Town of Halton Hills - Halton Region

Environmental Implementation Report
2nd Submission
Glen Williams Estates
Volume 1 of 3

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1. Introduction

The Subject Lands are located on the west side of Confederation Street, north of Main Street, in the Hamlet of Glen Williams (Town of Halton Hills). The Subject Lands are 18.6 ha and consist of agricultural lands as well as a tributary of the Credit River, its associated valleyland, woodlands and wetlands along the western and southern property limits. The EIR Study Area includes the Subject Lands as well as lands within 120m (see **Figure 1, Appendix B1**). Detailed fieldwork was undertaken within the Subject Lands however, due to ownership issues, the Study Area beyond the Subject Lands relies on air photo interpretation and information that can be gathered from existing data sources, viewing those lands from the property lines and public spaces such as roadways.

An Environmental Implementation Report (EIR) is required for these lands pursuant to Policy H4.3.7 of the Glen Williams Secondary Plan within the Halton Hills Official Plan (HHOP). In addition, given the presence of the Regional Natural Heritage System (RNHS) within the Study Area, Policy 118.3 of the Region of Halton Official Plan (RHOP) requires the preparation of an Environmental Impact Assessment (EIA). In addition to an EIR, a Functional Servicing Study/Report (FSS/FSR) is also required as part of the proposed development application for the Subject Lands. Through the pre-consultation process, a combined EIR/FSS Terms of Reference (ToR) were prepared however, at the request of the Region of Halton, the two reports are being prepared separately but will utilize the approved combined EIR/FSS ToR for guidance. A copy of the approved EIR/FSS ToR, dated September 6, 2019, is included in **Appendix A1**. The term FSS should be considered interchangeable with the term FSR. The ToR incorporates all aspects of an EIA and, as such, the term 'EIR' should be considered to be interchangeable with the term 'EIA' for the purposes of this report. This study has been completed in conformance with the approved ToR and, as such, is consistent with the Region's EIA Guidelines.

The EIR is intended to confirm the extent of the RNHS, with refinements where necessary and justified, as per Policy 116.1 of the RHOP. The EIR will identifies management and implementation measures required to ensure the protection of natural heritage features and functions and hydrological functions resulting in appropriate land use designations and management strategies.

The Study Area is located within Subwatershed 12 of the Credit River Watershed, which is within the jurisdictional area of Credit Valley Conservation (CVC). A tributary of the Credit River flows through the Study Area in a southeasterly direction and coalesces with the main Credit River approximately 400 m downstream, on the east side of Confederation Street, south of Main Street.

The proposed development includes the following:

- creation of 34 residential lots on an internal roadway with access from Confederation Street;
- a stormwater block to convey flows from the internal roadway to a proposed outfall;
- a walkway block to provide pedestrian access from the internal roadway to a trail within the Credit River tributary valley; and,
- natural heritage system block containing the valley, woodland, wetland and associated buffers.

In addition, servicing of the Subject Lands will require the installation of a sanitary sewer southerly along Confederation Street and then easterly under the Credit River to the existing pumping station on the east side of the river.

1.1 Study Team

As noted above, although a combined EIR/FSS ToR was prepared, the two reports have been prepared separately and are presented as Volume 1 (EIR), Volume 2 (FSR) and Volume 3 (Appendices). The EIR/FSR multi-disciplinary team members, and their respective responsibilities, are listed below:

- **Jennifer Lawrence and Associates Inc.** – study management/integration, environmental planning and policy and EIR report coordination
- **Urbantech Consulting (Urbantech)** – water resources engineering, stormwater management, grading, FSR coordination
- **GeoProcess Research Associates (GRA)** – ecology and fluvial geomorphology
- **DS Consultants (DS)** – geology and hydrogeology, stable slope assessment
- **Wellings Planning** – land use planning matters and proposed draft plan
- **Paradigm Transportation Solutions Limited** – transportation impact study
- **Municipal Engineering Solutions (MES)** – water distribution modeling

1.2 Agency Consultation

Two meetings were held with staff from the Town of Halton Hills (Town), Region of Halton (Region) and Credit Valley Conservation (CVC) staff (September 26, 2019 and March 12, 2020). The purpose of the meetings were to discuss fieldwork, stormwater management (including Low Impact Development (LID) measures) and grading. Minutes from these meetings are included in **Appendix A2**. In addition to the meetings, feature stakings took place on-site with CVC and Region staff. Details with respect to these stakings can be found in **Section 3.2**.

2. Approach

2.1 Applicable Legislation and Policies

An assessment of the quality and extent of natural heritage and natural hazard features and functions found within the Study Area was undertaken to comply with the requirements of the following legislation, plans and policies:

- Federal *Fisheries Act*, (2019)
- *Migratory Birds Convention Act* (1994)
- Provincial *Endangered Species Act, 2007* (ESA 2019)
- Greenbelt Plan (2017)
- *Planning Act* and Provincial Policy Statement (PPS; MMAH 2020)
- Region of Halton Official Plan (June 19, 2018 Office Consolidation)
- Town of Halton Hills Official Plan (May 1, 2019 Office Consolidation)
- Credit Valley Conservation (*Conservation Authorities Act* and Ontario Regulation 160/06).

2.1.1 Federal Fisheries Act

The Department of Fisheries and Oceans Canada (DFO) administers the federal *Fisheries Act* which defines fish habitat as "*spawning grounds and other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes*" [subsection (2)1]. The *Fisheries Act* prohibits the death of fish by means other than fishing [subsection 34.4 (1)] and the harmful alteration, disruption or destruction of fish habitat [HADD; subsection 35. (1)]. A HADD is defined as "*any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes*" (DFO 2019a).

Some projects may be eligible for exemption from the DFO review process, as specified under Step 3 of the DFO Fish and Fish Habitat Protection Program review process (DFO 2019b; e.g., clear-span bridges and bridge maintenance projects where DFO mitigation measures are applied, artificial waterbodies with no hydrological connection to occupied fish habitat, and projects that follow the Standards and Codes of Practice defined by DFO). All other projects or activities that have the potential to impact fish or fish habitat should be submitted to DFO through the "Request for Review" process. DFO will review the proposed project to determine whether there is potential to (1) impact an aquatic species at risk, (2) cause the death of fish or (3) result in HADD of fish habitat. The death of fish by means other than fishing or a HADD of fish habitat can be authorized by DFO under paragraphs 34.4(2)(b) or 35(2)(b) of the *Fisheries Act*. Authorizations require the preparation and submission of an application package identifying the impacts on fish and fish habitat as well as the avoidance, mitigation and offsetting measures that will be implemented as well as any monitoring that is proposed.

2.1.2 Migratory Birds Convention Act (1994)

This federal legislation protects the nests and offspring of listed migratory bird species from killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or

disturbing of nests. In its application, it requires best management practices to detect and avoid disturbance to active nests during development activities.

2.1.3 Provincial Endangered Species Act (2019)

The provincial *Endangered Species Act* (ESA) was developed to:

- Identify species at risk, based upon best available science;
- Protect species at risk and their habitats and to promote the recovery of species at risk; and
- Promote stewardship activities that would support those protection and recovery efforts.

The ESA protects all threatened, endangered and extirpated species itemized on the Species at Risk in Ontario (SARO) list. These species are legally protected from harm or harassment and their associated habitats are legally protected from damage or destruction, as defined under the ESA.

2.1.4 Greenbelt Plan (2017)

The Greenbelt Plan (2017) for Ontario's Greater Golden Horseshoe area, established under Section 3 of the *Greenbelt Act*, took effect on December 16, 2004, and was amended effective July 1, 2017. The Greenbelt Plan builds on the ecological protections provided by the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan to provide an umbrella plan that provides permanent protection to both the agricultural land base and the ecological features and functions within the plan areas.

The boundary of the Greenbelt Plan Area is prescribed by Ontario Regulation 59/05 and detailed maps that illustrate the applicable land use designations based on a grid breakdown are available on-line. As shown in **Figure 1, Appendix B1**, the lands to the north of the Subject Lands are identified as Natural Heritage System (NHS) within the Protected Countryside of the Greenbelt Plan.

The Subject Lands are not within the Greenbelt Plan Area however, the valley associated with the Credit River, that flows through the Subject Lands, is identified as an Urban River Valley on Schedule 1 within the Greenbelt Plan. As per Section 2.5 of the Greenbelt Plan, lands within the Urban River Valley designation are subject to the policies of Section 6 and the Protected Countryside policies do not apply except as set out in that section.

Section 6 (Urban River Valley Policies) are as follows:

6.1 Description

The Urban River Valley designation as shown on Schedule 1 applies to lands within the main corridors of river valleys connecting the rest of the Greenbelt to the Great Lakes and inland lakes. The lands in this designation comprise river valleys and associated lands and are generally characterized by being:

- *Lands containing natural and hydrologic features, including coastal wetlands; and/or*
- *Lands designated in official plans for uses such as parks, open space, recreation, conservation and environmental protection.*

6.2 Policies

For lands falling within the Urban River Valley, the following policies shall apply:

1. *Only publicly owned lands are subject to the policies of the Urban River Valley designation. Any privately owned lands within the boundary of the Urban River Valley area are not subject to the policies of this designation. For the purposes of this section, publicly owned lands means lands in the ownership of the Province, a municipality or a local board, including a conservation authority.*

Based on the above, since the lands shown as Urban River Valley are not currently in public ownership, the Urban River Valley policies do not apply. If, through the development approval process, the river valley is transferred into public ownership, the Urban River Valley policies would apply from that point forward.

Section 3.2.6 of the Plan further notes that these external connections (urban river valleys) are not regulated within the boundary of the Greenbelt Plan but outlines the following policies for these areas:

3.2.6.1 To support the connections between the Greenbelt's Natural System and the local, regional and broader scale natural heritage systems of southern Ontario, such as the Lake Ontario shoreline, including its remaining coastal wetlands, the Great Lakes Coast, Lake Simcoe, the Kawartha Highlands, the Carolinian Zone and the Algonquin to Adirondack Corridor, the federal government, municipalities, conservation authorities, other agencies and stakeholders should:

- *a) Consider how activities and land use change both within and abutting the Greenbelt relate to the areas of external connections and Urban River Valley areas identified in this Plan;*
- *b) Promote and undertake appropriate planning and design to ensure that external connections and Urban River Valley areas are maintained and/or enhanced; and*
- *c) Undertake watershed planning, which integrates supporting ecological systems with those systems contained in this Plan.*

3.2.6.2 The river valleys that run through existing or approved urban areas and connect the Greenbelt to inland lakes and the Great Lakes, including areas designated as Urban River Valley, are a key component of the long-term health of the Natural System. In recognition of the function of the urban river valleys, municipalities and conservation authorities should:

- *a) Continue with stewardship, remediation and appropriate park and trail initiatives which maintain and, to the extent possible, enhance the ecological features and functions found within these valley systems;*
- *b) In consideration land conversions or redevelopments in or abutting an urban river valley, strive for planning approaches that:*
  - *i. Establish or increase the extent or width of vegetation protection zones in natural self-sustaining vegetation, especially in the most ecologically sensitive areas (i.e., near the stream and below the stable top of bank);*
  - *ii. Increase or improve fish habitat in streams and in the adjacent riparian lands;*

iii. Include landscaping and habitat restoration that increase the ability of native plants and animals to use valley systems as both wildlife habitat and movement corridors; and

iv. Seek to avoid or, if avoidance is not possible, minimize and mitigate adverse impacts associated with the quality and quantity of urban runoff into the valley systems; and,

c) Integrate watershed planning and management approaches for lands both within and beyond the Greenbelt, taking into consideration the goals and objectives of protecting, improving and restoring the Great Lakes.

As noted above, a portion of the lands north of the Subject Lands are within the Natural Heritage System of the Greenbelt Plan (the farm residence and associated farm buildings are within the Greenbelt Plan Protected Countryside but outside of the NHS limits). Some grading on the lands to the north is proposed in order to assist with minimizing the use of retaining walls on the Subject Lands. Section 3.2.2 provides the Natural Heritage System policies that are applicable as part of a *Planning Act* application. Those policies are included below for completeness however, it is anticipated that the grading, if agreed to be the landowner to the north, would take place through a site alteration permit rather than as part of the draft plan process. As a result, a detailed analysis of the Greenbelt Plan policies has not been included as impacts will be addressed as required through the site alteration process:

3.2.2 For lands within the Natural Heritage System of the Protected Countryside, the following policies shall apply:

1. *The full range of existing and new agricultural, agriculture-related and on-farm diversified uses and normal farm practices are permitted subject to the policies of Section 3.2.2.2.*
3. *New development or site alteration in the Natural Heritage System (as permitted by the policies of this Plan) shall demonstrate that:*
    a. *There will be no negative impacts on key natural heritage features or key hydrologic features or their functions;*
    b. *Connectivity along the system and between key natural heritage features and key hydrologic features located within 240 metres of each other will be maintained or, where possible, enhanced for the movement of native plants and animals across the landscape;*
    c. *The removal of other natural features not identified as key natural heritage features and key hydrologic features should be avoided. Such features should be incorporated into the planning and design of the proposed use wherever possible;*
    d. *Except for uses described in and governed by the policies of sections 4.1.2 and 4.3.2,*
        i. *The disturbed area, including any buildings or structures, of the total developable area will not exceed 25% (40% for golf courses); and*
        ii. *The impervious surface of the total developable area will not exceed 10%; and,*
    e. *At least 30% of the total developable area will remain or be returned to natural self-sustaining vegetation, recognizing that section 4.3.2 establishes specific standards for the uses described there.*

2.1.5 Planning Act and Provincial Policy Statement (PPS 2020)

The Provincial Policy Statement (PPS) is created under the authority of the *Planning Act* and provides direction on matters of provincial interest related to land use planning and development and "…supports a comprehensive, integrated and long-term approach to planning…". The PPS is to be read in its entirety and land use planners and decision-makers need to consider all relevant policies and how they work together when reviewing development applications.

The fieldwork component of the EIR was designed to addresses those policies that are specific to Natural Heritage (PPS Section 2.1), Water (PPS Section 2.2) and Natural Hazards (PPS Section 3.1) and as required through the approved EIR ToR (**Appendix A1**).

2.1.5.1 Natural Heritage

Eight types of significant natural heritage features are defined in the PPS, as follows:

- Significant wetlands
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat;
- Fish habitat;
- Habitat of endangered and threatened species; and
- Significant areas of natural and scientific interest (ANSIs).

Development and site alteration shall not be permitted in significant wetlands, or in significant coastal wetlands. Development and site alteration shall not be permitted in: significant woodlands, significant valleylands, significant wildlife habitat or significant ANSIs, unless it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Development and site alteration shall not be permitted in the habitat of endangered and threatened species or in fish habitat, except in accordance with provincial and federal requirements.

Development and site alteration may be permitted on lands adjacent to the above features provided it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

The EIR ToR were developed to enable the Study Team to identify the presence of significant natural heritage features and functions within the Study Area in order to identify: (1) those areas where development is prohibited by PPS policy; (2) those areas where development may be permitted by PPS policy subject to demonstration of no negative impact; and (3) those areas that are not constrained by natural heritage features and functions. This includes detailed fieldwork to identify vegetation communities, specific wildlife surveys, a site walk with CVC to delineate the extent of wetlands and physical top of bank and a site walk with the Region of Halton to delineate the extent of woodland dripline.

2.1.5.2 Water

In terms of the PPS Water policies, Section 2.2.1 requires that planning authorities shall protect, improve or restore the quality and quantity of water by:

a) using the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;
b) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;
c) evaluating and preparing for the impacts of a changing climate to water resource systems at the watershed level;
d) identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed;
e) maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas;
f) implementing necessary restrictions on development and site alteration to:
    1. Protect all municipal drinking water supplies and designated vulnerable areas; and,
    2. Protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions;
g) planning for efficient and sustainable use of water resources, through practices of water conservation and sustaining water quality;
h) ensuring consideration of environmental lake capacity, where applicable; and,
i) ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

Section 2.2.2 further requires that development and site alteration be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored. Section 2.2.2 notes that mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features, and their hydrologic functions.

The Study Area was established in consultation with the review agencies and, where appropriate, will consider subwatershed recommendations, made by previous studies, in order to address subsection (a) above. The entire Study Area is within CVC's watershed and, as a result, there are no cross-jurisdictional or cross-watershed impacts as per subsection (b). The EIR ToR were developed to identify the water resource systems within the Study Area in order to address subsections (c) through (g) and (i). Subsection (h) is not applicable.

The EIR ToR were developed to enable the Study Team to identify the features and functions as listed in Section 2.1.1 of the PPS in order to identify those areas where restrictions on development and site alteration are necessary in order to protect, improve or restore the water resource system. This includes ground and surface water monitoring.

2.1.5.3 Natural Hazards

Section 3.1.1 of the PPS directs development to areas outside of hazardous lands adjacent to the shoreline of the Great Lakes – St. Lawrence River System (flooding, erosion and dynamic beach hazards), hazardous lands adjacent to river, steam and small inland lake systems (flooding and/or erosion hazards) and hazardous sites. Section 3.1.2 further prohibits development and site alteration within:

a) *the dynamic beach hazard;*
b) *defined portions of the flooding hazard along connecting channels (the St. Marys, St. Clair, Detroit, Niagara and St. Lawrence Rivers);*
c) *areas that would be rendered inaccessible to people and vehicles during times of flooding hazards, erosion hazards and/or dynamic beach hazards, unless it has been demonstrated that the site has safe access appropriate for the nature of the development and the natural hazard; and*
d) *a floodway regardless of whether the area of inundation contains high points of land not subject to flooding.*

The Study Area is not adjacent to a lake or connecting channels and, as such, subsections (a) and (b) of Section 3.1.2 are not applicable. Subsections (c) and (d) are addressed in the EIR ToR through the provision of delineating the stable top of bank through a geotechnical study. This will allow the Study Team to define the natural hazard limits within the Study Area. Given the depth of the valley feature, it is not anticipated that the Regional Storm flood plain will represent the greatest hazard. Through the review of the EIR/FSS ToR, CVC staff advised that, as it relates to an hydraulic assessment for the floodplain associated with the tributary, a full hydraulic assessment will not be required. Once a plan is prepared, outlining the limits of development, CVC staff will review the information and, if there are any concerns with the flood plain not being contained within the limit of the other features and/or limit of development, a scoped assessment to confirm that the flood plain is contained within these features will be requested.

Section 3.1.3 notes that planning authorities shall prepare for the impacts of a changing climate that may increase the risk associated with natural hazards. The EIR will consider the use of stormwater management, buffers and restoration plans to assist in addressing climate change implications.

2.1.6 Region of Halton Official Plan

The Region of Halton Official Plan (RHOP) is consistent with the PPS policies related to natural heritage, natural hazards and water. The RHOP has identified RNHS consisting of Key Features, linkages, enhancement areas and buffers. Policies 115.2 through 115.4 outline those features and functions that are included in the RNHS as follows:

115.2 The Regional Natural Heritage System consists of:
1. *areas so designated on Map 1,*
2. *the shoreline along Lake Ontario and Burlington Bay, and*
3. *significant habitats of endangered species and threatened species not included in the designation on Map 1.*

115.3 The Regional Natural Heritage System is a systems approach to protecting and enhancing natural features and functions and is scientifically structured on the basis of the following components:

1. *Key Features, which include:*
   a) *significant habitat of endangered and threatened species,*
   b) *significant wetlands,*
   c) *significant coastal wetlands,*
   d) *significant woodlands,*
   e) *significant valleylands,*
   f) *significant wildlife habitat,*
   g) *significant areas of natural and scientific interest,*
   h) *fish habitat,*

Key Features that have been identified are shown on Map 1G.

2. *enhancements to the Key Features including Centres for Biodiversity,*
3. *linkages,*
4. *buffers,*
5. *watercourses that are within a Conservation Authority Regulation Limit or that provide a linkage to a wetland or a significant woodland, and*
6. *wetlands other than those considered significant under Section 115.3(1)b).*

115.4 Included within the Regional Natural Heritage System are:

1. *Escarpment Natural Area and Escarpment Protection Area as identified in the Niagara Escarpment Plan, and*
2. *Regulated Flood Plains as determined, mapped and refined from time to time by the appropriate Conservation Authority.*
3. *Parts of the Agricultural System, being those areas of the Regional Natural Heritage System outside the Key Features or where the only Key Feature is a significant earth science area of natural and scientific interest, where agricultural operations are promoted and supported as compatible and complementary uses in the protection of the Regional Natural Heritage System in accordance with policies of the Agricultural System.*

The EIR ToR have been developed to enable the Study Team to identify the features and functions listed in RHOP Policies 115.2 through 115.4.

RHOP Policy 116.1 permits refinements to the RNHS as follows:

116.1 The boundaries of the Regional Natural Heritage System may be refined, with additions, deletions and/or boundary adjustments, through:

a) *a Sub-watershed Study accepted by the Region and undertaken in the context of an Area-Specific Plan;*
b) *an individual Environmental Impact Assessment accepted by the Region, as required by this Plan; or*
c) *similar studies based on terms of reference accepted by the Region.*

> *Once approved through an approval process under the Planning Act, these refinements are in effect on the date of such approval. The Region will maintain mapping showing such refinements and incorporate them as part of the Region's statutory review of its Official Plan.*

The information gathered through the EIR will be used to refine the RNHS, as appropriate, based on the conclusions of the study.

2.1.7 Town of Halton Hills Official Plan and Glen Williams Secondary Plan

The Subject Lands are within the Hamlet of Glen Williams and are designated as Hamlet Residential, Greenlands and Hamlet Buffer on Schedule H4-1 of the Halton Hill's Official Plan (HHOP). Schedule H4-1 also shows a Potential Trail and On-Road Linkage through the Subject Lands and a portion of the Regional Storm flood plain in the southeast quadrant of the Subject Lands. Schedule H4-2 further refines the Greenlands designation such that the Subject Lands also includes Core and Supportive Greenlands. Schedule H4-2 identifies that the northeast quadrant of the Subject Lands is an area of Potentially Higher Recharge. An EIR is required for these lands pursuant to Policy H4.3.7 of the Glen Williams Secondary Plan within the HHOP.

The Hamlet Residential policies permit single detached residential uses (Section H4.5.2). Section H.4.5.3 (Land Use Policies) outlines that development within this designation shall be serviced with piped Regional water and wastewater services and, that prior to draft plan approval, the following studies are required: Transportation Study, Design Study, Functional Servicing Plan and Environmental Implementation Report.

Section H4.9.1 (Greenlands - Purpose) establishes the following purposes of the Greenlands designation:

a) *To identify lands which are flood susceptible for the protection of life and property;*
b) *To protect the diversity of fauna and flora, ecosystems, plant communities and significant landforms of Halton Hills;*
c) *To maintain the water quality and natural flow regulation of rivers, streams ad wetlands within the rural areas of Halton Hills;*
d) *To provide opportunities, where appropriate, for passive outdoor recreational activities;*
e) *To contribute to a continuous natural open space system, to provide a visual buffer or separation of communities and to provide continuous corridors between ecosystems;*
f) *To protect significant scenic and heritage resources; and,*
g) *To maintain or enhance fish and wildlife habitats.*

Greenlands, as shown on Schedule H4-1, are further sub-divided into Core Greenlands and Supportive Greenlands. Both designations exist on the Subject Lands and are described below.

As outlined in Section H4.9.2, Core Greenlands contain the most important natural features and areas that perform the most critical ecological functions, as described in the Scoped Subwatershed Plan for Glen Williams. No new development is permitted within the Core Greenlands designation, with the exception of those uses specified in subsection H4.9.2.2. Section H4.9.2.1 outlines the following criteria for designation:

a) *Areas within the Regulatory Flood Plain, as determined and mapped by CVC, and refined from time to time, as shown on Schedule H4-1 of this Plan;*
b) *Areas of fish habitat;*
c) *Woodlands within or contiguous to the main valley system of the Credit River; and,*
d) *Riparian corridors linked to watercourses with fish habitat.*

Section H4.9.2.5 provides the development evaluation criteria by which the Town, in consultation with the Region and CVC will assess any proposed development, within or adjacent to a Core Greenlands designation. This includes the submission of: (1) engineering studies that address the existing environmental and/or physical hazards on the site, impact of such hazards, impact of the proposed works on the Greenlands designation (particularly natural quality and quantity of ground and surface water functions and resources) and techniques and management practices to mitigate the identified impacts; (2) an Environmental Impact Study that provides an inventory and analysis of all natural features and functions on the site and the identification of the exact boundary of the Greenlands designation and other natural areas; (3) a detailed site plan, landscaping and grading plans that demonstrate how ecological, valleyland and erosional systems and processes will be maintained including tree compensation plans and how disruption to existing landforms and landscape features will be minimized. This EIR, in combination with the FSR, is intended to address the requirements of Section H4.9.2.5.

Section H4.9.3 indicates that the Supportive Greenlands designation contains functions and linkages that support the ecological function of the features in the Core Greenlands designation and that these areas would benefit from rehabilitation and restoration efforts to enhance their ecological value. Any proposal for development within the Supportive Greenlands designation must be accompanied by an EIR that can demonstrate the ecological function of the area can be maintained, and environmental impacts can be appropriately mitigated. The criteria for designation as Supportive Greenlands are outlined in Section H4.9.3.1 as areas that have natural heritage features and ecological functions but may not have specific provincial policy to regulate development. This includes features such as woodlots, unevaluated wetlands, steep slopes and minor tributaries of the Credit River.

Section H4.9.3.2 notes that, in general, the land use policies that apply to the Core Greenlands designation also apply to the Supportive Greenlands designation however, development may be permitted in the Supportive Greenlands areas where an EIR is completed that illustrates how the environmental function of this area can be protected and improved through actions such as stream rehabilitation efforts, reforestation and vegetative planting programs. This EIR is intended to address the requirements outlined in Sections H4.9.3.2.

Section H4.9.4 identifies Greenlands Setbacks as follows:

- Lot line setback of 5m from the stable top of bank unless a subwatershed study, EIS or geotechnical study recommends more appropriate setbacks based on natural features and functions of the area;
- Minimum 5m setback from any identified erosion allowance associated with a watercourse;
- Minimum 5m building setback from the regulatory flood line
- Minimum setback based on the calculation of the meander belt width
- In non-valley situations, a 30m setback from the bank of the watercourse, or 5m from the floodline, whichever is greater

The EIR will take the above minimum setback requirements into consideration however, given that the Secondary Plan was prepared almost 15 years ago, current Regional and CVC setback standards will also be considered when refining the NHS on the Subject Lands.

2.1.7.1 Glen Williams Integrated Planning Project / Scoped Subwatershed Plan

The Glen Williams The Glen Williams Integrated Planning Project / Scoped Subwatershed Plan (IPP/SWS) (Dillon, 2003) includes both a planning (including servicing and transportation) and a subwatershed study component aimed at establishing a long-term plan for the community through the preparation of a Secondary Plan. The document outlines the potential impacts associated with future development within the Glen Williams Planning Area and provides a set of management strategies that should be adopted to facilitate moderate growth while also ensuring a healthy and enduring natural ecosystem. Many of the management strategies within the IPP/SWS were integrated in the Secondary Plan policies noted in **Section 2.1.7** Three broad management categories were identified (Stormwater Management, Rehabilitation and Enhancement Opportunities and Monitoring). Within those categories, seven broad and inter-related management strategies were created as follows:

Stormwater Management: to mitigate potentially adverse impacts associated with stormwater runoff, the following strategy was developed:

- Stormwater management practices that involve a variety of recommended structural and non-structural measures to mitigate the potentially adverse effects of urban stormwater runoff. The measures can be incorporated on individual lots, as part of the stormwater conveyance system and/or the end of pipe, to enhance water quality, control peak flows and control spills.
- Erosion and sediment control requirements consisting of a series of site measures to control erosion and sediment during the construction phase
- Design guidelines for development which includes a set of design recommendations for future development proposals to ensure it conforms to the intent of the stormwater management strategy.

Rehabilitation and Enhancement Opportunities: these focus on identifying opportunities to help restore or improve environmental features and functions that have been lost or degraded. The objective is to increase the size, extent and quality of the core valleylands, woodlands and terrestrial and aquatic habitats to improve ecosystem diversity, ecological function and resiliency. Specific activities are identified under the following subcomponents: Hazard Land Management; Natural Heritage and Environmental Protection; Surface and Ground Water Quality and Quantity Management; Rehabilitation and Restoration Measures; and, Agricultural and Rural Land Management.

Monitoring: monitoring strategy outlines the nature of work involved, locations and frequency of monitoring for the following elements: surface water quality, aquatic resources, terrestrial resources, stream flows, surface and ground water supply.

2.1.8 Town of Halton Hills Green Development Standards

In April 2014, the Town of Halton Hills approved a new set of Green Development Standards. The Standards include a set of criteria that are anticipated to result in more sustainable, high-performance and efficient development. The Standards have been designed to maximize development's positive attributes, while minimizing potentially negative impacts. The Standards are intended to advance many key Town objectives, including those of its Strategic Plan and Community Sustainability Strategy – contributing to economic prosperity, environmental health, cultural vibrancy and social well-being. The Standards apply Town-wide to Low-Rise Residential, Low-Rise Non-Residential and Mid to High Rise development.

Low Rise Green Development Standards include criteria related to energy conservation, water conservation and quality, community design, air quality, innovation and other green features, waste management and communication. The Town has created a checklist that utilizes a points-based system to demonstrate compliance with the Standards. A complete checklist is to be submitted with the *Planning Act* application. Compliance is achieved by declaring that 40% of the available points have been achieved.

2.1.9 Town of Halton Hills Subdivision Manual (1999)

The Town of Halton Hills Subdivision Manual applies to all proposed and approved draft plans of subdivision. The manual outlines the engineering submission expectations, standards and requirements for plans related to grading, stormwater management, servicing, geotechnical, traffic, noise, tree preservation, erosion and sediment control and environmental site assessments.

2.1.10 Town of Halton Hills Stormwater Management Policy

The purpose of the Town's Stormwater Management Policy is to augment the 2003 Ministry of the Environment "Stormwater Management Practices Planning and Design Manual" to achieve the highest level of utilization, aesthetics, environmental benefits and ease of maintenance for stormwater management facilities in the Town. The policy includes items related to stormwater quality and quantity controls, stormwater management report requirements, planting guidelines for stormwater ponds, monitoring requirements and maintenance costs.

2.1.11 Town of Halton Hills Active Transportation Master Plan

The Active Transportation Master Plan shows a connection through the Subject Lands from Confederation Street, through the Credit River tributary valley to McMaster Street on the west side of the valley. During an agency meeting on February 24, 2021, Town staff confirmed that there is a stormwater outfall that connects the publicly-owned valleyland to Meagan Drive.

2.1.12 Credit Valley Conservation

CVC provides plan review and input to their municipal partners through the review of *Planning Act* applications. Through this process, CVC provides peer review advice to the Region of Halton to assist them in fulfilling their responsibilities related to natural hazards, natural heritage and other relevant policy areas pursuant to the *Planning Act*. The parameters of this peer review are outlined in a Memorandum of Understanding between the Region, local municipalities and Conservation Authorities.

From a regulatory perspective, CVC administers the *Development, Interference with Wetlands, Alterations to Shorelines and Watercourses* regulation (Ontario Regulation 160/06). Permission is required from CVC for any development or site alteration within the areas covered by this regulation including flooding and erosion hazards, watercourses, wetlands and associated allowances adjacent to these areas.

The Study Area contains a tributary of the Credit River and its associated valley feature, which is regulated pursuant to Ontario Regulation 160/06. In addition, the Subject Property contains a wetland that has been identified as being regulated by CVC.

The CVC Watershed Planning and Regulations Policy Document (2010) document identifies minimum setbacks to natural heritage and natural hazard features. Section 6.2 requires a minimum 10 m setback from non-provincially significant wetlands, significant woodlands, stable top of bank, meander belt/erosion hazard and the regulatory floodplain to the proposed lot line/limit of development or as determined by a satisfactory technical report.

The EIR ToR were developed in consultation with CVC and include fieldwork, studies and monitoring intended to delineate and further refine those areas regulated by CVC (i.e., flooding/erosion hazards, wetlands and watercourses) through on-site staking, geotechnical studies and fieldwork.

3. Baseline and Biophysical Inventory

A review of secondary sources and information obtained from field investigations was evaluated to determine significance and sensitivity of natural heritage features and functions associated with the Subject Property. Key sources and criteria for determining significance of features and functions were evaluated according to a number of guiding documents, including the PPS (2020) and associated technical guidelines, the RHOP and the HHOP

3.1 Scope Overview

The following field studies were conducted by GRA during the 2019 field season (spring, summer, fall) to document existing conditions and to serve as the baseline inventory for future ecological monitoring. Surveys conducted, including personnel and date can be found in **Table 1, Appendix B2**:

- Amphibian call count surveys
- Bat habitat survey
- Botanical and Ecological Land Classification (ELC) surveys;
- Breeding bird surveys;
- Tree Inventory; and,
- Species at Risk Assessment

Incidental observations of insects, mammals and reptiles were recorded during all fieldwork as applicable.

3.1.1 Background Information Review

The following information was reviewed, as per the approved EIR/FSS ToR, to assist with characterizing the Study Area:

- Land Information Ontario (LIO) database;
- Natural Heritage Information Centre (NHIC) database (2020);
- Online Atlas Data;
- eBird database;
- iNaturalist (current source for reptile and amphibian observations);
- Aquatic species at risk distribution maps;
- Glen Williams Scoped Subwatershed Study.

3.1.1.1 Land Information Ontario (LIO) Database

Based on the MNRF LIO database, the following features are identified within the Study Area:

- Greenbelt Boundary Area
- Woodland
- Wetland
- Natural Heritage System

3.1.1.2 Natural Heritage Information Centre (NHIC) Database

3.1.1.2.1 Species-at-Risk

The NHIC database (MNRF 2020) was searched for records of provincially significant plants, vegetation communities and wildlife within the Study Area. The database provides occurrence data by 1 km^2 area squares, with 2 squares overlapping the Study Area (17NJ8535 & 17NJ8635).

The following records are considered as current occurrences for the purpose of this report:

- Species listed as Threatened or Endangered on the Species at Risk in Ontario (SARO) list:
    - Redside Dace (*Clinostomus eelongatus)*, S2, Endangered

3.1.1.2.2 Natural Heritage Features

The NHIC database also includes data on Natural Heritage features, the following features are identified within the Study Area:

- *Greenbelt Plan* Natural Heritage System and Urban River Valley
- Woodland

3.1.1.3 Ontario Breeding Bird Atlas

The Ontario Breeding Bird Atlas (OBBA) contains detailed information on the population and distribution status of Ontario birds (Bird Studies Canada et al. 2006). The data is presented in 100 km^2 area squares with 1 square overlapping the Study Area (17NJ83). The Study Area is a small component of the bird atlas square and therefore it is unlikely that all bird species are found within the Study Area.

A total of 115 species were recorded in the atlas square that overlaps with the Study Area, with the following species of interest noted:

- Species listed as Threatened or Endangered on the SARO list:
    - 6 species area listed as Threatened, 0 species are listed as Endangered
        - Bank Swallow
        - Barn Swallow
        - Bobolink
        - Chimney Swift
        - Eastern Meadowlark
        - Louisiana Waterthrush

- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
    - 5 species are listed as Special Concern
        - Canada Warbler
        - Eastern Wood Peewee
        - Golden Winged Warbler
        - Grasshopper Sparrow

- Woodthrush

3.1.1.4 Ontario Reptile and Amphibian Atlas

The Ontario Reptile and Amphibian Atlas contains detailed information on the population and distribution status of Ontario herpetofauna (Ontario Nature 2019). As of 2020, this atlas is hosted via the "Herps of Ontario" iNaturalist project. The data are no longer presented in the 1 km squares that they were formerly.

No species were recorded within the Study Area.

3.1.1.5 Ontario Butterfly and Moth Atlases

The Ontario Butterfly and Moth Atlases (Toronto Entomologists Association 2018, 2019) contain detailed information on the population and distribution status of Ontario butterflies and moths. The data is presented in 100 km^2 area squares with 1 square overlapping the Study Area (17NJ83). The Study Area is a small component of the atlas square and therefore it is unlikely that all butterfly and moth species are found within the Study Area.

A total of 66 butterfly species were recorded in the atlas square that overlaps with the Study Area, with the following species of interest noted:

- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
    - Monarch Butterfly (*Danaus plexippus)*

A total of 31 moth species were recorded in the atlas square that overlaps with the Study Area, with no species of conservation concern noted.

3.1.1.6 Aquatic Species at Risk Distribution Mapping

Aquatic species at risk distribution mapping (DFO 2020) was reviewed to identify any known occurrences of aquatic species at risk, including fish and mussels, within the Study Area.

No aquatic species at risk were identified within the Study Area on the DFO mapping.

3.1.1.7 Glen Williams Scoped Subwatershed Study

The Glen Williams Scoped Subwatershed Study was completed with the goal of developing an integrated management strategy that would provide future direction for sustainable development, ensure the long-term health of ecosystem through protection and conservation of significant natural heritage features, and protect human life and property from hazards such as flooding and erosion. An extensive consultation process occurred as part of the study, including public meetings, a Steering Committee, Technical Advisory committee, landowners, developers, residents, and staff of CVC, the Town of Halton Hills, and the Region of Halton.

Recommended management strategies in the Subwatershed Plan were grouped into the following three broad categories. A brief description of items under each category is provided.

1. Stormwater Management
    - Gives recommended structural and non-structural measures to mitigate adverse effects of urban stormwater runoff.
    - Includes erosion and sediment control requirements, including site measures for new developments.
    - Lays out design guidelines for development, to ensure conformity to stormwater management strategy.
2. Rehabilitation and Enhancement Opportunities
    - This includes guidelines around Hazard Land Management, Natural Heritage and Environmental Protection, Surface and Ground Water Quality and Quantity Management, Rehabilitation and Restoration Measures, and Agricultural and Rural Land Management.
    - Significant subwatershed natural heritage and environmental protection features were integrated into two categories of lands, category 1 is where no development is permitted, and category 2 is where development may be permitted, subject to an Environmental Implementation Report. The purpose of the EIR is to show how the direction and objectives of the Scoped Subwatershed Plan have been accommodated and how the proposal has been designed to co-exist with the natural environment in a sustainable manner, including actual construction activities.
3. Monitoring
    - This is an ongoing initiative, as part of the CVC and based on a monitoring strategy that has been developed.

Wastewater servicing was also considered as part of the study, and further reports were authored to assess servicing alternatives.

Overall, these recommendations set out guidelines that, if implemented, will help to meet the goals of sustainable development, long term ecosystem health, and protection of human life and property. These are meant to be reviewed in relation to proposed development and are laid out in much more detail in the January 2003 "Glen Williams Integrated Planning Project, Scoped Subwatershed Plan" report by Dillon Consulting.

3.1.1.8 Region of Halton Natural Heritage System

The Halton Region Natural Heritage System (RNHS) is identified within the ROP as natural areas, "*such as woodlands, wetlands, streams, creeks, valley lands, and meadows which provide habitat for diverse plants and animals*." The RHNS serves as a long-range planning tool to protect valuable green space in the Region and provide permanent natural heritage protection for identified features. The RNHS is made up of the Regional NHS and the Provincial Greenbelt NHS.

Per section 115.2 through 115.4, the RHOP outlines those features and functions that are included in the RNHS as follows:

115.2 The Regional Natural Heritage System consists of:

1. *areas so designated on Map 1,*
2. *the shoreline along Lake Ontario and Burlington Bay, and*
3. *significant habitats of endangered species and threatened species not included in the designation on Map 1.*

115.3 The Regional Natural Heritage System is a systems approach to protecting and enhancing natural features and functions and is scientifically structured on the basis of the following components:

1. *Key Features, which include:*

    a) *Significant habitat of endangered and threatened species,*
    b) *Significant wetlands,*
    c) *Significant coastal wetlands,*
    d) *Significant woodlands,*
    e) *Significant valley lands,*
    f) *Significant wildlife habitat,*
    g) *Significant areas of natural and scientific interest,*
    h) *Fish habitat,*

    Key Features that have been identified are shown on Map 1G.
2. *Enhancements to the Key Features including Centres for Biodiversity*
3. *Linkages,*
4. *Buffers,*
5. *Watercourses that are within a Conservation Authority Regulation Limit or that provide a linkage to a wetland or a significant woodland; and*
6. *Wetlands other than those considered significant under Section 115.3(1)b)*

115.4 Included within the Regional Natural Heritage System are:

1. *Escarpment Natural Area and Escarpment Protection Area as identified in the Niagara Escarpment Plan,*
2. *Regulated Flood Plains as determined, mapped and refined from time to time by the appropriate Conservation Authority,*
3. *Parts of the Agricultural System, being those areas of the Regional Natural Heritage System outside the Key Features or where the only Key Feature is a significant earth science area of natural and scientific interest, where agricultural operations are promoted and supported as compatible and complementary uses in the protection of the Regional Natural Heritage System in accordance with policies of the Agricultural System.*

Features identified on RHOP Map 1G on the Subject Lands include the following Key Features: Significant Woodlands. To the north and northwest of the Subject Property limit, within the Study Area, Prime Agricultural Areas in NHS Enhancements/Linkages/Buffers, Greenbelt NHS and Key Features are identified.

Key Features mapped per Map 1G for the Subject Lands generally coincide with designated Greenland's identified by the HHOP, Schedule H4-1: Glen Williams Land Use Plan, including Significant Woodlands, unevaluated wetlands and watercourse features. These features are further refined per Schedule H4-2 Glen

Williams Environmental Areas as Core Greenland's and Supportive Greenland's. These designations identify key natural heritage features and supporting features that perform critical ecological functions and linkages that support ecological functions.

Per section 116.1(b) of the RHOP, the boundaries of the RNHS may be refined, with additions or adjustments through an approved EIS. Features identified on the Subject Lands designated within the RHNS per Map 1G and further identified per the Town of Halton Hills Schedule H4-2 were assessed by GRA in the field and through a detailed review of secondary sources. Further assessment with applicable agencies, including CVC and Halton Region, identified and staked the limits of Key Features such as valleylands (physical top of bank), woodland dripline and wetland limits. Refer to **Section 3.3**, for further information regarding existing conditions and significant features.

3.2 Field Investigations

As outlined in **Section 3.1**, several ecological field investigations were undertaken to characterize the natural heritage features and functions within the Study Area. In addition to the field investigations undertaken by GRA, the following features were staked in the field with staff from the Region, CVC and Town:

- Top of Bank – staked with CVC staff in June 2010 and March 19, 2019;
- Wetland – staked with CVC staff in June 2010 and August 7, 2019;
- Dripline – staked with Region of Halton staff in June 2019

Detailed survey methodology and results are provided below. Field notes are provided in **Appendix B3** and CVs for GRA field staff are provided in **Appendix B4**.

3.2.1 Ecological Land Classification (ELC) and Floristic Surveys

Vegetation communities were mapped and described according to the Ecological Land Classification (ELC) system for Southern Ontario (Lee et al. draft 2008). Vegetation community boundaries were determined using desktop analysis and further refined in the field. The results of this assessment are provided in **Table 2, Appendix B2** and shown on **Figure 2, Appendix B1**.

Floristic surveys were completed in the Spring, Summer and Fall of 2019. Species nomenclature and ranking follows the MNRF NHIC database. A list of all vascular plant species observed is presented in **Table 3, Appendix B2.**

3.2.1.1 ELC Findings

The Subject Lands are comprised of a mixture of forested valleylands and tablelands with rolling agricultural land central to the property. The natural areas include drier Sugar Maple – mixed forest along rolling upland within the north and western limits of the property transitioning to bottomland wetland communities, including both swamp and meadow marsh types.

Recreational use was documented throughout the Subject Lands with a number of informal trails established within most vegetation communities to accommodate both hiking and ATV use. As a result of the recreation use, small changes in community structure and composition as well as occurrences of invasive species (predominantly Common Buckthorn) were noted.

A total of 13 ELC vegetation communities were delineated on the property and are described in **Table 2, Appendix B2.** Refer to **Figure 2, Appendix B1** for location of ELC communities.

3.2.1.2 Floristic Survey Findings

A total of 188 species of vascular plants were identified during the flora surveys, including 48 non-native species (approximately 26% percent of all species). No significant or rare species were identified on the Subject Lands. Significance was based on rarity at three geographical scales: global, provincial (NHIC database) and regional (Distribution and Status of the Vascular Plans of the Greater Toronto Area (Varga et. al. 2000), The Vascular Plants of the Region of Peel and the Credit River Watershed (Kaiser 2001)). A working vascular plant list is provided in **Table 3, Appendix B2**.

3.2.2 Tree Inventory

An assessment of individual trees included a 100% tally of trees 10 cm Diameter at Breast Height (DBH) and greater for the Subject Lands outside of significant woodland communities. Tree resources were assessed for condition utilizing the following parameters:

- **Tree #** - numbers assigned to tree that corresponds to their surveyed/mapped location.
- **Species** - common and botanical names provided in the inventory table.
- **DBH** - diameter (cm) at breast height, measured at 1.4 m above the ground.
- **Condition** - condition of trees were assessed for the following:
    - **Trunk integrity:** conditions on trunk that might affect likelihood of failure based on factors including co-dominant stems, cracks, decay, poor taper, lean, response growth, abnormal or missing/dead bark, etc.
    - **Crown Structure:** condition on crown structure that might affect likelihood of failure including live crown ratio, presence of defects (included bark, weak attachments, cracks, decay, cavities), crown density.
    - **Crown Vigor:** an assessment of overall tree health classified as weak/under stress (poor), average vigor for its species and site condition with some signs of stress (fair), growing well and appears to be free of significant health stress factors (good).
- **Comments** - additional relevant detail.

Topographic mapping and aerial imagery were used to identify the location of trees, which were then confirmed in the field. Refer to **Table 5, Appendix B2 and Figure 4, Appendix B1** for the Tree Inventory the location of trees surveyed on the Subject Lands.

3.2.2.1 Tree Inventory Findings

The Subject Lands are dominated by a mixture of early successional and mid-age tree species. Tree individuals assessed for the purposes of this report are located outside existing significant woodland limits and exist as either stand-alone trees, hedgerows or small tree clusters.

The tree inventory identified a total of 121 trees for the assessment area. Refer to **Table 4, Appendix B2** for individual tree inventory details and **Table 2, Appendix B2** for characteristics of hedgerows H1 and H2.

3.2.3 Breeding Birds

Breeding bird surveys (BBS) were undertaken on three separate dates, June 1, 8 and 16, 2019, by a breeding bird expert under appropriate weather conditions as provided in **Table 3-1**. The Study Area is composed of five habitat quadrants, defined below:

- Q1 - Deciduous forest
- Q2 - Deciduous forest
- Q3 - Agricultural field dominated by grassy vegetation 30 cm tall.
- Q4 - Residential lawn, planted trees and shrubs.
- Q5 - Thicket-dominated wetland.

These areas were thoroughly covered by walking random transects and recording presence, abundance and level of breeding evidence (using OBBA protocols).

Table 3-1 Breeding Bird Survey Details (2019)

Visit Date	Visit Time	Temp. Range [°C]	Cloud Cover [%]	Wind Speed [Beaufort scale]
June 1	6:00 – 10:00 am	14 - 17	40-80	0-1
June 8	5:45 – 9:50 am	13 - 16	60-80	1-2
June 16	6:15-10:15 am	14 - 20	90-100	1-2

Species status for all fauna was evaluated using the following sources:

- The COSEWIC list for national status designations (current list at time of report preparation);
- The *Species at Risk Act* for federally listed species (current at time of report preparation);
- The COSSARO list for provincial status designations (current list at time of report preparation);
- The NHIC Make a Map website for provincial rarity ranks (i.e. S-Ranks);
- The *Significant Wildlife Habitat Technical Guide* (OMNR 2000) – list of 'Area Sensitive' bird species
- Distribution and Status of the Vascular Plans of the Greater Toronto Area (Varga et. al. 2000)
- The Vascular Plants of the Region of Peel and the Credit River Watershed (Kaiser 2001)

3.2.3.1 Breeding Bird Survey Findings

Results of the BBS are provided in **Table 5, Appendix B2**. In the species columns, each species is assigned a breeding level, based on the highest level of breeding evidence observed. A species observed, showing no breeding evidence or where no suitable habitat is present, is marked 'X'. The number recorded represents the highest one-day total for that species.

The table also lists the COSSARO (provincial) and COSEWIC (national) rank (if any), as well as the NHIC S rank. COSSARO is the Committee on the Status of Species at Risk in Ontario [MNRF] and COSEWIC is the Committee on the Status of Endangered Wildlife in Canada.

Of the 48 summer resident bird species (40 with some breeding evidence), the following species of conservation concern (e.g. species that are "designated" by COSEWIC and/or listed under SARA; species "designated" by COSSARO, including Endangered and Threatened species listed and regulated under Ontario's ESA; and provincially rare species (NHIC S-rank of S1 to S3) were observed during field surveys:

- 4 species are listed Species at Risk (SAR) in Canada (by COSEWIC):
    - Chimney Swift – *Threatened*
    - Barn Swallow – *Threatened*
    - Bank Swallow – *Threatened*
    - Eastern Wood Pewee – *Special Concern*

- 4 species are listed Species at Risk (SAR) in Ontario (by COSSARO):
    - Chimney Swift – *Threatened*
    - Barn Swallow – *Threatened*
    - Bank Swallow – *Threatened*
    - Eastern Wood Pewee – *Special Concern*

3.2.3.1.1 SAR Bird Discussion

Chimney Swift – One bird was observed over the grassy field during the first survey. This species is an aerial forager that wanders considerable distance from its nest sites which are almost always in chimneys with large openings (1 by 2 feet) as found in older industrial buildings, churches, schools and apartment buildings. Residences rarely have suitable chimneys as chimneys are of inadequate size or have coverings which prevent exit/entry. No chimneys suitable for nesting were observed on the Subject Lands.

Barn Swallow – A maximum of 2 individuals recorded over the grassy field were identified as foraging over the Subject Lands. There are no on-site outbuildings that provide suitable nesting habitat for this species. Outbuildings located just outside of the Subject Lands along Confederation Road did not have open doors or windows which would provide access. Observations revealed that Barn Swallow breeding was probably occurring off-site.

Bank Swallow – 3 individuals recorded over the Subject Lands, aerial foraging. The Subject Lands do not possess the suitable attributes for nesting for this species.

Eastern Wood Pewee – One singing male was heard in the deciduous wooded area located in the eastern portion of the Subject Lands. The woodland habitat found along the southern and the western portion of the Subject Lands could also host the species. The large woodland on the western portion of the property, within the valley, is considered suitable breeding habitat for the species.

3.2.3.1.2 Eastern Meadowlark and Bobolink Surveys

Bobolink and Eastern Meadowlark point count surveys were carried out in suitable habitat within the Subject Lands in accordance with the MNR Bobolink survey methodology under the ESA, 2019 (MNR, 2011, 2015). These surveys were conducted on three separate dates (June 1, 8 and 16, 2019), for a total of approximately 9 person hours.

An open grassy field about 2 ha in area is in the centre of the Subject Lands. While rather small for occupancy

by Bobolink or Eastern Meadowlark, it has some potential for occurrence of either species, particularly as aerial imagery shows pasture to be extensive immediately to the northeast of the Subject Lands.

The surveys were conducted under suitable weather conditions (i.e. no precipitation, good visibility, low wind) by walking a transect across the field with 3-point count stations located along the transect at locations which covered the entirety of the field. Surveys were conducted between dawn and 9 am. Observers walked the transect stopping at each point count, where they undertook 10 minutes of observations. Information on all specimens observed or heard (including sex, general location, direction, distance, behavior, and interactions) was recorded.

Given the small area surveyed as well as the total observation time (including point counts, transects and general observations) exceeding 9 hours, these surveys are considered to be exhaustive and comprehensive. Refer to **Figure 3, Appendix B1** for location of survey points.

The Eastern Meadowlark and Bobolink were not recorded on the Subject Lands during any of three site investigations. The grassy field at approximately 2 ha in area is likely too small for either species.

Visit 1 – June 1 – No observations of Eastern Meadowlark or Bobolink were made from the site at any of the three-point count locations, while walking the transect or while conducting the general breeding bird survey. During this survey it was determined that the property to the northeast of the Subject Lands has been grazed by cattle almost to the ground and that it is unsuitable for either Eastern Meadowlark or Bobolink.

Visit 2 – June 8 - No observations of Eastern Meadowlark or Bobolink were made from the Subject Lands at any of the three-point count locations, while walking the transect or while conducting the general breeding bird survey.

Visit 3 – June 16 - No observations of Eastern Meadowlark or Bobolink were made from the Subject Lands at any of the three-point count locations or while walking the transect.

Preferred breeding habitat for Eastern Meadowlark includes native grasslands, pastures, and savannas, but also hay and alfalfa fields, weedy borders of croplands, roadsides, orchards, golf courses, reclaimed strip mines, airports, shrubby overgrown fields, or other open areas; tall-grass prairie (western edge of range) and desert grassland (southwestern populations). This species shows preference for habitats with good grass and litter cover (Lanyon, 1995).

Preferred breeding habitat for Bobolink consists of hayfields, pastures, and meadows which are dominated by a mixture of grasses and broad-leaved forbs (e.g., red clover, dandelion, timothy). It also occurs in wet prairie, graminoid peatlands, abandoned fields, no-till cropland, small-grain fields, and reed beds. It does not *typically* occupy agricultural fields of row crops such as corn, soybean, and wheat. However, during extensive surveys in south-western Ontario (Essex, Chatham Kent, Oxford, Peel, and York Counties) "widespread use of wheat fields for nesting Bobolink, especially where alternate (higher quality) habitat does not exist. Use of wheat fields in areas where higher quality habitat is present (i.e., pasture and hayfields) is most often predicated by wheat field size as compared to those areas of more suitable habitat. It is speculated that these large wheat fields provide more interior habitat - farther from woodland edges - and provide nesting habitat less prone to predation.'' (Holdsworth pers. obs).

It is also theorized (Holdsworth, Martin and Snider pers comm.) that Bobolink are forced to use wheat-fields

after the first cut of hay-fields occurs, often in early June. As Bobolink are likely already in the nesting process when cutting occurs, these birds are then forced to find proximal, similar habitat and (at this time) wheat-fields are often the only habitat area that offers suitable vegetation height and density.

Bobolink density is significantly higher in areas with relatively low amounts of total vegetative cover, low alfalfa cover, and low total legume cover but with high litter cover and high grass-to-legume ratios (e.g. hayfields ≥ 8 yr. old). Nest tends to be sited in wet habitats, transitional between drier soils and areas providing poor drainage. The nest is always on the ground, often at the base of large forbs such as meadow rue, golden alexander, clover, etc. Bobolink avoids nesting in habitats dominated by overly dense shrubs and overly deep litter layer (>2cm). Bobolink density and likelihood of occurrence increase as a function of distance from forest edges (Martin et al., 1995; COSEWIC 2010).

3.2.4 Bat Habitat Survey

Bat habitat surveys were completed by identifying the number and density of large diameter trees in the area of proposed removal. Based on the density being less than 10 trees per hectare (>25 cm), the potential for roosting was not demonstrated. Additional surveys were not required, as discussed and agreed with the review agencies (**Appendix A2**).

3.2.5 Amphibian Surveys

Amphibian Calling Surveys followed the Marsh Monitoring Protocol (Bird Studies Canada, 2000) requiring three visits at night beginning one half hour after sunset to end before midnight. Visits are to occur no less than fifteen (15) days apart and take place during the spring and early summer. This protocol ensures that the entire range of early, middle and late-breeding species will be surveyed.

In addition, surveys must be conducted under the appropriate weather conditions to coincide with breeding calling activity. It is required that surveys are conducted when conditions are moist (i.e. after a rain, during a light mist, on humid night), and do not occur when conditions are windy (i.e. wind noise reduces ability to hear calls and frogs generally do not call during windy conditions). Minimum air temperature requirements for the visits are provided in **Table 3-2.** Finally, it is recommended that the first survey occur shortly after the first or second warm spring shower with the required night-time air temperature. The results of the breeding amphibian surveys are found in **Section 3.2.4.1**. Refer to **Figure 3, Appendix B1** for sampling locations.

Table 3-2 Temperature Requirements for Amphibian Calling Surveys

Visit #	Target Species (Breeding Designation)	Required Minimum Night Temperature
1	Early	Above 5^{O}C
2	Middle	Above 10^{O}C
3	Late	Above 17^{O}C

3.2.5.1 Amphibian Survey Findings

Table 4, Appendix B2 summarizes the details and findings of the breeding amphibian surveys conducted for the Subject Lands.

Figure 3, Appendix B1 shows the location of Station 1, which was located at approximately 586051 E/4835496 N at the southern limit of the agricultural field adjacent the wetland communities. From this station, facing south/southeast, the wetland and adjacent watercourse were surveyed up to 100 m survey radius. Calls were observed on all three visits, including Spring Peepers, Green Frogs, American Toad and Gray Tree Frogs.

3.2.6 Incidental Wildlife

Additional surveys involved general coverage recording all species observations and sign (e.g. tracks / trails, scat, burrows, dens, browse, vocalizations). The surveys coincided with surveys for amphibians and breeding birds, watercourse and pond characterizations and vegetation inventories.

3.2.6.1 Incidental Wildlife Findings

A visual and aural assessment of the presence and abundance of wildlife for the Subject Lands was conducted during all-natural heritage field investigations. These surveys involved general coverage recording all species observations and signs (e.g. tracks / trails, scat, burrows, dens, browse, vocalizations).

The following species or their sign were detected: Raccoon, White-tailed Deer, Gray Squirrel and Eastern Cottontail. None of these species are designated as at risk either federally or provincially.

In addition, surveys for lepidoptera and odonata was conducted in conjunction with the BBS. One Lepidoptera / Odonata species considered species of concern was observed during field surveys:

- One species is designated as a Species at Risk (SAR) in Canada (by COSEWIC):
  - Monarch – *Endangered*
- One species is designated as a Species at Risk (SAR) in Ontario (by COSSARO):
  - Monarch – *Special Concern*

During the site visit on June 16, 2019, a single Monarch was observed flying over the central field. The Subject Lands do possess life-cycle habitat for this species, as the host plant (Milkweed) is present. The density of milkweed was limited on the Subject Lands and did not meet the quantity to support Significant Wildlife Habitat for this species.

3.3 Significant Natural Heritage Features and Functions

Based on the surveys and findings outlined above, the Study Area has been assessed for the presence of significant natural heritage features and functions as defined PPS, RHOP, HHOP and Greenbelt Plan.

3.3.1 Significant Habitat for Threatened and Endangered Species

A screening for possible Species at Risk (SAR) was conducted for the Study Area based on Federal and Provincial status and a review of the NHIC, the regional SAR list and a local list provided by the MNRF. Screening for the

habitat supporting any potential species identified from the background information was completed during the field studies.

No Significant Habitat for Threatened and Endangered Species was identified for the Subject Lands. A list of Species at Risk in Ontario provided by the MNRF and data distributed by the NHIC was reviewed and screened for the purposes of this report (Refer to **Table 7, Appendix B2** for the SAR Screening Table). The table includes the habitat requirements for SAR, a description of potential habitat in the Study Area and a determination if the SAR and/or its habitat have the potential to occur.

Based on the results of the SAR screenings and the observations made in the field, no SAR, except the foraging barn and bank swallows, or SAR habitat have been identified on the Subject Lands.

3.3.2 Significant Wetlands

The Subject Lands support several wetland features associated with the Credit River. These features include mineral cedar swamp (0.7 ha), open meadow marsh (1.9 ha), organic cedar swamp (2.2 ha), floodplain meadow marsh (0.2 ha) and shrub thicket swamp (0.2 ha) communities contained with the RHNS. In general, the level of disturbance and invasive species is low within these wetland communities. There are no PSW's located on or adjacent the Subject Lands, or within the Study Area. Unevaluated wetlands are identified along the western and southern limit of the Subject Lands associated with a tributary of the Credit River. These wetland features have not been evaluated pursuant to the Ontario Wetland Evaluation System (OWES) to establish significance based on provincial protocol as this was not a requirement of the EIR/FSS ToR. The limit of the wetlands was staked with CVC staff on August 7, 2019. Refer to **Figure 2, Appendix B1** for the location of wetlands identified on the Subject Lands.

The RHOP Key Features include significant wetlands (as designated by the MNRF) as well as wetlands that make a significant ecological contribution to the RNHS (ROP Section 115.3.6). While the wetlands within the Study Area have not been assessed pursuant to OWES, the Study Team does recommend that the wetlands, by virtue of their location within a significant valleyland and significant woodland as well as the presence of amphibian breeding habitat, should be considered wetlands that makes significant ecological contributions to the RNHS.

Based on the above, the wetlands are considered Key Features in the RNHS and are shown on **Figure 6, Appendix B1**.

In addition to the above, the wetlands are regulated by the CVC pursuant to O. Reg. 160/06.

3.3.3 Significant Coastal Wetlands

The Study Area is not on, or within 2 km of, the Lake Ontario shoreline. As such, no significant coastal wetlands are present.

3.3.4 Significant Woodlands

Section 277 of the ROP defines a Significant Woodland as:

> *a Woodland 0.5 ha or larger determined through a Watershed Plan, a Sub-watershed Study or a site-specific Environmental Impact Assessment to meet one or more of the four following criteria:*

1. *the Woodland contains forest patches over 99 years old,*
2. *the patch size of the Woodland is 2 ha or larger if it is located in the Urban Area, or 4 ha or larger if it is located outside the Urban Area but below the Escarpment Brow, or 10 ha or larger if it is located outside the Urban Area but above the Escarpment Brow,*
3. *the Woodland has an interior core area of 4 ha or larger, measured 100m from the edge, or*
4. *the Woodland is wholly or partially within 50 m of a major creek or certain headwater creek or within 150m of the Escarpment Brow.*

The Town of Halton Hills, Section B1.3.5, indicates all woodlands 0.5 ha or larger, have been identified by the Region to be an important natural heritage feature and candidates for assessment as significant woodlands. It is the policy of the HHOP to:

a) Identify and show on the Urban Land Use Schedules to this Plan, significant woodlands as a component of Greenlands B through Watershed Management Plans, Subwatershed Studies, or individual site-specific Environmental Impact Studies; and,

b) Require the submission and approval of an Environmental Impact Study that identifies or refines the boundaries of significant woodlands and implements measures to protect such significant woodlands for any development proposal, other than individual consents or uses conforming to this Plan and Zoning By-laws, located wholly or partially within 50 m of woodlands 0.5 ha or larger.

Criteria established by the Region and Town was derived from policies and definitions set out by the PPS.

The dripline of the southern and northern woodlands was staked by Region of Halton staff in June 2019. Based on field observations, both the southern and northern woodlands meet the following criteria to be considered significant based on ROP Section 277:

- The northern woodland is approximately 27 ha and the southern woodland is 4.2 ha. Both of which are greater than the size criteria of 4 ha for areas south of the Niagara Escarpment.
- Both woodlands surround *Major Creeks* as defined in the ROP.

Based on the above, Significant Woodlands exist within the Study Area as shown on **Figure 6, Appendix B1** and are considered a Key Feature within the RNHS.

The contiguity of these features based on current policy definitions and in-field observations were assessed based on RHOP and the MNRF Natural Heritage Reference Manual (NHRM). The NHRM for Natural Heritage Policies of the PPS, 2005, defines the delineation of woodland patches, per section 7.3.2, for woodland openings as, "*a bisecting opening 20 metres or less in width between crown edges is not considered to divide a woodland into two separate woodlands. The area of the development opening (e.g., maintained public road or rail line (is not included in the woodland area calculation)*."

GRA's in field assessment included determining the connectivity of the two Significant Woodlands present on-site through measurements of any woodland openings between the crown edge of each woodland and the width and length of any linear treed areas connecting the features. Field investigations identified a linear woodland hedgerow between the woodland along the western limit with the woodland to the south. The density of the linear hedgerow does not meet the definition of woodlands under the *Forestry Act* with land with at least:

- 1000 trees of any size per hectare; or
- 750 trees measuring over 5 cm in diameter, per hectare; or
- 500 trees measuring over 12 cm in diameter, per hectare; or
- 250 trees measuring over 20 cm in diameter, per hectare but does not include a cultivated fruit or nut orchard or a plantation established for the purpose of producing Christmas trees.

The length of the linear hedgerow feature was measured at ~32 m. Based on current policy definitions and measurements obtained in the field, the Significant Woodland features on the Subject Lands are not identified as a contiguous feature within the RNHS. The dripline limit of the southern woodland represents the extent of a disturbed edge adjacent to the organic cedar swamp.

Refer to **Figure 6, Appendix B1** for the location of Significant Woodlands identified within the Subject Lands. Significant Woodlands identified for the Subject Lands form part of the RNHS and HHOP Core Greenland's.

There is a smaller wooded feature, 0.48 ha in size, that does not meet the size threshold as outlined in the Region and Town policies above. This feature was reviewed by Region of Halton staff in the field on March 29, 2019. In an email dated April 2, 2019, Plan B Natural Heritage provided an assessment with respect to this feature and outlined that, in their opinion, this feature does not meet the criteria to be considered a significant woodland. A copy of this correspondence can be found in **Appendix A2**.

3.3.5 Significant Valleylands

A tributary of the Credit River flows through a confined valley within the western and southern portion of the Subject Lands. On March 19, 2019, the CVC staked two top of bank features – an upper and a lower tier top of bank. In an email dated March 4, 2020 (**Appendix A2**), CVC staff advised they would be open to proceed with considering the lower-tier valley slope as the CVC Regulated Valley Slope (i.e., they would not regulate the top tier or the proposed engineered top of slope) subject to the following:

1. A geotechnical/slope stability report to determine the Long-Term Stable Slope Line associated with the lower tier top of bank and confirmation of no impacts to this slope from the proposed grading.
    a. A minimum 10 m setback to the proposed grading and lot lines from the greater of the Top of Bank or Long-Term Stable Slope line of this slope however, it is expected that this buffer be maximized where possible.
    b. Further, the works for the upper tier slopes should be confirmed by a Geotechnical Engineer and confirmation is required from a Geotechnical Engineer the proposed grading works would not negatively impact the slope stability of the lower tier top of bank. This is especially important in the southern portion of the lower tier top of bank as the grades of this slope starts to connect to the higher tier top of slope.

2. Preparation and implementation of a robust restoration and enhancement landscape planting plan for the area between the CVC Regulated lower tier top of bank and the proposed new lots in order to provide an enhanced valley corridor compared to the current/existing condition.

3. At the south-west corner of the proposed subdivision [at the end of the higher tier (i.e., secondary) top of bank], the proposed lot line should be shifted further away from the Significant Woodland feature in

order to provide more room to allow for a larger buffer between the proposed grading and the dripline in order to protect the Significant Woodland. Typically look for a 10m buffer and the environmental impact assessment to confirm the appropriate setback and/or mitigation measures.

With respect to Item 1 above, as detailed in **Section 6.5.2.2**, the Geotechnical Slope Stability Study concluded that the physical top of bank of the lower tier/ primary top of bank is stable. Items 1(a) and (b) are discussed further in **Section 6.5.2.2**.

The general approach to restoration and enhancement planting along the newly graded slopes is discussed within **Section 7.3.2** to address Item 2 above. Detailed landscaping plans will be provided as a condition of draft plan approval.

Item 3 was in reference to an earlier grading plan that was provided to the agencies at a meeting on March 12, 2020. The grading as shown on all figures reflects the revision as requested in Item 3 above.

The western valleyland, as described above, is considered to be a significant valleyland based on the analysis in **Table 8, Appendix B2** and is a Key Feature of the RNHS. The southern top of bank feature appears to be more related to the wetland than a watercourse feature. As a result, the southern feature was not evaluated as a valleyland but will be protected by virtue of the significant woodland, significant wetland and CVC regulatory requirements.

3.3.6 Significant Wildlife Habitat

A screening for SWH following the MNRF Significant Wildlife Habitat Technical Guide (2000) and Significant Wildlife Habitat Criteria Schedule for Ecoregion 6E (January 2015) was conducted for the Subject Lands. Potential SWH identified was assessed during the field studies.

SWH features and functions as delineated within the OMNRF Significant Wildlife Habitat Ecoregion Criteria Schedule for Region 6E (OMNRF, 2015) were reviewed and evaluated for the Study Area. The document groups wildlife habitat into four main categories:

- Seasonal concentration areas of animals.
- Rare vegetation communities or specialized habitats for wildlife.
- Habitat for species of conservation concern; and,
- Animal movement corridors.

The screening, found in **Table 9, Appendix B2**, consisted of a review of the ELC codes and habitat criteria for candidate SWH. Any candidate SWH on the Subject Lands was noted and a rationale was provided.

Based on the results of the SWH habitat screening in **Table 9, Appendix B2**, and the observations made during field studies of the Subject Lands, the following candidate SWH were identified:

- Seasonal Concentration Areas of Animals
    - Waterfowl stopover and staging areas (aquatic)
    - Bat maternity colony

    - Colonially-nesting bird breeding habitat (tree/shrub)
- Specialized Habitat for Wildlife
    - Waterfowl nesting area
    - Amphibian breeding habitat (woodlands)
    - Amphibian breeding habitat (wetlands)
- Habitat for Species of Conservation Concern (not including Endangered or Threatened Species)
    - Marsh bird breeding habitat
    - Terrestrial crayfish

All Candidate SWH that was identified is within the valleylands and wetlands associated with the Credit River tributary. These lands are within the Town's Core Greenland Area and the RNHS. As such, these features will be protected and retained with setbacks to the proposed development determined based on the significance and sensitivity of those other features.

3.3.7 Significant Areas of Natural and Scientific Interest

No Areas of Natural and Scientific Interest are present within the Study Area.

3.3.8 Fish Habitat

Specific fish surveys were not required as part of the approved EIA ToR however, background information available from the CVC and DFO, and the Scoped Glen Williams SWS was reviewed for the purposes of this report. It is indicated on Figure 11 of the Credit River Fisheries Management Plan that the watercourse within the Study Area is classified as a warmwater community based on physiography, however the existing fish community (Figure 12) and applicable fish community management zone (Figure 13) describe the watercourse as a coldwater community. This discrepancy could be explained by the presence of upstream groundwater discharge into the watercourse. It is also one of the few coldwater tributaries of the Credit River that does not originate from above the Niagara Escarpment.

Fish that are characteristic of cold and cool water communities within the Credit Valley Watershed include trout species such as brook trout, rainbow trout and brown trout. Mottled skulpin, American brook lamprey, rainbow darter, fantail darter, northern hog sucker and stonecat are other commonly found species. However, it is unlikely that these species are present within the watercourse in the Study Area due to its location below the Niagara Escarpment and the fact that the majority of the watercourse lacks a defined channel and is situated within a wetland environment. A lack of open water, sustained flow and firm substrates may limit or alter the fish community from what could typically be expected from a small coldwater watercourse.

The DFO Aquatic Species at Risk Screening revealed no distribution of aquatic species at risk or their critical habitat within the Study Area, at any point along the length of the tributary or within the immediate downstream section of the Credit River. The Credit River West Branch is located approximately 1 km south of the Study Area and is within the known distribution of the Redside Dace, a fish species listed as endangered in Ontario. The proposed development does not pose a risk to Redside Dace habitat as their identified range is located beyond the 120 m study area.

4. Surface and Ground Water Resources

4.1 Surface Water Resources

As noted in preceding sections, the Subject Lands are located within Subwatershed 12 of the Credit River Watershed. A tributary of the Credit River flows through the Study Area in a southeasterly direction and flows into the main Credit River approximately 400 m downstream, on the east side of Confederation Street, south of Main Street. Surface drainage from the Subject Lands is generally north to south as shown on FSR Figure 2A. Based on analysis of the detailed site topography, the development area of the site (approximately 5.2 ha) drains to four (4) separate outlets as shown on FSR Figure 2A and summarized in **Table 4-1**. The majority of the drainage from the area to be developed drains to the existing wetland feature to the south. An external area drains across the north property line and also discharges to the south. This area was delineated based on existing subcatchment information from CVC and available topographic mapping (2002 MNR LIO topography). Note that the drainage area for the non-development portion of the Subject Lands was not discretized as no changes are proposed to the existing land use beyond the proposed development limit.

Table 4-1 – Existing Drainage Areas

Outlet ID	Location	Area [ha]	Land use	% IMP	Slope [%]
West	Drainage from west side of Subject Lands towards existing watercourse / valley	0.27	Cropland	-	25
South 1	Drainage from majority of Subject Lands to existing wetland	2.0	Cropland	-	12
South 2	Drainage from majority of Subject Lands to existing wetland	2.70	Cropland	-	8
South 3	Drainage from Subject Lands including existing external residential areas including Subject Lands, draining to existing wetlands	1.46	Settlement	30	8
East	Drainage directed to Confederation Street from part of Subject Lands and existing external areas	3.47	Settlement	25	7
External	Drainage from north discharging across Subject Lands to the southern wetland	5.90	Cropland	-	7

The total drainage area to the existing wetland is shown on FSR Drawing 2B and is approximately 221.9 ha. The total contribution from the development portion of the Subject Lands and external area is 15.81 ha, which is 7.1% of the total drainage area to the wetland.

A PCSWMM model was prepared to simulate the existing conditions flows and runoff volumes under various rainfall events including a continuous simulation used to assess seasonal runoff to the wetland.

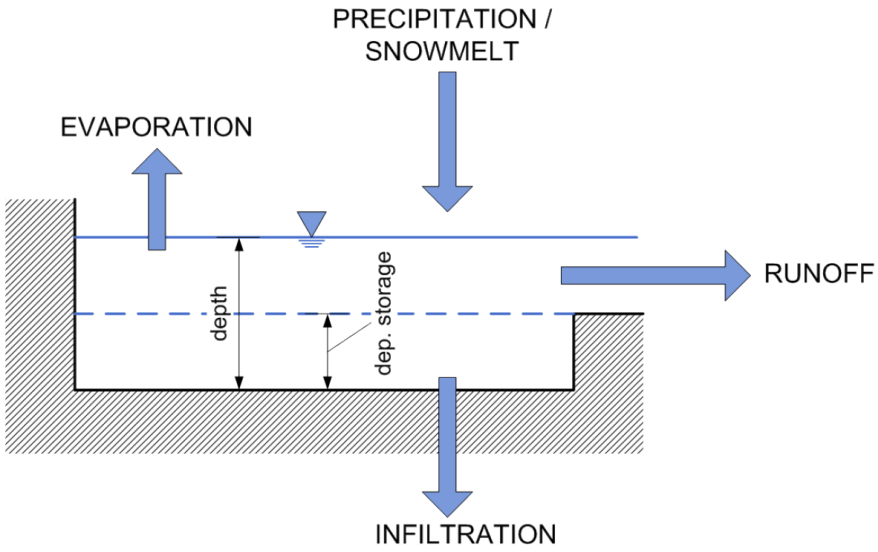
PCSWMM is based on the EPA Stormwater Management Model (SWMM) and is a deterministic, dynamic rainfall-runoff simulation model utilized for either single event or long-term (continuous) simulation of runoff quantity and quality. The runoff component of SWMM operates on a subcatchment area that receives precipitation and generates runoff based on land use, climate data, and soil properties. SWMM accounts for various hydrologic processes that produce runoff from rural and urban areas. SWMM can account for time and spatially varying rainfall, evaporation, snow accumulation and melting, rainfall interception in depression storage, and infiltration losses including soil wetting/drying.

The routing module of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity of runoff generated within each subcatchment and the flow rate and flow depth in each model element during a simulation period comprised of multiple time steps.

SWMM was first developed in 1971 and has undergone several major upgrades since then. It continues to be widely utilized throughout the world for planning, analysis and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems, including non-urban areas as well.

The Conservation Ontario “Integrated Watershed Management – Water Budget Overview” document (October, 2009) lists the SWMM engine as a suitable model for subwatershed-scale water balance analysis. The latest version of SWMM was produced by the Water Supply and Water Resources Division of the U.S. Environmental Protection Agency's National Risk Management Research Laboratory and is capable of modelling various LID measures such as bioretention, vegetative swales, pervious pavement, etc.

SWMM is ideal for water budget analyses as it can continuously simulate the major components of the water cycle (precipitation, snowmelt, infiltration, storage, evaporation, and runoff) with actual precipitation and temperature inputs. Note that while the model does not simulate transpiration directly, the evaporation parameters can be augmented seasonally to account for this. A conceptual view of surface runoff routine used by SWMM is illustrated in following schematic:



Each subcatchment surface is treated as a non-linear reservoir. Inflow comes from precipitation and snowmelt as well as run-on from any designated upstream subcatchment or point-source input. Outflows consist of infiltration, evaporation (corrected to include transpiration) and surface runoff. The capacity of this "reservoir" is the maximum depression storage, which is the maximum surface storage provided by ponding, surface wetting, and interception. Surface runoff occurs only when the depth of water in the "reservoir" exceeds the maximum depression storage. Depth of water over the subcatchment is continuously updated with time by solving numerically a water balance equation over the subcatchment.

The PCSWMM model incorporates the available land use, geotechnical (infiltration) and other physical catchment parameters. A complete listing of the model parameters is included in **Appendix D2**. The following tables summarize the results of the existing conditions single-event (**Table 4-2**) and continuous model results (**Table 4-3**), respectively. As shown in **Table 4-2**, peak flows discharged from the existing drainage areas are relatively low due to the high infiltration rates measured in the field (refer to infiltration testing results in **Table 4-10**).

Table 4-2 – Existing Peak Flows (single-event model)

Outlet ID	Area [ha]	Flow [L/s]						
		Q_{25mm}	Q_2	Q5	Q_{10}	Q_{25}	Q_{50}	Q_{100}
West	0.27	0	1	4	8	15	21	27
South 1	2.0	0	2	11	22	41	61	82
South 2	8.6	0	6	36	70	127	187	251
South 3	1.46	14	36	76	107	151	190	230
South Total*	12.06	10	36	110	183	296	408	527
East	3.47	10	27	63	96	142	184	227
External	5.90	0	3	23	44	79	116	156

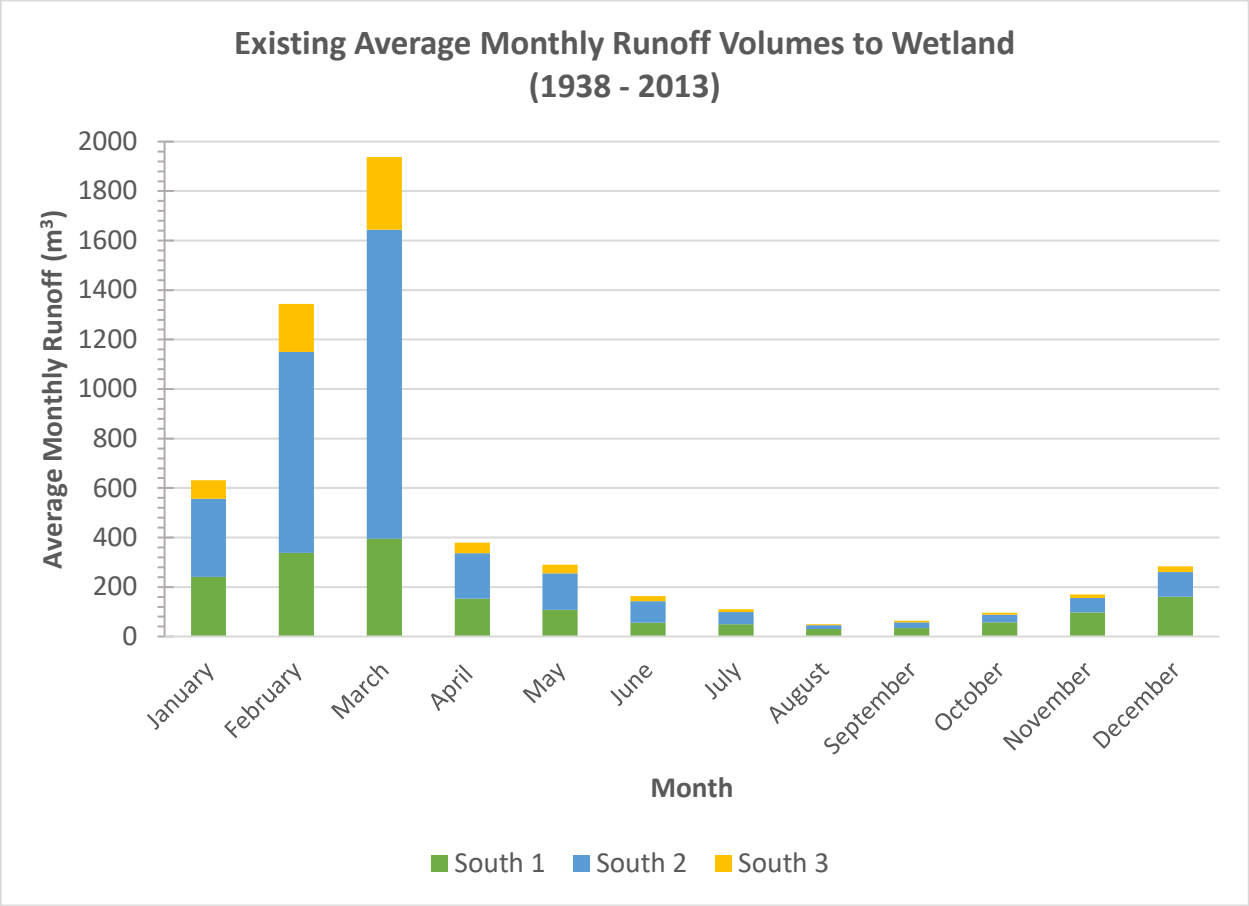
* South Total is not the sum of the South 1, South 2 and South 3 hydrograph peaks, but rather the actual combination of the hydrographs which includes time-to-peak effects

Based on the continuous model results, which simulated climate data from 1938 to 2013 based on the Toronto (Pearson) climate station, the following average runoff volumes from the "south" catchments to the wetland were calculated and summarized in **Table 4-3**.

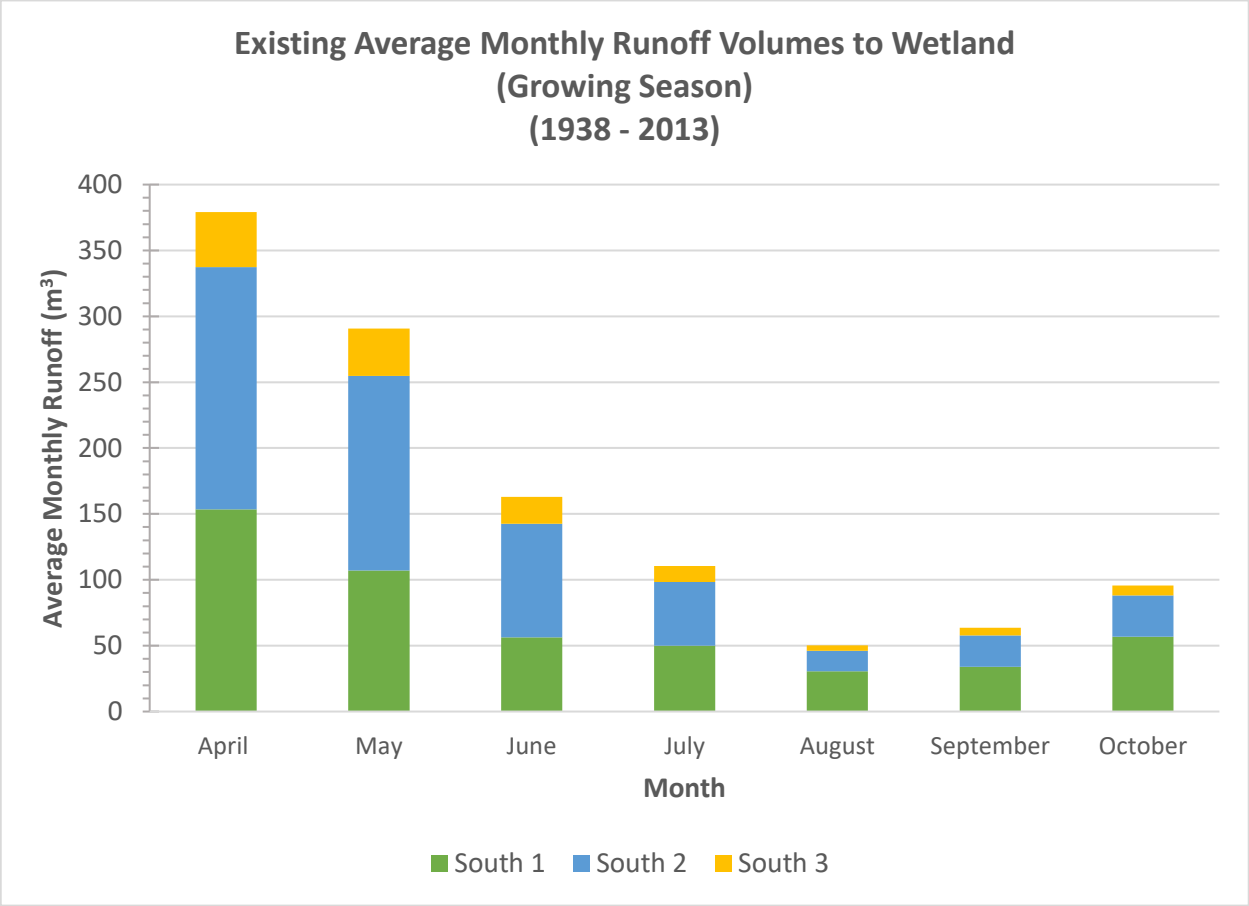
Table 4-3 – Existing Monthly Runoff Volumes Discharged to Wetland (average from 1938 to 2013)

Outlet To Wetland	Area [ha]	Existing Average Runoff Volumes (1938 - 2013) [m³]												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
South 1	2	75	194	294	42	36	21	12	4	6	8	14	23	728
South 2	2.7 + 5.9	316	812	1249	184	148	86	48	16	24	31	58	100	3072
South 3	1.46	241	337	394	153	107	56	50	30	34	57	98	161	1720
Total	**12.06**	**632**	**1344**	**1937**	**379**	**291**	**163**	**110**	**50**	**64**	**96**	**170**	**284**	**5520**

These values are depicted in **Graphs 4-1 and 4-2** prepared for the average year as well as for the growing season (April to October).



Graph 4-1 – Existing Average Monthly Runoff Volumes to Wetland (1938-2013)



Graph 4-2 – Existing Average Monthly Runoff Volumes to Wetland (Growing Season) 1938-2013

The proposed grading of the Subject Lands ensures that the existing drainage areas to the various outlets are generally maintained. Figure 5 and Figure 5A in the FSR (Urbantech 2020) illustrates the proposed drainage plan and **Table 4-4** compares the proposed drainage areas to each outlet to the existing areas. The future lots are estimated to be 30% IMP and the ROW is 45% IMP.

Table 4-4 - Proposed Drainage Areas

Outlet ID	Location	Area [ha] proposed (existing)	Land use	Reason for change	% IMP	Slope [%]
West	Drainage from west side of Subject Lands towards existing watercourse / valley	0.02 (0.27)	Rear yards / vegetated transition slope	Lot grading and proposed stormwater management strategy directs drainage away from the west outlet	0	50
South 1	Drainage from majority of Subject Lands to existing wetland	0.68 (2.0)	Lots / ROW	Majority of drainage area is directed to proposed stormwater outlet at Block 39 to existing wetland	10	15
South 2	Drainage from majority of Subject Lands to existing wetland	4.92 (2.70)	Lots / ROW		40	5
South 3	Drainage from Subject Lands including existing external residential areas including Subject Lands, draining to existing wetlands	0.60 (1.46)	Lots / ROW	North of Street A existing external residential area drains to proposed Street A	20	8
Total to South / Wetland		**12.35 (12.33)**				
East	Drainage directed to Confederation Street from part of Subject Lands and existing external areas	3.40 (3.47)	Lots / ROW	The majority of the proposed ROW drains to the south outlet	25	7
External	Drainage from north discharging across Subject Lands to the southern wetland	(5.90)	Cropland	No change	0	7

With the exception of the first 120 m of Street A, the proposed development will have a rural cross-section. Figure 9 of the FSR illustrates the proposed 20 m ROW section (9m pavement). The first 120 m of Street A will also have a 20 m ROW however, will be constructed as an urban cross-section with curb and gutter (8.5 m pavement). This is proposed as there is not enough space for a 20 m wide rural section at the entrance due to existing grading constraints with the existing properties to the north and south. Furthermore, the Town of Halton Hills prefers an urban cross-section to accommodate emergency access requirements, and an island is recommended to ensure access to the Subject Lands by preventing vehicles from parking across all traffic lanes.

Storm servicing infrastructure has been designed in accordance with the latest Town of Halton Hills standards and specifications and will consist of storm sewers 450 mm – 1200 mm in diameter and with slopes ranging from 0.5% – 5.0%. Storm flows within the rural cross-section will be captured by the proposed swales along both sides of Street A for infiltration and quality control and will eventually discharge to the RNHS via a headwall within the storm drainage block.

Refer to FSR Figure 5A and **Appendix D4** for the proposed storm drainage plan and design calculations.

The stormwater management strategy for the Subject Lands is based on the following objectives and design criteria:

- Control of the post-development design storm flows based on the Town of Halton Hills IDF parameters (Standard 105) and 24-hour SCS Type II distribution. All storms up to and including the 100-year event must be controlled to pre-development rates;
- Provide quality control via a treatment-train approach to achieve 80% TSS removal;
- Detain at least 5mm on site for at least 48 hours to provide erosion control;
- Capture and convey the 5-year storm in the minor system / road-side swales without surcharging / overtopping;
- Capture / continue to convey the external drainage from north of the development;
- Ensure the wetland water balance is adequately maintained;
- Limit maintenance requirements;
- Take advantage of high infiltration rates on the Subject Lands by encouraging infiltration-based stormwater management measures; and,
- Ensure that any fill brought to the site meets the same infiltration rate as the existing soils for areas that will be used for infiltration.

The following measures are proposed to manage stormwater and meet the criteria and objectives:

The proposed drainage areas will be conveyed as follows:

- External area (5.9 ha) – all flows up to and including the 100-year event to be captured in a 450mm storm sewer within the 5m easement between Lots 6 and 7, and conveyed through the Subject Lands to the south storm outfall;
- Lot areas to discharge roof leaders to pervious areas; excess flow to drain to rear or front yards subject to lot grading;
- Remaining lot runoff and ROW runoff to be captured in infiltration swales on either side of the ROW;
- Infiltration swales overflow to minor system (storm sewer);
- Excess flow conveyed by major system to the storm drainage block adjacent to Lot 24, which has additional storage / infiltration; and,
- Major and minor system pass through the storm drainage block.

The following LID measures are proposed on the Subject Lands:

- Road-side swales with infiltration;
- Additional topsoil on pervious lot areas (300mm to 450mm total; not simulated);
- Rain barrels, subject to builder acceptance (not simulated)
- End of pipe swale/infiltration.

Based on the drainage areas illustrated in FSR Figure 5 (Urbantech 2020) and shown in **Table 4-5**, a post-development PCSWMM model was created to simulate the proposed drainage and stormwater management strategy.

Table 4-5 - Proposed Peak Flows (single-event model)

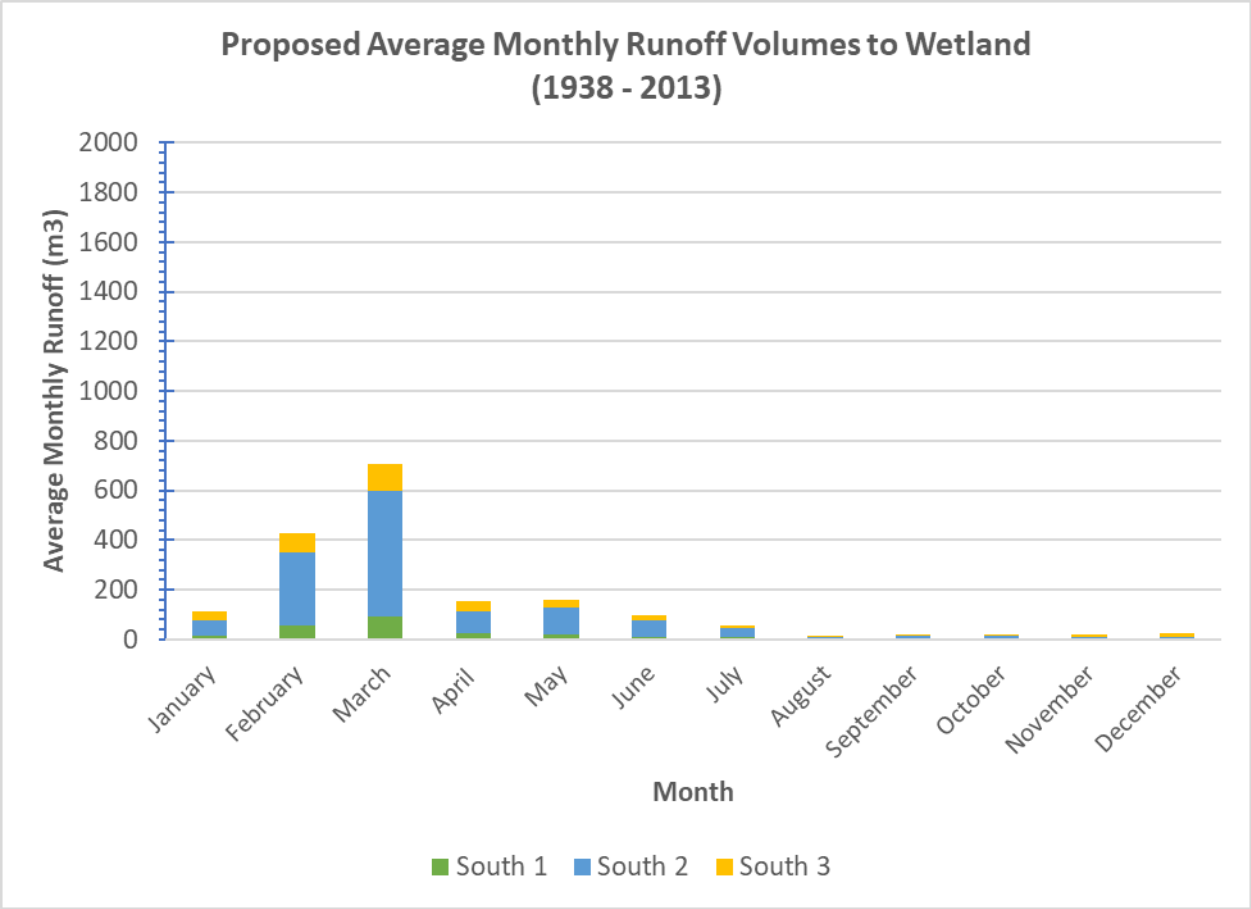
Outlet ID	Area [ha]	Flow [L/s]						
		Q_{25mm}	Q_2	Q5	Q_{10}	Q_{25}	Q_{50}	Q_{100}
West	0.02	0	0	0	1	2	2	3
South 1	0.68	1	4	20	34	54	70	87
South 2	11.05	0	6	34	69	123	176	236
South 3	0.63	4	21	80	142	235	320	412
South Total*	12.35	4	21	80	142	235	320	412
East	3.4	10	27	63	95	141	182	225
External	5.9	0	3	23	44	79	116	156

* South Total is not the sum of the South 1, South 2 and South 3 hydrograph peaks, but rather the actual combination of the hydrographs which includes time-to-peak effects

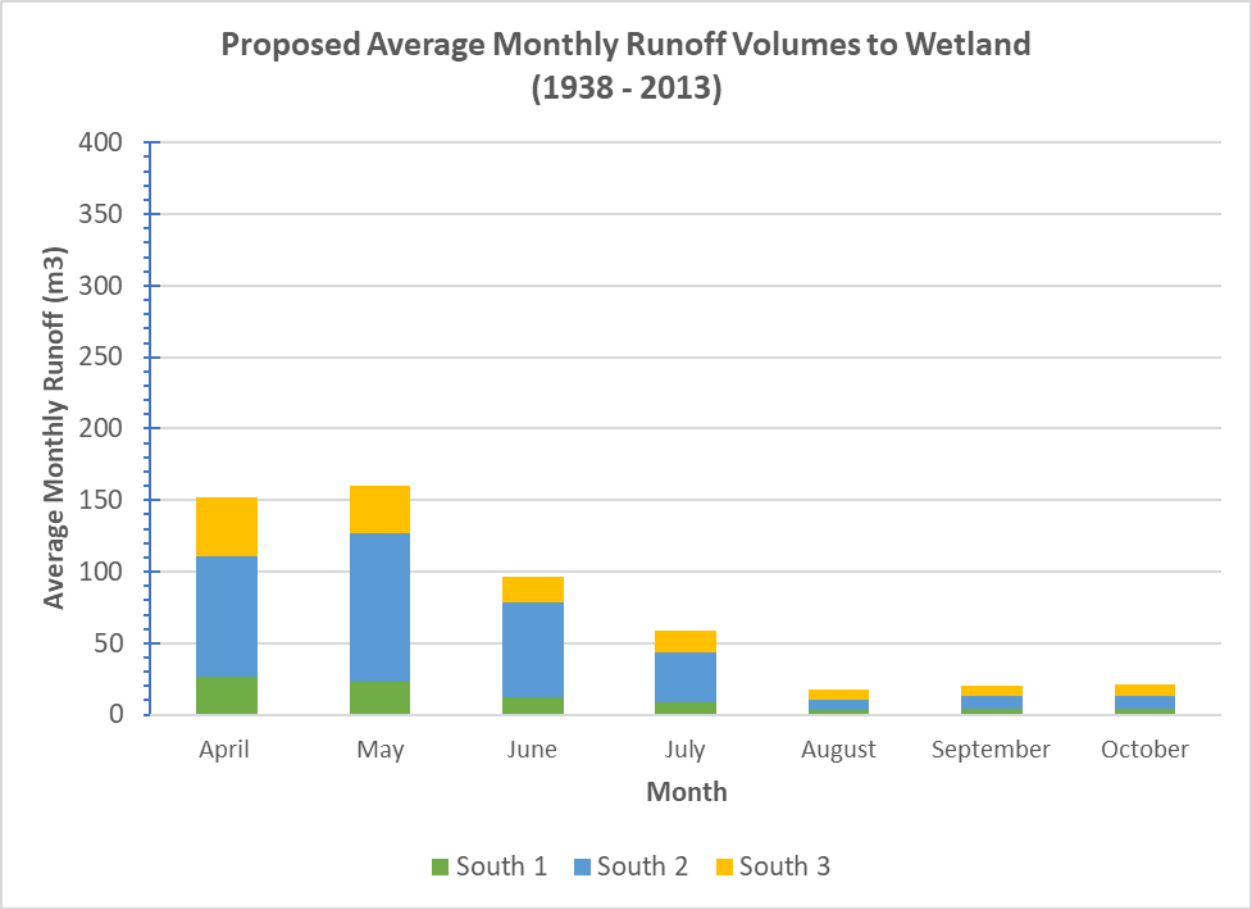
Based on the proposed SWM strategy and LID design, the continuous model was simulated to determine the post-development monthly runoff results for the existing wetland feature. As shown in **Table 4-6***,* there is a net decrease in runoff volumes to the wetland by 20% to 30% from the Subject Lands, however an overall decrease of less than 2% when the entire catchment is considered in the calculations. Furthermore, it is understood that the wetland feature is predominantly fed by groundwater, and that the overall surface water contributions are a small fraction of the total groundwater flow. The overall decrease in surface water flow is due to the use of LID measures to infiltrate runoff from the Subject Property and reduce the overall monthly runoff volumes. The wetland feature is primarily fed by groundwater, therefore the reduction of surface water runoff (in favour of infiltration) will enhance the primary source of water to the wetland. No impacts to the wetland as a result of decreased surface runoff are anticipated by DS Consultants and GeoProcess Research Associates. The following results have been coordinated with GeoProcess Research Associates as part of the EIR work. It is understood that the CVC requested consideration of maintaining the wetland water balance with "clean" sources of runoff only (i.e., rear yards and rooftops). This would necessitate a separate roof drain collector pipe to the wetland and an alternative storm drainage outlet for the ROW. There is no suitable outlet for the ROW other than the outlet to the south – directing any additional drainage to the east outlet would increase the flows to Confederation Street, which the Town does not support due to capacity issues. Furthermore, directing hard surfaces away from the wetland will further reduce the total runoff / infiltration volume directed to the wetland. Directing the ROW drainage (and lots / rooftops) will not impair the wetland water quality - as noted in **Section 4.2.3**, the proposed treatment train will provide a minimum of 80% TSS removal (or better) for the proposed drainage area, considering that the runoff from frequent events is minimal due to the proposed LID retention.

Table 4-6 – Proposed Monthly Runoff Volumes Discharged to Wetland (average from 1938 to 2013)

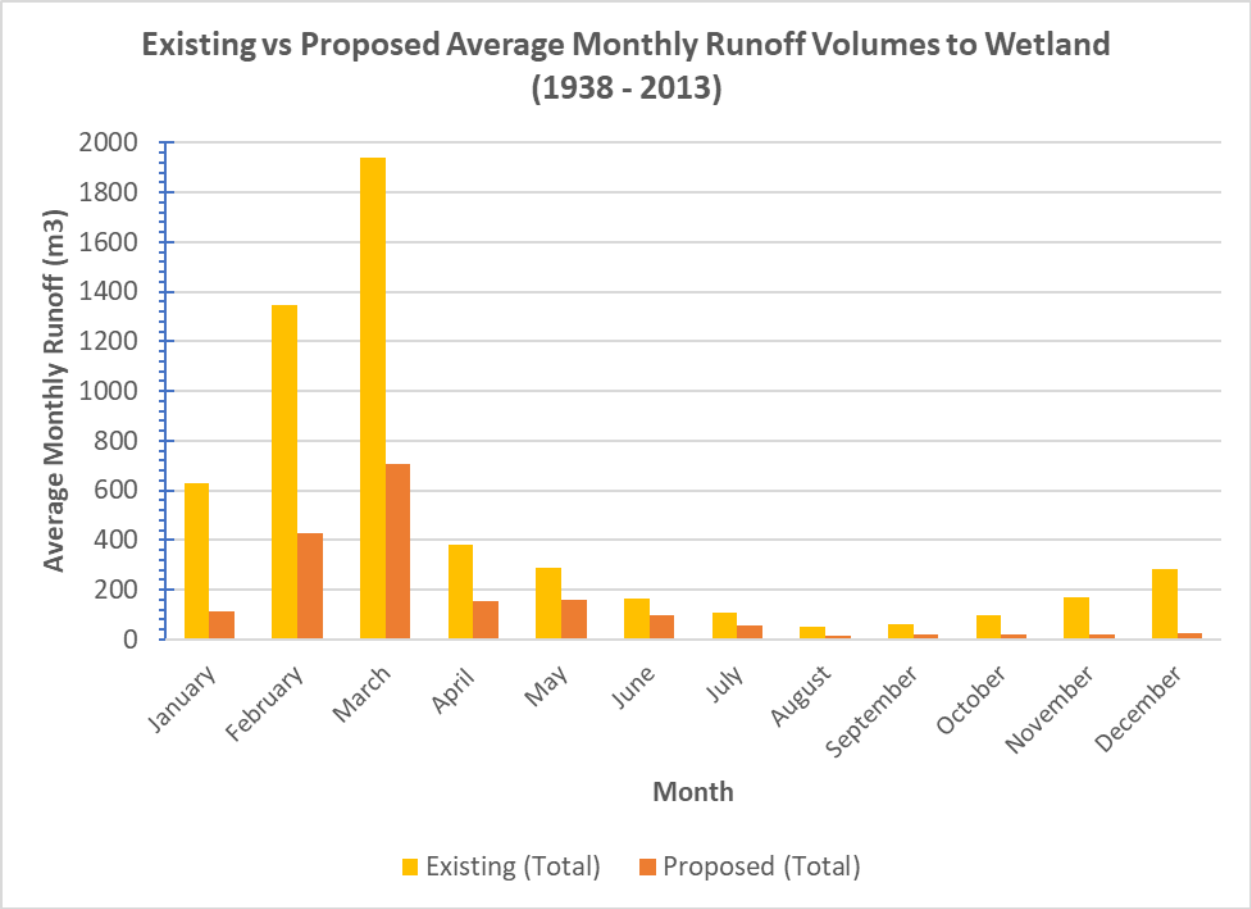
Outlet To Wetland	Area [ha]	Proposed Average Runoff Volumes (1938 - 2013) [m³]												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
South 1	0.60	17	59	921	27	23	12	9	3	4	4	4	5	258
South 2	4.92 + 5.9	60	292	509	84	104	66	35	7	10	9	4	6	1186
South 3	0.68	35	75	107	41	33	18	15	7	7	8	11	13	370
Total	**12.12**	**111**	**426**	**707**	**152**	**160**	**97**	**59**	**17**	**20**	**21**	**19**	**25**	**1814**
% Change vs. existing	**+0.41%**	-82%	-68%	-64%	-60%	-45%	-41%	-47%	-66%	-68%	-78%	-89%	-91%	-67%
% Change vs. overall 221.9 ha area	**+0.02%**	-4.5%	-3.7%	-3.5%	-3.3%	-2.5%	-2.2%	-2.6%	-3.6%	-3.7%	-4.3%	-4.9%	-5.0%	-3.7%



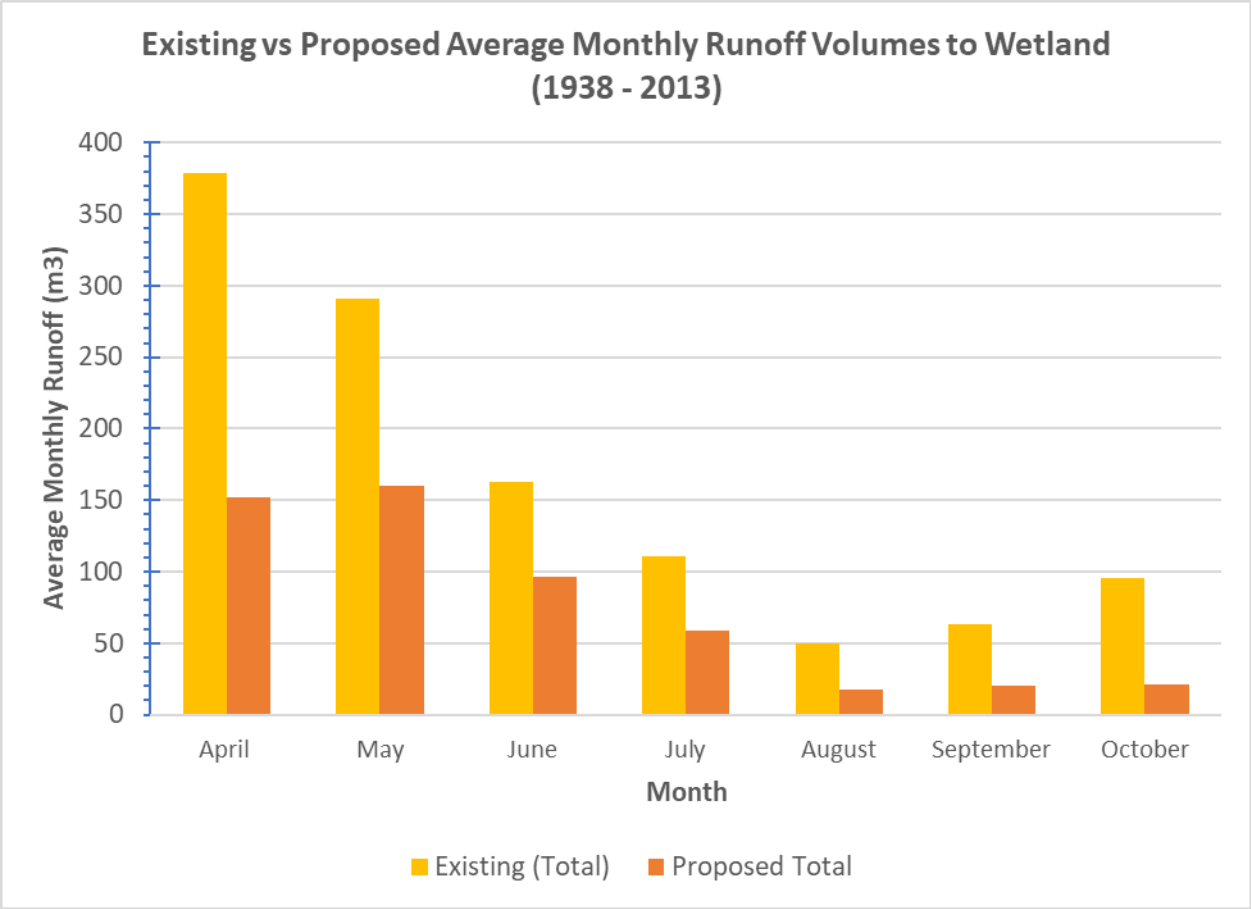
Graph 4-3 - Proposed Average Monthly Runoff Volumes to Wetland (1938-2013)



Graph 4-4 - Proposed Average Monthly Runoff Volumes to Wetland (1938-2013) – Growing Season



Graph 4-5 - Existing vs Proposed Average Monthly Runoff Volumes to Wetland (1938 – 2013)



Graph 4-6 - Existing vs Proposed Average Monthly Runoff Volumes to Wetland (1938 – 2013) – Growing Season

4.2 Groundwater Resources

The following sections provide an overview of the general hydrogeological characteristics of the Study Area. The hydrogeological conditions were evaluated using the data collected from the MECP water well records, on-site monitoring wells and surface water stations installed as part of this investigation and existing reports for the area.

4.2.1 Local Groundwater Use

As part of the hydrogeological study, DS completed a search of the MECP Water Well Record (WWR) database. A summary of the search is presented in **Table 4 and Figure 1, Appendix C1** which shows the location of all MECP-registered water well records within a 500m radius of the Study Area. A review of the water well records indicated that there are one hundred and thirty-four (134) water wells within the 500 m radius of the Study Area. The depths of these wells range from 4 to 27 mbgs. Of the one hundred and thirty-four (134) well records, the following well types are listed:

- one hundred and twenty (120) wells were noted for domestic use;
- three (3) are listed as public use monitoring wells;
- one (1) is listed for commercial use;
- one (1) is listed for livestock use;
- one (1) was listed as a monitoring well/test hole; and,
- seven (7) wells were listed as not in use or unknown.

A private door-to-door water well survey was conducted by DS staff on February 5, 2021 to assess the location of water wells within the expected zone of influence (ZOI) of the proposed construction dewatering operations. During the survey, a questionnaire was completed with the well owners, where possible. It was noted that most homeowners were not available at the time of the well survey, and a letter was left to inform them of the survey program and to encourage the residents to contact the DS office. The private well survey was conducted in the following streets within the vicinity of the proposed sanitary servicing:

- Confederation Street
- Glen Crescent Drive
- Mountain Street
- Main Street / Wildwood Road
- Beaver Street

Based on the results of the survey program, a total of sixteen (16) homeowners provided information regarding the source of their domestic water use. A summary of the responses received, or water wells identified on the front yard of properties during the survey program, are provided in **Table 3-1**.

Table 3-1 Private Water Well Survey Response Summary

Address	Date Knocked	Response?	Well Present?	Well ID	Sampled?
6 Glen Crescent Dr.	05-Feb-21	Yes	No	N/A	N/A
8 Glen Crescent Dr.	05-Feb-21	Yes	No	N/A	N/A
5 Glen Crescent Dr.	05-Feb-21	Yes	No	N/A	N/A
124 Confederation St.	05-Feb-21	No	Yes (Visible in Front Yard; Dug Well)	N/A	N/A
126 Confederation St.	05-Feb-21	No	Yes (Visible in Front Yard; Dug Well)	N/A	N/A
14 Mountain St.	05-Feb-21	Yes	No	N/A	N/A
100 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
98 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
94 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
86 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
84 Confederation ST.	05-Feb-21	Yes	Unknown (Tenants)	N/A	N/A
3 Wildwood Road	05-Feb-21	Yes	No	N/A	N/A
60 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
58 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
60A Confederation St.	05-Feb-21	Yes	No	N/A	N/A
56 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
52 Confederation St.	05-Feb-21	Yes	No	N/A	N/A
48 Confederation St.	05-Feb-21	Yes	No	N/A	N/A

Based on the results of the survey program, none of the interviewed homeowners were on well water and all reported receiving their water supply from municipal servicing. During the survey program, two (2) dug water wells were noted in the front yard of 124 and 126 Confederation Street respectively, however the residents were not available for further questioning. An email response from a homeowner located at 9 Mountain Street was received on February 5, 2021 indicating the property is connected to municipal servicing and the water well is no longer in use. Furthermore, it was reported by a local resident that all properties in the area were connected

to municipal servicing in the early 1990s. Based on the results of the survey program, there may be some existing water wells in the area, however they are not expected to be currently in use and/or are not the primary source of water for the residents. Additionally, the following servicing drawings were provided to DS for review:

- *"Drawing: G-2006: Watermain Extension, Confederation Street – Glen William, Town of Halton Hills, From Main Street to 160 m south of Mountain St."*, by McConnel Maughan Limited, dated: October 1991, File No.: 601E;
- *"Drawing: G-2007: Watermain Extension, Confederation Street – Glen William, Town of Halton Hills, From 160 m south of Mountain St. to 100 m South of Glen Crescent Drive"*, by McConnel Maughan Limited, dated: October 1991, File No.: 601E;

Based on the above, use of groundwater in the area for domestic purpose is not considered to be likely in the area within the expected ZOI during the construction period.

4.2.2 Groundwater Level Monitoring

The ten (10) monitoring wells installed by DS were used for the current hydrogeological assessment to assess groundwater conditions on the Subject Lands. Groundwater level monitoring was completed as part of the current investigation by DS between July 2019 and July 2020. **Table 1, Appendix C1** presents the reported groundwater levels in all monitoring wells. Throughout the Study Area and monitoring program, groundwater levels were found to range between 227.16 masl (MW19-14, November 2020) and 238.93 masl, (MW 19-8, April 2020) representing the groundwater elevation within the overburden at the Subject Lands. Based on the groundwater levels measured in October 2019 for deep piezometers and monitoring wells, groundwater flow direction was determined to be in a south east direction toward the confluence of the tributary and the Credit River as shown in **Figure 4, Appendix C1**. Using an average horizontal distance between groundwater contours, the horizontal groundwater gradient was determined to be approximately 0.03 m/m.

MW19-1 & MW19-5 to MW19-9

Monitoring wells MW19-1 and MW19-5 to MW19-9 are located within the proposed residential subdivision on the Subject Lands. Surface elevations at the boreholes range from 241.08 to 250.21 masl. Water level monitoring at these locations included collecting manual measurements and continuous measurements from MW19-6 which is presented in **Hydrograph D-1, Appendix C1**. Monitoring wells MW19-1, MW19-5, MW19-7 and MW19-9 were found dry during each monitoring event between July 2019 and July 2020. Groundwater measurements from MW19-6 and MW19-8 indicate that potentiometric water levels are about 4.5 m to over 6.1 metres below the ground surface from July 2019 to July 2020 with the highest groundwater elevation recorded in April 2020 at approximately 238.93 masl at MW19-8. Groundwater levels appear to be a subdued reflection of the ground surface throughout the majority of the Subject Lands.

MW19-13 to MW19-16

Monitoring wells MW19-13 to MW19-16 are located along Confederation Street and Main Street in the vicinity of the proposed external sanitary extension. Water level monitoring at this location included collecting manual measurements which are presented in **Hydrograph D-2, Appendix C1**. The water levels indicate that

potentiometric water levels are below the ground surface from November 2019 to July 2020 at MW19-13 and MW19-14 with the highest elevation recorded at about 228.12 masl (January 2020) at BH19-13. at MW19-15 water levels appear to rise above the surface up to 0.42 m above in March 2020 to an elevation of 229.17 masl at MW19-16 the well commonly froze over during the winter months making it inaccessible. It is expected that the water level at MW19-16 is also above the ground surface throughout most of the year.

4.2.3 Hydraulic Conductivity

Single Well Response Tests (SWRTs) to assess in-situ hydraulic conductivity (K) were completed by DS in November 2019 at seven (7) installed monitoring wells. The testing was completed using data loggers placed at the bottom of the monitoring wells to accurately measure the change in hydraulic head versus time. Manual water level measurements were also collected to confirm datalogger readings. K-values were calculated using the Bouwer & Rice method. At the interior monitoring wells, the K-values ranged from 1.13 x 10^{-5} m/sec in the sand and gravel unit to 4.53 x 10^{-7} m/sec in the silt unit. At the exterior wells, k-values ranged from 1.21 x 10^{-6} m/sec to 8.38 x 10^{-8} m/sec in the shale unit. **Table 4-7** presents a summary of the Hydraulic Conductivity (K) results for the testing. Individual reports are provided in **Appendix B of Appendix C1**.

Table 4-7: Summary of Hydraulic Conductivity Results

Monitoring Well	Depth (mbgs)	Sample Screened Interval (masl)	Screen Formation	In-situ Hydraulic Conductivity (K) (m/sec)
MW19-5	6.1	244.1-247.1	Sand & Gravel/Silt	1.13 x 10^{-5}
MW19-6	6.1	235-236.5	Sand & Gravel	9.87 x 10^{-6}
MW19-7	6.1	236.5-238.0	Silt	4.53 x 10^{-7}
MW19-8	6.1	237.3-238.8	Silt	7.17 x 10^{-6}
MW19-9	6.1	241-244.0	Silt/Sand & Gravel	1.01 x 10^{-5}
MW19-15	14.1	214.7-217.7	Shale-Queenston Formation	8.38 x 10^{-8}
MW19-16	11.1	213.8-216.8	Shale-Queenston Formation	1.21 x 10^{-6}

4.2.4 Surface Water Monitoring

Shallow groundwater and surface water levels were monitored along the tributary of the Credit River at two (2) upgradient locations that enter the Subject Lands at SG1 and SG2 and at one (1) downstream location (SG3) that exits the Subject Lands, as shown in **Figure 3, Appendix C1**. Additionally, a wetland located at the base of a slope between the proposed development and the tributary was monitored (SG4). Each station includes a staff gauge (SG) installed in the watercourse/wetland and shallow and deep piezometer to compare shallow groundwater levels. Stream transects were also constructed to provide consistent locations for flow measurements within the tributary. Surface water level monitoring results at each station include manual and continuous water level measurements which are presented in **Figures D-3 and D-4, Appendix C1.**

Continuous measurements from upstream stations SG1 shows that the watercourse has minimal responses to precipitation following rain events July through October 2019. At this time, streamflow at SG1 was measured ranging from dry conditions in late August to flowing conditions measuring at about 5 L/sec in July and October. Dry stream conditions in August correspond to low groundwater levels measured at piezometer nest PZ1 s/d. Larger responses to precipitation were recorded November 2019 through March 2020. Stabilized water levels within the watercourse begin to rise in November corresponding to increases in groundwater levels and measured flow. Based on comparisons to groundwater levels, there appears to be groundwater contributions throughout the winter and spring months at SG1 where water levels in the deep piezometer PZ1d were measured above water levels within the channel.

Manual measurements from upstream stations SG2 shows that the watercourse has similar seasonal variations to those measured at SG1. Streamflow at SG2 was measured ranging from dry conditions in late August to flowing conditions of about 1.5 L/sec in July and October. Dry stream conditions in August correspond to low groundwater levels measured at piezometer nest PZ2 s/d. Stabilized water levels within the watercourse begin to rise in November following a precipitation event at which time the highest flow was 3.4 L/sec. Based on comparisons to groundwater levels, there appears to be limited groundwater contributions throughout the winter and spring months at SG2 where water levels in the deep piezometer PZ2d were consistently measured below water levels within the channel.

SG3 is located at a downstream point where the tributary exits the Subject Lands. Similar to SG1, the watercourse has minimal responses to precipitation following rain events July through December 2019 with larger responses recorded January through March 2020. The water level in PZ3d is typically comparable to slightly higher than water levels measured within the SG3 channel. Shallow groundwater levels measured in piezometer PZ3s appears to be approximately 0.2m higher than deep groundwater levels measured at PZ3d. The measurements indicate that there is likely some groundwater contribution to the watercourse in the area of SG3 throughout the year. Water levels are within 0.15 m difference between PZ3d and SG3 throughout the year. This corresponds to streamflow measurements recorded at SG3 which shows the stream gains an average 3.5 L/sec of flow between upstream transects at SG1 and SG2 and the downstream SG3 location. The largest increase in flow was observed in August 2019 when a flow of 9.2 L/sec was measured at SG3 and upstream stations SG1 and SG2 were dry. Similarly, in March 2020 a flow of 19.3 L/sec was measured at SG3 and the combined flow of SG1 and SG2 were measured at 14.3 L/sec.

4.2.5 Wetland Hydrology

An objective of the hydrogeological investigation was to characterize a wetland that exists southeast of the development area of the Subject Lands at the bottom of a slope that runs east to west and then north connecting to the local valley system. The wetland is considered a combination of meadow, shallow marsh and cedar swamp. Portions of the wetland appear to be linked to the tributary and may receive surface water contributions via overflow during high flow conditions. Other areas of the wetland (cedar swamp) appear to have a relatively small drainage catchment area without a defined inlet from the surrounding drainage catchment. For the most part there are no surface water features associated with the wetland apart from areas of marsh on the west corner outside the cedar swamp wetland boundary and a drainage channel downgradient of the wetland boundary which serves as a drainage outlet for the wetland.

SG4 is located in the marsh section of the wetland that appears to be unconnected, at least directly, to the

tributary. It is mostly ponded water with a poorly defined outlet. Drainage from the wetland appears to occur overland toward the cedar swamp in an east direction. Water levels at SG4 appear to be influenced by precipitation events which can be seen in the hydrograph provided in **Figure D-4, Appendix C1**. The wetland also appears to have conditions indicative of groundwater contribution. With the exception of August 2019, groundwater levels were consistently measured above the wetland bottom with upward groundwater gradients. An example includes measurements from March 23, 2020, when the manual water levels in PZ4d, and PZ4s were 233.91 and 233.77 masl, respectively. Flow from the marsh was observed and measured only once during the March 23, 2020 monitoring period where it was observed flowing overland in an east direction toward the cedar swamp. Flow was estimated to be about 1 L/sec however, due to the absence of a defined channel, flow measurements should be considered with a high degree of uncertainty.

Two piezometer nests (PZ5s/d and PZ6s/d) were installed within the cedar swamp to monitor shallow groundwater levels. The location of the piezometers are shown in **Figure 3, Appendix C1**. The piezometers were installed within hand augured boreholes at a depth of 1m (shallow) and 2m (deep) below ground level. Based on the results of auguring, the wetland is directly underlain by a unit of peat up to 2m in depth. Comparing borehole logs BH19-01, BH19-06 and BH19-13, the peat is expected to be underlain by sand to silty sand, possibly gravel overlaying shale bedrock.

A groundwater seepage along the bottom of the slope into the cedar swamp was observed approximately 10m upgradient of the piezometer nest PZ5. The discharge was observed to infiltrate back into the soils at the bottom of the slope in the vicinity of PZ5. Shallow groundwater levels measured at piezometer nest PZ5s/d and PZ6s/d in April 2020 show near surface groundwater levels with a neutral to slightly downward groundwater gradient suggesting that upward gradients are only seen along the bottom of the slope as noted at piezometer nest PZ4s/d.

Based on the results, it is expected that the groundwater table within the cedar swamp has some seasonal variation. Using measurements observed at SG4, a decrease in groundwater levels up to 2m can be expected July through September until October when levels are observed to increase. The drop in water levels is expected to be in response to evapotranspiration demands throughout the summer months.

To estimate groundwater contributions to the wetland both lateral and vertical gradients were considered. Lateral Flow velocity through the silty sand soils toward the wetland is estimated at 1×10^{-6} m/s using the Darcy flux equation and estimates of effective porosity for the soils. Using the same equation, upward (vertical) flow velocity is estimated at an average 4.5×10^{-6} m/s based on vertical gradients measured July 2019 through July 2020 between PZ4s and PZ4d. The equation used is stated as follows:

$$V = K(\Delta H/\Delta L)/NE$$

Where,

K = Hydraulic Conductivity (1×10^{-5} m/s)
(ΔH/Δ:L) = Horizontal Gradient (0.03) / Vertical Gradient (0.14)
n_e = Effective Porosity (0.30)

Lateral groundwater contributions to the wetland can be estimated using the cross-sectional area of the upgradient side (northwest side) of intercepting wetland which include a length of approximately 250 m and a discharge area of 2 m at the bottom of the slope. Using the resulting area (~500 m^2), the lateral groundwater contribution to the wetland across the west boundary is estimated at about 1.5 x 10^{-4} m^3/sec or 0.15 L/sec.

Upward vertical flow through the overburden soil into the bottom of the wetland was estimated to occur only within upgradient portions of the wetland based on data collected from piezometer nests PZ5s/d and PZ6s/d. Considering the length (~250m) of the upgradient side of wetland a total area of about 2,500 m^2 was considered. Based on the measurements, the annual average vertical groundwater contribution to the wetland is estimated at 3.3 x10^{-3} m^3/sec or about 3.3 L/sec. Using vertical gradients measured from PZ4s/d, monthly contributions range from about 0.15 L/sec (August 30, 2019) to about 5.3 L/sec (Feb 20, 2020). Groundwater level monitoring results for PZ4s/d and estimated monthly groundwater contribution to the wetland is presented in **Figure D-4, Appendix C1**.

Based on the data provided, the high hydraulic conductivity soils underlying the wetland and a consistent horizontal and upward vertical groundwater gradient toward the feature provide a consistent contribution of groundwater to the system. As a result, the hydrologic system for the cedar swamp appears to be mainly sustained by groundwater with little dependence on surface water runoff.

4.2.6 Groundwater Quality

To assess groundwater quality and evaluate options for discharging water to Halton Region's sanitary/storm sewers, two (2) groundwater samples were collected on July 19, 2019 from MW19-6 and MW19-8. The samples were submitted under chain of custody to ALS Environmental, a CALA certified laboratory, for chemical analysis and compared to Halton Sanitary Sewer By-Law No. 02-03 criteria. The reported results indicate that several parameters exceeded sanitary sewer criteria from MW19-6, and that there were no exceedances from the samples obtained from MW19-8. The certificate of analysis is provided in **Appendix F of Appendix C1**. Exceedances are summarized in **Table 4-8** below.

Table 4-8: Parameters in Groundwater Exceeding Halton Region Sewer Use Bylaw

Parameter	Unit	Sanitary Sewer Use Bylaw Criteria	Storm Sewer Use Bylaw Criteria	BH19-6 Concentration	BH19-8 Concentration
Total Suspended	mg/L	350	N/A	**<u>91,800</u>**	27.6
Phosphorus- Total	mg/L	10		**22.9**	0.471
Aluminum-Total	mg/L	50		**1340**	1.03
Arsenic-Total	mg/L	1		**1.02**	0.0013
Copper-Total	mg/L	3		**6.90**	<0.010
Iron-Total	mg/L	10		**2,280**	2.16
Manganese-Total	mg/L	5		**119**	0.0455
Titanium- Total	mg/L	5		**19.3**	0.0231
Zinc-Total	mg/L	3		**6.20**	<0.030

Bold- Exceeds Sanitary Sewer use By Law Criteria

<u>Underlined</u>- Exceeds Storm Sewer use By Law Criteria

4.2.7 Surface Water Quality

Baseline surface water quality samples were collected and analyzed at locations SG2 and SG3 on July 23, 2019. Analytical results were compared against the Provincial Water Quality Objectives (PWQO). Copies of the certificates of analyses are included in **Appendix F of Appendix C1.** Exceedances of the PWQOs are summarized in **Table 4-9** below.

Table 4-9: Parameters in Surface Water Exceeding PWQO

Parameter	PWQO (mg/L)	Unit	SG2	SG3
Phosphorus (P)-Total	0.01	mg/L	0.0238	0.0223
E.Coli	100	CFU/100ml	900	320
Aluminum (Al)- Total	0.015	mg/L	0.175	0.132

4.2.8 Infiltration Testing

In total, ten (10) in-situ infiltration tests were completed on July 10, 2019 using the double ring infiltrometer method at five (5) locations. At each location, shallow and deep tests pits were dug approximately 0.2 mbgs and 1 mbgs, respectively, within silty sand soils. The location of the infiltration test pits is shown on **Figure 3, Appendix C1.** The infiltration test was conducted in general accordance with guidelines outlined in the Low Impact Development (LID) Stormwater Management Planning and Design Guide for stormwater infiltration, 2010. Results of the testing are shown in **Table 4-10** and were plotted in Time (s) Vs. Infiltration (mm) graphs shown in **Appendix E of Appendix C1.**

Table 4-10: Summary of Infiltration Rates

Infiltration Test	Measured Infiltration rate (mm/hr)	Average Infiltration Rate-Shallow (mm/hr)	Average Infiltration Rate-Deep (mm/hr)
IT-1S	156	131	93
IT-1D	283		
IT-2S	167		
IT-2D	26		
IT-3S	161		
IT-3D	103		
IT-4S	121		
IT-4D	173		
IT-5S	76		
IT-5D	51		

The in-situ result indicates that the silty sand material has an average infiltration rate of approximately 131 mm/hr approximately 0.3 mbgs and an average infiltration rate of approximately 93 mm/hr approximately 1 mbgs. Based on the results, the potential for infiltration is high due to the high permeability of the soils. During the time of the in-situ testing, groundwater was not encountered. Generally, design infiltration rates are used

for the design of on-site LID measures. Design infiltration rate can be obtained by applying safety correction factors to measured infiltration rates as per the Table C2 in the "Low Impact Development Storm Water Management Planning and Design Guide" (Appendix C).

Considering the location/distribution of the proposed swale system provided in the FSR (Urbantech, 2021), a geometric mean of the 1m depth in-situ test results were used to develop a design infiltration rate for the swales. Using the measured average of 93 mm/hr, a design infiltration rate of 37 mm/hr should be considered.

4.3 Water Balance

A water balance study was completed to predict changes to hydrological conditions at the Subject Lands as a result of the proposed development and to assess potential risks to the tributary and wetland along the south and east boundary. The assessment includes catchment mapping and risk evaluation using the Wetland Water Balance Risk Evaluation guidelines provided by the Toronto and Region Conservation Authority (TRCA, Nov 2017). The wetland complex is made up of a series of wetland community types that include mineral cedar swamp, cattail meadow marsh, organic cedar swamp, reed canary grass meadow marsh and shrub swamp thicket. The total area of the wetland complex is approximately 8.2 ha and it is fed by two distinct sources of water. The large Catchment A1 drains a tributary of the Credit River and feeds the mineral cedar swamp and meadow marsh located at the eastern portion of the property. This area has standing water in the spring and is the location of observed amphibian breeding. Catchment B1 is a very small surface catchment that feeds the organic cedar swamp. Groundwater investigations of the organic cedar swamp found that ground water contributions to this wetland community were the dominant source of water. Based on the small size of the surface catchment, these groundwater contributions are likely regional. Catchment B2 drains over the surface to the meadow marsh as the east of the property, as well as the swamp thicket. The wetland complex on a whole has a low hydrological risk based on the changes to the catchment however, sub-catchments within the wetland have medium risk hydrologic alterations. The ecological sensitivity of the wetland is medium to high based on the vegetation communities present, as well as the presence of breeding spring peepers. Overall, based on the low hydrological risk, the assessed risk is low.

Recognizing the medium hydrologic risk at the subcatchment level for Catchments B1 and B2, mitigation measures to maintain infiltration through Low Impact Development have been proposed. Further, run-off is mitigated through rear yard drainage and conveyance of the external flows from the north. The net result of a small decrease in runoff to Catchment B2 is more than offset by the large groundwater contributions to the organic cedar swamp. Increases to runoff in Catchment B2 drain to the Low sensitivity communities (Reed Canary Grass Meadow Marsh and Red Osier Dogwood Thicket). The assessment that was completed is summarized in **Table 4-11**.

Table 4-11 Wetland Risk Evaluation

	Catchment A1	Risk	Catchment B1	Risk	Catchment B2	Risk	Overall	Overall Risk
Hydrologic Parameters								
Predevelopment Catchment Size (m^2)	1,724,044		69,840		109,319		1,903,203	
Total Developable Area (m^2)	1,500		1,440		22,150		25,090	

	Catchment A1	Risk	Catchment B1	Risk	Catchment B2	Risk	Overall	Overall Risk
Area of Wetland (m^2)	28,124		40,732		13,582		82,438	
Percent Impervious Planned	0%	Low	20%	Medium	17%	Medium		Low
Size of Post Development Catchment (m^2)	1,723,702 (-0.02%)	Low	57,046 (-18.3%)	Medium	129,737 (+18.7%)	Medium	1,910,485 (+0.3%)	Low
Magnitude/Duration of Water Taking	Minimal to no water taking within this catchment	Low	Minimal to no water taking within this catchment	Low	Minimal to no water taking within this catchment	Low	Minimal to no water taking	Low
Locally Significant Recharge Present	Not identified on subject property	Low	Not identified on subject property	Low	Not identified on subject property	Low	Not identified on subject property	Low
Ecological Parameters								
Vegetation Community	SWC 1, MAMM 2-4 (Cattail)	Medium	MAMM 2-4 SWCO 1-2	Medium	MAMM1-3 (Reed Canary Grass) SWTM 2-1	Low	SWC 1, MAMM 2-4 SWCO 1-2 MAMM 1-3	Medium
Fauna	Spring Peeper	High						High within meadow marsh
Flora		Medium		Medium		Low		Medium
Habitat Features	Amphibian Habitat for Spring Peeper	High						High within meadow marsh
Wetland Hydrologic Type	Riverine	Low	Palustrine	High	Palustrine	Low	Riverine/Palustrine	Low-High

Based on the results of the evaluation, a Feature Based Water Balance (FBWB) was completed. The assessment involved completing a pre and post-development Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) for each catchment intersecting the Subject Lands. Based on available mapping, the wetland feature and tributary include only the three most southerly catchments out of five mapped as intersecting however, to include an overall assessment of the Subject Lands, each of the catchments were included. The results of the study provide support for overall servicing and guidance for integration of Low Impact Development (LID) measures.

4.3.1 Subcatchment Areas

4.3.1.1 Pre-development Subcatchments

Pre-development subcatchment mapping was completed to document existing drainage patterns across the Subject Lands and determine which areas are within the catchments of the tributary and wetland. Topographical divides were delineated using spatial analysis GIS software to analyze digital elevation data from the Provincial Digital Elevation Model (MNR, 2015). The Pre-Development subcatchment map is presented in **Figure 6, Appendix C1**.

The mapping shows five separate subcatchments currently intersect the Subject Lands. The largest subcatchment (A1) is mapped as draining directly into a tributary of the Credit River which runs through south and western portions of the Subject Lands. Subcatchment A1 contains a wetland at the downgradient extent of its boundary where there is a confluence with an external tributary from an adjacent subcatchment. Subcatchments B1, B2 and B3 are mapped as draining toward a swale located approximately 20m outside the southeast boundary of the Subject Lands. The swale flows east toward Confederation Street where it enters a culvert and is conveyed to the Credit River. Subcatchments B1 and B2 contain a wetland at the downgradient extent of their boundary. Subcatchment C1 is the northern most drainage area which includes external drainage toward Confederation Street.

4.3.1.2 Post-Development Subcatchments

Post-development subcatchment mapping was completed to document proposed changes to existing drainage patterns for subcatchments A1, B1, B2, B3 and C1. Changes to Subcatchment A1 includes some grading along the south slope of the proposed development which results in a loss of area totaling about 851 m^2, resulting in a 0.05% reduction in total catchment area. Subcatchments B1 and B2 include the majority of the proposed development. Changes to these subcatchments include an area reduction of about 16,016 m^2 (22.93% total decrease) for B1 and an area increase of 25,942 m^2 (23.73% total increase) for B2. The change is the result of the proposed drainage plan which directs stormwater to a single outfall located at the development boundary in the B2 subcatchment.

Subcatchments B3 and C1 include the majority of existing development and the road entrance for the proposed development along Confederation Street. Changes to these subcatchments include an area reduction of about 8,968 m^2 (31.03% total decrease) for Subcatchment B3 and an area increase of about 106 m^2 (0.31% total increase) for Subcatchment C1. The Post-Development Subcatchment Map is presented in **Figure 7, Appendix C1**. A summary of changes to catchment size and imperviousness is provided in **Appendix G, Table G-5 of Appendix C1**. The Proposed Storm Drainage Plan and an Imperviousness Plan were provided by Urbantech.

4.3.2 Thornthwaite Water Balance

To estimate potential hydrologic changes to the subcatchments as a result of the proposed development, a Thornthwaite Water Balance was completed for all subcatchments intersecting the Subject Lands and adjacent

natural features. The model was developed using 30-year climate normals from a nearby station and generalized site conditions including existing and proposed land uses.

The existing conditions across Subcatchments A1, B1, B2, B3 and C1 include a silty sand loam soil type on a hilly terrain with pervious cover consisting of pasture and shrub, forest and shallow rooted crop. In addition, Subcatchments A1, A2 and B1 have existing impervious surfaces consisting of rooftops and paved surfaces from existing development along Confederation Street, McMaster Street and 8th Line. **Table 4-12** shows the pre-development catchment breakdown of land uses for each subcatchment.

Table 4-12 – Pre-development Conditions

Subcatchment	Pre-development catchment area (m^2)	Mature Forest (m^2)	Pasture and Shrub (m^2)	Shallow Rooted Crop (m^2)	Landscaped (m^2)	Impervious Surface (m^2)
A1	1,724,044	431,692	189,573	1,065,148	36,131	1,500
B1	69,840	36,801	33,039	-	-	-
B2	109,319	42,755	63,728	-	2,736	100
B3	28,899	6,167	2,787	-	11,275	8,670
C1	34,764	555	17,830	-	7,688	8,691

Areas proposed for development are primarily within pasture and shrub areas across Subcatchments B1 and B2. The proposed development land uses are estate residential and include a street and open space. Without mitigation, it is assumed that traditional stormwater management techniques would collect and convey stormwater from the majority of the developed area to an outlet proposed in Subcatchments B2, discharging at the southeast boundary of the Subject Lands. The back yards of Lots 17 to 24 are proposed to drain via overland flow toward the wetland in Subcatchments B1 and B2. **Table 4-13** shows the post-development catchment breakdown of land uses for each subcatchment.

Table 4-13 – Post-development Conditions

Subcatchment	Post-development catchment area (m^2)	Mature Forest (m^2)	Pasture & Shrub (m^2)	Shallow Rooted Crop (m^2)	Landscaped (m^2)	Impervious Surface (m^2)
A1	1,723,193	431,700	188,714	1,065,148	36,131	1,500
B1	53,824	36,762	11,180	-	5,881	0
B2	135,161	30,700	52,461	-	34,015	17,985
B3	20,031	5,086	876	-	8,929	5,140
C1	34,658	444	18,005	-	7,518	8,691

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, Site latitude, precipitation and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspire (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST.

The annual water budget can be stated as:
P = ET + R + I + ST

Based on the physiographic setting and proximity to climate stations, the Georgetown WWTP Climate Station was chosen as the most representative climate data. The 30-year normal (average weather data) available from the Climate Station covers the period from January 1981 to December 2010.

To predict outputs of the pre-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, Site latitude, water holding capacity values for native soils and factors of infiltration. Various inputs and outputs of the model are described in detail in **Appendix C1.**

Post-development conditions across Subcatchments A1, B1, B2, B3 and C1 include changes to subcatchments boundaries and additions of impervious areas and pervious urban lawns replacing mainly pasture and shrub land use. The Drainage Plan provided by Urbantech includes conveyance of the north external drainage area in Subcatchment B2 and the majority of the proposed development area to a single outfall location at the downgradient development boundary. The plan also provides backyard overland drainage from Lots 17 through 24 in Subcatchment B1.

To predict outputs of the post-development water balance, the same 30-year average climate data and Site latitude inputs were used. Changes in land uses to landscaped areas (urban lawn) include a reduction in soil water holding capacity inputs and factors of infiltration to account for compaction during construction. Various inputs and outputs of the post-development model are described in detail in **Appendix C1**.

The results of the water balance show minimal change to Subcatchments A1 and C1 as a result of the proposed development. Subcatchments B1 and B3 appear to receive the majority of the infiltration and runoff deficits (2,854 and 2,632 m^3/yr, respectively for B1 and 918 and 3,673 m^3/yr, respectively for B3). The deficits are the result of an 22.93% decrease in catchment size for B1 and 30.69% decrease for B3. For Subcatchment B2 there is a slight increase in infiltration and a significant increase in runoff. This is expected as the majority of the proposed development is within Subcatchment B2.

Within the site boundary, the infiltration deficit totals 2,558 m^3/yr. To maintain the hydrologic function of the Subject Lands and that of the wetland located downgradient, LID measures designed to maintain infiltration across the Subject Lands should be considered. Maintaining groundwater gradients toward sensitive features such as the cedar swamp wetland will provide the groundwater contributions required to sustain groundwater levels within the wetland. Monthly contributions ranging from about 0.15 L/sec (summer) to about 5.3 L/sec (spring) were approximated based on piezometer measurements and soil characteristics. The wetland is considered to be dependent on groundwater contributions and not surface water run-on.

To maintain infiltration across the Subject Lands, a LID strategy has been provided in the FSR (Urbantech 2021). The strategy relies heavily on the use of road-side swales (referred to as Left Swale and Right Swale). The swales collect, store and infiltrate runoff from adjacent lots and Street A. The swales include stone infiltration trenches with a combined (Left and Right Swale) storage of 882 m^3 and additional surface storage within the swales of 1,530 m^3. The total area serviced by the system of swales includes the majority of the development consisting of about 29,228 m^2 of pervious landscaping and about 14,532 m^2 of impervious area comprising paved roads and rooftops.

Considering the swale catchment areas, available storage within the swales and runoff coefficients for pervious landscape (0.23) and impervious areas (0.85), as calculated from the post-development model completed by DS, it is estimated that the Left Swale LID will store runoff produced from up to a 150 mm event and the Right Swale a 100 mm event. As a result, it is expected that the swales will store and infiltrate runoff from over 99.9% of total annual rainfall depth within each corresponding LID catchment. Considering an approximate pore space of 40% within the 1.3m deep trench combined with the storage depth of the open swale (0.3m), a total of 0.82m of water column storage is provided. With a design infiltration rate of 37 mm/hr (average across the Subject Lands), the swales are expected to completely infiltrate from full conditions within 24 hours. Considering the storage in the swale system and the high infiltration potential, it is not expected that any runoff from this area would contribute to discharge from the stormwater outfall.

Areas of the development not serviced by the swales include the entrance road and run-on from existing

development areas along Confederation Street. These areas total about 4,787 m^2 of pervious landscaping and about 3,453 m^2 of impervious area comprising paved roads and rooftops. To treat and infiltrate stormwater generated over these areas, an end of pipe infiltration trench is provided at the downstream extent of stormwater outfall. The volume of storage within the trench is 75 m^3 and is expected to store and infiltrate runoff produced from up to a 20 mm event. Using estimated values from Figure 1a - % of Total Annual Average Rainfall Depth Vs. Daily Rainfall Amounts (Wet Weather Flow Management Guidelines, City of Toronto, 2006), the end of pipe infiltration trench will store runoff from approximately 90% of total annual rainfall depth. Considering the storage depth of the trench (0.75m x 40% pore space) and the design infiltration rate of 37 mm/hr (average across the Subject Lands), the trench is expected to completely infiltrate from full conditions within 24 hours.

Considering the effectiveness of the swale system and the trench, it is estimated that about 95% of the precipitation which falls within the Subject Lands will either evaporate, evapotranspire or infiltrate and recharge the local groundwater system. Detailed calculations and the monthly distribution of the mitigated water balance is provided in **Appendix C1, Table G-4**, and summarized in **Appendix C1, Table G-5 Appendix G**. The mitigation is estimated to increase overall site infiltration from pre-development conditions by about 17,711 m^3 which is a net benefit. Furthermore, the location of infiltration occurring in the post-development with mitigation scenario is well distributed across the proposed development. This is important for maintaining existing groundwater gradients and flow direction and removing potential impacts to downgradient wetland features.

4.4 Predicted Impacts

Groundwater contributions to the tributary and wetland occur year-round with increased contribution through the winter and spring as groundwater levels rise. A reduction in recharge over the Subject Lands as a result of the development may result in a lowering of the water table and thus a reduction in groundwater contribution. The water balance completed for the Subject Lands shows there is a total infiltration deficit of 2,558 m^3/yr. To reduce risk to the tributary and wetlands which significantly rely on groundwater contribution, the infiltration deficit should be removed by designing LIDs which encourage the infiltration of clean/treated sources of stormwater generated over the proposed development area. The LID design provided in the FSR (Urbantech 2021) appears to provide a suitable amount of infiltration to mitigate this risk.

Discharged water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for the discharge of pumped groundwater from any construction dewatering. It should be noted that construction dewatering in proximity to the tributary and wetland is not anticipated and that any zone of influence from construction dewatering for the external sanitary sewer connection is well outside the tributary and wetland boundary. It is however anticipated that dewatering in this area will temporarily take water from the Credit River although impacts are not currently anticipated.

The proposed SWM plan includes a LID strategy to ensure groundwater recharge is maintained from pre-development to post-development conditions. As a result, groundwater levels and gradients will be maintained

and will continue to provide groundwater contributions to downgradient features. For domestic groundwater supply wells in the area, no changes are expected. Users in the area of the proposed development draw supply from depths greater than the proposed construction which is anticipated to occur above the water table. Therefore, no effect on the operation of existing nearby domestic wells is expected. For the external sanitary sewer installation requiring construction dewatering, door-to-door survey results indicated that residences are municipally serviced in areas local to the sewer alignment. Any water wells present are expected to be a secondary supply.

To prevent degradation of groundwater quality within the immediate vicinity of the proposed development, it is suggested that only clean sources of stormwater be considered for infiltration LIDs. Additionally, engineered designs for discharged water from construction dewatering activities and storm sewer systems should ensure an adequate level of treatment to protect receiving areas and shallow groundwater quality. Despite an appropriate level of treatment, it is expected that small increases in urban pollutants such as those associated with de-icing (chloride and sodium) may occur in the shallow groundwater zone.

5. Biophysical Analysis

A biophysical analysis was used to evaluate the existing ecological features and functions and identify any constraints or limitations to the proposed development. In addition to the identification of constraints, opportunities are identified in which mitigation or restoration measures may be implemented to enhance the existing natural environment.

Constraints are identified as features or functions that prohibit or limit the development of an area due to their ecological significance or hazard potential. These features are assessed from a policy context and in field analysis to determine the extent of a feature and delineate the limits to development. Established setbacks are identified through the EIR process that provide physical distance measures from the edge of a developed area to the identified limit of the natural feature and/or function. Within the setback, ecological buffers may be proposed to minimize impacts on identified natural heritage features and provide opportunities for restoration, enhancement and net gain to existing natural heritage systems. Key Features, as identified in **Section 3**, are considered to be constraints to development. The following sections analyze the required buffers, linkages and enhancement areas that would also be considered constraints to development.

Through the constraint process, opportunities for restoration and enhancement to existing natural heritage features are presented. Opportunities typically include, but are not limited to, improving function of existing natural heritage features, providing or protecting movement corridors, linking nodes of natural heritage features and enhancing natural feature attributes.

5.1 Constraints to Development

As outlined in **Section 3**, secondary source information in conjunction with field investigations conducted for the Subject Lands was used to identify Key Features within the Study Area. In addition, as outlined in **Section 4**, the Study Area contains natural hazard constraints that must also be taken into consideration when identifying constraints to development. The following constraints to development/components of the RNHS were identified in **Sections 3** and **4**:

Key Features:

- Significant wetlands
- Significant woodlands
- Significant valleylands, based on the greater of physical top of bank or stable top of bank
- Significant Wildlife Habitat (Candidate)
- Fish habitat

RNHS Components in addition to Key Features:

- Watercourse within a Conservation Authority Regulation Limit
- Regulated flood plain

5.1.1 Buffers

The limits of the significant woodlands, valleylands and wetlands within the RNHS have been refined through the staking exercises with the Region and CVC. Those refined limits are reflected on **Figure 6, Appendix B1**. While Candidate SWH and fish habitat have been identified through this study, the limits of SWH are contained within the existing RNHS features associated with the woodlands, wetlands and valleylands as shown on **Figure 6, Appendix B1**.

As outlined in RHOP Section 115.3(4), buffers are also a component of the RNHS. Below is an evaluation of the recommended buffer widths to be included in the refined RNHS on the Subject Lands.

5.1.1.1 Wetland Buffer

Based on CVC regulatory policy, a 30m buffer to the wetlands is recommended. The overall constraint mapping (**Figure 8, Appendix B1**) incorporates this 30 m wetland buffer with no refinement.

5.1.1.2 Significant Valleyland Buffer

As described in **Section 3.3.5**, the CVC has advised that they require a 10 m grading and lot line setback from the greater of physical or stable top of bank of the lower-tier top of bank. A stable top of bank assessment was completed (**Appendix C1**) and the lower-tier physical top of bank was determined to be the stable top of bank along the eastern top of bank limit. Along the southern property limit, the physical top of bank was determined to be the stable top of bank. As shown on **Figure 5, Appendix B1,** with the exception of some minor grading behind Lot 24, no grading is proposed within the 10m setback from the stable top of bank and all lot lines are a minimum of 10m from stable top of bank however, in most cases, the setback is much greater than 10m. The 10m buffer is shown on **Figure 5, Appendix B1**.

5.1.1.3 Significant Woodland Buffer

There are two distinct woodland areas within the Subject Lands – a northern woodland and a southern woodland. These two areas are separated by a gap that is approximately 32 m in width. The northern woodland is associated with the Credit River tributary valleylands and is contiguous with a wooded area north of the Subject Lands within the Greenbelt Plan NHS. The Region has advised that, since the woodland on the Subject Lands is contiguous with the Greenbelt NHS woodland, the 30 m buffer afforded to the Greenbelt NHS woodland should extend southerly unless justification can be provided to reduce the buffer extent. Although the Study Team does not necessarily agree that a 30 m buffer is automatically required on a woodland that is outside of the Greenbelt Plan Area but contiguous with a Greenbelt NHS woodland, a 30 m lot line setback has been provided to this northern woodland. As shown on **Figure 7, Appendix B1**, some grading has been proposed within the 30m buffer in order to minimize the requirement for retaining walls. To minimize the amount of grading within the 30m buffer, the lots have been graded to maximize the amount of grade changes within the private realm to reduce the amount of grading required within the buffer. As can be seen on air photos as well as through site observations, the area of the 30m buffer is heavily disturbed as a result of previous excavation activities on the site, resulting in areas of exposed soil and limited vegetative cover. Although some grading is proposed within the 30m buffer, the proposed restoration plan for this area will be a significant improvement over existing conditions in this area.

As noted above, the southern woodland is not contiguous with the northern woodland. In addition, while meeting the definition of significant, the southern woodland is in a much more disturbed state than the northern woodland. As such, the Study Team is recommending a 10 m lot line setback from the dripline of the southern woodland. No grading is proposed within this 10 m setback.

5.1.1.4 Trails within Buffers

Trails within buffers are very limited throughout the plan. Two options have been provided for consideration: (1) utilize the existing informal trails; or (2) create a new looped trail behind Lots 13-16. The existing trails are well developed and transitioning them to formal trails would not require any widening or tree removal. However, the existing informal trails are within the 10m setback from top of bank as well as within the main valley/wetland. As a result of concerns raised by the agencies during the review of the 1st submission of the EIR, an alternative loop trail has been shown that provides for a new trail to be constructed behind Lots 13-16, outside of the 10m top of bank setback but within the 30m dripline setback. This option is proposed in an area of existing disturbance/historically altered topography so there are not anticipated negative impacts associated with Option 2. This option would result in the existing informal trails being restored and removed from active use.

A summary of the Key Features and other RNHS components as well as the recommended buffer widths, is provided in **Table 5-1**.

Table 5-1 Summary of Constraints to Development

Feature	Constraint to Development	Proposed Setback
Significant Wetland	Significant Wetlands identified within the RNHS. Limits of these features were staked with CVC staff. These features and proposed setback are wholly contained with the refined RNHS.	Minimum 30m lot line setback from staked limit
Significant Woodland – Northern Woodland	Significant Woodlands identified within the RHNS. Limit of this feature was staked with Halton Region staff. Woodland is contiguous with woodland to north of Subject Lands within Greenbelt NHS.	30 m lot line setback from staked dripline. Some grading is proposed within the 30m setback to eliminate use of retaining walls. Grading to accommodate the loop trail, if this is determined to be the preferred trail option, is also required but is proposed within an area of existing disturbance.
Significant Woodland – Southern Woodland	Significant Woodlands identified within the RHNS. Limit of this feature was staked with Halton Region staff. Woodland is not contiguous with woodland to north within Greenbelt NHS.	Minimum 10 m grading and lot line setback from staked dripline.
Significant Valleyland	A valleyland associated with the tributary of the Credit River is present on the Subject Property. The top of bank was staked with CVC staff and a stable top of bank assessment has been prepared. The physical top of bank has been confirmed as the stable top of bank.	Minimum 10 m grading and lot line setback from the staked/regulated top of bank associated with the western valley feature.
Top of Bank Feature	The top of bank feature along the southern property limit is associated with the wetland feature to the south. As such, the top of bank has not been evaluated as a significant valleyland however, the feature will be protected within the RNHS. The top of bank was staked with CVC staff and a stable top of bank assessment has been prepared. The physical top of bank has been confirmed as the stable top of bank.	Minimum 10m grading and lot line setback from top of bank with minor grading proposed within the 10m setback behind Lot 24.
CVC Regulated Watercourse	A tributary of the Credit River flows through the Subject Property. This feature and applicable setback are wholly contained within the RNHS. The feature is identified as having cold water species downstream and, as such, is to be managed as a coldwater feature.	Minimum 30 m grading and lot line setback from bankfull channel.
Significant Wildlife Habitat	Candidate SWH contained within the RNHS.	Follows the limits of identified Key Features and RHNS and will be protected with setbacks provided to the other significant features.
Fish Habitat	Fish habitat associated with the Credit River tributary is wholly contained within the significant valleyland component of the RNHS.	Minimum 15m grading and lot line setback from bankfull channel.

5.2 Buffer Management

Buffers associated with the proposed setbacks to identified natural heritage features are proposed to be planted with native species which will serve to minimize impacts from adjacent land use and increase the ecological function of existing features. Plantings within the buffer are proposed to mimic natural successional edges found around woodlands through the implementation of buffer zone plantings and should reflect the species composition of the forest within the RHNS. Two bands are recommended:

- Band 1: tree plantings immediately adjacent to the woodland
- Band 2: shrub plantings up to the edge of the buffer limit

For the northern woodland, each band is proposed to be 15m in width. A conceptual approach to the buffer planting is shown in **Figure 5-1** however, it is recognized that, as outlined in the CVC's email of March 4, 2020, in order to support the grading that is proposed between the lower and upper tier top of bank, a robust restoration and enhancement landscape planting plan is required to be prepared and implemented between the CVC regulated lower tier top of bank and the proposed new lot lines in order to provide an enhanced valley corridor compared to the current/existing condition.

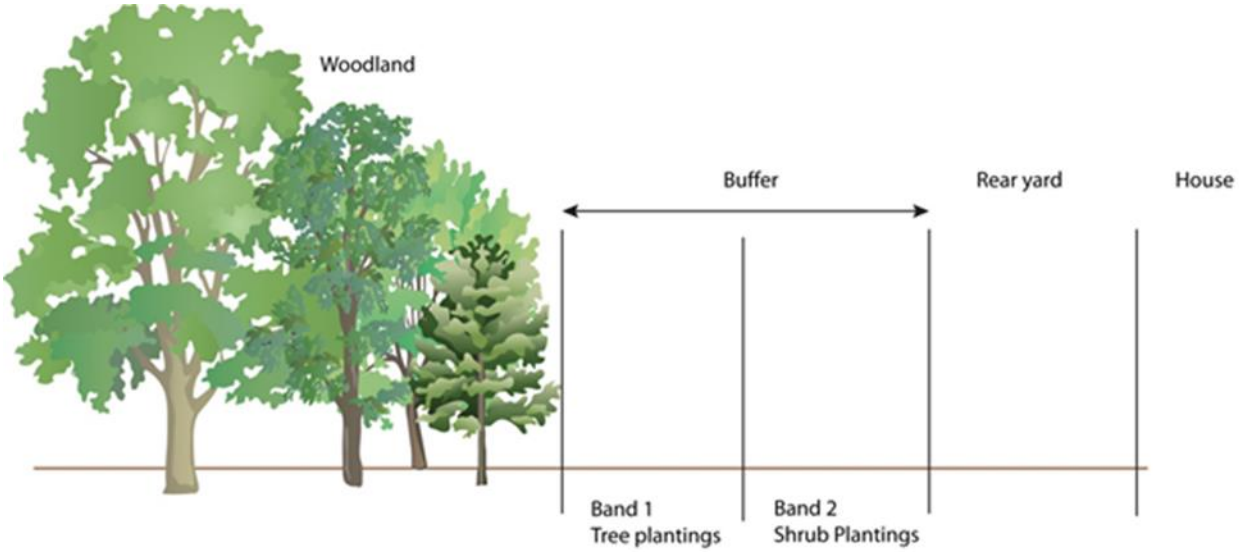


Figure 5-1. Proposed Buffer Planting Approach, Two Planting Bands of Trees and Shrubs

While the detailed restoration and enhancement landscape planting plan will be a condition of draft plan approval, in general, the plan should adhere to the following principles and should include the following species:

- For the southern RNHS components, the greater of a 30 m wetland buffer, 10 m woodland buffer and 10m stable top of bank buffer is proposed. For the northern RNHS components, the greater of a 30m wetland buffer, 30m woodland buffer and 10m stable top of bank buffer is proposed, with some grading proposed within the 30m from the woodland dripline and stable top of bank. The buffer approach in both areas should adhere to the following principles and consist of the following species:

- Planting of native and locally source (appropriate seed zone) trees, shrubs and forbs within the buffers is proposed to increase the biodiversity, provide wildlife habitat and protect the woodland and wetland edge from degradation;
- The buffer is proposed to be planted in two bands consisting of one dominated by trees immediately adjacent to the woodland and/or wetland edge and a second band of shrubs and herbaceous material. This planting scheme is intended to create a vertical stratification progression from the mature canopy to the private lots and a physical barrier to prevent encroachment and dumping within the protected features;
- Trees should be planted on 5m centres, with coverage of up to 60% of the area. Shrubs should be planted on 1.0 to 1.5m centres with coverage up to 30% of the area. The remaining open area should be planted with a seed mix selected from the CVC plant selection guideline (2018);
- All planted material should be maintained by regular watering throughout the plant warranty period. A watering schedule associated with restoration plantings has proven to be a significant success factor in restoration projects. It can take several months for roots to grow sufficiently beyond the planting hole to actively absorb nutrients and water from the surrounding soil. Initial watering should occur immediately following the installation of plant material. Care must be taken not to overwater planted material, soil should be cool and slightly moist but not wet. CVC post-plant care watering guidelines, recommends watering for the first two years, for 15 to 20 minutes twice a week during the growing season if no rain occurs. In the third year, change the frequency of watering to once a week if no rain occurs.

Table 5-2 Proposed Buffer Plant Species (Dry-Fresh Soil Moisture Regime)

Common Name	Scientific Name
Trees	
American Basswood	*Tilia americana*
Black Cherry	*Prunus serotina*
Red Oak	*Quercus rubra*
White Birch	*Betula papyrifera*
Sugar Maple	*Acer saccharum*
White Cedar	*Thuja occidentalis*
Shrubs	
Round-leaved Dogwood	*Cornus rugosa*
Red Elderberry	*Sambucus racemosa*
Smooth Rose	*Rosa blanda*
Choke Cherry	*Prunus virginiana*

Additional plants may be selected from the CVC plant selection guideline (2018) following the recommendations made therein.

5.3 Restoration and Enhancement Areas

Opportunities to enhance and restore existing natural heritage features are proposed within the RNHS. Disturbance within this area as a result of historical land use and existing recreational use has resulted in impacts to the ecological functions associated with the woodland, valleyland and wetland features.

The proposed development represents an opportunity to manage and restore portions of the RNHS through the installation of native plant species and wildlife habitat structures reflective of the local area. Native plantings will serve to increase biodiversity, enhance habitat for native wildlife species and provide a corridor function for species utilizing existing corridor.

Restoration and Enhancement Areas include the areas listed below. Refer to **Figure 7, Appendix B1**, for the location of Restoration and Enhancement Areas.

1. **Restoration Enhancement Area #1 (REA1)**: Located within the FODM5-9 and FODM7 communities. Existing recreational use is identified within these communities, including informal hiking and ATV trails. Impacts from on-going recreation use have resulted in disturbance to vegetation communities, soil compaction and the presence of non-native species. Opportunities to incorporate native plantings adapted to the community type are recommended.

   Opportunities to maintain the main existing informal trail running parallel to the watercourse and through the wetland to the southern limit of the property were discussed on-site with staff from the CVC, Town and Region on April 13, 2021. It was agreed that, given that there would be little work needed to make this informal trail into a formal trail (i.e., the informal trail is already quite wide and well-defined, no tree cutting would be required) maintaining the existing main informal trail is encouraged for recreation use for potential future landowners and the surrounding community. This would minimize and discourage further intrusion into the RHNS. The main informal trail is shown on **Figure 7, Appendix B1**. A short trail connection is proposed from the Walkway Block within the draft plan of subdivision to the existing informal trail is also shown on **Figure 7, Appendix B1**. Figure 7 also shows a potential connection from this informal trail to the publicly owned lands west of the Subject Lands. The exact alignment of this connecting trail would need to be undertaken in collaboration with the Town and would require a better understanding of where the trail on their property would be constructed for connection purposes. It is recommended that this could be a condition of draft plan approval.

   Given that it may take time to complete the trail connection to the Town's lands, a loop trail alignment, within the Subject is shown on **Figure 7, Appendix B1.** This loop trail consists of two walkway blocks, one between Lots 16 and 17 and the other between Lots 12 and 13 that provide entry into a trail system behind Lots 13 - 16 with a connection back to Street A. The ultimate location of the trail(s) can be a condition of draft plan approval.

2. **Restoration Enhancement Area #2 (REA2)**: Restoration of a recreational area (CGL_4) within the RHNS adjacent the FOMM2, FODM5 and SWC1 communities is recommended. This area is currently utilized for recreation use, primarily ATVs, which has resulted in the removal of vegetation and compaction and erosion of existing soils. This area is recommended to be planted with native trees and shrubs applicable to the surrounding NHS. Proposed species to include for planting reflect species chosen within **Table 5-3** for the buffer restoration areas. If a trail is proposed in the vicinity of REA2, educational signage is recommended to inform trail users of the restoration activities that are taking/have taken place and the importance of remaining on the approved trail.

3. **Restoration Enhancement Area #3 (REA3) (Optional, depending on ultimate trail location)**: This area runs along the extent of the existing informal trail that enters the valley and extends to the southern

property line. The informal trail intersects the Credit River tributary and existing meadow marsh wetlands and provides access to the CGL_4 community (REA2). The area is currently built up to provide light vehicular (ATV) and foot traffic to the southern limits of the property. Removing this access route and restoring that area to its natural condition will improve the ecological features and functions of the existing aquatic habitat and prevent future access to this area however, removal of this trail will eliminate an existing connection that could be used to create a trail connection into the Town-owned lands to the west. The option to restore REA3 has been maintained given that the agencies have not confirmed acceptance of the trail connection to the Town lands to the west. Ultimately, if the informal trail is maintained in order to facilitate a connection, REA3 would not need to be implemented.

Recommendations for native species to be planted within the proposed restoration enhancement areas, include species adapted to the local vegetation communities. For restoration areas with a higher soil moisture regime found within REA1 and REA3 (if REA3 advances to restoration), proposed species are provided in **Table 5-3.** For restoration areas with a dry-fresh soil moisture regime suited to REA2, proposed species are provided in **Table 5-2**.

Table 5-3 Proposed Restoration Plant Species (Fresh-Moist Soil Moisture Regime)

Common Name	Scientific Name
Trees	
American Basswood	*Tilia americana*
Red Maple	*Acer rubrum*
Trembling Aspen	*Populus tremuloides*
White Birch	*Betula papyrifera*
White Cedar	*Thuja occidentalis*
Shrubs	
Bebb's Willow	*Salix bebbiana*
Nannyberry	*Viburnum lentago*
Swamp Rose	*Rosa palustris*
Canada Elderberry	*Sambucus canadensis*

Through the protection of all existing significant natural heritage features (wetlands, woodlands, valleylands, wildlife habitat and fish habitat), the provision of appropriate buffers and the implementation of planting and restoration plans as outlined above, there will be a net gain in natural heritage features and functions in the Study Area.

6. Servicing

The purpose of this section is to outline the required servicing components for the proposed development. In addition to on-site servicing, there will be a need to extend the sanitary sewer to the existing pumping station on the south side of Main Street, east of the Credit River. This will necessitate the installation of a pipe southerly from the Subject Lands, along Confederation Street, then easterly along the southern limit of Main Street, below the Credit River to the pumping station on the east side of the river.

6.1 Sanitary Servicing

6.1.1 Existing Conditions

Based on the as-built site plan and plan & profile drawings provided by Stantec Consulting Ltd., there is an existing pumping station (Glen Williams Pumping Station), on the south side of Main Street and east of Confederation Street. The pumping station sends sanitary flow westerly via an existing 250 mm forcemain along Main Street. Based on the existing design sheet prepared by Stantec (July 2008), there is ample capacity downstream. Refer to **Appendix F1** for the capacity analysis of the downstream sewer.

There are no existing sanitary sewers along Confederation Street or near the Subject Lands for connections.

6.1.2 Proposed Conditions

To service the proposed development, new sanitary sewers are proposed within the Subject Lands and from the Subject Lands and along Confederation Street and Main Street to the existing pumping station, refer to **Figure 6**. The proposed sewer will accommodate sanitary flows from the Subject Lands, a future Bayfield Development north of the Subject Lands, and existing residential properties on the west side of Confederation Street south of the Subject Lands.

Based upon the latest standards and criteria prepared by Halton Region, the proposed Draft Plan projects a population of 116 and peak residential flow of 4.0 L/s, using a population density of 55 persons/ha and an infiltration allowance of 0.260 L/s/ha and the average dry weather flow of 275 L/c/day (refer to **Appendix F1**).

Sanitary servicing infrastructure for the Subject Lands is designed in accordance with the latest Halton Region standards and specifications. The sanitary sewers within the Subject Lands will consist of 200 mm sewers with slopes ranging from 0.5% – 5.0%. Sewers along Confederation Street and Main Street will be 200 mm sewers as well. The minimum self-cleaning velocity of 0.6m/s can be achieved at all locations as indicated on the sanitary sewer design sheets in **Appendix F1**.

The proposed sewers are required to cross under the Credit River on the south side of Main Street in order to connect into the Glen Williams Pumping Station. The 200mm sewer will be installed beneath the Credit River via tunneling (methodology to be confirmed at detailed design). The 200mm sewer will connect to a new sanitary manhole east of the river, from which a sewer will be extended to the existing pump station maintenance hole that is directly connected to the downstream pumping station. The proposed sewer depth is consistent with the existing sanitary crossing of the Credit River as shown in **Figure 8**. The proposed sanitary sewer is gravity-drained up to the existing pumping station.

The pump station has the capacity to accommodate proposed wastewater flows from the Subject Lands, the future Bayfield Development, and the existing residential properties.

GRA evaluated the potential for scour from the streambed to erode / expose the proposed sewer crossing. Their scour analysis report in **Appendix E1** concludes that there will be no impact to the proposed services based on the watercourse velocities provided that the proposed protection measures are implemented.

CVC requested reconsideration of the scour protection depth following review of the 1st submission of the EIR/ FSR to meet CVC's current crossing requirements per their *Fluvial Geomorphic Guidelines: Factsheet VI Scour Analysis (December 2019)*. Based on additional investigations, it was confirmed that the existing sanitary pipe at the existing manhole upstream of the pump station is approximately 7.8m deep (rim elevation 229.64m to approximate invert of 221.84m). These elevations are to be confirmed by a surveyor at detailed design. However, if the proposed crossing was run deeper than the existing Regional crossing, the proposed 200mm pipe obvert will be at 222.59m beneath the channel if laid at 1%, and 222.34m if laid at 0.50%. Under both of these scenarios (0.5% or 1% pipe slope), the obvert elevations are outside the most conservative (low risk) scour hazard limits calculated in GRA's scour assessment. If these elevations and slopes are acceptable to the approval agencies and, if the elevations as outlined above are confirmed as being accurate by the surveyor, then the elevation of the pipe would achieve CVC requirements without the need for scour management. The ultimate sewer crossing design is subject to further consultation with the Region and CVC through the CVC Permit process. If the alternate elevations/slopes are not deemed to be acceptable by the Region/CVC, and if the pipe is proposed at the same depth as the Region's existing pipe (i.e., at an elevation that does not meet CVC's current requirements), then methods for scour management will need to be explored.

In addition to the creek crossing, there is a portion of the proposed sanitary sewer along Confederation Street, from Main Street to approximately 280 m north that is located within the Regulatory floodplain that will also necessitate a Permit from the CVC. Design of this infrastructure will need to consider the flood plain hazard.

6.2 Water Servicing

6.2.1 Existing Conditions

Based on the available infrastructure plans for Confederation Street, there is an existing 300 mm watermain along the frontage of the Subject Lands. This watermain is immediately available to accommodate the Subject Lands.

The Subject Lands are in Pressure Zone 267.

MES was retained to undertake a hydrant test and to evaluate the existing system capacity to accommodate the Subject Lands. See additional details in **Section 6.2.2**.

6.2.2 Proposed Conditions

Water servicing infrastructure for the Subject Lands has been designed in accordance with the latest Halton Region standards and specifications. A 200 mm watermain is proposed for the entire site and will connect to the existing 300 mm watermain along Confederation Street to supply water demands to the development.

A conceptual watermain servicing plan showing the proposed water distribution system for the development is provided in FSR Figure 7 (Urbantech 2020).

According to the MES findings (refer to FSR Appendix F2), the existing 300mm watermain pressures and flows are sufficient to service the Subject Lands from a domestic servicing perspective. With respect to fire flow, the previous Regional guidelines (91 L/s) can be achieved. However, the recent change to the Fire Underwriters Survey (FUS) flow targets by the Region results in fire flows slightly below the standards. It is assumed that the adjacent / recent developments around the Subject Lands, such as Bishop Court, were based on the lower / original standard of 91 L/s which can be achieved.

Improved fire flows cannot be easily addressed through external infrastructure upgrades – the existing pipe on Confederation Street is already a 300 mm PVC main. The Confederation Street pipe is fed by smaller diameter pipes (refer to FSR Appendix F2) and there are many smaller diameter pipes between the development site and the supply.

Given that the surrounding area was likely designed assuming the previous / achievable Region standard of 91 L/s, if necessary, the mix of units / floor plans can be optimized to achieve suitable fire flows subject to the FUS requirements (i.e., the square footage and construction materials can be adjusted to reduce the fire flow requirements). Refer to FSR Appendix F2 for the MES report for further details.

6.3 Stormwater Management

The stormwater management strategy for the Subject Property is based on the following objectives and design criteria:

- Control of the post-development design storms flows based on the Town of Halton Hills IDF parameters (Standard 105) and 24-hour SCS Type II distribution. All storms up to and including the 100-year event must be controlled to pre-development rates;
- Provide quality control via a treatment-train approach to achieve 80% TSS removal;
- Detain at least 5 mm on site for at least 48 hours to provide erosion control;
- Capture and convey the 5-year storm in the minor system / road-side swales without surcharging / overtopping;
- Capture / continue to convey the external drainage from north of the development;
- Ensure the wetland water balance is adequately maintained;
- Limit maintenance requirements;
- Take advantage of high infiltration rates on the Subject Property by encouraging infiltration-based stormwater management measures; and,
- Ensure that any fill brought to the site meets the same infiltration rate as the existing soils for areas that will be used for infiltration.

The following measures are proposed to manage stormwater and meet the criteria and objectives:

The proposed drainage areas will be conveyed as follows:

- External area (5.9 ha) – all flows up to and including the 100-year event to be captured in a 600 mm storm sewer within the 5 m easement between Lots 6 and 7, and conveyed through the site to the south storm outfall (this pipe has been sized for the worst-case, ‘frozen’ conditions for the external area);

- Lot areas to discharge roof leaders to pervious areas; excess flow to drain to rear or front yards subject to lot grading;
- Remaining lot runoff and ROW runoff to be captured in infiltration swales on either side of the ROW;
- Infiltration swales overflow to minor system (storm sewer);
- Excess flow conveyed by major system to the storm block adjacent to Lot 24, which has additional storage / infiltration; and,
- Major and minor system pass through the storm block.

The evaluation of the SWM strategy and LID design is described in the FSR. There is an overall net decrease in the total peak flow discharged from the site. Note that the total peak flow to all three south outlets is reduced below existing conditions for the larger events. Additional control of the frequent events was considered, but as shown in the FSR, the wetland to the south has a minor deficit in monthly runoff volumes. Additional control of the frequent storms would likely reduce the monthly runoff volumes further.

The stormwater outfall has been designed to provide for an infiltration trench/swale at the downstream limit of the stormwater outfall pipe. This will provide for additional infiltration and water polishing prior to release of stormwater to the wetland. The outfall and infiltration trench/swale are outside of the natural heritage buffer block (see FSR Figures 3 and 5B). A level spreader is proposed at the downstream limit of the outfall swale, within the natural heritage buffer block, to further assist with slowing and spreading flows prior to entering the wetland (FSR Figures 3 and 5B). The provision of the level spreader within the buffer block is considered acceptable given that, in many cases, stormwater outfall headwalls and level spreaders are permitted within natural hazard/natural heritage features (i.e., within valleys) in order to convey stormwater to the downstream outlet. The level spreader, as proposed, is on the periphery of the 10m top of bank setback and outside of the natural features.

6.4 Roads

The Subject Lands will be serviced by an internal looped road (Street A) with a 20m ROW. The majority of the road will be designed with a rural cross-section, in-keeping with the Glen Williams Secondary Plan requirements however, a small length of the road (<120m) at the entrance off of Confederation Street, will be designed as an urban cross-section. This urban cross-section is necessary in order to accommodate the grade change between the property to the north and south of the entrance. Details with respect to the intersection with Confederation Street related to sightlines, grades and emergency access can be found in **Appendix G**.

With the exception of that portion of the road with an urban cross-section, sidewalks are not proposed within the subdivision. Given the low volume of traffic expected on this internal road, it is anticipated that pedestrians will walk along the shoulder of the road.

3m pedestrian walkway blocks (Blocks 37 and 38) are proposed between Lots 16 and 17 and Lots 12 and 13 respectively, to facilitate access from Street A to a proposed looped trail outside of the 10m setback from stable top of bank of the Credit River tributary valley.

6.5 Grading

The FSR (Urbantech 2021) contains detailed information pertaining to proposed grading on the Subject Lands. The grading has been designed to eliminate the use of retaining walls and, as a result, includes proposed grading

within the 30m setback from the significant woodland along the western limit of development and within the 30m setback from the wetland along the southern limit of development. There is also a small area (16 m^2) of grading within the 10m stable top of bank setback behind Lot 24.

6.5.1 Existing Conditions

Within the developable area, there is a high point at the northeast corner of the Subject Property. Existing grades slope southerly and westerly towards the RNHS. There is a significant variability in grades with an approximate 21.0 m fall across the site from the northeast to the southwest corners of the developable area. The grades along the north property line vary considerably from east to west due to the undulating terrain.

6.5.2 Proposed Conditions

The proposed grading plan is generally influenced by boundary conditions. Along the northern property boundary, external grading is required into the lands to the north of the Subject Lands to allow for grade matching, refer to **Section 6.5.2.1**. The grading along the south property limit is outside of the 10m dripline buffer but partially within the 30m wetland setback and there is a small area of grading (approximately 16m^2) behind Lot 24 within the 10m setback from stable top of bank. Along the western development limit, grading is outside of the dripline, top of bank and 10m top of bank setbacks however, it is proposed within the 30m dripline setback.

The preferred site grading design is shown on FSR Figure 3A and takes into consideration the following requirements and constraints:

- Conform to the Town of Halton Hills' design criteria;
- Minimize cut and fill operations and work towards a balanced site;
- Match existing boundary conditions, where feasible;
- Avoid grading within the NHS setbacks to the extent possible;
- Provide overland flow conveyance for major storm conditions;
- Reduce or eliminate (where possible) the need for retaining walls;
- Maximize the self-contained portion of the site conveying runoff to the storm sewer system(s);
- Maintain feature-based water balances to existing natural heritage features;
- Provide suitable cover on proposed servicing; and,
- Attempt to reduce or eliminate stormwater discharge from the site onto Confederation Street.

FSR Figure 3A illustrates the proposed grading, in relation to the natural hazards / natural heritage features and the associated setbacks, based on the above principles. Namely, FSR Figure 3A proposes grading within the private lots as well as within the buffer areas in order to eliminate the need for retaining walls. Note that the Region's "Approximate Limit of Key Features" has been shown on the property to the north of the Subject Lands for information purposes. This limit is approximate and based on the available online mapping information. This information was provided to demonstrate that there is a more than adequate separation between the proposed external grading and the approximate Key Features identified in the Region's 2021 proposed Regional Official Plan Review (ROPR) RNHS mapping. Prior to advancing the site alteration process for the lands to the north, the

dripline of the woodland and top of bank (Key Features) would be staked in the field with CVC and Regional staff.

FSR Figure 3B illustrates a grading scenario whereby retaining walls are used along the northern property limit thereby eliminating the requirement to alter the grades on the property to the north. This scenario includes the creation of a 3m wide swale, immediately south of the northern property limit and immediately north of the proposed retaining wall that would capture overland flows from the lands to the north and direct them to a catchbasin between Lots 6 and 7. The grading implications within the buffer area are generally the same between the two grading scenarios and, as such, only the preferred grading scenario (FSR Figure 3A) is described in this EIR.

6.5.2.1 Northern Property Boundary

Due to the undulating / extreme grade difference along the north property line, which would necessitate the use of retaining walls in excess of 4 m high in order to match existing elevations with the property to the north, a grade transition is proposed on the property to the north, in conjunction with grade changes on the Subject Lands. The cut and fill associated with the grade transition is intended to normalize the elevations along the northern property limit such that the existing low point along the northern property limit (near Lot 9) is proposed to be filled, and the existing high point (near Lot 5) will be lowered to "normalize" / flatten the rear property line grades. It is recognized that the proposed grading relies on the cooperation of the landowner to the north. This grading proposal will not restrict drainage from the lands to the north but will instead improve drainage conditions by eliminating steep slopes and low points as well as creating a more suitable surface for agricultural activities. Discussions with the landowner to the north have been initiated and are on-going in this regard. It is anticipated that such grading activities would be undertaken through a site alteration permit, outside of the draft plan of subdivision process.

For the remainder of the site, storm drainage flows are self-contained within the development. During major storm events, storm drainage will be directed overland to the RNHS via the storm drainage block. The proposed grading design matches into existing property line grades and buffer limits along the eastern and southern sides of the developable area. A description of the proposed grading along the western side of the developable area is provided in **Section 6.5.2.2**.

6.5.2.2 Grading Adjacent to the Credit River Tributary Valley

Proposed grading within the RNHS buffer, along the western development limit, has been minimized to the extent possible. In order to minimize the need for retaining walls, grading has been proposed within the 30m dripline buffer but outside of the 10m buffer to stable top of bank (FSR Figure 3A). The geotechnical and environmental impacts of the proposed grading have been evaluated in the EIR and have been confirmed to have no negative impact on slope stability or the natural heritage features to the west. In an email dated March 4, 2020, CVC staff advised they would be open to proceed with the considering the lower-tier valley slope (i.e., Top of Bank 2019 on FSR Figure 3A) as the CVC Regulated Valley Slope (i.e., they would not regulate the Top of Bank 2010 (FSR Figure 3A) or the engineered top of slope) subject to the following:

1. A geotechnical/slope stability report to determine the Long Term Stable Slope Line associated with the lower tier top of bank and confirmation of no impacts to this slope from the proposed grading.

a. A minimum 10 m setback to the proposed grading and lot lines from the greater of the Top of Bank or Long-Term Stable Slope line of this slope however, it is expected that this buffer be maximized where possible.
b. Further, the works for the upper tier slopes should be confirmed by a Geotechnical Engineer and confirmation is required from a Geotechnical Engineer the proposed grading works would not negatively impact the slope stability of the lower tier top of bank. This is especially important in the southern portion of the lower tier top of bank as the grades of this slope starts to connect to the higher tier top of slope.

2. Preparation and implementation of a robust restoration and enhancement landscape planting plan for the area between the CVC Regulated lower tier top of bank and the proposed new lots in order to provide an enhanced valley corridor compared to the current/existing condition.

3. At the south-west corner of the proposed subdivision [at the end of the higher tier (i.e., secondary) top of bank], the proposed lot line should be shifted further away from the Significant Woodland feature in order to provide more room to allow for a larger buffer between the proposed grading and the dripline in order to protect the Significant Woodland. Typically look for a 10 m buffer and the environmental impact assessment to confirm the appropriate setback and/or mitigation measures.

With respect to Item 1 above, the Geotechnical Slope Stability Study is included in **Appendix C2** and summarized in the EIR. The Slope Stability Study concluded that the physical top of bank of the lower tier 2019 top of bank is stable. Further, the report confirms that there is no impact to the stability of the slope as a result of the proposed grading to the east. As shown on **Figure 7, Appendix B1**, a minimum 10 m setback from the 2019 top of bank to the proposed grading/lot lines has been provided but, in most cases, the setback is much greater than 10 m. Subsequent to the first submission of the EIR, the Town requested that a looped trail be created to bring pedestrians back to Street A. This has resulted in the requirement to grade up to the 10m top of bank setback, but not within it, behind Lots 12 to 16.

The general approach to restoration and enhancement planting along the newly graded slopes is discussed within the EIR to address Item 2 above. Detailed landscaping plans will be provided as a condition of draft plan approval.

Item 3 was in reference to an earlier grading plan that was provided to the agencies at a meeting on March 12, 2020. The grading as shown on all of the figures reflect the revision as requested in Item 3 above.

6.5.2.3 Grading Adjacent to the Southern Woodland / Wetland

Grading along the southern development limit has been contained within the residential lots with only a very small area of grading proposed within the outer limit of the 30 m wetland setback and 10 m setback to top of bank behind Lot 24 (approximately 16 m^2). In addition, some minor grading is proposed at the outer limit of the 30 m wetland setback behind Lots 18-21 however, all grading has been kept outside of the 10 m dripline setback along the southern limit of development. The minor area of grading (16 m^2) behind Lot 24 is within an area that is currently agricultural field and is not in a natural state. The area will be restored and provided with suitable

erosion resistant cover. There is no anticipated impact to the woodland and/or the top of bank as a result of this minor grading. Refer to **Figure 8** for details.

6.5.2.4 Grading Adjacent to the Eastern Property Boundary

For the eastern property boundary north of the right-of-way, a 3.0 m undisturbed shelf is proposed to avoid impacts to trees on the existing properties to the east. A maximum 2:1 downwards slope is proposed within the Subject Lands. The grades along the eastern property boundary south of the Street A right-of-way are regraded to be a local high point. 3:1 sloping within the Subject Lands as well as on the existing properties is proposed to match the existing grades and ensure storm drainage from the existing properties does not enter the site.

7. Impact Assessment

This section includes an evaluation of the potential impacts to the natural heritage and water resource systems as a result of the proposed development. The proposed draft plan of subdivision has been overlaid on a recent aerial photograph for reference purposes (**Figure 5**). The plan identifies the limit of natural features including woodlands, valleylands and wetlands as well as recommended development setbacks. Opportunities for public access to the natural areas have also be explored with walkway blocks proposed in order to provide access from Street A to a proposed trail outside of the 10m stable top of bank setback associated with the Credit River tributary valley. The Town has expressed an interest in constructing a trail that connects the proposed Glen Williams Estates development to the existing development on the west side of the valley. This would involve utilizing/formalizing existing informal trails within the valley and creating a new connection to a publicly owned block of land to the west of the Subject Lands (**Figure 5A**). At the time of writing this report, a final decision had not been made by the review agencies with respect to whether this connection through the valley would be supported however, a site visit was conducted on April 13, 2021 with representatives from the CVC, Region and Town to review the existing informal trail(s). During that site meeting it was agreed that very little work would be required to formalize the existing informal trail (s) and that no tree cutting would be required.

The impact assessment includes all aspects of the proposed development including issues related to servicing, grading, construction access, trails/public access, impacts associated with the long-term use of the property, etc. The impact associated with the proposed grading on the lands to the north has not been included in this section as this will be addressed through a future site alteration permit. In addition, the impact of creating a trail within the valley, that would connect to the Town owned parcel to the west, has not been assessed given that direction has not been received from the review agencies as to whether this would even be considered. If needed, as a condition of draft plan approval, a Trails Plan could be created that assesses the use of the existing informal trail(s) within the valley, appropriate connection points to the Town owned parcel to the west and any natural heritage impacts.

As outlined in **Section 6,** and further detailed in the FSR, substantial grading is required in order to eliminate the need for retaining walls on the Subject Lands. While no grading is proposed within the 10m setback from the woodland dripline or 30m setback from the wetland, along the southern development limits, grading is proposed within the 30m setback from woodland dripline along the western limit of the proposed development. The impact of this proposed grading has been evaluated both from a natural heritage perspective as well as a natural hazard perspective to ensure there are no negative impacts to the natural heritage features/functions or the stability of the slope along the western property limit.

Proposed stormwater management and servicing requirements are also described in this section along with potential impacts and mitigation measures, including the use of LIDs to address stormwater management and water balance.

Mitigation measures for the protection of groundwater resources (quality and quantity), including potential impacts to natural heritage features that may be reliant on groundwater are also provided. A feature-based water balance has been prepared to demonstrate no negative impacts to the wetlands on the Subject Lands as a result of the proposed development.

Finally, this section includes an evaluation as to whether the proposed development, including mitigation measures, will result in no negative impacts to the RNHS adjacent to the development, as required in Section 118(3) of the ROP and the systems approach outlined in Section 118(2).

As outlined in **Section 1**, the proposed development includes the following:

- creation of 34 residential lots on an internal roadway with access from Confederation Street
- a stormwater block to convey flows from the internal roadway to a proposed outfall
- walkway blocks to provide pedestrian access from the internal roadway to a trail outside of the 10m stable top of bank setback associated with the Credit River tributary valley
- natural heritage system block containing the valley, woodland, wetland and associated buffers.

In addition, a sanitary sewer connection is required along Confederation Street and under the Credit River to connect to the existing pumping station east of the river.

The following sections provide an analysis of the potential short and long-term direct, indirect, cumulative and induced impacts that could result from the proposed development and recommends mitigation measures to minimize the potential impacts.

7.1 Short and Long Term Impacts

Impacts to the various natural heritage features and functions associated with and adjacent to the Subject Lands were considered in the impact analysis. **Table 10, Appendix B2** presents the natural heritage components which were considered in this assessment, the proposed activity associated with that component, potential short term and long-term impacts (direct, indirect, cumulative and induced) and recommended mitigation measures and if any residual effects are anticipated. Potential impacts were assessed using field collected data and secondary source information, including an overlay of the proposed Draft Plan.

7.2 Cumulative and Induced Impacts

Cumulative impacts are changes to the environmental due to past, present and the reasonably foreseeable future impacts. The surrounding landscape has experienced disturbance since its initial settlement in the early 1820's, when a grant of 200 acres was made by the crown to John Butler Muirhead in the Township of Esquesing, a historic municipality in Halton County. Following his death, the land was sold to a Benajah Williams, who then increased the acreage from 200 to 400 acres in what would become Glen Williams. Glen Williams and the presence of the Credit River was a main focal point for the community, which was utilized for saw and flour mills. The Williams family would proceed to establish several mill operations within the area, including the Glen Woolen Mills Company Limited. Many of the historical mill buildings and associated properties have become heritage features and central to the history of the village.

The long history of industrial use and agriculture has resulted in a number of impacts to natural heritage features on the landscape. The introduction of European species for cultivation and aesthetics and the fragmentation of natural heritage features changed the species composition and ecological integrity of the area undoubtedly. It is assumed that during this initial period of human development between 1800 and the 1930's local species would have been impacted to an unknown degree.

The progression of development within the vicinity of the Subject Lands over recent history and on-going and historical agricultural use has resulted in the loss of large-scale natural vegetation communities and open spaces and led to fragmentation of natural heritage features across the landscape. The proposed development of the Subject Lands will add to the cumulative impacts of urbanization over time. The conversion of rural landscape to an urban one will change the character of the landscape but it is expected that the nearby Greenbelt boundary and RHNS will serve as a mitigation measure by providing open space and habitat for wildlife species to live out their life processes.

The findings of this EIR have found that key natural heritage features identified for the Subject Lands will be protected with appropriate buffers and the loss of vegetation required to implement the proposed development will be minor and mitigated through the planting of native species within the identified buffers and planting of street trees across the property. The vegetation identified for removal are culturally influenced features, including old fields and landscape trees, which will not result in the loss of integral habitat or landscape function. Mitigation measures have been provided to ensure that impacts on the Subject Lands, adjacent natural heritage features and the greater landscape are minimized.

7.3 Mitigation Measures

The following is a summary of mitigation measures, as outlined in **Table 10, Appendix B2**, to avoid and minimize impacts of the proposed development on the natural heritage features and functions within, and adjacent to, the Subject Lands:

7.3.1 Natural Heritage System Mitigation Measures

- Minimize outdoor lighting and direct it down and away from natural areas.
- Gateless fencing is recommended along the property line of all lots that are adjacent to the RHNS to prevent encroachment and dumping. The Town requires a 1.5m black chain link fence offset 6” on Town property in order to control the installation of gates;
- Educational and trail signage is recommended to be installed to inform and education landowners on the existing natural heritage features and restoration measures installed; and,
- Inspection by a qualified person(s) to conduct regular monitoring of all sediment and erosion measures implemented to ensure they are in working order. Any deficiencies observed are to be recorded and immediately reported to the site contractor and rectified.

7.3.2 Restoration Plan

- Planting of native and locally sourced (appropriate seed zone) trees and shrubs within the identified buffers to increase the biodiversity, provide wildlife habitat and protect the woodland and wetland edge from degradation;
- The buffer is proposed to be planted in two bands consisting of one dominated by trees immediately adjacent to the woodland edge and a second band of shrubs. This planting scheme is intended to create a vertical stratification progression from the mature canopy to the private lots and a physical barrier to prevent encroachment and dumping within the RHNS;
- All planted material should be maintained by regular watering throughout the plant warranty period; and,
- Monitoring of planted species should occur post-construction to ensure survivorship of species and assess individual plant health.

7.3.3 Offsetting Plan

The proposed plan includes ecological offsetting for the removal of 80 trees to facilitate the proposed development. To determine the necessary compensation, the CVC Ecosystem Offsetting Guidelines (March 13, 2020) were used. The purpose of the guidelines "*is to guide how to determine the total amount of offsetting required to replace lost or altered ecosystems in a repeatable and transparent manner".* Trees identified for removal for the Subject Property will follow the criteria and protocol defined in section 2.3.2 of the Guideline (*Offsetting for Woodland Understory Vegetation, and Vegetation in Communities with Less than 35% Tree Cover*). Tree removal areas identified on the Subject Property are contained in vegetation communities with less than 35% tree cover, primarily within a meadow community (MEMM3) and within "*narrow linear features less than 30 m wide"* along the current entrance to the property. Criteria used to determine offsetting for these areas requires a tree protection plan that provides the location and diameter of trees to be removed, which is then used to determine the required offset for the loss of the trees. The result of this assessment is provided in **Table 7-1**.

Table 7-1 Tree Planting Offsetting Requirements

DBH Range (cm)	Count	Offsetting Ratio	Offset Required
>5 – 10	4	1:1	4
10.1 -20	33	1:3	99
20.1-30	12	1:10	120
30.1-40	13	1:15	195
40.1-50	7	1:20	140
50.1-60	4	1:30	120
60.1-70	1	1:40	40
70.1+	6	1:50	300
		Total	**1,018**

Based on the results of the assessment, a total of 1,018 trees are required to be planted. Tree replacement details will be provided on a restoration and landscape plan to be completed as part of the draft plan conditions by a certified Landscape Architect.

7.3.4 Construction Measures

- Clearing of vegetation within the Subject Lands as part of site preparation should be conducted in late summer or winter months so as not to coincide with breeding bird season (March 31 to August 31). If clearing is to proceed within the breeding bird window, the Subject Lands should be screened by a qualified bird biologist to determine if any migratory songbirds are nesting within the work zone;
- No machinery or disturbance of any type is permitted within the tree protection fence;
- Sediment and erosion control fencing installed along the limits of construction to minimize siltation and encroachment during construction;
- Topsoil removed during stripping recommended for reapplication post-construction;
- A construction work plan should designate specific locations for stockpiling of soils and other material;
- Tree protection measures will have to be implemented prior to the commencement of construction (earthworks) to ensure trees identified for preservation are not impacted by the proposed development;

- Tree protection fencing should be comprised of paige wire fencing supported on metal T-bars at 3 m centres. Fences should be erected at the dripline plus 1 metre of individual trees identified for preservation outside of the RNHS;
- All tree protection measures should follow the guidelines as set out by the Town of Halton Hills. Tree protection barriers need to be inspected on a regular basis to ensure they meet the design requirements detailed by the Town of Halton Hills;
- Inspection by a qualified person(s) to conduct regular monitoring to ensure all tree protection and mitigation measures are implemented as intended;
- Implementation of dust control measures, such as application of water to haul roads, during construction to reduce dust impacts on the adjacent lands; and,
- Store all oils and fuels away from water in properly designated locations with appropriate spill containment and clean-up equipment.

Through the implementation of the recommended buffers, restoration plans and mitigation measures outlined in this report, no negative impacts to the significant natural heritage features and functions are anticipated as a result of the proposed development.

8. Monitoring Program

The following monitoring plan is intended to assess the implementation and efficacy of mitigation measures and includes three monitoring phases: pre-construction, during-construction and post-construction. An environmental inspection plan is described below and includes details concerning the frequency of monitoring, a reporting schedule and protocols that will ensure protection of natural features and functions, including invoking stop work orders, rectifying the causes of environmental damage, and restoring areas that have been impacted by construction activities. The protocols and methods are broken down into six different sections as listed below:

Monitoring Sections:

- Terrestrial Resources
- Ground and Surface Water
- LIDs

8.1 Objectives

The overall objectives of the monitoring plan are to:

- Collect information that will assist in determining the functionality of the natural environment;
- Determine the effectiveness of mitigation practices intended to limit the effect of the proposed surrounding development on the natural environment and whether these practices require modification; and,
- Determine if further enhancement and restoration initiatives are required to maintain the functionality of the natural environment.

8.2 Monitoring Phases

8.2.1 Pre-construction Monitoring

Prior to construction activities, data will be collected to establish a baseline of natural environment conditions and functionality. Further monitoring will rely on this data to accurately assess impacts to natural heritage features. The data collected as part of the EIR fieldwork is considered to fulfill the pre-construction monitoring requirements

8.2.2 During Construction Monitoring

Monitoring will take place during construction to confirm that mitigation targets are being met and to isolate any issues that may pose risk of impacts.

8.2.3 Post Construction Monitoring

Post construction monitoring measures will evaluate the potential short-term, long-term and cumulative impacts of the proposed development and to assess the effectiveness of mitigation measures.

8.3 Methods

8.3.1 Terrestrial Resources

A baseline assessment of restoration communities will be conducted year 1 post-construction, following the ELC protocols for Southern Ontario (Lee et al. 2008). This will include a three-season inventory conducted during the appropriate survey windows (Spring-May to early June, Summer-July to August and Fall-September to October). This baseline will allow for comparison of vegetation growth rates and the relative success of restoration treatments over time. A key component of the monitoring program will be to track progress of native plantings within the proposed natural heritage buffers, which will be achieved with follow-up monitoring in subsequent years (years 2 and 3 post-construction). Invasive species removal and replacement plantings will be completed as required.

In addition to yearly ELC community analyses, the Vegetation Sampling Protocol (VSP) will be used for terrestrial monitoring. VSP was developed by Danijela Puric-Mladenovic, an Assistant Professor at the University of Toronto, as a joint venture between the University of Toronto and the Ministry of Natural Resources and Forestry. This protocol works in conjunction with ELC, but where ELC provides a broad overview of ecosystems and their boundaries, VSP provides a more quantitative approach. This includes field data stored within a central database for statistical analysis and detailed mapping. Both protocols employ similar methodologies for field data collection.

As a whole, VSP is a quantitative, integrative and adaptable vegetation sampling method that will provide more rigorous data than ELC and is better suited to conducting research on the long-term trends of changes within an ecosystem. VSP is also scalable, and plots that are assessed during this project will join the larger data set for southern Ontario. This allows for larger questions about regional connectivity to be answered.

Planting monitoring will begin during the implementation of plantings to ensure that the correct species and planting protocols will be upheld. These plantings will then be monitored during subsequent VSP surveys.

8.3.1.1 Species Utilization

Amphibian surveys will be conducted in Year 2 and 3 throughout the monitoring program. Amphibian surveys will follow the Marsh Monitoring Protocol (Bird Studies Canada, 2000) requiring all survey stations to be visited on three separate nights beginning one half hour after sunset to end before midnight. Visits are to occur no less than fifteen (15) days apart and take place during the spring and early summer. This protocol ensures that the entire range of early, middle and late-breeding species will be surveyed for. In addition, surveys must be conducted under the appropriate weather conditions to coincide with breeding calling activity. It is required that surveys are conducted when conditions are moist (i.e. after a rain, during

a light mist, on humid night), and do not occur when conditions are windy (i.e. wind noise reduces ability to hear calls and frogs generally do not call during windy conditions). Minimum air temperature requirements for the visits are provided earlier in this report in Error! Reference source not found. **3-2.** Finally, it is recommended that the first survey occur shortly after the first or second warm spring shower with the required night-time air temperature.

8.3.2 Ground and Surface Water

Table 8-1 provides an overview of the ground and surface water monitoring requirements pre-, during and post-construction.

Table 8-1 Ground and Surface Water Monitoring

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Comments / Recommendations
Groundwater Levels					
Pre-Construction	Groundwater level monitoring (available on-site monitoring wells)	Continuously for one week	Dataloggers within the existing wells	None	Complete hydrographs to document baseline water levels. The monitoring completed for the EIR/FSR is considered to be the pre-construction monitoring
During Construction	Existing monitoring wells or replacements adjacent to dewatering area	Daily until target water level is reached	Dataloggers with weekly downloads	Target drawdown not reached or exceeded	Increased / reduced pumping; if pumping is approaching 400 m^3/day, a PTTW will be required
	Discharge volume	Daily at discharge location	Manual with totalizing flow meter in-line	Flow exceeds predicted volumes	Reduce to maximum allowed or obtain a PTTW
Post Construction	Existing monitoring wells or replacements adjacent to dewatering area	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	n/a	n/a
Surface Water Levels					
Pre-Construction	Surface water level monitoring (available on-site stream and wetland monitoring stations)	Continuously for one week	Dataloggers within the existing staff gauges	None	Complete hydrographs to document baseline water levels. The monitoring completed for the EIR/FSR is considered to be the pre-construction monitoring

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Comments / Recommendations
During Construction	Existing surface water stations or replacements upstream and downstream of discharge areas	Continuously for duration of construction	Dataloggers with weekly downloads	Reduction in levels from baseline conditions during pumping	Reduced pumping
Post-Construction	Existing surface water stations or replacements upstream and downstream of discharge areas	Weekly for one month or until groundwater levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	n/a	n/a
Water Quality					
During construction (discharge to sewer)	Groundwater discharge from dewatering	Sample for parameters listed in the Sewer Use By-Law	Once at the start of dewatering at the point of discharge. Weekly from the dewatering system first month of active dewatering and monthly for the remainder of the dewatering period if compliant	Discharge quality exceeds the Sewer Use By-Law criteria	More frequent monitoring will be considered. Enhanced treatment of the discharge water will be considered if needed
During construction (discharge to watercourse)	Surface water discharge from site drainage	Field monitoring for turbidity and correlation with lab results	Weekly surface water first month of construction. Assuming water quality is compliant, monthly for the remainder of the construction period.	Field TSS / Turbidity in watercourse exceeds 25 mg/L	Additional ESC mitigation required

8.3.3 LID Monitoring

The following monitoring procedures are recommended for measuring the performance of the LID features. It is recommended that one (1) swale receiving the most drainage area be monitored "intensively" as follows:

- Water level sensor at inlet weir to measure inflow
- Level sensor on surface to track surface water level / surface drawdown / overflows

- Level sensor in perforated monitoring well to track sub-surface water level and drawdown time
- Level sensor in pipe connection to downstream sewer to measure flow leaving LID
- A visual assessment of potential erosion at the stormwater outlet in Years 2 and 3 should be conducted in conjunction with the terrestrial monitoring program to identify any erosion issues

Note that CVC staff will be consulted with regarding the appropriate monitoring strategy through detailed design of the LID measures.

The LID swales should be monitored for at least three events per year. The monitoring should include at least one spring runoff event and one winter event for every year up to assumption for intensive monitoring.

At the end of each year, the depth of the sediment accumulated on the surface should be measured.

The performance of the other features can be visually evaluated by the sediment accumulation and ponding level on the surface or by measuring the depth of water in the monitoring wells. These water levels should be measured at various time intervals after storm events to ensure adequate drawdown occurs.

8.3.4 Contingency Measures

Contingency measures will address any unforeseen circumstances that may impact the natural environment outside of what was intended post-construction. If there is a significant problem, the contingency measures will be implemented to correct any deficiencies. Unforeseen circumstances may include minor restoration of the constructed habitats from the effects of erosion, unauthorized access or recreation use, removal of plantings, replacement of plantings due to mortality. Contingency measures may include, but are not limited to, the following:

- Additional plant installation to address survivorship or cover issues;
- Weeding, invasive species removal to address competition issues;
- Plant substitutions of species, quantity and or location;
- Additional seeding of proposed seeding areas to increase cover; and/or
- Providing fencing or additional guards around plantings to prevent browsing.

Contingency plans will be created for review and approval by the Town and CVC, where appropriate. In addition, contingency measures will be included in annual monitoring reports for the 5-year monitoring term.

8.3.5 Reporting

The details within this EIR are considered to provide the baseline data for the natural heritage features and functions. Annual monitoring reports will be provided to the Town of Halton Hills and the CVC documenting monitoring results. Monitoring reports will be submitted by March 31 of the year following the completion of the data collection.

If any encroachment activities are identified during the monitoring program, the Town of Halton Hills will be notified in writing directly following the survey in which the activity was identified as 'new'.

9. Operations and Maintenance

In general, all roads, infrastructure and the RNHS, including trails, will be maintained by the Town of Halton Hills, with the exception of sanitary sewers and the water distribution system (maintained by Halton Region). An operations and maintenance manual for the proposed infiltration swales is provided in **Appendix D4**.

10. Conclusions and Recommendations

This EIR, in combination with the FSR, has been prepared to fulfill the requirements as outlined in the approved ToR (**Appendix A1**). The following table provides an overview of the policy review and conformance.

Table 10-1 EIR/FSR Policy Analysis and Conformance

Legislation and Policies	Analysis
Federal Fisheries Act	No development or site alteration are proposed on the Subject Lands within fish habitat. The sanitary sewer will be installed beneath the Credit River, south of Main Street, with no anticipated impacts to fish habitat.
Migratory Birds Convention Act	The majority of the trees on-site will be retained post development within the RNHS however, as identified on the TPP, there will be a few trees removed to facilitate Street A, some lot grading and the building envelopes. Efforts will be made to restrict vegetation removal outside of nesting season however, if tree removal is proposed during nesting season, a nest search will be required as per standard protocols. An offsetting calculation has been completed, based on CVC guidelines, to identify the number of trees required to be planted (1,018 trees) to offset the removal of tableland trees.
Endangered Species Act	No significant habitat for endangered or threatened species was found within the Study Area.
Greenbelt Plan	The Subject Lands are not within the Greenbelt Plan Area however, a portion of the Study Area (north of the Subject Lands) is within the Greenbelt Natural Heritage System. On the Subject Lands, the valley associated with the Credit River is identified as an Urban River Valley on Schedule 1 of the Greenbelt Plan. Since the valley is not in public ownership, the Urban River Valley policies of the Greenbelt Plan do not apply however if, through the draft plan approval process, these lands come into public ownership, the Urban River Valley policies will apply at that time. In-keeping with Section 3.2.6.1(b) of the Greenbelt Plan, this external connection is being maintained and enhanced to support the connection between the Greenbelt's NHS and the Regional NHS. Also, as recommended in Section 3.2.6.2(a) and (b), the proposed development includes the provision of a trail either within the existing valley along existing informal trails and/or adjacent to the river valley, outside of the 10m stable top of bank setback, and increases the extent of

Legislation and Policies	Analysis
	the vegetated buffer as well as the provision of vegetation within the valley feature (i.e., above and below stable top of bank). Opportunities for an additional trail connection to a Town-owned parcel to the west can be investigated as a condition of draft plan approval. Native plantings will result in habitat restoration within the RNHS and the provision of stormwater management within the Subject Lands will avoid adverse impacts associated with the quality and quantity of urban runoff into the valley system. Finally, as per Section 3.2.6.2(c), the EIR has integrated the recommendations from the Glen Williams Secondary Plan Scoped Subwatershed Study through the provision of stormwater management, protection and enhancement of the natural heritage system and the inclusion of monitoring requirements.
Planning Act and Provincial Policy Statement	<u>Natural Heritage:</u> The ecological fieldwork, background review and analysis has identified the following significant natural heritage features and functions within the Study Area: • Significant wetland • Significant woodland • Significant valleyland • Fish habitat No development or site alteration is proposed within the above noted significant natural heritage features. In addition, the following buffers have been provided to the features to ensure no negative impact to the feature or its function: • Significant wetland – minimum 30m • Significant woodland – minimum 30m for woodland associated with Credit River tributary and 10m for woodland along southern limit of the Subject Lands • Significant valleyland – minimum 10m from stable top of bank however, in many locations, much more than 10m • Fish habitat – greater than 30m

Legislation and Policies	Analysis
	Natural Hazards: The Subject Lands are traversed by a tributary of the Credit River and contains flooding and erosion hazards associated with that feature. The Regional Storm flood plain is contained within the valley and the stable top of bank represents the greatest hazard. In that portion of the site where a top of bank was noted staked, Urbantech has provided an analysis to confirm that the flood plain and associated setback are contained within the other constraints and do not affect the proposed limit of development (see Section 3.2.3 of the FSR). A stable top of bank assessment has been completed and has concluded that the physical top of bank is the stable top of bank. No development is proposed within the natural hazards on the Subject Lands. Servicing of the Subject Lands will require a sanitary sewer installation below the Credit River, south of Main Street. This installation will take place within the flooding and erosion hazards of the Credit River and will require a Permit from CVC pursuant to O. Reg. 160/06. Climate Change: A significant portion of the property will be protected as natural heritage system in perpetuity. A robust planting plan within the buffers and enhancement area will be provided as a condition of draft plan approval. These plantings will provide additional canopy cover, shading, infiltration and evapotranspiration opportunities. Water: Hydrogeological investigations have been completed and no impacts to groundwater or surface water features are anticipated as a result of the proposed development. Linkages among groundwater and surface water resources will be maintained and the amount of impervious surfaces has been minimized. LID measures, rather than an end-of-pipe stormwater pond, will be provided which will enhance groundwater infiltration and reduce thermal impacts.
Region of Halton Official Plan	As noted above, four significant features have been identified within the Study Area. These features are considered Key Features within Section 115.3 of the Region's OP. Region of Halton Forestry Staff have attended on-site to stake the dripline limit and have confirmed that the small

Legislation and Policies	Analysis
	Cultural Woodland east of the tributary valley does not meet the size criteria (0.5ha) to be considered as a significant woodland. The fieldwork completed as part of this study has further confirmed that this small Cultural Woodland does not represent Significant Wildlife Habitat or Significant Habitat of Endangered and Threatened Species. As a result, this small Cultural Woodland has not been included in the RNHS. Although a wetland evaluation was not completed, it has been determined that the wetland on the Subject Lands makes an important ecological contribution to the Region's Natural Heritage System, as per the Region's definition of significant (Section 287.5(3)). As a result, the wetland is a Key Feature within the Region's NHS. The woodlands associated with the western valley and southern valley/wetland have been identified as Significant Woodlands and, as such, are Key Features within the RNHS. Although specific fish surveys were not completed as part of the EIR, background information confirms that the watercourse on the Subject Lands is considered fish habitat and, as such, the fish habitat would be considered a Key Feature within the RNHS. The Credit River tributary on the Subject Lands in a component of the RNHS, as is its associated Regional Storm flood plain. In addition to the Key Features and RNHS components, buffers are proposed as per Section 115.3(3) of the ROP and enhancements within the RNHS are proposed as per ROP Section 115.3(2). Grading has been proposed within the 30m buffer from the significant woodland along the western portion of the Subject Lands in order to eliminate the use of retaining walls. As permitted through Section 116.1(c), this EIR has proposed a refined NHS which has resulted in an increase in NHS area as compared to Map 1G of the ROP. The refined NHS, as a result of the site-specific fieldwork, has resulted in the identification of approximately 13.7ha of land within the RNHS on the Subject Lands.
Town of Halton Hills Official Plan and Glen Williams Secondary Plan	This EIR has been prepared in accordance with Policy H4.3.7 of the Glen Williams Secondary Plan and the content of the EIR and FSR meet the requirements as outlined in Section H4.9.2.5 of the Halton Hills Official Plan. Specifically, engineering studies have been completed to address

Legislation and Policies	Analysis
	physical hazards on the site as well as surface and ground water resources, environmental fieldwork has been completed to provide an inventory and analysis of all natural features and functions and the refined limit of the RNHS has been recommended and grading and tree preservation plans have been prepared to minimize impacts to the natural environment. The hydrogeological assessment has confirmed the presence of soils that provide infiltration capacity, thereby confirming the area of potentially higher recharge as identified on Schedule H4-2. The proposed lot line setbacks, which vary from 10m – 30m, depending on the adjacent feature, exceed those which are identified in Section H4.9.4 (i.e., 5m). Servicing requirements are outlined in this EIR and provided in greater detail in the FSR. A sanitary sewer connection will be required to the pumping station on the east side of the Credit River, south of Main Street. The proposed development has incorporated a trail and on-road linkage and, through further discussion with the review agencies, could accommodate a trail within the valley (along the alignment of an existing informal trail) to connect to the Town-owned parcel to the west, as shown on Schedule H4-1 of the Town's Official Plan. This can be provided through draft plan conditions.
Glen Williams Integrated Planning Project / Scoped Subwatershed Plan	In general, the management strategies identified within the Scoped Subwatershed Plan relate to stormwater management, rehabilitation and enhancement opportunities and monitoring. The use of LIDs for stormwater management along with the use of erosion and sediment controls during development meet the stormwater management strategy to mitigate adverse impacts associated with stormwater runoff. The proposed buffers and enhancement areas will help to restore and improve the environmental features on the Subject Lands and will increase the size, extent and quality of the core features on the Subject Lands. Finally, post-development monitoring is recommended in order to assess the effectiveness of the mitigation measures.
Town of Halton Hills Green Development Standards	The Green Development Standards checklist will be submitted as part of the draft plan of subdivision application, as required by the Town of Halton Hills. The provision of LID measures to treat stormwater at the source, protection of all significant natural heritage features on the Subject Lands and provision of 10m – 30m buffers to these features are all components that will be considered in the checklist.

Legislation and Policies	Analysis
Town of Halton Hills Subdivision Manual	The Town of Halton Hills Subdivision Manual was referenced during the completion of the EIR and FSR in order to ensure compliance with Town standards.
Town of Halton Hills Stormwater Management Policy	The Stormwater Management Policy was referenced during the completion of the FSR.
Credit Valley Conservation O. Reg. 160/06	CVC staff have attended on-site and staked the physical top of bank as well as the wetland limits. In addition, a stable top of bank assessment was completed which confirmed that the physical top of bank is considered the stable top of bank. CVC's regulated limits have been shown on the appropriate figure/drawings. With the exception of some minor grading within 10m of the top of bank of the southern valley feature (behind Lot 24) and some minor grading within 30m of the southern wetland, no development is proposed within the CVC's regulated area.

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