1.4 0.809E+00   0.38     1.93    0.38     0.00
.20797E+01
      3.27     0.00    0.00     1.4 0.808E+00   0.38     2.10    0.38     0.00
.53212E+01
      3.44     0.00    0.00     1.4 0.805E+00   0.38     2.24    0.38     0.00
.85626E+01
      3.60     0.00    0.00     1.4 0.802E+00   0.38     2.37    0.38     0.00
.11804E+02
      3.77     0.00    0.00     1.4 0.800E+00   0.38     2.48    0.38     0.00
.15045E+02
      3.94     0.00    0.00     1.4 0.798E+00   0.38     2.59    0.38     0.00
.18287E+02
      4.10     0.00    0.00     1.4 0.797E+00   0.38     2.68    0.38     0.00
.21528E+02
      4.27     0.00    0.00     1.4 0.796E+00   0.38     2.78    0.38     0.00
.24770E+02
      4.43     0.00    0.00     1.4 0.795E+00   0.38     2.86    0.38     0.00
.28011E+02
 Cumulative travel time =          28.0112 sec  (    0.01 hrs)

END OF MOD234a: UPSTREAM SPREADING AFTER NEAR-FIELD INSTABILITY
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** End of NEAR-FIELD REGION (NFR) **

 Recall that the plume is symmetric to the bank/shore on which the centerline
   (X-axis) is located.
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BEGIN MOD241: BUOYANT AMBIENT SPREADING
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Plume is ATTACHED to RIGHT bank/shore.
Plume width is now determined from RIGHT bank/shore.

Profile definitions:
BV = top-hat thickness, measured vertically
BH = top-hat half-width, measured horizontally in y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)
TT = Cumulative travel time

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
4.43	0.00	0.00	1.4	0.795E+00	0.38	2.86	0.38	0.00	.28011E+02
5.10	0.00	0.00	1.5	0.781E+00	0.37	3.05	0.37	0.00	.39197E+02
5.77	0.00	0.00	1.5	0.768E+00	0.35	3.23	0.35	0.00	.50382E+02
6.45	0.00	0.00	1.5	0.756E+00	0.34	3.40	0.34	0.00	.61568E+02
7.12	0.00	0.00	1.5	0.745E+00	0.33	3.56	0.33	0.00	.72754E+02
7.79	0.00	0.00	1.5	0.735E+00	0.32	3.71	0.32	0.00	.83939E+02
8.46	0.00	0.00	1.6	0.726E+00	0.31	3.86	0.31	0.00	.95125E+02
9.13	0.00	0.00	1.6	0.717E+00	0.30	4.00	0.30	0.00	.10631E+03
9.80	0.00	0.00	1.6	0.708E+00	0.30	4.14	0.30	0.00	.11750E+03
10.47	0.00	0.00	1.6	0.700E+00	0.29	4.27	0.29	0.00	.12868E+03
11.14	0.00	0.00	1.6	0.692E+00	0.28	4.40	0.28	0.00	.13987E+03
11.81	0.00	0.00	1.7	0.684E+00	0.28	4.52	0.28	0.00	.15105E+03
12.49	0.00	0.00	1.7	0.677E+00	0.28	4.64	0.28	0.00	.16224E+03
13.16	0.00	0.00	1.7	0.670E+00	0.27	4.76	0.27	0.00	.17342E+03
13.83	0.00	0.00	1.7	0.663E+00	0.27	4.88	0.27	0.00	.18461E+03
14.50	0.00	0.00	1.7	0.656E+00	0.26	4.99	0.26	0.00	.19580E+03
15.17	0.00	0.00	1.7	0.649E+00	0.26	5.10	0.26	0.00	.20698E+03
15.84	0.00	0.00	1.8	0.643E+00	0.26	5.20	0.26	0.00	.21817E+03
16.51	0.00	0.00	1.8	0.636E+00	0.26	5.31	0.26	0.00	.22935E+03
17.18	0.00	0.00	1.8	0.630E+00	0.25	5.41	0.25	0.00	.24054E+03
17.86	0.00	0.00	1.8	0.623E+00	0.25	5.51	0.25	0.00	.25172E+03
18.53	0.00	0.00	1.8	0.617E+00	0.25	5.61	0.25	0.00	.26291E+03
19.20	0.00	0.00	1.8	0.611E+00	0.25	5.71	0.25	0.00	.27409E+03
19.87	0.00	0.00	1.9	0.605E+00	0.24	5.80	0.24	0.00	.28528E+03

20.54	0.00	0.00	1.9	0.599E+00	0.24	5.90	0.24	0.00	.29647E+03
21.21	0.00	0.00	1.9	0.593E+00	0.24	5.99	0.24	0.00	.30765E+03
21.88	0.00	0.00	1.9	0.587E+00	0.24	6.08	0.24	0.00	.31884E+03
22.55	0.00	0.00	1.9	0.582E+00	0.24	6.17	0.24	0.00	.33002E+03
23.22	0.00	0.00	1.9	0.576E+00	0.24	6.25	0.24	0.00	.34121E+03
23.90	0.00	0.00	2.0	0.570E+00	0.24	6.34	0.24	0.00	.35239E+03
24.57	0.00	0.00	2.0	0.565E+00	0.24	6.43	0.24	0.00	.36358E+03
25.24	0.00	0.00	2.0	0.559E+00	0.23	6.51	0.23	0.00	.37477E+03
25.91	0.00	0.00	2.0	0.553E+00	0.23	6.59	0.23	0.00	.38595E+03
26.58	0.00	0.00	2.0	0.548E+00	0.23	6.68	0.23	0.00	.39714E+03
27.25	0.00	0.00	2.1	0.542E+00	0.23	6.76	0.23	0.00	.40832E+03
27.92	0.00	0.00	2.1	0.537E+00	0.23	6.84	0.23	0.00	.41951E+03
28.59	0.00	0.00	2.1	0.532E+00	0.23	6.92	0.23	0.00	.43069E+03
29.26	0.00	0.00	2.1	0.526E+00	0.23	7.00	0.23	0.00	.44188E+03
29.94	0.00	0.00	2.1	0.521E+00	0.23	7.07	0.23	0.00	.45306E+03
30.61	0.00	0.00	2.2	0.516E+00	0.23	7.15	0.23	0.00	.46425E+03
31.28	0.00	0.00	2.2	0.511E+00	0.23	7.23	0.23	0.00	.47544E+03
31.95	0.00	0.00	2.2	0.505E+00	0.23	7.30	0.23	0.00	.48662E+03
32.62	0.00	0.00	2.2	0.500E+00	0.23	7.38	0.23	0.00	.49781E+03
33.29	0.00	0.00	2.2	0.495E+00	0.23	7.45	0.23	0.00	.50899E+03
33.96	0.00	0.00	2.3	0.490E+00	0.23	7.52	0.23	0.00	.52018E+03
34.63	0.00	0.00	2.3	0.485E+00	0.23	7.60	0.23	0.00	.53136E+03
35.30	0.00	0.00	2.3	0.480E+00	0.23	7.67	0.23	0.00	.54255E+03
35.98	0.00	0.00	2.3	0.475E+00	0.23	7.74	0.23	0.00	.55374E+03
36.65	0.00	0.00	2.4	0.470E+00	0.23	7.81	0.23	0.00	.56492E+03
37.32	0.00	0.00	2.4	0.465E+00	0.23	7.88	0.23	0.00	.57611E+03
37.99	0.00	0.00	2.4	0.461E+00	0.23	7.95	0.23	0.00	.58729E+03
38.66	0.00	0.00	2.4	0.456E+00	0.23	8.02	0.23	0.00	.59848E+03
39.33	0.00	0.00	2.5	0.451E+00	0.23	8.09	0.23	0.00	.60966E+03
40.00	0.00	0.00	2.5	0.446E+00	0.23	8.16	0.23	0.00	.62085E+03
40.67	0.00	0.00	2.5	0.442E+00	0.23	8.23	0.23	0.00	.63203E+03
41.34	0.00	0.00	2.5	0.437E+00	0.23	8.29	0.23	0.00	

.64322E+03								
42.02	0.00	0.00	2.5	0.433E+00	0.23	8.36	0.23	0.00
.65441E+03								
42.69	0.00	0.00	2.6	0.428E+00	0.23	8.43	0.23	0.00
.66559E+03								
43.36	0.00	0.00	2.6	0.424E+00	0.23	8.49	0.23	0.00
.67678E+03								
44.03	0.00	0.00	2.6	0.419E+00	0.23	8.56	0.23	0.00
.68796E+03								
44.70	0.00	0.00	2.7	0.415E+00	0.23	8.62	0.23	0.00
.69915E+03								
45.37	0.00	0.00	2.7	0.410E+00	0.24	8.69	0.24	0.00
.71033E+03								
46.04	0.00	0.00	2.7	0.406E+00	0.24	8.75	0.24	0.00
.72152E+03								
46.71	0.00	0.00	2.7	0.402E+00	0.24	8.82	0.24	0.00
.73271E+03								
47.39	0.00	0.00	2.8	0.397E+00	0.24	8.88	0.24	0.00
.74389E+03								
48.06	0.00	0.00	2.8	0.393E+00	0.24	8.94	0.24	0.00
.75508E+03								
48.73	0.00	0.00	2.8	0.389E+00	0.24	9.01	0.24	0.00
.76626E+03								
49.40	0.00	0.00	2.8	0.385E+00	0.24	9.07	0.24	0.00
.77745E+03								
50.07	0.00	0.00	2.9	0.381E+00	0.24	9.13	0.24	0.00
.78863E+03								
50.74	0.00	0.00	2.9	0.377E+00	0.24	9.19	0.24	0.00
.79982E+03								
51.41	0.00	0.00	2.9	0.373E+00	0.24	9.25	0.24	0.00
.81101E+03								
52.08	0.00	0.00	3.0	0.369E+00	0.24	9.32	0.24	0.00
.82219E+03								
52.75	0.00	0.00	3.0	0.365E+00	0.24	9.38	0.24	0.00
.83338E+03								
53.43	0.00	0.00	3.0	0.361E+00	0.24	9.44	0.24	0.00
.84456E+03								
54.10	0.00	0.00	3.1	0.357E+00	0.25	9.50	0.25	0.00
.85575E+03								
54.77	0.00	0.00	3.1	0.353E+00	0.25	9.56	0.25	0.00
.86693E+03								
55.44	0.00	0.00	3.1	0.349E+00	0.25	9.62	0.25	0.00
.87812E+03								
56.11	0.00	0.00	3.1	0.346E+00	0.25	9.68	0.25	0.00
.88930E+03								
56.78	0.00	0.00	3.2	0.342E+00	0.25	9.74	0.25	0.00
.90049E+03								
57.45	0.00	0.00	3.2	0.338E+00	0.25	9.80	0.25	0.00
.91168E+03								
58.12	0.00	0.00	3.2	0.335E+00	0.25	9.86	0.25	0.00
.92286E+03								
58.79	0.00	0.00	3.3	0.331E+00	0.25	9.92	0.25	0.00
.93405E+03								
59.47	0.00	0.00	3.3	0.328E+00	0.25	9.98	0.25	0.00
.94523E+03								
60.14	0.00	0.00	3.3	0.324E+00	0.25	10.03	0.25	0.00
.95642E+03								
60.81	0.00	0.00	3.4	0.321E+00	0.26	10.09	0.26	0.00
.96760E+03								
61.48	0.00	0.00	3.4	0.317E+00	0.26	10.15	0.26	0.00
.97879E+03								
62.15	0.00	0.00	3.4	0.314E+00	0.26	10.21	0.26	0.00
.98998E+03								

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     62.82      0.00     0.00      3.5 0.310E+00   0.26    10.27    0.26    0.00
.10012E+04
     63.49      0.00     0.00      3.5 0.307E+00   0.26    10.32    0.26    0.00
.10123E+04
     64.16      0.00     0.00      3.6 0.304E+00   0.26    10.38    0.26    0.00
.10235E+04
     64.83      0.00     0.00      3.6 0.300E+00   0.26    10.44    0.26    0.00
.10347E+04
     65.51      0.00     0.00      3.6 0.297E+00   0.26    10.50    0.26    0.00
.10459E+04
     66.18      0.00     0.00      3.7 0.294E+00   0.26    10.55    0.26    0.00
.10571E+04
     66.85      0.00     0.00      3.7 0.291E+00   0.27    10.61    0.27    0.00
.10683E+04
     67.52      0.00     0.00      3.7 0.288E+00   0.27    10.67    0.27    0.00
.10795E+04
     68.19      0.00     0.00      3.8 0.285E+00   0.27    10.72    0.27    0.00
.10906E+04
     68.86      0.00     0.00      3.8 0.282E+00   0.27    10.78    0.27    0.00
.11018E+04
     69.53      0.00     0.00      3.9 0.279E+00   0.27    10.84    0.27    0.00
.11130E+04
     70.20      0.00     0.00      3.9 0.276E+00   0.27    10.89    0.27    0.00
.11242E+04
     70.88      0.00     0.00      3.9 0.273E+00   0.27    10.95    0.27    0.00
.11354E+04
     71.55      0.00     0.00      4.0 0.270E+00   0.28    11.00    0.28    0.00
.11466E+04
 Cumulative travel time =        1146.5731 sec  (    0.32 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.529E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.265E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X         Y        Z         S       C        BV       BH      ZU      ZL
TT
     71.55      0.00     0.00      4.0 0.270E+00   0.28    11.00    0.28    0.00
.11466E+04
     72.83      0.00     0.00      4.0 0.267E+00   0.28    11.00    0.28    0.00
.11680E+04
     74.12      0.00     0.00      4.0 0.264E+00   0.28    11.00    0.28    0.00
.11894E+04
     75.40      0.00     0.00      4.1 0.262E+00   0.28    11.00    0.28    0.00
.12108E+04
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     76.68      0.00     0.00      4.1 0.259E+00   0.29    11.00    0.29    0.00
.12322E+04
     77.97      0.00     0.00      4.2 0.256E+00   0.29    11.00    0.29    0.00
.12536E+04
     79.25      0.00     0.00      4.2 0.254E+00   0.29    11.00    0.29    0.00
.12750E+04
     80.54      0.00     0.00      4.2 0.251E+00   0.29    11.00    0.29    0.00
.12964E+04
     81.82      0.00     0.00      4.3 0.249E+00   0.30    11.00    0.30    0.00
.13178E+04
     83.11      0.00     0.00      4.3 0.246E+00   0.30    11.00    0.30    0.00
.13393E+04
     84.39      0.00     0.00      4.3 0.243E+00   0.30    11.00    0.30    0.00
.13607E+04
     85.68      0.00     0.00      4.4 0.241E+00   0.30    11.00    0.30    0.00
.13821E+04
     86.96      0.00     0.00      4.4 0.238E+00   0.31    11.00    0.31    0.00
.14035E+04
     88.25      0.00     0.00      4.5 0.236E+00   0.31    11.00    0.31    0.00
.14249E+04
     89.53      0.00     0.00      4.5 0.233E+00   0.31    11.00    0.31    0.00
.14463E+04
     90.81      0.00     0.00      4.6 0.231E+00   0.32    11.00    0.32    0.00
.14677E+04
     92.10      0.00     0.00      4.6 0.228E+00   0.32    11.00    0.32    0.00
.14891E+04
     93.38      0.00     0.00      4.6 0.226E+00   0.32    11.00    0.32    0.00
.15105E+04
     94.67      0.00     0.00      4.7 0.223E+00   0.33    11.00    0.33    0.00
.15319E+04
     95.95      0.00     0.00      4.7 0.221E+00   0.33    11.00    0.33    0.00
.15533E+04
     97.24      0.00     0.00      4.8 0.218E+00   0.33    11.00    0.33    0.00
.15748E+04
     98.52      0.00     0.00      4.8 0.216E+00   0.33    11.00    0.33    0.00
.15962E+04
** WATER QUALITY STANDARD OR CCC HAS BEEN FOUND **
 The pollutant concentration in the plume falls below water quality standard
   or CCC value of 0.215E+00 in the current prediction interval.
 This is the spatial extent of concentrations exceeding the water quality
   standard or CCC value.
     99.81      0.00     0.00      4.9 0.214E+00   0.34    11.00    0.34    0.00
.16176E+04
    101.09      0.00     0.00      4.9 0.211E+00   0.34    11.00    0.34    0.00
.16390E+04
    102.38      0.00     0.00      5.0 0.209E+00   0.35    11.00    0.35    0.00
.16604E+04
    103.66      0.00     0.00      5.0 0.207E+00   0.35    11.00    0.35    0.00
.16818E+04
    104.94      0.00     0.00      5.1 0.204E+00   0.35    11.00    0.35    0.00
.17032E+04
    106.23      0.00     0.00      5.1 0.202E+00   0.36    11.00    0.36    0.00
.17246E+04
    107.51      0.00     0.00      5.2 0.200E+00   0.36    11.00    0.36    0.00
.17460E+04
    108.80      0.00     0.00      5.2 0.197E+00   0.36    11.00    0.36    0.00
.17674E+04
    110.08      0.00     0.00      5.3 0.195E+00   0.37    11.00    0.37    0.00
.17888E+04
    111.37      0.00     0.00      5.4 0.193E+00   0.37    11.00    0.37    0.00
.18103E+04
    112.65      0.00     0.00      5.4 0.190E+00   0.37    11.00    0.37    0.00
.18317E+04
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    113.94     0.00     0.00      5.5 0.188E+00   0.38    11.00    0.38    0.00
.18531E+04
    115.22     0.00     0.00      5.5 0.186E+00   0.38    11.00    0.38    0.00
.18745E+04
    116.50     0.00     0.00      5.6 0.184E+00   0.39    11.00    0.39    0.00
.18959E+04
    117.79     0.00     0.00      5.6 0.182E+00   0.39    11.00    0.39    0.00
.19173E+04
    119.07     0.00     0.00      5.7 0.180E+00   0.40    11.00    0.40    0.00
.19387E+04
    120.36     0.00     0.00      5.8 0.177E+00   0.40    11.00    0.40    0.00
.19601E+04
 Plume interacts with SURFACE.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    121.64     0.00     0.00      5.8 0.177E+00   0.40    11.00    0.40    0.00
.19815E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    122.93     0.00     0.00      5.8 0.177E+00   0.40    11.00    0.40    0.00
.20029E+04
    124.21     0.00     0.00      5.8 0.176E+00   0.40    11.00    0.40    0.00
.20243E+04
    125.50     0.00     0.00      5.8 0.176E+00   0.40    11.00    0.40    0.00
.20458E+04
    126.78     0.00     0.00      5.8 0.176E+00   0.40    11.00    0.40    0.00
.20672E+04
    128.07     0.00     0.00      5.8 0.176E+00   0.40    11.00    0.40    0.00
.20886E+04
    129.35     0.00     0.00      5.8 0.176E+00   0.40    11.00    0.40    0.00
.21100E+04
    130.63     0.00     0.00      5.8 0.175E+00   0.40    11.00    0.40    0.00
.21314E+04
    131.92     0.00     0.00      5.8 0.175E+00   0.40    11.00    0.40    0.00
.21528E+04
    133.20     0.00     0.00      5.8 0.175E+00   0.40    11.00    0.40    0.00
.21742E+04
    134.49     0.00     0.00      5.8 0.175E+00   0.40    11.00    0.40    0.00
.21956E+04
    135.77     0.00     0.00      5.8 0.175E+00   0.40    11.00    0.40    0.00
.22170E+04
    137.06     0.00     0.00      5.8 0.174E+00   0.40    11.00    0.40    0.00
.22384E+04
    138.34     0.00     0.00      5.8 0.174E+00   0.40    11.00    0.40    0.00
.22598E+04
    139.63     0.00     0.00      5.8 0.174E+00   0.40    11.00    0.40    0.00
.22812E+04
    140.91     0.00     0.00      5.8 0.174E+00   0.40    11.00    0.40    0.00
.23027E+04
    142.20     0.00     0.00      5.8 0.173E+00   0.40    11.00    0.40    0.00
.23241E+04
    143.48     0.00     0.00      5.8 0.173E+00   0.40    11.00    0.40    0.00
.23455E+04
    144.76     0.00     0.00      5.8 0.173E+00   0.40    11.00    0.40    0.00
.23669E+04
    146.05     0.00     0.00      5.8 0.173E+00   0.40    11.00    0.40    0.00
.23883E+04
    147.33     0.00     0.00      5.8 0.173E+00   0.40    11.00    0.40    0.00
.24097E+04
    148.62     0.00     0.00      5.8 0.172E+00   0.40    11.00    0.40    0.00
.24311E+04
    149.90     0.00     0.00      5.8 0.172E+00   0.40    11.00    0.40    0.00
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.24525E+04
    151.19     0.00     0.00      5.8 0.172E+00   0.40    11.00     0.40     0.00
.24739E+04
    152.47     0.00     0.00      5.8 0.172E+00   0.40    11.00     0.40     0.00
.24953E+04
    153.76     0.00     0.00      5.8 0.172E+00   0.40    11.00     0.40     0.00
.25168E+04
    155.04     0.00     0.00      5.8 0.171E+00   0.40    11.00     0.40     0.00
.25382E+04
    156.33     0.00     0.00      5.8 0.171E+00   0.40    11.00     0.40     0.00
.25596E+04
    157.61     0.00     0.00      5.8 0.171E+00   0.40    11.00     0.40     0.00
.25810E+04
    158.89     0.00     0.00      5.8 0.171E+00   0.40    11.00     0.40     0.00
.26024E+04
    160.18     0.00     0.00      5.8 0.170E+00   0.40    11.00     0.40     0.00
.26238E+04
    161.46     0.00     0.00      5.8 0.170E+00   0.40    11.00     0.40     0.00
.26452E+04
    162.75     0.00     0.00      5.8 0.170E+00   0.40    11.00     0.40     0.00
.26666E+04
    164.03     0.00     0.00      5.8 0.170E+00   0.40    11.00     0.40     0.00
.26880E+04
    165.32     0.00     0.00      5.8 0.170E+00   0.40    11.00     0.40     0.00
.27094E+04
    166.60     0.00     0.00      5.8 0.169E+00   0.40    11.00     0.40     0.00
.27308E+04
    167.89     0.00     0.00      5.8 0.169E+00   0.40    11.00     0.40     0.00
.27522E+04
    169.17     0.00     0.00      5.8 0.169E+00   0.40    11.00     0.40     0.00
.27737E+04
    170.46     0.00     0.00      5.8 0.169E+00   0.40    11.00     0.40     0.00
.27951E+04
    171.74     0.00     0.00      5.8 0.169E+00   0.40    11.00     0.40     0.00
.28165E+04
    173.02     0.00     0.00      5.8 0.168E+00   0.40    11.00     0.40     0.00
.28379E+04
    174.31     0.00     0.00      5.8 0.168E+00   0.40    11.00     0.40     0.00
.28593E+04
    175.59     0.00     0.00      5.8 0.168E+00   0.40    11.00     0.40     0.00
.28807E+04
    176.88     0.00     0.00      5.8 0.168E+00   0.40    11.00     0.40     0.00
.29021E+04
    178.16     0.00     0.00      5.8 0.168E+00   0.40    11.00     0.40     0.00
.29235E+04
    179.45     0.00     0.00      5.8 0.167E+00   0.40    11.00     0.40     0.00
.29449E+04
    180.73     0.00     0.00      5.8 0.167E+00   0.40    11.00     0.40     0.00
.29663E+04
    182.02     0.00     0.00      5.8 0.167E+00   0.40    11.00     0.40     0.00
.29878E+04
    183.30     0.00     0.00      5.8 0.167E+00   0.40    11.00     0.40     0.00
.30092E+04
    184.59     0.00     0.00      5.8 0.167E+00   0.40    11.00     0.40     0.00
.30306E+04
    185.87     0.00     0.00      5.8 0.166E+00   0.40    11.00     0.40     0.00
.30520E+04
    187.15     0.00     0.00      5.8 0.166E+00   0.40    11.00     0.40     0.00
.30734E+04
    188.44     0.00     0.00      5.8 0.166E+00   0.40    11.00     0.40     0.00
.30948E+04
    189.72     0.00     0.00      5.8 0.166E+00   0.40    11.00     0.40     0.00
.31162E+04
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    191.01     0.00    0.00     5.8 0.165E+00   0.40    11.00    0.40    0.00
.31376E+04
    192.29     0.00    0.00     5.8 0.165E+00   0.40    11.00    0.40    0.00
.31590E+04
    193.58     0.00    0.00     5.8 0.165E+00   0.40    11.00    0.40    0.00
.31804E+04
    194.86     0.00    0.00     5.8 0.165E+00   0.40    11.00    0.40    0.00
.32018E+04
    196.15     0.00    0.00     5.8 0.165E+00   0.40    11.00    0.40    0.00
.32232E+04
    197.43     0.00    0.00     5.8 0.164E+00   0.40    11.00    0.40    0.00
.32447E+04
    198.72     0.00    0.00     5.8 0.164E+00   0.40    11.00    0.40    0.00
.32661E+04
    200.00     0.00    0.00     5.8 0.164E+00   0.40    11.00    0.40    0.00
.32875E+04
 Cumulative travel time =        3287.4712 sec  (    0.91 hrs)

 Simulation limit based on maximum specified distance =    200.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
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CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222
222222222222
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CORMIX2 PREDICTION FILE:
22222222222222222222222222222222222222222222222222222222222222222222222222222222222
222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                              CORMIX Version 10.0GT
                        HYDRO2 Version 10.0.0.0 July 2016
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CASE DESCRIPTION
 Site name/label:   West Credit River
 Design case:       Erin WWTP - 7172
 FILE NAME:         C:\... WWTP-7172-diffuser vertical-good-side-update.prd
 Time stamp:        03/14/2017--12:53:32

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     11.00  AS    =      4.40  QA    =      0.23  ICHREG= 3
 HA    =      0.40  HD    =      0.40
 UA    =      0.051 F     =      0.130 USTAR =0.6529E-02
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.9542

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= alternating_parallel
 BANK  =  RIGHT     DISTB =      0.00  YB1   =      0.50  YB2   =      0.50
 LD    =      5.00  NOPEN =   15       SPAC  =      0.36
 D0    =      0.050 A0    =      0.002 H0    =      0.00  SUB0  =      0.40
 D0INP =      0.050 CR0   =      1.000
 Nozzle/port arrangement:   near_vertical_discharge
 GAMMA =      0.00  THETA =     90.00  SIGMA =      0.00  BETA  =     90.00
 U0    =      2.818 Q0    =      0.083 Q0A   =0.8300E-01
 RHO0  =  998.4062  DRHO0 =-.4520E+00  GP0   =-.4442E-02
 C0    =0.5450E+00  CUNITS=  mg/l
 IPOLL =  2         KS    =0.0000E+00  KD    =0.5787E-04

DIFFUSER PARAMETERS WITH IMAGE EFFECTS (metric units)
 The bank/shore proximity effect is accounted for by the following flow
 variables and definitions of length scales and parameters.
 LD    =      5.00  Q0    =      0.166 Q0A    =0.8300E-01

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6640E-01  m0    =0.4678E-01  j0    =-.7374E-04  SIGNJ0=     -1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.024 lM    =     26.52  lm    =     35.78
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1660E+00  M0    =0.2339E+00  J0    =-.3687E-03
 Associated 3-d length scales (meters)
 LQ    =      0.04  LM    =     17.52  Lm    =     13.38  Lb    =      5.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    550.91  FRD0  =    189.09  R     =     55.11  PL    =  140.00
 (slot)             (port/nozzle)


FLOW CLASSIFICATION
 222222222222222222222222222222222222222222
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 2  Flow class (CORMIX2)      =    MNU14  2
 2  Applicable layer depth HS =     0.40  2
 2  Limiting Dilution S =QA/Q0=     2.36  2
 2222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5450E+00  CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  1         CSTD  =0.1950E+00
 REGMZ =  0
 XINT  =    200.00  XMAX  =    200.00

X-Y-Z COORDINATE SYSTEM:
  because of bank/shore proximity, the ORIGIN is located directly
   at the RIGHT bank/shore.
  the bank/shore acts as a plane of symmetry for the predicted
  plume geometry.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 100 display intervals per module
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BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.00     1.0 0.545E+00   0.00     2.50     2.818
.00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
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BEGIN MOD234: UNSTABLE RECIRCULATION REGION OVER LAYER DEPTH

 The MIXING of this alternating diffuser is somewhat REDUCED
   due to its PARALLEL ALIGNMENT.
 INITIAL LOCAL VERTICAL INSTABILITY REGION:
   Bulk dilution (S =   1.41) occurs in a limited region (horizontal extent
   =    3.00 m) surrounding the discharge location.

  Control volume inflow:
       X        Y       Z        S       C       BV       BH         TT
      0.00     0.00    0.00     1.0 0.545E+00   0.00     2.50   .00000E+00

  Control volume outflow:
       X        Y       Z        S       C       BV       BH         TT
      3.00     0.00    0.20     1.4 0.385E+00   0.40     1.00   .00000E+00

END OF MOD234: UNSTABLE RECIRCULATION REGION OVER LAYER DEPTH
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BEGIN MOD234a: UPSTREAM SPREADING AFTER NEAR-FIELD INSTABILITY

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 UPSTREAM INTRUSION PROPERTIES:
        Upstream intrusion length               =      0.55 m
        X-position of upstream stagnation point =      2.45 m
        Thickness in intrusion region           =      0.40 m
        Half-width at downstream end            =      6.01 m
        Thickness at downstream end             =      0.39 m

  Control volume inflow:
       X        Y       Z        S       C       BV       BH        TT
      3.00     0.00    0.20     1.4 0.385E+00   0.40     1.00   .00000E+00

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time
```

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
2.45	0.00	0.00	9999.9	0.000E+00	0.00	0.00	0.00	0.00	.58745E+02
2.52	0.00	0.00	3.2	0.173E+00	0.40	0.85	0.40	0.00	.00000E+00
2.87	0.00	0.00	1.5	0.372E+00	0.40	2.06	0.40	0.00	.00000E+00
3.22	0.00	0.00	1.4	0.385E+00	0.39	4.06	0.39	0.00	.42412E+01
3.57	0.00	0.00	1.4	0.384E+00	0.39	4.41	0.39	0.00	.11054E+02
3.91	0.00	0.00	1.4	0.383E+00	0.39	4.70	0.39	0.00	.17867E+02
4.26	0.00	0.00	1.4	0.382E+00	0.39	4.97	0.39	0.00	.24680E+02
4.61	0.00	0.00	1.4	0.381E+00	0.39	5.21	0.39	0.00	.31493E+02
4.96	0.00	0.00	1.4	0.380E+00	0.39	5.43	0.39	0.00	.38306E+02
5.31	0.00	0.00	1.4	0.380E+00	0.39	5.63	0.39	0.00	.45119E+02
5.66	0.00	0.00	1.4	0.379E+00	0.39	5.82	0.39	0.00	.51932E+02
6.00	0.00	0.00	1.4	0.379E+00	0.39	6.01	0.39	0.00	.58745E+02

Cumulative travel time =   58.7450 sec (0.02 hrs)

END OF MOD234a: UPSTREAM SPREADING AFTER NEAR-FIELD INSTABILITY

** End of NEAR-FIELD REGION (NFR) **

Recall that the plume is symmetric to the bank/shore on which the centerline (X-axis) is located.

BEGIN MOD241: BUOYANT AMBIENT SPREADING

Plume is ATTACHED to RIGHT bank/shore.
Plume width is now determined from RIGHT bank/shore.

Profile definitions:
BV = top-hat thickness, measured vertically
BH = top-hat half-width, measured horizontally in y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)
TT = Cumulative travel time

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
6.00	0.00	0.00	1.4	0.379E+00	0.39	6.01	0.39	0.00	.58745E+02
6.37	0.00	0.00	1.4	0.377E+00	0.38	6.08	0.38	0.00	.63935E+02
6.73	0.00	0.00	1.4	0.376E+00	0.38	6.15	0.38	0.00	.69124E+02
7.09	0.00	0.00	1.4	0.374E+00	0.38	6.22	0.38	0.00	.74314E+02
7.46	0.00	0.00	1.5	0.373E+00	0.38	6.29	0.38	0.00	.79503E+02
7.82	0.00	0.00	1.5	0.372E+00	0.37	6.36	0.37	0.00	.84693E+02
8.18	0.00	0.00	1.5	0.370E+00	0.37	6.43	0.37	0.00	.89883E+02
8.55	0.00	0.00	1.5	0.369E+00	0.37	6.50	0.37	0.00	.95072E+02
8.91	0.00	0.00	1.5	0.367E+00	0.36	6.56	0.36	0.00	.10026E+03
9.27	0.00	0.00	1.5	0.366E+00	0.36	6.63	0.36	0.00	.10545E+03
9.64	0.00	0.00	1.5	0.365E+00	0.36	6.70	0.36	0.00	.11064E+03
10.00	0.00	0.00	1.5	0.363E+00	0.36	6.76	0.36	0.00	.11583E+03
10.36	0.00	0.00	1.5	0.362E+00	0.36	6.82	0.36	0.00	.12102E+03
10.73	0.00	0.00	1.5	0.361E+00	0.35	6.89	0.35	0.00	.12621E+03
11.09	0.00	0.00	1.5	0.360E+00	0.35	6.95	0.35	0.00	.13140E+03
11.45	0.00	0.00	1.5	0.358E+00	0.35	7.01	0.35	0.00	.13659E+03
11.82	0.00	0.00	1.5	0.357E+00	0.35	7.07	0.35	0.00	.14178E+03
12.18	0.00	0.00	1.5	0.356E+00	0.35	7.13	0.35	0.00	.14697E+03
12.54	0.00	0.00	1.5	0.355E+00	0.34	7.19	0.34	0.00	.15216E+03
12.91	0.00	0.00	1.5	0.353E+00	0.34	7.25	0.34	0.00	.15735E+03
13.27	0.00	0.00	1.5	0.352E+00	0.34	7.31	0.34	0.00	.16254E+03
13.63	0.00	0.00	1.5	0.351E+00	0.34	7.37	0.34	0.00	.16773E+03
14.00	0.00	0.00	1.5	0.350E+00	0.34	7.43	0.34	0.00	.17292E+03
14.36	0.00	0.00	1.5	0.349E+00	0.34	7.49	0.34	0.00	.17811E+03

14.72	0.00	0.00	1.6	0.348E+00	0.33	7.55	0.33	0.00	.18330E+03
15.09	0.00	0.00	1.6	0.347E+00	0.33	7.60	0.33	0.00	.18848E+03
15.45	0.00	0.00	1.6	0.345E+00	0.33	7.66	0.33	0.00	.19367E+03
15.81	0.00	0.00	1.6	0.344E+00	0.33	7.71	0.33	0.00	.19886E+03
16.18	0.00	0.00	1.6	0.343E+00	0.33	7.77	0.33	0.00	.20405E+03
16.54	0.00	0.00	1.6	0.342E+00	0.33	7.82	0.33	0.00	.20924E+03
16.90	0.00	0.00	1.6	0.341E+00	0.33	7.88	0.33	0.00	.21443E+03
17.27	0.00	0.00	1.6	0.340E+00	0.32	7.93	0.32	0.00	.21962E+03
17.63	0.00	0.00	1.6	0.339E+00	0.32	7.99	0.32	0.00	.22481E+03
17.99	0.00	0.00	1.6	0.338E+00	0.32	8.04	0.32	0.00	.23000E+03
18.36	0.00	0.00	1.6	0.337E+00	0.32	8.09	0.32	0.00	.23519E+03
18.72	0.00	0.00	1.6	0.336E+00	0.32	8.15	0.32	0.00	.24038E+03
19.08	0.00	0.00	1.6	0.335E+00	0.32	8.20	0.32	0.00	.24557E+03
19.45	0.00	0.00	1.6	0.334E+00	0.32	8.25	0.32	0.00	.25076E+03
19.81	0.00	0.00	1.6	0.333E+00	0.32	8.30	0.32	0.00	.25595E+03
20.17	0.00	0.00	1.6	0.331E+00	0.31	8.35	0.31	0.00	.26114E+03
20.53	0.00	0.00	1.6	0.330E+00	0.31	8.40	0.31	0.00	.26633E+03
20.90	0.00	0.00	1.6	0.329E+00	0.31	8.45	0.31	0.00	.27152E+03
21.26	0.00	0.00	1.6	0.328E+00	0.31	8.50	0.31	0.00	.27671E+03
21.62	0.00	0.00	1.6	0.327E+00	0.31	8.55	0.31	0.00	.28190E+03
21.99	0.00	0.00	1.6	0.326E+00	0.31	8.60	0.31	0.00	.28709E+03
22.35	0.00	0.00	1.6	0.325E+00	0.31	8.65	0.31	0.00	.29228E+03
22.71	0.00	0.00	1.7	0.324E+00	0.31	8.70	0.31	0.00	.29747E+03
23.08	0.00	0.00	1.7	0.323E+00	0.31	8.75	0.31	0.00	.30266E+03
23.44	0.00	0.00	1.7	0.322E+00	0.31	8.80	0.31	0.00	.30785E+03
23.80	0.00	0.00	1.7	0.321E+00	0.31	8.85	0.31	0.00	.31304E+03
24.17	0.00	0.00	1.7	0.321E+00	0.30	8.89	0.30	0.00	.31822E+03
24.53	0.00	0.00	1.7	0.320E+00	0.30	8.94	0.30	0.00	.32341E+03
24.89	0.00	0.00	1.7	0.319E+00	0.30	8.99	0.30	0.00	.32860E+03
25.26	0.00	0.00	1.7	0.318E+00	0.30	9.04	0.30	0.00	.33379E+03
25.62	0.00	0.00	1.7	0.317E+00	0.30	9.08	0.30	0.00	.33898E+03
25.98	0.00	0.00	1.7	0.316E+00	0.30	9.13	0.30	0.00	

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.34417E+03
     26.35     0.00     0.00      1.7 0.315E+00   0.30      9.17     0.30     0.00
.34936E+03
     26.71     0.00     0.00      1.7 0.314E+00   0.30      9.22     0.30     0.00
.35455E+03
     27.07     0.00     0.00      1.7 0.313E+00   0.30      9.27     0.30     0.00
.35974E+03
     27.44     0.00     0.00      1.7 0.312E+00   0.30      9.31     0.30     0.00
.36493E+03
     27.80     0.00     0.00      1.7 0.311E+00   0.30      9.36     0.30     0.00
.37012E+03
     28.16     0.00     0.00      1.7 0.310E+00   0.30      9.40     0.30     0.00
.37531E+03
     28.53     0.00     0.00      1.7 0.309E+00   0.30      9.45     0.30     0.00
.38050E+03
     28.89     0.00     0.00      1.7 0.308E+00   0.30      9.49     0.30     0.00
.38569E+03
     29.25     0.00     0.00      1.7 0.307E+00   0.30      9.53     0.30     0.00
.39088E+03
     29.62     0.00     0.00      1.7 0.306E+00   0.29      9.58     0.29     0.00
.39607E+03
     29.98     0.00     0.00      1.7 0.305E+00   0.29      9.62     0.29     0.00
.40126E+03
     30.34     0.00     0.00      1.7 0.304E+00   0.29      9.67     0.29     0.00
.40645E+03
     30.71     0.00     0.00      1.8 0.304E+00   0.29      9.71     0.29     0.00
.41164E+03
     31.07     0.00     0.00      1.8 0.303E+00   0.29      9.75     0.29     0.00
.41683E+03
     31.43     0.00     0.00      1.8 0.302E+00   0.29      9.80     0.29     0.00
.42202E+03
     31.80     0.00     0.00      1.8 0.301E+00   0.29      9.84     0.29     0.00
.42721E+03
     32.16     0.00     0.00      1.8 0.300E+00   0.29      9.88     0.29     0.00
.43240E+03
     32.52     0.00     0.00      1.8 0.299E+00   0.29      9.92     0.29     0.00
.43759E+03
     32.89     0.00     0.00      1.8 0.298E+00   0.29      9.97     0.29     0.00
.44277E+03
     33.25     0.00     0.00      1.8 0.297E+00   0.29     10.01     0.29     0.00
.44796E+03
     33.61     0.00     0.00      1.8 0.296E+00   0.29     10.05     0.29     0.00
.45315E+03
     33.98     0.00     0.00      1.8 0.295E+00   0.29     10.09     0.29     0.00
.45834E+03
     34.34     0.00     0.00      1.8 0.295E+00   0.29     10.13     0.29     0.00
.46353E+03
     34.70     0.00     0.00      1.8 0.294E+00   0.29     10.17     0.29     0.00
.46872E+03
     35.07     0.00     0.00      1.8 0.293E+00   0.29     10.21     0.29     0.00
.47391E+03
     35.43     0.00     0.00      1.8 0.292E+00   0.29     10.26     0.29     0.00
.47910E+03
     35.79     0.00     0.00      1.8 0.291E+00   0.29     10.30     0.29     0.00
.48429E+03
     36.16     0.00     0.00      1.8 0.290E+00   0.29     10.34     0.29     0.00
.48948E+03
     36.52     0.00     0.00      1.8 0.289E+00   0.29     10.38     0.29     0.00
.49467E+03
     36.88     0.00     0.00      1.8 0.288E+00   0.29     10.42     0.29     0.00
.49986E+03
     37.25     0.00     0.00      1.8 0.288E+00   0.29     10.46     0.29     0.00
.50505E+03
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     37.61      0.00     0.00      1.8 0.287E+00   0.29    10.50    0.29    0.00
.51024E+03
     37.97      0.00     0.00      1.9 0.286E+00   0.29    10.54    0.29    0.00
.51543E+03
     38.34      0.00     0.00      1.9 0.285E+00   0.28    10.58    0.28    0.00
.52062E+03
     38.70      0.00     0.00      1.9 0.284E+00   0.28    10.62    0.28    0.00
.52581E+03
     39.06      0.00     0.00      1.9 0.283E+00   0.28    10.66    0.28    0.00
.53100E+03
     39.42      0.00     0.00      1.9 0.282E+00   0.28    10.69    0.28    0.00
.53619E+03
     39.79      0.00     0.00      1.9 0.282E+00   0.28    10.73    0.28    0.00
.54138E+03
     40.15      0.00     0.00      1.9 0.281E+00   0.28    10.77    0.28    0.00
.54657E+03
     40.51      0.00     0.00      1.9 0.280E+00   0.28    10.81    0.28    0.00
.55176E+03
     40.88      0.00     0.00      1.9 0.279E+00   0.28    10.85    0.28    0.00
.55695E+03
     41.24      0.00     0.00      1.9 0.278E+00   0.28    10.89    0.28    0.00
.56214E+03
     41.60      0.00     0.00      1.9 0.277E+00   0.28    10.93    0.28    0.00
.56732E+03
     41.97      0.00     0.00      1.9 0.277E+00   0.28    10.96    0.28    0.00
.57251E+03
     42.33      0.00     0.00      1.9 0.276E+00   0.28    11.00    0.28    0.00
.57770E+03
 Cumulative travel time =         577.7041 sec  (    0.16 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.529E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.265E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X         Y        Z         S       C        BV       BH       ZU      ZL
TT
     42.33      0.00     0.00      1.9 0.276E+00   0.28    11.00    0.28    0.00
.57770E+03
     43.91      0.00     0.00      1.9 0.274E+00   0.28    11.00    0.28    0.00
.60023E+03
     45.48      0.00     0.00      1.9 0.273E+00   0.28    11.00    0.28    0.00
.62275E+03
     47.06      0.00     0.00      1.9 0.272E+00   0.28    11.00    0.28    0.00
.64528E+03
```

48.64	0.00	0.00	1.9	0.271E+00	0.29	11.00	0.29	0.00	.66780E+03
50.21	0.00	0.00	1.9	0.269E+00	0.29	11.00	0.29	0.00	.69032E+03
51.79	0.00	0.00	2.0	0.268E+00	0.29	11.00	0.29	0.00	.71285E+03
53.37	0.00	0.00	2.0	0.267E+00	0.29	11.00	0.29	0.00	.73537E+03
54.94	0.00	0.00	2.0	0.266E+00	0.29	11.00	0.29	0.00	.75790E+03
56.52	0.00	0.00	2.0	0.264E+00	0.29	11.00	0.29	0.00	.78042E+03
58.10	0.00	0.00	2.0	0.263E+00	0.29	11.00	0.29	0.00	.80295E+03
59.67	0.00	0.00	2.0	0.262E+00	0.29	11.00	0.29	0.00	.82547E+03
61.25	0.00	0.00	2.0	0.261E+00	0.29	11.00	0.29	0.00	.84799E+03
62.83	0.00	0.00	2.0	0.259E+00	0.29	11.00	0.29	0.00	.87052E+03
64.40	0.00	0.00	2.0	0.258E+00	0.30	11.00	0.30	0.00	.89304E+03
65.98	0.00	0.00	2.0	0.257E+00	0.30	11.00	0.30	0.00	.91557E+03
67.56	0.00	0.00	2.0	0.256E+00	0.30	11.00	0.30	0.00	.93809E+03
69.13	0.00	0.00	2.0	0.254E+00	0.30	11.00	0.30	0.00	.96061E+03
70.71	0.00	0.00	2.0	0.253E+00	0.30	11.00	0.30	0.00	.98314E+03
72.29	0.00	0.00	2.0	0.252E+00	0.30	11.00	0.30	0.00	.10057E+04
73.86	0.00	0.00	2.0	0.251E+00	0.30	11.00	0.30	0.00	.10282E+04
75.44	0.00	0.00	2.1	0.250E+00	0.30	11.00	0.30	0.00	.10507E+04
77.02	0.00	0.00	2.1	0.248E+00	0.30	11.00	0.30	0.00	.10732E+04
78.60	0.00	0.00	2.1	0.247E+00	0.31	11.00	0.31	0.00	.10958E+04
80.17	0.00	0.00	2.1	0.246E+00	0.31	11.00	0.31	0.00	.11183E+04
81.75	0.00	0.00	2.1	0.245E+00	0.31	11.00	0.31	0.00	.11408E+04
83.33	0.00	0.00	2.1	0.244E+00	0.31	11.00	0.31	0.00	.11633E+04
84.90	0.00	0.00	2.1	0.242E+00	0.31	11.00	0.31	0.00	.11859E+04
86.48	0.00	0.00	2.1	0.241E+00	0.31	11.00	0.31	0.00	.12084E+04
88.06	0.00	0.00	2.1	0.240E+00	0.31	11.00	0.31	0.00	.12309E+04
89.63	0.00	0.00	2.1	0.239E+00	0.31	11.00	0.31	0.00	.12534E+04
91.21	0.00	0.00	2.1	0.238E+00	0.31	11.00	0.31	0.00	.12760E+04
92.79	0.00	0.00	2.1	0.236E+00	0.32	11.00	0.32	0.00	.12985E+04
94.36	0.00	0.00	2.1	0.235E+00	0.32	11.00	0.32	0.00	.13210E+04
95.94	0.00	0.00	2.2	0.234E+00	0.32	11.00	0.32	0.00	.13435E+04
97.52	0.00	0.00	2.2	0.233E+00	0.32	11.00	0.32	0.00	

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.13660E+04
    99.09     0.00     0.00     2.2 0.232E+00   0.32    11.00    0.32    0.00
.13886E+04
   100.67     0.00     0.00     2.2 0.231E+00   0.32    11.00    0.32    0.00
.14111E+04
   102.25     0.00     0.00     2.2 0.229E+00   0.32    11.00    0.32    0.00
.14336E+04
   103.82     0.00     0.00     2.2 0.228E+00   0.32    11.00    0.32    0.00
.14561E+04
   105.40     0.00     0.00     2.2 0.227E+00   0.32    11.00    0.32    0.00
.14787E+04
   106.98     0.00     0.00     2.2 0.226E+00   0.33    11.00    0.33    0.00
.15012E+04
   108.55     0.00     0.00     2.2 0.225E+00   0.33    11.00    0.33    0.00
.15237E+04
   110.13     0.00     0.00     2.2 0.224E+00   0.33    11.00    0.33    0.00
.15462E+04
   111.71     0.00     0.00     2.2 0.223E+00   0.33    11.00    0.33    0.00
.15688E+04
   113.28     0.00     0.00     2.2 0.221E+00   0.33    11.00    0.33    0.00
.15913E+04
   114.86     0.00     0.00     2.3 0.220E+00   0.33    11.00    0.33    0.00
.16138E+04
   116.44     0.00     0.00     2.3 0.219E+00   0.33    11.00    0.33    0.00
.16363E+04
   118.01     0.00     0.00     2.3 0.218E+00   0.33    11.00    0.33    0.00
.16589E+04
   119.59     0.00     0.00     2.3 0.217E+00   0.34    11.00    0.34    0.00
.16814E+04
   121.17     0.00     0.00     2.3 0.216E+00   0.34    11.00    0.34    0.00
.17039E+04
   122.74     0.00     0.00     2.3 0.215E+00   0.34    11.00    0.34    0.00
.17264E+04
   124.32     0.00     0.00     2.3 0.214E+00   0.34    11.00    0.34    0.00
.17490E+04
   125.90     0.00     0.00     2.3 0.213E+00   0.34    11.00    0.34    0.00
.17715E+04
   127.47     0.00     0.00     2.3 0.211E+00   0.34    11.00    0.34    0.00
.17940E+04
   129.05     0.00     0.00     2.3 0.210E+00   0.34    11.00    0.34    0.00
.18165E+04
   130.63     0.00     0.00     2.3 0.209E+00   0.35    11.00    0.35    0.00
.18391E+04
   132.20     0.00     0.00     2.4 0.208E+00   0.35    11.00    0.35    0.00
.18616E+04
   133.78     0.00     0.00     2.4 0.207E+00   0.35    11.00    0.35    0.00
.18841E+04
   135.36     0.00     0.00     2.4 0.206E+00   0.35    11.00    0.35    0.00
.19066E+04
   136.93     0.00     0.00     2.4 0.205E+00   0.35    11.00    0.35    0.00
.19292E+04
   138.51     0.00     0.00     2.4 0.204E+00   0.35    11.00    0.35    0.00
.19517E+04
   140.09     0.00     0.00     2.4 0.203E+00   0.35    11.00    0.35    0.00
.19742E+04
   141.66     0.00     0.00     2.4 0.202E+00   0.36    11.00    0.36    0.00
.19967E+04
   143.24     0.00     0.00     2.4 0.201E+00   0.36    11.00    0.36    0.00
.20192E+04
   144.82     0.00     0.00     2.4 0.200E+00   0.36    11.00    0.36    0.00
.20418E+04
   146.39     0.00     0.00     2.4 0.199E+00   0.36    11.00    0.36    0.00
.20643E+04
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   147.97      0.00     0.00      2.4 0.197E+00   0.36    11.00    0.36    0.00
.20868E+04
   149.55      0.00     0.00      2.5 0.196E+00   0.36    11.00    0.36    0.00
.21093E+04
   151.12      0.00     0.00      2.5 0.195E+00   0.36    11.00    0.36    0.00
.21319E+04
** WATER QUALITY STANDARD OR CCC HAS BEEN FOUND **
 The pollutant concentration in the plume falls below water quality standard
   or CCC value of 0.195E+00 in the current prediction interval.
 This is the spatial extent of concentrations exceeding the water quality
   standard or CCC value.
   152.70      0.00     0.00      2.5 0.194E+00   0.37    11.00    0.37    0.00
.21544E+04
   154.28      0.00     0.00      2.5 0.193E+00   0.37    11.00    0.37    0.00
.21769E+04
   155.85      0.00     0.00      2.5 0.192E+00   0.37    11.00    0.37    0.00
.21994E+04
   157.43      0.00     0.00      2.5 0.191E+00   0.37    11.00    0.37    0.00
.22220E+04
   159.01      0.00     0.00      2.5 0.190E+00   0.37    11.00    0.37    0.00
.22445E+04
   160.58      0.00     0.00      2.5 0.189E+00   0.37    11.00    0.37    0.00
.22670E+04
   162.16      0.00     0.00      2.5 0.188E+00   0.37    11.00    0.37    0.00
.22895E+04
   163.74      0.00     0.00      2.5 0.187E+00   0.38    11.00    0.38    0.00
.23121E+04
   165.31      0.00     0.00      2.6 0.186E+00   0.38    11.00    0.38    0.00
.23346E+04
   166.89      0.00     0.00      2.6 0.185E+00   0.38    11.00    0.38    0.00
.23571E+04
   168.47      0.00     0.00      2.6 0.184E+00   0.38    11.00    0.38    0.00
.23796E+04
   170.04      0.00     0.00      2.6 0.183E+00   0.38    11.00    0.38    0.00
.24022E+04
   171.62      0.00     0.00      2.6 0.182E+00   0.38    11.00    0.38    0.00
.24247E+04
   173.20      0.00     0.00      2.6 0.181E+00   0.39    11.00    0.39    0.00
.24472E+04
   174.77      0.00     0.00      2.6 0.180E+00   0.39    11.00    0.39    0.00
.24697E+04
   176.35      0.00     0.00      2.6 0.179E+00   0.39    11.00    0.39    0.00
.24923E+04
   177.93      0.00     0.00      2.6 0.178E+00   0.39    11.00    0.39    0.00
.25148E+04
   179.50      0.00     0.00      2.7 0.177E+00   0.39    11.00    0.39    0.00
.25373E+04
   181.08      0.00     0.00      2.7 0.176E+00   0.39    11.00    0.39    0.00
.25598E+04
   182.66      0.00     0.00      2.7 0.175E+00   0.40    11.00    0.40    0.00
.25824E+04
   184.23      0.00     0.00      2.7 0.174E+00   0.40    11.00    0.40    0.00
.26049E+04
   185.81      0.00     0.00      2.7 0.173E+00   0.40    11.00    0.40    0.00
.26274E+04
 Plume interacts with SURFACE.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
   187.39      0.00     0.00      2.7 0.172E+00   0.40    11.00    0.40    0.00
.26499E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
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   188.96      0.00    0.00     2.7 0.172E+00   0.40    11.00    0.40    0.00
.26724E+04
   190.54      0.00    0.00     2.7 0.172E+00   0.40    11.00    0.40    0.00
.26950E+04
   192.12      0.00    0.00     2.7 0.172E+00   0.40    11.00    0.40    0.00
.27175E+04
   193.69      0.00    0.00     2.7 0.172E+00   0.40    11.00    0.40    0.00
.27400E+04
   195.27      0.00    0.00     2.7 0.171E+00   0.40    11.00    0.40    0.00
.27625E+04
   196.85      0.00    0.00     2.7 0.171E+00   0.40    11.00    0.40    0.00
.27851E+04
   198.42      0.00    0.00     2.7 0.171E+00   0.40    11.00    0.40    0.00
.28076E+04
   200.00      0.00    0.00     2.7 0.171E+00   0.40    11.00    0.40    0.00
.28301E+04
 Cumulative travel time =        2830.1162 sec  (    0.79 hrs)

 Simulation limit based on maximum specified distance =    200.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
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CORMIX2: Multiport Diffuser Discharges       End of Prediction File
222222222222222222222222222222222222222222222222222222222222222222222222222222222222
222222222222
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    X-axis points downstream
    Y-axis points to left as seen by an observer looking downstream
    Z-axis points vertically upward (in CORMIX3, all values Z = 0.00)
NSTEP = 100 display intervals per module
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BEGIN MOD301: DISCHARGE MODULE

 Efflux conditions:
      X        Y       Z        S       C       BV       BH         TT
     0.00     0.00    0.00     1.0 0.114E+01   0.20     0.08 .00000E+00

END OF MOD301: DISCHARGE MODULE
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BEGIN MOD302: ZONE OF FLOW ESTABLISHMENT

  Control volume inflow:
      X        Y       Z        S       C       BV       BH         TT
     0.00     0.00    0.00     1.0 0.114E+01   0.20     0.08 .00000E+00

 VERTICAL MIXING occurs in the initial zone of flow establishment.

 Profile definitions:
   BV = Gaussian 1/e (37%) vertical thickness
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction efects, if any)
   TT = Cumulative travel time

  Control volume outflow:                                  SIGMAE=     89.52
      X        Y       Z        S       C       BV       BH         TT
     0.00     0.06    0.00     1.0 0.114E+01   0.30     0.09 .51796E-01
 Cumulative travel time =           0.0518 sec  (    0.00 hrs)

END OF MOD302: ZONE OF FLOW ESTABLISHMENT
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BEGIN CORSURF (MOD310): BUOYANT SURFACE JET - NEAR-FIELD REGION

 Surface jet in shallow crossflow with shoreline-attachment.

 Profile definitions:
   BV = water depth (vertically mixed)
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction efects, if any)
   TT = Cumulative travel time

      X        Y       Z        S       C       BV       BH         TT
     0.00     0.06    0.00     1.0 0.114E+01   0.30     0.09 .51796E-01
     0.08     0.29    0.00     1.3 0.912E+00   0.30     0.12 .27976E+00
     0.24     0.48    0.00     1.4 0.814E+00   0.30     0.14 .54407E+00
     0.31     0.53    0.00     1.5 0.788E+00   0.30     0.15 .63949E+00
     0.45     0.62    0.00     1.5 0.744E+00   0.30     0.17 .84063E+00
     0.60     0.69    0.00     1.6 0.706E+00   0.30     0.19 .10549E+01
     0.84     0.79    0.00     1.7 0.660E+00   0.30     0.21 .13998E+01
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0.92	0.81	0.00	1.8	0.647E+00	0.30	0.22	.15208E+01
1.08	0.86	0.00	1.8	0.623E+00	0.30	0.24	.17717E+01
1.33	0.92	0.00	1.9	0.592E+00	0.30	0.26	.21695E+01
1.41	0.94	0.00	2.0	0.582E+00	0.30	0.27	.23077E+01
1.57	0.98	0.00	2.0	0.565E+00	0.30	0.29	.25925E+01
1.82	1.02	0.00	2.1	0.542E+00	0.30	0.31	.30400E+01
1.99	1.05	0.00	2.2	0.528E+00	0.30	0.33	.33517E+01
2.07	1.06	0.00	2.2	0.522E+00	0.30	0.34	.35115E+01
2.23	1.09	0.00	2.2	0.510E+00	0.30	0.36	.38389E+01
2.40	1.11	0.00	2.3	0.498E+00	0.30	0.37	.41767E+01
2.65	1.15	0.00	2.4	0.483E+00	0.30	0.40	.47027E+01
2.82	1.17	0.00	2.4	0.474E+00	0.30	0.42	.50660E+01
2.90	1.18	0.00	2.4	0.469E+00	0.30	0.42	.52515E+01
3.07	1.19	0.00	2.5	0.461E+00	0.30	0.44	.56299E+01
3.24	1.21	0.00	2.5	0.453E+00	0.30	0.46	.60183E+01
3.49	1.24	0.00	2.6	0.442E+00	0.30	0.48	.66195E+01
3.66	1.25	0.00	2.6	0.435E+00	0.30	0.50	.70326E+01
3.82	1.27	0.00	2.7	0.428E+00	0.30	0.52	.74555E+01
3.91	1.27	0.00	2.7	0.425E+00	0.30	0.52	.76706E+01
4.16	1.29	0.00	2.8	0.416E+00	0.30	0.55	.83305E+01
4.24	1.30	0.00	2.8	0.413E+00	0.30	0.56	.85554E+01
4.41	1.31	0.00	2.8	0.408E+00	0.30	0.57	.90123E+01
4.66	1.33	0.00	2.9	0.400E+00	0.30	0.60	.97157E+01
4.75	1.33	0.00	2.9	0.397E+00	0.30	0.61	.99550E+01
5.00	1.35	0.00	2.9	0.390E+00	0.30	0.63	.10687E+02
5.08	1.36	0.00	2.9	0.388E+00	0.30	0.64	.10936E+02
5.25	1.37	0.00	3.0	0.384E+00	0.30	0.66	.11441E+02
5.50	1.38	0.00	3.0	0.377E+00	0.30	0.68	.12216E+02
5.58	1.39	0.00	3.0	0.375E+00	0.30	0.69	.12479E+02
5.84	1.40	0.00	3.1	0.369E+00	0.30	0.71	.13283E+02
5.92	1.40	0.00	3.1	0.368E+00	0.30	0.72	.13555E+02
6.09	1.41	0.00	3.1	0.364E+00	0.30	0.74	.14107E+02
6.34	1.42	0.00	3.2	0.359E+00	0.30	0.76	.14953E+02
6.42	1.43	0.00	3.2	0.357E+00	0.30	0.77	.15240E+02
6.68	1.44	0.00	3.2	0.352E+00	0.30	0.79	.16114E+02
6.76	1.44	0.00	3.3	0.351E+00	0.30	0.80	.16411E+02
6.93	1.45	0.00	3.3	0.348E+00	0.30	0.82	.17010E+02
7.18	1.46	0.00	3.3	0.343E+00	0.30	0.84	.17926E+02
7.26	1.46	0.00	3.3	0.342E+00	0.30	0.85	.18236E+02
7.52	1.47	0.00	3.4	0.338E+00	0.30	0.87	.19181E+02
7.60	1.47	0.00	3.4	0.336E+00	0.30	0.88	.19501E+02
7.85	1.48	0.00	3.4	0.333E+00	0.30	0.90	.20473E+02
8.02	1.49	0.00	3.5	0.330E+00	0.30	0.92	.21133E+02
8.11	1.49	0.00	3.5	0.329E+00	0.30	0.93	.21467E+02
8.27	1.50	0.00	3.5	0.326E+00	0.30	0.94	.22140E+02
8.53	1.50	0.00	3.5	0.323E+00	0.30	0.97	.23169E+02
8.69	1.51	0.00	3.6	0.321E+00	0.30	0.98	.23866E+02
8.86	1.51	0.00	3.6	0.319E+00	0.30	1.00	.24572E+02
8.95	1.52	0.00	3.6	0.318E+00	0.30	1.01	.24929E+02
9.11	1.52	0.00	3.6	0.315E+00	0.30	1.02	.25649E+02
9.37	1.53	0.00	3.7	0.312E+00	0.30	1.04	.26747E+02
9.53	1.53	0.00	3.7	0.310E+00	0.30	1.06	.27491E+02
9.62	1.53	0.00	3.7	0.309E+00	0.30	1.07	.27866E+02
9.79	1.54	0.00	3.7	0.308E+00	0.30	1.08	.28623E+02
9.95	1.54	0.00	3.7	0.306E+00	0.30	1.10	.29390E+02
10.21	1.55	0.00	3.8	0.303E+00	0.30	1.12	.30557E+02
10.38	1.55	0.00	3.8	0.301E+00	0.30	1.13	.31346E+02
10.46	1.55	0.00	3.8	0.301E+00	0.30	1.14	.31745E+02
10.63	1.56	0.00	3.8	0.299E+00	0.30	1.16	.32548E+02
10.80	1.56	0.00	3.8	0.297E+00	0.30	1.17	.33360E+02
11.05	1.56	0.00	3.9	0.295E+00	0.30	1.19	.34596E+02
11.22	1.57	0.00	3.9	0.293E+00	0.30	1.21	.35432E+02
11.30	1.57	0.00	3.9	0.293E+00	0.30	1.22	.35853E+02

11.47	1.57	0.00	3.9	0.291E+00	0.30	1.23	.36702E+02
11.64	1.57	0.00	3.9	0.290E+00	0.30	1.25	.37560E+02
11.89	1.58	0.00	4.0	0.287E+00	0.30	1.27	.38864E+02
12.06	1.58	0.00	4.0	0.286E+00	0.30	1.28	.39745E+02
12.14	1.58	0.00	4.0	0.285E+00	0.30	1.29	.40189E+02
12.31	1.58	0.00	4.0	0.284E+00	0.30	1.30	.41084E+02
12.48	1.59	0.00	4.0	0.283E+00	0.30	1.32	.41988E+02
12.73	1.59	0.00	4.1	0.280E+00	0.30	1.34	.43360E+02
12.90	1.59	0.00	4.1	0.279E+00	0.30	1.35	.44287E+02
12.98	1.59	0.00	4.1	0.278E+00	0.30	1.36	.44753E+02
13.15	1.59	0.00	4.1	0.277E+00	0.30	1.38	.45693E+02
13.32	1.60	0.00	4.1	0.275E+00	0.30	1.39	.46642E+02
13.57	1.60	0.00	4.2	0.273E+00	0.30	1.41	.48083E+02
13.74	1.60	0.00	4.2	0.272E+00	0.30	1.42	.49054E+02
13.82	1.60	0.00	4.2	0.271E+00	0.30	1.43	.49543E+02
13.99	1.60	0.00	4.2	0.269E+00	0.30	1.45	.50528E+02
14.16	1.60	0.00	4.3	0.268E+00	0.30	1.46	.51522E+02
14.41	1.60	0.00	4.3	0.265E+00	0.30	1.48	.53030E+02
14.58	1.61	0.00	4.3	0.264E+00	0.30	1.49	.54046E+02
14.66	1.61	0.00	4.3	0.263E+00	0.30	1.50	.54558E+02
14.83	1.61	0.00	4.4	0.261E+00	0.30	1.51	.55587E+02
15.00	1.61	0.00	4.4	0.259E+00	0.30	1.53	.56626E+02
15.25	1.61	0.00	4.4	0.257E+00	0.30	1.55	.58200E+02
15.42	1.61	0.00	4.5	0.255E+00	0.30	1.56	.59261E+02
15.50	1.61	0.00	4.5	0.254E+00	0.30	1.57	.59795E+02
15.67	1.61	0.00	4.5	0.252E+00	0.30	1.58	.60869E+02
15.93	1.61	0.00	4.6	0.250E+00	0.30	1.60	.62497E+02
16.09	1.61	0.00	4.6	0.248E+00	0.30	1.61	.63593E+02
16.26	1.61	0.00	4.6	0.246E+00	0.30	1.63	.64698E+02
16.43	1.61	0.00	4.7	0.244E+00	0.30	1.64	.65811E+02
Maximum lateral extent of recirculation bubble.							
16.51	1.61	0.00	4.7	0.243E+00	0.30	1.65	.66372E+02

End of RECIRCULATION BUBBLE for shoreline-attached jet motion.
Dilution in recirculation bubble = 5.5
Corresponding concentration = 0.207E+00
Cumulative travel time = 66.3715 sec (0.02 hrs)

END OF CORSURF (MOD310): BUOYANT SURFACE JET - NEAR-FIELD REGION

** End of NEAR-FIELD REGION (NFR) **

The initial plume WIDTH/THICKNESS VALUE in the next far-field module will be
CORRECTED by a factor 2.31 to conserve the mass flux in the far-field!
The correction factor is quite large because of the small ambient velocity
relative to the strong mixing characteristics of the discharge!
This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.

Some lateral bank/shore interaction occurs at end othe near-field.

In the next prediction module, the jet/plume centerline will be set
to follow the bank/shore.

BEGIN MOD341: BUOYANT AMBIENT SPREADING

Plume is ATTACHED to RIGHT bank/shore.
Plume width is now determined from RIGHT bank/shore.

Profile definitions:
BV = top-hat thickness,measured vertically
BH = top-hat half-width, measured horizontally from bank/shoreline
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)
TT = Cumulative travel time

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	TT
16.51	0.00	0.00	4.7	0.243E+00	0.40	7.62	.66372E+02
16.59	-0.00	0.00	4.7	0.243E+00	0.40	7.66	.67636E+02
16.67	-0.00	0.00	4.7	0.243E+00	0.40	7.70	.68900E+02
16.74	-0.00	0.00	4.7	0.242E+00	0.40	7.73	.70164E+02
16.82	-0.00	0.00	4.7	0.242E+00	0.39	7.77	.71428E+02
16.89	-0.00	0.00	4.7	0.242E+00	0.39	7.81	.72692E+02
16.97	-0.00	0.00	4.7	0.241E+00	0.39	7.84	.73957E+02
17.04	-0.00	0.00	4.7	0.241E+00	0.39	7.88	.75221E+02
17.12	-0.00	0.00	4.7	0.241E+00	0.39	7.92	.76485E+02
17.20	-0.00	0.00	4.7	0.240E+00	0.39	7.95	.77749E+02
17.27	-0.00	0.00	4.8	0.240E+00	0.39	7.99	.79013E+02
17.35	-0.00	0.00	4.8	0.240E+00	0.39	8.03	.80278E+02
17.42	-0.00	0.00	4.8	0.239E+00	0.38	8.06	.81542E+02
17.50	-0.00	0.00	4.8	0.239E+00	0.38	8.10	.82806E+02
17.58	-0.00	0.00	4.8	0.239E+00	0.38	8.14	.84070E+02
17.65	-0.00	0.00	4.8	0.238E+00	0.38	8.17	.85334E+02
17.73	-0.00	0.00	4.8	0.238E+00	0.38	8.21	.86599E+02
17.80	-0.00	0.00	4.8	0.238E+00	0.38	8.24	.87863E+02
17.88	-0.00	0.00	4.8	0.237E+00	0.38	8.28	.89127E+02
17.95	-0.00	0.00	4.8	0.237E+00	0.38	8.32	.90391E+02
18.03	-0.00	0.00	4.8	0.237E+00	0.37	8.35	.91655E+02
18.11	-0.00	0.00	4.8	0.236E+00	0.37	8.39	.92920E+02
18.18	-0.00	0.00	4.8	0.236E+00	0.37	8.42	.94184E+02
18.26	-0.00	0.00	4.8	0.236E+00	0.37	8.46	.95448E+02
18.33	-0.00	0.00	4.8	0.236E+00	0.37	8.49	.96712E+02
18.41	-0.00	0.00	4.8	0.235E+00	0.37	8.53	.97976E+02
18.49	-0.00	0.00	4.8	0.235E+00	0.37	8.57	.99240E+02
18.56	-0.00	0.00	4.9	0.235E+00	0.37	8.60	.10050E+03
18.64	-0.00	0.00	4.9	0.234E+00	0.37	8.64	.10177E+03
18.71	-0.00	0.00	4.9	0.234E+00	0.36	8.67	.10303E+03
18.79	-0.00	0.00	4.9	0.234E+00	0.36	8.71	.10430E+03
18.87	-0.00	0.00	4.9	0.233E+00	0.36	8.74	.10556E+03
18.94	-0.00	0.00	4.9	0.233E+00	0.36	8.78	.10683E+03
19.02	-0.00	0.00	4.9	0.233E+00	0.36	8.81	.10809E+03
19.09	-0.00	0.00	4.9	0.233E+00	0.36	8.84	.10935E+03
19.17	-0.00	0.00	4.9	0.232E+00	0.36	8.88	.11062E+03
19.24	-0.00	0.00	4.9	0.232E+00	0.36	8.91	.11188E+03
19.32	-0.00	0.00	4.9	0.232E+00	0.36	8.95	.11315E+03
19.40	-0.00	0.00	4.9	0.232E+00	0.36	8.98	.11441E+03
19.47	-0.00	0.00	4.9	0.231E+00	0.35	9.02	.11567E+03
19.55	-0.00	0.00	4.9	0.231E+00	0.35	9.05	.11694E+03
19.62	-0.00	0.00	4.9	0.231E+00	0.35	9.09	.11820E+03
19.70	-0.00	0.00	4.9	0.230E+00	0.35	9.12	.11947E+03
19.78	-0.00	0.00	4.9	0.230E+00	0.35	9.15	.12073E+03
19.85	-0.00	0.00	4.9	0.230E+00	0.35	9.19	.12200E+03
19.93	-0.00	0.00	5.0	0.230E+00	0.35	9.22	.12326E+03
20.00	-0.00	0.00	5.0	0.229E+00	0.35	9.26	.12452E+03
20.08	-0.00	0.00	5.0	0.229E+00	0.35	9.29	.12579E+03
20.15	-0.00	0.00	5.0	0.229E+00	0.35	9.32	.12705E+03
20.23	-0.00	0.00	5.0	0.229E+00	0.35	9.36	.12832E+03
20.31	-0.00	0.00	5.0	0.228E+00	0.34	9.39	.12958E+03
20.38	-0.00	0.00	5.0	0.228E+00	0.34	9.42	.13085E+03
20.46	-0.00	0.00	5.0	0.228E+00	0.34	9.46	.13211E+03
20.53	-0.00	0.00	5.0	0.228E+00	0.34	9.49	.13337E+03

20.61	-0.00	0.00	5.0	0.227E+00	0.34	9.53	.13464E+03
20.69	-0.00	0.00	5.0	0.227E+00	0.34	9.56	.13590E+03
20.76	-0.00	0.00	5.0	0.227E+00	0.34	9.59	.13717E+03
20.84	-0.00	0.00	5.0	0.226E+00	0.34	9.63	.13843E+03
20.91	-0.00	0.00	5.0	0.226E+00	0.34	9.66	.13969E+03
20.99	-0.00	0.00	5.0	0.226E+00	0.34	9.69	.14096E+03
21.06	-0.00	0.00	5.0	0.226E+00	0.34	9.72	.14222E+03
21.14	-0.00	0.00	5.0	0.225E+00	0.34	9.76	.14349E+03
21.22	-0.00	0.00	5.0	0.225E+00	0.33	9.79	.14475E+03
21.29	-0.00	0.00	5.0	0.225E+00	0.33	9.82	.14602E+03
21.37	-0.00	0.00	5.1	0.225E+00	0.33	9.86	.14728E+03
21.44	-0.00	0.00	5.1	0.224E+00	0.33	9.89	.14854E+03
21.52	-0.00	0.00	5.1	0.224E+00	0.33	9.92	.14981E+03
21.60	-0.00	0.00	5.1	0.224E+00	0.33	9.95	.15107E+03
21.67	-0.00	0.00	5.1	0.224E+00	0.33	9.99	.15234E+03
21.75	-0.00	0.00	5.1	0.224E+00	0.33	10.02	.15360E+03
21.82	-0.00	0.00	5.1	0.223E+00	0.33	10.05	.15486E+03
21.90	-0.00	0.00	5.1	0.223E+00	0.33	10.08	.15613E+03
21.98	-0.00	0.00	5.1	0.223E+00	0.33	10.12	.15739E+03
22.05	-0.00	0.00	5.1	0.223E+00	0.33	10.15	.15866E+03
22.13	-0.00	0.00	5.1	0.222E+00	0.33	10.18	.15992E+03
22.20	-0.00	0.00	5.1	0.222E+00	0.33	10.21	.16119E+03
22.28	-0.00	0.00	5.1	0.222E+00	0.32	10.25	.16245E+03
22.35	-0.00	0.00	5.1	0.222E+00	0.32	10.28	.16371E+03
22.43	-0.00	0.00	5.1	0.221E+00	0.32	10.31	.16498E+03
22.51	-0.00	0.00	5.1	0.221E+00	0.32	10.34	.16624E+03
22.58	-0.00	0.00	5.1	0.221E+00	0.32	10.37	.16751E+03
22.66	-0.00	0.00	5.1	0.221E+00	0.32	10.41	.16877E+03
22.73	-0.00	0.00	5.1	0.220E+00	0.32	10.44	.17004E+03
22.81	-0.00	0.00	5.1	0.220E+00	0.32	10.47	.17130E+03
22.89	-0.00	0.00	5.2	0.220E+00	0.32	10.50	.17256E+03
22.96	-0.00	0.00	5.2	0.220E+00	0.32	10.53	.17383E+03
23.04	-0.00	0.00	5.2	0.220E+00	0.32	10.57	.17509E+03
23.11	-0.00	0.00	5.2	0.219E+00	0.32	10.60	.17636E+03
23.19	-0.00	0.00	5.2	0.219E+00	0.32	10.63	.17762E+03
23.26	-0.00	0.00	5.2	0.219E+00	0.32	10.66	.17888E+03
23.34	-0.00	0.00	5.2	0.219E+00	0.32	10.69	.18015E+03
23.42	-0.00	0.00	5.2	0.218E+00	0.31	10.72	.18141E+03
23.49	-0.00	0.00	5.2	0.218E+00	0.31	10.75	.18268E+03
23.57	-0.00	0.00	5.2	0.218E+00	0.31	10.79	.18394E+03
23.64	-0.00	0.00	5.2	0.218E+00	0.31	10.82	.18521E+03
23.72	-0.00	0.00	5.2	0.218E+00	0.31	10.85	.18647E+03
23.80	-0.00	0.00	5.2	0.217E+00	0.31	10.88	.18773E+03
23.87	-0.00	0.00	5.2	0.217E+00	0.31	10.91	.18900E+03
23.95	-0.00	0.00	5.2	0.217E+00	0.31	10.94	.19026E+03
24.02	-0.00	0.00	5.2	0.217E+00	0.31	10.97	.19153E+03
24.10	-0.00	0.00	5.2	0.216E+00	0.31	11.00	.19279E+03

Cumulative travel time = 192.7918 sec (0.05 hrs)
Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD341: BUOYANT AMBIENT SPREADING

BEGIN MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = 0.529E-03 m^2/s
Horizontal diffusivity (initial value) = 0.132E-02 m^2/s

Profile definitions:
BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to water depth, if fully mixed

BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction efects, if any)
TT = Cumulative travel time

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	TT
24.10	0.00	0.00	5.2	0.216E+00	0.31	11.00	.19279E+03

** WATER QUALITY STANDARD OR CCC HAS BEEN FOUND **
The pollutant concentration in the plume falls below water quality standard or CCC value of 0.215E+00 in the current prediction interval.
This is the spatial extent of concentrations exceeding the water quality standard or CCC value.
Plume interacts with BOTTOM.
The passive diffusion plume becomes VERTICALLY FULLY MIXED within this prediction interval.

38.86	0.00	0.00	6.8	0.165E+00	0.40	11.00	.43877E+03

Effluent is FULLY MIXED over the entire channel cross-section.
Except for possible far-field decay or reaction processes, there are NO FURTHER CHANGES with downstream direction.

53.62	-0.00	0.00	6.8	0.163E+00	0.40	11.00	.68476E+03
68.38	-0.00	0.00	6.8	0.160E+00	0.40	11.00	.93074E+03
83.13	-0.00	0.00	6.8	0.158E+00	0.40	11.00	.11767E+04
97.89	-0.00	0.00	6.8	0.156E+00	0.40	11.00	.14227E+04
112.65	-0.00	0.00	6.8	0.154E+00	0.40	11.00	.16687E+04
127.41	-0.00	0.00	6.8	0.151E+00	0.40	11.00	.19147E+04
142.17	-0.00	0.00	6.8	0.149E+00	0.40	11.00	.21607E+04
156.93	-0.00	0.00	6.8	0.147E+00	0.40	11.00	.24066E+04
171.69	-0.00	0.00	6.8	0.145E+00	0.40	11.00	.26526E+04
186.45	-0.00	0.00	6.8	0.143E+00	0.40	11.00	.28986E+04
201.21	-0.00	0.00	6.8	0.141E+00	0.40	11.00	.31446E+04
215.97	-0.00	0.00	6.8	0.139E+00	0.40	11.00	.33906E+04
230.73	-0.00	0.00	6.8	0.137E+00	0.40	11.00	.36366E+04
245.48	-0.00	0.00	6.8	0.135E+00	0.40	11.00	.38825E+04
260.24	-0.00	0.00	6.8	0.133E+00	0.40	11.00	.41285E+04
275.00	-0.00	0.00	6.8	0.131E+00	0.40	11.00	.43745E+04
289.76	-0.00	0.00	6.8	0.129E+00	0.40	11.00	.46205E+04
304.52	-0.00	0.00	6.8	0.128E+00	0.40	11.00	.48665E+04
319.28	-0.00	0.00	6.8	0.126E+00	0.40	11.00	.51125E+04
334.04	-0.00	0.00	6.8	0.124E+00	0.40	11.00	.53584E+04
348.80	-0.00	0.00	6.8	0.122E+00	0.40	11.00	.56044E+04
363.56	-0.00	0.00	6.8	0.121E+00	0.40	11.00	.58504E+04
378.32	-0.00	0.00	6.8	0.119E+00	0.40	11.00	.60964E+04
393.07	-0.00	0.00	6.8	0.117E+00	0.40	11.00	.63424E+04
407.83	-0.00	0.00	6.8	0.115E+00	0.40	11.00	.65884E+04
422.59	-0.00	0.00	6.8	0.114E+00	0.40	11.00	.68343E+04
437.35	-0.00	0.00	6.8	0.112E+00	0.40	11.00	.70803E+04
452.11	-0.00	0.00	6.8	0.111E+00	0.40	11.00	.73263E+04
466.87	-0.00	0.00	6.8	0.109E+00	0.40	11.00	.75723E+04
481.63	-0.00	0.00	6.8	0.108E+00	0.40	11.00	.78183E+04
496.39	-0.00	0.00	6.8	0.106E+00	0.40	11.00	.80643E+04
511.15	-0.00	0.00	6.8	0.105E+00	0.40	11.00	.83102E+04
525.91	-0.00	0.00	6.8	0.103E+00	0.40	11.00	.85562E+04
540.66	-0.00	0.00	6.8	0.102E+00	0.40	11.00	.88022E+04
555.42	-0.00	0.00	6.8	0.100E+00	0.40	11.00	.90482E+04
570.18	-0.00	0.00	6.8	0.987E-01	0.40	11.00	.92942E+04
584.94	-0.00	0.00	6.8	0.974E-01	0.40	11.00	.95402E+04
599.70	-0.00	0.00	6.8	0.960E-01	0.40	11.00	.97861E+04
614.46	-0.00	0.00	6.8	0.946E-01	0.40	11.00	.10032E+05
629.22	-0.00	0.00	6.8	0.933E-01	0.40	11.00	.10278E+05
643.98	-0.00	0.00	6.8	0.920E-01	0.40	11.00	.10524E+05
658.74	-0.00	0.00	6.8	0.907E-01	0.40	11.00	.10770E+05

673.50	-0.00	0.00	6.8	0.894E-01	0.40	11.00	.11016E+05
688.25	-0.00	0.00	6.8	0.881E-01	0.40	11.00	.11262E+05
703.01	-0.00	0.00	6.8	0.869E-01	0.40	11.00	.11508E+05
717.77	-0.00	0.00	6.8	0.856E-01	0.40	11.00	.11754E+05
732.53	-0.00	0.00	6.8	0.844E-01	0.40	11.00	.12000E+05
747.29	-0.00	0.00	6.8	0.832E-01	0.40	11.00	.12246E+05
762.05	-0.00	0.00	6.8	0.821E-01	0.40	11.00	.12492E+05
776.81	-0.00	0.00	6.8	0.809E-01	0.40	11.00	.12738E+05
791.57	-0.00	0.00	6.8	0.798E-01	0.40	11.00	.12984E+05
806.33	-0.00	0.00	6.8	0.786E-01	0.40	11.00	.13230E+05
821.09	-0.00	0.00	6.8	0.775E-01	0.40	11.00	.13476E+05
835.84	-0.00	0.00	6.8	0.764E-01	0.40	11.00	.13722E+05
850.60	-0.00	0.00	6.8	0.753E-01	0.40	11.00	.13968E+05
865.36	-0.00	0.00	6.8	0.743E-01	0.40	11.00	.14214E+05
880.12	-0.00	0.00	6.8	0.732E-01	0.40	11.00	.14460E+05
894.88	-0.00	0.00	6.8	0.722E-01	0.40	11.00	.14706E+05
909.64	-0.00	0.00	6.8	0.712E-01	0.40	11.00	.14952E+05
924.40	-0.00	0.00	6.8	0.702E-01	0.40	11.00	.15198E+05
939.16	-0.00	0.00	6.8	0.692E-01	0.40	11.00	.15444E+05
953.92	-0.00	0.00	6.8	0.682E-01	0.40	11.00	.15690E+05
968.68	-0.00	0.00	6.8	0.672E-01	0.40	11.00	.15936E+05
983.44	-0.00	0.00	6.8	0.663E-01	0.40	11.00	.16182E+05
998.19	-0.00	0.00	6.8	0.654E-01	0.40	11.00	.16428E+05
1012.95	-0.00	0.00	6.8	0.644E-01	0.40	11.00	.16674E+05
1027.71	-0.00	0.00	6.8	0.635E-01	0.40	11.00	.16920E+05
1042.47	-0.00	0.00	6.8	0.626E-01	0.40	11.00	.17166E+05
1057.23	-0.00	0.00	6.8	0.617E-01	0.40	11.00	.17412E+05
1071.99	-0.00	0.00	6.8	0.609E-01	0.40	11.00	.17658E+05
1086.75	-0.00	0.00	6.8	0.600E-01	0.40	11.00	.17904E+05
1101.51	-0.00	0.00	6.8	0.592E-01	0.40	11.00	.18150E+05
1116.27	-0.00	0.00	6.8	0.583E-01	0.40	11.00	.18396E+05
1131.03	-0.00	0.00	6.8	0.575E-01	0.40	11.00	.18642E+05
1145.78	-0.00	0.00	6.8	0.567E-01	0.40	11.00	.18888E+05
1160.54	-0.00	0.00	6.8	0.559E-01	0.40	11.00	.19134E+05
1175.30	-0.00	0.00	6.8	0.551E-01	0.40	11.00	.19380E+05
1190.06	-0.00	0.00	6.8	0.543E-01	0.40	11.00	.19626E+05
1204.82	-0.00	0.00	6.8	0.535E-01	0.40	11.00	.19871E+05
1219.58	-0.00	0.00	6.8	0.528E-01	0.40	11.00	.20117E+05
1234.34	-0.00	0.00	6.8	0.520E-01	0.40	11.00	.20363E+05
1249.10	-0.00	0.00	6.8	0.513E-01	0.40	11.00	.20609E+05
1263.86	-0.00	0.00	6.8	0.506E-01	0.40	11.00	.20855E+05
1278.62	-0.00	0.00	6.8	0.499E-01	0.40	11.00	.21101E+05
1293.37	-0.00	0.00	6.8	0.492E-01	0.40	11.00	.21347E+05
1308.13	-0.00	0.00	6.8	0.485E-01	0.40	11.00	.21593E+05
1322.89	-0.00	0.00	6.8	0.478E-01	0.40	11.00	.21839E+05
1337.65	-0.00	0.00	6.8	0.471E-01	0.40	11.00	.22085E+05
1352.41	-0.00	0.00	6.8	0.464E-01	0.40	11.00	.22331E+05
1367.17	-0.00	0.00	6.8	0.458E-01	0.40	11.00	.22577E+05
1381.93	-0.00	0.00	6.8	0.451E-01	0.40	11.00	.22823E+05
1396.69	-0.00	0.00	6.8	0.445E-01	0.40	11.00	.23069E+05
1411.45	-0.00	0.00	6.8	0.439E-01	0.40	11.00	.23315E+05
1426.21	-0.00	0.00	6.8	0.432E-01	0.40	11.00	.23561E+05
1440.97	-0.00	0.00	6.8	0.426E-01	0.40	11.00	.23807E+05
1455.72	-0.00	0.00	6.8	0.420E-01	0.40	11.00	.24053E+05
1470.48	-0.00	0.00	6.8	0.414E-01	0.40	11.00	.24299E+05
1485.24	-0.00	0.00	6.8	0.409E-01	0.40	11.00	.24545E+05
1500.00	-0.00	0.00	6.8	0.403E-01	0.40	11.00	.24791E+05

Cumulative travel time = 24791.1406 sec (6.89 hrs)

Simulation limit based on maximum specified distance = 1500.00 m.
This is the REGION OF INTEREST limitation.

END OF MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

CORMIX3: Buoyant Surface Discharges   End of Prediction File

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Appendix H. CVC Comments, MOECC Comments, Mussel Survey Report

CVC
CREDIT VALLEY CONSERVATION

January 31, 2017

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

Attention: Dina Lundy, Clerk (by email only)

Re: Draft West Credit River Assimilative Capacity Study

Through the SSMP there was no determination of appropriate location for discharge of surface flows from a proposed Waste Water Treatment Plant. However, recognizing that there is an increase in flows and groundwater discharge downstream of the Village of Erin, CVC has no objection to the proposed location for the new Waste Water Treatment Plant below 10th Line.

Staff of Credit Valley Conservation (CVC) have had an opportunity to review the following documents:

1. West Credit River Assimilative Capacity Study. Hutchinson Environmental Sciences Ltd. Black Creek Assimilative Capacity Study – Draft – November 14, 2016
2. Correction to West Credit River Assimilative Capacity Study Draft Report. Hutchinson Environmental Sciences Ltd. - November 30, 2016

Overall CVC has no objection to the West Credit River Assimilative Capacity Study report subject to the correction with respect to revised unionized ammonia guideline being included in the final report. Additionally, in the minutes of the May 2nd, 2016 Technical committee meeting (where we discussed the Terms of Reference for the Assimilative Capacity Study) it is documented that CVC requested that the water quality parameter of concern chloride be including in the modelled parameters for the impact assessment.

Upon review it was found that chloride was not analysed in the November ACS report. CVC recommends that this parameter be included in the analysis, specifically mass balance analysis to understand mixed instream chloride concentration changes downstream of the WWTP discharge location. This has been a concern in other assimilative capacity studies occurring in small receivers in our watershed (Orangeville and Acton).

It is recommended that the CORMIX model results also be updated with the PWQO (0.0165 mg/L NH4-N) and table 24 be updated accordingly.

Credit Valley Conservation 1255 Old Derry Road, Mississauga, Ontario L5N 6R4
Phone (905) 670-1615 Fax (905) 670-2210

Please do not hesitate to contact the undersigned if you have any questions.

Yours truly,

Liam Marray
Senior Manager Planning Ecology

Cc: Triton Engineering Services Limited
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cfurlong@tritoneng.on.ca (by email only)

MOECC
West Central Region
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Barbara.slattery@ontario.ca (by email only)

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Kitchener ON N2B 1L3
Attn: **Deborah Sinclair, M.A.Sc. I Senior Aquatic Scientist**
Deborah Sinclair Deborah.Sinclair@environmentalsciences.ca (by email only)

Ainley Group
2 County Court Blvd., 4th Floor
Brampton, ON L6W 3W8
Attn: **Gary Scott, M. Sc., P. Eng.**
Vice President, Water Business
scott@ainleygroup.com (by email only)

CREDIT VALLEY CONSERVATION

May 10, 2017

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

Attention: Dina Lundy, Clerk

Re: West Credit River Assimilative Capacity Study
Hutchinson Environmental Services Ltd.
March 29, 2017

Staff of Credit Valley Conservation (CVC) have had an opportunity to review and find satisfactory the above-noted report. We provide the following comments for your consideration.

Although CVC has no further concerns with the methodology for the mass balance modeling of the water quality parameters of concern, the results show that under full build out instream chloride concentrations will exceed aquatic guidelines for chronic exposure. At present, it is not technically feasible to remove chloride in the treatment process, therefore, CVC recommends that emphasis should be placed on controlling the input of chloride at the source. Recognizing water softeners are a significant source of chloride/salts in the wastewater stream specifically in areas where groundwater is used for drinking water, One method to reduce chloride is to use high efficiency water softeners.

Therefore, Erin Urban Centre Wastewater Servicing Class Environmental Assessment Environmental study should include recommendations such as:

- New Developments:
  - That Subdivision Agreements include conditions to require the installation of high efficiency water softeners for all new residences.
- Existing Developments:
  - That funding sources be made available to residents for high efficiency water softeners when they tie into the new sewer lines.
  - That an education program be developed for the residents of Erin on how they can minimize their environmental impacts on their own property including the installation of high efficiency water softeners.

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

Yours truly,

Liam Marray
Senior Manager Planning Ecology

Cc: (email only)

Triton Engineering Services Limited
105 Queen Street West, Unit 14
Fergus, ON N1M 1S6

ATTN: Christine Furlong
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MOECC
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Hutchinson Environmental Services
1-5 Chancery Lane
Bracebridge, On., P1L 2E3

ATTN: Deborah Sinclair
Deborah.sinclair@environmentalsciences.ca

Ministry of the Environment and Climate Change
West Central Region

Ministère de l'Environnement et de l'Action en matière de changement climatique
Direction regionale du Centre-Quest

119 King Street West
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Hamilton, Ontario L8P 4Y7
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119 rue King Quest
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Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

August 3, 2017

Ms Deborah Sinclair
Hutchinson Environmental Sciences Ltd.
(via email only)

Ms. Christine Furlong
Triton Engineering
(via Email only)

Please be advised that we have completed our review of the *West Credit River Assimilative Capacity Study (*Hutchinson Environmental Ltd.'s Report of March 29, 2017) prepared in support of the Class EA for a communal wastewater system intended to service Erin, Hillsburgh and some additional development. Comments provided by the Credit Valley Conservation Authority were taken into consideration and staff of the ministry's Standards Development Branch were also consulted. Overall the study and supporting analysis were found satisfactory. However, a few concerns listed below should be resolved to finalize the effluent criteria.

(1) Design objectives and loadings should be included for the proposed effluent parameters and included in the effluent criteria;

(2) Effluent temperature should be included as an additional parameter to protect the most productive brook trout spawning habitat immediately downstream of the proposed discharge. A compliance limit and a design objective for effluent temperature to protect cold water fishery downstream should be proposed;

(3) No information was provided as to how the effluent would be disinfected. If chlorine is planned to be used as a disinfectant, 'total chlorine residual' shall be included as an effluent parameter with a compliance limit and design objective concentrations. Please provide information on the proposed plan of effluent disinfection, and propose a compliance limit and design objective of the residual disinfectant;

(4) Total Ammonia Nitrogen criteria have been proposed for summer and winter. Please define summer and winter by calendar dates in the recommendation section of the report (i.e., in section 5);

(5) (a) Chloride may be a parameter of concern as predicted effluent chloride concentration appears to be high (396 - 534 mg/L). The source of this chloride to

the municipal waste water is the water softener used at household level to reduce hardness of the groundwater.

(b) Once that effluent mixes with the receiving water, the predicted fully mixed downstream chloride concentration for the full build out effluent flow scenario is estimated to be 142 mg/L (average), and 180 mg/L (maximum). These concentrations are well below the short-term benchmark concentration for chloride of 640 mg/L, which is an estimator of severe effects to the aquatic ecosystem, and is intended to give guidance on the impacts of severe, but transient, situations. However, both concentrations do exceed the long-term CWQG for chloride of 120 mg/L, which is derived to be protective of all aquatic organisms, for all life stages, during indefinite exposure periods.

(c) According to our review, the predicted concentrations of chloride would have no impact on brook trout present at the site however, there is the potential to impair freshwater mussels.

(d) For most organisms used in aquatic toxicity testing, exposures to assess long-term (chronic) effects are at least 7 days in duration, with the exception of testing conducted with larval life stage of freshwater mussels. Looking to the aquatic toxicity data set used to derive the chronic CWQG, the most sensitive organisms are freshwater mussels, specifically the early (larval) life-stage. Testing conducted with a COSEWIC species of special concern (*Lampsilis fasciola*, wavy-rayed lampmussel) and a COSEWIC endangered species (*Epioblasma torulosa rangiana*, northern riffle shell) resulted in a no effect concentration (EC10, or effect concentration resulting in 10% mortality of test organisms) of 24 and 42 mg/L, respectively. These exposures were 24 hours in duration, due to the fact that the larval life stage is short, and die off is rapid if the larvae (glochidia) are unable to attach to a host fish and continue metamorphosis to a juvenile life-stage. Chloride exposure prevents the glochidia from closing their valves, which is required in order to clamp onto a host fish gill, thereby resulting in their mortality.

(e) If a species of special concern, or an endangered species, is present at a site of interest (in this case the West Credit River), then a Protection Clause is invoked. The protection clause may be invoked if an acceptable single (or geometric mean) no-effect or low-effect level endpoint (e.g., ECx for growth, reproduction, survival, or behavioural) for a species at risk (as defined by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC]) is lower than the proposed guideline (i.e., is below the 5th percentile intercept to the fitted curve), then that endpoint becomes the recommended guideline value. In this case, if an endangered freshwater mussel species is present, the site-specific chloride CWQG could be lowered to 24 or 42 mg/L.

(f) We spent some time to find if any freshwater mussel survey data was available for the West Credit River, it appears Credit River Conservation did not have any data but DFO provided us with some information which is limited to only two species identified **(Lasmigona compressa,** creek heelsplitter and *Strophitus undulates*, squawfoot). Of the information provided, none of the species listed are found on the Canadian Species at Risk Public Registry.

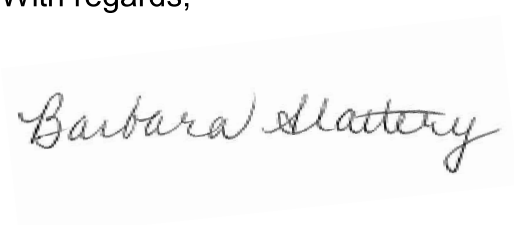
(g) However, it is suggested that a survey be considered, in order to confirm that no species of special concern or species at risk freshwater mussels are present at the site of interest. If the survey finds no presence of that species, the predicted chloride concentration in the effluent would be acceptable to us and no chloride criterion will be included in the effluent parameters. On the other hand, if survey finds presence of that species, an effluent criterion (design objective and compliance limit) for chloride should be proposed to protect fresh water mussels.

(6) The proposed effluent discharge must not be acutely lethal as defined by meeting a 96 hour LC_{50} whole effluent toxicity test using Rainbow Trout and *Daphnia Magna*. This requirement shall be included in the form of an Effluent Limit and shall be monitored through sampling and analysis once in every three months once an ECA is issued.

(7) Details as to the outfall configuration, effluent and receiving water monitoring will be finalized at the permitting stage when an ECA application will be submitted.

Should you have any questions or wish to discuss the specifics of these comments, please contact Sajjad Khan directly either by calling (905) 521-7607 or by email at mohammad.khan@ontario.ca

With regards,



Barbara Slattery
EA/Planning Coordinator

cc. Liam Murray, CVC (via email)
Rick Neubrand, MOECC-DWMD (via email)
S. Khan, MOECC (via email)

Table H1 Response to MOECC August 3, 2017 Comments

No.	MOECC Comment	Response
1	Design objectives and loadings should be included for the proposed effluent parameters and included in the effluent criteria	Ainley Group are recommending design objectives as part of their Technology Review Technical Memorandum (in draft) as part of Phase 3 of the Class EA. These objectives, in addition to loading limits have been provided in Section 5, Table 28 of the ACS.
2	Effluent temperature should be included as an additional parameter to protect the most productive brook trout spawning habitat immediately downstream of the proposed discharge. A compliance limit and a design objective for effluent temperature to protect cold water fishery downstream should be proposed	The Municipal Water Systems for the Urban areas of Erin and Hillsburgh are supplied by groundwater which exhibits an even temperature year-round. It is recognized that hot water use and storage tank exposure to sunlight will increase the temperature of the water. In addition, exposed treatment tanks in the WWTP could also increase the temperature. There is no economically feasible means to adjust effluent temperature. The temperature increases can be mitigated to some extent by using in-ground storage and covered tanks at the WWTP site, by the ~ 2km of buried forcemain between the plant and the river which will be exposed to groundwater temperatures to help attenuate any temperature increases and by the 2.7X dilution available between the 7Q20 flow and the effluent flow at full build out The recommended location for the outfall to the river has been moved downstream to Winston Churchill Boulevard where the river water is cooler and there is a longer exposure of the forcemain to groundwater temperatures.
3	No information was provided as to how the effluent would be disinfected. If chlorine is planned to be used as a disinfectant, 'total chlorine residual' shall be included as an effluent parameter with a compliance limit and design objective concentrations. Please provide information on the proposed plan of effluent disinfection, and propose a compliance limit and design objective of the residual disinfectant;	Ainley group are recommending UV for disinfection of the effluent. This will be outlined in Technology Review Technical Memorandum being prepared by Ainley Group (in draft) as part of Phase 3 of the Class EA.
4	Total Ammonia Nitrogen criteria have been proposed for summer and winter. Please define summer and winter by calendar dates in the recommendation section of the report (i.e., in section 5);	Summer and winter dates have been defined as May 15 – October 15 and Oct 16-May 14 respectively. Table 28 (Section 5) has been updated to reflect summer and winter calendar dates.
5 (g)	However, it is suggested that a survey be considered, in order to confirm that no species of special concern or species at risk freshwater mussels are present at the site of interest. If the survey finds no presence of that species, the predicted chloride concentration in the effluent would be acceptable to us and no chloride criterion will be included in the effluent parameters. On the other hand, if survey finds presence of that species, an effluent criterion (design objective and compliance limit) for chloride should be proposed to protect fresh water mussels.	NSRI completed a mussel survey of the WCR on October 3, 2017 (report appended). The survey found no SAR mussel species in the reach downstream of 10th Line to Shaw's Creek Road. No criterion for effluent chloride concentrations have been proposed. Results of mussel survey have been incorporated into report section 4.6 Mass Balance Modelling - Chloride
6	The proposed effluent discharge must not be acutely lethal as defined by meeting a 96 hour LC50 whole effluent toxicity test using Rainbow Trout and Daphnia Magna. This requirement shall be included in the form of an	Our ACS (Section 4.8.1) recommends effluent limits for TAN to maintain non-acutely lethal effluent

	Effluent Limit and shall be monitored through sampling and analysis once in every three months once an ECA is issued.	
7	Details as to the outfall configuration, effluent and receiving water monitoring will be finalized at the permitting stage when an ECA application will be submitted	Comment acknowledged. The outfall was modelled as 5 m long multi-port diffuser running parallel to the south bank of the West Credit River, with vertical ports located along the river bed. (See Table 6 in ACS). Any alternative configuration can be modelled as required, and monitoring details finalized at the ECA submission stage.

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Memo

Project No.2001

To: **Deborah Sinclair, Hutchinson Environmental Science Ltd.**

From: **Gina MacVeigh, Natural Resource Solutions Inc.**

Date: **December 6, 2017**

Re: **West Credit River Freshwater Mussel Survey, Town of Erin Ontario**

Introduction

NRSI was retained by Hutchinson Environmental Science Ltd. to complete a SAR mussel survey and habitat assessment associated with a Class EA for a new WWTP for the Town of Erin that is to discharge to the West Credit River. The Ministry of Environment and Climate Change (MOECC) requested the mussel survey in response to a CCME guideline for chloride and the concerns to SAR mussels in south western Ontario. NRSI conducted a survey and habitat assessment in the West Credit River near the Town of Erin, Ontario on October 3, 2017 to determine the suitability of the habitat for Species at Risk (SAR) mussels. The assessments were done for two proposed outfall alternatives, shown on Map 1a and 1b in Appendix I, and are as follows:

1. West Credit River – downstream of 10th Line at Erin to Winston Churchill Boulevard.
2. West Credit River – Downstream of Winston Churchill Boulevard for 1km.

Collection and Review of Background Information

Background information on the West Credit River within the two proposed outfall alternative locations was requested from the Credit Valley Conservation Authority (CVC) and the Ministry of Natural Resources and Forestry (MNRF) Aurora District. CVC provided mussel occurrence records on November 6, 2017 (email from A. Ockenden). As of November 22, 2017, no response from the MNRF has been received. NRSI also reviewed the DFO's distribution mapping of fish and mussel SAR (DFO 2017a) and the MNRF's Natural Heritage Information Centre (NHIC) (MNRF 2017a) within the West Credit River which indicates that there is no record of SAR mussels present within the West Credit River.

Field Survey Methodology

Two aquatic biologists, one of which is considered a Freshwater Mussel Specialist, conducted a field survey for mussels and mussel habitat within the two proposed outfall alternative locations. The method for the examination of features followed the informal sampling design described in A Guide to Sampling Freshwater Mussel Populations (Smith and Strayer 2003). As SAR mussels were not expected within these sections of the West Credit River, a quantitative survey to determine presence/absence was not conducted, but instead a timed search was done at each of the two locations. Based on the guide, a timed search of five person hours was completed at each of the two locations (2.5 hours per aquatic biologist per location). Water levels at the time of the assessment were average to below average for the time of year and clear water conditions provided high visibility for viewing the substrates. The survey included walking in an upstream direction utilizing view finders to conduct visual searches within habitat that was suitable for mussels. Additional effort was spent looking for shells along the banks of the river to add to the species information. Surveys for mussels, including SAR, are usually conducted before temperatures drop below 16ºC, as mussels become less active and start to bury deep into the substrate (Mackie et al. 2008). As the survey was conducted in October, the water temperature was below the recommended 16 ºC; however, the West Credit River is a cool-cold water river, which means that the mussel species present are likely to be more tolerant to cooler water temperatures. The weather leading up to the survey had been warmer than average for the end of September. There had been no precipitation during the previous few days prior to the survey.

Mussel Habitat and Species

Information regarding the mussel species present within the West Credit was received from CVC. There are limited observations, dating back to 2006, and spread out throughout the West Credit subwatershed, and no SAR mussel observations have been made. Mussel species that have previously been found within the West Credit River, their status, preferred habitat, and condition they were found in are below in Table 1.

Table 1. Mussel Species from the West Credit River

Common name	Scientific Name	SRANK[1]	ESA[2]	SARA[3]	Preferred Habitat[1]	Condition
Creek Heelsplitter	*Lasmigona compressa*	S5	N/A	N/A	Small streams and the headwaters of small to medium-sized rivers in fine gravel or sand.	Weathered shells have been found within the West Credit River.
Creeper	*Strophitus undulatus*	S5	N/A	N/A	Small to medium-sized streams or occasionally large rivers in mud, sand or fine gravel in a range of flow conditions.	Weathered shells have been found in different locations within the West Credit River.
Cylindrical Papershell	*Anodontoides ferussacianus*	S4	N/A	N/A	Small, slow-moving stream and the headwaters of large streams in silt or mud or sometimes sand.	Weathered shells have been found within the West Credit River. An alive specimen, freshly dead shells and weathered shells have been found within a tributary to the West Credit River.
Giant Floater	*Pyganodon grandis*	S5	N/A	N/A	Small streams to large rivers in backwaters with little or no current in clay silt or mud.	A weathered shell has been found within the West Credit River.

[1]Metcalfe-Smith et al. 2005, [2]MNRF 2017b, [3]Government of Canada 2017b

Reach 1 - Upstream of Shaw's Creek Road to Winston Churchill Blvd

Aquatic biologists conducted a visual mussel survey and habitat assessment for approximately 1km within the West Credit River. The survey started upstream of Shaw's Creek Road at 0930hrs and was conducted to the culvert crossing at Winston Churchill Boulevard, ending at 1215hrs. Water quality parameters were taken upstream of Shaw's Creek Road within the surveyed area. At 0930hrs water temperature was 10.3ºC while air temperature was 9ºC. The air temperature increased throughout the survey to 14.5ºC at 1215hrs. Recorded water quality parameters at 0930hrs include: pH of 8.26, dissolved oxygen of 11.30mg/L and 107%, conductivity of 600µS (microsiemens), and total dissolved solids of 3.0 parts per million (ppm). A turbidity tube was also utilized and was greater than 90cm which means it had a turbidity of less than 5 NTU's (very clear).

Throughout this reach the West Credit River is primarily undeveloped, with the majority of the river having a good flood plain and treed valley (conifers and poplars). The substrates throughout this section consist of primarily sand, gravel, and cobble, with areas of silt, muck and detritus along some of the edges. A few boulders are also present throughout. Filamentous algae were present on the larger cobble and boudlers. Remnants of an old dam and corresponding elevation change are present within this section (Map 1a). Immediately upstream of the old dam, the substrates are comprised more so of silt and detritus overtop of a firmer bottom. Overhanging trees and submerged wood was also abundant. Areas of pure sand were noted within the river. These areas are indicative of ground water upwelling. Watercress, which is also a groundwater indicator, was also very abundant throughout this section. Groundwater seeps were observed along the valley, under the conifer trees. Brook Trout (*Salvalinus fontinalis*) of various sizes were observed during the survey. Brook Trout are considered a cold-water indicator species preferring clear, cool-cold water habitat to complete its life cycle and reproduce. Two partial shells of Cylindrical Papershell were found during the mussel survey. These shells were weathered but still had distinguishing features. No additional live mussels or mussel shells were observed within Reach 1.

Reach 2 – Winston Churchill Blvd to 10th Line

Aquatic biologists conducted a visual mussel survey and habitat assessment for approximately 1km within the West Credit River. The survey started at the upstream edge of the culvert under Winston Churchill Boulevard at 1245hrs and was conducted to the culvert crossing at 10th Line, ending at 1520hrs. Water quality parameters were taken upstream of Winston Churchill Boulevard, just upstream of the culvert. At 1245hrs water temperature was 10.3ºC while air temperature was 14.5ºC. The air temperature increased throughout the survey to 16.5ºC at 1430hrs. Additional water quality parameters recorded at 1245hrs include; pH of 8.29, dissolved oxygen of 12.77mg/L and 112.8%, conductivity of 600µS (microsiemens), and total dissolved solids of 3.1 part per million (ppm). A turbidity tube was also utilized and was greater than 90cm which means it had a turbidity of less than 5 NTU's (very clear).

Similar to the first reach, the West Credit River is primarily undeveloped, with only a few residential properties or areas where there is clearing right to the water's edge. A small section of the river also appears to have been influenced by humans or children, with a manicured lawn right to the river and larger substrates removed from the river and placed into a small rock dam across the river (Map 1b). The majority of the river has a good flood plain and treed valley (conifers and poplars). The substrates are very similar to the previous reach consisting of sand, gravel, and cobble, with areas of silt, muck and detritus along some of the edges. Algae was also observed on the substrate within this section. Overhanging trees and submerged wood was also abundant. Watercress and areas of pure sand were noted in excess throughout this reach. A large number of Brook Trout, of various sizes, were observed during the survey and assessment. A partial and very weathered Cylindrical Papershell was also found within this reach. No additional live mussels or mussel shells were observed within Reach 2.

Overall Habitat for Mussels

In general, the permanently wetted habitat within both reaches of the West Credit River would provide suitable habitat for a number of mussel species, including the four common species in the above table. There were pool, riffle and run habitats, which all had suitable substrates required for mussels to burrow and survive within. The limited abundance and diversity of mussels within this reach is most likely driven by the cooler water temperatures and the location being within the Niagara escarpment. The smaller diversity of fish would also limit the number of mussel species present, as a large number of mussels use fish hosts that prefer warm water habitats. Photos of the West Credit River are provided within Appendix II.

Summary Review of Mussels

None of the species that were found during the survey or previously observed within the background information are listed as SAR under the provincial *Endangered Species Act* or the federal *Species at Risk Act*. The Creeper, Creek Heelsplitter, and Giant Floater each have a S-Rank of S5 (Very common and demonstrably secure within Ontario), and the Cylindrical Papershell has an S-Rank of S4 (Common and apparently secure within Ontario) (MNRF 2015).

Non-SAR mussels do not receive protection under the *ESA* or the *SARA*, but as they are considered fish under the *Fisheries Act*, they are afforded protection and require consideration and projects should avoid causing serious harm to them.

No SAR mussels were observed within the West Credit River in the vicinity of either alternative for new WWTP for the Town of Erin. Due to the lack of SAR mussel presence, chloride (under the new CCME guideline) will not result in impacts to SAR mussel as a result of the new WWTP.

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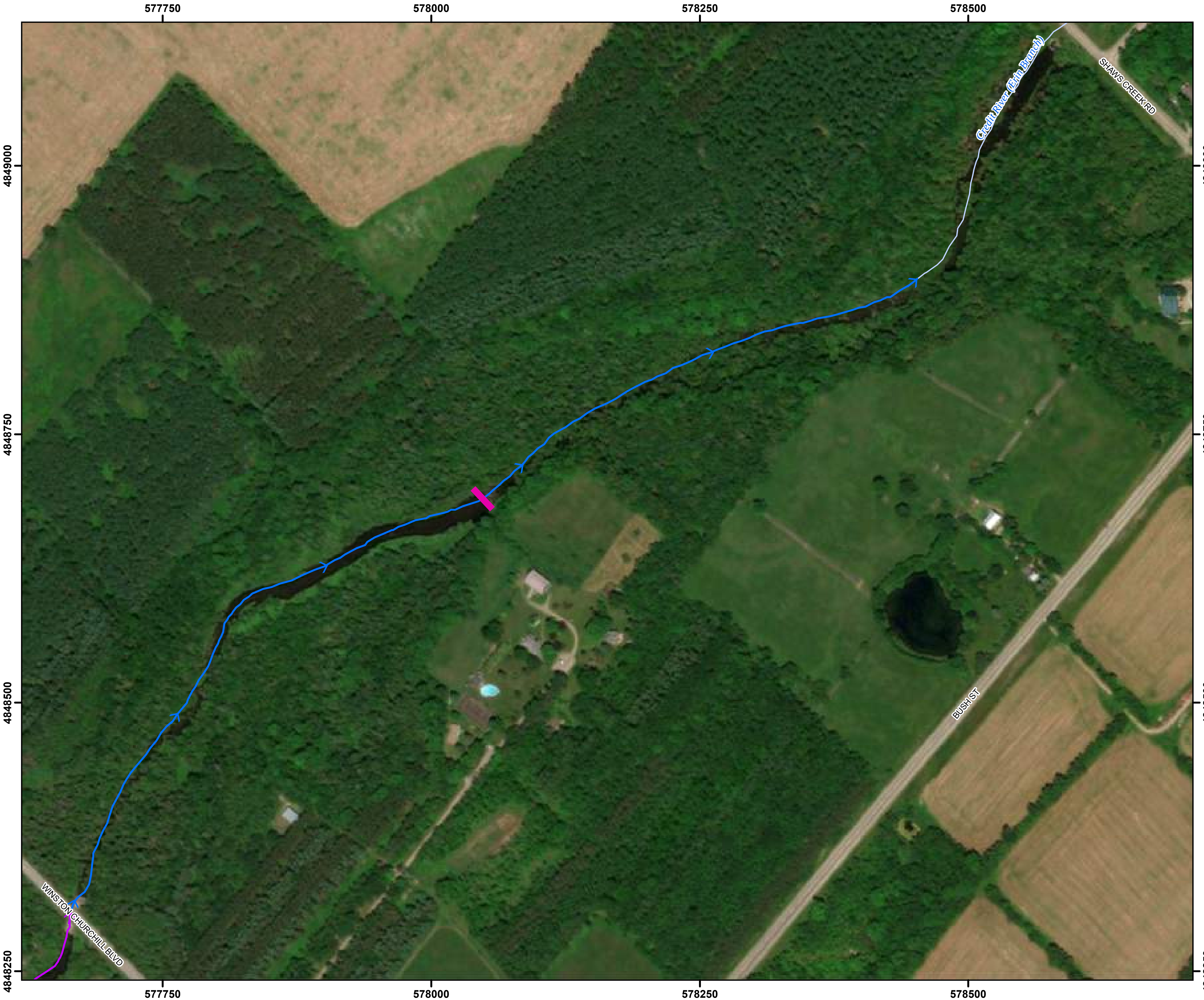
APPENDIX I
Map

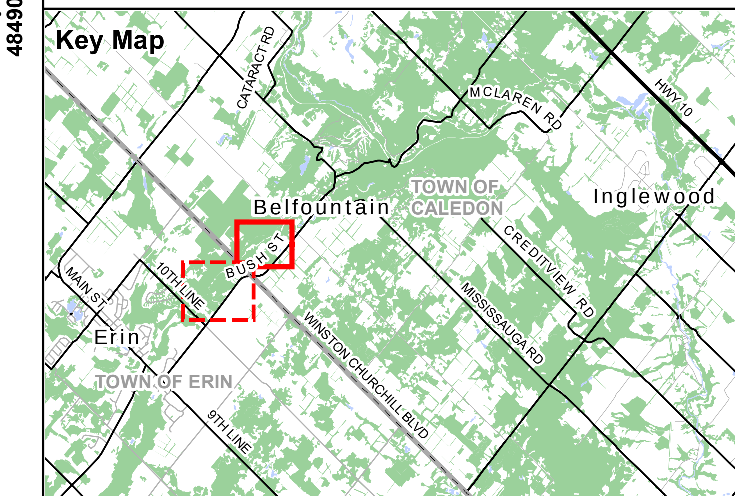
Map 1a

Town of Erin WWTP Outfall Alternatives

West Credit River Mussel Survey



Key Map



Legend

- Reach 1
- Reach 2
- Remnant Dam
- Permanent Watercourse
- Intermittent Watercourse

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Map Produced by Natural Resource Solutions Inc. This map is proprietary and confidential and must not be duplicated or distributed by any means without express written permission of NRSI. Data provided by MNRF© Copyright: Queen's Printer Ontario. Imagery: ESRI (2015).

Project: 2001
Date: November 21, 2017

NAD83 - UTM Zone 17
Size: 11x17"
1:3,500

0 40 80 120 160 200 Metres

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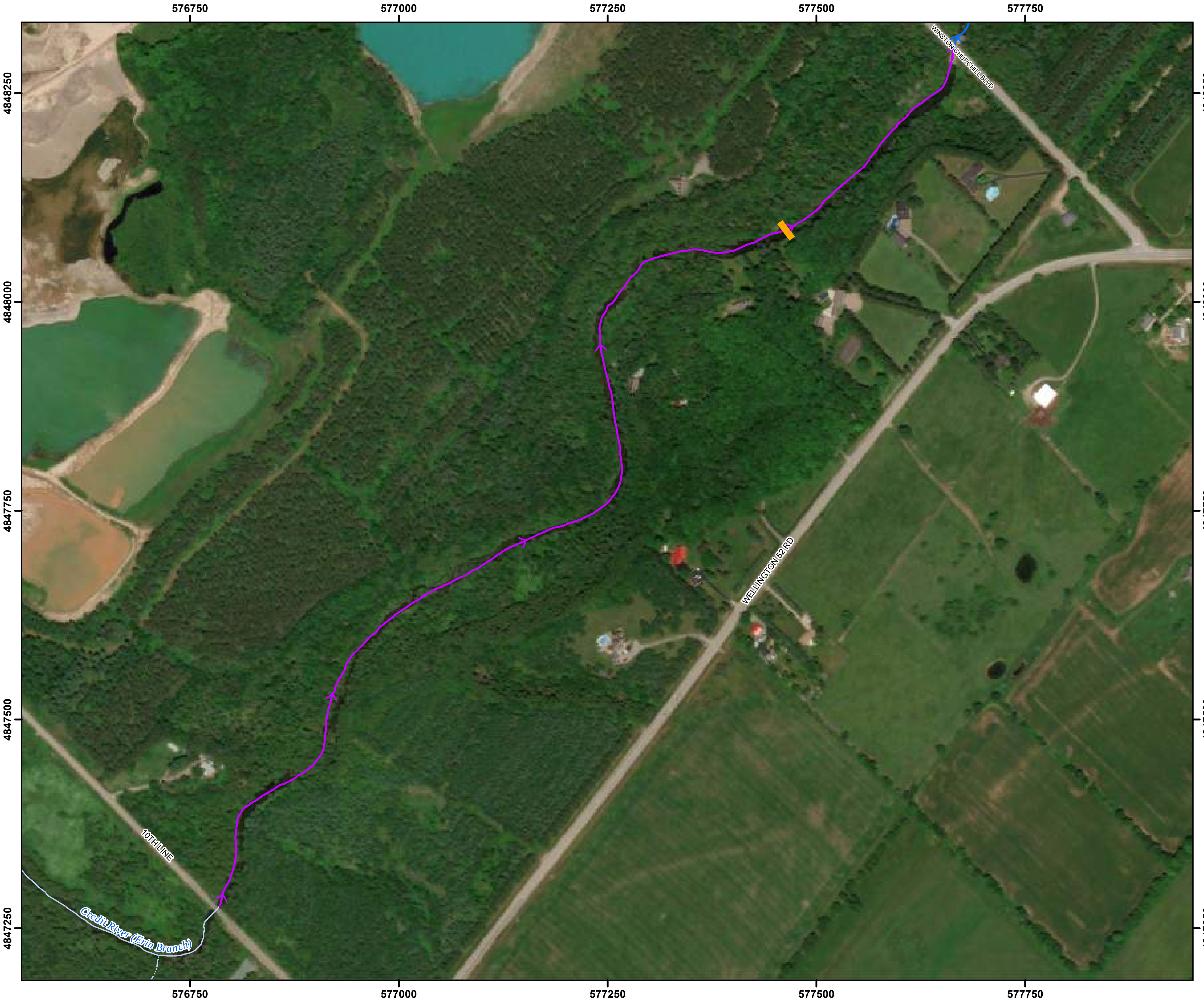
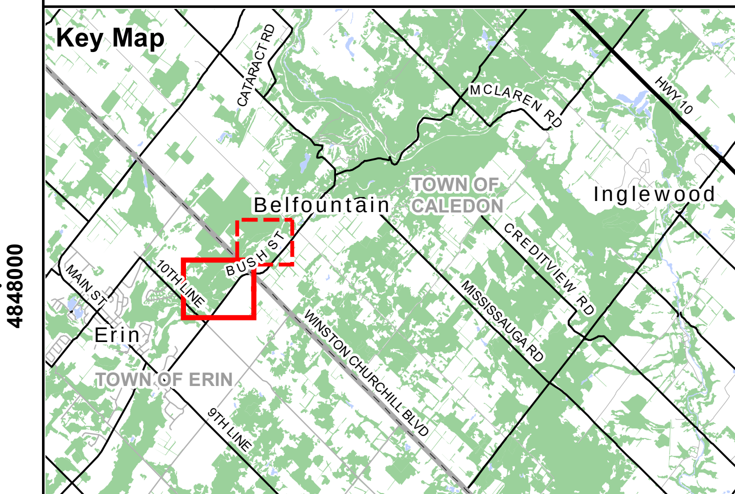
Map 1b

Town of Erin WWTP Outfall Alternatives

West Credit River Mussel Survey



Key Map



Legend

- Reach 1
- Reach 2
- Rock Dam
- Permanent Watercourse
- Intermittent Watercourse

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Project: 2001 Date: November 21, 2017	NAD83 - UTM Zone 17 Size: 11x17" 1:4,500

0 40 80 120 160 200 Metres

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APPENDIX II
Photos

Reach 1 – Shaw's Creek Road to Winston Churchill Blvd


Photo 1: Downstream view at downstream extent.

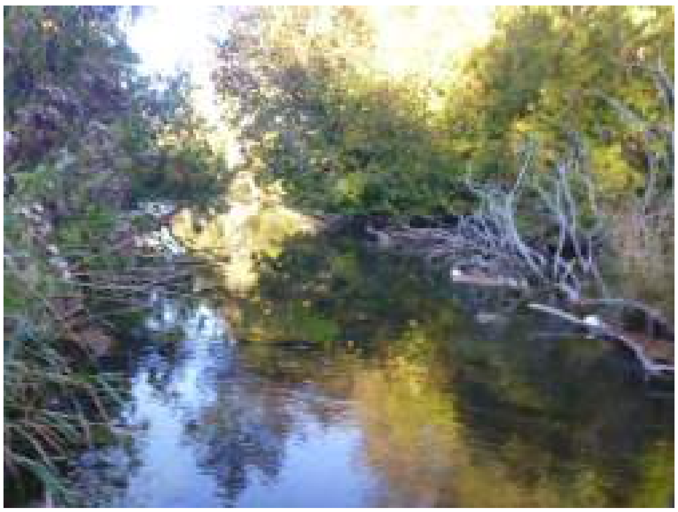
Photo 2: Upstream view at downstream extent.


Photo 3: Gravel and cobble substrates, clear water.


Photo 4: Upstream view with substrates and showing clear water good bank vegetation.


Photo 5: Downstream view. Good flow, clear water.


Photo 6: Watercress, algae on substrates.

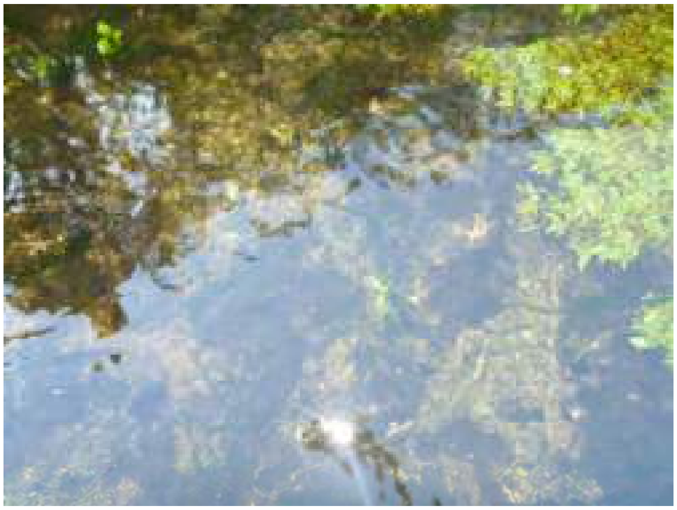
Photo 7: Substrates – sand, gravel, algae.


Photo 10: Side channel with abundant watercress, cobble and gravel substrates.


Photo 8: Downstream view within reach. Good flow, clear water.


Photo 11: Upstream view showing remnant dam.


Photo 9: Upstream view of riffle. Cobble substrates. Overhanging cedar trees.


Photo 12 – Downstream of remnant dam. Gravel and sand substrates.


Photo 13: Remnant Dam. Boulders and elevation change.


Photo 14: Downstream view looking towards remnant dam. Showing silt substrates, slower flow.


Photo 15: Looking across river upstream of remnant dam. Aquatic vegetation and soft silt substrates.

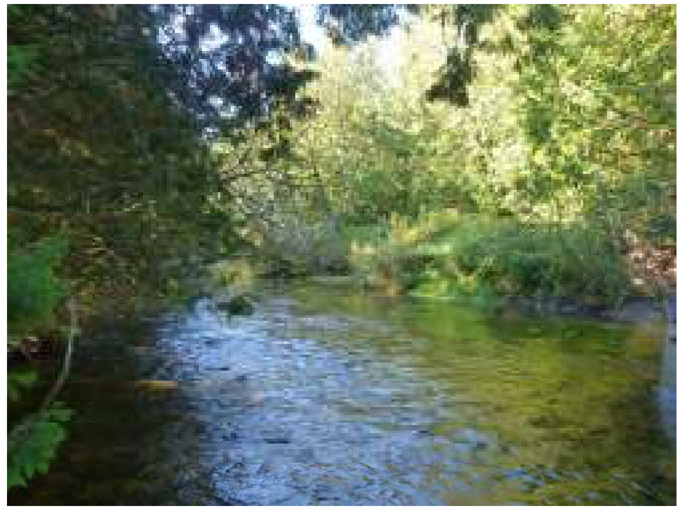
Photo 16: Upstream view upstream of the soft substrates.


Photo 17: Substrates back to gravel, cobble and sand just downstream from Winston Churchill Blvd.


Photo 18: Culvert at Winston Churchill Blvd.

Reach 1 –Winston Churchill Blvd to 10th Line

Photo 19: Upstream view immediately upstream of Winston Churchill Blvd.

Photo 20: Cobble substrates upstream of Winston Churchill Blvd.

Photo 21: Across the West Credit at Winston Churchill Blvd.

Photo 22: Upstream view towards rock dam. Sand, gravel and cobble substrates.

Photo 23: Downstream view at rock dam.

Photo 24: Upstream view of a side channel. Sand and gravel substrates. Overhanging cedar trees.


Photo 25: Upstream view of watercress, some silt on substrates.

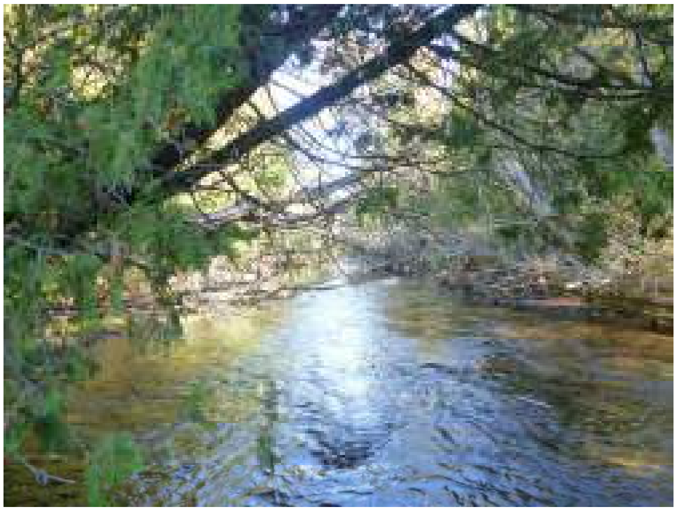
Photo 26: Upstream view within reach.


Photo 27: Algae on boulders and large cobble throughout reach.


Photo 28: Upstream view showing substrate and watercress.


Photo 29: Abundant amount of watercress, sand and upwelling of ground water.


Photo 30: Upstream near upstream extent showing abundant algae.


Photo 31: Woody debris present in water throughout West Credit.


Photo 32: Watercress and algae on substrates.


Photo 33: Upstream view of 10th Line Bridge.


Photo 34: Upstream view upstream of 10th Line.

Appendix E
Two Treatment Plant Alternative

Town of Erin
Urban Centre Wastewater Servicing
Class Environmental Assessment

Technical Memorandum
Two Treatment Plants Alternative
(One Hillsburgh and One Erin)

Final

October 2017

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
Two Treatment Plants Alternative
(One Hillsburgh and One Erin)

Project No. 115157

Prepared for:
The Town of Erin

Prepared By:

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Simon Glass, B.ASc

____
Gary Scott, M.Sc., P.Eng.

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Executive Summary

Overview/Objectives

- This Technical Memorandum looks at the viability of a surface water discharge of treated effluent in Hillsburgh in support of a "Two-Plant Solution" for Hillsburgh and Erin.
- Based on the results of this review, the Technical Memorandum recommends whether to further study the two-plant solution or whether to proceed with the preferred alternative solution identified in the Servicing and Settlement Master Plan (SSMP)
- The review looks at available water quality data and river flow data to determine the viability of a surface water discharge in Hillsburgh and compares the cost of a two-plant solution with the single plant solution proposed in the SSMP

SSMP Approach to Establishing the Preferred Discharge Location

- The SSMP collected water quality data on the river from Hillsburgh through to south of Erin and based on this, recommended a preferred discharge south of Erin for the entire service area
- The preferred discharge location identified in the SSMP was supported by MOECC and CVC
- Subsequent to the SSMP, the current Class EA (UCWS EA) has established effluent limits and flows capable of supporting full build out of the urban areas at this location

Ability of the West Credit River to Assimilate Wastewater Effluent

- Based on this review, there is insufficient water quality data and insufficient river flow data available to support an assimilative capacity study to be able to define effluent limits and obtain MOECC/CVC approval for a discharge of treated effluent within the Hillsburgh area.
- No additional water quality or flow data has been collected for the West Credit River through Hillsburgh since the SSMP.
- Establishing whether river water quality can support a treated effluent discharge within Hillsburgh would require collection of additional data over several years
- Establishing a 7Q20 river flow, needed to determine whether the river through Hillsburgh could accept a discharge from the community, cannot be completed based on available data and would take several years of flow measurement to confirm viability and as much as 10 years to support an approval from MOECC/CVC. As such, it is not known whether the river can support full build out population for Hillsburgh or even the existing population.
- Collection of all required flow and quality data and completion of an assimilative capacity study for a surface water discharge in Hillsburgh would cost in excess of $500,000

Cost of Two Treatment Plants Compared to One Treatment Plant

- This Technical Memorandum also addresses the economic viability of using a two plant solution versus a one plant solution. Implementation plans were developed for both alternatives and the capital and operating costs were developed for each alternative on the basis of full build out of the communities and for each of the existing communities separately. The following has been established from this review:

- There is an industry focus on reduction of operational and compliance costs
- The Net Present Value of 50 year capital, operation and maintenance costs of the single plant solution is 32% cheaper for the full build-out scenario and 27% cheaper for the existing community scenario.
- The following represents the costs to full build out:

Inflation Adjusted Costs	One Plant	Two Plants
Capital Cost	$60,669,310	$98,348,076
Operation and Maintenance Costs	$75,113,136	$100,118,368
Total	$135,782,445	$198,466,444
Present Value Cost	**$70,497,472**	**$104,250,255**

- The following represents the costs to service just the existing community:

Inflation Adjusted Costs	One Plant	Two Plants
Capital Cost	$ 30,904,188	$42,910,949
Operation and Maintenance Costs	$31,707,382	$41,826,759
Total	$62,611,569	$84,737,708
Present Value Cost	**$36,810,320**	**$50,655,454**

- Even when the cost to convey the wastewater between Hillsburgh and the proposed WWTP site, is taken into account, the capital and operating costs of the two plant solution remains significantly more expensive than the single plant alternative.
- Subject to development of a cost sharing plan with developers, the full build out cost allocation to the existing community could substantially reduce the per capita cost to existing residents.

Conclusion and Recommendation

Based on the results of this review, it is recommended that the preferred alternative solution identified in the SSMP with a single treatment plant discharging to the West Credit River south of Erin Village, remain the preferred alternative.

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List of Abbreviations

ACS	-	Assimilative Capacity Study
CVC	-	Credit Valley Conservation
ECA	-	Environmental Compliance Approval
ECR	-	Existing Conditions Report
GTA	-	Greater Toronto Area
MOECC	-	Ministry of Environment and Climate Change
NPV	-	Net Present Value
PLC	-	Programmable Logic Controllers
PWQO	-	Provincial Water Quality Objectives
SCADA	-	Supervisory Control and Data Acquisition
SSMP	-	Servicing and Settlement Master Plan
UCWS EA	-	Urban Centre Wastewater Servicing Class EA
WSC	-	Water Survey of Canada
WWTP	-	Wastewater Treatment Plant

1.0 Introduction and Background

To date, the Erin Urban Centre Wastewater Servicing Class EA (UCWS EA) has proceeded with developing and evaluating alternative solutions for wastewater servicing of the urban areas of Erin Village and Hillsburgh based on a single treatment plant solution servicing both communities in keeping with the recommendations of the Servicing and Settlement Master Plan (SSMP) completed by BM. Ross in 2014 and the established terms of reference for the UCWS EA study. The preferred alternative solution established in the SSMP is to establish a municipal wastewater system for the study area; to collect all wastewater from the study area and to treat these flows and discharge treated effluent to the West Credit River. A review of available data on river water flows and quality established that the preferred discharge location for the treated effluent was between 10th Line and Winston Churchill Boulevard south of Erin Village. Having reviewed the discharge capabilities of the river throughout the study area based on available data and having established a preferred location for that discharge, a single treatment plant solution with a discharge at the preferred location, was identified as the preferred alternative solution.

An assimilative capacity study (ACS, BM Ross 2014) was completed for a discharge to the river within the preferred reach between 10th Line and Winston Churchill Boulevard and agreement was obtained for this solution from the Ministry of Environment and Climate Change (MOECC) and from Credit Valley Conservation (CVC). The terms of reference for the UCWS EA provided for a refinement of the ACS completed during the SSMP and this was completed during the initial phase of the UCWS EA and effluent criteria for the discharge are now accepted by MOECC and CVC. Although the ACS completed during the SSMP established effluent limits capable of treating wastewater flows from a population of 6,000 persons, the ACS completed during the UCWS EA, has established effluent limits capable of supporting a discharge from a population of 14,500 persons. This discharge would be capable of servicing all of the development lands identified in the present Town of Erin Official Plan.

In closing out Phase 2 activities, the UCWS EA has established servicing limits, system capacity and required effluent limits for the study area and the results are planned to be presented to the public in an upcoming Public Information Centre (PIC).

After the study team had developed the system capacity and effluent limits for a single surface water discharge, on March 2, 2017 Council requested the study team to address concerns expressed by members of the Public Liaison Committee that a solution based on decentralised treatment was being overlooked. To address this, the study team prepared a Technical Memorandum on the potential for Subsurface Disposal of treated effluent. This study was presented to Council on May 17, 2017 and concluded that the preferred solution established under the SSMP, was still valid. It is also noted that the Subsurface Disposal Technical Memorandum (Ainley May 2017) also looked at a two plant scenario for Hillsburgh and Erin (based on subsurface disposal) and concluded that it was more expensive than the single plant alternative.

At the May 2, 2017 Council Meeting, the following resolution was passed:

"Be it resolved that Council would like to determine why a two smaller sewage treatment plants option (one Hillsburgh and one Erin) has not been pursued; And that the Mayor direct our engineering consultants to put a short summary report on the potential feasibility of this option, requesting the MOECC (Ministry of Environment and Climate Change) and CVC (Credit Valley Conservation) to comment".

Based on this resolution, the intent of this Technical Memorandum is to review the alternative of a "two-plant solution" with separate surface water discharges and either, confirm selection of the preferred alternative solution established through the Servicing and Settlement Master Plan (SSMP) or to recommend further study of the two-plant approach with a surface water disposal alternative during Phase 3 of the UCWS EA."

1.1 Objectives of Technical Memorandum

The main objective of this technical memorandum is to review and establish the viability of collecting and treating wastewater in two separate systems for Hillsburgh and Erin Village with separate surface water discharges. As such, this technical memorandum:

- Provides an overview of the SSMP approach to identifying a discharge point for treated effluent to the West Credit River
- Summarises and re-presents the surface water quality and quantity information for the West Credit River through the study area gathered during the SSMP augmented with up to date available information on water quality and river flow.
- Outlines the activities required to conduct an Assimilative Capacity Study (ACS) for a discharge to the river in Hillsburgh.
- Identifies and compares conceptual level capital and operating costs for the single plant and two-plant solutions.

2.0 SSMP Approach to Establishing a Preferred Discharge Location

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 very clear conclusion of the SSMP was to establish a single plant with surface water discharge downstream of Erin Village and this was based on an evaluation of all available data on the river between Hillsburgh and Erin Village. In addition, work completed during this UCWS EA has established effluent limits for a surface water discharge between 10^{th} 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.

3.0 Surface Water discharge in Hillsburgh

3.1 Summary of Available Surface Water Quality Data

Surface water quality data was collected and presented in the "Phase 1 – Environmental Component – Existing Conditions Report" (ECR) completed in 2011, authored by the CVC, Aquafor Beech, and Blackport Hydrogeology. The data was gathered between 2007 and 2008 and covered a range of water quality indicators for chemical, microbiological and physical condition of the water and sediment in the West Credit River. Water quality information was collected from a series of locations along the West Credit River as well as from some tributaries. A map of the sampling locations is provided, see Figure 1.

Overall, water quality within the study area was determined to be fair-good based on the rankings of each station under the Water Quality Index scoring system. The primary parameters affecting the score of each station were total phosphorus, nitrate nitrogen and elevated bacterial levels. For the upper portions of the study area through Hillsburgh, water quality was fair in terms of the impact to the health of aquatic biota. A general trend of improving water quality exists through the mid-potions of the study area as significant groundwater discharge adds higher flows, increasing the streams ability to assimilate contaminants. The influence of urban land use is apparent; measurements at the sampling locations surrounding both of the urban areas show increases in total phosphorus, nitrate and bacterial concentrations.

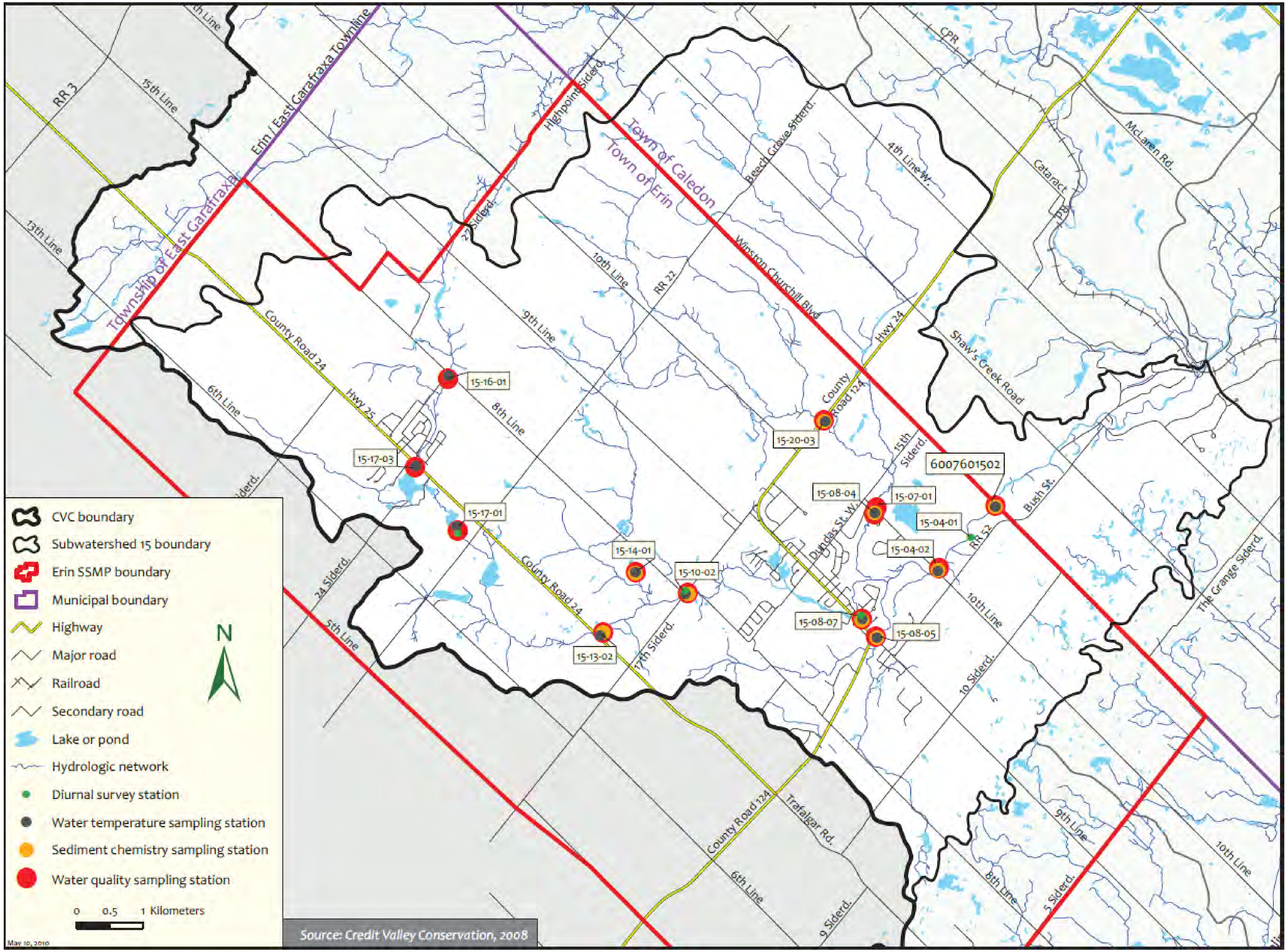

Figure 1 – Sampling Location Reference Map

The key parameters affecting the quality of treatment that will be required at the treatment facility and the volume of effluent that may be discharged to the receiver are, in this case, total phosphorus and nitrate-nitrogen. Discharge volumes are typically limited by available flow in the river (based on the 7Q20 flow statistic) and the capacity of the treatment facility to remove these nutrients from the wastewater before discharge to the river in order to keep the concentrations in the river below the provincial water quality objectives (PWQO). The PWQO limits are provided in Table 1.

Table 1 – PWQO Nutrient Limits of Concern

Nutrient Parameter	Limit (mg/L)
Total Phosphorus (MOECC 1994)	0.03
Nitrate-Nitrogen (CCME 2012)	3.0

A box-and-whisker plot of the total phosphorus data collected at each monitoring location is provided in Figure 2. For the purposes of comparison with the PWQO, the 75th percentile (upper quartile in Figure 3) value is used. Figure 3 is provided as a quick reference guide for understanding box-and-whisker plots.

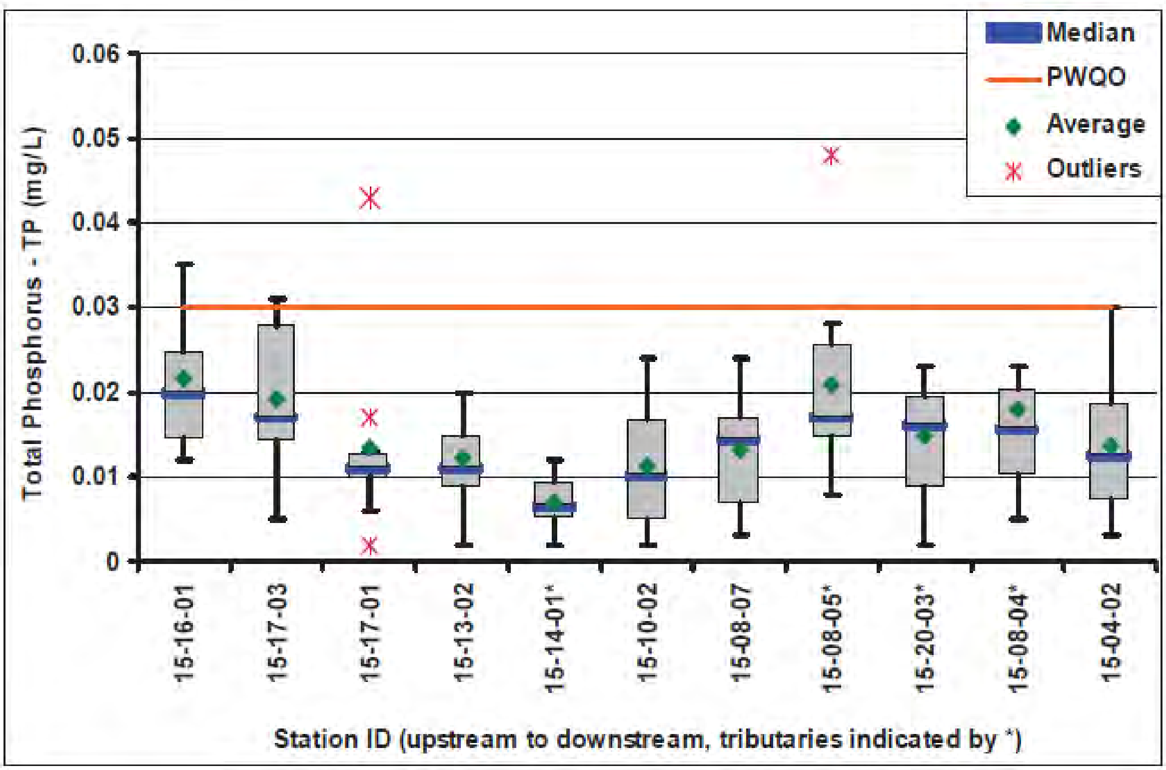

Figure 2 – Total Phosphorus Box-and-Whisker Plots (SSMP)

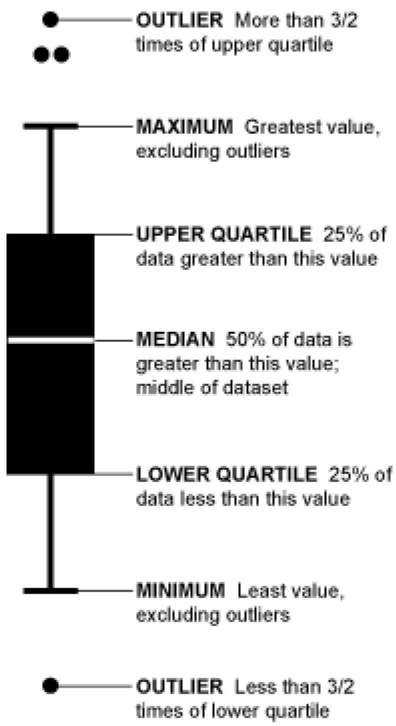

Figure 3 – Box-and-Whisker Plot Description

A box-and-whisker plot of the nitrate-nitrogen data collected at each monitoring location is provided in Figure 4.

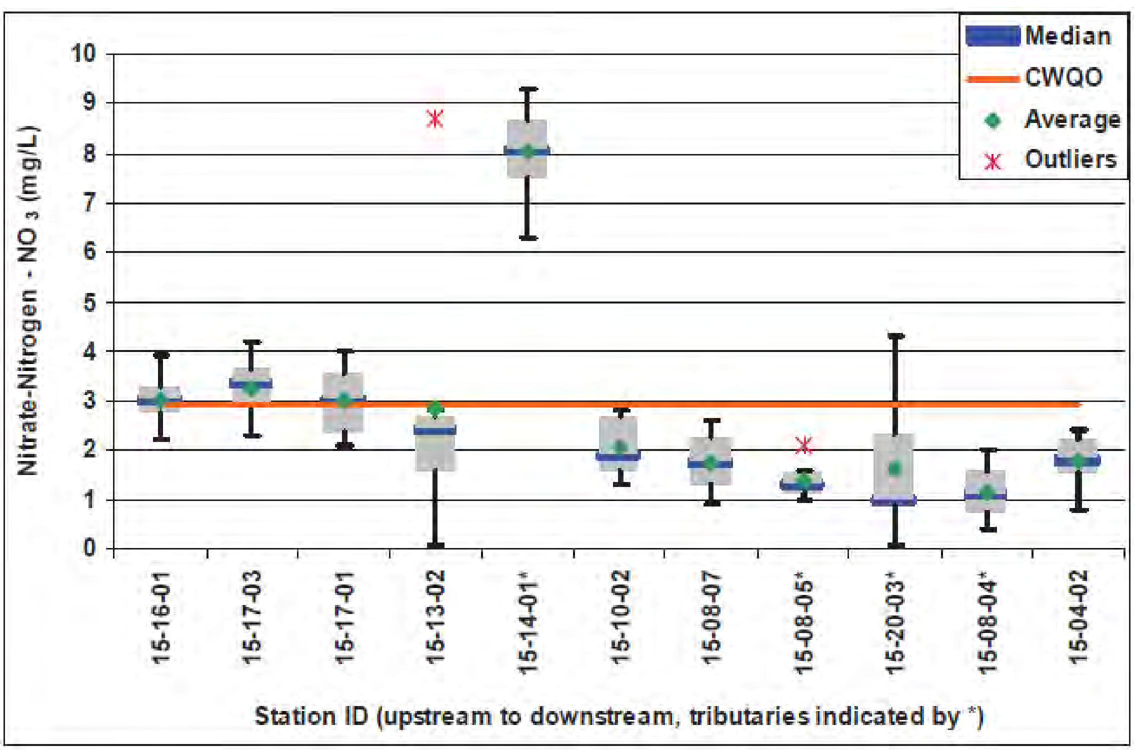

Figure 4 – Nitrate-Nitrogen Box-and-Whisker Plots (SSMP)

The station which is located closest to the planned discharge location in Erin Village is Station 15-04-02. This station is located at the intersection of the West Credit River and 10th Side Road and the following characteristics have been documented:

- 75th percentile total phosphorus concentration of 0.018 mg/L (ECR, 2007/08 data)
- Slight improvement of phosphorus levels over time, a 75th percentile phosphorus concentration of 0.016 mg/L (ACS Update, 2016 data)
- 75th percentile nitrate-nitrogen concentration of 2.3 mg/L (ECR, 2007/08 data)
- Slight improvement of nitrate-nitrogen levels over time, a 75th percentile nitrate-nitrogen concentration of 1.9 mg/L (ACS Update, 2016 data)
- 7Q20 flow rate of 225 L/s

Two monitoring locations exist at the south end of Hillsburgh. Based on the topography, the better discharge location would likely be between the two stations (15-17-03 and 15-17-01). The station closest to Hillsburgh is 15-17-03; this station has reduced water quality due to the proximity to the urban area, there is a general improvement of water quality downstream towards station 15-17-01. Based on the findings of the Existing Conditions Report (ECR):

- 75th percentile total phosphorus concentration of 0.028 mg/L at station 15-17-03.
- 75th percentile nitrate-nitrogen concentration of 3.6 mg/L at station 15-17-03.
- 75th percentile total phosphorus concentration of 0.013 mg/L at station 15-17-01.
- 75th percentile nitrate-nitrogen concentration of 3.5 mg/L at station 15-17-01.

While the total phosphorus concentrations measured show a significant improvement from station 15-17-03 to station 15-17-01, it should be noted that this is based on a limited dataset and there are significant outliers at the downstream station. Based on the tributary and impoundment network in the area it is not possible to reliably predict river water quality in the area. The nitrate-nitrogen concentrations remain relatively consistent from 15-17-03 to 15-17-01. The 75th percentile concentration of 3.5 mg/L exceeds the PWQO limits and would be a major limiting factor in obtaining approval for discharge at this location. The MOECC requires no further degradation of water quality in rivers and streams where water quality parameters have been exceeded.

There is insufficient site specific water quality data available to support an assimilative capacity study and to be able to define effluent limits and obtain MOECC approval for a discharge. Since completion of the SSMP, there is no additional water quality data available for the river through Hillsburgh. It is possible that the level of nitrates in the river would limit any approval for a discharge or require costly denitrification of the effluent to avoid any additional degradation of water quality.

3.2 River Flow Rate and 7Q20 Flow Data

A Water Survey of Canada (WSC) gauge located in the West Credit River at 8th Line provides a long-term (1983 - present) record of flow. Due to differences in geological conditions between the catchment area of this station and the WWTP study area (i.e., West Credit River between 10th Line and Winston Churchill Blvd.), flows from 8th Line could not be pro-rated for catchment size at 10th Line for the preliminary ACS (B.M.Ross 2014).

A flow gauging station was established at 10th Line in July 2013 by Credit Valley Conservation (CVC). Insufficient data had been collected from this station to determine a reliable 7Q20 low flow statistic; a minimum of 10 years of data is typically required. Flows measured at this gauge, however, were used by CVC to develop a flow transposition factor between the 8th Line and the 10th Line data. The preliminary ACS used 7Q20 flows for 10th Line as determined by CVC using a transposition factor based on stream flows collected from July to October 2013 at 10th Line. Additional flow data have been collected since the preliminary ACS to refine the transposition factor. In 2016, CVC recalculated the 7Q20 low flow statistic for 10th Line, using data from July 2013 to December 2015. The new 7Q20 flow statistic for 10th Line of 225 L/s includes a 10% reduction to account for potential effects of climate change.

Only minimal flow data is currently available for the span of river downstream of Hillsburgh. During the ECR a spot measurement of flow was taken in Hillsburgh at the same time as a measurement at 10^{th} Line in Erin village. Based on the spot measurement, flow through Hillsburgh is approximately 26% of the flow at 10^{th} Line, however, clearly there is insufficient data to be able to establish a 7Q20 flow that would be required to support approval for a discharge of treated wastewater effluent through Hillsburgh. It would take several years of flow data to support an assimilative capacity study for Hillsburgh and perhaps as much as 10 years before CVC and MOECC would be able to approve a discharge. CVC have indicated that they have no need or intent to establish a gauging station through Hillsburgh.

3.2.1 Conclusions on Discharge Potential to the West Credit River in Hillsburgh

There is insufficient water quality data and insufficient river flow data available to support an assimilative capacity study and to be able to define effluent limits and obtain MOECC/CVC approval for a discharge of treated effluent within the Hillsburgh area. It is possible that the level of nitrates in the river would limit any approval for a discharge.

No additional water quality or flow data has been collected for the West Credit River through Hillsburgh since the SSMP.

Establishing whether river water quality can support a treated effluent discharge within Hillsburgh would require collection of data over several years. Establishing a 7Q20 river flow that would be needed to determine whether the river could accept a discharge from the community, would take several years of flow measurement to even confirm viability and as much as 10 years to support an approval from MOECC/CVC. As such, it is not known whether the river can support full build out population for the community or even the existing population.

Since CVC have no plans to construct a gauging station to measure river flows in Hillsburgh, the cost of this station and the annual monitoring and analysis of all the flow and quality data over several years would become a cost to the ECWS Class EA. Once sufficient data had been collected, an assimilative capacity study could be undertaken. It is likely that the total cost of all data collection and the ACS will be in excess of $500,000.

4.0 Overview of Wastewater Collection and Treatment Planning

The planned wastewater system for the urban areas of Erin and Hillsburgh represents a small system and the overall area serviced will still be significantly smaller than the systems of many medium and large urban areas. The water and wastewater industry in Ontario is highly regulated to protect the health of its citizens and to protect the environment. In particular, effluent discharge limits are becoming stricter and the operational requirements for testing, monitoring and reporting to ensure compliance with MOECC Environmental Compliance Approvals (ECA) represent a significant operational cost for wastewater treatment plants. In many jurisdictions municipalities are looking to reduce the number of treatment plants in order to reduce operations cost. Decisions by municipalities over the last 20 years reflect the trend towards a lower number of larger treatment facilities in order to lower operational cost. The following are offered as a few examples:

- District of Muskoka is presently intending to eliminate one of its two Wastewater Treatment Plants in Huntsville, primarily to reduce operations cost.
- Clearview Township (Stayner) decided to pump its wastewater to Wasaga Beach rather than expand/upgrade its lagoon
- The Town of Tecumseth decided to pump its wastewater to Windsor rather than expand/upgrade their own plant
- York Region eliminated septic systems in King City and connected the wastewater system to the large York-Durham system rather than construct a smaller local treatment plant in King City
- The Town of Georgina decided to collect wastewater from all of the shoreline communities between Sutton and Keswick and pump all wastewater to the Keswick WWTP south of Keswick rather than build a more central treatment facility

Due to compliance issues and operational costs, the tendency is clearly towards elimination of smaller plants and to constructing larger systems which are less costly on a per capita basis.

5.0 Implementation Plan for Treatment Plant Alternatives

In order to compare the two-plant alternative with the single plant alternative, an implementation plan for each alternative was developed through to full build out of the growth areas identified in the system capacity technical memorandum. Cost scenarios for full build out and for each of the existing communities alone have been developed based on these implementation plans.

The final implementation plan will depend on many factors including:

- Revision and approval of the Town Official Plan to define growth;
- Limits for the urban areas; and
- Funding for the portion required to service the existing population.

The implementation plan used in this technical memorandum is purely for comparative analysis to illustrate cost differences between plant scenarios. Implementation phasing was developed with consideration of the following:

- The need to service the existing community in the first phase;
- The need to provide for a level of growth in the first phase; and
- Making best use of the scale effect where in larger capacity plants cost less on a per capita basis thus offsetting some cost for the existing communities.

For the purpose of evaluation, a two-phase approach was selected with allocation to growth in Phase 1 representing 33% of the overall treatment capacity. In addition to identifying full build out phasing, the analysis identifies the cost of a plant to service the existing community. The costing excludes the cost of treatment for septic wastes from rural communities in the town. It is assumed that this waste would be processed at only one plant.

It is noted that the implementation plan is significantly different from the scenario identified in the SSMP wherein the system was primarily aimed at servicing the existing community with a small growth allocation (up to a population of 6000). Based on work completed to date within this study, it is possible to service population greater than 14,500. In order to provide a meaningful comparison with the single plant solution developed as part of the UCWS EA, the implementation plans are for full build out to a service population of 14,500.

Within the discussion of alternatives it is assumed that all plants are designed to meet the effluent limits established under the assimilative capacity study undertaken as part of this project.

The alternatives considered are as follows:

- Alternative 1 – A single treatment facility for both communities with phased implementation
- Alternative 2 – Separate treatment facilities for each community with phased implementation

5.1 Alternative 1 – Single Plant Servicing Erin & Hillsburgh

Under Alternative 1, implementation is based on a two phase approach with a single plant designed for the population and flow capacities presented in Table 2.

Table 2 – Populations and Flows for Erin and Hillsburgh

Erin & Hillsburgh	Population	Capacity (m^3/d)
Existing Population	4,616	2,844
Growth	9,943	4,329
Total	14,559	7,173

The phasing plan is presented in Table 3. The table presents the plant size required to service the existing community in addition to a two-phase plant implementation plan with the capacity associated with each implementation phase.

Table 3 – Single Treatment Plant Phasing

Phase	Capacity (m^3/d)	Allocation to Existing	Allocation to Growth	Year Built
Existing Only	2,844	100%	Zero	2020-2022
Phase 1	4,300	66%	34%	2020-2022
Phase 2	2,873	Zero	100%	2028-2030

5.2 Alternative 2 – Two Plants Servicing Erin & Hillsburgh

Under Alternative 2, implementation is based on a two phase approach with separate treatment plants for Erin and Hillsburgh. Under this scenario, the population and flow capacities for Erin are presented in Table 4.

Table 4 – Populations and Flows for Erin

Erin	Population	Capacity (m^3/d)
Existing Population	3,225	2,244
Growth	5,340	2,523
Total	8,565	4,767

The phasing strategy is presented in Table 5. The table presents the plant size required to service the existing community in addition to a two-phase plant implementation plan with the capacity associated with each implementation phase.

Table 5 – Independent Treatment for Erin, Plant Phasing

Phase	Capacity (m^3/d)	Allocation to Existing	Allocation to Growth	Year Built
Existing Only	3,244	100%	Zero	2020-2022
Phase 1	3,400	66%	34%	2020-2022
Phase 2	1,367	Zero	100%	2028-2030

The population and flow capacities for Hillsburgh are presented in Table 6.

Table 6 - Populations and Flows for Hillsburgh

Hillsburgh	Population	Capacity (m^3/d)
Existing Population	1,391	599
Growth	4,603	1,806
Total	5,994	2,405

The phasing strategy is presented in Table 7. The table presents the plant size required to service the existing community in addition to a two-phase plant implementation plan with the capacity associated with each implementation phase.

Table 7 - Independent Treatment for Hillsburgh, Plant Phasing

Phase	Capacity (m^3/d)	Allocation to Existing	Allocation to Growth	Year Built
Existing Only	599	100%	Zero	2020-2022
Phase 1	900	66%	34%	2020-2022
Phase 2	1,505	Zero	100%	2028-2030

6.0 Cost Implications for a two Treatment Plant Solution

6.1 Capital Costs

The capital cost of the process components at each facility proposed was developed based on the cost estimation curve presented in Figure 5. Costing curves were originally developed for individual wastewater treatment processes as part of a Ministry of Infrastructure study (Water and Wastewater Asset Cost Study, Ministry of Public Infrastructure Renewal R J Burnside and Associates). The combined curve presented in Figure 5 was developed for full tertiary treatment process components and was supplemented with additional construction cost information for facilities constructed in Ontario over the past 10 years. Additional costs for individual facilities were included in the NPV calculation for land purchase, site works and operations buildings.

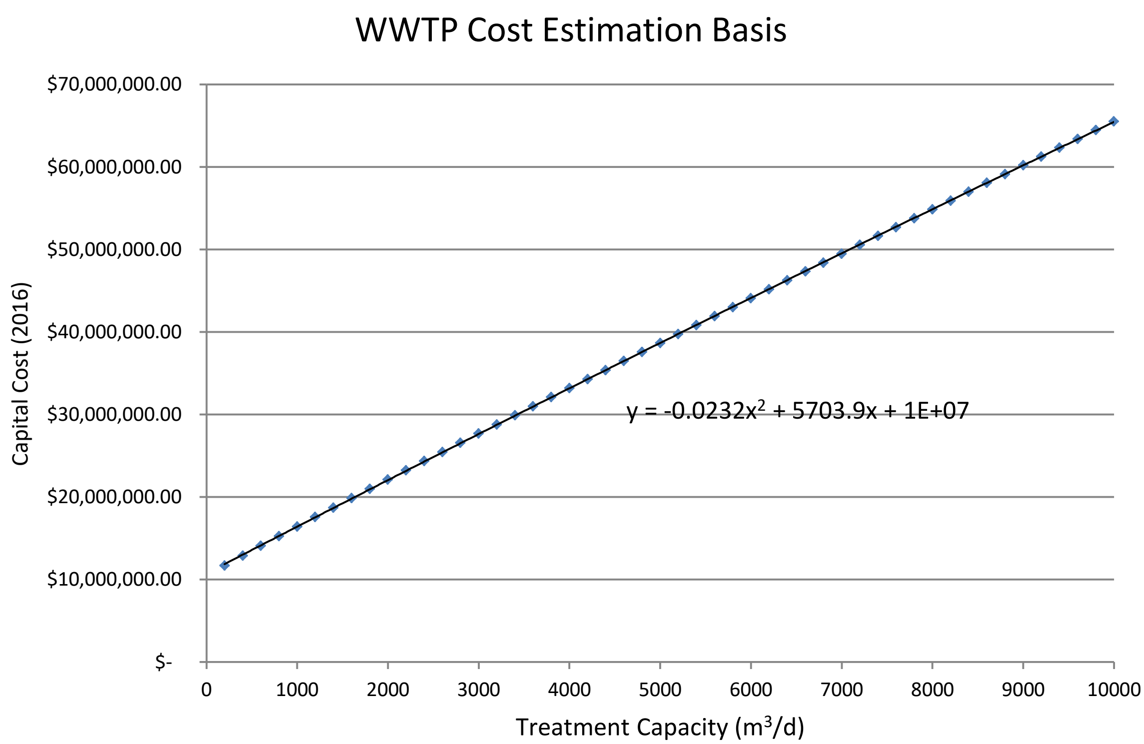

Figure 5 – Cost Basis for Process Aspects of Wastewater Treatment

6.2 Operation and Maintenance Costs

The cost of operating Municipal Wastewater Treatment Plants varies widely depending on the type of treatment, size and number of facilities operated by the particular municipality. Small communities with facultative lagoon type treatment represent low cost treatment and this approach has been used for many small communities throughout Ontario. However, as regulations change and these communities experience the need for growth, these lower cost systems are being replaced by more complex treatment plants needed to meet stricter discharge criteria. For example the Village of Havelock recently replaced their lagoon at a cost of $8.7 million resulting in a substantial increase in treatment cost.

Generally, the larger GTA Municipalities and Cities, such as City of Hamilton, City of Waterloo, City of Ottawa etc. have the lowest operating cost per cubic metre processed. Other larger municipalities with multiple facilities such as District of Muskoka, Township of Springwater and Kawartha Lakes for example, have operating costs of 1.7 to 1.8 times larger than Region/City plants. Smaller communities with advanced treatment plants have even higher operating costs.

In preparing this technical memorandum, we have reviewed the operations budgets of a number of municipalities. Based on this and discussion with operating authorities, we have compared operating cost components for both a single treatment plant and two treatment plants. Costs are expressed in terms of $/m^3 of installed plant capacity per day.

6.2.1 Personnel Costs

A comparison was conducted between the Phase 1 Single Plant and Phase 1 Two Plants. Discussions were held with operating authorities regarding personnel costs. For the single plant, three staff will be required on a part time basis for a total of 2,100 hours, while two plants would require around 3,700 hours of operation and maintenance per year. Typically more time is required for operation of the collection system than the treatment system and staff can be integrated to some degree, however, it is likely that two treatment plants would require a higher number of staff overall. Based on our assessment of the hours required to operate these plant alternatives, we anticipate that the personnel cost would be 70% more for two plants, versus one plant.

Translating this to the operating cost of similar plants gives a cost of \$0.12/m^3 of installed capacity per day for a single plant versus \$0.20/m^3 for two plants.

6.2.2 Power / Chemicals / Consumables

Two Plants would require duplication of building space for administration functions and larger overall building space for electrical, mechanical equipment and maintenance facilities. Power costs associated with lighting and heating for the larger space will be increased for two plants. Two plants will also require a higher number of process trains requiring a larger number of pumps, process equipment and control equipment and this will increase the overall power consumption. Chemicals used in wastewater are typically used in proportion to flow and so total chemical use for two plants should be similar to the one plant solution. Other consumables such as water, cleaning materials and transportation etc. will be significantly higher for the two plant scenario. Overall, our analysis indicates that two plants would cost some 20% more for power, chemicals and consumables.

Translating this to the operation cost of similar plants gives a cost of \$0.25/m^3 of installed capacity per day for a single plant versus \$0.30/m^3 of installed capacity for two plants.

Compliance with the MOECC ECA requires on-going monitoring of flows and water quality collected through instrumentation and automatic sampling devices. All of this work would be doubled for two plants versus one plant. Annual reporting and plant administration would also be doubled for two plants versus one plant.

6.2.3 Plant Maintenance

Although each of the two plants will have a smaller capacity than the larger single plant and therefore smaller pumps, motors and process equipment, the actual number of pieces of equipment will be double in the two plant scenario. Again, while parts for smaller equipment will cost less, it is likely that equipment maintenance costs will still be higher for the two plant alternative.
Modern wastewater treatment plants use advanced automation systems to control many plant functions. The entire automation (SCADA) and instrumentation system would be doubled for two plants versus one plant and maintenance costs associated with instruments, controllers (PLC), computers, and control software will be double with the two plant scenario. Likewise, a great deal of the electrical systems including the motor control centres would be doubled in two plants, versus one plant again leading to increased maintenance. Overall, it is considered that maintenance costs will be 20% more for the two plant scenarios.

Translating this to the operation cost of similar plants gives a cost of $0.10/m^3 of installed capacity per day for a single plant versus $0.12/m^2 for two plants.

6.2.4 Operations Cost Summary

Based on the above analysis, the daily Operations and Maintenance Costs are summarized in the Table 8.

Table 8 – Cost of Operations for Wastewater Treatment

Category	$ / m^3 of Installed Capacity per day Single Plant	Two Plants
Personnel	$ 0.12	$ 0.20
Power / Chemicals / Consumables	$ 0.25	$ 0.30
Maintenance Materials	$ 0.10	$ 0.20
Total	$ 0.47	$ 0.62

It is therefore anticipated that two plants will be some 32% more expensive to operate and maintain as compared to a single plant.

6.3 Net Present Value (NPV) Assessment

Four NPV calculations were completed evaluating the Alternatives discussed in Section 4.0. The scenarios evaluated include:

- A single treatment plant with phased implementation to service the full build-out population
- Separate treatment plants for Erin and Hillsburgh to service the full build-out population
- A single treatment plant to service the existing population
- Separate treatment plants for Erin and Hillsburgh to service the existing population

The net present value calculations assumed a 1% yearly inflation rate and a 4% interest rate. A reduction in the spread between inflation and interest rate will increase the NPV difference. All of the costs presented are calculated to 2016 as the base year. The results of the NPV calculations are summarised in Table 9 and Table 10. The calculation sheets for each scenario are provided in ***Appendix A.***

Table 9 – Full Buildout Servicing, Cost Comparison of Alternatives

Inflation Adjusted Costs	One Plant	Two Plants
Capital Cost	$60,669,310	$98,348,076
Operation and Maintenance Costs	$75,113,136	$100,118,368
Total	$135,782,445	$198,466,444
Present Value Cost	**$70,497,472**	**$104,250,255**

Table 10 – Existing Community Servicing, Cost Comparison of Alternatives

Inflation Adjusted Costs	One Plant	Two Plants
Capital Cost	$ 30,904,188	$42,910,949
Operation and Maintenance Costs	$31,707,382	$41,826,759
Total	$62,611,569	$84,737,708
Present Value Cost	**$36,810,320**	**$50,655,454**

Based on the NPV calculations providing servicing utilising a single plant is a better solution from a capital and operational cost basis. Over the 50-year life calculated the single plant solution is 32% cheaper for the full build-out scenario and 27% cheaper for the existing community scenario.

It should further be noted that whereas the existing residents would pay the full $ 30.9 million for a single plant with no growth, they would be liable to pay approximately one third of the $ 60.7 million cost of the full build out plant to a population of 14,500 or $ 20.2 million, provided an implementation plan can be devised that equally apportions costs. Likewise the operational burden on the existing residents would also be reduced for a full build out population of 14,500.

The calculations for NPV did not take into account the cost of constructing a forcemain between Hillsburgh and Erin or the required oversizing of gravity sewers through Erin to accommodate pumped waste from Hillsburgh. The associated costs for the additional collection system requirements to support the single plant solution have been estimated to be as follows:

- Forcemain/sewer from Hillsburgh to Erin (Elora Cataract Trail – 4.7 km) - $3.75 million
- Increase in trunk sewer diameter through Erin (approx. 1.4 km) – $200,000
- Increased forcemain diameter to plant (approx. 2.25 km) - $250,000
- Increased SPS capacity at 2 sites - $1.00 million

Considering that the additional collection system costs of over $5.0 million to convey wastes to a single treatment plant does not offset the additional capital cost of constructing two plants and considering that the operational costs associated with two treatment plants is higher, the single plant solution remains superior in terms of economic feasibility.

7.0 Conclusions and Recommendations

The approach taken in the SSMP was to evaluate water flows and water quality based on available data and additional water quality data collected for the river from Hillsburgh through to south of Erin in an effort to identify the best possible use of the West Credit River as a discharge for treated effluent. Based on this evaluation a recommended preferred discharge location was identified south of Erin Village for the entire service area.

Additional work within this UCWS EA study has confirmed that the preferred discharge location and effluent limits and flows are capable of supporting full build out of the urban areas and this has been accepted by MOECC and CVC as a valid solution.

Based on this review, it is apparent that there is insufficient water quality data and insufficient river flow data available to support an assimilative capacity study to be able to define effluent limits and obtain MOECC/CVC approval for a discharge of treated effluent within the Hillsburgh area.

No additional water quality or flow data has been collected for the West Credit River through Hillsburgh since completion of the SSMP.

In order to establish whether river water quality could support a treated effluent discharge within Hillsburgh it would require collection of data over several years.

In order to establish a 7Q20 river flow to determine whether the river could accept a discharge from the community, it would take several years of flow measurement to even confirm viability and as much as 10 years to support an approval from MOECC/CVC.

As such, it is not known whether the river can support a discharge from the existing population or even the full build out population for the community. Completing an assimilative capacity study for a surface water discharge in Hillsburgh could cost in excess of $500,000 and could take up to 10 years to complete.

This Technical Memorandum also addresses the economic viability of using a two plant solution versus a one plant solution. Implementation plans were developed for both alternatives and the capital and operating costs were developed for each alternative on the basis of full build out of the communities and for the existing communities alone. The following has been established from this review:

- The industry trend is towards less and larger treatment plants in order to reduce operational and compliance costs

- The Net Present Value of 50 year capital, operation and maintenance costs of the single plant solution is 32% cheaper for the full build-out scenario and 27% cheaper for the existing community scenario.

- The following represents the costs to full build out:

Inflation Adjusted Costs	One Plant	Two Plants
Capital Cost	$60,669,310	$98,348,076
Operation and Maintenance Costs	$75,113,136	$100,118,368
Total	$135,782,445	$198,466,444
Present Value Cost	**$70,497,472**	**$104,250,255**

- The following represents the costs to service just the existing community:

Inflation Adjusted Costs	One Plant	Two Plants
Capital Cost	$ 30,904,188	$42,910,949
Operation and Maintenance Costs	$31,707,382	$41,826,759
Total	$62,611,569	$84,737,708
Present Value Cost	**$36,810,320**	**$50,655,454**

- Even when the cost to convey the wastewater between Hillsburgh and the proposed WWTP site, is taken into account, the capital and operating costs of the two plant solution remains significantly more expensive than the single plant alternative.

- Subject to development of a cost sharing plan with developers, the full build out cost allocation to the existing community could substantially reduce the per capita cost to existing residents.

Based on the results of this review it is recommended that the preferred alternative solution identified in the SSMP with a single treatment plant discharging to the West Credit River south of Erin village, remain the preferred alternative.

Appendix - A

Net Present Value Calculations

Erin Urban Centre Wastewater Servicing Class EA

Single Plant - Full Build Out

Discount Rate: **4%**

Inflation Rate **1%**

Asset Description	Phase 1 - Annual Value in Constant Year 2016 Dollars	Phase 2 - Annual Value in Constant Year 2016 Dollars	NPV Total	2019	2020	2021	2022	2023	2028	2029	2030	2031	2068	2069
1) Capital Cost														
Treatment Process Components				$ 1,000,000	$ 15,000,000	$ 15,000,000	$ 6,600,000		$ 1,000,000	$ 11,000,000	$ 1,000,000			
Operations Building / Site Works					$ 4,500,000									
Land Cost				$ 150,000										
Engineering				$ 30,000	$ 450,000	$ 450,000	$ 198,000		$ 30,000	$ 330,000	$ 30,000			
Current Year Sub-total				$ 1,180,000	$ 19,950,000	$ 15,450,000	$ 6,798,000	$ -	$ 1,030,000	$ 11,330,000	$ 1,030,000	$ -	$ -	$ -
Inflation Adjusted				$ 1,215,755	$ 20,760,050	$ 16,238,105	$ 7,216,214	$ -	$ 1,160,630	$ 12,894,597	$ 1,183,958	$ -	$ -	$ -
NPV			$ 47,028,990	$ 1,080,802	$ 17,745,778	$ 13,346,539	$ 5,703,079	$ -	$ 724,926	$ 7,744,161	$ 683,706	$ -	$ -	$ -
2) O&M Costs														
Personnel	$ 188,340	$ 315,360						$ 188,340	$ 188,340	$ 188,340	$ 315,360	$ 315,360	$ 315,360	$ 315,360
Power/ Chemicals / Consumables	$ 392,375	$ 657,000						$ 392,375	$ 392,375	$ 392,375	$ 657,000	$ 657,000	$ 657,000	$ 657,000
Equipment Maintenance	$ 156,950	$ 262,800						$ 156,950	$ 156,950	$ 156,950	$ 262,800	$ 262,800	$ 262,800	$ 262,800
Current Year Sub-total								$ 737,665	$ 737,665	$ 737,665	$ 1,235,160	$ 1,235,160	$ 1,235,160	$ 1,235,160
Inflation Adjusted								$ 790,877	$ 831,219	$ 839,532	$ 1,419,785	$ 1,433,982	$ 2,072,214	$ 2,092,936
NPV			$ 23,468,482					$ 601,001	$ 519,177	$ 504,201	$ 819,890	$ 796,240	$ 269,588	$ 261,812
Total Costs (Infrastructure and O&M Costs)			$ 105,162,255	$ 1,180,000	$ 19,950,000	$ 15,450,000	$ 6,798,000	$ 737,665	$ 1,767,665	$ 12,067,665	$ 2,265,160	$ 1,235,160	$ 1,235,160	$ 1,235,160
Inflation Adjusted			$ 125,522,943	$ 1,215,755	$ 20,760,050	$ 16,238,105	$ 7,216,214	$ 790,877	$ 1,991,849	$ 13,734,128	$ 2,603,743	$ 1,433,982	$ 2,072,214	$ 2,092,936
PV Costs (Infrastructure and O&M Costs)			**$ 70,497,472**	$ 1,080,802	$ 17,745,778	$ 13,346,539	$ 5,703,079	$ 601,001	$ 1,244,103	$ 8,248,362	$ 1,503,597	$ 796,240	$ 269,588	$ 261,812

Erin Urban Centre Wastewater Servicing Class EA

Single Plant - Existing Community

Discount Rate: 4%

Inflation Rate 1%

Asset Description	**Phase 1 - Annual Value** in Constant Year 2016 Dollars	NPV Total	2019	2020	2021	2022	2023	2024	2025	2048	2049	2066	2067	2068	2069
1) Capital Cost															
Treatment Process Components			$ 1,000,000	$ 15,900,000	$ 10,000,000										
Operations Building / Site Works				$ 1,750,000											
Land Cost			$ 150,000												
Engineering			$ 30,000	$ 477,000	$ 300,000	$ -									
Current Year Sub-total			$ 1,180,000	$ 18,127,000	$ 10,300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Inflation Adjusted			$ 1,215,755	$ 18,863,029	$ 10,825,404	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
NPV		$ 26,102,691	$ 1,080,802	$ 16,124,196	$ 8,897,693	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2) O&M Costs															
Personnel	$ 124,567					$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567
Power/ Chemicals / Consumables	$ 259,515					$ 259,515	$ 259,515	$ 259,515	$ 259,515	$ 259,515	$ 259,515	$ 259,515	$ 259,515	$ 259,515	$ 259,515
Equipment Maintenance	$ 103,806					$ 103,806	$ 103,806	$ 103,806	$ 103,806	$ 103,806	$ 103,806	$ 103,806	$ 103,806	$ 103,806	$ 103,806
Current Year Sub-total						$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888
Inflation Adjusted						$ 517,903	$ 523,082	$ 528,313	$ 533,596	$ 670,817	$ 677,526	$ 802,396	$ 810,420	$ 818,525	$ 826,710
NPV		$ 10,707,629				$ 409,306	$ 397,499	$ 386,033	$ 374,898	$ 191,222	$ 185,706	$ 112,907	$ 109,650	$ 106,487	$ 103,416
Total Costs (Infrastructure and O&M Costs)		$ 50,586,193	$ 1,180,000	$ 18,127,000	$ 10,300,000	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888	$ 487,888
Inflation Adjusted		$ 58,559,066	$ 1,215,755	$ 18,863,029	$ 10,825,404	$ 517,903	$ 523,082	$ 528,313	$ 533,596	$ 670,817	$ 677,526	$ 802,396	$ 810,420	$ 818,525	$ 826,710
PV Costs (Infrastructure and O&M Costs)		**$ 36,810,320**	$ 1,080,802	$ 16,124,196	$ 8,897,693	$ 409,306	$ 397,499	$ 386,033	$ 374,898	$ 191,222	$ 185,706	$ 112,907	$ 109,650	$ 106,487	$ 103,416

Erin Urban Centre Wastewater Servicing Class EA
Two Plants - Full Build Out

Discount Rate: 4%
Inflation Rate 1%

Asset Description	Phase 1 - Annual Value in Constant Year 2016 Dollars	Phase 2 - Annual Value in Constant Year 2016 Dollars	NPV Total	2019	2020	2021	2022	2028	2029	2030	2031	2068	2069
1) Capital Cost													
Treatment Process Components - Erin				$ 1,000,000	$ 20,000,000	$ 8,900,000		$ 1,000,000	$ 16,700,000	$ 1,000,000			
Treatment Process Components - Hillsburgh				$ 1,000,000	$ 13,850,000	$ 1,000,000		$ 1,000,000	$ 17,300,000	$ 1,000,000			
Operations Building / Site Works - Erin					$ 2,600,000								
Operations Building / Site Works - Hillsburgh					$ 1,480,000								
Land Cost - Erin				$ 150,000									
Land Cost - Hillsburgh				$ 150,000									
Engineering				$ 60,000	$ 1,137,900	$ 297,000	$ -	$ 60,000	$ 1,020,000	$ 60,000	$ -	$ -	$ -
Current Year Sub-total				$ 2,360,000	$ 39,067,900	$ 10,197,000	$ -	$ 2,060,000	$ 35,020,000	$ 2,060,000	$ -	$ -	$ -
Inflation Adjusted				$ 2,431,510	$ 40,654,213	$ 10,717,149	$ -	$ 2,321,260	$ 39,856,027	$ 2,367,917	$ -	$ -	$ -
NPV			$ 72,475,473	$ 2,161,604	$ 34,751,392	$ 8,808,716	$ -	$ 1,449,852	$ 23,936,497	$ 1,367,413	$ -	$ -	$ -
2) O&M Costs													
Personnel	$ 313,900	$ 525,600					$ 313,900	$ 313,900	$ 313,900	$ 525,600	$ 525,600	$ 525,600	$ 525,600
Power/ Chemicals / Consumables	$ 470,850	$ 788,400					$ 470,850	$ 470,850	$ 470,850	$ 788,400	$ 788,400	$ 788,400	$ 788,400
Equipment Maintenance	$ 188,340	$ 315,360					$ 188,340	$ 188,340	$ 188,340	$ 315,360	$ 315,360	$ 315,360	$ 315,360
Current Year Sub-total							$ 973,090	$ 973,090	$ 973,090	$ 1,629,360	$ 1,629,360	$ 1,629,360	$ 1,629,360
Inflation Adjusted							$ 1,032,955	$ 1,096,502	$ 1,107,467	$ 1,872,907	$ 1,891,636	$ 2,733,559	$ 2,760,895
NPV			$ 31,774,782				$ 816,359	$ 684,872	$ 665,116	$ 1,081,557	$ 1,050,359	$ 355,627	$ 345,369
Total Costs (Infrastructure and O&M Costs)			$ 155,577,220	$ 2,360,000	$ 39,067,900	$ 10,197,000	$ 973,090	$ 3,033,090	$ 35,993,090	$ 3,689,360	$ 1,629,360	$ 1,629,360	$ 1,629,360
Inflation Adjusted			$ 184,932,633	$ 2,431,510	$ 40,654,213	$ 10,717,149	$ 1,032,955	$ 3,417,762	$ 40,963,494	$ 4,240,824	$ 1,891,636	$ 2,733,559	$ 2,760,895
PV Costs (Infrastructure and O&M Costs)			**$ 104,250,255**	$ 2,161,604	$ 34,751,392	$ 8,808,716	$ 816,359	$ 2,134,724	$ 24,601,613	$ 2,448,970	$ 1,050,359	$ 355,627	$ 345,369

Erin Urban Centre Wastewater Servicing Class EA

Two Plants - Existing Community

Discount Rate: **4%**

Inflation Rate **1%**

Asset Description	**Phase 1 - Annual Value** in Constant Year 2016 Dollars	**Phase 2 - Annual Value** in Constant Year 2016 Dollars	**NPV Total**	**2019**	**2020**	**2021**	**2022**	**2023**	**2026**	**2037**	**2041**	**2042**	**2043**	**2044**	**2068**	**2069**
1) Capital Cost																
Treatment Process Components - Erin				$ 1,000,000	$ 17,000,000	$ 5,500,000										
Treatment Process Components - Hillsburgh				$ 1,000,000	$ 12,100,000	$ 1,000,000										
Operations Building / Site Works - Erin					$ 1,400,000											
Operations Building / Site Works - Hillsburgh					$ 750,000											
Land Cost - Erin				$ 150,000												
Land Cost - Hillsburgh				$ 100,000												
Engineering				$ 60,000	$ 937,500	$ 195,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Current Year Sub-total				$ 2,310,000	$ 32,187,500	$ 6,695,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Inflation Adjusted				$ 2,379,995	$ 33,494,442	$ 7,036,512	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
NPV			$ 36,530,496	$ 2,115,807	$ 28,631,189	$ 5,783,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2) O&M Costs																
Personnel	$ 207,612	$ 525,600					$ 207,612	$ 207,612	$ 207,612	$ 207,612	$ 207,612	$ 207,612	$ 207,612	$ 207,612	$ 207,612	$ 207,612
Power/ Chemicals / Consumables	$ 311,418	$ 788,400					$ 311,418	$ 311,418	$ 311,418	$ 311,418	$ 311,418	$ 311,418	$ 311,418	$ 311,418	$ 311,418	$ 311,418
Equipment Maintenance	$ 124,567	$ 315,360					$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567	$ 124,567
Current Year Sub-total							$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597
Inflation Adjusted							$ 683,191	$ 690,023	$ 710,932	$ 793,164	$ 825,370	$ 833,623	$ 841,960	$ 850,379	$ 1,079,756	$ 1,090,553
NPV			$ 14,124,957				$ 539,936	$ 524,361	$ 480,280	$ 348,067	$ 309,610	$ 300,679	$ 292,006	$ 283,582	$ 140,473	$ 136,421
Total Costs (Infrastructure and O&M Costs)			$ 68,867,180	$ 2,310,000	$ 32,187,500	$ 6,695,000	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597	$ 643,597
Inflation Adjusted			$ 79,391,853	$ 2,379,995	$ 33,494,442	$ 7,036,512	$ 683,191	$ 690,023	$ 710,932	$ 793,164	$ 825,370	$ 833,623	$ 841,960	$ 850,379	$ 1,079,756	$ 1,090,553
PV Costs (Infrastructure and O&M Costs)			**$ 50,655,454**	$ 2,115,807	$ 28,631,189	$ 5,783,500	$ 539,936	$ 524,361	$ 480,280	$ 348,067	$ 309,610	$ 300,679	$ 292,006	$ 283,582	$ 140,473	$ 136,421

Appendix F
Subsurface Disposal Alternative

TOWN OF ERIN

Town of Erin
Urban Centre Wastewater Servicing
Class Environmental Assessment

Technical Memorandum
Subsurface Disposal Alternative
Final

May 2017

Ainley GROUP
CONSULTING ENGINEERS & PLANNERS

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
Subsurface Disposal Alternative

Project No. 115157

Prepared for:
The Town of Erin

Prepared By:

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Executive Summary

This technical memorandum examines subsurface disposal of treated effluent as an alternative to the preferred alternative established in the SSMP involving a surface water discharge to the West Credit River downstream of Erin Village. Whereas the SSMP identified a more detailed process to examine subsurface disposal, as a means to increase the serviced population, it did not consider subsurface disposal as a general alternative solution for the existing communities. This technical memorandum examines the alternative of subsurface disposal as a general alternative solution in order to confirm whether or not it represents a valid alternative for the communities of Erin and Hillsburgh.

Subsurface disposal of treated effluent from the existing and full build out of the communities would require design according to Ministry of Environment and Climate Change (MOECC) requirements for Large Subsurface Sewage Disposal Systems (LSSDS). This technical memorandum provides an overview of the MOECC design requirements for subsurface disposal. Based on these MOECC requirements, extensive field investigations would be required to confirm viability and design parameters. The scope of this technical memorandum is to determine whether there is merit in proceeding with these detailed field investigations.

LSSDS systems are used throughout Ontario and an overview is provided of similar subsurface disposal systems in order to provide a comparative analysis of system requirements. It is noted that most LSSDS systems developed in Ontario are associated with communities or facilities where the developer controls the lands needed for the disposal system.

This technical memorandum provides an overview of the likely effluent standards that a LSSDS would have to meet and also identifies the likely treatment systems that would need to be put in place to meet these standards. 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 limits for nitrates would be anticipated to be no greater than 2.5 mg/L at the property boundary of the disposal field. Due to the volumes of wastewater proposed, it is expected that the dilution volumes would be greatly exceeded by the effluent thereby minimizing the natural attenuation potential. Further, it is expected that the sorption capacity of the tile bed would be expended over time allowing for contaminant breakthrough. As this is the case, it is believed that the plant would require the establishment of a denitrification system.

While LSSDS's are a common effluent management practice throughout rural Ontario, they are typically used for small single developments such as nursing homes, hotels, subdivisions, recreational parks and centres, industrial and commercial parks. Such applications typically have an Average Day Flow (ADF) in the range of 10-80 m^3/d, much less than the ADF anticipated for the communities of Erin or Hillsburgh. These systems are known to be sensitive to plugging from intermittent periods of high flow causing solids to enter the disposal beds resulting in potential effluent breakout at the surface. Design of treatment systems for LSSDS's need to be robust in order to protect against disposal field failure.

Based on a broad generalisation of groundwater quality within the study area, and an understanding of the existing “Reasonable Use” guidelines for effluent criteria, the key effluent quality requirements anticipated are listed in Table ES1:

Table ES1 - Potential Effluent Requirements Subsurface Disposal

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

It is noted that the effluent requirements for surface water discharge are much more stringent for phosphorus concentration and somewhat less stringent for nitrate concentration. In effect, a plant discharging to the surface water will require 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.

Subsequent to the SSMP, this Class EA study (Assimilative Capacity Study) has confirmed that the preferred surface water discharge alternative identified in the SSMP can support full buildout of the existing community Official Plan. This is a significant finding of the study and is still subject to public comment. However, it is reasonable to assume that alternatives to the surface water discharge would also be evaluated on the same basis. For this reason the subsurface disposal approach to effluent management discussed in this Technical Memorandum, for both of the communities of Erin and Hillsburgh considers the full build out flows as noted in Table ES2.

Table ES2 - 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

While overall alternative solutions should address the full build out flows, components of the solution could be based on subsurface disposal. In order to evaluate the range of potential solutions for subsurface disposal, three (3) alternative treatment and disposal strategies were considered:

- Alternative 1: Decentralised treatment and disposal systems servicing sewer decision areas established in the Septic System Survey technical memorandum.
- Alternative 2: 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: Centralised treatment system for either Erin Village or Hillsburgh with a single disposal field suitable for subsurface disposal based on the hydrogeological overview of the study area

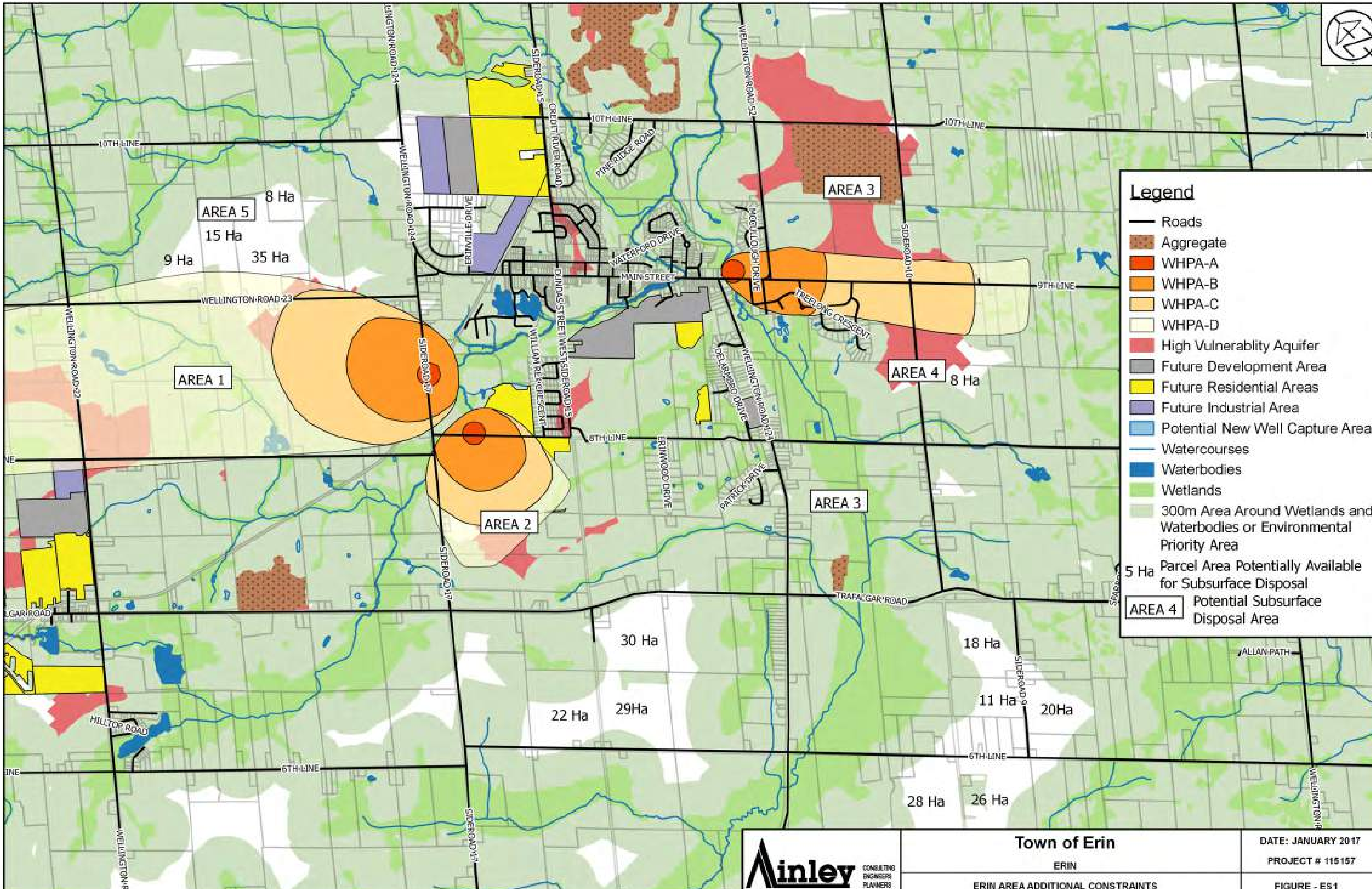
This technical memorandum provides an overview of the existing environmental constraints, within the Erin and Hillsburgh study areas with respect to developing LSSDS's for the communities. Based on these restraints, which require set-backs from existing surface waters and avoidance of sensitive aquifer conditions as well as interference with existing and potential future municipal wells, remaining areas potentially suitable for LSSDS's are identified. These are shown in Figure ES1 and Figure ES2. It is clear from this overview, that potential locations for subsurface disposal within the Erin and Hillsburgh areas is severely limited mostly due to the extensive pattern of surface water drainage and topography but also due to the potential impact on drinking water supplies. Well Head Protection Areas, areas with Highly Vulnerable Aquifers, and the required 300m buffer from surface water features have all been considered in establishing potential areas for subsurface disposal. Potential areas are identified and discussed in the technical memorandum.

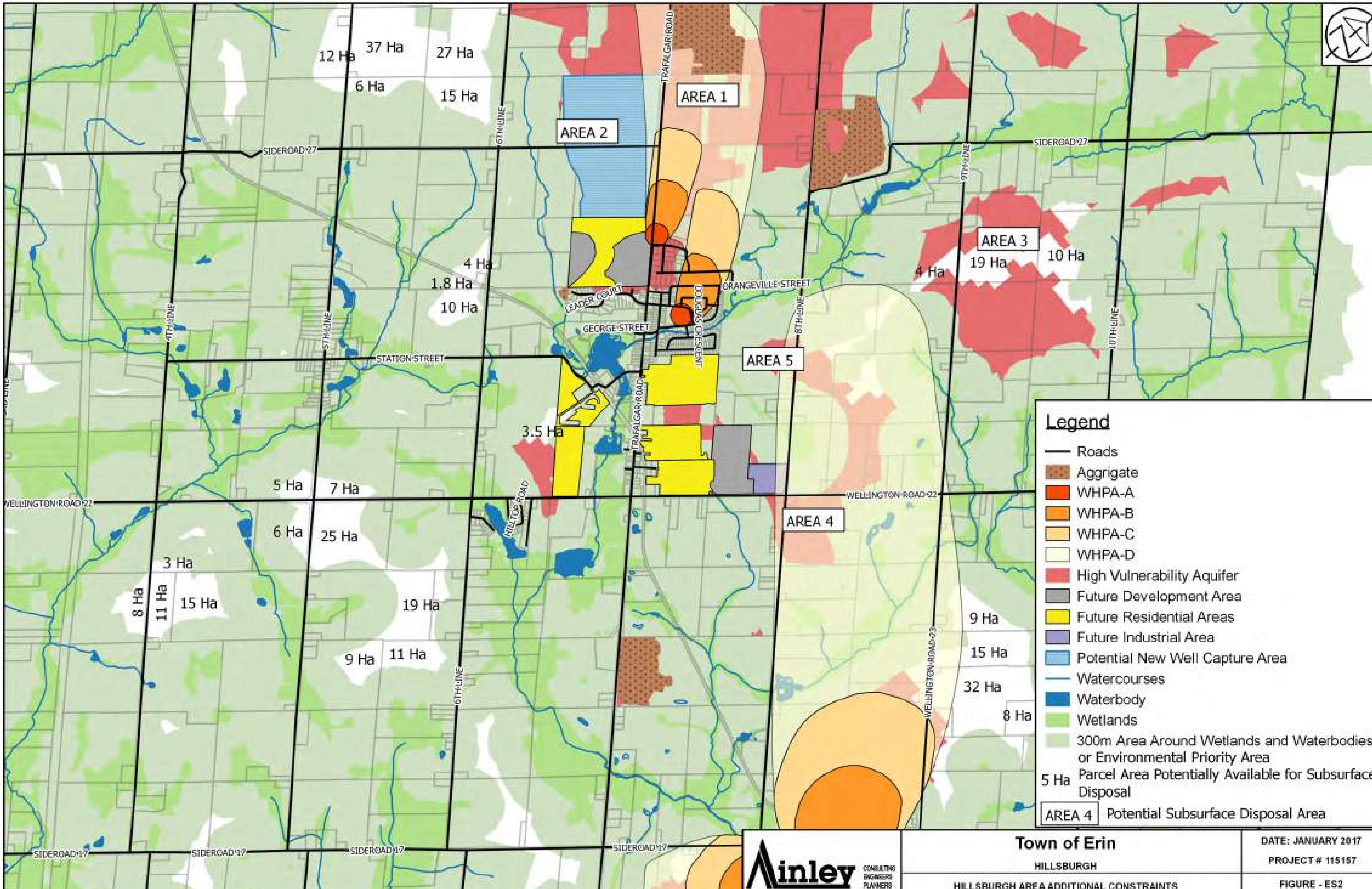
While the exact requirements to obtain an ECA for a treatment system and LSSDS will depend on the local conditions of potential disposal sites, there are a number of requirements which will be imposed regardless of the site selected. The following treatment plant components are anticipated to be required regardless of the location selected for the LSSDS:

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

Based on the potentially available disposal areas and review of alternatives for Erin Village, it is concluded that there is little opportunity around the 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 based on present land use. 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 around Erin 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 alternative to surface water discharge for Erin Village.

Based on the potentially available disposal areas and review of alternatives for the community of Hillsburgh, it is concluded that there may be opportunity around the community to support a subsurface disposal solution. A review of the potential environmental restraints indicates that the required 19.5 Ha may be available to support disposal from either multiple disposal fields or a single disposal field. Based on this, a more detailed assessment was undertaken of the alternatives for Hillsburgh and the potential solutions were costed and compared to the preferred surface water alternative established in the SSMP.


Legend
Roads
Aggregate
WHPA-A
WHPA-B
WHPA-C
WHPA-D
High Vulnerablity Aquifer
Future Development Area
Future Residential Areas
Future Industrial Area
Potential New Well Capture Area
Watercourses
Waterbodies
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
AREA 1
AREA 2
AREA 3
AREA 3
AREA 4
AREA 5
8 Ha
15 Ha
9 Ha
35 Ha
8 Ha
30 Ha
18 Ha
22 Ha
29Ha
11 Ha
20Ha
28 Ha
26 Ha
10TH LINE
9TH LINE
8TH LINE
6TH LINE
WELLINGTON ROAD 23
WELLINGTON ROAD 22
WELLINGTON ROAD 24
WELLINGTON ROAD 52
WELLINGTON ROAD 124
SIDEROAD 15
SIDEROAD 17
SIDEROAD 10
SIDEROAD 9
CREDIT RIVER ROAD
PINE RIDGE ROAD
WATERFORD DRIVE
MAIN STREET
MCCULLOUGH DRIVE
TREELINE CRESCENT
ERINVILLE DRIVE
DUNDAS STREET WEST
WILLIAM REVERE CRESCENT
DELARMBRO DRIVE
ERINWOOD DRIVE
PATRICK DRIVE
TRAFALGAR ROAD
HILLTOP ROAD
ALLAN PATH
Ainley
CONSULTING ENGINEERS PLANNERS
Town of Erin
ERIN
ERIN AREA ADDITIONAL CONSTRAINTS
DATE: JANUARY 2017
PROJECT # 115157
FIGURE - ES1


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
19 Ha
10 Ha
4 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
9 Ha
15 Ha
32 Ha
8 Ha
TRAFALGAR ROAD
SIDEROAD 27
6TH LINE
9TH LINE
ORANGEVILLE STREET
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Future Development Area
Future Residential Areas
Future Industrial Area
Potential New Well Capture Area
Watercourses
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300m Area Around Wetlands and Waterbodies or Environmental Priority Area
5 Ha Parcel Area Potentially Available for Subsurface Disposal
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FIGURE - ES2

Based on the review of the costs to establish an LSSDS for Hillsburgh, it is concluded that it is likely to cost between 10-20% more in capital costs to service both communities to official plan build out based on a subsurface disposal alternative for Hillsburgh and a surface water alternative for Erin. In addition, the operation and maintenance of two treatment plants would add significantly to the lifecycle cost of this alternative.

Based on the findings of this technical memorandum the following is concluded:

1) Treatment and Disposal Regulations

- The requirements for both treatment and disposal for subsurface disposal systems in Ontario will require the Town to meet reasonable use guidelines at the property line and to demonstrate that the treatment process meets all MOECC design guidelines to ensure a robust and reliable system that meets all effluent requirements.
- While treatment processes for subsurface disposal are less stringent than for surface water, the treatment processes for subsurface disposal still require a high level of treatment
- Servicing Hillsburgh using subsurface disposal would represent one of the largest subsurface disposal systems in Ontario and this would require an extensive hydrogeological study to ensure that effluent limits can be maintained at the property limits
- MOECC will likely require the Town to secure sufficient lands for replacement of the disposal beds in event that they fail.
- Environmental approvals will also require an extensive monitoring program to verify ongoing compliance

2) Land Availability

- Available lands without environmental restraints likely do not exist to support a subsurface disposal alternative for Erin Village
- For Hillsburgh, the study has identified availability of lands with potentially no restraints in terms of subsurface disposal, however, confirmation of this is clearly subject to extensive additional study
- LSSDS systems are usually designed within developments wherein the developer/site owner actually owns the lands required for the LSSDS. Purchase of lands specifically for this purpose from a limited number of land owners, may prove to be problematic
- This overview study does not consider existing land use or the willingness of land owners to sell their lands.
- Purchase of necessary lands would be subject to agreement between the owners and the Town
- Developers may not be willing to purchase additional lands for wastewater disposal when a suitable and more cost effective alternative exists

3) Topography around Erin and Hillsburgh

- The extensive pattern of surface water drainage around the existing communities severely limits the availability of lands for subsurface disposal without impact to these surface waters
- The topography around Erin and Hillsburgh limits the availability of lands for subsurface disposal

4) Cost

- Based on the results of this technical memorandum it is unlikely that there is any cost advantage in developing a subsurface alternative for Hillsburgh

Based on this review, it is suggested that subsurface disposal of treated wastewater effluent for Erin Village is not viable. Also based on this review, it is suggested that subsurface disposal of treated wastewater effluent for the community of Hillsburgh offers no advantage over the preferred surface water discharge alternative established during the SSMP.

It is recommended that the results of this technical memorandum be incorporated into the public review process for Phase 2 of the Class EA with the recommendation that the Town moves forward with Phase 3 of the Class EA based on a single treatment plant discharging to the West Credit River downstream of Erin Village.

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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 10^{th} 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. 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.

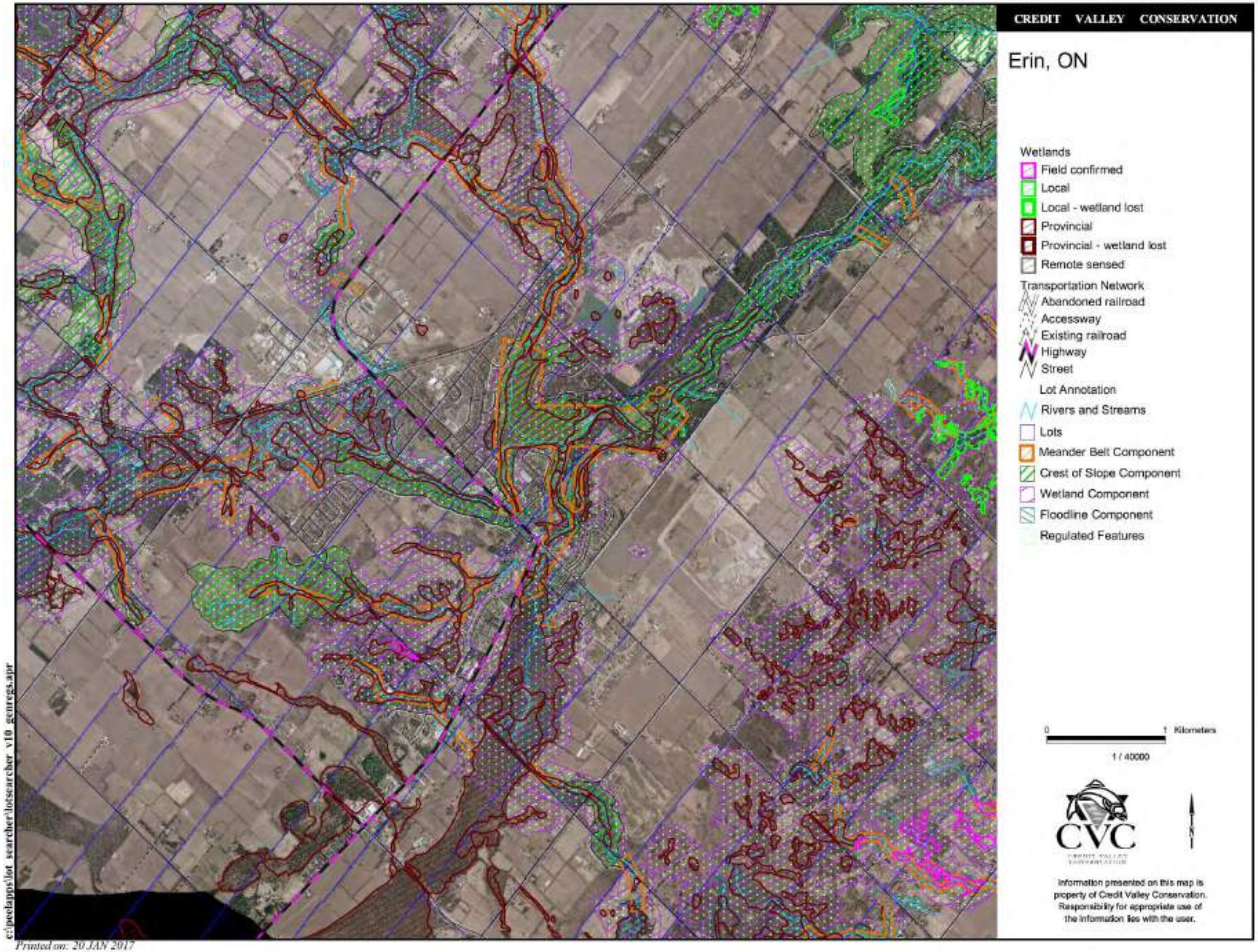
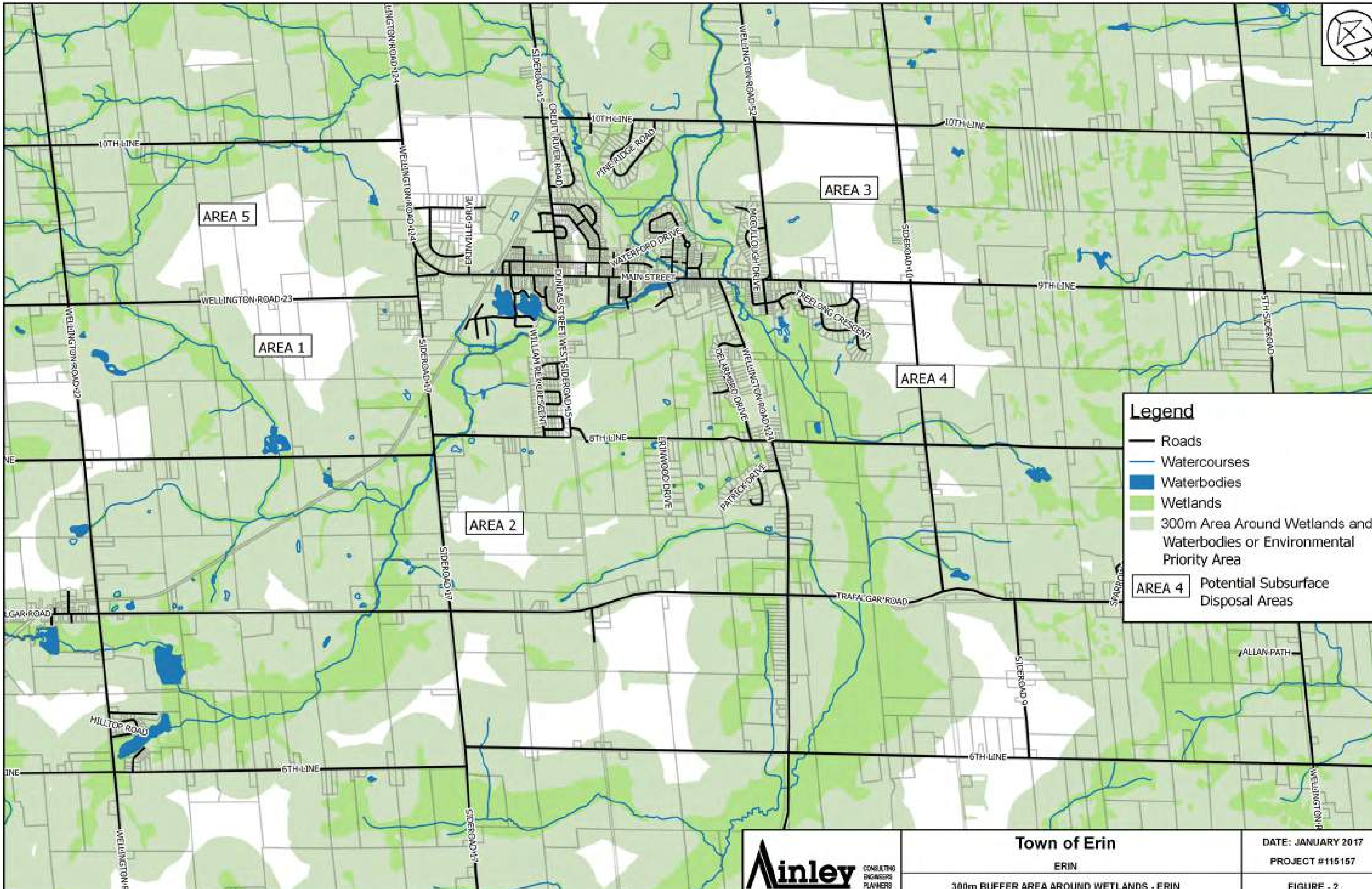


Figure 1 – CVC Wetlands and Watercourses Erin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WELLINGTON ROAD 22
WELLINGTON ROAD 124
WELLINGTON ROAD 52
SIDEROAD 15
SIDEROAD 17
SIDEROAD 10
SIDEROAD 9
5TH SIDEROAD
CREDIT RIVER ROAD
PINE RIDGE ROAD
ERINVILLE DRIVE
WATERFORD DRIVE
MAIN STREET
DUNDAS STREET WEST
WILLIAM REHILL CRESCENT
MCCULLOUGH DRIVE
TREELONG CRESCENT
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ERIN
300m BUFFER AREA AROUND WETLANDS - ERIN
DATE: JANUARY 2017
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FIGURE - 2

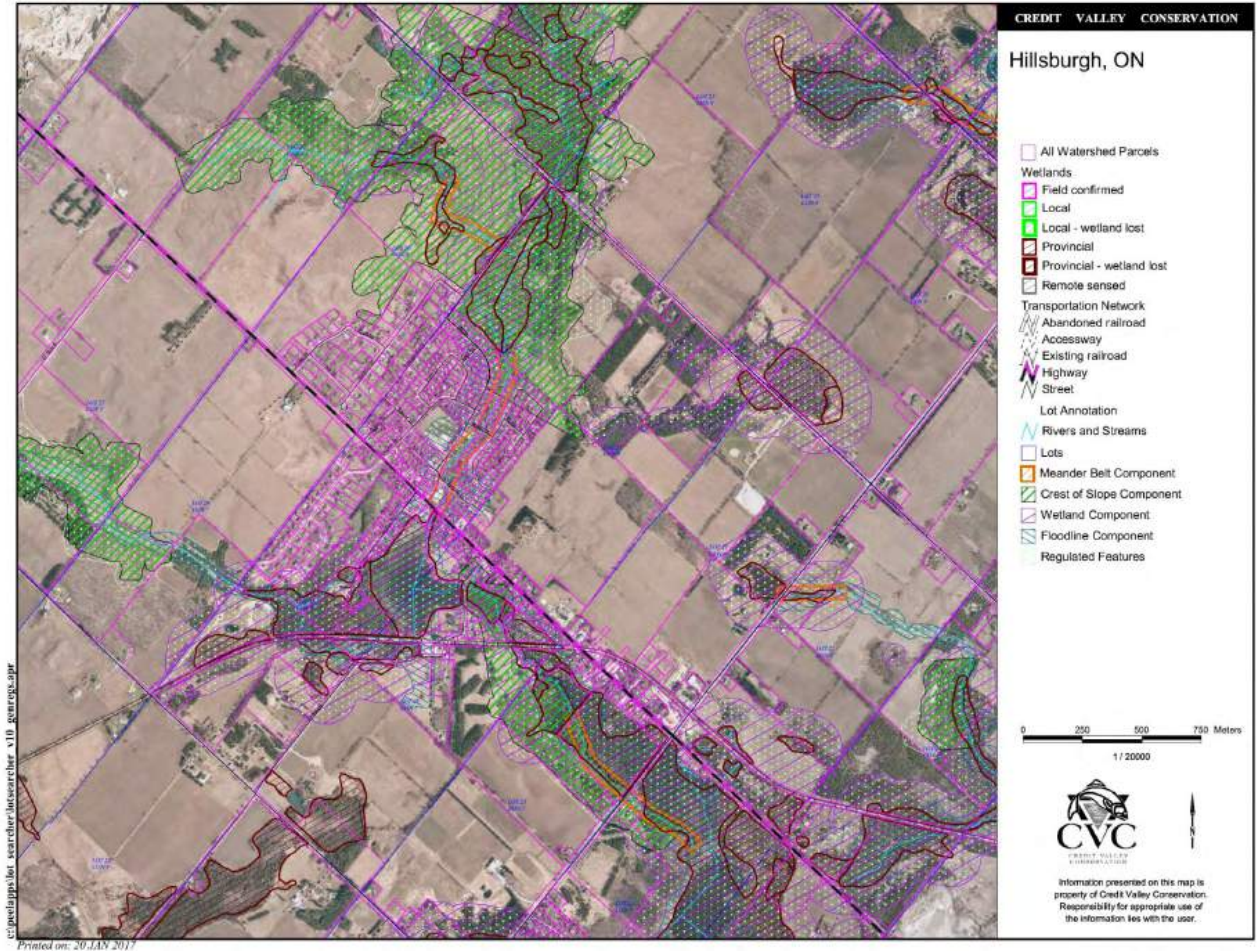
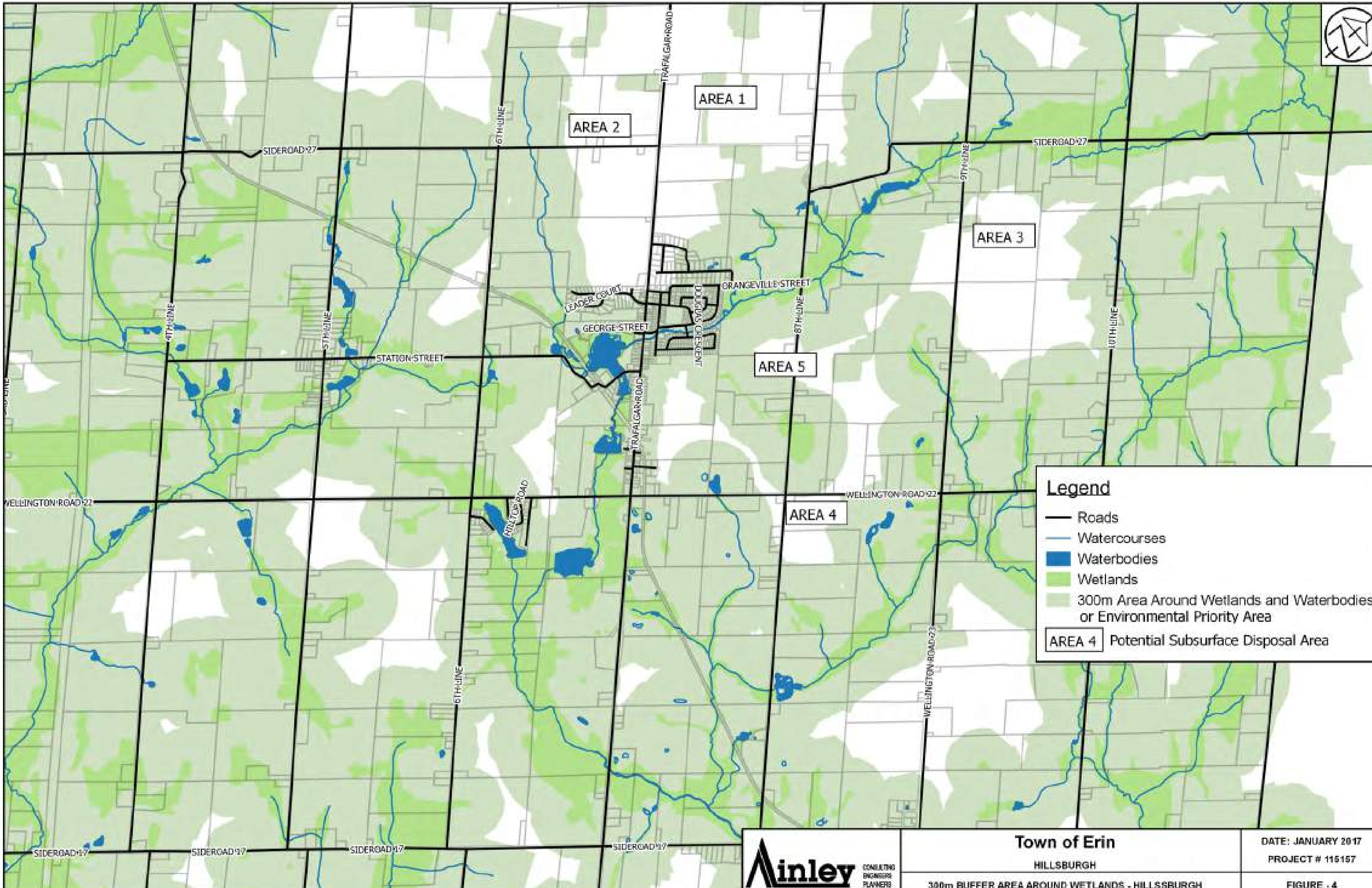


Figure 3 – CVC Wetlands and Watercourses Hillsburgh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300m BUFFER AREA AROUND WETLANDS - HILLSSBURGH
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FIGURE - 4

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.

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

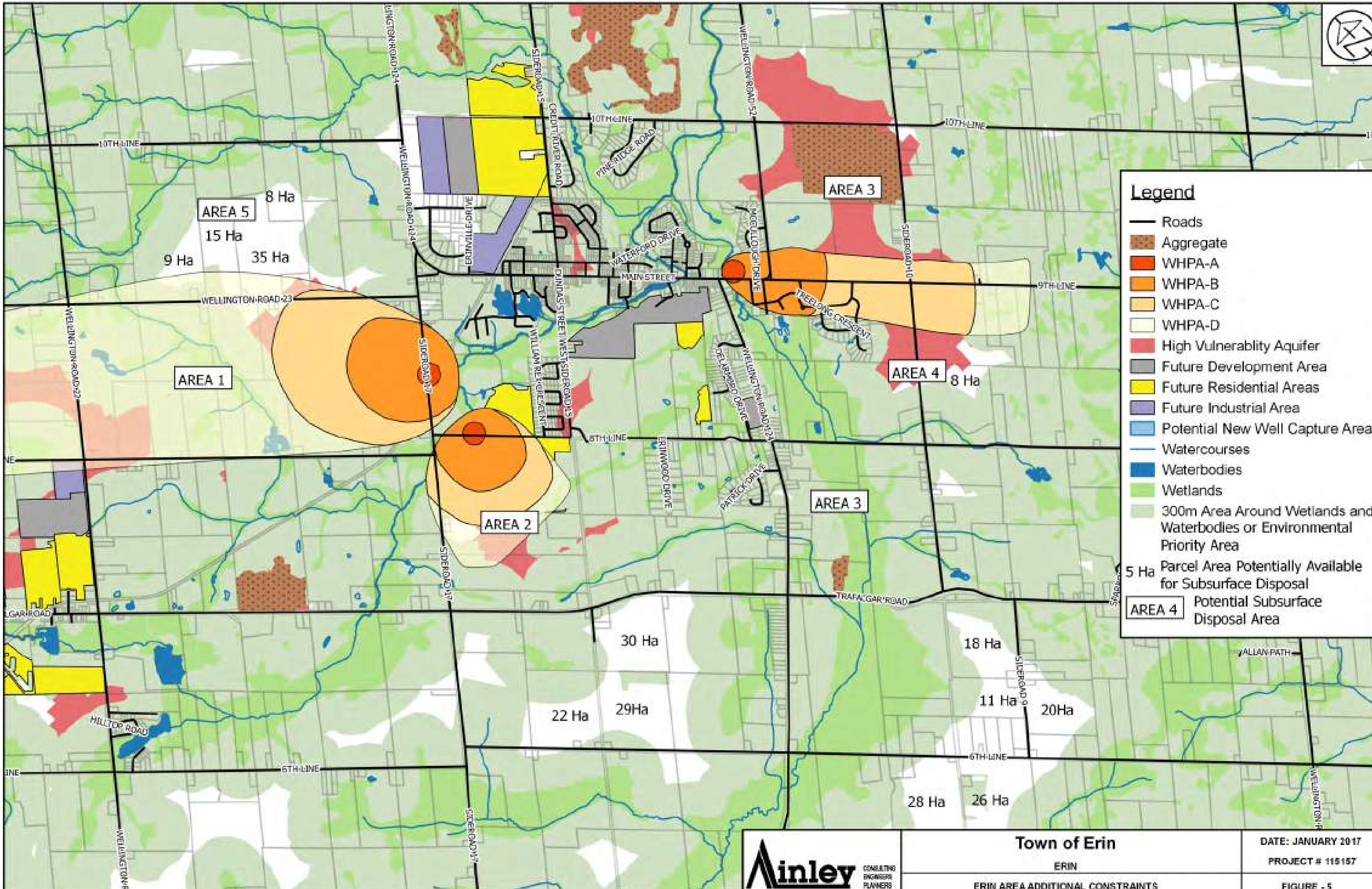
The environmental constraints in the vicinity of the Erin Village Urban Area are shown in Figure 1. Many of the constraint areas are located, as expected, along the West Credit River, primarily west and east of Erin. There are numerous small tributaries and wetlands. When factoring in a 300 m setback 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 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.


Legend
Roads
Aggregate
WHPA-A
WHPA-B
WHPA-C
WHPA-D
High Vulnerablity Aquifer
Future Development Area
Future Residential Areas
Future Industrial Area
Potential New Well Capture Area
Watercourses
Waterbodies
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
AREA 1
AREA 2
AREA 3
AREA 3
AREA 4
AREA 5
8 Ha
15 Ha
9 Ha
35 Ha
8 Ha
30 Ha
18 Ha
22 Ha
29Ha
11 Ha
20Ha
28 Ha
26 Ha
10TH LINE
9TH LINE
8TH LINE
6TH LINE
WELLINGTON ROAD 23
WELLINGTON ROAD 22
WELLINGTON ROAD 124
WELLINGTON ROAD 52
SIDEROAD 17
SIDEROAD 15
SIDEROAD 10
SIDEROAD 9
CREDIT RIVER ROAD
PINE RIDGE ROAD
ERINVILLE DRIVE
WATERFORD DRIVE
MAIN STREET
MCCULLOUGH DRIVE
TREELINE CRESCENT
DUNDAS STREET WEST
WILLIAM REVERE CRESCENT
DELARMBRO DRIVE
ERINWOOD DRIVE
PATRICK DRIVE
TRAFALGAR ROAD
ALLAN PATH
HILLTOP ROAD
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Town of Erin
ERIN
ERIN AREA ADDITIONAL CONSTRAINTS
DATE: JANUARY 2017
PROJECT # 115157
FIGURE - 5

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.

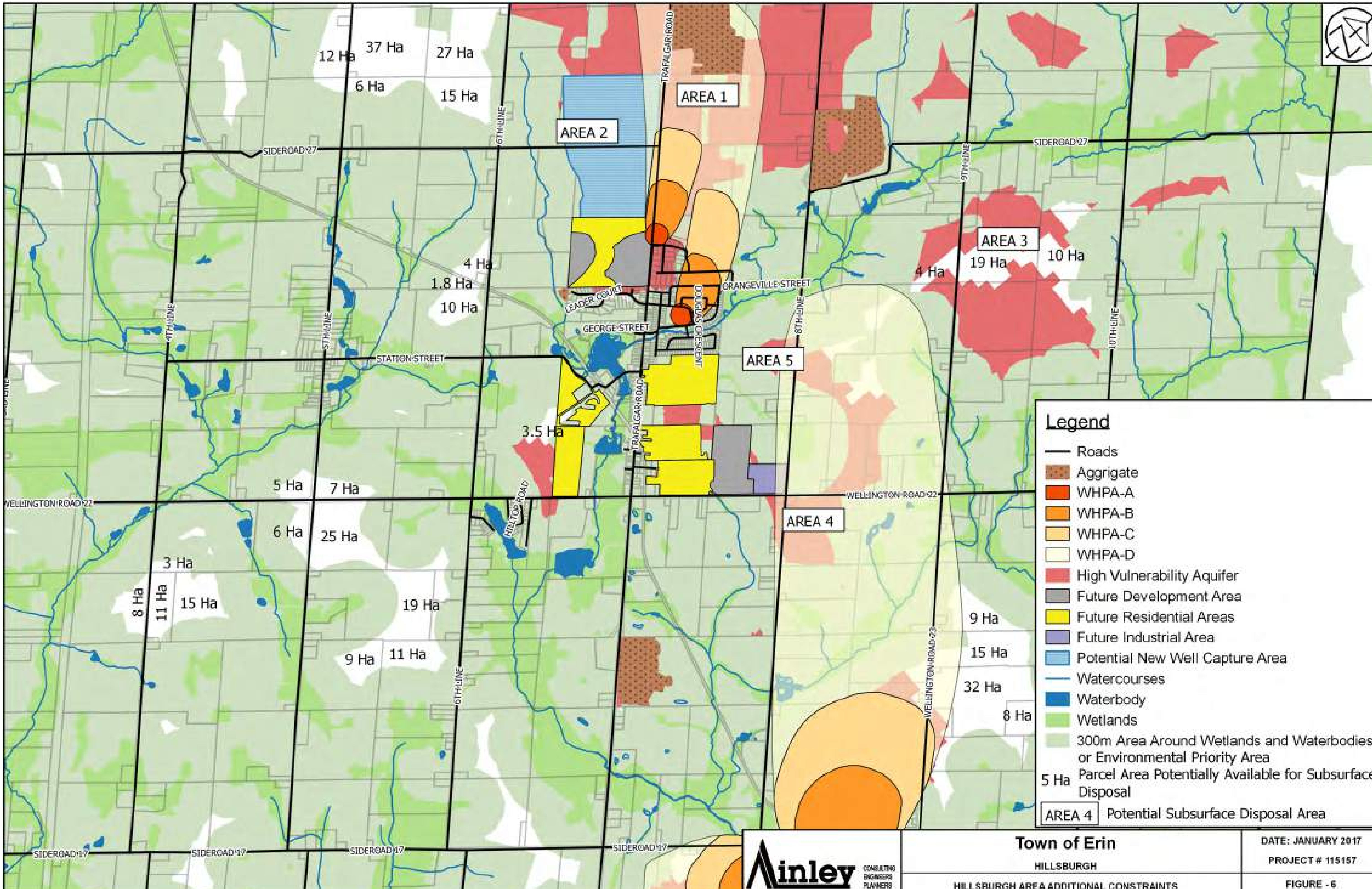
6.6 Hillsburgh

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


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
19 Ha
10 Ha
4 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
9 Ha
15 Ha
32 Ha
8 Ha
SIDEROAD 27
SIDEROAD 17
WELLINGTON ROAD 22
WELLINGTON ROAD 23
TRAFALGAR ROAD
ORANGEVILLE STREET
GEORGE STREET
STATION STREET
LEADER COURT
DOUGLAS CRESCENT
HILLTOP ROAD
4TH LINE
5TH LINE
6TH LINE
8TH LINE
9TH LINE
10TH LINE
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
Ainley CONSULTING ENGINEERS PLANNERS
Town of Erin
HILLSBURGH
HILLSBURGH AREA ADDITIONAL CONSTRAINTS
DATE: JANUARY 2017
PROJECT # 115157
FIGURE - 6

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.

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**

System Capacity (m^3/d)	100	365	600	2,400	4,750
	Subdivision	**Island Lake**	**Existing Hillsburgh**	**Full Hillsburgh**	**Full Erin**
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.

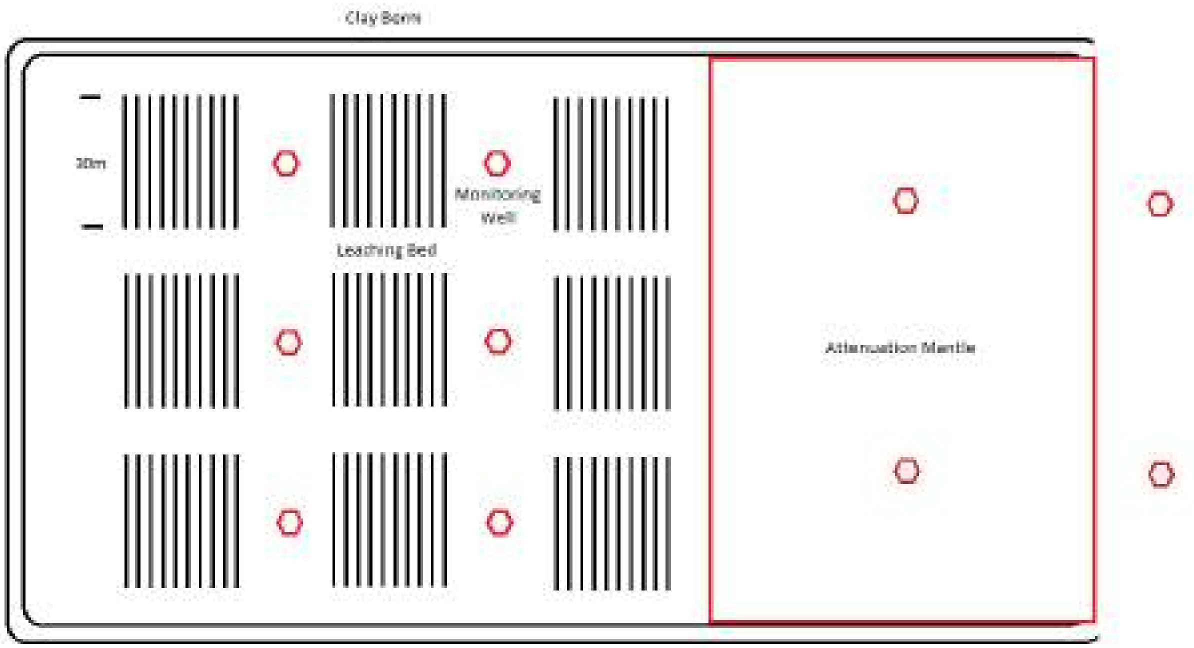


Figure 7 - Example LSSDS Design

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.

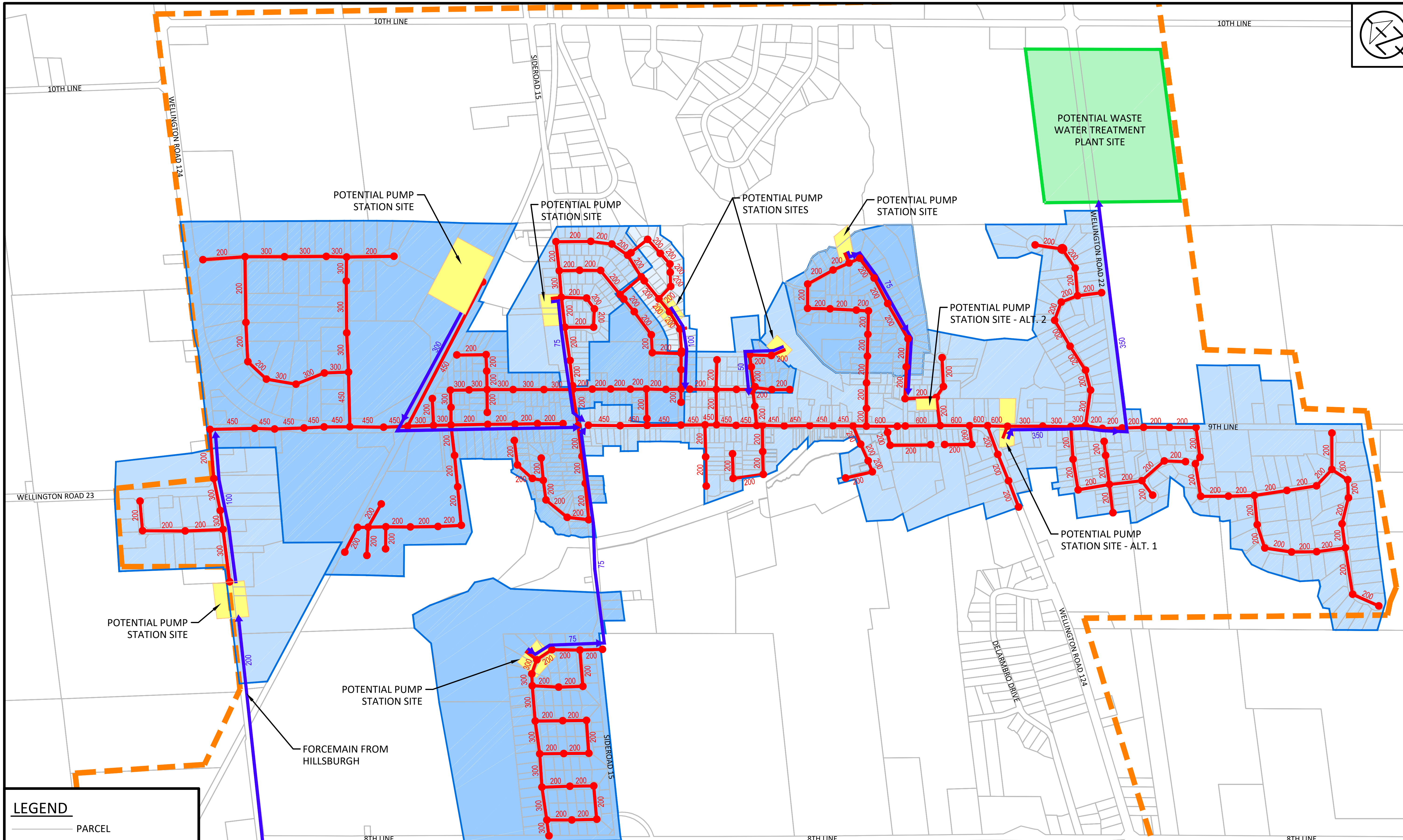
As noted in section 6 above, there is very little land available for subsurface disposal around Erin Village and there is no solution for Erin wherein multiple treatment plants and disposal fields can service each sewer catchment area. Erin Heights subdivision consists of 114 residential lots, which 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.

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.



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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

8.3.3 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

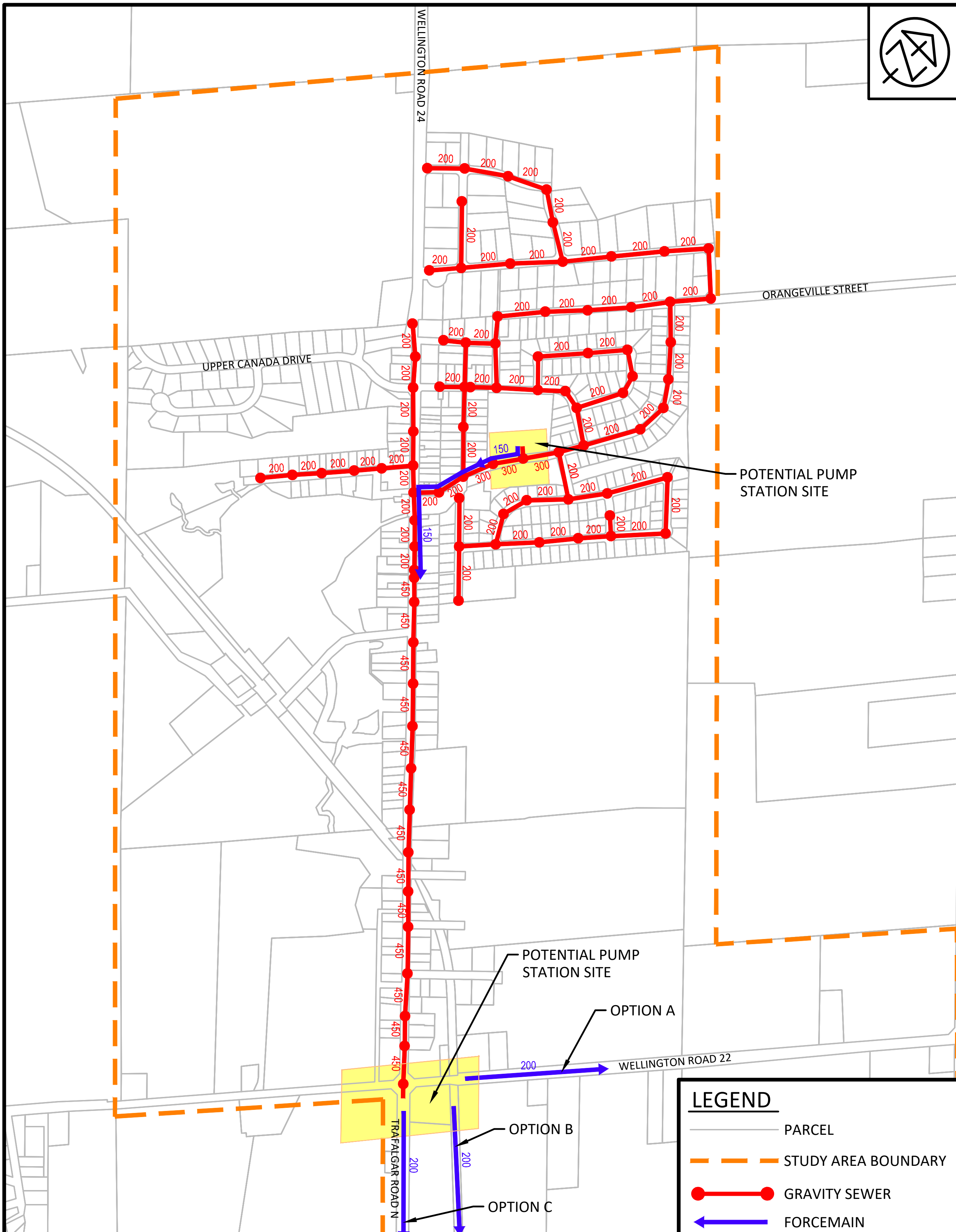
8.4.1 Hillsburgh Alternative 1 - Multiple Plants and Disposal Fields

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



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

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.

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 m³/d)**	**Erin (4,700 m³/d)**	**(7,170 m³/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
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

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

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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.

MOECC's Comments

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.

Conclusions and Recommendations:

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.

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