MEV WLU Milton Campus – SWMF 2 – Preliminary Design Report

Wilfrid Laurier University Milton Campus – Stormwater Management Facility 2 – Preliminary Design Report

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Abbreviations

Abbreviation	Full Name
CH	Conservation Halton
CUWR	Centre for Urban Watershed Research
CVC	Credit Valley Conservation Authority
ELC	Ecological Land Classification
ESC	Erosion and Sediment Control
FSEMS	Functional Stormwater and Environmental Management Strategy
FSR	Functional Servicing Report
GI	Green Infrastructure
HDF	Headwater Drainage Feature
LID	Low Impact Development
MAMM	Mineral Meadow Marsh
MECP	Ministry of the Environment, Conservation and Parks (nee MOE)
MEV	Milton Education Village
MNRF	Ministry of Natural Resources and Forestry (now the MECP)
MOE	Ministry of the Environment (now the MECP)
MZO	Ministry Zoning Order
NHS	Natural Heritage System
PSW	Provincially Significant Wetland
Region	Region of Halton
ROPA	Region Official Plan Amendment
SAR	Species at Risk
SARA	Federal Species at Risk Act
SIS	Subwatershed Impact Study
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
SWMF	Stormwater Management Facility
SWMPDM	Stormwater Management Planning and Design Manual
Town	Town of Milton
TRCA	Toronto and Region Conservation Autority
VPZ	Vegetation Protection Zone
WLU	Wilfrid Laurier University

1.0 INTRODUCTION

1.1 PREAMBLE

To inform the development of the Milton Education Village (MEV) Secondary Plan lands inclusive of the Wilfrid Laurier University (WLU) lands, a number of significant studies and reports have been completed including a Functional Stormwater and Environmental Strategy Report (FSEMS). Amongst other disciplines, the FSEMS characterizes baseline environmental conditions, guides the implementation of development works and determines environmental constraints. As part of the overall MEV stormwater management strategy, the FSEMS identified three stormwater management facilities:

1. SWMF-1 – The northern facility located at the northeast corner of the MEV lands
2. SWMF-2 – The central facility located on the western limit of the WLU lands
3. SWMF-3 – The southern facility located at the south limit of the MEV lands

This report focuses, determines and supports the form, function and location of SWMF-2.

Within the FSEMS SWMF-2 (the central facility) is generally located along the western limit of the WLU campus lands adjacent to the Provincial Greenbelt. Recognizing a unique opportunity to provide research and environmental stewardship as envisioned by the WLU campus, WLU in coordination with WLU's Centre for Urban Watershed Research (CUWR) seeks to harmonize the location and siting of SWMF-2 to peruse and promote research objectives and to allow for SWMF-2 to uniquely function as both a research and engineered SWMF while meeting all required Town, Regional, Conservation Authority and Ministry requirements for SWM facilities. In addition, by implementing trails, education spaces, and additional plantings into proposed designs WLU strives to enhance the vision of the WLU campus experience and incorporate a SWMF meeting engineering/environmental requirements, provide research opportunities, and provide both public space and education.

To support and realize WLU's vision, SWMF-2 is proposed to be located within the Greenbelt lands which will impact existing wetlands and a headwater drainage feature (HDF) noted in the FSEMS as ICT-9. The preliminary concept and layout of the stormwater management pond (SWMF-2) and the realignment of ICT-9 are presented in **Figure 1.2**.

This objective of this report is to provide documentation of how locating SWMF-2 within the greenbelt lands can comply with the Greenbelt Plan (2017) specifically Policies 4.2.3.4 and 4.2.3.5.

1.2 MILTON EDUCATION VILLAGE

As noted in the Functional Stormwater and Environmental Management Strategy (FSEMS), the Milton Education Village (MEV) lands (the site) encompass an area of approximately 155 ha, west of Tremaine

Road, north of Britannia Road, 570 m south of Derry Road and generally east of Bell School Line within the Town of Milton. This area lies within the Indian Creek Subwatershed which is a tributary of the Bronte Creek Watershed.

Current land use is predominantly agricultural with small wetland complexes located along the west limit of the site with the Indian Creek Main Branch extending across the north limit of the site. As part of the Secondary Plan process for this area, a preferred land use plan has been developed for the future urban development within the study area. The location of the MEV lands is noted in **Figure 1.1**.

1.3 LAURIER LANDS

The proposed Wilfrid Laurier University (WLU) Milton campus is located on the property located northwest of the Tremaine Road and Britannia Road intersection (legal description Lot 8, Concession 7, PIN 250820005), in the Town of Milton, and Regional Municipality of Halton (the Property). The Property consists of two parts: Part 1 and Part 4. Part 4 is located within the Milton Education Village (MEV) Secondary Plan Area. Part 1 is designated as Protected Countryside and Natural Heritage System (NHS) within the Greenbelt Plan (2017; Schedule 1). The WLU campus buildings are proposed to be situated within Part 4 and green stormwater management (SWM) infrastructure is proposed to be located within a portion of Part 1 and service the proposed WLU Milton campus and adjacent lands of the MEV Secondary Plan Area. The location of the Laurier lands is noted in **Figure 1.1.**

1.4 PLANNING CONTEXT

The vision of the MEV Secondary Plan is to create a complete community inclusive of a mixed-used innovation district, anchored by a post-secondary education campus. To realize this vision, the Town of Milton (the Town) has submitted a Regional Official Plan Amendment (ROPA) for the MEV Secondary Plan Area and complementary Greenbelt lands. The Town is seeking to remove the Regional Employment Area overlay and provide policy direction that supports knowledge-based employment growth over the long-term through the MEV Secondary Plan. The submitted ROPA also provides site-specific policy to enable consideration of green infrastructure which provides the potential for innovative stormwater management systems and a broad range of activities related to the use of renewable resources, research and educational programing within the Protected Countryside lands of the Greenbelt.

The function of the stormwater management system within the Greenbelt lands adjacent to the MEV will serve the surrounding urban area to provide opportunities for academic research and support the recommended strategies of the Bronte Creek Watershed Plan.

Sound environmental stewardship practices and the development of a connected system of publicly accessible open space and trails will be encouraged to support recreational enjoyment and the study of the Greenbelt NHS.

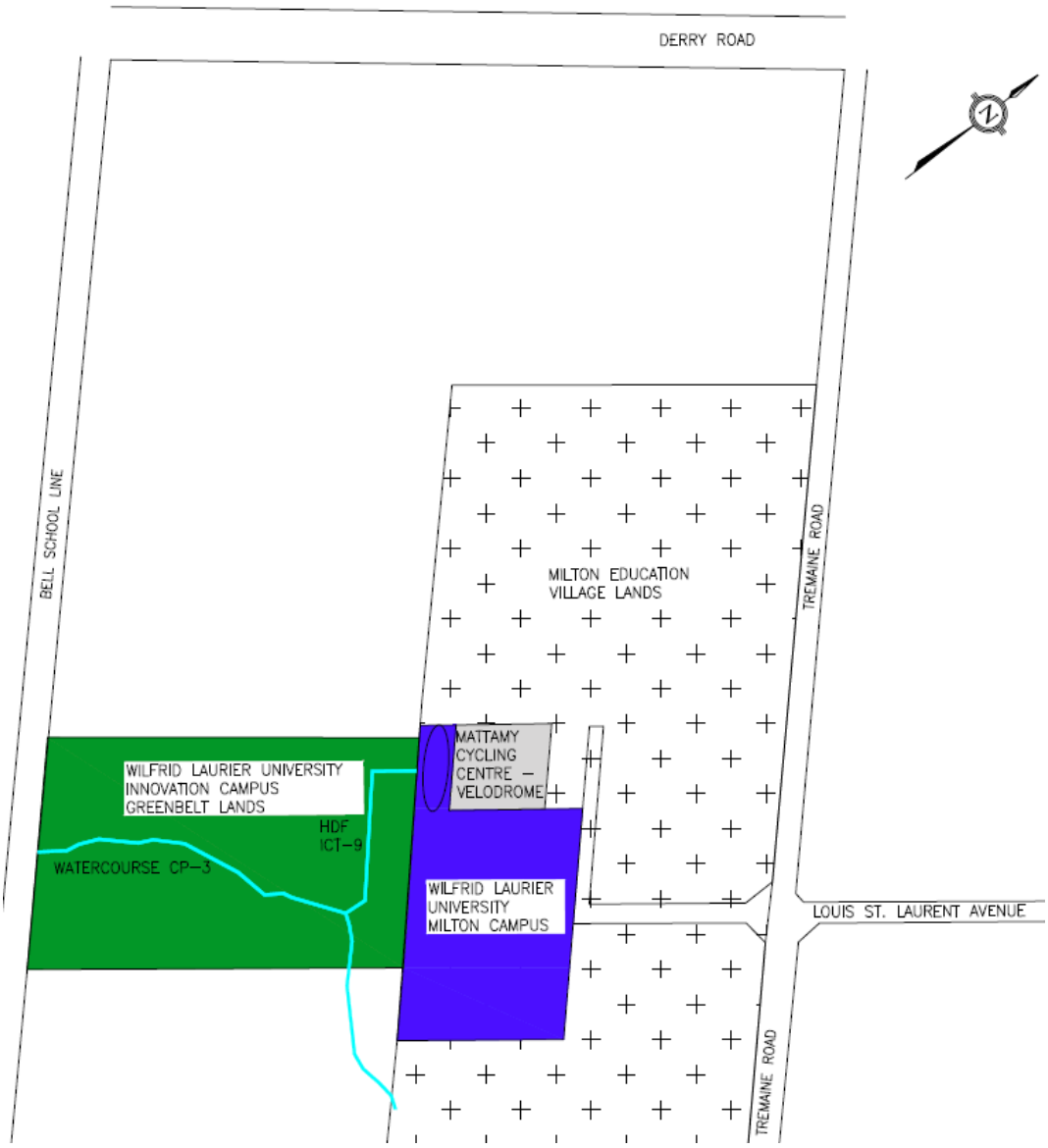

Figure 1.1 – Site Location

1.5 GREENBELT

Part 1 of the Property is subject to planning policies of the Greenbelt Plan, as it is designated as Protected Countryside and Natural Heritage System (NHS) within Schedule 1. As indicated in Section 2.4 of the Greenbelt Plan, Lands within the Protected Countryside designation "*are subject to the entirety of the Greenbelt Plan, except for Section 6.0*." In addition to the Agricultural System, the Protected Countryside designation includes the Natural System (Section 3.2), which is intended to provide a *"continuous and permanent land base necessary to support human and ecological health*."

Policies for the Natural System protect "*areas of natural heritage, hydraulic and/or landform features... and contribute to conserving Ontario's Biodiversity and maintaining the ecological integrity of the Greenbelt.*" The Natural System consists of the NHS and Water Resource System (WRS). The NHS includes "*core areas and linkage areas of the Protected Countryside with the highest concentration of the most sensitive and/or significant natural features and functions*." The WRS is made up of "*both ground and surface water features and areas and their associated functions which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems*."

Specifically, lands of Part 1 within the Property are designated as part of the NHS under Schedule 4 (Map 92). Policies for the NHS are provided in Section 3.2.2 of the Greenbelt Plan (2017).

As per subsection 3.2.2 (3), the Greenbelt Plan states that "*new development or site alteration in the NHS (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*;"

Key natural heritage features and Key hydrologic features are defined under Section 3.2.5; in accordance with this section:

"*Key natural heritage features include:*

- *Habitat of endangered species and threatened species;*
- *Fish habitat;*
- *Wetlands;*
- *Life science areas of natural and scientific interest (ANSIs);*
- *Significant valleylands;*
- *Significant woodlands;*
- *Significant wildlife habitat (including habitat of special concern species);*
- *Sand barrens, savannahs and tallgrass prairies; and*
- *Alvars*."

"*Key hydrologic features include:*

- *Permanent and intermittent streams;*
- *Lakes (and their littoral zones);*
- *Seepage areas and springs; and*
- *Wetlands*."

The regulation of key natural heritage features and key hydrologic features are provided in subsequent policies of Section 3.2.5.

As per Section 3.2.5(1), "*Development or site alteration is not permitted in key hydrologic features and key natural heritage features within the Natural Heritage System, including any associated vegetation protection zone, with the exception of:*

a) Forest, fish and wildlife management;

b) Conservation and flood or erosion control projects, but only if they have been demonstrated to be necessary in the public interest and after all alternatives have been considered; or

c) *Infrastructure, aggregate, recreational, shoreline and existing uses, as described by and subject to the policies of section 4*."

Furthermore, under Section 3.2.5 (4): *"In the case of wetlands, seepage areas and springs, fish habitat, permanent and intermittent streams, lakes and significant woodlands, the minimum vegetation protection zone (VPZ) shall be a minimum of 30 metres measured from the outside boundary of the key natural heritage feature or key hydrologic feature*."

Section 3.2.5(5) states that: "*A proposal for new development or site alteration within 120 metres of a key natural heritage feature within the NHS or a key hydrologic feature anywhere within the Protected Countryside requires a natural heritage evaluation or a hydrological evaluation which identifies a vegetation protection zone which:*

a) Is of sufficient width to protect the key natural heritage feature or key hydrologic feature and its functions from the impacts of the proposed change and associated activities that may occur before, during and after construction and, where possible, restore or enhance the feature and/or its function; and

b) *Is established to achieve and be maintained as natural self-sustaining vegetation*."

The green infrastructure proposed to occur in Part 1 of the Property overlaps with lands designated as Protected Countryside (Schedule 1) and NHS (Schedule 4, Map 92) by the Greenbelt Plan. General policies guiding infrastructure are provided in Section 4.2.1; in addition to the general infrastructure policies, specific policies regarding SWM infrastructure are listed in Section 4.2.3.

Section 4.2.3(3) states that "*SWM systems are prohibited in key natural heritage features, key hydrologic features and their associated vegetation protection zones. The determination of appropriate VPZ shall be defined in accordance with sections 3.2.5.4 and 3.2.5.5 of this Plan, which consider the area and nature of the feature being protected and the nature of the proposed SWM system*.

Within those portions of the Protected Countryside that define the major river valleys that connect the Niagara Escarpment and Oak Ridges Moraine to Lake Ontario, naturalized stormwater management systems may be permitted within the vegetation protection zone of a significant valleyland, provided they are located a minimum of 30 metres from the river or stream, and they are located outside of the vegetation protection zone of any other key natural heritage feature or key hydrologic feature. "

As per Section 4.2.3(4), "*Applications for development and site alteration in the Protected Countryside shall be accompanied by a SWM plan which demonstrates that:*

a) *Planning, design and construction practices will minimize vegetation removal, grading and soil compaction, sediment erosion and impervious surfaces;*

b) *An integrated treatment approach will be used to minimize stormwater flows and mimic natural hydrology through lot level controls, low impact development and other conveyance techniques;*

c) *Applicable recommendations, standards or targets within a subwatershed plan or equivalent and water budgets will be complied with; and*

d) *Applicable objectives, targets, and any other requirements within a stormwater master plan will be met in accordance with the policies in subsection 3.2.7 of the Growth Plan.*"

Lastly, Section 4.2.3(5) indicates that: "*the objectives of a SWM plan are to avoid, or if avoidance is not possible, minimize and mitigate stormwater volume, contaminant loads and impacts to receiving water courses in order to:*

a) *Maintain groundwater quality and flow and stream baseflow;*

b) *Protect water quality;*

c) *Minimize the disruption of pre-existing (natural) drainage patterns wherever possible;*

d) *Prevent increases in stream channel erosion;*

e) *Prevent any increase in flood risk; and*

f) *Protect aquatic species and their habitat."*

While the policies specific to SWM infrastructure suggest that development cannot occur within key natural features and key hydrologic features, general infrastructure policies of the preceding Section (4.2.1) indicate there may be some flexibility which may permit the development of infrastructure within the Protected Countryside designation.

Section 4.2.1(1) states that "*All existing, expanded or new infrastructure subject to and approved under the Canadian Environmental Assessment Act, the Environmental Assessment Act, the Planning Act, the Aggregate Resources Act or the Telecommunications Act or by the National or Ontario Energy Boards, or which receives a similar environmental approval, is permitted within the Protected Countryside, subject to the policies of this section and provided it meets one of the following two objectives:*

a) It supports agriculture, recreation and tourism, Towns/Villages and Hamlets, resource use or the rural economic activity that exists and is permitted within the Greenbelt; or

b) It serves the significant growth and economic development expected in southern Ontario beyond the Greenbelt by providing for the appropriate infrastructure connections among urban centres and between these centres and Ontario's borders."

In addition, Section 4.2.1(2) of the Greenbelt Plan states*: "The location and construction of infrastructure and expansions, extensions, operations and maintenance of infrastructure in the Protected Countryside are subject to the following:*

c) New or expanding infrastructure shall avoid key natural heritage features, key hydrologic features or key hydrologic areas unless need has been demonstrated and it has been established that there is no reasonable alternative; and

d) *Where infrastructure does cross the Natural Heritage System or intrude into or result in the loss of a key natural heritage feature, key hydrologic feature or key hydrologic areas, including related landform features, planning, design and construction practices shall minimize negative impacts on and disturbance of the features or their related functions and, where reasonable, maintain or improve connectivity*."

1.6 BACKGROUND DOCUMENTS

Previous studies have been completed in support of the Milton Education Village Lands and the Site. These studies are relied on to provide the appropriate criteria that apply to this design. The studies include:

- *"Functional Servicing Report – Pan American Games Milton Velodrome Water, Wastewater and Stormwater Management Servicing",* prepared by AMEC Environmental & Infrastructure, dated June, 2012;
- *"Milton Education Village Lands – Scoped Characterization and Baseline Inventory (Draft Final) – Town of Milton"*, prepared by Amec Foster Wheeler (AFW), dated, March 9, 2018;
- *"Amended No. 62to the Official Plan of the Town of Milton – Subject: Milton Education Village Secondary Plan and Related Official Plan Amendments"*, prepared by the Town of Milton, dated September 30, 2021;

- "*Milton Village Secondary Plan and Related Official Plan Amendments",* prepared by the Town of Milton, dated December 2020;
- *"Ontario Regulation 476/21 made under the Planning Act – Zoning Order – Milton Education Village, Town of Milton"*, issued by the Government of Ontario, dated June 17, 2021; and
- *"Functional Stormwater and Environmental Management Strategy (Draft Final) – Milton Education Village – Milton, ON – Project #TP112016"* (FSEMS), prepared by Wood Environment & Infrastructure Solutions a Division of Wood Canada Limited (Wood), dated September 30, 2021.

Additional planning and design documents reviewed as part of the Site design/analysis include:

- *"Stormwater Management Planning and Design Manual"* (SWMPDM), prepared by the Ministry of the Environment (now the Ministry of the Environment Conservation and Parks), dated March, 2003;
- *"Greenbelt Plan"*, prepared by the Government of Ontario, dated 2017;
- *"Town of Milton Engineering and Parks Standards Manual",* prepared by the Town of Milton, dated March 2019; and
- *"Conservation Halton Guidelines for Stormwater Management Engineering Submissions",* prepared by Conservation Halton, dated May, 2021 (draft).

1.7 STUDY TEAM

A multi-disciplinary study team has been assembled to evaluate the environmental conditions and provide recommendations related to servicing requirements, SWM strategy, and NHS design of the Study Area. Their responsibilities include:

- Brook McIlroy – Architecture, Landscape Architecture, Urban Design
- Dillon Consulting Limited – Environmental, Natural Heritage – Terrestrial and Aquatic
- Paul Brown & Associates Inc. – Project Management
- Stantec Consulting Inc. – Engineering, and Water Resources

Figure 1.2 – SWMF-2 and ICT-9

2.0 AQUATIC AND TERRESTRIAL FEATURES SUMMARY

Detailed field studies were completed by Dillon between April and August of 2021 to provide an update on the existing conditions of the Property identified in the FSEMS and Characterization Study. As a result of the 2021 field program, several natural heritage features were identified and delineated. While Part 4 consisted of active agricultural lands, Part 1 of the Property contains several terrestrial (wetland units including a deciduous forest swamp), and aquatic features (HDFs). A summary of the natural features observed are provided below; a more fulsome review of the existing conditions will be provided in the forthcoming MEV SIS.

2.1 AQUATIC FEATURES

2.1.1 Headwater Drainage Feature (ICT-9)

An HDF assessment of ICT-9 (as identified in the FSEMS) was completed within the Property, consisting of three site visits in general accordance with the 'standard methods' outlined in the Evaluation, Classification, and Management of Headwater Drainage Features (Toronto Region Conservation Authority (TRCA) and Credit Valley Conservation (2014). During the first visit (April 12, 2021) the site was walked to inventory and assess potential HDF's present within the Property boundaries, specifically focusing on areas identified in background mapping. During the second (May 11, 2021) and third (August 27, 2021) site visits, data collection was more focused on presence/absence as typically HDF's are dry or starting to dry up during these periods. If flow was present, the same field data was collected as the first assessment to further inform hydroperiod as well as aquatic and terrestrial habitat potential associated with HDFs within the Property.

The data collected during the site visits is then used to help determine appropriate management recommendations for HDF's present within the Property, based on their classification in accordance with the 2014 guidance document.

The evaluation criteria within the TRCA guidance document are broken down into four categories:

1. Hydrology Classification
2. Riparian Classification
3. Fish and Fish Habitat Classification
4. Terrestrial Habitat Classification.

Generally, data collected for ICT-9 aligned with data previously collected for the 2021 FSEMS. In its current state, ICT-9 is associated with meadow marsh habitat (MAMM1-16; **Figure 2.1**) and receives flow

from the existing Velodrome SWM pond to the northeast. The meadow marsh feature associated with ICT-9 is dominated by non-native species and is associated with a low area of the agricultural field. Flow from ICT-9 outlets to CP-3 located farther south within the Property (**Figure 2.1**). Both reaches of CP-3 and CP-4 are considered intermittent features which dry out in the summer months. Surface flow conveyed from ICT-9 to CP-3 and CP-4 may also contribute to the water balance of the deciduous swamp forest (SWDM3-3/SWMD2-2) located further south within Part 1.

While no fish were observed within the HDF by Dillon in 2021, one Northern Red Bellied Dace (*Chrosomus eos*) was captured within ICT-9 in 2018 as part of surveys conducted in support of the 2021 FSEMS. As flow within the HDF is consistent throughout the year given the inputs from the Velodrome SWM pond, fish habitat is considered present (albeit, poor).

2.1.2 Watercourse (CP-3)

A fisheries habitat assessment was conducted by Dillon on June 25, 2021, for the watercourse identified as CP-3 within the Property in the 2021 FSEMS. Information collected during the assessment included (where applicable): substrate type, feature dimensions (e.g. width and depth) and riparian vegetation. This data was used, in part, to determine the overall health and sensitivity of the watercourse.

Given that CP-3 was dry during the assessment, it was assessed as an intermittent feature. Substrates of CP-3 were clay-dominant. Riparian habitat was classified as Reed Canary Grass and cultural meadow (**Figure 2.1**). The majority of instream cover to CP-3 was provided by vascular macrophytes and woody debris was also noted to provide minimal instream and overhanging cover. Emergent vegetation (Reed Canary Grass) provided 90-100% of shore cover to the feature.

2.2 TERRESTRIAL FEATURES (WETLANDS)

The form and function of wetland units present within Part 1 of the Property were evaluated during the 2021 field program through ELC, botanical inventories, and wildlife surveys.

2.2.1 Ecological Land Classification

Vegetation communities present within Part 1 and Part 4 of the Property were evaluated by Dillon in early spring (April 8, 2021) and during the summer growing season (July 5, 2021). Vegetation communities were assessed using the ELC system for Southern Ontario, second approximation (Lee et al., 1998; Lee, 2008) to identify and assess potential natural heritage features within and adjacent to the Property. During the field investigations, vegetation was characterized using ELC in order to classify and map ecological communities to the vegetation level. Soil texture and site moisture characteristics were determined through the examination of hand auger soil profiles to further refine the ELC classification.

The boundaries of the wetland units were delineated by Dillon and Conservation Halton (CH) on June 25 and July 15, 2021. ELC communities and staked boundaries of wetlands within the Property are depicted on **Figure 2.1**. The community types present in each of the wetland units are described below in **Table 2.1**. Photos for each community are provided in Appendix A.

Table 2.1 - ELC Communities for Wetland Units Present in Part 1 and Part 4

ELC CODE	Name	Description	Photo #
MASM1-14	Reed Canary Grass Mineral Shallow Marsh	Two wetland communities located next to each other adjacent to a fallow agricultural field on the southern extent of Part 1.	
		The vegetation composition of the first community consists primarily of non-native or invasive species: Reed Canary Grass (*Phalaris arundinacea*), Purple loosestrife *(Lythrum salicaria*), Narrow-leaved Cattail (*Typha angustifolia L.*) with occasional occurrences of Common Reed (*Phragmites australis*)	1
		Likewise, the vegetation composition of the second community also consists primarily of non-native or invasive species: Reed Canary Grass and Purple Loosestrife with occasional occurrences of Narrow-leaved Cattail, Soft Rush (*Juncus effusus*), and Lance-leaved Aster (*Symphyotrichum lanceolatum*).	2
MAMM1-3	Reed-canary Grass Graminoid Mineral Meadow Marsh	Three similar vegetation communities located in the central northern portions of Part 1 within the Property.	
		The first community is confined to the floodplain of the mapped watercourse (CP-3) located on Part 1. The vegetation composition of this community is dominated by Reed Canary Grass. Other species present as occasional occurrences consisted of Soft Rush, Lance-leaved Aster, Tall Goldenrod (*Solidago altissima*), Sedge species (*Carex sp*), Horseheal (*Inula helenium*), Purple Loosestrife and Wild Carrot (*Daucus carota*).	3-4
		The second community is located on the edge of a fallow agricultural field on the southwestern extent of Part 1. This community is dominated by Reed Canary Grass and Purple Loosestrife (non-native species).	5
		The third community is located on the western edge of the Part 1 and is part of the Indian Creek Provincially Significant Wetland Complex. This feature was previously staked by the Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF, formerly the Ministry of Natural Resources and Forestry MNRF) and identified as a PSW in 2011 and 2017 (FSEMS, 2021). Since the 2011 and 2017 agency site visits, the boundary of the PSW had reduced significantly due to plowing activities north of the Property boundary (decreased from approximately 0.43 ha to 0.017 ha). The staked boundary delineated by CH and Dillon on July 15, 2021 represents the remaining portion of the PSW. The small section of remaining wetland within Part 1 was dominated by Reed Canary Grass, Purple Loosestrife and Tall Goldenrod.	6-7
MASM1-1	Cattail Mineral Shallow Marsh	This community is considered part of the Indian Creek Provincially Significant Wetland Complex (PSW) and was located on the western edge of the Britannia Wetland Area of Natural and Scientific Interest (ANSI). This community is dominated by Narrow-leaved Cattail with occasional occurrences of Reed Canary Grass, Purple Loosestrife and Lance-leaved Aster.	8
MAMM1-16		Three vegetation communities present within the central and eastern extent of Part 1 of the Property:	

ELC CODE	Name	Description	Photo #
	Mixed Graminoid Graminoid Mineral Meadow Marsh	The first community is part of the Indian Creek Provincially Significant Wetland Complex and is located on the western edge of the Britannia Wetland ANSI. The boundaries of wetland appear to have expanded from the MNDMNRF mapping as the agricultural fields directly adjacent to the wetland have begun to re-naturalize.. Vegetation is primarily dominated by Reed Canary Grass with Soft Rush, Lance-leaved Aster, Purple Loosestrife and Narrow-leaved Cattails present as associate species.	9-12
		This community is located within a fallow agricultural field and contained an outflow from the previous wetland unit described above. Based on a review of past areal imagery, this community has recently formed in a historically wet/low-lying area once active agricultural ceased. Dominate vegetation consisted of Reed Canary Grass and Narrow-leaved Cattail with occasional Lance-leaved Aster and Purple Loosestrife.	13-14
		This community is located primarily along the southwestern and western extents of the property boundary for Part 1. This community is dominated by Narrow-leaved Cattail, Reed Canary Grass and Purple Loosestrife with occasional occurrences of Lance-leaved Aster, Fox Tail Barley (*Hordeum jubatum*), Soft Rush, Willowherb species (*Epilobium sp*.) and rare occurrences of Woolgrass (*Scirpus cyperinus*). At the time of survey soils were observed to be saturated. This is consistent with review of historic aerial imagery which shows darks areas, indicating that this area has been historical saturated. The soil consisted of a clay loam A horizon and a Silty Clay to Clay B horizon which was heavily mottled. It was noted the free flowing water from the A horizon infiltrated the soil pit. Based on these observations this community has likely recently formed through re-naturalized of a historical wet area once active agricultural in the area ceased.	15-18
SWDM3-3/ SWDM2-2	Swamp Maple Mineral Deciduous Swamp/Green Ash Mineral Deciduous Swamp	Deciduous swamp community located centrally within the Property, dominated by Silver Maple (*Acer saccharinum*), Burk Oak (*Quercus macrocarpa*), Swamp Maple (*Acer rubrum*), and Green Ash (*Fraxinus pennsylvanica),* with the sub-canopy consisting of White Elm (*Ulmus laevis*), Shagbark Hickory (*Carya ovata*), and Common Buckthorn (*Rhamnus cathartica*). Understory layers included young Green Ash, and Gray Dogwood (*Cornus racemosa*), while the ground layers consisted of Fowl Manna Grass (*Glyceria striata*), Thicket Creeper (*Parthenocissus vitacea*), and White Avens (*Geum canadense*). The deciduous swamp community meets Significant Woodland criteria under policies of the Region of Halton Official Plan (Section 277) as it is larger than 2 ha in size.	19

As noted in **Table 2.1**, the wetland communities consisted predominantly of non-native species. Furthermore, no provincially rare botanical species were observed. While the surface of the unevaluated wetlands units were observed to be wet in early spring (April 8, 2021); the surfaces were noted to be dry during the second (May 17, 2021) and third (June 23, 2021) amphibian surveys and first breeding bird survey (June 7,2021). Surface water was again present in the features following large rain events occurring later in July, 2021.

The remaining habitat identified within Part 1 consisted of cultural meadows (CUM; **Figure 2.1**) and treed hedgerows (TAGM5). As mentioned previously in Section 2.0, Part 4 consisted of agricultural land uses (annual row crops, OAGM1; and cultural meadows, CUM).

2.2.2 Significant Wildlife Habitat

Based on the existing conditions, the wetlands had the potential to provide candidate amphibian breeding (wetland and woodland) significant wildlife habitat (SWH), marsh breeding bird SWH, and terrestrial crayfish SWH. Criteria for SWH was evaluated using the Significant Wildlife Habitat Technical Guide Ecoregion 7E Criterion Schedules (MNDMNRF, 2015). Candidate Turtle Overwintering SWH was ruled out for wetland units present in Part 1 as water depths present were too shallow throughout the Property. Survey results, and observations to confirm the absence or presence of each SWH are summarized below.

2.2.2.1 Amphibian Breeding SWH (Wetland and Woodland)

Eight survey stations were assessed to evaluate the presence of breeding amphibians within the wetlands associated with the Property. Nocturnal acoustic amphibian surveys followed methods of the Marsh Monitoring Protocol (Bird Studies Canada, 1995). Three surveys were conducted between late-April and early July in 2021 to document early, mid, and late-season breeders with a minimum of 15 days separating each survey. Each of the three surveys were undertaken when nighttime temperatures were a minimum of 5°C, 10°C and 17°C, respectively.

Surveys consisted of three minute point-counts conducted no earlier than 30 minutes after sunset. Information collected during surveys included documentation of species observed, as well as estimations of population size and species density. As a supplement to the nocturnal acoustic surveys, incidental amphibian observations, which included individual species sightings, as well as evidence of breeding behaviour (i.e. the presence of eggs, tadpoles and pollywogs) within the meadow marshes were documented during site visits (if observed).

The amphibian call surveys were conducted on April 29, 2021, May 17, 2021 and June 23, 2021. Results of the amphibian call surveys are provided below in **Table 2.2**.

Survey stations 1, 5, 7, and 8 were assessed against EcoRegion 7E criteria for woodland amphibian breeding SWH, as the associated wetland communities were located within 120 m of a woodland. Conversely, survey stations 2, 3, 4, and 6 were used to assess wetland communities under the EcoRegion 7E amphibian breeding SWH criteria for wetlands. Amphibian survey stations used during the 2021 field program by Dillon are depicted on **Figure 2.1**.

Table 2.2 - Results of 2021 Amphibian Call Surveys

Scientific Name	Common Name	SARA[1]	ESA[2]	SRANK[3]	Call Codes Identified per 2021 Survey Date[4]						Criteria for SWH met?[5]
					April 28		May 17		June 23		
					Within 100 m	Outside 100 m	Within 100 m	Outside 100 m	Within 100 m	Outside 100 m	
Station 1 (MAS2-1: Woodland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	3	---	1-2	---	---	---	***Yes***
Pseudacris crucifer	Spring Peeper	---	---	S5	3	---	3	---	---	---	
Hyla versicolor	Gray Treefrog	---	---	S5	---	---	2-7	---	---	---	
Lithobates clamitans	Green Frog	---	---	S5	---	---	---	---	---	1-1	
Station 2 (MAMM1-16; Wetland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	1-1, 1-1	---	---	---	---	---	*No*
Pseudacris crucifer	Spring Peeper	---	---	S5	1-2	---	1-1, 1-1, 1-1	---	---	---	
Station 3 (MAMM1-16; Wetland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	1-1	---	---	---	---	---	*No*
Hyla versicolor	Gray Treefrog	---	---	S5	---	---	---	1-1	---	---	
Station 4 (MAMM1-3; Wetland Amphibian Breeding SWH)											
No amphibians heard											*No*
Station 5 (MASM1-1 & SWDM3-3/SWDM2-2 ; Woodland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	*3*	---	---	*1-2*	---	---	***Yes***
Pseudacris crucifer	Spring Peeper	---	---	S5	*3, 2-7*	---	---	*1-2*	---	---	
Lithobates clamitans	Green Frog	---	---	S5	---	---	---	---	*1-1*	---	
Station 6 (MAMM1-3; Wetland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	1-2	---	---	---	---	---	*No*
Pseudacris crucifer	Spring Peeper	---	---	S5	2-3	---	---	---	---	---	
Station 7 (MAMM1-3; Woodland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	1-2, 1-2	---	---	---	---	---	*No*
Pseudacris crucifer	Spring Peeper	---	---	S5	1-2	3	---	---	---	---	

Scientific Name	Common Name	SARA[1]	ESA[2]	SRANK[3]	Call Codes Identified per 2021 Survey Date[4]						Criteria for SWH met?[5]
					April 28		May 17		June 23		
					Within 100 m	Outside 100 m	Within 100 m	Outside 100 m	Within 100 m	Outside 100 m	
Station 8 (MASM1-14; Woodland Amphibian Breeding SWH)											
Anaxyrus americanus	American Toad	---	---	S5	3, 1-3	3	---	1-2	---	---	***Yes***
Pseudacris crucifer	Spring Peeper	---	---	S5	3	3	---	2-5	---	---	
Hyla versicolor	Gray Treefrog	---	---	S5	---	---	---	1-2	---	---	

[1] *Federal Species at Risk Act, 2002.*
[2] *Provincial Endangered Species Act, 2007.*
[3] *Provincial Conservation Ranking (SRank) where S5 = secure, S4 = apparently secure, S3 = vulnerable, S2 = imperiled, S1 = critically imperiled, SX = extirpated, SH = possibly extirpated, SNA = A conservation status rank is not applicable because the species is not a suitable target for conservation activities, SE = exotic, SU = unranked, B = breeding, N = non-breeding, and? = some uncertainty with the classification due to insufficient information.*
[4] *Call codes represented by: X-Y; where X denote the estimated population size, and Y estimated the number of individuals heard. X of 1 = very low population estimate with few individuals present/no overlap in calls, X of 2 = medium population with few overlapping calls, X of 3 = large population, full chorus singing.*
[5] *Assessment for presence of confirmed SWH using the MNDMNRF 2015 SWH Criterion Schedules for Ecoregion 7E.*

Generally, low call codes of spring peepers and American toads were documented during the early spring survey (April 29, 2021) in the majority of wetland units; however full chorus' of spring peeper and American toad were documented from survey stations 1, 5, and 8. As the wetland units dried out over the course of the spring (May 17, 2021) and summer (June, 23, 2021) surveys, fewer calls of amphibians were heard at all stations, with the exception at station 1 (call code of 3 observed for Spring Peepers). Based on 2021 amphibian survey results, wetland communities MAS2-1, MASM1-1 & SWDM3-3/SWDM2-2, and MASM1-14 meet criteria for woodland amphibian breeding SWH under the Significant Wildlife Habitat Technical Guide Ecoregion 7E Criterion Schedules (MNDMNRF 2015; **Figure 2.2**). Criteria was not met for the remaining wetland units present within Part 1.

2.2.2.2 Marsh and Woodland Area-Sensitive Breeding Bird SWH

Marsh communities present within Part 1 of the Property have the potential to provide candidate SWH for Marsh Breeding Bird SWH. Similarly, Candidate Area Sensitive Breeding Bird SWH has the potential to occur in association with the deciduous swamp. Breeding bird surveys were conducted to evaluate the presence of both SWH types.

Diurnal breeding bird surveys followed methods outlined in the Ontario Breeding Bird Atlas Guide for Participants (Cadman et al. 2007). Two surveys were conducted between May 24 and July 10 to document both early-season and late-season breeders. The first survey was undertaken on June 7, 2021 while the second survey was conducted on July 5, 2021.

Surveys consisted of 10 minute point-counts generally conducted between dawn and five hours after sunrise to establish quantitative estimates of bird abundance in suitable habitat types within the Property.

Evidence of breeding behavior were recorded during the surveys, which generally includes but was not limited to, males singing, nest building, egg incubation, territorial defense, carrying food, and feeding young. Breeding bird survey point count stations are depicted on **Figure 2.1**. To supplement the surveys, area searches within candidate habitat were completed. Area searches involved noting individual bird species and their corresponding breeding evidence while traversing the habitat on foot between point counts.

None of the listed indicator species for either SWH types in the Ecoregion 7E Criterion Schedules (MNDMNRF, 20215) were observed during the two breeding bird surveys. As such, none of the vegetation communities are considered marsh breeding bird SWH, or Woodland Area-Sensitive Breeding Bird SWH.

2.2.2.3 Special Concern and Rare Wildlife SWH

Eastern Wood-pewee (Contopus virens) and Wood Thrush (Hylocichla mustelina) were both observed during breeding bird surveys conducted within the deciduous swamp forest (point count station 5; SWDM3-3/SWMD2-2). Therefore, SWH for these two species exists in association with the Significant Woodland/deciduous swamp.

2.2.2.4 Terrestrial Crayfish SWH

While not formally surveyed, incidental observations of terrestrial crayfish burrows were noted throughout the Property during each site visit during the growing season. Crayfish burrows were identified incidentally within the majority of wetland units (marsh and swamp) present within Part 1. Features where Crayfish burrows were observed are considered confirmed SWH for Terrestrial Crayfish. Locations of confirmed terrestrial crayfish SWH are mapped on **Figure 2.2**.

2.2.3 Species at Risk

Limited habitat for species at risk (SAR) was observed within the Property, and has the potential to be directly impacted as a result of the proposed development within Parts 1 and 4.

While targeted surveys for snag and cavity trees were not performed for the Property, potential habitat for SAR bat species (Little Brown Myotis, *Myotis lucifugus*; Northern Myotis, *Myotis septentrionalis*; Tricoloured Bat, *Perimyotis subflavus*; Eastern Small-footed Myotis, *Myotis leibii*) exists in association with the deciduous swamp community/Significant Woodland (SWDM3-3/SWDM2-2). Given that no snag and/or cavity trees were observed in association with hedgerows (TAGM5) and/or isolated tress, potential bat roosting habitat was assessed as being limited to the Significant Woodland/swamp community.

Barn Swallow (*Hirundo rustica*) were observed during breeding bird surveys foraging over wetlands of Part 1. Breeding habitat was ruled out for this species, as no breeding behavior was observed, and no suitable structures were present with active or historic nests.

Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlarks (*Sturnella magna*) were not observed as a result of three grassland breeding bird surveys conducted in 2021 (June 7, June 24, and July 5); similar results were reported by the Town as a result of field studies conducted in support of the 2021 FSEMS. While cultural meadow habitat is present within the interior of Part 1 of the Property, breeding habitat was ruled out as the botanical composition is dominated by forbe species. While no Bobolinks were observed during the grassland bird surveys during the breeding season, two were incidentally observed during the July 5, 2021 staking exercise with Dillon and CH. The two birds were observed perching together and flying within the cultural meadow habitat. Due to the time of year these birds were observed, the poor composition of habitat (forbe dominant), and lack of observations made during the breeding season during targeted grassland bird surveys, it is assumed that these observations were of a transient pair foraging, and that the Property does not support breeding habitat for this species.

No other SAR or SAR habitat was observed within wetland communities present within Part 1 or Part 4.

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TREMAINE ROAD AND BRITANNIA ROAD
MILTON, ONTARIO

FIGURE 2.1
ECOLOGICAL LAND CLASSIFICATION

- Property Boundary
- Study Area
- Amphibian Call Survey Station
- Breeding Bird Survey Location
- Watercourse
- Headwater Drainage Feature

Staked Wetland (Dillon and CH; July 15, 2021)

- Dripline
- Wetland

Ecological Land Classification

- CGL-4 - Recreation
- CVI-1 - Transportation
- CVR-1 - Low Density Residential
- CVR-4 - Rural Property
- CUM - Cultural Meadow
- MAMM1-16 - Mixed Graminoid Graminoid Mineral Meadow Marsh
- MAMM1-3 - Reed-canary Grass Graminoid Mineral Meadow Marsh
- MAS2-1 - Cattail Mineral Shallow Marsh
- MASM1-1 - Cattail Mineral Shallow Marsh
- MASM1-14 - Reed Canary Grass Mineral Shallow Marsh
- SWDM3-3/ SWDM2-2 - Swamp Maple Mineral Deciduous Swamp / Green Ash Mineral Deciduous Swamp
- OAGM1 - Annual Row Crops
- TAGM5 - Hedgerow

1:5,000

0 50 100 200 m

N W E S

MAP DRAWING INFORMATION:

DATA PROVIDED BY ESRI, MNRF & DILLON CONSULTING

MAP CREATED BY LK
MAP CHECKED BY CV

MAP PROJECTION: NAD 1983 UTM Zone 17N

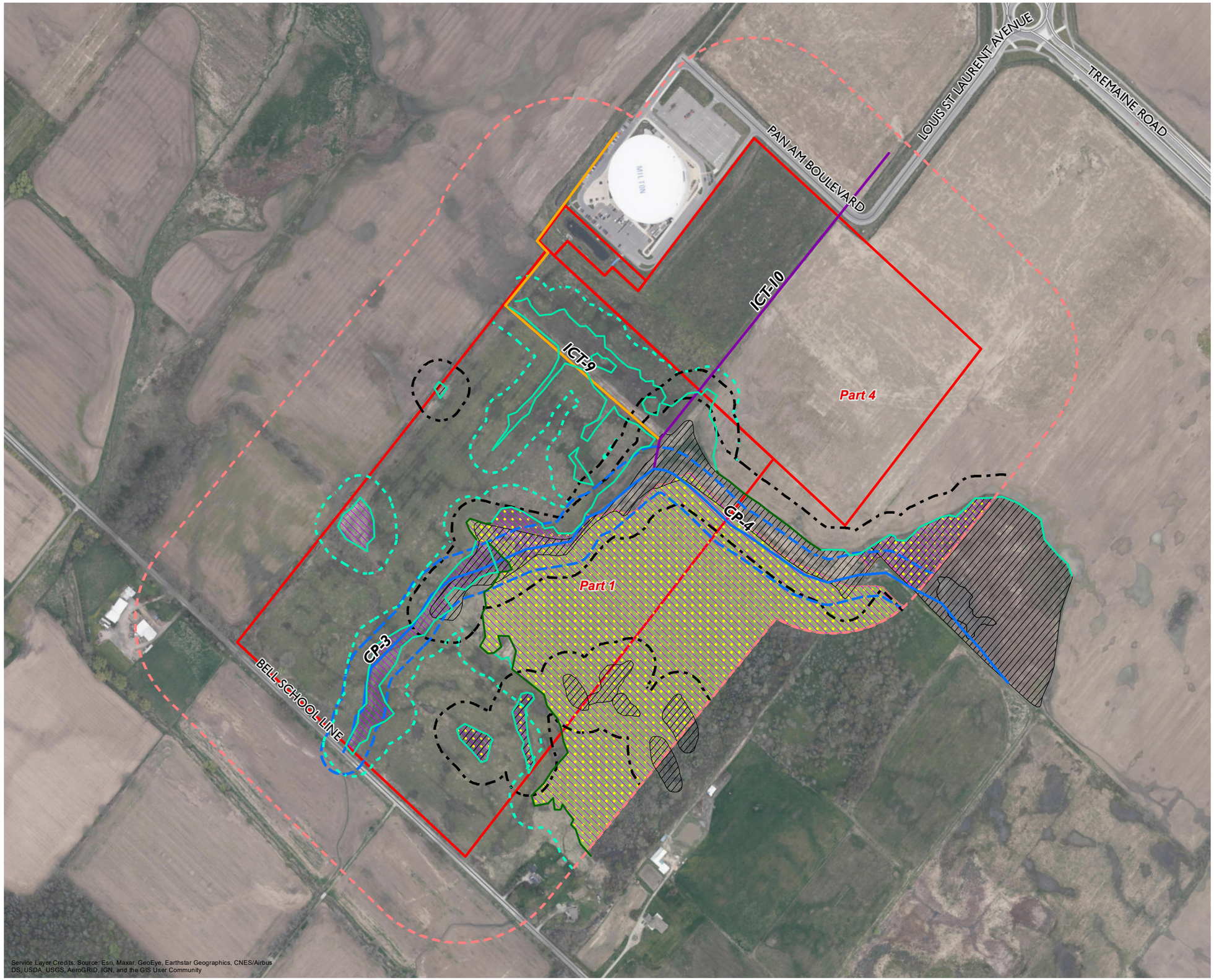
DILLON CONSULTING

PROJECT: 203875

STATUS: DRAFT

DATE: 2021-08-04

FILE LOCATION: K:\2020\203875 - WLU EIS Milton\Product\Client\Memo\Figure 1 ELC.mxd



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TREMAINE ROAD AND BRITANNIA ROAD
MILTON, ONTARIO

FIGURE 2.2
NATURAL HERITAGE EVALUATION
AND **CONSTRAINTS**

- Property Boundary
- Study Area
- Significant Woodlands, Confirmed SWH for Eastern Wood Pewee and Wood Thrush, Candidate SWH for Bat Maternity Roosts, Potential SAR Bat Habitat
- Provincially Significant Wetland (PSW)
- Confirmed SWH for Terrestrial Crayfish
- Confirmed SWH for Amphibian Breeding (Woodland)
- Watercourse

Preliminary HDF Management Recommendations

- Conservation
- No Management Required

Staked Wetland (Dillon and CH; July 15, 2021)

- Dripline
- Wetland

Constraint Buffers

- 30 m Unevaluated Wetland
- 30 m PSW Buffer
- 30 m Watercourse Buffer

1:5,000

0 50 100 200 m

N W E S

MAP DRAWING INFORMATION:

DATA PROVIDED BY ESRI, MNRF & DILLON CONSULTING

MAP CREATED BY LK
MAP CHECKED BY CV

MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 203875

STATUS: DRAFT

DATE: 2021-10-28

FILE LOCATION: K:\2020\203875 - WLU EIS Milton\Product\Client\Memo\Figure 2 Constraints_20211028.mxd

3.0 ICT-9 REALIGNMENT

3.1 BACKGROUND AND FSEMS DESIGNATION

Based on aerial photographs, ICT-9 appears to have been present in the landscape as a ditch prior to the construction of the Velodrome and, as a result it is not unrealistic to assume that it may have received inputs from the adjacent agricultural fields. In its current state, ICT-9 functions as the outfall channel for the Velodrome SWM Pond; however, the feature also likely collects flow from the adjacent agricultural fields from the west and north.

Within the FSEMS, ICT-9 was initially classified as 'Protection' due to standing water throughout the year with fish found in pools during the spring; however, the classification was ultimately updated to 'Conservation' based on the poor nature of the fish habitat and the source of flow (upstream SWM pond). Within the FSEMS a 'Conservation' feature is noted as having "Valued Functions: e.g. seasonal fish habitat with woody riparian cover; marshes with amphibian breeding habitat; or general amphibian habitat with woody riparian cover". The FSEMS notes the following for 'Conservation' features:

> "Realignment permitted provided important ecological functions are maintained, including linkage functions if the existing feature provides a linkage function. Conservation features providing important linkage functions may be incorporated into the NHS. Also, realignment may be permitted within existing buffer areas, provided that the feature realignment/creation supports the objectives of the buffer."

As noted within Table 5.5.1 of the FSEMS, realignment of a HDF such as ICT-9 must be done with natural channel principals; additionally, the valued functions of the HDF (e.g. habitat and enhanced linkage) must be maintained.

While ICT-9 was noted to have associated valued functions, the habitat associated with the feature were noted to be limited as a result of surveys conducted in 2021. As mentioned previously in Section 2.1.2, wetland vegetation extending from the HDF was dominated by non-native botanical species. Furthermore, no SWH, SAR or SAR habitat was identified within the HDF or associated wetland habitat. Lastly, limited fish habitat was identified within ICT-9. While ICT-9 provides a direct connection to the larger deciduous swamp and PSW located to the south, opportunities exist elsewhere to lengthen, improve and enhance the feature.

3.2 REALIGNMENT

In support of the proposed development, HDF ICT-9 is to be realigned to the north and west of SWMF-2. The realignment location was selected to provide linkage between Wetland Unit 3 (a PSW) and CP-3. As Wetland Unit 3 does not currently connect to ICT-9 hydraulically, a direct hydraulic connection (e.g. realigning the low flow channel within the staked area of Wetland Unit 3) is not proposed.

3.2.1 Natural Channel Design

The realignment will follow key design principles including:

- Creating stream channels that will be dynamically stable and functional at low-flows (as these watercourses become intermittent during periods of low precipitation) as well as during higher flood-flow conditions;
- Providing channel inverts, as required, to service the adjacent tablelands;
- Incorporating a diversity of aquatic habitat components within the low-flow channel, riparian zone and adjacent floodplain to establish a functional connection between areas of fish habitat (where feasible), aquatic habitat and terrestrial habitat, based on anticipated flow and channel widths;
- Incorporating a diverse channel morphology with the inclusion of meanders, online/offline wetlands, riffles/pools and runs, and;
- Integrating recreational facilities in the form of pedestrian crossings.

The above noted goals can be achieved with a HDF design based on principles of natural channel design. Natural channel design is most commonly accomplished by restoring the dimension, pattern and profile of a disturbed river system by emulating a natural and stable reference reach.

Under preliminary design conditions, a 20 m wide channel block has been provided. In accordance with Section 3.2.5 of the Greenbelt Plan (2017), the realigned 20 m channel block would be considered a Key Hydrologic Natural Heritage Feature. As such, a 30 m Vegetation Protection Zone (VPZ) has been provided on either side in accordance with Section 3.2.5 (4) of the Greenbelt Plan in order to protect the feature in the post-construction conditions. The final channel block width is to be confirmed though a detailed geomorphic assessment as part of future studies.

3.2.2 Aquatic and Terrestrial Design

The proposed channel length for the realignment of ICT-9 depicted on **Figure 4.1** is anticipated to increase from approximately 263 m to 629 m under the proposed conditions (a 366 m increase in linear length), providing a net gain in aquatic habitat/Key Hydrologic Natural Heritage Feature. In comparison to the straightened ditch that currently exists in the landscape, the realigned HDF will be designed to have a slight meandering natural channel. The net gain provided through the extended aquatic habitat is in alignment with Section 3.3.2(b) of the FSEMS.

In addition to the increase in length, plantings proposed directly within the realigned feature will consist of native species tolerant of wet conditions. Additional native botanical species will be proposed as buffer plantings within the 30 m VPZ as adjacent riparian habitat. The inclusion of native species within planting plans for the proposed realignment is in accordance with Section 3.2.2 and Section 3.4.5 of the Greenbelt

Plan. Preliminary details regarding plantings proposed for Part 1 are discussed in **Section 7.0** of this report.

Furthermore, the realigned ICT-9 has been designed to improve linkages and ecological connections within the landscape. Improving linkages and the connectivity with existing natural features within the landscape is in accordance with Section 3.2.2 (3b) of the Greenbelt Plan. The 30 m VPZ of the realigned HDF overlaps with, and provides a connection to a retained wetland feature within the landscape (i.e. the Reed Canary Grass Graminoid Mineral Meadow Marsh; MAMM1-3). This connection may convey surface flow to the feature under the post-construction conditions and provide contiguous habitat for wildlife passage between the aquatic and terrestrial habitats. In addition, the realignment maintains a connection to CP-3, as well as a linkage to terrestrial habitat associated with the deciduous swamp community located farther south (Maple Mineral and Green Ash Mineral Swamp; SWDM3-3/SWDM2-2). The new connections may improve wildlife passage (particularly for migrating amphibians) to available breeding habitat present in Part 1. As noted in **Section 2.2.1** and **Table 2**, the isolated meadow marsh feature at survey station 6 (**Figure 2.1**) was not well utilized by breeding amphibians in the spring of 2021 as low call codes, population estimates, and species diversity were recorded during the call surveys.

Additional enhancements to the realigned ICT-9 may include wildlife habitat features such as brush piles, cover and mounds, raptor poles, snake hibernaculums, turtle nesting sites, and large woody debris. The form and function of the riparian enhancements will be determined through the SIS and designed formally during the draft plan process.

3.2.3 Water Supply to ICT-9

To maintain water supply to the upstream portion of ICT-9 two alternatives were identified:

1. Direct stormwater generated by the roof of the existing velodrome (typically considered to be clean) to an underground chamber with an outlet to a headwall within ICT-9. The use of an underground chamber will ensure cooler water input and will allow for a replication of baseflow which will increase the duration of time where water is present within ICT-9. The chamber could also be designed to allow for smaller ‘pulses’ of stormwater to enter ICT-9 mimicking the flow patterns of a storm in pre-development conditions. If the roof water cannot be fully isolated, pretreatment prior to discharge to ICT-9 will be required.

2. Direction of stormwater generated by the lands to the north and west of the velodrome to Low Impact Development (LID) and Green Infrastructure (GI) for treatment with either direct connection to ICT-9 via a headwall or indirect connection to ICT-9 via an infiltration/cooling trench. If required, an underground storage chamber (as noted in Alterative 1 above) could be implemented.

The preferred alternative will be selected though the detailed design process and will be coordinated with the overall MEV water balance requirements that will be presented within the forthcoming SIS.

To avoid the need for overcontrol of stormwater within SWMF-2, input structures from the preferred alternative(s) will be designed with a control device (e.g. Ipex tempest inlet control device to maintain a discharge rate based on the overall water balance guidance to be provided in the forthcoming SIS). The preferred solution will also strive to provide stormwater detention as well as an opportunity for stormwater retention.

3.2.4 CP-3 Tie In

To allow for ICT-9 to provide water to CP-3, the confluence has been located as far east as possible. The downstream tie in of the ICT-9 realignment is to be located at a natural low point or draw in the local topography allowing for minimal disturbance through the 30 m wetland VPZ and no grading or disturbance within the wetland itself.

4.0 STORMWATER MANAGEMENT FACILITY

4.1 BACKGROUND AND OBJECTIVES

The FSEMS provides guidelines for the management of stormwater under post development land use conditions. These guidelines have been developed through an integrated stormwater management plan for the proposed development areas, which included hydrologic modelling of the watersheds.

Within the FSEMS, three stormwater management facilities (SWMF) are noted within the MEV lands. The central facility noted as SWMF-2 will service the Laurier Lands.

4.1.1 Stormwater Management Facilities

Based on the hydrologic modelling, the FSEMS recommends that stormwater management (SWM) facilities be provided for control of water quality, water quantity, and erosion control. Within the MEV FSEMS the SWMFs were sized using the HSP-F hydrologic model and continuous simulation modelling; hydraulic verification of the proposed facilities will be completed by the Town's engineer during the detailed design phase.

As noted in Section 3.2.2 of the FSEMS, the Stormwater management for the future MEV is required to satisfy the following objectives and requirements:

- Maintain/enhance baseflow to the receiving regulated watercourses and specific HDFs classified as protection;
- Post to Pre-development peak flow control (as a minimum) would be required to achieve flood control objectives for all events up to and including the Regional Storm event;
- Control (storage) of stormwater runoff to maintain existing cumulative shear stress exceedance within acceptable tolerances in the receiving regulated watercourses;
- Stormwater Quality treatment of runoff from the MEV is required to mitigate surface water quality impacts in accordance with MECP guidelines, to an Enhanced standard;
- Incorporate measures to mitigate thermal impacts from future development;
- Incorporate measures to mitigate impacts related to road salt from future development; and
- Maintaining existing conditions outlet locations.

4.1.2 Onsite Low Impact Development

As noted within Section 3.2.4 of the FSEMS:

> "Source controls in the form of Low Impact Development Best Management Practices (LID BMPs) are anticipated to maintain groundwater recharge and water budget to sensitive features within the area which rely on hydrologic inputs (e.g. wetlands). Furthermore, the application of LID BMPs to promote infiltration and groundwater recharge would serve to further mitigate the minor residual increase to erosion potential along the Indian Creek Main Branch."

Low Impact Development (LID) measures or the provision of Green Infrastructure (GI) is a more integrated approach to stormwater management than traditional end-of pipe measures. LID promotes filtration and infiltration and seeks to maintain the existing hydrology of the site after development. These methods are commonly referred to as LID / GI and are described in detail within the *CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide (LID Guide).*

Part of the focus of onsite LID / GI will be to maintain the pre-development groundwater recharge, as well as satisfying local requirements for feature-based water balance for the high constraint terrestrial features located along the west limit of the site.

Infiltration augmentation options that could potentially be available for use across the Site to assist in maximizing infiltration under the post-development condition include:

- Roof downspouts,which discharge to landcaped areas.
- Extra depth topsoil and/or amended soils.
- Bioretention facilities.
- Enhanced grass swales.
- Permeable pavement.
- Perforated pipe systems (i.e., linear infiltration trenches or linear soakaways); and
- Underground infiltration trenches and chambers.

The suitability of using the previously mentioned infiltration augmentation options within the Subject Lands will be evaluated further at detailed design. Overall, it is reasonable to conclude that the application of some or all the previously mentioned infiltration augmentation measures in those areas of the Subject Lands where the seasonal groundwater table can be made to be greater than one meter below final grades will assist in achieving the maximum groundwater recharge possible throughout these lands under the post-development condition.

LID and GI works best when integrated within a development rather than being designed as an end of pipe facility (similar to a SWM pond). As such, LID and GI are anticipated to be strategically located throughout the MEV development lands and the design details of the LID and GI form, and function will be provided, within the Functional Servicing and Stormwater Management Reporting for each development site (e.g. the WLU Lands).

4.2 PROPOSED DRAINAGE CONDITIONS

Consistent with the FSEMS, SWMF – 2 (i.e., MEV Central SWM pond) has been sized to accommodate drainage from the central development lands, the existing Velodrome, and an external area consisting of Tremaine Road. Within the FSEMS, SWMF – 2 is located along the western boundary of the development lands with an outlet to the adjacent ICT-9 HDF and CP-3 watercourse. **Table 4.1** below provides a summary of the FSEMS areas used in the preliminary sizing of SWMF – 2.

Table 4.1 - FSEMS –Drainage Areas

Drainage Zone	FSEMS Catchment	Area (ha)	% Imp
Tremaine Road	433	1.30	90
Development Lands	2871	44.90	80
Existing Velodrome	421	6.10	90
Drainage to SWM Pond		52.30	82

Through design works completed as part of the SIS, the drainage areas and imperviousness were updated based on the overall stormwater servicing and site grading plans, and the proposed development plan/block use. The updated drainage area and impervious coverage presented used to size the proposed SWMF – 2 are provided in **Table 4.4**.

Table 4.2 - Drainage Areas Used to Size SWMF - 2

Drainage Zone	Area (ha)	C	% Imp
Tremaine Road	2.30	0.90	94
N Development Lands	19.30	0.87	91
S Development Lands	31.00	0.87	91
Existing Velodrome	5.10	0.90	94
SWM Pond	6.40	0.75	78
Drainage to SWM Pond	64.10	0.86	90

Additional calculations are provided in **Appendix B**. The quality and quantity requirements for the Site are discussed in more detail in **Section 4.4** of this report.

4.3 STORMWATER MANAGEMENT FACILITY DESIGN REQUIREMENTS

As this report preceeds the Subwatershed Impact Study for the area, SWMF design criteria have been compiled based on the findings of the FSEMS and from other SIS Documents prepared within Milton. The following stormwater management strategies and criteria will also be applied to the subject site, including SWMF - 2:

- The SWMF will be graded with side slopes of 3:1 from the pond bottom to the extended detention elevation or 3 m (horizontally) outside of the permanent pool elevation, whichever is greater, above which the slopes of a maximum of 5:1 with a planting shelf around the normal water level;
- Permanent pool volume will be sized to provide MOECC Enhanced Protection with a mean depth of 1.5 m and a preferred depth of 2.0 m;
- Ponds to maximize length to width ratios;
- The Permanent pool elevation is set above the 5 year level of receiving watercourse;
- Extended detention storage as per the requirements in the FSEMS to a maximum depth of 1.0 m as per the MOE guidelines;
- Extended detention storage and flood control storage to the 100-year storm event will be limited to a maximum depth of 1.8 m as per the Town standards (noted in the FSEMS);
- Provide a 3 m deep permanent pool area at the bottom-draw outlets to create a zone of cooler and deeper water to mitigate thermal impacts;
- Planting strategy following CH Guidelines will maximize shading particularly the south and west edges; and
- A 4 m wide maintenance access road with a maximum slope of 10:1 from top of pond to the bottom of the forebay and a maximum cross-fall of 2% to be provided. It will be used to facilitate the access to the forebay and outlet structure for maintenance.

Considerations for the design of the SWM pond outlet structures will include the following:

- Target discharge rates will be achieved through the use of orifices and weirs;
- Bottom-draw outlets with deeper pool will be implemented to minimize thermal impacts to the adjacent watercourse;
- Installing riparian vegetation from the pond outlet headwall to the receiving watercourse for shading; and
- Provide flow dissipation (e.g. flow spreader) to minimize flow velocity/shear stress of water entering the watercourse.

The FSEMS provided unitary rates for both required quantity storage and allowable discharge, specifically for the MEV Central Development Area. These rates are summarized in **Table 4.3** below.

Table 4.3 – Peak Flow and Storage Requirements

Storage Component	Required Cumulative Storage (m^3/impervious ha)	Discharge (m^3/s/ha)
Erosion Control / Extended Detention	450	0.00084
25 Year	650	0.015
100 Year	850	0.024
Regional	1250	0.092

***Note**: Values based on Table 3.2.6 from the FSEMS*

4.4 STORMWATER MANAGEMENT FACILITY DESIGN

4.4.1 Quality Treatment

Quality treatment will be provided within SWMF - 2. The pond will provide MOECC Enhanced (80% TSS removal) water quality treatment for the contributing drainage areas in accordance with the MOE Stormwater Planning and Design Manual (SWMPDM), March, 2003. The Enhanced water quality storage requirements are presented in **Table 5.2** below, with additional calculations provided in **Appendix B**.

Table 4.4 – Permanent Pool Requirement for SWM Facilities

SWM Pond	Drainage Area (ha)	Percent Impervious	MOE Enhanced -Storage Required (m^3/ha) (less 40 m^3/ha for ED)	Storage Required (m^3)	Storage Provided (m^3)
SWMF -2	64.10	90	210	13,461	34,388

The provided pond water quality volume will exceed the required storage requirements and will satisfy MOE/MECP Enhanced criteria.

Preliminary stormwater management quality treatment calculations are provided in **Appendix B**.

4.4.2 Quantity Control

SWMF-2 has been sized based on a total contributing drainage area of 64.10 ha which accounts for the developed portions of the Site, external drainage from Tremaine Road, and the SWMF-2 block. **Table 4.5** below, provides the erosion control, 25 year, 100 year and Regional storage requirements, allowable discharge and actual discharge for the proposed SWMF-2 based on the unitary rates noted in **Table 4.3.** Orifice and weir controls will be utilized within a control manhole located in the SWM pond to control flows to the allowable targets (sizing details are provided in Appendix B). An emergency spillway will be sized to safely convey flows to the adjacent watercourse (CP-3 via HDF ICT-9).

Table 4.5 –Storage and Peak Discharge for SWMF-2

Storage Component	Required Storage (m^3)	Provided Storage (m^3)	Estimated Elevation (m)	Allowable Discharge (m^3/s)

Extended Detention	26,008	26,500	184.68	0.054
25 Year	37,567	38,000	184.98	0.962
100 Year	49,126	49,500	185.27	1.538
Regional	72,244	74,500	185.86	5.897

The proposed pond block is able to provide the required permanent pool and active storage volumes in accordance with the FSEMS.

Preliminary stormwater management quantity control calculations are provided in **Appendix B**.

4.4.3 Layout

SWMF-2 has been designed with the following features:

- Multiple forebays and main cells to allow for research on the impacts of various layouts on water quality parameters including suspended solids removal, water chemistry and temperature;
- A combined aft cell with a single discharge point through a single control manhole that draws water from the aft cell at a location that is generally 3m deep;
- A control manhole to control stormwater outflow to the rates specified in the FSEMS (or specified per updates included in the forthcoming SIS);
- An outfall location near the portion of ICT-9 that is to remain which will provide stormwater input to Watercourse CP-3 in a manner similar to existing conditions;
- A 5m wide maintenance road around the pond including a small laydown area near the forebays/research ponds; and
- A aft cell with an extend / elongated flow path to provide additional water quality benefits above and beyond what would typically be provided by a forebay/main cell SWM pond.

To facilitate research (refer to **Section 8.0** for details) and public access to SWMF-2, the following features have been included in the preliminary design:

- An island feature within the aft cell that is to be planted to provide research opportunities related to the shading of SWMF;
- Multiple outfalls and outfall channels to allow for research on outfall configurations;
- Offline research ponds separated within the stormwater management pond block to provide separation from the natural environment (e.g. floodplain);
- A 5m wide pedestrian trail around the pond including a trail network through some pond features (e.g. the aft cell island); and

- Outdoor education areas and/or stations to educate the students and public about the function and importance of stormwater management facilities.

The preliminary layout of SWMF-2 is noted in **Figure 4.1**.

For details regarding the planting of SWMF-2, refer to **Section 7.0** of this report.

4.5 WATER SUPPLY TO NHS FEATURES

Detailed feature based water balance analysis for the entirety of the MEV will be included in the forthcoming SIS to ensure that adequate water is supplied to CP-3 and all other natural heritage features within the Study Area in accordance with Greenbelt Policy 4.2.3.5 a. Relatively clean water sources such as rainwater from roof areas and/or runoff from landscaped areas will be prioritized and directed to natural heritage features, LID / GI facilities and outfalls.

30m VEGETATION PROTECTION ZONE

REALIGNED MDE ICT-9

30m VEGETATION PROTECTION ZONE

30m OFFSET

STAKED LIMIT OF WETLAND

EXISTING WETLAND

LIMIT BETWEEN LOTS 8 AND 9, CONCESSION 7 NEW SURVEY

3:1 GRADING TO EXISTING

RESEARCH PONDS

20m WIDE ICT-9 REALIGNMENT (EST. 5m MEANDER + 15m WETLAND)

30m WIDE NHS BUFFER

10m WIDE GRADING BUFFER

RESEARCH POND WORK AREA

5m WIDE MAINTENANCE ACCESS ROAD/TRAIL

ECOLOGICAL RESEARCH AREA

30m VEGETATION PROTECTION ZONE

3:1 GRADING TO EXISTING

AFT CELL

RESEARCH CELL #1

RESEARCH CELL #2

RESEARCH CELL #3

RESEARCH CELL #4

NWL 183.90

MAIN CELL

AFT CELL

RESEARCH FOREBAY #1

RESEARCH FOREBAY #2

CENTRAL FOREBAY BOTTOM 182.40

FOREBAY

EXISTING VELODROME SWMF

BELL SCHOOL LINE

20m WIDE ICT-9 REALIGNMENT (EST. 5m MEANDER + 15m WETLAND)

CULVERT CONNECTOR C/W GATE VALVE

5m WIDE MAINTENANCE ACCESS ROAD/TRAIL

EXISTING WETLAND

10m WIDE GRADING BUFFER

30m OFFSET

STAKED LIMIT OF WETLAND

OP-3 WATERCOURSE

30m VEGETATION PROTECTION ZONE

CONTROL FLOW MANHOLE C/W FLOW SPLIT TO THREE OUTFALLS

ICT-9

PART 6 PLAN 20R-18587

Stantec

Legend

- Staked Wetland Feature
- 30m Wetland VPZ
- Proposed Wetland Feature
- Proposed 30m VPZ
- Realignment of ICT-9
- Top of Pond
- High Water Level
- Pond Grading
- Pond Normal Water Level (NWL)
- Bottom of Pond
- 5m Wide Pond Access Road / Pedestrian Path
- SWM Pond Infrastructure
- Pond Outfall Channels
- ICT-9 To Remain

MILTON EDUCATIONAL VILLAGE

1:2000H 0 20 60 100m

FIGURE 4.1 - SWMF-2

File: V:\01606\Active\160622935 - Laurier Milton\Drawing\C3D\sheet_files\swm\C-POND.dwg - Revised by <Trenam, Hamish>, Thu, Oct 28, 2021, 8:14 PM

5.0 WETLAND REPLACEMENT

5.1 BACKGROUND AND FSEMS DESIGNATION

As a result of studies conducted in support of the background documents listed in **Section 1.5**, several unevaluated wetlands and PSWs (PSW; Indian Creek PSW), were identified by the Town and described in the 2021 FSEMS. Field studies conducted by the Town included site walks with agency groups in 2011 and 2017 to delineate and evaluate wetland communities within the MEV lands. It is understood from the 2021 FSEMS that additional unevaluated wetland units exist within Part 1 which were not staked by agencies during either site visit. These unevaluated wetland units were identified separately in Map 4, Appendix E of the 2021 FSEMS and were not evaluated further for significance.

5.2 WETLAND REPLACEMENT

The replacement of select wetland units are required in support of the proposed SWM pond designs proposed in this report. The anticipated preliminary impacts and mitigation are discussed below. While further details for the replacement activities will be provided in the SIS and draft plan stages, the preliminary assessment discussed herein demonstrates that a net gain in available habitat will be provided in accordance with Section 3.3.2(b) of the 2021 FSEMS.

5.2.1 Anticipated Impacts

A total of 1.36 ha of three wetland units are currently proposed for replacement in support of the proposed green infrastructure and ICT-9 realignment in Part 1 (**Figure 4.1**). The anticipated impacted areas include a portion of the meadow marsh associated with ICT-9 (Mixed Graminoid Mineral Meadow Marsh, MAMM1-16), the small fragmented PSW located along the northern property boundary (Reed Canary Grass Graminoid Mineral Meadow Marsh, MAMM1-3), and a similar vegetation community associated with riparian habitat of CP-3 (MAMM1-3). The proposed SWM pond designs and ICT-9 realignment minimizes impacts within Part 1 in accordance to Section 4.2.1(e) of the Greenbelt Plan, as all other wetland units are to be retained in the landscape under the post-construction conditions.

All three wetland units were dominated by non-native plant species (**Table 2.1**). With the exception of the meadow marsh riparian habitat of CP-3 (MAMM1-3), the remaining two wetland units (MAMM1-3 PSW or MAMM1-16) did not meet criterial for SWH or contain SAR or SAR habitat. The riparian meadow marsh associated with CP-3 was identified as confirmed SWH for terrestrial crayfish as crayfish burrows were identified during field surveys. While this SWH is confirmed, encroachments are considered minimal and temporary in the area where the realigned ICT-9 will connect to CP-3. Furthermore, additional habitat of greater quality was also identified farther south within Part 1 within retained wetland features.

It was also noted that the PSW (MAMM1-3) located along the northern property boundary had reduced significantly in size since the feature was mapped for the FSEMS (2021). During staking exercises, the size of the feature had reduced from 0.43 ha to 0.017 ha as a result of agricultural activities north of Part 1. The reduction in size of the PSW has further isolated the feature in the landscape and reduced the quality of available habitat.

Based on the results of the 2021 field studies and observed anthropogenic disturbances, the three wetland vegetation communities are considered good candidates for replacement within Part 1.

5.2.2 Mitigation

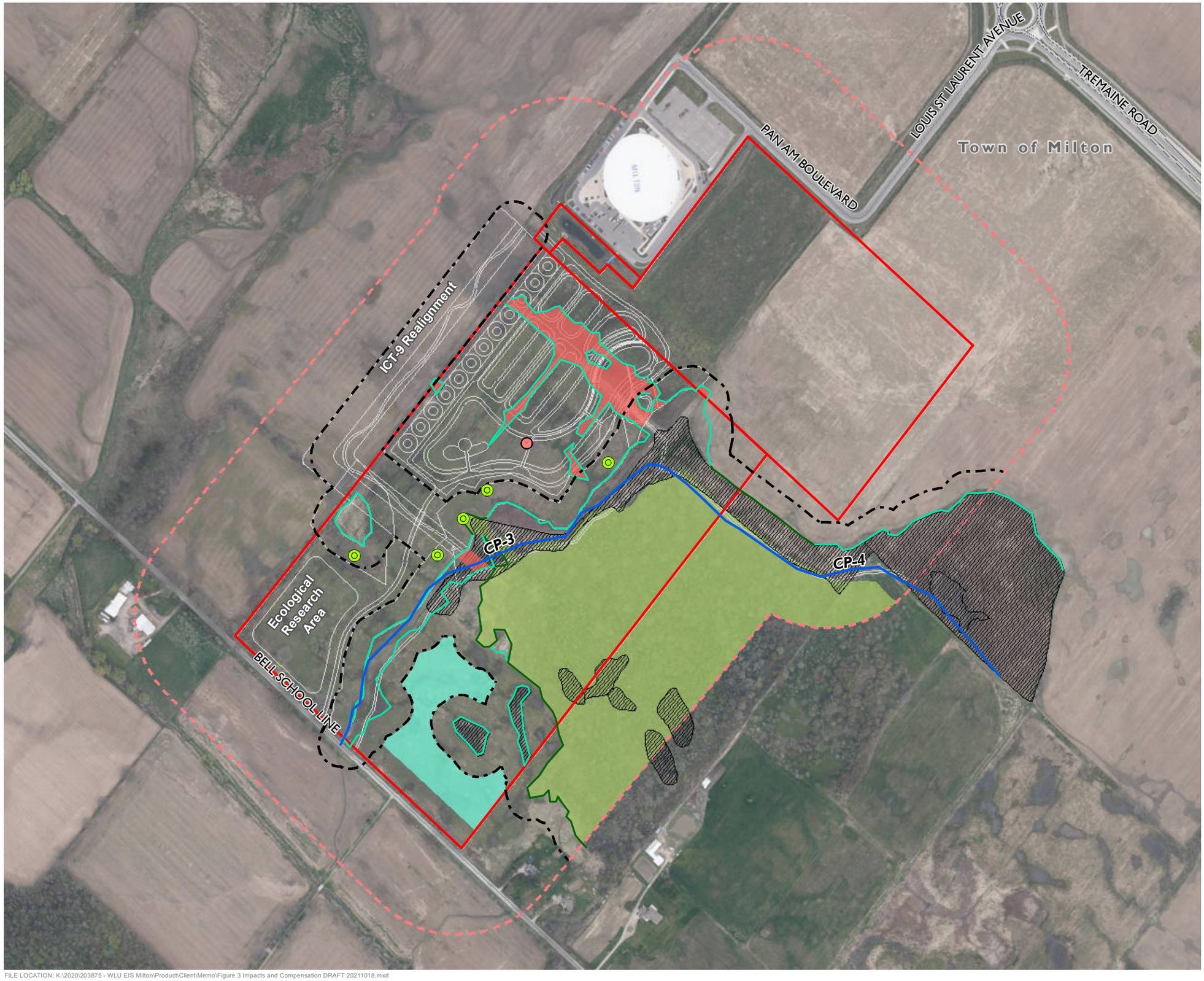
There are greater opportunities present to enhance the natural heritage system (NHS) and provide improved linkages and connectivity within Part 1 through the replacement of the three wetland units.

A preliminary compensation area (1.8 ha) for the replacement wetlands has been identified in **Figure 5.1.** The area identified for replacement is 0.44 ha greater than the identified impact area for the proposed green infrastructure, therefore a net benefit in wetland habitat will have been achieved for Part 1. Providing a net gain to the NHS is in alignment with Section 3.3.2(b) of the FSEMS.

The proposed location for the replacement wetland area improves the connectivity of the NHS within the southwestern corner of Part 1, as it links retained habitat associated with the deciduous swamp/significant woodlands to isolated meadow marsh units currently present in association with the cultural meadow and along CP-3. The improvement of linkages within Part 1 was designed in accordance with Section 3.2.2 of the Greenbelt Plan, and Section 3.3.2 of the FSEMS (2021).

Furthermore, the use of native species in the design and plantings of the compensation wetlands would be considered an overall net benefit to the NHS through providing improved habitat consisting of diverse native flora. Native species will also be incorporated into buffer planting plans for each of the wetland units in Part 1. Both retained and replaced wetland features are/would be considered Key Natural Heritage Features under Section 3.2.5 of the Greenbelt Plan. As such, a 30 m VPZ has been applied to the limits of retained and replaced wetland features to provide protection during and post construction (Section 3.2.5 (4) of the Greenbelt Plan; **Figure 5.1**).

To mitigate for potential impacts to confirmed SWH for Terrestrial Crayfish along the riparian meadow marsh habitat of CP-3, salvage plans will be developed during detailed design for crayfish. These plans will direct the safe practice of handling and removal of terrestrial crayfish within impacted wetland units prior to ground disturbance. It is anticipated that captured crayfish during salvage activities will be released within retained habitat within Part 1. While the wetland units identified for replication did not meet criteria for other SWH, salvage plans for wildlife will also include protocols for the safe removal and handling of amphibians and reptiles for due diligence purposes.



WILFRID LAURIER UNIVERSITY

TREMAINE ROAD AND BRITANNIA ROAD
MILTON, ONTARIO

FIGURE 5.1
IMPACTS AND COMPENSATION

- Property Boundary
- Study Area
- Watercourse
- Provincially Signficant Wetland (PSW)
- Significant Woodlands
- Proposed Development Plan
- Wetlands Proposed for Removal (~1.36 ha)
- Potential Compensation Area (~1.8 ha)

Approximate Mature Tree

- Tree to be Retained
- Tree to be Removed

Staked Wetland (Dillon and CH; July 15, 2021)

- Dripline
- Wetland

Constraint Buffers

- 30 m VPZ for Key Hydrologic Features *

*To be applied to wetlands, watercourses and re-aligned HDF/ICT-9

1:5,000

0 50 100 200 m

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY ESRI, STANTEC, MNRF & DILLON CONSULTING LTD

MAP CREATED BY LK
MAP CHECKED BY CV

MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 203875
STATUS: DRAFT
DATE: 2021-10-28

FILE LOCATION: K:\2020\203875 - WLU EIS Milton\Product\Client\Memo\Figure 3 Impacts and Compensation DRAFT 20211018.mxd

6.0 CONSTRUCTION PHASING AND ESC

Construction phasing plans for the Property will be designed such that there is almost always an open channel with gravity drainage available. This allows for the majority of the ICT-9 and SWMF-2 construction works to be completed offline or "in the dry". Exceptions are times when the water is "flipped" from the existing to the proposed HDF and when phasing notes detail that this work should be completed on dry weather days. As the ICT-9 is typically dry, this is considered to be a reasonable expectation.

The expected construction phasing includes:

1. Construction and stabilization of the realigned ICT-9 in they dry including the low flow channel, aquatic enhancements, and wetland features.
2. Construction of a berm at the edge of the 30 m VPZ along the south and east portion of the realigned ICT-9 channel. The berm will hydraulically separate ICT-9 from SWMF-2.
3. Construction of a berm along the southern limit of SWMF-2 at the interface of the 30 m VPZ to the PSW to hydraulicly separate SWMF-2 from CP-3.
4. Completion of fish and amphibian rescues as required within the existing portion of ICT-9.
5. Redirection of stormwater from the existing velodrome SWM pond to the top of ICT-9.
6. Salvage of preferred native, non-invasive vegetation, and natural materials from ICT-9 as recommended.
7. Construction and stabilization of SWMF-2 including placement of fill, inlets, outfalls, walkways, and research components.

As part of detailed design, a watercourse/HDF specific erosion and sediment control (ESC) plan will be prepared in conjunction with the phasing plan to ensure any potential sediment release to the downstream watercourse is minimized to the extent possible. In general, the ESC plans will include all necessary siltation control facilities designed in accordance with current Town guidelines and the requirements of Conservation Halton. Below is a list of typically recommended erosion and sediment control measures that will be installed and maintained during the construction of the Subject Site. As SWMF-2 and the realignment of HDF ICT-9 are to occur within the Greenbelt, additional ESC may be required; for example, use of heavy duty silt fence in place of single row silt fence, double filtering of water discharged through a pump, etc.).

- Temporary sediment control fences, and tree protection fences (if required) will be placed prior to grading;
- Install temporary swales throughout site along with check dams;

- If required during the topsoil stripping phase prior to bulk earthworks, temporary sediment traps and/or small temporary sediment control ponds may be installed to capture and treat runoff before releasing to open space areas;

- The proposed SWM pond may be constructed early on in the earthworks phase to function as a temporary ESC pond during the earthworks and servicing phases of construction;

- Temporary topsoil stockpiles will be seeded to prevent wind erosion; and,

- All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.

In conclusion, all reasonable measures will be taken to ensure the sediment transport to the downstream watercourse is minimized both during and following construction.

7.0 PLANTING AND RESTORATION

A proposed planting plan will be prepared and submitted in future phases of the development. Planting areas associated with Part 1 of the Property (i.e., including ICT-9 realignment and VPZ), are assumed to be governed by Conservation Halton's planting guidelines as well as the Town's Restoration Framework (where applicable).

It is critical that environmental protection, ecological restoration, and stewardship be integrated into the WLU Campus Master Plan design framework, especially components falling within the greenbelt. The existing land use of the site includes a stripped agricultural landscape that contains degraded and fragmented habitats. In these areas the natural ecosystem has been damaged; however, it is planned to restore the native landscape to encourage natural regeneration, as well as introduce a variety of native species and enhance the wildlife corridors.

The proposed strategy for restoring the landscape will be accomplished in three distinct ways. The first is by introducing ecological succession planting. In the initial phase, nurse crops and pioneer species will be introduced, providing rapid habitats, shade and erosion control as the new ecosystems begin to take hold. As shown in **Figure 7.1** succession planting along the wetland and waterways will help establish diverse and native plants over a long period of time. By introducing vertical complexities through a variety of species, the succession planting will improve the quality, efficiency, and success of the ecosystem. Every component of the landscape will fulfill more than one function, creating a holistic and integrated approach.

Figure 7.1 – Restoration in a Protection Zone Ecological Succession Planting

The second strategy as shown in **Figure 7.2** involves creating zones of planting along the waterways that host a range of ecological communities. Each zone will include different plant materials that vary

depending on the wetness of the soils, and will provide a range of habitats for the local flora and fauna. Closest to the waterway, plants will provide slope stabilization, shoreline protection and erosion control. Moving away from the water's edge, the plants will focus on succession planting of shrubs and trees that can sustain the water fluctuation of the wetland. Upland, the zone farthest from the water's edge will be home to larger tree species and a variety of native shrubs and perennials.

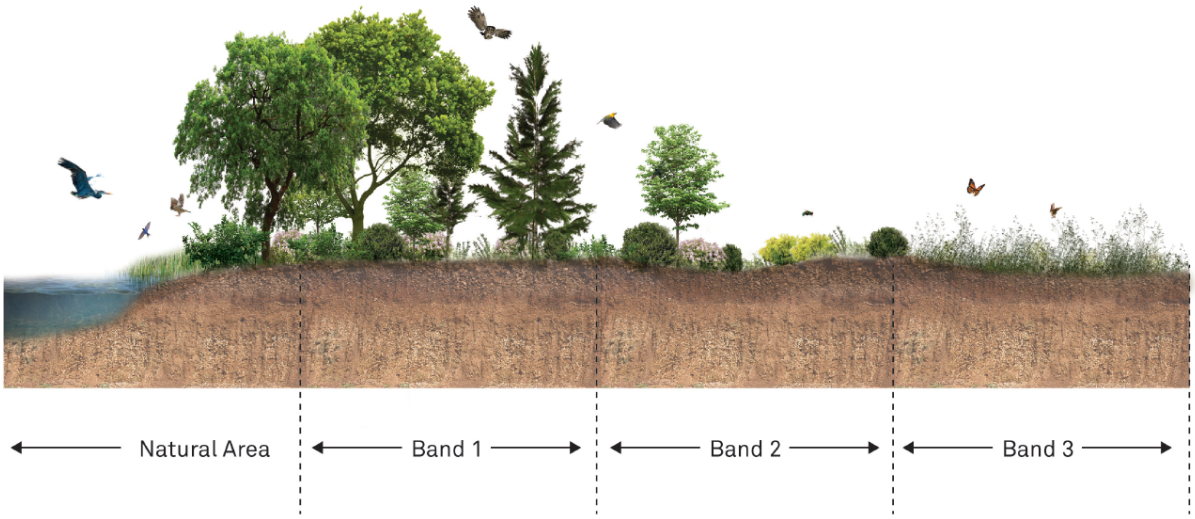


Figure 7.2 – Vegetation Bands Adjacent to Natural Areas and Wetlands

The third strategy includes the maintenance and monitoring of the site over time. It is important to understand how the plants have adapted to the landscape and what, if any, measures need to take place to further their growth. To achieve this, it is important that throughout the process, a monitoring and maintenance plan is in effect to provide support for the ecosystem. As part of the forthcoming SIS, a robust post-construction monitoring plan will be developed.

By working with Conservation Halton and adhering to relevant plans, policies and guidelines, the planting plan will return the landscape to its natural form, creating functioning, diverse and self-sustaining communities of native plants and wildlife, which support the overall health of the Halton watershed.

8.0 RESEARCH OPPORTUNITIES

8.1 CENTRE FOR URBAN WATERSHED RESEARCH

Recognizing the need for sound science to guide management decisions that will preserve the integrity of our watersheds, Wilfrid Laurier University is partnering with Conservation Halton to establish a Centre for Urban Watershed Research (CUWR). An overview of the Laurier Institute for Water Science Centre for Urban Watershed Research is presented in **Appendix C**.

The CUWR programs will focus on research within SWMF-2 and also on research within a series of offline ponds located within the SWMF-2 pond block. In addition, various public outreach activities will be developed and assessed to highlight research and our connections to water and the environment.

8.2 SWMF-2 RESEARCH

Since the publication of the 2003 Stormwater Management Plan and SWMP design manual there has been increased recognition that our climate has and continues to change. Researchers at the CUWR will utilize SWMF – 2 to assess how effective current design recommendations are given our changing climate, evaluate modifications to existing recommendations and develop and test the utility of comprehensive monitoring approaches using real-time smart technologies and citizen science. In addition, public outreach activities will be developed and assessed to highlight research and emphasize connections to water and the environment. In general, CUWR and CH seek to:

- Determine how well design criteria from nearly 20 years ago (2003 SWMPDM) perform given our changed and changing climate
- Compare minimum and preferred design criteria to new or enhanced designs; and
- Assess the utility of existing monitoring requirements and compare to new comprehensive monitoring using real-time smart technologies.

Specific questions that may be addressed include:

1) When are SWM ponds sources or sinks of contaminants (i.e. chloride, phosphorus)? What are effective and economic removal strategies?
2) What are interactions among water quality parameters (i.e., pH and phosphorus).
3) When do sediment bound contaminants become available and where in the water column does this occur?

4) Are current monitoring requirements (three grab samples/year) sufficient to base long term decisions upon? Are more comprehensive monitoring strategies needed to guide future decisions?

5) How can real-time monitoring contribute to adaptive management? If a problem or deficiency were detected – what could be done to remedy this and how do climate change predictions contribute to these decisions?

6) Do new technologies such as drone systems with sensors (e.g., chlorophyll, C, surface temperature and water column temperature) offer opportunities for monitoring with informed adaptive management processes?

7) How does he choice of vegetation and planting approaches (seeds, plugs, density) affect SWM function and improve removal of contaminants including phosphorus and salt?

8) How do vegetation planting approaches impact maintenance schedules (e.g. sediment removal frequency)?

9) How does pond sloping (e.g., the provision of a larger planting shelf) affect SWM function?

10) How does the frequency and duration of flooding in fringe areas impact vegetation and their capacity to contribute to SWMP function?

11) What are the effects of outflow structures on stream integrity and aquatic biota?

12) How do removal processes differ in ponds designed following minimum or preferred criteria?

13) How can SWMP outfall design be integrated into the natural environment, and can additional benefits such as polishing or cooling of SWMP effluent be built into outfall design?

14) How do conventional SWMP compare to LIDs in Southern Ontario's climate?

15) What impact does shading have on water temperatures within a SWMF?

8.3 OFFLINE PONDS AND MESOCOSM FACILITY

While monitoring of existing watershed features and traditional SWMF is informative these non-experimental approaches are only able to establish correlations between water quality and management practices. To establish cause and effect relationships between water quality and management practices, experimental approaches, where conditions can be manipulated and replicated are essential. The CUWR a series of experimental ponds for to conduct mid to long-term exposure studies to examine contaminant effects on wetland biota and wetland processes. Highly controlled, short-term studies conducted at a mesocosm facility will be used to complement longer-term studies using realistic condition in the offline ponds and the larger functioning SWM pond. Additionally, the use of hydrologically isolated (offline) areas will allow the study of hydrological design aspects including depth of permanent pool and retention time.

9.0 ADHERENCE TO GREENBELT POLICY AND CONCLUSION

9.1 GREENBELT POLICY

As noted in **Section 1.1** and **Section 1.5** of this report, Greenbelt Plan Policies 4.2.3.4 and 4.2.3.5 must be adhered to support development within the Greenbelt. These polices have been noted below in plain text with references to how our proposed design adheres to the Policy below in italics.

Policy 4.2.3.4. Applications for development and site alteration in the Protected Countryside shall be accompanied by a stormwater management plan which demonstrates that:

a) Planning, design and construction practices will minimize vegetation removal, grading and soil compaction, sediment erosion and impervious surfaces;

   The proposed designs for the green infrastructure minimize impacts to the existing NHS and allow for the majority of existing wetlands and significant woodland to be retained within Part 1. With the exception of the ICT-9 realignment, grading and construction is proposed to occur outside of the 30 VPZ of retained wetland units.

   *For details, refer to **Section 1.5** and **Section 4.0** of this report.*

b) An integrated treatment approach will be used to minimize stormwater flows and mimic natural hydrology through lot level controls, low impact development and other conveyance techniques;

   *Site plan level controls consisting of low impact development and green infrastructure are to be provided at the site level. For details, refer to **Section 4.1.2** of this report. Additionally, SWMF-2 will include an aft cell with an extend / elongated flow path to provide additional water quality benefits above and beyond what would typically be provided by a forebay/main cell SWM pond.*

   *For details, refer to **Section 4.4.1** of this report.*

c) Applicable recommendations, standards or targets within a subwatershed plan or equivalent and water budgets will be complied with; and

   Stormwater quantity control targets were detailed within Section 3.2.3 of the FSEMS, these targets can be achieved by SWMF-2.

   *For details, refer to **Section 4.4.2** of this report.*

d) Applicable objectives, targets, and any other requirements within a stormwater master plan will be met in accordance with the policies in subsection 3.2.7 of the Growth Plan.

Applicable Policies in Subsection 3.2.7 of the Growth Plan stipulate proposals for large scale development proceeding by way of Secondary Plan, Plan of Subdivision, vacant land plan of condominium or site plan will be supported by a stormwater management plan or equivalent, that:

- Is informed by a Subwatershed Study or equivalent
- Incorporates an integrated treatment approach to minimize stormwater flows and reliance on stormwater management ponds, which includes appropriate low impavct development and green infrastructure
- Establishes planning, design and construction practices to minimize vegetation removal, grading and soil compaction, sediment erosion and impervious surfaces; and,
- Aligns with a stormwater master plan or equivalent for the Settlement Area, where applicable

Stormwater Management for the MEV Secondary Plan wherein the Wilfrid Laurier Lands are located have been comprehensively addressed from a stormwater management perspective through the following studies, reports and documents:

- Indian Creek/Sixteen Mile Creek Sherwood Survey Subwatershed Management Study prepared by Philips Engineering Ltd. December 2004 (SMS)
- MEV Scoped Characterization and Baseline Inventory (DRAFT) prepared by Wood, March 2021 (DRAFT)
- MEV Functional Stormwater Management and Environmental Management Strategy (DRAFT) prepared by Wood, September 2021 (FSEMS)
- Functional Servicing Report – Pan American Games Milton Velodrome Water, Wastewater and Stormwater Management Servicing prepared by AMEC Environmental & Infrastructure, dated June, 2012

Additional planning and design documents informing this stormwater management report include:

- Stormwater Management Planning and Design Manual prepared by the Ministry of the Environment, March 2003
- Greenbelt Plan prepared by the Government of Ontario, 2017
- Conservation Halton Guidelines for Stormwater Management Engineering Submissions prepared by Conservation Halton, May 2021 (DRAFT)

These studies, report and documents included inventorying existing conditions and assessed impacts of proposed development to inform policies, objectives and criteria in order to recommend implementation and monitoring strategies for the MEV lands. Further, the above

studies inform this stormwater management report and its findings and recommendations providing a unique integrated stormwater management approach for the Wilfrid Laurier University Lands to minimize stormwater management flows, establish planning and engineering design and construction practices to minimize potential of vegetation removal, grading, impervious and sediment and erosion during construction. The stormwater management plan for the WLU lands aligns with previously completed studies, report and documents previously completed.

Policy 4.2.3.5 The objectives of a stormwater management plan are to avoid, or if avoidance is not possible, minimize and mitigate stormwater volume, contaminant loads and impacts to receiving water courses in order to:

a) Maintain groundwater quality and flow and stream baseflow;

To maintain water supply to the upstream portion of ICT-9 two alternatives were identified: 1) Direction of stormwater from the velodrome roof to an underground chamber that feeds into ICT-9 and/or the use of LIDs/GI to feed into ICT-9. The preferred alternative will be selected though the detailed design process. To maintain flows to CP-3, the confluence of ICT-9 and CP-3 has been located as far east as possible.

*For details, refer to **Section 3.2** of this report.*

The overall MEV water balance strategy including groundwater quality and flow and stream baseflow will be presented as part of the forthcoming SIS.

b) Protect water quality;

Stormwater quality treatment is to be provided by SWMF-2 which has been designed to provide Enhanced (80% total suspended solids removal) within the forebays and main cells. An aft cell with an extended / elongated flow path to provide additional water quality benefits above and beyond what would typically be provided by a forebay/main cell SWM pond. Additionally, SWMF-2 will be used for research that will include water quality components.

*For details, refer to **Section 4.4.1** and **Section 8.2** of this report.*

c) Minimize the disruption of pre-existing (natural) drainage patterns wherever possible;

The outlet of SWMF-2 has been located to maintain flows to the portion of HDF ICT-9 that is to remain and to continue to provide stormwater input to Watercourse CP-3 similar to under existing conditions.

*For details, refer to **Section 4.4.3** of this report.*

d) Prevent increases in stream channel erosion;

Stormwater erosion control targets were detailed within Section 3.2.3 of the FSEMS, these targets can be achieved by SWMF-2.

*For details, refer to **Section 4.4.2** of this report.*

e) Prevent any increase in flood risk; and

Stormwater quantity control targets were detailed within Section 3.2.3 of the FSEMS, these targets can be achieved by SWMF-2.

*For details, refer to **Section 4.4.2** of this report.*

f) Protect aquatic species and their habitat.

The proposed ICT-9 realignment and wetland compensation area will provide a net benefit to the existing NHS, as a greater area of aquatic and terrestrial habitat will be achieved under the post construction conditions: the channel length of ICT-9 will increase by 366 m as a result of the proposed realignment, and an additional 0.44 ha of wetland will exist within Part 1 as a result of the proposed wetland replacement activities. Furthermore, self-sustaining native vegetation will be included in planting plans for replaced/realigned features and within 30 m VPZs within the landscape. The combination of the proposed realigned/replacement habitat and native plantings will improve connectivity to existing key hydrologic features and key natural heritage features within the NHS by positioning compensation wetlands adjacent to retained features of Part 1.

*For details, refer to **Section 4.0** and **Section 7.0** of this report.*

9.2 CONCLUSION

We are pleased to submit this Preliminary Design Report in support of SWMF-2, which is located within the Greenbelt, to the west of the WLU MEV lands . The objective of this report is to demonstrate the following:

- That SWMF-2 will meet relevant stormwater management guidelines from the FSEMS, Town, Region and Conservation Authority, for the anticipated contributing MEV drainage area;
- That SWMF-2 will feature Green Infrastructure and exciting research opportunities that will inform future design;
- That the development will produce an overall net benefit to NHS systems in the Provincial Greenbelt; and
- That the development will comply with the Greenbelt Plan (2017), specifically Policies 4.2.3.4 and 4.2.3.5.

Although, it is understood that the MEV design will continue to evolve through the SIS and future development phases, it is our belief that this report meets the objectives listed above and provides a strong framework for the detailed design of SWMF-2.

If you have any questions, please don’t hesitate to contact the Study Team.

Appendix A WETLAND, WATERCOURSE AND HDF MAPPING

Appendix A - Ecological Land Classification Photographs for Wetland Units within Part 1

Photo 1 April 8th, 2018 Reed Canary Grass Mineral Shallow Marsh (MASM1-14) - facing southeast	
Photo 2 April 8th, 2018 Reed Canary Grass Mineral Shallow Marsh (MASM1-14) – facing south .	

Photo 3 April 8th, 2018 Reed-canary Grass Graminoid Mineral Meadow Marsh (MAMM1-3) - facing northeast	
Photo 4 April 8th, 2018 Reed-canary Grass Graminoid Mineral Meadow Marsh (MAMM1-3) - facing south	

Appendix B STORMWATER MANAGEMENT CALCULATIONS

Project Description: MEV Lands
Job Number: 160622935
Creation Date: 6/24/2021
Revision Date: 10/28/2021
Author: HT
Pond Name: MEV Greenbelt Pond

MEV Central SWM Pond (SWMF-2) Volume and Release Rates

Drainage Area

Drainage Zone	Area (ha)	C	% Imp
Tremaine Road	2.30	0.90	94
N Development Lands	19.30	0.87	91
S Development Lands	31.00	0.87	91
Existing Velodrome	5.10	0.90	94
SWM Pond	6.40	0.75	78
Drainage to SWM Pond	64.10	0.86	90

Note: Percent impervious (I) converted from C values based on Simple Method, C = 0.05 + 0.009(I); (Schueler, 1987)

Permanent Pool

Storage Component	MOE Enhanced - Storage Required (m^3/ha) - less 40 m^3/ha for ED	Required Storage (m^3)	Provided Storage (m^3)
Permanent Pool	210	13,461	34,388

Allowable Release Rate (From FSEMS)

Table 3.2.6. Stormwater Management Facility Sizing Criteria

Quantity Component	Cumulative Unitary Volume (m^3/impervious ha)	Unitary Discharge (m^3/s/ha)
SWMF 1 – North		
Erosion	450	0.00084
25 Year	750	0.015
100 Year	950	0.026
Regional	1725	0.061
SWMF 2 - Central		
Erosion	450	0.00084
25 Year	650	0.015
100 Year	850	.024
Regional	1250	.092
SWMF 3 - South		
Erosion	450	0.00084
25 Year	650	0.012
100 Year	800	0.021
Regional	1500	0.068

Active Storage

Storage Component	Cumulative Storage Required (m^3/imp ha)	Impervious Hectares Draining to Pond	Required Storage (m^3)	Provided Storage (m^3)	Allowable Discharge (m^3/s/ha)	Allowable Discharge (m^3/s)
Erosion / Ext. Det.	450	57.80	26,008	-	0.00084	0.054
25 Year	650	57.80	37,567	-	0.015	0.962
100 Year	850	57.80	49,126	-	0.024	1.538
Regional (AMEC H-SPF)	1,250	57.80	72,244	74,500	0.092	5.897

Summary

Storage Component	Required Storage (m^3)	Available Storage (m^3)	Elevation (m)	Allowable Discharge (m^3/s)
Permanent Pool	13,461	34,388	Variels	N/A
Normal Water Level	0	0	183.90	0
Erosion Control/Ext. Det.	26,008	26,500	184.68	0.054
25 Year	37,567	38,000	184.98	0.962
100 Year	49,126	49,500	185.27	1.538
Regional	72,244	74,500	185.86	5.897

Project Description: MEV Lands
Job Number: 160622935
Creation Date: 6/24/2021
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Pond Name: MEV Greenbelt Pond

MEV Central SWM Pond (SWMF-2) Forebay Sizing Calculations

Single Forebay Requirements

Parameters

Length to Widty Ratio =	5		
Peak Quality Storm Release Rate =	0.054	m^3/s	
Peak Storm Sewer Design Flow Into Pond =	4.172	m^3/s	
Particle Settling Velocity =	3.00E-04	m/s	3.00E-4 FOR 150um Particles
Forebay Depth =	1.50	m	
Forebay Berm Target Velocity =	0.5	m/s	0.5 Standard

Settling Length Calculation

Forebay Length =	**30**

Dispersion Length Calculation

Forebay Length =	**45**

Forebay Dimensions

Forebay Length =	**45**
Forebay Width =	**9**
Forebay Depth =	**1.5**

Split Forebay Requirements (Half Drainage Area)

Parameters

Length to Widty Ratio =	5		
Peak Quality Storm Release Rate =	0.027	m^3/s	
Peak Storm Sewer Design Flow Into Pond =	2.086	m^3/s	
Particle Settling Velocity =	3.00E-04	m/s	3.00E-4 FOR 150um Particles
Forebay Depth =	1.50	m	
Forebay Berm Target Velocity =	0.5	m/s	0.5 Standard

Settling Length Calculation

Forebay Length =	**21**

Dispersion Length Calculation

Forebay Length =	**22**

Forebay Dimensions

Forebay Length =	**22**
Forebay Width =	**4**
Forebay Depth =	**1.5**

Project Description: MEV Lands
Job Number: 160622935
Creation Date: 6/24/2021
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Author: HT
Pond Name: MEV Greenbelt Pond

MEV Central SWM Pond (SWMF-2) Volume Calculations

Elev. (m)	North Forebay		Central Forebay		South Forebay		North Main		Central Main		South Main		Combined Aft Cell		Perm. Pool Volume (m^3)	Total Volume (m^3)	
	Area (m^2)	Inc. Vol. (m^3)	Area (m^2)	Inc. Vol. (m^3)	Area (m^2)	Inc. Vol. (m^3)	Area (m^2)	Inc. Vol. (m^3)	Area (m^2)	Inc. Vol. (m^3)	Area (m^2)	Inc. Vol. (m^3)	Area (m^2)	Inc. Vol. (m^3)			
180.90													1,350		0		
181.40																	
181.90											950						
182.40	500		500		475												
182.90							200										
183.40									200								
183.90	1,550	1,538	1,550	1,538	1,775	1,688	3,450	1,825	3,450	913	3,550	4,500	13,575	22,388	34,388		<-- NWL
183.90	1,550		1,550		1,775		3,450		3,450		3,550		13,575			0	<-- NWL
184.90	2,250	1,900	2,250	1,900	3,000	2,388	5,400	4,425	5,400	4,425	5,400	4,475	19,250	16,413		27,025	
185.90													52,000	47,475		74,500	<-- Top of Storage
186.00													53,150	5,257		79,757	<-- Top of Pond

Appendix C CUWR OVERVIEW

The Laurier Institute *for* Water Science

Centre for Urban Watershed Research

Currently, more than 80% of Canadians live in urban areas. This percentage increases every year.[1] With further urbanization, watershed management and protection of our water resources becomes increasingly challenging. As water flows overland and enters streams, rivers, ponds and lakes, it travels through a landscape rife with pollutants and toxins originating from oily/salty roads and parking lots, and parks, golf courses and lawns, picking-up pesticides and cleaning products. Furthermore, effluent from wastewater treatment plants, increase nutrient and microbial loads and introduce chemicals from pharmaceutical and personal care products into our watersheds. Our increasing populations will increase this contaminant load. Urbanization also results in vegetation loss, reducing a watershed's capacity to absorb and capture moisture increasing the volume and speed of run-off. This in turn increases the water temperature disrupting normal ecosystem functions and destabilizes stream banks leading to erosion and reduced soil filtration. As watersheds become more urbanized, natural surfaces that absorb water and recharge aquifers, become covered with impervious surfaces. Our streets, sidewalks, rooftops, driveways and parking lots further reduce the absorption capacity of the landscape. The result is greater run-off that travels more quickly to surface waters increasing peak flows and velocities which can lead to flooding of homes, businesses and damage to critical infrastructure.

To preserve the integrity of our watersheds, we are in dire need of scientific research to fully understand impacts of urbanization and update our watershed management practices. Our watershed regulations, policies and common practice must keep up with the changing climate and increased development that have occurred in the past 50 years. Urban watershed management is among the biggest challenges facing Ontario's Conservation Authorities; the local agencies responsible of watershed management and conservation. Recognizing the need for sound science to guide management decisions, Conservation Halton is partnering with Wilfrid Laurier University to establish a Centre for Urban Watershed Research. This centre will be located at the site of our new campus in Milton, a campus that will be focused on the theme of Planetary Health in one of the fastest growing regions in Southern Ontario.

While monitoring of existing watershed features are informative, these non-experimental approaches are only able to establish *correlations* between water quality and management practices. To establish *cause and effect* relationships between water quality and management practices, experimental approaches, where conditions can be manipulated and replicated are

[1] https://www.statista.com/statistics/271208/urbanization-in-canada/

essential. We seek to establish a world class research facility comprising experimental ponds, streams and mesocosms, that will allow freshwater ecologists, water chemists, hydrologists, microbiologists, aquatic ecotoxicologists, and environmental engineers and planners to study the impacts of urbanization and management practices on water quality in a region of Canada that accounts for one-third of the total Canadian population.[2] Specific areas of research include:

1) Monitoring water quality and ecosystem health in natural and artificial systems
2) Assessing the performance of existing and proposed SWM designs
3) Quantifying effects of waterborne contaminants on watershed biota
4) Developing citizen science approaches to improve watershed monitoring/protection

The Centre for Urban Watershed Research will become Canada's premier research facility for the study of urban watersheds. Laurier already has a thriving water science research community embodied in the Laurier Institute for Water Science and we will add to this strength considerably over the next few years with the establishment of our School of Planetary Health Engineering. Together with our partners in Conservation Halton we will create new knowledge about the impacts of watershed management and pioneer new management techniques that will change policy and result in improved urban water quality for all Canadians.

[2] https://on360.ca/policy-papers/measuring-ontarios-urban-rural-divide/