FINAL EAST SIXTEEN MILE CREEK ES6-EAST ENVIRONMENTAL IMPLEMENTATION REPORT AND FUNCTIONAL SERVICING STUDY

North Oakville East
Sherborne Lodge Developments Limited
and Eno Investments Inc.

June 2024

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1.0 INTRODUCTION

1.1 Study Purpose

This Environmental Implementation Report and Functional Servicing Study (EIR/FSS) has been prepared in accordance with the requirements of the Town of Oakville's (the Town) Official Plan Amendment 272 (OPA 272) in support of the development of lands located within Subcatchment ES6-East in the North Oakville East Secondary Plan Area. **Figure 1.1** illustrates the location of this subcatchment east of Neyagawa Boulevard, north of Core 5.

This EIR/FSS supports the proposed Draft Plans of Subdivision for the Sherborne Lodge Developments Limited ("Sherborne Lodge") and Eno Investments Inc. ("Eno Investments") lands located south of Burnhamthorpe Road in Subcatchment ES6-East. The locations of these properties, referred to as the Subject Lands herein, are shown in **Figure 1.1**. The Subject Lands encompass a combined gross area of approximately 62.51ha. Approximately 83% of the Subject Lands lie within the ES6-East subcatchment with the remaining 17% located to the south within Core 5 in subcatchment ES7. Lands within this EIR Subcatchment Area north of Burnhamthorpe Road are not participating in the preparation of this EIR/FSS.

This EIR/FSS has been prepared to address the following OPA 272 policy requirements in support of the approval of Draft Plans of Subdivision for the Subject Lands.

- Policy 7.8.3a) requires that an EIR be prepared for each subcatchment area, in accordance with the directions established in the Implementation Report, North Oakville Creeks Subwatershed Study (NOCSS), dated August 2006.

- Policy 7.8.3b) requires that a FSS be completed. The FSS must include a preferred servicing plan based on an analysis of servicing requirements, in accordance with any approved Class Environmental Assessment Studies, Halton Transportation Master Plan and the Master Servicing Plan for the North Oakville East Planning Area, and including:
  i. servicing design requirements;
  ii. preliminary sizing of water and wastewater infrastructure;
  iii. layout for roads and other transportation systems, including transit and trails; and,
  iv. preliminary sizing and location of stormwater management (SWM) facilities and integration with environmental features and development areas.

- Policy 7.8.3a) iii) requires that EIRs be prepared in accordance with the Terms of Reference (TOR) approved by the Town, the Region of Halton (the Region) and the applicant(s), in consultation with Conservation Halton (CH).

The work completed as part of this EIR/FSS and documented in this report, was guided by requirements set out in the EIR/FSS TOR (May 2013) approved by the Town and CH, and is intended to satisfy the above policy requirements of OPA 272. A copy of the approved TOR is provided in **Appendix A-1**.

The purpose of the EIR is to characterize and analyze the natural heritage features and functions within the study area and to determine and address the potential impacts of a proposed development application, including servicing requirements, on the Natural Heritage System (NHS).

The purpose of the FSS is to identify servicing requirements related to roads, water supply, sanitary sewers, storm drainage, stormwater, and site grading. Further, the purpose of both the EIR and FSS is to provide a link between the Town's NOCSS Management Report and Implementation Report, the North Oakville East Secondary Plan, and the required planning approvals.

The EIR/FSS is intended to assist in the development of draft plans of subdivision, address the requirements of the NOCSS and Secondary Plan, and ensure that the site characteristics are understood in sufficient detail to provide the information necessary to process draft plans and identify conditions of approval.

As set out in the TOR, the EIR/FSS for the Subject Lands has been prepared as a joint report to fully integrate environmental and engineering recommendations to protect the function of the NHS and service the Subject Lands.

This EIR/FSS supports the draft plan applications submitted for the Sherborne Lodge and Eno Investments lands, and addresses EIR/FSS requirements for other lands in the EIR Subcatchment Area that do not currently have Draft Plan of Subdivision applications. These other lands primarily refer to developing areas north of Burnhamthorpe Road, owned by other developers, plus a small area east of the Subject Lands, which are not proceeding with Draft Plans of Subdivision at this time. Further study, including potential Addendums to this EIR/FSS, will be required to support draft plan approval of these other lands. Prior to the preparation of further studies, the specific scope of study should be addressed with the Town and CH.

1.2 EIR Subcatchment Area and FSS Study Area

1.2.1 EIR Subcatchment Area

The Subject Lands lie almost entirely within the East Sixteen Mile Creek subcatchment referred to as ES6-East. Only a small portion at the south end of the Subject Lands lies within the subcatchment referred to as ES7. The Subject Lands within subcatchment ES7 are wholly contained within Core 5 and will not be developed or affected by this proposed development, therefore this subcatchment is not included or discussed in this report.

The East Sixteen Mile Creek subcatchment is divided into two subcatchments, referred to as ES6-West and ES6-East, as shown on **Figures 1.2R** and **1.3R**. This division of subcatchments is consistent with those outlined on Figure 7.4.2 from OPA 272 that delineates the extent of EIR Subcatchment Areas.

Neyagawa Boulevard forms the common boundary between these two subcatchments. Surface runoff from lands west of Neyagawa Boulevard flows generally southeasterly to outlet across Neyagawa Boulevard via stream reach SMA-6. Surface runoff from lands east of Neyagawa Boulevard flows generally southerly via the eastern Neyagawa Boulevard ditch to outlet into stream reach SMA-6 in Core 5. Flows from these two subcatchments combine in stream reach SMA-6 just east of Neyagawa Boulevard. Lands downstream of this point lie with the ES7 subcatchment.

A small area in the northeast corner of the Subject Lands on the Eno Investments lands lies within the existing Upper West Morrison Creek (UWMC) subcatchment under both pre development and post development conditions. This ES6-East EIR/FSS reflects the servicing recommendations for this small portion of the Subject Lands as presented in the *EIR/FSS Addendum for Upper West Morrison Creek Subcatchment UWM1 Addendum* (November 2020).

The limits of the ES6-East EIR Subcatchment Area, adjacent subcatchments and the Subject Lands are shown on **Figure 1.2R**. Ownership of lands within the EIR Subcatchment Area is shown on **Figure 1.4R**. **Table 1.1** notes the areas of various landholdings in this Subcatchment Area.

Lands within the ES6-East subcatchment north of Burnhamthorpe Road are not proceeding with development at this time and therefore are not participating in the preparation of this EIR/FSS. Non-participating lands are shown on **Figure 1.2R**; their areas are listed in **Table 1.1**.

Table 1.1 – Lands Within the EIR Subcatchment Area

Properties	Area within ES6-East Subcatchment (ha)	Percentage of Total Area in ES6-East Subcatchment
Subject Lands		
Sherborne Lodge	17.92	18.8
Eno Investments	33.22	34.8
Non-Participating Lands		
North of Burnhamthorpe Road	36.50	38.2
East & West of Subject Lands	7.81	8.2
Total	**95.45**	**100**

The EIR/FSS Terms of Reference differentiate between the study area for the FSS and the subcatchment study area for the EIR. The EIR is to be completed on a subcatchment basis, while the FSS will address specific servicing requirements in support of draft plans of subdivision. The NOCSS provides direction to the preparation of EIRs including the delineation of EIR subcatchments. **Figure 7.4.2** from the NOCSS Addendum illustrates EIR subcatchments. With reference to this figure (included herein) and direction from the Terms of Reference, the appropriate study areas for this EIR/FSS are:

- **EIR Subcatchment Area** is defined to be the East Sixteen Mile Creek Tributary subcatchment (ES6-East), focusing on the area south of Burnhamthorpe Road generally north of Core 5 as delineated in **Figures 1.2R** and **1.3R**; and,

- **FSS Study Area** is defined to be the lands within the Sherborne Lodge and Eno Investments lands.

The EIR Subcatchment Area and the FSS Study Area for the Subject Lands are shown on **Figure 1.3R**. The Subject Lands are approximately 67% of the EIR Subcatchment Area.

This EIR/FSS consistently uses the following four terms when referring to various land areas:

- the “Subject Lands” referring to the Sherborne Lodge and Eno Investments landholdings;
- the “FSS Study Area” referring to the area within the Subject Lands that will be developed;
- the “EIR Subcatchment Area” referring to the East Sixteen Mile Creek Tributary subcatchment (ES6-East); and,
- the “Study Areas”, referring to both the EIR Subcatchment Area and the FSS Study Area.

As required by the EIR/FSS Terms of Reference, land uses as proposed by the Town’s Secondary Plan for lands adjacent to the FSS Study Area are recognized and considered

in planning and servicing analyses. In this regard, servicing considerations are addressed herein for the non-participating lands north of Burnhamthorpe Road.

The EIR Subcatchment Area was discussed with the Town and CH at an EIR/FSS pre-consultation meeting held in June 2019.

1.2.2 Functional Servicing Study Area

The FSS is to address specific servicing requirements in support of Draft Plans of Subdivision and therefore FSS Study Area boundaries generally follow the extent of ownership of the landowner(s) preparing the FSS, but do not include all areas within the Subject Lands within Core 5. This includes the ownerships of the Sherborne Lodge and Eno Investments lands shown on **Figure 1.4R**.

For the purposes of the FSS, a suggested road and lot layout is illustrated on the non-participating lands north of Burnhamthorpe Road as presented on the Town's Master Plan. When these lands come forward with development plans, an EIR/FSS Addendum will be required.

1.3 EIR / FSS Study Objectives

The objectives to be fulfilled by the EIR/FSS are set out in the approved TOR. They are:

- to demonstrate how the subwatershed requirements set out in the NOCSS Management Report (including targets), the Implementation Report, and the Secondary Plan are being fulfilled in all proposed Draft Plans;
- to provide sufficient level of conceptual design to ensure that the various components of the NHS and infrastructure can be implemented, as envisaged in the NOCSS and Secondary Plan and to ensure that the Draft Plans are consistent with this conceptual design;
- to ensure servicing requirements, as determined in the FSS for the areas external to the Draft Plan, are adequate;
- to identify details regarding any potential development constraints or conflicts and how they are to be resolved;
- to provide any further implementation details as needed;
- to streamline the Draft Plan approval process; and,
- to facilitate the preparation of Draft Plan conditions.

1.4 EIR/FSS Study Team

A multi-disciplinary study team has analyzed the environment and servicing of the Study Areas. Their responsibilities include:

- Stonybrook Consulting Inc. – Lead consultant addressing study integration and team management;
- Urbantech Consulting Inc. – Lead FSS consultant addressing municipal servicing, SWM and site grading;
- Bird and Hale Limited and LGL Limited - Limits of development and aquatic and terrestrial ecology;
- R. J. Burnside & Associates Limited – Geology and hydrogeology;
- GEO Morphix Limited – Fluvial geomorphology; and
- Korsiak & Company and Bousfields – Municipal planning matters and preparation of Draft Plans of Subdivision.

1.5 Previous Studies, Reports and Planning Documents

Several approved or ongoing EIR/FSS reports for lands surrounding the ES6-East subcatchment were referenced during the preparation of this EIR/FSS to ensure consistency with environmental and engineering recommendations for adjacent areas. This includes:

- Final EIR/FSS, East Sixteen Mile Creek Tributary Subcatchment ES6-West and the Davis-Minardi North Lands North Oakville East (June 2015) (Final DMN EIR/FSS);
- Final Consolidated Preserve EIR/FSS, Shannon's and Munn's Creek Subcatchments (May 2017);
- Upper West Morrison Creek EIR/FSS (2022);
- Final EIR/FSS, Sixteen Mile Creek (April 2018);
- Preserve North EIR/FSS (2022); and
- Final Drainage Area Exchange Report (January 2019).

The following additional studies/guidelines/documents were also reviewed in preparation of this EIR/FSS:

- Town of Oakville North Oakville Creeks Subwatershed Study, August 2006;
- Town of Oakville North Oakville Creeks Subwatershed Study Addendum, September 2007;
- Ontario Municipal Board Mediation Agreements, 2007;
- Town of Oakville Official Plan Amendment 272, August 2007;
- Region of Halton Official Plan Amendment 25;
- Ontario Municipal Board Minutes of Settlement, June 2006 and August 2007;
- North Oakville Environmental Implementation Report and Functional Servicing Study Terms of Reference, May 2013;

- North Oakville East Subwatersheds Study, prepared for the North Oakville Landowners' Group, August 2004;
- Halton Water and Wastewater Master Plan Review, KMK Consultants Limited, October 2002 (Master Plan);
- South Halton Water and Wastewater Master Plan Update;'
- Region of Halton, 2007 (Master Plan Update);
- Conservation Halton's Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06, April 27, 2006;
- Stormwater Management Planning and Design Manual, Ministry of Environment, March 2003 (SWMP Design Manual);
- Final Drainage Area Exchange Report (January 2017) prepared by Stonybrook Consulting Inc. et al.;
- Development Engineering Procedures & Guidelines Manual, Town of Oakville, May 2007;
- Thermal Impacts of Urbanization Including Preventative and Mitigation Techniques, Credit Valley Conservation, 2011
- Conservation Halton Landscaping and Tree Preservation Guidelines, Conservation Halton, 2010
- Design Criteria, Contract Specifications and Standard Drawings, Region of Halton, February 2001 (updated 2007); and,
- Erosion and Sediment Control Guide for Urban Construction (TRCA, 2019).

1.6 EIR/FSS Consultation

In June 2019, the EIR/FSS Study Team and Owner's representatives initiated consultation with the Town and CH to discuss SWM pond outfall options and other EIR/FSS general content. This included discussion of pre and post drainage patterns, pond location, alternative pond outfall locations, site grading, management of external flows and flows to PSW 3, and impacts to Core 5. Three pond options were presented, all of which include the same general pond footprint; variations in options related to pond outfall locations. These options were evaluated from engineering and ecological perspectives and a preferred outfall option was presented. Although no formal approval was given, feedback at the meeting included generally positive comments on the recommended pond pipe outfall location and the need to discuss the preferred option with the Region of Halton. No specific concerns were raised and there was general concurrence with the preferred pond outfall option. A formal submission of the pond outfall evaluation was provided to the Town and CH at that time. A copy of the submission is provided in Appendix B-2 and discussed further in Section 7.12 of this report. No comments were received following the meeting.

On July 17, 2019, a submission regarding the preferred pond outfall was made to the Region of Halton. It addressed the preferred pond outfall location and implications to the existing Neyagawa Boulevard ditch lowering requirements. The Region advised that they would review the pond outfall location through the EIR/FSS process.

A NOARM meeting was attended on November 24, 2020 to discuss the pond outfall followed by the initial ES6-East EIR/FSS submission to the Town of Oakville in November 2021. Agency comments were received from the Town (May 12, 2022), CH (May 13, 2022) and the Region (December 2, 2022). These comments were discussed at NOARM meetings on May 16, 2022, June 20, 2022 and October 17, 2022. While many agency comments were discussed at these meetings, the focus of discussions was on SWM pond outfall evaluations and the preferred SWM pond outfall design. A site visit with Town and CH staff was attended on October 13, 2022 to view the proposed preferred Neyagawa Boulevard outfall option. At the October 17, 2022 NOARM meeting, the Town, CH and the Region advised that they concurred with the preferred SWM Pond outfall location along the Neyagawa ditch where natural drainage from the ES6-East subcatchment currently drains. Input was provided by the Region and the Town regarding proposed ditch modifications that are reflected herein.

Other matters addressed during the October 13, 2022 agency site visit included review of the PSW 2 and PSW 8 boundaries, a request to contact MNRF (Steve Varga, Management Biologist) regarding the PSW boundaries, dripline staking within Core 5 in the vicinity of the proposed SWM pond, and the proposed trail alignment. A request was made by CH to stake the dripline of the woodlot along the east side of Neyagawa Boulevard, which is interior to Core 5 boundary. A November 4, 2022 site visit with CH staff was held to stake/survey this dripline boundary.

During agency review of the EIR/FSR, several meetings and discussions were held with the Town, Region and Conservation Halton to discuss the SWM Pond 9 outlet location and design. Further discussion regarding agency design inputs is outlined in Section 7.12.4.2. This EIR/FSS reflects the agencies' preference and input on SWM Pond 9 outfall design.

Through the preparation of this EIR/FSS, multiple discussions were held with Region of Halton staff regarding construction coordination and local infrastructure within William Halton Parkway. Eno Investments and Sherborne Lodge Developments have formally requested that the Region of Halton include local infrastructure in the William Halton Parkway project to mitigate further disturbance to the roadway in the future to support of their draft plans. This section of William Halton Parkway along the frontage of the Subject Lands has been completed. The Region did not install any local services for the Subject Lands.

This ES6-East EIR/FSS includes revisions to the initial EIR/FSS submission that address all agency comments. Appendices A-2, A-3 and A-4 contain the CH, Town and Region Comment/ Responses Matrices respectively.

Separate from the EIR/FSS process, in June 2015, Sherborne Lodge Developments made submissions to the Town and CH to remove the existing farm pond on their lands. That submission included the review of NOCSS and OPA 272 policies, description of historic and existing conditions, an outline of activities to capture, rescue and relocate fish and

other wildlife, and other works/timing to remove the pond. A Permit to Take Water for pond pump-down was obtained from the MECP. These works were not completed at that time as CH and the Town considered them to be premature outside of the EIR/FSS process. Through their review of the submission, CH provided direction with respect to suitable proposed locations for fish and other wildlife re-locations which were accepted as the most viable options. Additionally, Fish and Wildlife Collection permits were obtained from MNRF to capture and re-locate fish and turtles into nearby natural systems, although these permits have lapsed. This EIR/FSS includes a section on the farm pond removal (Section 11.4).

2.0 NATURAL HERITAGE SYSTEM FRAMEWORK

2.1 Natural Heritage System Components

OPA 272, the Town's NOCSS and the North Oakville Creeks Subwatershed Study Addendum (NOCSS Addendum) provide policies and/or directions with respect to the protection and management of the North Oakville East Natural Heritage/Open Space System. The NOCSS is divided into four sections, which follow the four phases of a subwatershed management approach. They include Characterization, Analysis, Management Strategy and Implementation.

The Management Strategy outlines requirements with respect to lands restricted from development, lands with development limitations or constraints, SWM, input to land use policies and servicing requirements. The Implementation Plan outlines the implementation requirements for the recommended management strategy, studies required in subsequent stages of the development process, environmental reporting requirements, Agency responsibilities, and the approval process with the Town, the Region and CH, and, where applicable, the Ministry of Natural Resources and Forestry (MNRF) .

With respect to the Subject Lands and the EIR Subcatchment Areas, OPA 272, the NOCSS and the NOCSS Addendum identify various environmental features to be protected and/or studied further during the EIR/FSS. **Figure 2.1R**, prepared from Figure NOE3 of OPA 272, illustrates these features:

- *Core Preserve Area* – Core Preserve Areas include key natural features or groupings of key natural features, together with required buffers and adjacent lands intended to protect the function of those features and ensure the long-term sustainability of the Natural Heritage component of the System within the urban context.

  Core 5, the Neyagawa Woodlot Core, is located in the southern portion of the Subject Lands and forms the southern boundary of the development proposed within the Sherborne Lodge and Eno Investments Draft Plans of Subdivision. This Core extends from west of Neyagawa Boulevard easterly to approximately 170m and 200m west of Sixth Line (70m to 100m of which will comprise a Linkage Preserve Area along the east side of Core 5). This Core is composed of wooded areas, wetlands, active agricultural lands, cultural meadows and thickets.

  Section 3.0 of this EIR/FSS addresses Core 5 boundary delineation.

- *Linkage and Optional Linkage Preserve Areas* – Linkage and Optional Linkage Preserve Areas include areas which are designed to link the Core Preserve Areas together to maintain and enhance their environmental sustainability. They follow natural features whenever possible and are intended to be of sufficient size and character, including buffers, to ensure the functionality and sustainability of the NHS.

  There are no Linkage Preserve Areas (LPA) or Optional Linkage Preserve Areas (OLPA) in the Study Areas.

- *High Constraint Steam Corridor (Red Stream)* – High Constraint Stream Corridor areas include certain watercourses and adjacent riparian lands, as well as buffers measured from the stable top-of-bank or meander belts. These areas are located primarily inside Core Preserve Areas and LPAs, but also are found outside such areas, as per OPA 272. They are to be protected in their existing locations for hydrological and ecological reasons.

  There are no Red Streams in the EIR Subcatchment Area or in the FSS Study Area, although the FSS Study Area is located immediately upstream of Red Stream Reach SMA-6, which is proposed to receive SWM pond outflows via the roadside ditch along Neyagawa Boulevard, and thus is discussed in Sections 5 and 7 of this EIR/FSS.

- *Medium Constraint Stream Corridor (Blue Stream)* – Medium Constraint Stream Corridor areas include certain watercourses and adjacent riparian lands, including buffers measured from the stable top-of-bank or meander belts. These areas are located primarily inside Core Preserve Areas and LPAs, but also are found outside such areas. As set out in OPA 272 policies, these watercourses may be deepened and/or re-located, but must be left open for hydrological and ecological reasons.

  There are no Blue Streams in the Study Areas.

- *Other Hydrological Features* - In addition to the High and Medium Constraint Stream Corridor Areas, there are a number of other hydrological features that also form part of the Natural Heritage and Open Space System to the extent that they are maintained after development occurs. These Features include Low Constraint Streams, Hydrologic Features A and Hydrologic Features B as described in the following points.

  - *Low Constraint Stream Corridor (Green Stream)* – These streams do not need to be maintained, but the function of the watercourse must be sustained in accordance with the directions established in the NOCSS and Federal, Provincial and Conservation Authority regulations.

There are no Green Streams in the Study Areas.

- *Hydrologic Feature A* – Hydrologic Features "A" are defined in NOCSS to be hydrological features located within Blue or Red Streams. The NOCSS (page 7-5) states that *"Hydrologic Features A have hydrological functions and consequently both their form and function shall be considered through hydrological and hydrogeological assessment as part of an EIR. This review will also consider the ecological benefits of these features. Further, any required buffers associated with these features will be determined through the preparation of the EIR, and will only be related to the hydrologic function of the feature."*

  There are no Hydrologic Features A in the Study Areas.

- *Hydrologic Feature B* – Hydrologic features not associated with the NHS, are called Hydrologic Feature B. The NOCSS states that *"Hydrologic Features B may be relocated and consolidated with other wetlands, water features or SWM facilities…".* OPA 272 further states *"Hydrologic Features "B" may be relocated and consolidated with other wet features, wetlands or stormwater management ponds, provided the hydrologic function of the feature is maintained."*

  As indicated on OPA 272 Figure NOE3, there are five Hydrologic Features B in the Study Areas, including two within the FSS Study Area (**Figure 2.1R**). One of these is the constructed farm pond on the Sherborne Lodge property. This feature is identified on Figure A attached to *Mediation Item: Depression Storage* (May 30, 2007) as a pond, and constructed ponds do not have to be included in the assessment of depression storage even if shown as a Hydrologic Feature B (HYDFB) (see Section 2.2.2 below).

  Specifically, depressions that are constructed, although shown on Figure A, do not have to be included in the storage volume of the depression area that is to be maintained, as indicated in the **Table 2.1**. In this regard, the potential historical natural storage of the area where the large constructed Pond 47 was created is addressed in Section 7.14.1.

  The Hydrologic Features B, along with the Topographic Depressions (addressed below), are summarized in **Table 2.1**. These features are addressed in Sections 4.3 and 7.14.

- *Topographic Depressions* – These depressions do not form part of the NHS, however, NOCSS identifies topographic depressions, ponds and pits (DPP) and indicates that they must be addressed as part of the SWM system design. Constructed ponds do not have to be included in the assessment of depression storage.

In addition to the five features identified on OPA 272 Figure NOE3 (**Figure 2.1R**), within the EIR Subcatchment Area, there are 16 topographic depressions identified on Figure A attached to *Mediation Item: Depression Storage* (May 30, 2007).

As indicated in **Table 2.1**, five of these depressions, in addition to two of the features identified as HYDFB, are located within the FSS Study Area. The remaining depressions and HYDFB are located within the EIR Subcatchment Area, outside of the Subject Lands.

The storage available in the HYDFBs and depressions is addressed in Section 7.14.

- *Provincially Significant Wetlands* – One Wetland Unit of the North Oakville-Milton East Wetland Complex (PSW 3) is located within the EIR Subcatchment Area within Core 5. The northern and eastern buffers to this wetland unit have defined the Core 5 boundary in the southwest portion of the Subject Lands, as described in Section 3, below. This wetland unit is described in more detail in Sections 5.1 and 7.10.

Table 2.1 - Pits, Ponds and Depressions

Feature Type *	Feature Identification	Origin	Comment
WITHIN SUBJECT LANDS			
HYDFB	Pond 47	Constructed	This is man-made agricultural pond. As per OMB Mediation Agreement, no further analysis is required.
HYDFB	Pit and Depression B-68	Natural	These areas are natural depressions in topography. As per the OMB Mediation Agreement, storage comparisons (depressions versus SWM pond storage) have been completed; see Section 7.14. Analyses concluded that storage functions are included in the SWM pond design.
DPP	Depression 71	Natural	
DPP	Depression 147	Natural	Depression is located in the NHS in the area where SWM Pond 9 is allowed. Current SWM Pond 9 design does not alter this depression.
DPP	Pit 69	Natural	These areas are natural depressions in topography. As per the OMB Mediation Agreement, storage comparisons (depressions versus SWM pond storage) have been completed; see Section 7.14. Analyses concluded that storage functions are included in the SWM pond design.
DPP	Pit 70	Natural	
OUTSIDE OF SUBJECT LANDS, WITHIN EIR SUBCATCHMENT AREA			
HYDFB	Depression 66	Natural	These features appear to be natural from air photo interpretation. Access permission was not given to address these features. These areas should be assessed when planning applications come forward for these lands as part of a future EIR/FSS Addendum to determine management requirements.
HYDFB	Pits 62 and 64	To be confirmed	
DPP	Pits 19, 53, 55, 56 to 61, 63, 65		
DPP	Depression 67	Natural	This area will drain in the future to the east and its volume considerations are not applicable to SWM Pond 9.

*HYDFB = Hydrologic Feature B; DPP means depression, pit or pond

2.2 Permitted Uses in the Natural Heritage System

2.2.1 OPA 272 and NOCSS

OPA 272, Policy 7.4.7.3 identifies potential permitted uses in the NHS. This policy addresses permitted uses including development, land disturbance, roads and related utilities, expansion of existing water and wastewater services, trails and passive recreational uses, SWM facilities, grading, private driveways and the adaptive use of institutional buildings. **Table 2.2** summarizes policy direction on permitted uses and notes report sections in this EIR/FSS that address these permitted uses.

Section 7.3.1 of NOCSS also lists permitted uses in Cores, Linkages and High and Medium Constraints Stream Corridors. These include:

- Development or land disturbances required for flood and stream bank erosion control and protection of fish, wildlife and conservation management;
- Infrastructure/utility access and crossings;
- Public pedestrian trails; and,
- SWM facilities.

These uses are subject to studies such as this EIR/FSS to address the placement of facilities/uses to ensure that they are compatible with core area management set out in Section 6.3.5 of NOCSS. Management recommendations for Core 5 are listed in Section 3.0.

Sections 6.3.5.2 of NOCSS and some mediation agreements also address permitted uses in the NHS. With respect to this EIR/FSS, reference was made to direction provided on trails in the NHS in Section 6.3.5.2 of the NOCSS.

Direction provided in Section 6.3.5.3 on permissible grading in the NHS also was referenced and provided guidance to the preparation of a preliminary grading plan for the Subject Lands.

2.2.2 OMB Settlement and Mediation Agreements

Several water resources related agreements were made between the Town, CH and the Landowners during Ontario Municipal Board hearing mediation discussions. Also, Minutes of Settlement (MOS) were entered into between the Town, CH, the Region and the Landowners. The mediation agreements and MOS have been reviewed and matters relating to EIR study components were addressed through the preparation of this EIR/FSS.

The Subject Lands are bound by MOS dated June 15, 2006 and August 13, 2007 between Sherborne Lodge Developments, Eno Investments Limited, other landowners, the Town

and CH. The MOS outline agreements with respect to proposed development on the Subject Lands, including buffer setbacks, core boundaries, linkages, natural heritage features, SWM facility locations and sizes, and restoration and enhancement areas. The relevant sections of the MOS that are pertinent to this EIR include:

June 15, 2006 MOS, Sections regarding Natural Heritage Lands:

Section 4 (b) states that, "*subject to Sections 6 to 9, the Natural Heritage Lands shall be dedicated on an "as-is, where-is" basis. The boundaries of the Natural Heritage Lands are more particularly delineated on Schedule "D" hereto. The final precise boundaries of the Natural Heritage Lands shall be determined by an Environmental Implementation Report accepted by the Town in accordance with the Town's Position (which is intended to "ground truth", but not substantially revise, the boundaries as shown on Schedule "D" hereto.*"

Section 7 states that, *"…the Town will not require the Landowners to undertake or fund, directly or indirectly,*

a) *any maintenance after dedication;*
b) *any works to enhance the Natural Heritage Lands; and*
c) any monitoring of the Natural Heritage Lands, other than in respect of the Landowners' stormwater management facilities."

Section 8 notes, "The Town and Landowners agree that Sections 4(b) and 7 shall not apply:

a) *in respect of lands identified as "Medium Constraint Stream Corridors" on Figure NOE 3 in the Town's Position in respect of which the Landowner has altered or intends to alter the Medium Constraint Stream Corridor in accordance with the provisions of the Town's Position and the Town's Subwatershed Study,*
b) in respect of lands designated "Natural Heritage System Area" on Figure NOE 2 in the Town's Position in respect of which the Landowner locates stormwater management facilities in accordance with the provisions of the Town's Position and the Town's Subwatershed Study; and
c) in respect to works undertaken on the Natural Heritage Lands that relate to municipal services such as roads, watermains, sanitary sewers, stormwater management works or trails (provided that nothing herein shall be deemed to grant any approval or permission to undertake such works)."

August 13, 2007 MOS Regarding Encroachment of Certain SWM Ponds

The MOS address conditions under which several SWM ponds may be located within the NHS Area. Schedule C to the MOS illustrate SWM facilities permitted in the NHS. One proposed SWM pond is shown on the Subject Lands – Pond 9 in a portion of Core 5.
With respect to Pond 9, Schedule D, Supplementary Minutes of Settlement with Eno Investments Limited, address the location of Pond 9. Clause 2 states:

"2. The Town and Conservation Halton agree that a Stormwater Management Pond including any grading and associated disturbance ("SWMP") will be permitted to encroach into Core 5 in the location generally shown as Pond 9 on Schedule C to the Minutes of Settlement between the parties hereto and others dated August 13, 2007, to which these Minutes of Settlement are attached as a Schedule (the "Comprehensive Minutes of Settlement"), only on the following basis:

(a) The southerly limit of the SWMP can be no closer to the southerly limit of Core 5 than 250 metres;

(b) The encroachment may not extend into any area which is within 10 metres of the dripline of the wooded areas; and,

(c) A financial contribution is received by the Town of an amount equal to $10 per square metre for each square metre which the SWMP encroaches into Core 5. This contribution shall be used to assist in the establishment of a wooded area in Core 5, south of the proposed pond in the area which is currently open country. The payment will be indexed in accordance with the financial index established in the Comprehensive Minutes of Settlement to which these Minutes are attached as a Schedule."

<u>May 30, 2007 Mediation Agreement: Depression Storage</u>

The Mediation Item addresses the NOCSS requirement to "verify that the SWM pond storage is equal to or greater than the depressional storage." It then clarifies the manner by which the depression storage would be determined. Clause 2 states:

> "*2. The principle is to ensure that the natural depression storage is maintained in the SWM system. This approach is not to include artificially created storage such as that created by embankments or dug facilities. The topographic depressions are illustrated on Figure A, referred to as pits, ponds and depressions. Current mapping does not provide for accurate delineation of these depressi*ons." (Figure A from this agreement is provided in Appendix B-3)

<u>Other Mediation Agreements include:</u>

- Stage-Storage-Discharge Characteristics dated February 21, 2007;
- Infiltration dated February 22, 2007;
- Regional Storm Flood Protection dated May 30, 2007;
- Total Phosphorus dated May 31, 2007;
- Erosion Control for SWM and Erosion Thresholds dated May 31, 2007;
- Hydrology model and hydraulics model for a portion of Joshua's Creek floodplain mapping dated May 31, 2007;

- Stream Corridor Components dated May 31, 2007;
- SWM Ponds Outside of Core and Linkages dated June 19, 2007;
- Changes to EIR Subcatchment Boundaries dated June 29, 2007;
- Flow Rates/Hydrology dated July 4, 2007;
- Stormwater Management - Temperature and Dissolved Oxygen Targets dated July 12, 2007;
- Monitoring dated July 26, 2007;
- EIR/FSS Terms of Reference dated August 2, 2007; and,
- Grading and the Natural Heritage System, undated.

Table 2.2: Summary of Policy Direction on NHS Permitted Uses

OPA 272 Policy Number	Potential Permitted Use	Policy Direction	Addressed in EIR/FSS Sections
7.4.7.3 c) i)	Development or land disturbance	Permitted in accordance with the directions of the North Oakville Creeks Subwatershed Study and any related Environmental Implementation Report, and Federal, Provincial and Conservation Authority regulations for required flood and stream bank erosion control; for fish, wildlife and conservation management; to accommodate a stormwater outfall; or in Medium Constraint Stream Corridor Areas.	Sections 7.7 and 7.12
7.4.7.3 c) ii)	Roads and related utilities	Permitted only to cross the designation in the general area of the road designations shown on Figures NOE2 and NOE4 or as defined through an Environmental Assessment; road design criteria are identified in policies.	Not applicable to this EIR/FSS
7.4.7.3 c) iii)	Expansion to existing Water and Wastewater services	Expansion permitted to existing Water and Wastewater services which are located on sites with existing facilities subject to any required Environmental Assessment	Not applicable to this EIR/FSS
7.4.7.3 c) iv)	Trails, interpretative displays or signage or other similar passive recreation uses	Permitted if consistent with the purpose of the applicable designation and criteria listed in policy.	Section 6.2 and 6.3
7.4.7.3 c) v)	Stormwater management facilities	Permitted subject to directions of the North Oakville Creeks Subwatershed Study, conformance with technical performance specifications listed in policy and as shown conceptually on Figure NOE3.	Section 7.0
7.4.7.3 c) vi)	Grading in the Natural Heritage component of the Natural Heritage and Open Space System	Permitted in accordance with the directions established in the North Oakville Creeks Subwatershed Study or appropriate Environmental Assessment.	Section 7.11
7.4.7.3 c) vii)	Private Driveways	Permitted across the Linkage Preserve Area joining the north area and south area of the Core Preserve Area located north of Burnhamthorpe Road and west of Trafalgar Road	Not applicable to this EIR/FSS
7.4.7.3 c) viii)	Adaptive re-use of heritage buildings for institutional uses	Art gallery and art school permitted in the Linkage Preserve Area associated with Reach JC-7	Not applicable to this EIR/FSS

3.0 CORE 5 – NEYAGAWA WOODLOT

3.1 Core 5 Boundary

As noted in Section 2.0, OPA 272 and NOCSS, the Subject Lands include a portion of Core Preserve Area 5 in the southern portions of the EIR Subcatchment Area. Core 5 extends from west of Neyagawa Boulevard easterly to just west of Sixth Line. NOCSS describes this Core as, "*one of the largest and most diverse Cores in the area, measuring approximately 2.5 km in length with a maximum width of 600m. The central portion of the Core Area is the large woodlot that provides forest interior habitat beyond 100m from the edge as well as beyond 200m from the edge*". In addition to the wooded areas noted, Core 5 contains wetlands, active agricultural lands and cultural meadows and thickets.

The majority of the Core 5 boundary between Neyagawa Boulevard and east of Sixth Line was staked, surveyed in the field, and approved by the Town and CH as input into the preparation of *The Preserve EIR/FSS* (2008) and the *EIR/FSS for the Osenego Creek and the Davis-Minardi Lands* (2008). This finalized and approved Core boundary within the Subject Lands also was reproduced in the "*Final Consolidated Preserve Environmental Implementation Report and Functional Servicing Study, Shannon's and Munn's Creek Subcatchments"* (May 31, 2017). The details of the delineation and approval of the Core boundary was documented in that EIR/FSS; see Drawing "Core 5 External NHS Limits East of Neyagawa Boulevard and Sixth Line - NHS 1" (November 11, 2011), included herein in Appendix B-1 for reference. An excerpt from the approved Core 5 boundary drawing is presented in **Drawing 3.2R** and reflected in other figures in this EIR/FSS for the Subject Lands.

On the Subject Lands, the boundary was determined as follows:

- 10m from the staked dripline of the trees of the wooded areas;
- 30m from the staked edge of PSW 3;
- on the east side of PSW 3, the boundary is a straight line south from the 30m buffer from the wetland to the 10m buffer from the wooded area;
- a straight line connection from the northern limit of the woodland buffer to the east and west of the area within the Core where a SWM facility is permitted.

The Core 5 boundary on the Subject Lands remains the same as the approved boundary noted above. A refinement to the woodland limit internal to the Core has been made along the east side of Neyagawa Boulevard where the NHS in this location is dictated by the dripline east of the road. The dripline in the location was revised through the completion of Neyagawa Boulevard road widening by the Region of Halton. The current dripline location was staked by the EIR team and CH on November 4, 2022. This surveyed line has been added to **Drawing 3.2R and Figure 6.3R**.

As outlined in this EIR/FSS, SWM Pond 9 is permitted within a portion of Core 5. For this SWM facility, the Minutes of Settlement and OPA 272 policy 7.4.7.3 c) v) allows portions of the facility to be situated on the agricultural field within Core 5 such that the southerly limit of the SWM pond can be no closer to the southerly limit of Core 5 than 250m and the encroachment may not extend into any area which is within 10m of the dripline of the wooded areas. Internal driplines were staked in the field with CH on October 13, 2022. The resulting survey, prepared by J. D. Barnes, is provided in Appendix A-5, and included on **Drawing 3.2R,** and **Figures 5.1R** and **5.2R**.

3.2 NOCSS Core 5 Management Recommendations

As presented in the "*Final Consolidated Preserve Environmental Implementation Report and Functional Servicing Study, Shannon's and Munn's Creek Subcatchments"* (May 31, 2017) and reiterated here, NOCSS identified a management strategy to, "…protect and enhance the natural environmental in a sustainable fashion". With respect to Core 5, Section 6.3.3.5 lists the management recommendations to be:

- *"The existing woodlands and wetlands are recommended for retention.*
- *The provision of a forested linkage between this large woodlot and the Sixteen Mile Creek valley is seen as a key management feature. A minimum width connection of 200m has been recommended.*
- *A connection to the south of Dundas Street via Shannon's Creek is secondary and anticipated to be fairly narrow.*
- *The eastern linkage is recommended to be substantial to connect to Morrison Creek to the east.*
- *The north linkage associated with West Morrison Creek directly connect this Core Area to other Cores (i.e., #7).*
- *Management of the landfill portion of the Core is recommended to be continued open country habitat with a created forest connection along the south margin if possible"*.

These recommendations, along with settlement and mediation agreements, provide direction to the management of Core 5 and were acknowledged and respected during the preparation of this EIR/FSS.

4.0 GEOLOGY AND HYDROGEOLOGY

4.1 Scope of Work

The Subject Lands are located within a large tributary subcatchment to East Sixteen Mile Creek that is referred to as ES6-East. The scope of work completed for the hydrogeological component of the ES6-East EIR/FSS study was designed to address the technical requirements as set out in the EIR Hydrogeological Terms of Reference for North Oakville (2007). Specifically, the hydrogeological work program was completed to:

- review the regional hydrogeological setting;
- characterize the local soil, groundwater, and surface water flow conditions;
- assess the local groundwater/surface water interactions and identify areas for recharge/discharge function protection;
- characterize the existing surface water and groundwater quality;
- calculate the pre- and post-development groundwater balance conditions;
- identify hydrogeological opportunities and constraints to maintaining the groundwater balance;
- identify the type, location and size of infiltration or storage measures that may be feasible for use based on the geological and hydrogeological conditions;
- evaluate opportunities for augmenting groundwater infiltration through appropriate and practical Best Management Practices (BMPs) and Low Impact Development (LID) measures to balance, or at least in part, make up the post-development infiltration deficit; and
- identify potential construction constraints related to the hydrogeological conditions.

The detailed scope of work included:

1. Review of Ministry of the Environment Conservation and Parks (MECP) water supply well records for the EIR Subcatchment Area as an aid to assess the regional hydrogeological setting and soil conditions. A listing of the MECP water supply well records for the area is provided in **Appendix C-1**.

2. The installation of a network of boreholes, groundwater observation wells, and shallow drive-point piezometers to investigate the site-specific soil and groundwater conditions. Available geotechnical and observation well records from boreholes completed during the SWS and other studies have also been used for this EIR. Copies of the borehole logs and observation well construction details are provided in **Appendix C-2**.

3. Detailed soil descriptions during drilling and laboratory testing of selected soils for grain-size analyses. These data were reviewed to characterize the surficial sediments and

estimate hydraulic conductivity of the soils encountered. Copies of the soil grain-size analyses are provided in **Appendix C-3**.

4. Single well response testing of eight groundwater observation wells to estimate in-situ hydraulic conductivity of the geological units. The field testing results are included in **Appendix C-3**.

5. Monitoring of groundwater levels to measure the depth to the water table and assess the horizontal and vertical groundwater flow conditions. For this study, groundwater level monitoring was completed monthly for most months between 2014 and mid-2016, and since then, the monitoring frequency has generally been quarterly to focus on seasonal conditions. This report also includes historical water level monitoring data from previous studies conducted in the EIR Subcatchment Area during the 2005 to 2012 period. The available groundwater monitoring data are summarized in Table C-4-1, Table C-4-2 and Table C-4-3 in **Appendix C-4**. Hydrographs to illustrate the monitoring data are also provided on Figures C-4-1 through C-4-31 in **Appendix C-4**. In addition to the manually recorded groundwater levels, automatic water level recorders (dataloggers) were installed in MW1, MW2, MW3, MW4s, MW4d, MW2-15 and MW5-15 (well locations are shown on **Figure 4.1R**) to record detailed and continuous water level measurements. The datalogger hydrographs are presented on Figures C-4-6 to C-4-9, Figure C-4-11 and Figure C-4-14 in **Appendix C-4**.

6. Monitoring of surface water levels in ponds and wetlands. Monitoring has been completed at staff gauge SG1-14 installed in the farm pond located in the southern portion of the EIR Subcatchment Area (**Figure 4.1R**). This was a replacement for a previous staff gauge in the pond that was referred to as SG16-SL in previous studies. Surface water monitoring data are also available from a previous study for a small pond in the northern portion of the EIR Subcatchment Area at SG1-WN (**Figure 4.1R**). The surface water level monitoring data are provided in Tables C-5-1 and C-5-2 in **Appendix C-5**.

7. Monitoring of surface water flow for this study was completed at a similar frequency as the groundwater monitoring outlined above. When possible, the monitoring was completed during dry weather conditions to characterize low flow conditions. Surface water flow observations and measurements were conducted at 5 road culvert locations along Burnhamthorpe Road (ESM-B1 through ESM-B5) and 4 surface water flow stations (SS1-SL, SS1-14, SS2-14 and SS3-14 in the EIR Subcatchment Area; **Figure 4.2R**). The monitoring at the road culverts was a continuation of flow monitoring initiated at these stations in 2001 during the North Oakville East landowners North Oakville East Subwatersheds Study (2004) and in 2011 during a study of the property north of Burnhamthorpe Road. Flow was estimated using a stream area - velocity method. The surface water monitoring locations are shown on **Figure 4.2R**. The surface water flow

data are summarized, along with the historical culvert monitoring data on Tables C-5-3, C-5-4 and C-5-5 in **Appendix C-5**.

8. Collection of groundwater samples from 2 observation wells (MW2-15 and MW6-15) and review of groundwater quality data from BH11-4s and BH11-4d. The water samples were submitted to an accredited laboratory for analyses of general quality indicators (e.g., pH, hardness, conductivity), basic ions (including chloride and nitrate) and selected metals. Groundwater quality data are summarized in Table C-6-1 and Table C-6-2 in **Appendix C-6**.

9. Surface water quality data collected from watercourses and a farm pond in previous studies were reviewed and 2 culverts along Burnhamthorpe Road (ESM-B1 and ESM-B4) were sampled in 2016. The water samples were submitted to an accredited laboratory for analyses of general quality indicators (e.g., pH, hardness, conductivity), basic ions (including chloride and nitrate) and selected metals. Field testing of selected parameters such as temperature, pH, conductivity and total dissolved solids was completed at selected locations when surface water flows were present. The laboratory and field water quality data are provided in **Appendix C-6**.

10. Pre-development water balance calculations (based on existing land use conditions) and post-development water balance calculations (based on the proposed development concept) for the EIR Subcatchment Area to assess the potential impacts of development on the local water resources. The water balance calculations are provided in **Appendix C-7**.

4.2 Physiography and Topography

The ES6-East Subcatchment Area is located on the south slope of the Trafalgar Moraine, a 'till moraine' originally mapped by Chapman and Putnam (1951, 1984) and by the Ontario Geological Survey (Barnett, 1992a). The Trafalgar Moraine consists of a belt of gently undulating topography extending across the North Oakville area. Highway 407, generally, marks the crest of the Trafalgar Moraine between Sixteen Mile Creek and Trafalgar Road. The crest of the Moraine forms the regional surface water divide with all subwatershed areas on the south slope draining towards the south.

The land surface across the EIR Subcatchment Area slopes gently to the south and west and is characterized by a low relief undulating till surface (**Figure 4.2R**). The topography is characterized as hummocky, particularly in the northeastern area of the subcatchment resulting in numerous shallow depressions. Analysis of the detailed topography mapping shows there is a maximum relief amplitude across the study area of about 22m. The highest elevations (up to 192 masl - metres above mean sea level) are found along the north boundary of the

subcatchment with the lowest elevations of about 170 masl found in the southwest part of the subcatchment along Neyagawa Boulevard (**Figure 4.2R**).

4.3 Drainage

The East Sixteen Mile Creek ES6-East subcatchment drainage area is shown on **Figure 4.2R**. Surface water generally flows towards the south. The EIR Subcatchment Area is bounded to the north by Highway 407, to the south by NHS (Core 5), with Neyagawa Boulevard marking the western boundary of the subcatchment (**Figure 4.2R**).

4.3.1 Watercourse Conditions

There are no permanent watercourses in the EIR Subcatchment Area. Surface water runoff is directed overland via a series of drainage swales through the farm fields and ditches along the roads. The observations and monitoring data for the drainage swales across the EIR Subcatchment Area confirm that the swales are ephemeral and have a surface water conveyance function. Surface water flows were measured at five road culvert locations along Burnhamthorpe Road (ESM-B1 to ESM-B5; **Figure 4.2R**). Table C-5-3 in **Appendix C-5** summarizes the data recorded during this study. Surface water flow monitoring data from 2001-2006 and 2011-2012 are also available for these culvert locations, and flow was also monitored at a culvert crossing Neyagawa Boulevard at ESM-NG3 (**Figure 4.2R**). The historical data are included in **Appendix C-5** on Tables C-5-4 and C-5-5 respectively.

The monitoring data show the culverts are mostly dry with standing water or minimal flow (less than 0.1 L/s) recorded even during spring conditions. The only significant flows recorded during the period of review were noted during snowmelt and spring conditions (e.g., February 2017 and May 2019), or in response to major rainfall events, e.g., December 2019 (Table C-5-3, **Appendix C-5**). The absence of flow in the swales confirms that these areas are ephemeral, with a conveyance function related to precipitation and seasonal water runoff events.

There are two dug ponds present (further discussed in Section 4.3.2), and there is evidence to suggest that some of the drainage swales have been tiled to direct drainage to ditches and these ponds. The age, layout and effectiveness of the tile drainage systems are not known, however, in some areas tile outlets have been monitored as discussed in Sections 4.3.3 and 4.3.4. The Sherborne Lodge farm pond in the southwest corner of the EIR Subcatchment Area outlets to a shallow swale that runs through a small wetland area identified as PSW 3 (**Figure 4.2R**) that outlets to the roadside ditch along Neyagawa Boulevard.

Surface water in the Neyagawa Boulevard ditch flows southwards to join the watercourse that flows from the west side of Neyagawa at culvert ESM-NG3, and then the combined drainage flows southeast along stream reach SMA-6 to join with reach SMA-5, a reach that drains flows towards the west through the Core 5 area (**Figure 4.2R**). Flows then turn southwest (reach SMA-4; **Figure 4.2R**) and cross back under Neyagawa Boulevard. Flow in the downstream

reaches of this tributary between Neyagawa Boulevard and Dundas Street has been described as intermittent with no flow conditions being recorded frequently (GHD, 2013). A site walk completed in October 2011 noted the flow conditions through the Core 5 woodlot. Flows were observed in reaches SMA-4 and SMA-6, however; reach SMA-5 was observed to be dry at the confluence) located south of the EIR Subcatchment Area (**Figure 4.2R**). Watercress was observed in a few places along reach SMA-6, close to its confluence with reach SMA-5 and the presence of such vegetation suggests that there may be some groundwater seepage in this area of the woodlot. This was not observed in August 2011 when the stream was dry, indicating that the groundwater seepage conditions are likely seasonal (i.e., seepage only occurs under wet, high water table conditions).

Further descriptions of the watercourse conditions downstream of the EIR Subcatchment Area are provided in Section 5.

4.3.2 Hydrologic Features

Hydrologic Features A are defined in NOCSS to be hydrological features located within Blue or Red Streams. There are no Hydrologic Features A within the EIR Subcatchment Area.

Hydrologic features not associated with the NHS, are called Hydrologic Features B. There are 5 Hydrologic Features B within the EIR Subcatchment Area (**Figure 4.2R**). Three of the features are north of Burnhamthorpe Road. Two are small and shallow depressions in the till that result from the hummocky topography, and the larger Feature B is a small farm pond excavated into the water table. This feature was instrumented with a staff gauge and piezometer nest and was monitored during a previous study (refer to the SG1-WN and PZ1-WN locations shown on **Figure 4.1R**). The monitoring in this feature showed that the pond water level varied seasonally by about 0.4m and the pond has a recharge function; it fills with runoff during wet periods and dries out under summer/fall periods of low precipitation (refer to Figure C-4-30; **Appendix C-4**).

Two Hydrologic Features B are located south of Burnhamthorpe Road (**Figure 4.2**). NOCSS also identified these two features as part of the mapping of topographic depressions, ponds and pits. Depression 68 (and Hydrologic Feature B) is located in the southeastern portion of the EIR Subcatchment Area. This area was instrumented with a piezometer nest (PZ1s/d-15 as shown on **Figure 4.1R**). The data from this monitoring location found that the depression has a recharge function in the spring when the feature holds water contributing to locally high water table conditions. There is a downward gradient and during summer/fall conditions the water table drops more than 0.7m below grade (Figure C-4-21, **Appendix C-4**).

The other Hydrologic Feature B south of Burnhamthorpe Road is the Sherborne Lodge farm pond, a large excavated and bermed pond also referred to as Pond 47 (**Figure 4.2R**). A number of drainage swales direct flow towards this pond and numerous staff gauges, piezometers and monitoring wells have been installed in and around the feature for monitoring purposes in this study (**Figure 4.1R**). Figure C-4-18 in **Appendix C-4** shows that the surface

water level in this pond varies with seasonal conditions and precipitation events, with water level fluctuations up to about 1m. The surface water is higher than the shallow groundwater elevation measured at the pond in piezometer PZ1-SL, showing that the pond has a recharge function. It is noted that as part of the planned development, Pond 47 will be drained and filled. Further discussion of Pond 47 is provided below in Section 4.3.3.

The storage available in the Hydrologic Features B and topographic depressions is addressed in Section 7.14.

4.3.3 Pond 47 – Sherborne Lodge Farm Pond

Pond 47 was constructed on the Sherborne Lodge farm. The pond was excavated at the confluence of several drainage swales and was bermed to impound surface water runoff. As described in Section 5.4, it is likely that this pond was created in the mid-1980's. There is some visual evidence (e.g. observed pipes) that the swales contributing runoff into this pond have been tiled in an attempt to improve flows through the surficial till soils. During the field studies, the resident noted that it was their understanding that the pond was constructed for aesthetic purposes only; there has been no known pumping of this pond for irrigation, and the extent of any field tiling is not known.

A bathymetric survey of the pond was completed in 2014. The pond is approximately 150m long by 100m wide. The pond was excavated to a depth of about 2.25m in the middle with shallow sloping sides. The geology in this area has a shallow layer of silty clay glacial till soils overlying shale bedrock, and the bathymetry suggests that the pond was excavated through the till overburden to the weathered top of the shale, as illustrated in cross section on **Figure 4.7** (the geology of the EIR Subcatchment Area and the stratigraphy is discussed in Section 4.5).

The seasonal surface water level variations observed at the pond are related to precipitation and runoff inputs. A staff gauge was installed in the pond in June 2014 (SG1-14; **Figure 4.2R**) replacing a previous gauge installed in 2005 (SG16-SL). The water level fluctuations over the period of record show that the pond levels have varied by about 1m from a recorded low of 171.55 masl to a high of 172.58 masl. The highest surface water levels recorded generally occur in the spring or fall and are associated with rainfall events or snow melt (refer to Figure C-4-18, **Appendix C-4**).

Review of the groundwater elevations in monitoring wells and piezometers surrounding the pond also show seasonal variations. MW2 (north of pond) and MW3 (west of pond) are both screened in the upper portion of the shale/bottom of the till sediments (refer to **Figure 4.7**) and these hydrographs show seasonal variations in groundwater levels of up to about 1.5 m. The detailed datalogger hydrographs also show response of groundwater levels to individual precipitation events (refer to Figures C-4-7 and C-4-8 in **Appendix C-4**). BH111 and PZ2s/d-14, located on the eastern side of the pond and screened in the till sediments overlying the bedrock, show a slightly more muted seasonal variation in groundwater levels of about 1m

(Figures C-4-5 and C-4-20, **Appendix C-4**). These observations suggest that the hydraulic conductivity of the surficial materials is variable from moderately low to very low with moderately low rates developed in the zone along the top of the weathered shale. There are high water table conditions observed in the till, but the groundwater movement is very limited due to the very low hydraulic conductivity. At a piezometer nest along the drainage swale just northwest of Pond 47 (PZ1s/d-14; **Figure 4.1R**), the clayey soils were so tight it was not possible to drive the piezometers deeper than about 1.5m and the groundwater levels took more than a year to stabilize (Figure C-4-19, **Appendix C-4**). The pond is sustained because it was excavated into the local water table to a depth sufficient to intersect the moderately low hydraulic conductivity zone at the till/shale contact. Infiltration or percolation within the pond is limited due to its intercepting the water table and hence the only means of water loss from the pond is evaporation or surface outflow. During dry conditions, it is interpreted that local groundwater moves through the moderately low to very low hydraulic conductivity sediments and towards the pond to eventually flows through the pond. Groundwater flow through the pond is limited by the low hydraulic conductivity of the sediments. As discussed above in Section 4.3.2, the pond also receives surface water runoff during and after rainfall events. Due to the low hydraulic conductivity and high water table conditions, the rate of infiltration/ percolation from the pond to groundwater is slow, however the ponded water will be retained within the pond and under these conditions, the pond recharges the local groundwater in the area.

There are surface water flow monitoring stations established at pipes observed to be entering the pond at SS1-14 and SS2-14 (**Figure 4.1R**), presumably contributing drainage from shallow field tiles to the pond. The pipe at SS1-14 is about 30cm in diameter, and under high water level conditions, the water level at the pipe is the same as the pond so flow was often not measurable. At SS2-14, the pipe is semi-buried and again, flows are difficult to measure or estimate. So while the specific flow values at these locations are not highly accurate, the monitoring has shown that in general, measurable flows occur during snowmelt events, spring runoff conditions and in response to rain events, consistent with the ephemeral nature of the drainage courses (Table C-5-3, **Appendix C-5**).

As part of the planned development, Pond 47 will be drained and filled. The volume of water held in the pond was estimated based on the bathymetric survey as 20,000 m^3 prior to overtopping. In accordance with Ministry of the Environment Conservation and Parks (MECP) guidelines, a Category 3 Permit to Take Water (PTTW) has been obtained to pump the water from the existing pond. In addition to removing the impounded surface water, temporary dewatering of the local groundwater will occur to reconstruct the area in dry conditions. Following pond removal, groundwater will continue to flow southwards through the upper portions of the shale through this area and surface water drainage to PSW 3 will be maintained by the stormwater management system (refer to Section 7.10).

4.3.4 PSW 3

The overflow pipes from Pond 47 direct flow west through a small wetland feature mapped by the MNRF as a provincially significant wetland (PSW3; **Figure 4.2R**). Analysis of the local topography and drainage indicates that an area of approximately 3.67ha immediately adjacent to Neyagawa Blvd contributes overland surface runoff directly to PSW 3. In the field, a field tile drain has been observed flowing directly into the wetland; the pipe is located on the north side of the feature and west of the Pond 47 berm. There is a shallow swale, not well delineated through the feature that conveys flows to the road ditch along the east side of Neyagawa Boulevard.

Flows into and out of PSW 3 are monitored at stations SS1-SL and SS3-14 respectively (**Figure 4.2R**). SS1-SL is located just downstream of both the pond and observed field tile outlets. The only significant flows recorded during the period of review were noted during snowmelt and spring conditions (e.g., March 2016, February 2017, April 2018, and May 2019), or in response to major rainfall events, e.g., June 2015 and December 2019 (Table C-5-3, **Appendix C-5**). Ponded water is typically observed seasonally during the spring, and then the feature dries out with occasional small pools of standing water observed in places. It is noted that the feature is covered by tall grass and cattails that make observations of the surface water conditions and precise measurements of flows difficult. So while the specific flow values at these locations are not highly accurate, it is noted that the flows into the feature are generally higher than the flows out of the feature, suggesting loss of flow as it spreads through the wetland.

To investigate the shallow groundwater conditions in the feature, a piezometer nest was installed in a low area near the outlet (PZ2-WNs/d; **Figure 4.1R**). It was not possible to drive the piezometers more than 1.3m deep, suggesting that the soils are very tight or the bedrock is very shallow beneath this feature. As shown on Figure C-4-31 (historical data) in **Appendix C-4**, the water level data in these piezometers showed a recharge gradient in the fall of 2011 suggesting recharge in the wetland. It was noted that the groundwater levels took considerable time to stabilize in the deep drive point piezometer suggesting very tight soil conditions in this area. In the spring of 2012, the water levels in the deeper piezometer rose slightly higher than the water levels in the shallow drive point piezometer, i.e., showing a reversal of gradient to slightly upwards, before dropping below the shallow water level again in the late fall (Figure C-4-31, **Appendix C-4**). Monitoring resumed in 2014 at this location and the data show both piezometers fill up to surface during spring conditions when there is surface water in the PSW, and then groundwater levels decline during the dry summer months (Figure C-4-17, **Appendix C-4**). These data suggest the potential for minor seasonal groundwater discharge in the spring and it is likely that the high water table and tight soils contribute to the ponding of surface water in the wetland feature during spring conditions. While the seasonal discharge gradients will help to support high water table conditions beneath the PSW, the overall wetland observations and monitoring data do not indicate actual groundwater discharge in the feature or groundwater contributions to baseflow from the feature.

The groundwater levels in the slightly deeper piezometer fluctuate more than the water levels in the shallower piezometer (i.e., variations of more than 1.3m in the deeper pipe and less than 1m in the shallow). The deeper piezometer often goes completely dry suggesting that the deeper pipe may be at or near the more transmissive zone at the top of the shale. The differences in the shallow groundwater level responses result in the observed gradient reversals. The groundwater elevation data from nearby DP20 (Figure C-4-16, **Appendix C-4**) on the north side of the feature suggest groundwater in the area flows southwards under the PSW.

It is concluded that the wetland is primarily sustained by precipitation and surface water runoff, as well as high underlying water table conditions. In addition to groundwater flow from the north, seasonal standing water in the PSW increases the availability of water for infiltration into the underlying sediments and gives the feature a seasonal recharge function that will also help to support the high water table.

4.4 Climate

The reported long-term average annual precipitation for the period between 1981 and 2010 for the North Oakville area is 897 mm based on data from the Environment Canada Royal Botanical Garden monitoring station (Station 6153301 - 43°17'30''N, 79°54'30''W, elevation 102 masl). Daily precipitation data from this station are also provided on the datalogger hydrographs in **Appendix C-4**. Average monthly records of precipitation and temperature from this station have been used for the water balance calculations in this study (refer to Section 8 and **Appendix C-7**).

4.5 Geology

4.5.3 Stratigraphy

The Ministry of the Environment Conservation and Parks (MECP) maintains a database that provides geological records of water supply wells drilled in the province. A list of the available MECP water well records for local private wells is provided in **Appendix C-1**, and the approximate well locations are plotted on **Figure 4.5R**. Along with all of the site-specific geological information obtained from the geotechnical boreholes and groundwater observation wells drilled within the EIR Subcatchment Area (drilling logs provided in **Appendix C-2**), these MECP records provide geology data to help assess the stratigraphy.

To illustrate the geological conditions, schematic cross-sections through the EIR Subcatchment Area have been prepared. The cross-section locations are shown on **Figure 4.5R** and the interpreted cross-sections are shown on **Figures 4.6** to **4.8**. These figures illustrate the local stratigraphy of a surficial layer of glacial till overburden sediments overlying shale bedrock. The till overburden is quite thick along the Trafalgar Moraine in the area north of Burnhamthorpe Road (interpreted to be up to about 20m thick as shown on **Figure 4.6**), however, the till is much thinner (generally less than 5m) south of Burnhamthorpe Road (refer to **Figures 4.7** and

4.8). In places, the bedrock is very shallow (i.e., within about 2m of ground surface) in the FSS Study Area.

4.5.4 Surficial Geology

Surficial geology mapping published by the Ontario Geological Survey shows that the Study Area is covered by glacial till (**Figure 4.3**). Detailed geological work in the North Oakville East area by Eyles & Eyles (2003) identified two layers of glacial till materials: an upper silt-rich till referred to as the Wildfield till, and a lower coarser-grained till referred to as the Halton till. The Halton till generally occurs north of Burnhamthorpe Road and is not continuous throughout the area so that in most places, the Wildfield till directly overlies the shale bedrock.

Drilling records show a layer of organic topsoil ranging in thickness from 10cm to 45cm overlies glacial till overburden sediments ranging from less than 1m to more than 14m thick. Copies of the geotechnical reports and borehole logs are included in **Appendix G**. Over most of the EIR Subcatchment Area, the till is described as silty clay to clayey silt till with trace to some sand, gravel and shale fragments (**Appendix G**). This is interpreted to be Wildfield till. Underlying Wildfield till, a coarser till, described as sandy silt to silty sand till, was encountered only in the northern portion of the EIR Subcatchment Area, with thickness reported at BH11-4d of about 8 m. This is interpreted to be Halton till. Cross-section A-A' (**Figure 4.6**) shows that the total till thickness reaches about 20m in the area of higher elevation in the northern part of the EIR Subcatchment Area, and thins towards the south with bedrock found near surface at the southern EIR Subcatchment Area boundary. Across the FSS Study Area, the overburden is thinner, with about 4m to 6m of till overlying a gently undulating bedrock surface (**Figures 4.6**, **4.7** and **4.8**).

4.5.5 Bedrock Geology

Provincial mapping shows the EIR Subcatchment Area is underlain by red and green shale bedrock of the Queenston Formation (**Figure 4.4**). This late-Ordovician aged bedrock consists of relatively soft, friable shale containing thin (< 30 cm) interbeds of fine sandstone and siltstone and greenish grey shale. Rock cores have indicated that up to 3m of the top of the shale is heavily weathered and the weathered zones are highly fractured and contain thin layers of clay. At SL4, more competent shale was encountered directly below the till (refer to borehole logs in **Appendix C-2**).

As noted in Section 4.5.2 and shown on **Figures 4.6** to **4.8**, the overburden is relatively thin in the southern portions of the EIR Subcatchment Area, with the bedrock encountered at relatively shallow depths (i.e., generally within about 4m of ground surface). The bedrock elevation ranges from a high of about 178 masl at BH11-1 north of Burnhamthorpe Road to about 169 masl near BH107 at Neyagawa Boulevard (refer to **Figure 4.5** for borehole and section locations and cross-section **Figures 4.7** and **4.8**).

4.6 Hydrogeology

4.6.1 Local Groundwater Use

In the North Oakville area there are no high-yielding or extensive water supply aquifers reflecting the lack of coarse-grained sand and gravels and the relatively thin, glacial till overburden. There is no municipal groundwater use and no identified Well Head Protection Areas (WHPA). The Source Water Information Atlas (MECP, 2020) indicates that there are also no Significant Groundwater Recharge Areas (SGRA) or Highly Vulnerable Aquifers (HVA) in the EIR Subcatchment Area. The absence of these vulnerable areas is in keeping with the known very low hydraulic conductivity surficial soils and absence of high yielding aquifers.

A review of MECP well records (**Appendix C-1**) indicates that local supply wells generally tap the upper portions of the Queenston shale bedrock. Typically the low hydraulic conductivity till and shale materials are considered as relatively poor aquifers and the local well yields are typically very low (3.8 to 17 L/min). Singer et al. (2003) suggest that the pore spaces within the Queenston Formation have relatively poor interconnections and that the rock itself does not fracture or dissolve readily thus limiting its effective porosity. In addition, it is stated by Singer et al. (2003) that typically only the top 3m to 5m of this rock is fractured which often limits domestic supply wells completed in this formation.

The proposed development will be municipally serviced from Lake Ontario, and in the long term it is anticipated that the entire North Oakville area will be on lake-based municipal supplies. There is no proposed groundwater use for the development (refer to Section 9 for Water Servicing Details).

It is noted that there may be continued interim use of groundwater for private well supplies in the areas surrounding the proposed development. It is important that the development does not disrupt these local water supplies and, as required by the Region of Halton, monitoring of any active local supply wells before, during and after construction will be completed (refer to Section 11.8 for details of the proposed monitoring of local water supply wells still in use during development).

4.6.2 Hydraulic Conductivity

During local geotechnical studies by SPL Consultants (2011), AME Materials Engineering (2012) and Soil Engineers Ltd. (2014 and 2015), shallow soil samples were collected and tested for grain-size analysis (**Appendix G**). The grain-size analyses confirm the silty clay nature of the surficial till, and these data suggest that the hydraulic conductivity of the Wildfield till is very low (less than 1×10^{-6} cm/sec). It is noted, however, that other characteristics of the surficial materials (such as the degree of weathering and fracturing) may locally affect the overall hydraulic conductivity of the overburden layer. Grain size and hydraulic conductivity test data used to assess hydraulic conductivity are summarized in **Appendix C-3**.

In-situ hydraulic conductivity field tests were conducted in November 2011 (on the property north of Burnhamthorpe Road) and again in July 2014 and June 2015 at eight wells within the FSS Study Area (BH11-4s/d, MW2, MW3, MW4d, MW2-15, MW5-15 and MW6-15). Five wells were completed in the shale and three (BH11-4s/d and MW5-15) were completed in the overburden. The test data are summarized in **Appendix C-3**. The analyses for the wells completed in the silty clay till to sandy silt till overburden indicate a very low hydraulic conductivity in a range of 6.9×10^{-7} cm/sec to 1.4×10^{-6} cm/sec. The hydraulic conductivity of the shale tends to be affected by fracturing and bedding planes and the test analyses for the wells completed in the shale indicate a relatively higher hydraulic conductivity of the upper weathered portion of the shale, with estimates of 8.7×10^{-5} cm/sec to 2.5×10^{-6} cm/sec.

4.6.3 Groundwater Levels

Groundwater monitoring locations within the EIR Subcatchment Area were installed in different stages for various studies since 2005. The locations include monitoring wells completed in the overburden and shale, as well as a series of shallow drive-point piezometers (DP/PZ) installed along drainage courses, wetland and pond features. All monitoring locations are shown on **Figure 4.1R** with the locations that have been decommissioned or removed since installation greyed out. Most of the monitoring wells in the FSS Study Area are screened in the shale bedrock or across the till/shale contact zone. North of Burnhamthorpe Road, where the overburden is much thicker, all of the monitoring wells are screened in silty clay till and sandy silt till.

Details of the groundwater monitoring in the piezometers and wells in the vicinity of the ponds and PSW 3 were discussed in detail in Sections 4.3.3 and 4.3.4. This section focusses on the monitoring well data to characterize the overall groundwater conditions across the EIR Subcatchment Area. The groundwater monitoring data show the following (refer to **Figure 4.1R** for the monitoring locations and the hydrographs in **Appendix C-4**):

- Seasonal variations typically show higher groundwater levels during spring and late fall conditions and lower groundwater levels during summer dry periods, and the magnitude of variations will depend on annual climatic conditions and precipitation patterns. Across the EIR Subcatchment Area, the recent and historical groundwater monitoring trends show seasonal groundwater level variability at most of the monitoring locations, with the groundwater levels typically changing in a range of about 1.0m to 2.5m. The range of variation is observed in wells completed in the overburden as well as those completed in the shale. Anomalous observations were noted in the PZ1s/d-14 piezometer nest; after taking more than a year to stabilize, the pipes filled to ground level and show little to no seasonal variations.

- The depth to the water table is also variable, seasonal and dependent on topography. In the upland areas the water table tends to be deeper (e.g., at BH11-2 and BH11-3 on top of

the moraine where seasonally water levels in the till have been recorded in the 2m to 6m below grade range; Figures C-4-23 and C-4-24, **Appendix C-4**). In lower areas along the drainage swales and around the ponds and PSW 3, the water table tends to be shallow and seasonally at or close to grade (e.g., water levels in the piezometers at PZ1s/d-14, PZ2s/d-14, PZ1s/d-15 and PZ2-WNs/d; Figures C-4-19, C-4-20, C-4-21 and C-4-17, **Appendix C-4**).

- A less typical situation was observed at BH11-1 (a well completed in the deeper Halton till located on the slope of the moraine just north of Burnhamthorpe Road; **Figures 4.1R** and **4.6**). Monitoring completed at this well in 2011/2012 found a very high water level, with seasonally high readings up to 0.7m above ground in March, 2012 and a seasonal low level in August 2012 of only 0.6m below ground (Figure C-4-22, **Appendix C-4**). There is a deeper sandy till that is interpreted to be present under the Trafalgar Moraine, that pinches out against the tighter Wildfield till to the south, just north of Burnhamthorpe Road (**Figure 4.6**). This confined condition is interpreted to be the cause of the artesian head recorded at the BH11-1 location. It is noted, however, that there is no evidence of groundwater seepage or wet ground conditions in this area due to the low hydraulic conductivity of the overlying Wildfield till in this area

- Two nests of monitoring wells (i.e., wells located adjacent to each other but completed at different depths) were installed in the EIR Subcatchment Area, BH11-4s/d north of Burnhamthorpe Road and MW4s/d just south of Pond 47 (**Figure 4.1R**). The monitoring in BH11-4s/d shows that groundwater levels in the two wells (both completed in the deeper sandy Halton till; **Figure 4.6**) are quite similar, with little to no hydraulic gradient suggesting lateral flow is dominant through the confined sandy till layer (Figure C-4-25, **Appendix C-4**). At MW4s/d, the shallow well was completed in silty clay till and the deep well was screened in shale. The hydrographs (Figure C-4-9, **Appendix C-4**) show the groundwater level in MW4s took months to recover after the well construction which indicates the very low hydraulic conductivity of the till soils and the limited volume of groundwater moving in the subsurface in this area. Groundwater levels in the shale recovered more quickly, and also respond more rapidly to rainfall events, consistent with the interpretation that the weathered top of the shale has higher hydraulic conductivity (refer to Section 4.3.3). The water level in the till tends to be slightly higher than the water level in the shale in the spring, indicating downward hydraulic gradients and groundwater recharge conditions. During dry aquifer conditions such as in late 2016, the water levels in the till dropped just below the levels at the shale, reversing the hydraulic gradient. Gradient reversals have also been observed under spring conditions in recent years, indicating the potential for discharge from the shale to the till in the immediate vicinity of the shale/till interface.

- Review of the water levels at the nested piezometers located along drainage swales in the southern portion of the EIR Subcatchment Area (PZ1s/d-15, PZ1s/d-14 and PZ2s/d-14; **Figure 4.1R**) indicates that the stabilized water levels tend to be close to grade, with

relatively flat to seasonally downward gradients (Figures C-4-19, C-4-20 and C-4-21 **Appendix C-4**). The water levels, particularly in the deeper piezometers were slow to stabilize showing the low hydraulic conductivity of the till underlying the drainage features. The data support the interpretation that there is a high water table beneath the swales, but limited potential for groundwater discharge consistent with the observed surface water conveyance functions. When flow is present in the swales, recharge may occur to the underlying sediments, although again, water volumes will be very limited by the tight soils.

- MW1 is screened in the silty clay till overburden and the datalogger trace shows a relatively smooth hydrograph with no apparent direct response in groundwater levels to individual precipitation events (Figure C-4-6, **Appendix C-4**). Datalogger hydrographs from well locations close to Pond 47 (MW2, MW3 and MW4d) feature spikes in water level following significant precipitation events (Figures C-4-7 to C-4-9, **Appendix C-4**). MW2, MW3 and MW4d are all completed and screened in the bedrock and in close proximity to the pond. These data are consistent with the interpretation that the lower till/top of shale contact area is the more transmissive zone for groundwater movement.

4.6.4 Groundwater Flow Conditions

Groundwater elevation data from May 2019 are shown on **Figure 4.9R**, along with the interpreted groundwater elevation contours for the EIR Subcatchment Area. Topography strongly influences the shallow groundwater flow pattern, such that the groundwater flow directions reflect the general surface water drainage patterns. Groundwater flow is moving generally towards the south across the EIR Subcatchment Area, from higher elevation areas towards lower elevation areas (**Figure 4.9R**). In the southern portion of the EIR Subcatchment Area, the excavation of Pond 47 and tiling along drainage channels appears to have attracted local convergence of groundwater flow to the area (**Figure 4.9R**).

As described in Section 4.6.3, the depth to the water table varies with topography and seasonal conditions. The groundwater rises and falls within the till and shale materials and there is no apparent hydraulic separation between these two geological layers in the areas where the till is relatively thin and bedrock is shallow, i.e., in the area south of Burnhamthorpe Road. The contact area between the till and weathered top of the shale is a zone with somewhat higher hydraulic conductivity and is interpreted to be the main zone of lateral groundwater flow across the EIR Subcatchment Area.

The groundwater monitoring has demonstrated that groundwater is relatively shallow in the topographically lower areas within the EIR Subcatchment Area and the ponds intercept the water table. Seasonally high water table conditions occur in the lower swales and PSW 3, however, the features are underlain by very low hydraulic conductivity clayey silt till and show no evidence of groundwater seepage or baseflow.

4.6.5 Recharge and Discharge Conditions

In general, the upland areas are considered to be groundwater recharge areas, where infiltrating precipitation may recharge into the topsoil, till layers and underlying shale. The vertical gradients are generally low and the lateral flow gradient is also low (0.01), however, the gradients suggest that the groundwater that recharges across the EIR Subcatchment Area will move generally southwards through the till and/or shale materials. The recharge volume is restricted by the low gradients and the low hydraulic conductivity of the till. It is likely that deeper infiltration to the water table and groundwater movement is predominantly controlled by fracturing within the till and upper weathered shale.

As noted in Section 4.6.1, the Source Water Information Atlas (MECP, 2020) indicates that there are no Significant Groundwater Recharge Areas (SGRA) mapped in the EIR Subcatchment Area.

There are times when seasonally high groundwater levels intersect the ground surface in the topographically lower areas, and minor seasonal discharge gradients have been recorded in PSW 3, although no discharge seepage to surface or baseflow contributions have been observed (refer to Section 4.3.4).

4.7 Water Quality

4.7.1 Groundwater Quality

The local groundwater quality is considered to be relatively poor in terms of drinking water supplies. In a water resources study of the area in 1979, the MECP characterized water from the Queenston Formation shale as having high total dissolved solids (TDS) and elevated chloride, sodium, and sulphate concentrations compared to water from other types of bedrock or overburden materials. The MECP study reported minimum, maximum and mean concentrations of these parameters (based on 14 samples). Chloride, for example, ranged from 6 mg/L to 495 mg/L with a mean of about 150 mg/L (MECP, 1979). During subwatershed studies of the North Oakville area in 2004, the chloride concentrations in local groundwater samples were reported in a similar range. The Ontario Drinking Water Quality Standards (ODWQS) set the drinking water standard for chloride at 250 mg/L. Water with a chloride concentration above about 250 mg/L may have a salty taste and often residents will rely on bottled water for drinking supplies.

In order to characterize the site-specific groundwater quality in the EIR Subcatchment Area, groundwater samples were collected on November 7, 2011 and June 4, 2015 from four observation wells: two nested wells located north of Burnhamthorpe Road (BH11-4s and BH11-4d), and two single wells located in the southeastern area of the subcatchment (MW2-15 and MW6-15). BH11-4s is screened in sandy silt till sediments and BH11-4d is completed in silty sand till sediments just above the contact with the shale. MW2-15 and MW6-15 are both

screened in shale bedrock (refer to well logs in **Appendix C-2**). The groundwater chemistry results from the analytical laboratory are summarized in Table C-6-1 and Table C-6-2, **Appendix C-6**.

The key groundwater quality findings are as follows:

- The chloride concentrations in the till deposits show values of 17 mg/L in BH11-4s and 144 mg/L BH11-4d. Chloride concentrations in the bedrock groundwater samples show values of 25.7 mg/L in MW2-15 and 15.1 mg/L in MW6-15. These concentrations are considered low when compared to the ODWQS of 250 mg/L for chloride.

- Sodium was reported in a range of 58.3 mg/L to 341 mg/L in the overburden groundwater and 119 mg/L to 30.4 mg/L in groundwater from shale (above the recommended ODWQS of 20 mg/L for sodium-restricted diets, but within the standard 200 mg/L limit).

- The reported hardness for overburden groundwater ranged from 365 mg/L to 511 mg/L (levels above 100 mg/L are considered 'hard water') and the total dissolved solids ranged from 748 mg/L to 1,450 mg/L (i.e., the water is mineralized). Groundwater from the shale was similar, with hardness values of 303 mg/L to 404 mg/L and total dissolved solids from 678 mg/L to 508 mg/L.

- The sulphate concentration data for the well nest show levels of sulphate of 304 mg/L (BH11-4s) and 711 mg/L (BH11-4d). The deep well sample exceeds the ODWQS of 500 mg/L for sulphate. Groundwater samples from the shale in the southern part of the EIR Subcatchment Area showed much lower sulphate concentrations with values of 179 mg/L and 77.4 mg/L which are below the ODWQS limit.

- Use of fertilizers on agricultural land can result in elevated phosphorus and nitrate concentrations in runoff and groundwater, however, none of the groundwater samples from the overburden or shale reported dissolved phosphorus concentrations (orthophosphate). Total phosphorus was reported in the 0.18 mg/L to 1.91 mg/L range for the four samples. Nitrate was not found in the samples from the till, but was elevated above ODWQS in one of the shale groundwater samples (17.5 mg/L at MW6-15). These data suggest that overall, the shallow groundwater has not been widely impacted by agricultural land uses.

- Iron concentrations in the samples from the overburden are slightly above the ODWQS of 0.3 mg/L, reported at 0.533 mg/L and 3.18 mg/L. Iron was not found in the groundwater samples from shale reported iron concentrations. Manganese concentrations in all samples were at or above the ODWQS of 0.05 mg/L.

4.7.2 Surface Water Quality

A surface water sample was collected in May 2002 and again in December 2011 from the east side of the road at ESM-NG3. A surface water sample was collected in July 2014 from Pond 47. Surface water runoff samples were also collected in 2016 at culverts ESM-B1 and ESM-B4 under Burnhamthorpe Road (refer to **Figure 4.2R**). The surface water samples were analyzed for general water quality indicator parameters (pH, conductivity, hardness, total suspended solids, etc.), basic ions such as chloride and nitrate, and selected metals. The surface water chemistry results are summarized in Tables C-6-3, C-6-4 and C-6-5 and C-6-6 in **Appendix C-6**. The surface water quality results have been compared to the Ontario Provincial Water Quality Objectives (PWQO) and the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for Surface Water (Freshwater).

In addition to the laboratory analysis, field monitoring of temperature, pH, conductivity, and total dissolved solids was also completed when surface water flow was present during the stream flow monitoring program. The results of the field monitoring are summarized in Tables C-6-7 and Table C-6-8 in **Appendix C-6**.

The surface water quality data show:

- Chloride exceeded the CCME Guideline for both short-term (640 mg/L) and long-term (120 mg/L) exposure with a reported concentration of 1,160 mg/L at ESM-B1 on April 21, 2016.
- The sodium and chloride concentrations at ESM-NG3 were 88 mg/L and 120 mg/L, respectively, in the May 2002 sample. In the December 2011 samples, the salt concentrations were lower with sodium at 25.9 mg/L and chloride at 34.4 m/L. The higher spring readings are considered to reflect of the use of road salt along Neyagawa Boulevard. Road salt effects are also evident in the spring runoff samples collected along Burnhamthorpe Road in April 2016 at ESM-B1 and ESM-B4. Sodium was reported at 648 mg/L and 86.9 mg/L respectively; chloride concentrations were 1,160 mg/L and 101 mg/L.
- Salt concentrations in the surface water sample from Pond 47 in July 2015 showed sodium and chloride values of 41.5 mg/L and 62.2 mg/L respectively.
- Iron exceeded both the PWQO and CCME Guideline of 0.3 mg/L with a reported concentration of 0.51 mg/L at ESM-NG3 (Neyagawa crossing upstream of stream reach SMA-2) on May 3, 2002 and 1.49 mg/L at Pond 47 (e.g., the Sherborne Lodge farm pond) on July 25, 2014. Iron was below the Guideline at ESM NG3 on December 13, 2011 with a reported concentration of 0.241 mg/L.
- Aluminum exceeded both the PWQO (0.075 mg/L) and CCME Guideline (0.10 mg/L) with reported concentrations of 0.39 mg/L and 0.45 mg/L at ESM NG3 on May 3, 2002 and December 13, 2011, respectively.

- Total phosphorus exceeded the interim PWQO of 0.02 mg/L with reported concentrations of 0.07 mg/L and 0.10 mg/L at ESM-NG3 on May 3, 2002 and December 13, 2011, respectively; 0.20 mg/L at ESM B4 on April 21, 2016; and 0.38 mg/L at Pond 47 on July 25, 2014. There is no firm PWQO for phosphorus, however, these concentrations exceed the PWQO recommended phosphorus concentration of 0.03 mg/L to avoid excessive plant growth in streams.

- Fluoride exceeded the CCME Guideline of 0.12 mg/L with a field concentration of 0.17 mg/L at ESM NG3 on May 3, 2002. Fluoride was not detected in the laboratory-analyzed sample from ESM NG3 on December 13, 2011. The field-measured concentration of fluoride is not considered reliable compared to the laboratory data and it is recommended that the field-tested value be disregarded.

- The laboratory detection limits exceeded the CCME Guidelines for fluoride (at ESM-B4), mercury (at all sampled locations except Pond 47) and selenium (at all sampled locations).

- Nitrate was not detected (<0.05 mg/L) in any of the surface water samples.

5.0 STREAM, AQUATIC AND TERRESTRIAL SYSTEMS INCLUDING SPECIES AT RISK

5.1 Overview of EIR Subcatchment Area Characteristics

As explained in Section 1.2 and shown on **Figures 1.2** and **1.5**, the EIR Subcatchment Study Area is defined by Subcatchment ES6-East. The majority of the Subject Lands lie within this EIR Subcatchment Area, with small portions that lie within Shannon's Creek Subcatchment SC1, East Sixteen Mile Creek Subcatchment ES7, East Sixteen Mile Creek Subcatchment SM1 and Upper West Morrison Creek Subcatchment, UWM1. With the exception of a small northern portion of ES7, areas within the SC1, SM1, and UWM1 subcatchments are located outside the protected NHS and currently are occupied entirely by cropped agricultural fields. The small northern portion of Subcatchment ES7 that lies within Core 5 is discussed herein only to provide completeness of the description of the portion of Core 5 on the Subject Lands.

The majority of Subcatchment ES6-East is located outside the protected Natural Heritage System; however, a small southern portion (1.05ha) of the subcatchment lies within Core 5.

The NOCSS NHS comprises Core Preserve Areas, Linkages, and, High and Medium Constraint Stream Corridors. The only Natural Heritage System component within this EIR Subcatchment Area is a portion of Core 5, as explained in Section 2 and illustrated on **Figure 2.1R**.

Within the ES6-East Subcatchment Area, both inside and outside of Core 5, there are no watercourses, as shown on **Figures 2.1R** and **5.1R**. However, as discussed in Section 2, the EIR and FSS Study Areas are located immediately upstream of Red Stream Reach SMA-6, which is proposed to receive SWM pond outflow through a pipe and then via the roadside ditch along the east side of Neyagawa Boulevard. Therefore, this Reach SMA6 is discussed herein. As indicated in Section 2 and further described below, PSW 3 is located in the southwestern corner of the EIR Subcatchment Area within Core 5. There are no defined channels identified in the surface catchment of this PSW unit. PSW 3 receives overland and tile drainage flow from the north and, during major events, from the constructed farm pond to the east when flow may overtop the weir at the downstream end of the pond. The PSW drains to the roadside ditch along Neyagawa Boulevard.

The EIR Subcatchment Area, outside the Core 5 area, currently is entirely under agricultural uses mainly supporting croplands and two, small, remnant farm cultural thickets not identified for retention by NOCSS. In addition, there are small, amenity landscaped areas around existing and removed farm structures, hedgerows (comprising red ash, red oak, bur oak, shagbark hickory, white elm and basswood), one large pond dug for previous farming/aesthetic purposes (Sherborne Lodge farm pond, referred to as P47 in NOCSS), three small Hydrologic Feature 'B'

identified by NOCSS north of Burnhamthorpe Road West, one topographic depression on the Eno Investments lands north of Core 5 (NOCSS Depression 68), and several others nearer to the 407 ETR.

Ecological Land Classification (ELC) ecosites in the EIR Subcatchment Area were identified in NOCSS Figure 6.3.8 and further reviewed and refined as part of this EIR as shown on **Figure 5.1R** herein. Vegetation communities within the EIR Subcatchment Area consist of a mix of cultural, wetland and forest communities. They are widespread and common in Ontario and are secure globally. Outside of Core 5, the EIR Subcatchment Area is largely in active agricultural use and ELC includes cultural thicket (CUT1) and cultural woodland (CUW1). Within Core 5 on the Subject Lands, vegetation communities comprise cultural woodland (CUW1), cultural thicket (CUT1),, Dry-Fresh Sugar Maple-Beech Deciduous Forest (FOD5-2), and wetland (PSW 3) (MAM2-2, MAM2). PSW 2 and PSW 8 are located outside of, adjacent to, the Subject Lands. North of Burnhamthorpe Road within the EIR Subcatchment Area, cover types include agricultural uses, landscaped homesteads and remnant wooded areas, cultural meadow, cultural thicket, and wet depressions , none of which are located in the NHS. These unit types are described following and summarized in **Table 5.1**.

Field investigations confirmed vegetation communities noted in the NOCSS, with some revisions; see **Figure 5.1R**.

Wetland Communities and Wet Depressions

There is a PSW wetland unit east of Neyagawa Road (PSW 3). During EIR field investigations it was observed that the wetland community is no longer dominated by cattails and currently comprises primarily reed canary grass (*Phalaris arundianacea*) with interspersions of purple loosestrife (*Lythrum salicaria*). This community has been reclassified as a Reed Canary Grass Mineral Meadow Marsh (MAM2-2). In addition, the eastern portion of the wetland complex identified as a MAM2-2 by NOCSS, has since been observed to be European reed (*Phragmites australis* ssp. *australis*) monoculture and has been reclassified to a Meadow Marsh (MAM) community. European reed is highly invasive exotic species and often outcompetes and replaces other plant species and can lead to a reduction in biodiversity, and habitat quality while altering wetland structure. This species also can affect hydrologic functions of wetlands due to high transpiration rates as compared native species.

Spatial/digital data for PSW 2 were obtained from Land Information Ontario and attribute data was provided by MNRF (Steve Varga Management Biologist) October 14, 2022. Riparian species observed by the EIR team botanists along Stream Reach SMA6 during a September 2022 include rice cut-grass (*Leersia oryzoides*), common beggar-ticks (*Bidens frondosa*), calico aster (*Symphotricum laterifolum*), spotted touch-me-not (Impatiens capensis), fowl manna grass (*Glyceria striata*), reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria)*, bittersweet nightshade (*Solanum dulcamara*), herb-robert (*Geranium robertianum*), and abundant fallen red ash trees. MNRF describes PSW 2 as a narrow wetland community confined to the bed of a watercourse, varying to approximately 15 metres in width and is a forb

or herb marsh dominated by panicled aster, spotted jewelweed, and a secondary graminoid layer of Virginia cutgrass and fowl manna grass. PSW 2 was reviewed with CH in the field on October 13, 2022. The MNRF (LIO) mapping of PSW 2 boundaries is reflected on EIR/FSS drawings with a revision to refine the boundary to exclude the Neyagawa Boulevard road embankment. The extent of riparian wetland vegetation at/near the outlet of the east Neyagawa Ditch was staked and surveyed with CH on October 13, 2022. This small staking location is shown on **Figure 5.2R**.

PSW 8 was reviewed by the EIR team June 30 and September 8, 2022. A dug pond, on the adjacent (east) Preserve Lands is located in the adjacent Shannon's Creek subcatchment. It is surrounded by cattail, willow, and abundant reed canary grass within an old field on the Preserve Lands adjacent to the Subject Lands. As with PSW 2, spatial/digital data was obtained from Land Information Ontario and attribute data was provided by MNRF (Steve Varga) October 14, 2022. PSW 8 includes a swamp community dominated by bur oak with black ash and Freeman's maple noted only as saplings, with an understorey of fowl mannagrass, necklace sedge, and bladder sedge. Note that the EIR team did not find any black ash saplings or canopy trees. PSW 8 was reviewed with CH in the field on October 13, 2022. The MNRF (LIO) mapping of PSW 8 boundaries is reflected on EIR/FSS drawings.

There are a number of wet depressions distributed throughout the EIR Subcatchment Area that are shown on **Figure 2.1R** and discussed in Section 2.0.

Cultural Vegetation Communities

Two Mineral Cultural Thicket (CUT1) communities were identified south of Burnhamthorpe Road and east of Neyagawa Boulevard. During field investigations it was observed that these communities support tree species to include sugar maple (*Acer saccharum* var. *saccharum*), American beech (*Fagus grandifolia*) and oak species (*Quercus* spp.) with a canopy cover of greater than 35%. Thus, this community meets the criteria for Mineral Cultural Woodland (CUW1) and has been reclassified.

North of Burnhamthorpe Road, only fenceline and farmstead trees are present.

A Dry-Moist Old Field Meadow (CUM1-1) was identified by NOCSS adjacent to Neyagawa Road north of the wetland complex, however, this community now supports a shrub layer dominated by common buckthorn (*Rhamnus cathartica*) and staghorn sumac (*Rhus hirta*) with >25% shrub cover. This community now could be classified as a Mineral Cultural Thicket (CUT1).

North of Burnhamthorpe Road, small areas of cultural meadow (CUM1) are present.

Forest Communities

There is a large deciduous forest block identified along the southern edge of the EIR Subcatchment Area within Core 5. No other forest communities are located in the EIR Subcatchment Area. It was confirmed during field investigation that the classification of this community as a Dry-Fresh Sugar Maple-Beech Forest (FOD5-2) and Dry-Fresh Oak Hardwood Deciduous Forest (FOD2-4) in the NOCSS remains accurate and changes to the community classification were not necessary.

Driplines within Core 5, in the southern portion of the EIR/FSS lands, where relevant to the limits of the proposed SWM pond, were staked by the EIR team and endorsed by CH on October 13, 2022. These driplines do not change the external Core 5 boundary.

The dripline of the woodlot on the east side of Neyagawa Boulevard and the proposed ditch works, was staked by the EIR team and endorsed by CH on November 4, 2022.

Staked driplines were subsequently surveyed by J.D. Barnes (Ontario Land Surveyor). The Barnes survey is attached in Appendix A-5. These driplines are illustrated on **Figure 5.2R, Figure 7.12R** and **Drawing 3.2R**.

Flora

A total of 88 plant species have been recorded within the Subject Lands. Onsite inventories outside of the Subject Lands north of Burnhamthorpe Road have not been undertaken. Detailed inventory did not occur north of Burnhamthorpe Road, north of the FSS Study Area. Four of these species could only be identified to genus and are not included in the following calculations. Of the 84 plants identified to species, 56 (66%) plant species identified are native to Ontario and 28 (36%) plant species are considered introduced and non-native to Ontario. A list of vascular plants is presented in **Appendix D-1**.

Table 5.1 - Summary of Ecological Land Classification Vegetation Communities

ELC Code	Vegetation Type	Species Association	Community Characteristics	Approximate Area Within Subject Lands
Natural/Semi-Natural				
FOD	Deciduous Forest			
FOD5-2	Dry-Fresh Sugar Maple-Beech Deciduous Forest	**Canopy:** includes sugar maple (*Acer saccharum* var. *saccharum*), red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), and white oak (*Quercus alba*). **Understory:** includes ironwood (*Ostyra virginiana*), red-panicled dogwood (*Cornus racemosa*), sugar maple, and eastern white cedar (*Thuja occidentalis*). **Ground Cover:** includes white avens (*Geum canadense*), large-leaved aster (*Eurybia macrophylla*), prickly gooseberry (*Ribes cynobasti*), and zig-zag goldenrod (*Solidago flexicaulis*). PSW 2 is a narrow wetland on the bed of Stream Reach SMA-6, and includes panicled aster, spotted jewelweed, Virginia cutgrass, fowl manna grass.	▪ Tree cover > 60 % (FO). ▪ Deciduous trees > 75 % of canopy cover (D). ▪ Moderately dry to fresh moisture regime, sugar maple dominant (5). ▪ Beech associates (-2)	>15 ha (of which a large portion occurs south of the Subject Lands)
FOD2-4	Dry-Fresh Oak Hardwood Deciduous Forest	**Canopy:** includes red oak, bur oak, American elm (*Ulmus americana*), and sugar maple. **Understory:** includes red oak, sugar maple, common buckthorn (*Rhamnus catharica*), and red-panicled dogwood. **Ground Cover:** includes avens (*Geum* spp), garlic mustard (*Alliaria petiolata*), dames rocket (*Hesperis matronalis*), and wild red raspberry (*Rubus idaeus* ssp. *strigosus*). PSW 8 includes small areas of topographic depressions with include spotted touch-me-not, Bebb's sedge (Carex bebbiana), Bladder sedge (Carex intumescens), fowl manna grass.	▪ Tree cover > 60 % (FO). ▪ Deciduous trees > 75 % of canopy cover (D). ▪ Oak species dominant (2). ▪ Sugar maple associates (-4).	>5 ha entirely outside of Subject Lands.

ELC Code	Vegetation Type	Species Association	Community Characteristics	Approximate Area Within Subject Lands
Wetland				
MAM	Meadow Marsh			
MAM	MAM	**Ground Cover:** European reed (*Phragmites australis* ssp. *australis*).	▪ Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). ▪ Species less tolerant of prolonged flooding (MAM). ▪ Mineral soil (2).	▪ 0.16 ha
MAM2-2	Reed-canary Grass Mineral Meadow Marsh	**Emergent Trees/Shrubs**: includes red ash (*Fraxinus pennsylvanica*). **Ground Cover:** includes reed-canary grass (*Phalaris arundinacea*), broad-leave cattail (*Typha latifolia*), and wool-grass (*Scirpus cyperinus*).	▪ Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). ▪ Species less tolerant of prolonged flooding (MAM). ▪ Mineral soil (2). ▪ Reed-canary grass dominant (2).	▪ 0.48 ha
Cultural Thicket				
CUT1	Mineral Cultural Thicket			
CUT1	Mineral Cultural Thicket	**Canopy:** includes common buckthorn (*Rhamnus catharica*), white mulberry (*Morus alba*), pear (*Pyrus* sp.), and red ash. **Ground cover:** includes Canada goldenrod (*Solidago canadensis*), awnless brome (*Bromus inermis* spp. *inermis*), and aster species (*Aster* ssp.)	▪ Cultural community (CU). ▪ Tree cover <25 %; shrub cover >25% (T). ▪ Mineral soil (1).	▪ 0.49 ha
Cultural Woodland				
CUW1	Mineral Cultural Woodland	**Canopy:** includes Manitoba maple (*Acer negundo*), sugar maple, red oak, black walnut (*Juglans nigra*), eastern white pine (*Pinus strobus*), and basswood (*Tilia americana*). **Understory:** includes shagbark hickory (*Carya ovata* var. *ovata*), bur oak (*Quercus macrocarpa*), common buckthorn, and Tartarian honeysuckle (*Lonicera tatarica*). **Ground cover:** includes garlic mustard (*Alliaria petiolata*), dame's rocket (*Herpermis matronalis*), Canada goldenrod, scarlet strawberry (*Fragaria virginiana* ssp. *virginiana*), and aster species.	▪ Cultural communities (CU). ▪ 35 % < tree cover ≤ 65 % (W). ▪ Mineral Soil (1).	▪ 0.68 ha (CUW adjacent Burnhamthorpe Road), ▪ 0.76 ha (CUW adjacent Carding Mill Drive)

Core 5 Area

Only a small part of Core 5 exists within the southern portion of the EIR Subcatchment Area. It extends well beyond the EIR Subcatchment Area to the south and east. As shown on **Figure 5.1R**, within and directly south of the EIR Subcatchment Area, it comprises several habitat units including Dry-Fresh Sugar Maple-Beech Deciduous Forest (FOD5-2), Dry-Fresh Oak Hardwood Deciduous Forest (FOD2-4), PSW 3 (revised to MAM2 and MAM2-2), and additional small Provincially Significant Wetlands (PSWs 2, 4, 5, 7, 8), Cultural Thicket (CUT1), and Cultural Woodland (CUW1). A portion of Core 5 on the Subject Lands is currently under agricultural uses.

As detailed in the *Final Consolidated Preserve EIR/FS*S (May 2017), the dripline boundary of Core 5 was staked on site with the Town of Oakville and CH. In accordance with the NOCSS and OPA 272 requirements, a 10m buffer was applied to the dripline forming the NHS boundary in some locations.

PSW 3 was described by NOCSS as MAS2-1 (cattail mineral marsh), and MAM2-2 (reed-canary grass meadow marsh) and MAM2-10 (forb mineral meadow marsh), although June 2021 investigations confirm the MAS2-1 has transitioned to MAM2-2 as much of the wetland area is now dominated by reed-canary grass.

In addition, approximately 0.16ha of the NOCSS identified MAM2-2 has since been overrun with *Phragmites*, an invasive plant that negatively impacts native ecosystems. The PSW 3 boundary was staked previously with the Town and CH. A 30m buffer has been applied to the wetland boundary. PSW 3 is discussed in further detail in Section 7.10.

The farm field east of the Sherborne Lodge farm pond and on the Eno Investments lands in the southern portion of the Subject Lands is included in the Core 5 NHS by applying a straight line between the northern limit of the 10m buffer to the adjacent woodland corners (generally from a corner of Core 5 woodland near the Sherborne Lodge farm pond to the woodland corner near future Carding Mill Drive (see **Figure 5.1R**).

SWM Pond 9 is permitted in this farm field. In accordance with Ontario Municipal Board Minutes of Settlement (August 13, 2007) between Eno Investments Inc., the Town and CH, a 10m buffer is required from the driplines east and west of the open field to define the east and west boundaries of the area that can be used for a SWM facility. No SWM pond encroachment is permitted in any area defined by dripline plus 10m. The southern boundary of the SWM facility was defined by the Minutes of Settlement, to be “no closer to the southerly boundary of Core 5 than 250 metres”. This southern boundary was identified in the approved Drawing Core 5-NHS-1 prepared by Stantec Consulting (2014). An excerpt from this drawing relevant to the Subject Lands is presented in **Drawing 3.2R**.

5.2 Comparison of EIR/FSS Drainage Area to NOCSS Drainage Area

The EIR/FSS TOR requires that the existing subcatchment drainage boundaries be delineated utilizing detailed topographic mapping. Previously approved EIR/FSS reports have compared and documented EIR/FSS drainage areas to NOCSS drainage areas that are applicable to the Subject Lands. As such, large portions of ES6-East subcatchment boundary have been finalized as part of previously completed and approved EIR/FSS reports. Where this occurs, the approved boundaries are reflected in the delineation of the ES6-East subcatchment boundary in this EIR. Currently approved portions of this boundary include:

- **Boundary between subcatchments ES6-West and ES6-East** was determined in the *Final Environmental Implementation Report and Functional Servicing Study, East Sixteen Mile Creek Tributary Environmental Implementation Report and Functional Servicing Study, East Sixteen Mile Creek Tributary Subcatchment ES6-West and the Davis-Minardi North Lands North Oakville East* (June 2015) (*Final DMN EIR/FSS);*

- **Boundary between subcatchments SC1 and ES6-East** was determined in the *Final Consolidated Preserve EIR/FSS, Shannon's and Munn's Creek Subcatchments* (May 2017);

- **Boundary between subcatchments UWM1 and ES6-East** was determined in the *Final EIR/FSS Upper West Morrison Creek, Subcatchment UWM1* (November 2017) and the *EIR/FSS Addendum for Upper West Morrison Creek Subcatchment UWM1 Addendum* (November 2020); and

- **Boundary between subcatchments SM1 and ES6-East** was determined in the *East EIR/FSS, Sixteen Mile Creek* (April 2018).

These previous reports document the comparisons between LIDAR mapping and NOCSS mapping and identified EIR/FSS boundaries for each of those EIR/FSS Subcatchment Areas. Boundary comparisons have not been reproduced herein; however, their LiDAR based approved subcatchment boundaries have been reflected in the delineation of the ES6-East subcatchment boundary.

There is one subcatchment boundary area (ES6-East/ES7) where the NOCSS versus LiDAR mapping subcatchment boundaries needs to be reviewed and identified. This is the southern boundary of ES6 adjacent to ES7, located in Core 5, just north of the southern boundary the Subject Lands. The comparison of the EIR/FSS drainage area to the NOCSS drainage area in this area was done following the same procedures as for the previously

approved EIR/FSS's. The topographic mapping prepared from a Digital Elevation Model (DEM, provided from Terrapoint through Rady-Pentek & Edwards Surveyors) using LiDAR technology was employed.

Drawing 5.2R presents approved drainage boundaries where available and a comparison of the LiDAR mapped subcatchment boundaries and the NOCSS boundaries for the East/ES7 boundary. For the comparison, **Drawing 5.2R** illustrates:

i) LiDAR mapping with the EIR/FSS subcatchment boundaries (blue line - 95.45ha); and,
ii) Town's topographic mapping with the NOCSS boundaries (green line – 93.08ha).

As shown, as expected, there are some differences in boundaries although the total drainage areas compare well: NOCSS drainage area of 93.08ha versus the EIR/FSS drainage area of 95.45ha). This change of less than 3% is minimal and as such, the LIDAR mapped boundary will be used and NOCSS unit target rates remain valid.

5.3 Downstream Receiving Drainage Features

As mentioned in Section 5.1 above, the drainage from the Subject Lands flows through PSW 3, discharging into the eastern roadside ditch along Neyagawa Boulevard. Flows from the roadside ditch discharge into Stream Reach SMA-6, to the south of the FSS Study Area, outside the EIR Subcatchment Area.

5.3.1 Neyagawa Roadside Ditch

The current condition and size of the roadside ditch are the result of road improvements completed by works by the Region of Halton. The roadside ditch is straight feature with an variable depth from 0.26m to 1.45m at its outlet. Dense riparian vegetation is present on the east side of the ditch in association with the adjacent existing ELC unit (FOD5-2), but riparian vegetation is limited on the west side of the ditch given its proximity to Neyagawa Boulevard. The ditch feature displays evidence of erosion and contains a moderate level of riparian vegetation encroachment (grasses). The substrate is predominantly clay, with scattered cobble and gravel throughout.

The Neyagawa ditch is the surface drainage outlet from the EIR Subcatchment Area as well as drainage directly from Neyagawa Boulevard. It flows intermittently in response to rainfall events and in the spring during snowmelt conditions.

A tree inventory was completed to a distance 10m east of the existing Neyagawa Boulevard roadside ditch eastern top of slope, within the adjacent FOD5-2 unit on June 18, 2019 (see **Appendix D-2, Tree Inventory**). Sixty-one trees were inventoried in this area and include Apple, Bur Oak, Ironwood, Pear, Red Ash, Red Maple, Red Oak, Shagbark Hickory, Sugar

Maple, White Elm, White Oak, and White Pine (see **Figure 5.2R**). These specimens range in size from 10cm DBH (lower limit of survey threshold) and 96cm DBH. Notably large diameter trees include #216 (White Oak, 96cm), #237 (Red Oak, 94cm) and #257 (Red Oak, 67cm). Most of the trees were assessed to be in good condition, although, many of the Red Ash were dead or dying due to Emerald Ash Borer infestation.

5.3.2 Stream Reach SMA-6

Although Reach SMA-6 is downstream of the Subject Lands outside the EIR Subcatchment Area, it receives surface runoff from areas upstream of it, including the Subject Lands. This reach was described in the *Final DMN EIR/FSS* (2015). A description of the channel form and stability, vegetation communities, fisheries and aquatic habitat, corridor boundaries, and regulatory floodplain are presented therein in detail. As well, a comprehensive photographic record of this reach was prepared and included in the *Final DMN EIR/FSS*. A summary of the reach characteristics is presented here, to provide context.

Reach SMA-6 crosses Neyagawa Boulevard approximately 240m south of the FSS Study Area limit via a culvert which collects flow from lands to the west/northwest. From the culvert, the stream flows south entirely within Core 5, where it empties into Reach SMA-4, at the confluence of Reaches SMA-4 and SMA-5. The streams flow through a mature-to-young mature, generally closed canopy – open understorey dry-fresh oak – hardwood deciduous forest. Silt, gravel and cobble bed material is evident along with a substantial amount of vegetation litter. The presence of undercut banks and exposed rooting systems of adjacent trees are common throughout the entire length of these stream reaches. The channel is relatively straight and displays a meandering form with oxbow features and undercut banks east of Neyagawa Boulevard.

Reach SMA-4 crosses Neyagawa Boulevard approximately 450m south of the more northerly crossing. On the west side of Neyagawa Boulevard, the stream has been channelized to skirt the southern limit of the former landfill. The substrate exhibits silt, gravel and cobble with bedrock being at or near the surface in some locations.

A narrow band along the entire portion of Stream Reaches SMA-6 and SMA-4 through the wooded Core 5 east of Neyagawa Boulevard, is classified as PSW2, part of the North Oakville-Milton East Wetland Complex (see **Figure 4.2R**).

The *Final Davis-Minardi EIR/FSS* identified the fluvial geomorphological conditions along these stream reaches. It notes that this stream reach flows through a mature-to-young mature, generally closed canopy – open understorey dry-fresh oak – hardwood deciduous forest. The silt, gravel and cobble bed material is evident along with the substantial amount of vegetation litter. The presence of undercut banks and exposed rooting systems of adjacent trees are common throughout the entire length of the stream reach.

5.4 Flora and Fauna Inventories

Flora and fauna inventories focused on SAR species and investigations associated with the Sherborne Lodge farm pond. Because the farm pond will be removed it was investigated in more detail. The natural heritage condition of the Sherborne Lodge farm pond area was examined in 2003, then again in 2014, 2019 and 2020. Historically, from examination of archival aerial photographs, it has been determined that this pond was created sometime between 1979 and 1998. The pond and wetland are not present on 1978 aerial photos but present on 1999 aerial photos (see **Appendix D-3**).

On the 1972 aerial photo, it is evident that the areas of the wetland and pond are tilled, with no developed channels or higher soil moisture conditions. On the 1978 coverage, the flow from the field to the northeast to the area that becomes the pond is defined by a channel and higher soil moisture conditions are evident. Wetland conditions have not begun to develop; i.e., no wetland is present in the location that will support the wetland. In the 1998, the pond and wetland are well developed, and channelized overland flow from the north and northeast is better developed. Also, Neyagawa Boulevard is present on the 1998 aerial photo. Given the age and structure of the vegetation in the vicinity of the pond on the 1998 photos, it likely that it was constructed in the early to mid-1980's.

5.4.1 Vegetation

The pond edge was historically manicured and can be observed on historical air photography dating from at least 2004 to 2017 (accessed through Google Earth). Since approximately 2017, the pond edge has naturalized slightly to include an approximate 7m riparian zone (e.g., willows, asters, goldenrods, thistles, and sparse cattail). There are two exceptions to this though, the swale contributing to the pond on the east side where a small patch of small Willow trees and shrubs exists (approximately 0.1ha), and the receiving wetland around a concrete weir on the west side of the pond where volunteer Manitoba Maple, Willow, and Buckthorn have arisen.

5.4.2 Wildlife

In 2014, the Sherborne Lodge farm pond was visited to confirm the potential presence of birds, amphibians, and reptiles and fish within or adjacent to the pond. Detailed site investigations occurred through 2014, with specific emphasis as follows:

- May 5, May 28 - amphibians and reptiles;
- May 31, June 14 - birds, amphibians and reptiles;
- June 15 - amphibians and reptiles;
- June 18 - birds, reptiles and fish; and,
- June 19 - reptiles and fish.

Those amphibian and bird inventories took place starting before sunrise, and after sunset on each applicable date.

In 2019, calling amphibian surveys were conducted in the vicinity of the pond and suitable habitats in the adjacent NHS, on April 21, May 9, May 29, and June 27, and methods were consistent with the Marsh Monitoring Program protocol.

Dates and times of calling amphibian surveys in 2019 are listed in **Table 5.2**.

Table 5.2 – Dates and Times (24hr) of Calling Amphibians Surveys, 2019

2019 Dates	Sherborne Lodge Farm Pond	PSW 3 East of Neyagawa Blvd.	Wetland West of Neyagawa Blvd.
April 21	21:00	21:15	21:35
May 9	21:07	21:39	22:15
May 29	21:45	21:55	22:15
June 27	21:55	22:10	22:20

Breeding bird surveys were conducted in open field, Core 5 forest, and wetland areas of the Subject Lands on June 12 and July 3, 2019, and methods were consistent with the Breeding Bird Atlas protocol.

In 2020, turtle surveys were conducted in the vicinity of the pond on May 13, May 25, June 1, June 4, and June 17, 2020, and were consistent with the Visual Encounter Survey Protocol for Blanding's Turtle (*Emydoidea blandingii*) in Ontario. Results from the 2019 and 2020 surveys are presented in **Appendix D-4**, Wildlife Inventory.

Birds

In 2014, call count and visual surveys confirmed a modest diversity and a low population of species. No nests were noted in the vicinity. Barn swallows (and possibly tree swallows) were noted in the vicinity, but no nesting areas were identified in the vicinity (species appear to be ubiquitous in North Oakville). With the exception of the swallows (which only were observed flying over), none of the species noted were listed by MNRF as SAR (as listed at that time). The presence of Barn Swallow is discussed further in Section 5.6 Species at Risk.

In 2019, similar survey results were found. Barn Swallow were observed foraging over the fields and Sherborne Lodge farm pond but nesting structures were not present, nor was nesting evidence (distressed behaviour, carrying food, disposal of fecal sacs). Eastern Wood-pewee, regulated as Special Concern by the Endangered Species Act, was observed registering territorial song on at least two days, a week apart, from the interior of Core 5. A

total of 39 bird species were documented during 2019 surveys (see **Appendix D-4**, Wildlife Inventory).

Amphibians

In 2014, call count surveys and visual inspections confirmed a low diversity and population of amphibians within or adjacent to the pond and downstream in the vicinity of the wetland; 3 species of frog (spring peeper, northern leopard frog, and green frog) and one species of toad (American toad). None of the amphibian species identified at this site in 2014 were listed by the MNRF as Species at Risk.

In 2019, similar survey results were found. Spring peeper, gray treefrog, green frog, and American toad were confirmed. Frog surveys were conducted within the Sherborne Lodge farm pond, PSW 3 east of Neyagawa Boulevard, and portion of wetland west of Neyagawa Boulevard. There were no Species at Risk frogs or toads observed on the Subject Lands. As noted in **Table 5.3**, spring peepers, American Toad, gray tree frog, and green frog were heard calling in or near the Sherborne Lodge farm pond and in adjacent Core 5 wetland habitat west of Neyagawa Boulevard. Spring peeper and green frog were not heard in PSW 3. Incidental observations on August 10, 2021, revealed numerous observations of leopard frogs in the surrounding riparian zone of the farm pond.

Table 5.3 - Calling Amphibians, 2019

Species	Sherborne Lodge Farm Pond	PSW 3 East of Neyagawa Blvd.	Wetland West of Neyagawa Blvd.
American Toad	X	X	X
Spring Peeper	X		X
Green Frog	X		X
Gray Treefrog	X	X	X

None of the amphibian species confirmed present are regulated by the Endangered Species Act.

Reptiles

In 2014, incidental observations of snake species and counts of turtles confirmed three species of the former (Dekay's brown snake, Eastern milksnake, and Eastern garter snake) and one species of the latter (Midland painted turtle). Of the three snakes, only Eastern garter snake was observed on the pond's perimeter; single individuals of the other two species were encountered around the buildings located north of the pond. The lone turtle

species occurs in relatively high numbers; counts of individuals on the pond surface ranged from 21 to 55 and it is estimated that the population may be considerably higher.

In 2019, there were no incidental observations of snakes during site inventories and the farm buildings had been removed several years prior.

To ensure a comprehensive survey, in advance of the field work for turtles, in addition to the known Oakville SAR list provided by MECP, the Ontario Reptile and Amphibian Atlas database was searched for background information regarding known ranges for each of Ontario's turtle species. The result of this search suggests the following species present in Oakville *before and after 1999*, in 10km grid squares including the EIR/FSS lands:

- Midland painted turtle;
- Northern map turtle; and,
- Snapping turtle.

This information, and the presence of the Sherborne Lodge farm pond, led to surveys during the 2020 spring/summer season. Turtle surveys were conducted across 5 days during the summer of 2020. Survey dates were May 13, May 25, June 1, June 4, and June 17, 2020, and survey times were between 8 am and 5 pm during sunny periods with air temperature less than 25˚C. Binoculars and a camera with a 400mm telephoto lens were used to confirm and document turtle species within the Sherborne Lodge farm pond. Observations were conducted from the north, west, and south shore of the pond. Basking sites (such as logs, dock, shore), where available, were searched, as was riparian vegetation, and open water areas of the pond. Riparian vegetation, pond banks, and a gravel area on the tableland north of the pond was searched for evidence of nesting activity (e.g., small pits/mounds, predated egg remnants) though no evidence of nesting was found. Contrastingly, varying sizes of turtles had been observed and suggests nesting and recruitment is occurring.

There were no turtles observed during the May survey, but each of the June surveys produced observations of multiple (generally 10-15, though turtle counts can be complicated by submersion) Midland painted turtles. Midland painted turtle is currently not regulated by the Endangered Species Act. There were no observations of Species at Risk turtles during any of the targeted or incidental surveys.

Fish

In 2014, the results of electro-fishing the pond confirmed the presence of only two species of fish, one native (Brown Bullhead) and one non-native (goldfish species). The results of electro-fishing were forwarded to MNRF for review, as per the conditions of the License to Collect Fish For Scientific Purposes.

It was not considered necessary to redo the fish sampling subsequent to 2014 since the pond is isolated by the concrete weir which would restrict access by fish from the Neyagawa Boulevard ditch or downstream habitats. To date, no fish have been identified in the ditch.

5.5 Sherborne Lodge Farm Pond Existing Drainage Conditions

The Sherborne Lodge farm pond is an online feature controlled by a weir and low flow pipe arrangement. This pond configuration traps flows from the upstream catchments and dampens the peak in storm events downstream. Under the current pond arrangement, there is no water in the downstream Neyagawa Boulevard ditch through July and August unless there is a substantive flow event.

In geomorphological terms, the pond has only been in existence for a short period (it did not exist prior to the 1980's). Bankfull channel geometry usually scales to the 1.5 to 2-year return flow event. The development of this geometry occurs over tens to hundreds of years. As such, the downstream channel geometry and sedimentology is likely a product of long-term, historical hydrology. Although vegetation has likely encroached on the historical bankfull channel, the channel geometry is still scaled to the historical hydrology. It is also likely that the channel sediments were historically coarser.

The contributing drainage area to the Sherborne Lodge farm pond under existing conditions is approximately 90.2ha comprised of agricultural lands and a small portion of Burnhamthorpe Road east of Neyagawa Boulevard. Drainage is generally in the north to south direction. Surface runoff from the lands north of Burnhamthorpe Road sheet drain to a roadside ditch on the north side of Burnhamthorpe Road and are conveyed through five culverts to the Sherborne Lodge lands. Runoff from the lands north Burnhamthorpe Road and from the Subject Lands is conveyed in swales southerly to the pond. The swales enter the pond at the northeast and northwest corners of the pond. A small area located south of the pond also contributes drainage to the pond. Refer to **Figure 7.1R** for the existing drainage areas.

The existing pond outlet includes two 200mm culverts and a spillway weir located at the west end of the pond (elev. 172.2m), upstream of PSW 3. Based on site investigations, the culverts are blocked and do not drain positively to PSW 3. According to the site survey, there is another localized high point (elevation approx. 172.10m) between the pond outlet and PSW 3 with a resulting ponding area in between. This spill point results in limited active storage below the spillway weir, despite the fact that the culverts are at a lower elevation. Water level fluctuations below 172.20m were observed, suggesting that the flow leaves the pond through some other means (most likely evaporation, since soil information suggests that groundwater flow through the pond is minimal). While some flow may leave through the crushed / blocked culverts, this is likely limited and would not all reach PSW 3

since the culverts discharge to a low point between the elevation of the spillway and PSW 3. When the existing pond fills up during a significant event, it will discharge over a long broad crested weir structure.

The groundwater conditions in the Pond 47 area are discussed in detail in Section 4.3.3. The pond is sustained because it was excavated into the local water table to a depth sufficient to intersect a higher transmissivity zone at the till/shale contact. It is interpreted that local groundwater moves towards the pond and flows through the pond. The pond also receives surface water runoff and when the surface water level in the pond rises, the pond recharges the local groundwater in the area.

A detailed hydrogeological assessment was completed in support of a Permit to Take Water application to the MECP for dewatering and decommissioning of the pond. The application was reviewed and approved and a PTTW was issued.

Airphoto interpretation was undertaken on several archival airphotos that covered Sherborne Lodge Pond and environs prior to the construction of that pond. This task occurred to assess the drainage and moisture conditions that prevailed prior to pond construction, to determine whether there was a topographic depression that historically functioned as a water detention area. The purpose was to determine whether there was natural depression storage that may need to be replicated in the design of SWM Pond 9.

The findings for each year are presented below, and are shown on **Figure 5.3**.

Archival airphotos from 1934, 1954, 1965, 1971 and 1978 were examined under a stereoscope. On each airphoto, there was a lowland area of low relief. This area drained to the west and showed some areas of higher soil moisture content than the surrounding lands. The conditions as exhibited in each photo-year are shown on **Figure 5.3**. The current location of the existing Sherborne Lodge pond also is outlined on each photo-year.

In summary, all years exhibited similar conditions. No pond or ponded water was evident for any of those years. For all years, water flowed toward the current pond area from the northeast, and from 1965 onward, through a channelized drainage feature. In addition, drainage down the minor slopes to the north and south of the low area was conveyed to the low area, in the form of swales that exhibit phantom drainage on the airphotos. Phantom drainage is a term used to describe a situation in which soil moisture, not surface water is exhibited. The areas where the higher soil moisture conditions occurred most readily shows up as a slightly darker area on some of the airphotos, mimicking the pattern shown by surface drainage features (the pattern is referenced as phantom drainage). In all years, agricultural activity is evident.

Where the soils consistently showed the condition of somewhat higher soil moisture content, it represents the lower area that existed naturally, a portion of which now is

occupied by the constructed pond. The small phantom swales are most obvious on the 1934 airphotos but are present on all years on **Figure 5.3**. These areas drain freely without any natural ponding areas.

This drainage then discharged to and flowed through the area that now is occupied by PSW 3. Thus, this area functioned as a 'flow-through' area, not a detention storage area.
Because of the lack of evidence of naturally ponded water and the consistent flow-through conditions, and with reference to the Mediation Agreement on topographic depressions, there is no volume of natural depression storage that needs to be replicated in the design of SWM Pond 9. Observations from the multiple years of aerial photography include:

1934 – summer coverage; 1:15,400
- No ponded water
- Low wide natural swale through area, trending generally east to west, receiving drainage from the northeast, and the woodlot to the south, extending to an indistinct channel through the area where PSW 3 will develop
- Cropped
- Small areas of phantom drainage evident

1954 – summer coverage; 1:20,000
- No ponded water
- Entire area appears drier than it appears in 1934
- Phantom drainage pattern is masked by vegetation and generally not evident
- Cropped; one tree present in northwestern corner

1965 – summer coverage; 1:17,300
- No ponded water
- Ditch evident in the vicinity of the mid-area of where pond will be in the future, along the north side of where moist soil is evident; the ditch picks up drainage from fields to north and northeast
- Minor swales are evident from woodlands to south
- Phantom drainage pattern generally is not apparent in Sherborne Lodge pond area but is present in fields to north
- Cropped; tree still present in northwestern corner

1971 – summer coverage; 1:20,000
- No ponded water
- Similar drainage conditions are exhibited to that evident in 1965 although the ditch is much more pronounced
- Ploughed

1978 – summer coverage; 1:10,000
- No ponded water
- Ditch still functioning
- Swales from the woodland to the south are prominent
- Lawn/grass visible except immediately north of woodland where the sparse vegetation allows bare soil to show through

1985 – Google Earth Coverage (very poor quality image)
- A portion of the existing pond is present
- Construction of Sherborne Lodge buildings/developed area underway

For further discussion on this pond and its proposed removal, see Section 11.4.

5.6 Species at Risk on the Subject Lands

Endangered and threatened species are identified by the MECP using procedures established by the Committee on the Status of Species at Risk in Ontario (COSSARO). Species and their habitats are protected under the *Endangered Species Act,* 2007. Species at risk are classified in 1 of 4 categories:

- Extirpated - Lives somewhere in the world, and at one time lived in the wild in Ontario, but no longer lives in the wild in Ontario;
- Endangered - Lives in the wild in Ontario but is facing imminent extinction or extirpation;
- Threatened - Lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it; and,
- Special concern - Lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats.

The Ministry of Environment, Conservation, and Parks (MECP) was contacted to obtain a list of SAR species confirmed in the Town of Oakville as of August 2019 to improve the effectiveness of the species at risk screening.

The list of SAR occurrences was used to screen for species known to occur in the municipality and compare their preferred habitats with existing habitats found in the Subject Lands. Lands within the EIR Subcatchment Area, outside the Subject Lands will have to be inventoried when those lands advance for development.

The potential for occurrence is based on direct wildlife observations and with comparison of habitat requirements of the listed species with habitat conditions found (Appendix D-5 Species at Risk Screening). The screening identified species with confirmed occurrence, and suggests which species have a potential to occur on Subject Lands. SAR confirmed

and those considered of reasonable likelihood to occur on the Subject Lands are discussed below.

5.6.1 Birds

Breeding bird surveys (**Appendix D-4**, Wildlife Inventory) were conducted on June 12, and July 3, 2019, to document breeding bird evidence (BBE) and to characterize the nature, extent and significance of breeding bird usage of the Subject Lands with specific attention to SAR. Surveys were conducted between dawn and 4 hours after dawn. Bird vocalizations along with direct observations of bird breeding behaviours and opportunistic locating of bird nests were used to record BBE. Survey methodology and breeding bird behaviours used as evidence of breeding success were categorized according to the Breeding Bird Atlas five-year surveys organized by Bird Studies Canada (Cadman et al., 2007). To make an accurate determination, the following definitions have been applied in this case:

- Possible breeding: observed in breeding season, observed in breeding season in suitable nesting habitat, singing male present or breeding calls heard in breeding season;

- Probable breeding: permanent territory presumed through registration of territorial song or occurrence of an adult on at least 2 days, a week or more apart, at the same place; agitated behavior or anxiety calls of an adult; and,

- Confirmed breeding: used nest or eggshell found (occupied or laid within the period of study), recently fledged young or downy young, including young incapable of flight, adult carrying food for young, nest containing eggs, nest with young seen or heard.

Of the 39 species of birds documented, 37 are protected by the *Migratory Bird Convention Act* (MBCA), *Fish and Wildlife Conservation Act*, 4 are protected by the *Fish and Wildlife Conservation Act*, one was listed as Threatened under the *Endangered Species Act,* 2007 (ESA) but has since been downgraded to Special Concern (Ontario Regulation 230-08 Schedule 4); barn swallow. As well, Eastern wood-pewee is listed as Special Concern under the ESA. The implications of these latter two species are discussed below.

Barn Swallow

Barn Swallows have been documented foraging throughout the North Oakville lands, including the EIR/FSS lands. The *General Habitat Description for Barn Swallow* (an MNRF technical document which provides greater clarity on the area of habitat protected for a species) describes three levels of habitat characterization ranging in sensitivity from Category 1 (most sensitive) to Category 3 (least sensitive) as follows:

- Category 1 - the nest;
- Category 2 - within 5 metres of a nest; and,
- Category 3 - between 5 and 200 metres of the nest.

No evidence was found to confirm breeding on the Subject Lands; birds were not observed to be defending territory, nor nest building or carrying food to a nest. Barn swallow was observed foraging for aerial insect prey during both breeding bird surveys. Anthropogenic structures (e.g., buildings, bridges, culverts) represent nesting opportunities for this species but there are no appropriate structures present on the Subject Lands for which to affix a nest.

Eastern Wood-Pewee

Eastern wood-pewee is regulated as Special Concern, and was heard singing in Core 5, as can be expected, as this species prefers mid-canopy layers of forest clearings and edges of deciduous and mixed forests, with affinity for intermediate-age mature forest stands with little understorey. Special Concern species do not receive species or habitat protection by the Endangered Species Act; however, responsible site planning has resulted in the preservation of this species' habitat; Core 5, and the development of the FSS Study Area will not negatively impact this species.

5.6.2 Frogs and Toads

As discussed above, surveys were conducted April 21, May 9, May 29, and June 27, 2019, within the Sherborne Lodge farm pond, PSW 3 east of Neyagawa Boulevard, and a portion of wetland west of Neyagawa Boulevard (**Figure 5.1R**). There were no Species at Risk frogs or toads observed on the Subject Lands.

5.6.3 Turtles

There were no observations of species at risk turtles. Midland painted turtle is the only species of turtle observed within the Subject Lands; this species is not regulated by the Endangered Species Act.

5.6.4 Plants

Surveys for SAR plants were conducted in PSW 3, within Core 5 (interior to 50m of the northern limit of Core 5), hedgerows and cultural thickets within the Subject Lands on June 18, 2019, July 18, 2019, April 22, 24, 29, May 5, 2020, and June 1, 2021. Species at risk plants, even those with potentially suitable habitat conditions (e.g. butternut, spotted wintergreen) were not found during surveys within the Subject Lands.

5.6.5 Bats

Four bat species (little brown myotis, Northern myotis, Eastern small-footed myotis, and tri-colored bat) are identified provincially as 'endangered' and protected under the ESA. Three of the four bat SAR use trees with openings, cavities or peeling/sloughing bark in various

stages of decay for maternal roosts. The tri-coloured bat relies on tree foliage to establish roosts and in particular, clusters of dead or dying leaves mainly in mature oak trees (MNRF 2017). Trees within the NHS, and likely to provide potential bat roost habitat will not be affected by the proposed land use and thus, bat suitability was not assessed within Core 5.

Bat habitat suitability was assessed in hedgerows and cultural thickets outside of the Core 5 NHS where these features are not part of the NHS and are proposed for removal. Bat maternal roost habitat screening typically begins with the characterization of available vegetation communities within the study area. Existing ELC ecosites, described above in Section 5.1 and shown on **Figure 5.1R** was reviewed as it relates to habitat suitability. The approach used is consistent with the MNRF Guelph District Survey Protocol for Species at Risk Bats within Treed Habitats (April 2017).

A screening of the tree resources outside of the NHS was completed using tree survey data (2019, 2020). The objective was to screen for trees greater than 25cm diameter with cavities, sloughing or peeling bark that may have potential to be used for bat maternal roosting. Two cultural woodlands and hedgerows were assessed to have low potential to support roosting bats due to sparseness, unsuitably small diameter trees (e.g., trees less than 25 cm; #727-791, #956-1053, #502-550) and few instances of cavities (10 in the aforementioned data set, in mostly Manitoba maples).

A bat habitat assessment was submitted to the MECP on October 15, 2021, to describe the potential for SAR bats to occur on the Subject Lands and to recommend mitigation measures to avoid/minimize potential impacts to roosting bats as a result of the proposed tree removals. Timing windows are recommended for vegetation removals to avoid periods of bat activity and roosting (e.g., tree removals are not to occur between April 1 to September 30). The MECP provided correspondence on October 18, 2021, confirming that the proposed mitigation can avoid impacts to SAR bats (see Appendix D-6). Section 11.0 describes precautionary mitigation measures, consistent with recent EIR applications across North Oakville, to include timing windows for vegetation removals to minimize or eliminate impacts to potential roosting bats and other tree dwelling wildlife.

5.6.6 Species at Risk Summary

Surveys of the Subject Lands in 2019 revealed 50 species of wildlife including 5 amphibians, 1 reptile, 40 species of birds, and 5 species of mammals. Natural heritage inventories confirmed the presence of:

- Barn swallow, though, important habitat features (e.g., nesting structures) are not found in the Subject Lands; and,
- Eastern wood-pewee, though the habitat of this species is located within Core 5, is identified for preservation with buffers, and will not be affected by the proposed land use.

SAR habitat screening (**Appendix D-5**) considers that there is a potential for other SAR bird, insect, and bat species to occur within North Oakville and the Subject Lands and provides cautionary mitigation in the form of timing windows and habitat avoidance to eliminate or minimize impacts to SAR.

6.0 LAND USE

6.1 General Description of Development Plans

The Town of Oakville Master Plan shown on **Figure 6.1** illustrates proposed land uses in North Oakville East. Consistent with the Master Plan, the Subject Lands, comprising Sherborne Lodge and Eno Investments lands, will be developed for a wide range of residential, commercial, institutional and open space uses consistent with the Master Plan for North Oakville East. Proposed residential uses consist of detached and townhouse units, and multiple dwellings.

The proposed Sherborne Lodge and Eno Investments Draft Plans of Subdivision (dated January 24, 2024 and December 12, 2023 respectively) are shown on **Figures 6.1A-R** and **6.1B**. They include residential and mixed-use lots and blocks, a commercial site, an elementary school, a neighborhood park, a village square, one stormwater management facility, and NHS blocks in the southern portions of the Plans. A total of 1108 new residential dwelling units are proposed including single-detached lots, on-street townhouse units, townhouses, back-to-back townhouses, live/work and apartment units.

Primary access to the proposed development will be gained from William Halton Parkway and the future extension of Carding Mill Trail. Access is also proposed through the future subdivisions to the south and east.

The SWM pond is partially located with Core 5, as set out in Ontario Municipal Board Minutes of Settlement.

6.2 Trail Planning

Trail planning direction, as described by Policy 7.4.7.3 of OPA 272, Section 2.3.5.2 of the NOCSS, and the North Oakville Trails Plan, May 2013, has provided the framework for which to design the trail system of this EIR. This EIR addresses all trail requirements for the Sherborne Lodge and Eno Investments lands as per the TOR.

The location of trails as proposed by the North Oakville Trails Plan is shown on **Figure 6.2** (Figure 1 (East) from the North Oakville Trails Plan). Within these EIR lands, the North Oakville Trails Plan indicates a Major Trail along the north side of Core 5, a Minor Trail through the interior of Core 5, and a Multi-use Trail north of the NHS through the southern portion of the development area. The Major and Multi-Use Trail alignments as presented in this EIR generally are consistent with and meet the intent of the alignments as specified in the North Oakville Trails Plan (2013), which is to provide east-west trail connectivity through

the area in the vicinity of the NHS. The adjustments that are proposed are based on natural heritage protection, design, including SWM pond location, and grading considerations, as discussed below.

The Minor Trail through the interior of Core 5 has been eliminated, to minimize impacts to natural heritage and specifically PSW 4 and PSW 7. The rationale for this elimination is documented in the *Final Consolidated Preserve EIR/FSS* (2017) which has been accepted by the Town and CH.

Major Trails, as dictated by the North Oakville Trails Plan, are:

- to be off-road, soft-surfaced trails (compacted limestone screenings) through natural areas, open space corridors, typically 2.4 metres wide;
- intended for pedestrian, cyclists and passive recreation use;
- accessible where possible;
- typically seasonal use, will not receive winter maintenance.

Multi-use Trails are:

- off road (within boulevard or community parks), hard surfaced trails, typically 3.0 metres wide;
- intended for shared use by pedestrians, cyclists, in-line skaters, etc.;
- are fully accessible, intended for year round maintenance;
- to form part of the Active Transportation Master Plan;
- to provide access to adjacent neighborhoods;
- not to be located in the Natural Heritage System.

A site meeting was held with CH and the Town on October 13, 2022, to review the proposed alignment of the trail and in doing so, fulfill requirements of the Terms of Reference. No objections or concerns were raised regarding the proposed trail alignment. The site visit agenda and notes are provided in Appendix A-5.

6.3 Locations of Trails in the NHS

6.3.1 Overview

Site-specific natural heritage investigations, in concert with engineering and design, have resulted in a section of the Major Trail being proposed to be shifted (from the North Oakville Trails Plan alignment) north, to the north side of SWM Pond 9. This increases its distance from the Core 5 woodland. In addition, it is proposed that there be a segment of the Multi-use Trail on the north side of SWM Pond 9. This will provide diversity of landscape for Multi-use Trail users and, improve continuous east-west connectivity for Major Trail users.

Figure 6.3R illustrates the location and types of trails proposed through the southern portion of the Subject Lands. The proposed trail extends from in the vicinity of Neyagawa

Boulevard in the west along the northern edge of the NHS and the north side of SWM Pond 9 to the east boundary of the development. This alignment follows the outer edges of the NHS or is along the northern edge of SWM Pond 9. It is located in areas of the existing remnant farm pond (to be removed) and cropped fields (Sherborne Lodge and Eno Investments lands) of low ecological sensitivity. The trail interface with the lands to the east will be coordinated with the adjacent landowner.

6.3.2 Species at Risk Potential in the Trail Vicinity

Matters related to the Endangered Species Act are under the jurisdiction of the Ministry of Environment, Conservation and Parks. The EIR/FSS TOR document provides direction of the study requirement of an EIR/FSS to address trails. TOR section 3.7.1 states that "*Trail sections that are exclusively located within buffers that are active agricultural lands (row crops) must undertake Species at Risk (SAR) screening and complete appropriate seasonal field surveys*."

As discussed in Section 5, botanical inventories, breeding bird surveys, turtle basking and nest surveys, and a bat summer roost habitat assessment have been completed. Species at Risk were not observed specific to the proposed trail areas. No SAR have been recorded in the vicinity of the proposed trail alignment. In addition, precautionary mitigation measures, including timing windows for vegetation clearing, are recommended to minimize/eliminate the potential for negative effects to plant and wildlife communities/species.

6.3.3. Description of Trail Alignment Sections

As shown on **Figure 6.3**, the trail is proposed at the northern limit of the buffer to PSW 3 in an existing crop field, through the area that was part of the Sherborne Lodge farm pond in the western portions of the EIR lands, and through cropped fields and Core 5 buffer/remnant farm access through a hedgerow stub in the eastern portions.

For the purposes of trail description and impact assessment, the trail has been divided into four segments shown on **Figure 6.3R**. **Table 6.1** provides a description of each trail segment including general location, topography, trees, and relationship to NHS. **Table 6.2** provides description of specific trees that may be affected by the proposed trail. As shown in Table 6.2, there are five trees, comprising small sweet cherry, red oak, sugar maple, ironwood and a large willow that will require removal for the trail and/or SWM pond access. These trees are common species (not endangered or species at risk) and are not unique or distinctive specimens.

6.4 Trail Restoration Plantings

For locations within the NHS where disturbance will occur due to the construction of the trail features, a detailed landscape naturalization-restoration plan will be required at detailed design and prepared to the satisfaction of the Town (Parks) and CH, following the CH guidelines. Conservation Halton's *Guidelines for Landscaping and Rehabilitation Plans v.3.1* (endorsed in 2021) will be consulted for minimum planting standards. Restoration of works in the regulated area, edge management, and compensation will be addressed at detailed design.

Table 6.1 – Description of Trail Segments

Trail Section	Location	Comment
TR1 Major Trail Segment	Located just inside the buffer limit of PWS-3; as much as possible, will be situated on top of the right-of-way for the SWM discharge pipe; then along easement to Street B Portion of trail within PSW 3 buffer located in Core 5 NHS	▪ The limit of PSW 3 has been staked with regulatory agencies. The trail is located in the northerly ~3.4m of the wetland buffer, providing a 0.5m separation to the lots to the north and east. It then extends through the Village Square. ▪ Existing land cover is cultural meadow or agricultural field, and cultural meadow/farm pond riparian and open water of the existing farm pond. ▪ Grades north of PSW 3 will be raised to create positive drainage to the proposed SWM pond. Grading plans illustrate the future grades along the Core boundary where the trail is located. Two thicket trees (see **Table 6.2**) will be affected within the NHS in this trail section. This will not negatively impact Core features or functions. ▪ The trail will connect to Neyagawa Boulevard via Street A.
TR2 Major Trail Segments	Two subsegments, TR2-W and TR-2-E, west and east of TR3 Along northern edge of proposed SWM pond, located entirely outside Core 5 NHS	▪ Existing land use comprises the Sherborne Lodge farm pond (TR2-W) which will be eliminated, and agricultural field area (TR2-E). ▪ Conveyance between the western and eastern portions of TR2 will be via a portion of the Multi-use Trail segment TR3. ▪ The entire area will be regraded/constructed in support of the SWM pond. The trail will be located coincident with the SWM pond access road. ▪ There are no topographic/grading conditions associated with the trail that will impact Core 5.
TR3 Multi-Use Trail segment	Comprises the westerly and easterly easements to the SWM pond, and the intervening section of the SWM pond access road Located entirely outside Core 5 NHS	▪ Existing land use comprises the Sherborne Lodge farm pond which will be eliminated, a small grouping of trees present on the east shoreline of the existing pond outside of Core 5; a treed fenceline outside of Core 5, and agricultural field. ▪ The entire area will be regraded/constructed in support of the SWM pond. The trail will be located coincident with the SWM pond access road. ▪ Provides a Multi-Use Trail that is connected at both ends to residential streets (i.e., not dead-ending as proposed in the Master Trails Plan), enhancing user experience. ▪ There will be no impacts to Core 5.

Trail Section	Location	Comment
TR4 Major Trail segment	Extends from the northeastern limit of the SWM pond to the eastern boundary of EIR Located in outer northern edge of Core 5 NHS	▪ The trail traverses an open cropped field which has been reserved as NHS. There are no trees in the field. It will be is located in the northerly ~3.4m of the NHS, providing a 0.5m separation to the lots to the north. ▪ The trail then passes through a remnant farm lane or natural clearing (now dense with hawthorn) through a hedgerow inside Core 5 at its northern limit. ▪ The trail connects to the adjacent Preserve North trail by passing through another hedgerow within Core 5 where small trees (less than the Oakville tree protection bylaw criteria of 15 cm diameter) will be removed (see **Table 6.2**). ▪ Topography is generally flat within this segment. There are no topographic implications and no negative impacts to the features of Core 5.

Table 6.2 - Trees in NHS Affected by Trail Alignment

Trail Section	Trees in the 2m Disturbance Zone of Trail		Species	Comments	Tree Removals Within NHS
	Unique tree ID#	Quantity			
TR1	1969, 1970	2	#1969 - willow, 45 cm diameter, #1970 – sweet cherry, 16 cm diameter.	Two trees will require removal for the proposed SWM pond maintenance easement which is partially coincident with the trail location.	Two trees within the NHS (#1969-1970) will require removal to construct the SWM maintenance easement/ vehicle turnaround.
TR2	N/A	0		There are no trees that will be affected by the proposed trail alignment.	None
TR3	N/A	0		There are no trees that will be affected by the proposed trail alignment. (A few trees located outside the Core will be removed for SWM access road and will be documented at detailed design stage).	None
TR4	1431, 1435, 1436	3	#1431- Red Oak,11 cm diameter, #1435 - Sugar Maple, 13 cm diameter and in poor condition, #1436 - Ironwood, 14 cm diameter.	There are three trees within the 2m expected disturbance limit either side of the trail. These trees are on the EIR/FSS boundary with Preserve Phase 4 (property to the east of the Subject Lands). There are no Species at Risk trees in the area.	Three small deciduous trees, in a hedgerow within Core 5.

7.0 STORMWATER MANAGEMENT

7.1 OPA 272 and NOCSS Recommendations

Preparation of the Stormwater Management Plan for the Subject Lands has been guided by OPA 272 and the NOCSS recommendations.

OPA 272 policy 7.4.5 states that, *"The management of water resources within the North Oakville East Planning Area shall be undertaken in accordance with the directions established in the North Oakville Creeks Subwatershed Study. No amendments to the Secondary Plan shall be required to implement the recommendations of the Subwatershed Study or for changes to the number or location of stormwater management facilities in accordance with the policies of Section 7.6.2.2 a) of this Plan".*

Section 6.0 of the NOCSS presents the recommended Management Strategy for North Oakville. It includes strategies for natural heritage protection, stormwater management, terrestrial and wetland resources management, riparian corridor management, rehabilitation plans, remediation plans and monitoring. The goals, objectives and targets of the Management Strategy are set out in NOCSS Section 6.2 (see Table 6.2.1 of NOCSS as modified by the September 5, 2007 Addendum).

The recommended NOCSS Management Strategy addresses the development of an approach to stormwater management that will, *"… protect and enhance environmental characteristics through managing stormwater response and conveyance processes".* The water resource related goals, objectives and targets from the Management Strategy are presented in **Table 7.1**.

The NOCSS Section 6.3.6 discusses the Stormwater Management component of the Management Strategy. It includes discussion on hydrology, peak flow control, hydrogeology, water quality, fisheries protection, low impact development, source pollution protection and various types of SWM measures.

Table 7.1 - North Oakville Creeks Subwatershed Study
Meeting the Subwatershed Goals & Objectives - Target Setting

Goals	Objectives	Targets
1. To minimize the threat of life and destruction of property and natural resources from flooding, and preserve (or re-establish, where possible) natural floodplain hydrologic functions.	1.1 To ensure that runoff from developing and urbanized areas is controlled such that it does not increase the frequency and intensity of flooding at the risk of threatening life and property.	• Maintain existing peak discharge rates for all design events, particularly high flows. • Target discharge rates required for each catchment (unit area). • Stream reach floodplain storage targets to protect existing floodplain storage. • Remove flood potential at identified locations within the Study Area. • Delineate floodplains to provide development limits. • Restrict development in the floodplains as per Provincial and CA policies.
	1.2 To adopt appropriate land use controls and development standards to prevent development in natural flood hazard and erosion hazard areas.	• Delineate floodplains to provide development limits. • Restrict development in the floodplains as per Provincial and CA policies. • Delineate meander belt and erosion setback to be applied on all streams designated to be left as open watercourse (providing erosion protection). • Apply valley wall setback standard (slope plus top of valley setback). • Develop SWM plan to replicate flow-frequency-duration from existing conditions. • Meet threshold tractive force targets. • Use Distributed Runoff Control (DRC) approach.
	1.3 To ensure that new development incorporates the most appropriate development form and mitigation measures necessary to optimize compatibility with natural features and their associated functions.	• Aquatic protection based upon resident fish community and existing aquatic habitat conditions. • Achieve MOE ‘enhanced’ level of SWM protection (80% TSS removal) for all reaches of streams supporting resident Redside Dace populations (14 Mile and Morrison Creeks). • For all other stream reaches, achieve ‘normal’ level of SWM protection (70% TSS removal) to adequately protect aquatic habitat and resident fish. Note that ‘enhanced’ protection of these streams will be required for reasons not directly related to aquatic habitat and resident fish (see Section 2.2 regarding Phosphorus loadings).

Goals	Objectives	Targets
2. To restore, protect, and enhance water quality and associated aquatic resources and water supplies for watercourses, including their associated hydrologic and hydrogeologic functions, within the subwatershed areas.	2.1 Protect stream morphological and fluvial character; restore, where appropriate and feasible, sinuosity; maintain physical habitat attributes (e.g., pools and riffles), diversity and fluvial processes (e.g., bedload transport and energy reduction through sinuosity); and prevent increase in erosions and deposition, through maintenance of hydrological regime.	• Streams that displayed a high sensitivity to change and have a well-developed geomorphic form and function. • Streams that exhibited some sensitivity to change and geomorphic function with a moderate degree of form. • Streams that lacked a defined form but still had a geomorphic function such as sediment transport, flow conveyance, and connectivity to other features.
	2.2 To prevent the accelerated enrichment of streams and contamination of waterways from runoff containing nutrients, pathogenic organisms, organic substances, and heavy metals and toxic substances.	• Control current nutrient levels in the streams to mitigate the potential increases in nutrients and associated impacts on algae growth. • The potential increase in suspended solids and associated urban pollutants. • The level of chloride and potential increase. • The need to manage stream temperature for fisheries protection.
	2.3 To maintain or restore a natural vegetative canopy along streams, where required, to ensure that mid-summer stream temperatures do not exceed tolerance limits of desirable aquatic organisms.	• Maintain existing riparian vegetation associated with watercourses, where feasible. • Active restoration of riparian zones with native plantings, in cases where watercourse modifications/alterations require permitting/authorization.
	2.4 To minimize the disturbance of the streambed and prevent streambank erosion and, where practical, to restore eroding streambanks to a natural or stable condition.	• Targets as outlined in Objectives 2.1 and 2.2.
	2.5 To restore, rehabilitate, or enhance water quality and associated resources through the implementation of appropriate best management practices on the land.	• Targets for surface water as outlined in Objective 2.2. • For groundwater, target of no detrimental change in existing groundwater quality.
	2.6 To ensure that hydrogeologic functions are preserved and maintained and take full advantage of stream and groundwater discharge/baseflow enhancement opportunities.	• Maintaining groundwater supplies for existing residents while development and servicing proceed. • Keeping changes in the depth to the local water table to within the seasonal fluctuations normally experienced. Maintaining the groundwater contribution to stream health (groundwater quantity and quality), where it currently exists.

Goals	Objectives	Targets
	2.7 To maintain and enhance the aquatic habitat.	• The targets relating to biodiversity for Fourteen Mile, Morrison, and Joshua's Creeks should be that the biodiversity of the fish community be, at a minimum, maintained at existing levels and increased if possible. • Identify stream corridors for protection.
		• Fluvial geomorphology/erosion control targets under Objective 2.1. • Water quality targets under Objective 2.2. • Designate reaches, which support Redside Dace populations, as "no touch" areas where stream sections cannot be relocated. • Enhanced level of stormwater quality control for Fourteen Mile and Morrison Creeks. • Retain wetlands associated with streams if possible and incorporate into drainage system.
	2.8 To minimize disturbance of wetlands, preserving and/or enhancing the habitat and functions they provide.	• Minimize fragmentation of wetlands. • Maintain the function of all wetlands associated with watercourses. • Maintain the function and structure of wetlands within woodlands.
	2.9 Provide appropriate buffers to wetlands, watercourses, and valleylands to maintain or enhance their biological health and meet objectives of long-term sustainability of these features.	• Establish appropriate feature-specific buffers for protection of natural habitats.
3. To restore, protect, develop, and enhance the natural heritage, historic cultural, recreational, and visual amenities of rural and urban stream corridors.	3.1 To ensure that environmental resource constraints are fully considered in establishing land use patterns in the subwatershed.	• Minimize the fragmentation of woodlands. • Maintain the function of all woodlands that are >200m in width (i.e., provide potential interior conditions). • Maintain the function of woodlands associated with watercourses.
	3.2 To ensure that existing wildlife linkages are preserved and that opportunities for improving these linkages are considered/implemented as part of any future development.	• Minimize the discontinuities in linkages (especially >20m). • Linkages to be 100m wide. • Allow for linkages to habitats or other linkages located outside the study area (for example Sixteen Mile Creek valley and Bronte Creek).

Goals	Objectives	Targets
	3.3 To retain, preserve, or maintain natural heritage features (i.e., open space and visual amenities) in urban and rural areas by establishing and maintaining greenbelts along stream corridors and adjacent natural areas and maintaining linkages between these areas.	• See discussions under Objectives 2.8, 3.1, and 3.2.
	3.4 To ensure that development in the stream corridor is consistent with the historical and cultural character of the surroundings and reflects the need to protect visual amenities.	• Presence of visual and historic amenities through the subwatershed and secondary planning processes.
	3.5 To ensure that the recreational and fisheries potential of a stream corridor are developed to the fullest extent practicable.	• See discussion under Objectives 1.3, 2.3, and 2.7.

The NOCSS Management Strategy makes the following recommendations regarding the design of SWM systems in support of development in North Oakville.

Peak Flow Control - The NOCSS recommends that SWM systems be designed to control post development peak flows to target unit flow rates presented in NOCSS Table 7.4.1 for the 2 year to 100-year events and Regional Storm. No new hydrologic modelling of existing conditions in the subcatchment is necessary to establish existing conditions target peak flows, however, the NOCSS notes that more accurate topographic information is required to define subcatchment boundaries. Target peak flows for the full range of events are to be calculated at the EIR/FSS stage on the basis of updated subcatchment boundaries. Section 7.4 of this EIR/FSS addresses drainage boundaries and target peak flows for the East Sixteen Mile Creek (ES6) catchment. The approved *Final ES6-West EIR/FFS* study (2015) demonstrated that Regional flow control is not required due to the negligible increase in flows and water levels in the East Sixteen Mile Creek reaches downstream of the Subject Lands. This EIR/FSS has reviewed and updated the approved Regional Storm control analyses based on the currently proposed SWM Plan that includes some differences in drainage areas, land uses and hence imperviousness values, and SWM pond numbers and designs. See Sections 7.5 and 7.13.

Role of Topographic Depressions/Hydrologic Features A and B - The NOCSS Analysis Report and Management Strategy address the hydrologic function of terrestrial features (woodlands, wetlands), streams and riparian corridors in the formulation of the recommended Natural Heritage System and SWM System. These reports also identified numerous topographic depressions across the landscape in North Oakville. The NOCSS Addendum recommends that the storage functions of these depressions be confirmed through the completion of an EIR/FSS when more detailed topographic information would be available. The NOCSS recommends that the form and function of Hydrologic Features be carefully considered as part of the EIR/FSS studies. If relocating these features, the form and function must be maintained. Section 2.1 discusses the existing hydrologic features. There are no Hydrologic Feature A areas in the EIR Subcatchment Area or the FSS study area. **Table 2.1** presents the pits, pond and depressions and the Hydrologic Features B.

With respect to Hydrologic Features B, the NOCSS notes that their preservation is encouraged but not required. If they are proposed for removal, the active storage volume of these features must be addressed as part of SWM facility design (with the exception of the existing Pond 47).

Figure 2.1R illustrates the features noted in **Table 2.1**. Section 7.14 describes how the feature volumes are compensated in the proposed SWM pond blocks.

Floodplain Mapping - The NOCSS analyses included preliminary flood mapping along each of the watercourses in North Oakville. There are no watercourses within the ES6-East watercourse that require flood mapping.

Erosion Control – The NOCSS identifies the need to complete erosion threshold and erosion control analyses as part of an EIR/FSS so that existing channel erosion or aggradation is not

exacerbated by development. The erosion control approach established in the *ES6-West EIR/FSS* (Stantec / GHD) has been updated given that the drainage areas and imperviousness values for the EIR Subcatchment Area are higher than the values used in the ES6-West EIR/FSS modelling. Furthermore, the erosion threshold downstream (in SMA-4) has been updated based on more recent monitoring efforts during the freshet events of early 2023. The general approach to the erosion threshold analyses is set out in the ES6-West EIR/FSS and the refined erosion modelling is summarized in Section 7.6 and Appendix E-4.

Water Quality Control – The NOCSS recommendations for water quality control focus on the management of phosphorus, suspended solids, and chloride. The focus on these water quality parameters is, "… *intended to provide controls to the meet the objective of not permitting further enrichment of the streams (i.e., nutrient control), fisheries protection and overall water quality protection*". It further notes that SWM systems are to be designed to meet targets set out in NOCSS Section 6.0 and outlined in NOCSS Table 6.2.2.

With respect to each of these water quality parameters, NOCSS recommendations for Sixteen Mile Creek are:

- Provide Normal Level of water quality protection. This level of control provides for the removal of 70% of suspended solids. However, minutes of settlement from May 2007 require that in order to meet phosphorus loading requirements Enhanced Level of water quality protection or a removal of 80% of suspended solids will be provided. No further analysis of Phosphorus loading is necessary.

- Chloride recommendations relate to the Town's management of salt applications and do not require any further analysis in the EIR/FSS.

The SWM pond design details including measures to ensure the Enhanced Level of sediment removal is provided are found in Section 7.12.

Infiltration – The NOCSS notes that the management of groundwater resources focuses on the management of the hydrologic cycle. For groundwater, the overall goal was stated to be, "to maintain infiltration as close to current levels as possible". It further notes that the soils in North Oakville are, "… poorly permeable, resulting in little infiltration" and "infiltration targets are very difficult to meet". As such, best efforts are to be made to address maintenance of groundwater recharge and baseflows in Sixteen Mile Creek. Section 8.0 of this EIR/FSS addresses the groundwater water balance conditions within the subwatershed, discusses potential development impacts and outlines best management practices and low impact development measures to promote infiltration across the area.

SWM Facility Numbers/Locations – The NOCSS completed a preliminary assessment of the required numbers and locations of SWM ponds to meet the SWM design criteria. It presented preliminary locations for ponds in each subcatchment in North Oakville East. This preliminary

analysis identified two SWM ponds in the ES6-East subcatchment. The North Oakville East of Sixteen Mile Creek Secondary Plan also identified two SWM ponds in the ES6-East subcatchment (Pond 9 partially in/partially out of Core 5 and Pond 9A north of Burnhamthorpe Road).

This EIR/FSS addresses the location, design and operating characteristics of SWM Pond 9. SWM requirements for lands north of Burnhamthorpe Road have been addressed conceptually only since these lands are not participating in the EIR/FSS or advancing development plans at this time. The EIR/FSS has addressed conceptual sizing of SWM Pond 9A and also presents an option where two additional SWM facilities are provided north of Burnhamthorpe Road if the three properties (Westerkirk, Ashoe High Speed and Dorham Holdings) proceed independently. In that case, as shown on **Figure 7.7R**, Pond 9A would service the Westerkirk lands, Pond 9B would service the Ashoe High Speed lands and Facility 9C would service the Dorham Holdings lands. This approach provides flexibility in the servicing of the future / external lands and reduces reliance on any single property / outlet. Facilities 9A, 9B and 9C would drain south through the Subject Lands and through Pond 9.

Facilities 9A, 9B, and 9C could be combined subject to participation/timing of the various owners north of Burnhamthorpe Road. Storage requirements for a single external pond (Pond 9A) would be equivalent to the sum of the individual Facility 9A, 9B, and 9C volumes presented herein. Due to the relatively small size of the Dorham Holdings property (less than 5ha), Facility 9C would likely be an underground storage facility rather than a conventional wet pond. Facilities 9A and 9B are wet ponds.

Evaluation of SWM Measures, LID Measures and Source Pollution Prevention – While NOCSS identifies the requirement for end-of-pipe SWM facilities for water quality and quantity control, it also recommends that consideration be given to alternative management measures to meet the SWM objectives and targets. In this regard, the NOCSS discusses alternative LID techniques, various source pollution protection programs and alternative SWM practices to be considered. **Section 7.4** presents the evaluation of alternative SWM measures.

7.2 Updated Subcatchment Boundaries

The NOCSS identified drainage boundaries based on the best topographic information available at that time. As outlined in Section 5.2, in 2007, detailed LiDAR topographic mapping was obtained by Rady-Pentek Edward Surveyors to refine the drainage boundaries for each subcatchment and have more detailed mapping available for engineering design. **Drawing 5.2R** presents approved drainage boundaries where available and a comparison of the LiDAR mapped subcatchment boundaries and the NOCSS boundaries that have not been previously approved in other EIR/FSS reports. While there are some differences in boundaries, the total ES6-East drainage areas compare well: NOCSS drainage area of 93.08ha versus the EIR/FSS drainage area of 95.45ha. This change of less than 3% is minimal and as such, the LiDAR mapped boundary will be used and NOCSS unit target rates remain valid.

7.3 Pre-Development Flows

The NOCSS established target unit peak flows for the 2-year to 100-year events and the Regional Storm using the GAWSER model (NOCSS Addendum, 2007). It is also noted that further modelling of existing conditions target flows was not required at the EIR/FSS or detailed design stages.

In accordance with NOCSS recommendations, and recommendations from the approved ES6-West EIR/FSS for no Regional Storm controls in the ES6-West and ES6-East subcatchments, NOCSS unit flow rates have been used, along with the updated pre-development drainage areas based on updated mapping to calculate pre-development target flows for the SWM facilities design within the EIR/FSS Subcatchment Area for the 2-year to 100-year events. **Table 7.2** provides the unit flows and overall target flows for the ES6-East Subcatchment Area.

Table 7.2 - NOCSS Unit Flow Rates and EIR/FSS Pre-development Flows at Key Locations

		Return Period						
		2	5	10	25	50	100	REG[1]
		Unit Rates [$m^3/s/ha$]						
NOCSS Unit Rates for East Sixteen Mile Creek (NOCSS Addendum, July 2007)		0.004	0.007	0.009	0.012	0.014	0.016	0.044
Location	**Area (ha)**	**Existing (Target) Flow [m^3/s]**						
ES6-East	95.45	0.38	0.67	0.86	1.15	1.34	1.53	4.20

[1] Regional Storm controls not required as per ES6-West EIR/FSS (Stantec, 2015) downstream assessment

7.4 Stormwater Management Plan

As required by NOCSS and the EIR/FSS Terms of Reference, alternative approaches to stormwater management have been identified and evaluated to assess and incorporate appropriate stormwater management practices in the development design to satisfy NOCSS SWM goals, objectives and targets.

Stormwater management practices are specific planning and technical measures, which are implemented to manage the quantity and quality of urban runoff. The stormwater management measures specifically required to manage urban runoff and mitigate potential drainage impacts can be grouped into three main categories:

- Lot level, or source control measures (i.e., reduced lot grades, roof drainage control or storage, porous pavements, rain gardens, grassed swales, etc.);
- Infiltration measures (i.e., infiltration basins and trenches, exfiltration pipes or porous pavement, etc.); and,

- End-of-pipe measures (i.e., detention wet ponds or wetlands, oil/grit separators, etc.).

In reviewing these options for inclusion in the proposed Stormwater Management Plan, these alternatives were evaluated on the basis of capabilities, limitations and physical constraints associated with their implementation. This included the following factors:

- Their ability to meet SWM goals, objectives and targets discussed in Section 7.1;
- Suitability of soils and groundwater conditions;
- Site topography and size of contributing drainage areas;
- Compatibility with urban form and natural features; and
- Municipal servicing requirements.

The evaluation of alternative stormwater management practices has made use of guidelines in the MOE *Stormwater Management Planning and Design Manual,* March 2003, (referred to herein as the *MOE SWMP Design Manual*) and has considered the practical feasibility of implementing alternative low impact development techniques.

Low Impact Development (LID) is a comprehensive land planning and engineering design approach, the goals of which include preserving natural heritage areas and managing stormwater to minimize increases in surface flow and pollutants. The LID approach combines planning with micro-management techniques to reach these goals. Many of the SWM practices outlined above are considered types of LID measures.

The NOCSS identified examples of LID measures to include conservation of natural features (i.e., Hydrologic Features), reducing impervious areas, bioretention areas, rain gardens, green roofs, use of rain barrels and cisterns, vegetated filter strips and permeable pavements.

The proposed development will introduce the impervious areas in the form of residential, commercial and retail buildings, parking lots and roads with an overall density higher than traditional single-family housing developments. The proposed urban form, as set out in OPA 272, combines the protection of large tracts of lands in the NHS along with higher density development in the remaining areas for development.

In this regard, the NOCSS and OPA 272 provide for the retention and enhancement of significant environmental areas and features to maintain and enhance the existing environmental functions and linkages throughout North Oakville. Core Preserve Areas, Linkage Preserve Areas, High and Medium Constraint Stream Corridors combine to provide a large connected NHS; all development is confined to areas outside of the NHS. This approach results in more compact forms of development with generally smaller lots, higher density residential products and reduced setbacks. The reduced building setbacks result in relatively small yard surfaces limiting the practical feasibility of at-source measures.

Depending on the housing form, there may be some opportunities to introduce lot level controls to address stormwater quantity and quality. There are limited opportunities for LID measures that include disconnected roof leaders, and grassed swales in side-yard and rear-yard areas,

increased topsoil depths, bioswales in commercial / private site plan parking lots and rooftop and parking lot storage, as appropriate. The discharge of roof runoff to grassed areas and the provision of grass swales is recommended on all single detached units. Increased topsoil thickness in these areas can aid storage of runoff and infiltration. The ability to implement these measures on other unit types must be assessed at the detailed design stage based on the building form, building setbacks, location of impervious surfaces, and ability to direct flows away from areas where there is the potential for icing problems.

From a conveyance perspective, the density of development required in OPA 272 is not compatible with the use of rural road cross sections with ditch/swale systems. In all areas, urban road cross sections are proposed compatible with higher density housing forms proposed in OPA 272 and Town standards.

With respect to the LID measure of “reduced impervious areas”, as discussed above, the implementation of the proposed NHS has resulted in a more compact built form on lands outside the NHS. This is achieved through higher density residential product and reduced building setbacks. As a result, the total development is confined to a smaller footprint. While the total building coverage may not be reduced, the amount of road required to serve the development is reduced. As such, the total impervious area associated with the roads has been reduced versus a lower density development servicing the same target population.

Dependent upon municipal budgets, there may be more opportunity to implement LID measures on public use lands. This may include use of porous pavement in parking areas, directing surface flows from paved areas to landscaped gardens, and/or the collection, storage and use of roof water for landscape irrigation. These options will continue to be explored through the detailed design phases of the subject lands and do not impact the Draft Plan or block sizes.

In addition to the proposed urban form, the hydrogeological analyses completed for this study (Section 4.0) provides important considerations to the selection of effective SWM measures. Consistent with the findings of the NOCSS, the analyses conclude that the Subject Lands are characterized by dense silty till soils having a low infiltration potential. As such, constructed infiltration facilities are considered not feasible or effective on the Subject Lands.

End-of-pipe SWM wet ponds are proposed to provide the required Enhanced Level of water quality control, erosion control and flood control storage volume requirements. No amount of source control, conveyance controls or other LID measures will eliminate the need for these end-of-pipe solutions.

With respect to Source Pollution Prevention, the NOCSS identifies a number of source pollution prevention measures including reduced fertilizer and pesticide use, alternate lawn practices, pet litter control, street cleaning, salt management, and sewer use by-law enforcement. Many of these measures are the municipalities’ responsibilities. The preparation of a Homeowner’s Manual is recommended to provide information to new homeowners on reduced

fertilizer/pesticide use, alternate lawn practices, rain gardens, rain barrels, pet litter control and environmental sensitivities of the NHS.

The following is a summary of the recommended stormwater management measures within this EIR/FSS Subcatchment Area:

Lot Level Controls (Medium / Low Density Land use)

Conventional controls for low and medium density land uses are proposed, including:

- Roof leaders directed to pervious areas (in accordance with Town standards);
- Increased topsoil depths;
- Avoidance of steep lot grades; and
- Recommendations for use of rain barrels to encourage water re-use.

End-of-pipe Stormwater Management Facilities

- SWM wet ponds are proposed to provide an Enhanced Level of water quality control, erosion control, and quantity controls for a full range of storm events up to and including the 100-year event for all developing lands in the EIR Subcatchment Area. This includes Pond 9 south of Burnhamthorpe Road and up to three facilities north of Burnhamthorpe Road (Ponds 9A and 9B and Facility 9C). Ponds 9A and 9B, and Facility 9C could be combined into one facility subject to participation by the various owners.

- Facility 9C (Dorham) is a relatively small facility with a small drainage area and would not meet the MECP criteria for wet ponds. Therefore, if proceeding independently, it would likely be underground storage.

Outfall Pipe to PSW 3

To manage surface water inputs to PSW 3, a separate pipe is proposed to direct water to PSW 3 from an area of 1.08ha north of this wetland. An oil/grit separator and stone core wetland pocket at the outlet of the pipe will provide Enhanced water quality controls for this small area.

Thermal Mitigation

Thermal mitigation measures were reviewed and recommended for implementation in SWM Pond 9 and future external ponds north of Burnhamthorpe Road. Section 7.12 outlines the review and discussion of various thermal mitigation measures.

SWM Modelling

The SWM Plan is supported through the completion of various design and hydrologic, hydraulic and erosion modelling analyses. Unless otherwise noted, these models are included in Appendix E. The purpose of each of the models is described below:

- GAWSER modelling of the ultimate development with SWM facilities in place to confirm that the 2 year to 100 year NOCSS flow targets are met and to assess attenuation effects of the Regional Storm flows through the 100 year pond;

- Similar to the above, GAWSER modelling to assess interim conditions (pre-development conditions north of William Halton Parkway and ultimate conditions south of William Halton Parkway within the Subject Lands) with SWM facilities in place.

- GAWSER modelling of the ultimate development with no SWM facilities in place. This was done to simulate the Regional Storm flow and compare it to the approved ES6-West EIR/FSS uncontrolled flows. Flows were input to HEC-RAS modeling of the downstream reaches west of Neyagawa Road to evaluate the impacts of uncontrolled Regional Storm flows to downstream floodlines (see **Appendix A-6**);

- QUALHYMO (continuous modelling) and PCSWMM modelling of the PSW 3 pre and post development water balance;

- QUALHYMO modelling (continuous modelling) of the SWM Plan and proposed land uses to provide continuous simulation of future flows for input to the erosion analyses;

- Erosion modelling completed by GEO Morphix to calculate various erosion indices (cumulative time of exceedance, number of exceedance events, cumulative effective discharge and cumulative effective work index) and identify changes in the erosive potential within the downstream receiving watercourse;

- PCSWMM modelling to evaluate major system capture on William Halton Parkway;

- HEC-RAS modelling of future flows at the outlet of the EIR Subcatchment Area to determine flood levels within the existing and proposed Neyagawa Boulevard east ditch at the catchment outlet (see **Appendix I**).

7.5 Downstream Investigations – Regional Storm Controls

Policy 7.4.13.2 of OPA 272 states, "*The North Oakville Creeks Subwatershed Study recommends that stormwater targets include control of the peak flow to predevelopment levels for various return periods, including the Regional Storm. Through the land development application process, an investigation of the potential increase to flood risk may be carried out to confirm if Regional Storm controls are necessary, in accordance with the directions established in the North Oakville Creeks Subwatershed Study*."

The NOCSS recommends that stormwater management targets include the control of peak flows to predevelopment levels for the 2-year to 100-year return period events and the Regional

Storm. However, it also states that, "*The flow targets represent existing conditions peak flows for the full range of design events (2-year to Regional Storm). This is provided as a peak flow target to prevent the increase in flow potential to private property along receiving watercourses. In cases, such as Sixteen Mile Creek, where the floodplain is contained within a well-defined, publicly owned valley system, consideration can be given to not controlling peak flows under Regional Storm conditions, as long as flood potential is not increasing on private property. Control of lesser events is still required to protect local flow regime characteristics of the outlet. If considered, this will require evaluation at the EIR stage.*"

Under NOCSS, Regional Storm controls are not required for areas draining to the Sixteen Mile Creek. Additionally, as part of the *Final ES6-West EIR/FSS* (2015) for the Davis-Minardi North Lands, an evaluation of the need for Regional Storm controls in the ES6-West and ES6-East subcatchments was undertaken by Stantec Consulting. Hydrology and hydraulic assessments of uncontrolled Regional Storm flows on downstream areas in the subcatchment were completed for existing, interim and ultimate development conditions. Hydrology and hydraulics models were prepared to establish existing and uncontrolled Regional Storm flows and water levels in stream reaches SMA-6, SMA-4, SMA-3 and SMA-2 downstream of the ES6-West and ES6-East subcatchments for each scenario. Changes in flows, water levels, velocities, areas flooded and culvert capacities under both proposed scenarios were assessed and compared to existing conditions to determine impacts to downstream areas. While small increases in Regional Storm water levels were identified, they remain within publicly-owned lands, and downstream culvert improvements were recommended in two areas to accommodate uncontrolled Regional Storm flows without overtopping of the road. The assessment concluded that no Regional Storm controls were recommended in the ES6 subcatchments. The *Final ES6-West EIR/FSS* (2015) was approved and no Regional Storm controls were implemented in the ES6-West subcatchment.

As part of this EIR/FSS, the Stantec analyses (development imperviousness and drainage areas) were reviewed and compared to imperviousness and drainage areas reflective of the proposed Draft Plans of Subdivision. The Stantec GAWSER and HEC-RAS models were updated to reflect current development proposals and downstream flows were compared to the 2015 hydrology model flows and water levels to confirm the approach to no Regional Storm controls. These analyses are outlined in Section 7.13.

7.6 Erosion Control Analysis

7.6.1 Past Approved Erosion Assessment and Recommendations

ES6-East Subcatchment drains toward a single outlet point at the upstream end of Reach SMA-6. Approximately 350m downstream of this point, Reach SMA-6 combines with Reach SMA-5 at the origin of Reach SMA-4. The *North Park EIR/FSS* identified that Reach SMA-4 upstream

of Neyagawa Boulevard had a critical depth of 0.04m, a critical velocity of 0.26 m/sec and critical discharge of 0.04 m^3/sec.

As part of the *Final ES6-West EIR/FSS* (2015) for the Davis-Minardi North Lands, an evaluation of the erosion threshold and erosion analyses for future development in both the ES6-West and ES6-East subcatchments were completed by GHD. This assessment included determination of a theoretical critical erosion threshold, field verification of erosion thresholds, continuous hydrologic modelling of pre- and post-development flows and an assessment of potential geomorphic adjustments due to potential changes in the flow regime. Study findings, documented in the *Final ES6-West EIR/FSS* (2015), applied to developing areas within both the ES6-West and ES6-East subcatchments. Based on the varying development parcels in the two subcatchments, in addition to maximizing the use of LID measures to the extent feasible, erosion control recommendations were provided for small sites versus other areas as follows:

- For smaller subareas, it was recommended that the subcatchments draining to the SMA-4 tributary control runoff on a 'best-efforts' basis, whereby the minimum orifice size is set at the Town's guideline of 75mm (or greater where larger catchments permit; and

- For other facilities, a minimum of 250 m^3/impervious hectare of extended detention should be provided (i.e., to ensure that 25mm rainfall is detained over a 24 to 48 hour period).

This previous erosion analysis model and study assumed development in ES6-East with an estimated overall imperviousness of 66.5% within a total drainage area of 88.5ha. It indicated that SWM Pond 9 would have a 0.7m deep extended detention storage depth and be controlled by a 75mm orifice. This resulted in a 478 hour drawdown time (19.9 days). This drawdown time would result in storm stacking conditions, which were not evaluated at the time of the previous study.

7.6.2 Refinement of Erosion Threshold

The GHD assessment indicated that the 0.040 m^3/s theoretical critical discharge was conservative, and that the actual erosion threshold was likely substantially higher. To review and refine the downstream erosion threshold, successive site visits were completed by GEO Morphix on February 9 to 13, 2023 following snowmelt and 30.6 mm of rainfall. An array of monitoring instrumentation was installed to monitor flows, bedload transport, and turbidity levels throughout the event. Point measurements of flow and bedload transport were periodically completed throughout the falling limb of the event until erosion activity ceased. Detailed results of the field validation activities are provided in Appendix E-4. Through the field validation activities, it was determined that systemic bed and bank erosion ceased at approximately 0.098 m^3/s. This monitoring served to further field-validate and refine the theoretical erosion thresholds documented within the *Final ES6-West EIR/FSS* (2015). The refined erosion threshold of 0.098 m^3/s has been used in this ES6-East EIR/FSS erosion analyses.

7.6.3 Erosion Exceedance Analyses

The currently proposed development within ES6-East has a calculated imperviousness of 71.5% within a total drainage area of 89.9ha. Since the imperviousness and drainage area is slightly higher than assumed in the *Final ES6-West EIR/FSS* (2015) erosion assessment, this EIR/FSS has updated subcatchment hydrology and the analyses of erosion indices to reflect the updated development plans and SWM Plan and confirm the erosion control criteria required to meet NOCSS and Final ES6-West EIR/FSS recommendations.

To assess the potential impacts of the ES6-East proposed land uses and SWM Plan, the original QUALHYMO continuous modelling from the *Final ES6-West EIR/FS*S (2015) was updated based on the ES6-East proposed drainage design, imperviousness, and pond rating curves. Urbantech updated the QUALHYMO continuous simulation hydrologic modelling, and GEO Morphix calculated various erosion indices (cumulative time of exceedance, number of exceedance events, cumulative effective discharge and cumulative effective work index) to identified changes in the erosive potential within the downstream receiving watercourse.

A number of pond design scenarios were evaluated to iteratively determine the optimum pond storage and release rate requirements and resulting detention times. The results presented herein represent the final iteration of modelling, where the results reached acceptable levels. The results of the following scenarios are documented herein:

- Simulation #1 used the original *Final ES6-West EIR/FSS* 2015 development and SWM plan with critical discharge at 0.040 m^3/s (i.e., re-creation of the original modelling). Results for the cumulative effective discharge and cumulative effective work indices were calculated and provided for comparison purposes;

- Simulation #2 used the *Final ES6-West EIR/FSS* development and SWM plan with the refined critical discharge of 0.098 m^3/s to create the updated 'baseline' of acceptability; and

- Simulation #3 used the updated development plan and SWM plan presented in this EIR/FSS with the refined critical discharge of 0.098 m^3/s to identify the impacts of the proposed development to downstream erosion potential. Erosion control design criteria included:

  External lands:
  - Ponds 9A and 9B to provide 250m^3/imp ha of extended detention storage while controlling flows to approximately 0.01 m^3/s (75mm orifice with 0.7m head assumed), with detention times of 24 – 48 hours
  - Facility 9C to provide 250m^3/imp ha of extended detention storage while controlling flows to 0.005 m^3/s

Subject lands:

- Pond 9 to provide 346m^3/imp ha of extended detention storage while controlling flows to approximately 0.036 m^3/s (0.66 L/s/ha). This can be achieved with a 150mm orifice with 0.65m head and detention time of approximately 7 days. Smaller orifice sizes increase the detention time beyond 7 days.

Table 7.3 below shows the erosion threshold control volumes for each of the proposed SWM facilities in the ES6-East Subcatchment Area.

Table 7.3 – Erosion Control Volumes, Simulation #3

SWM Facility	Contributing Drainage Area (ha)	Erosion Control Volume (m^3)
Pond 9 – Sherborne/Eno	54.4	12,902
Pond 9A - Westerkirk	15.8	3,358
Pond 9B - Ashoe	13.5	2,869
Facility 9C - Dorham	1.8	383

Note: If only one SWM facility proceeds north of Burnhamthorpe Road, volumes for Ponds 9A and 9B and Facility 9C would be added together.

Table 7.3A presents modelling results for each scenario under pre development and ultimate post development conditions. A detailed summary of calculation methods for the four erosion indices considered is provided in Appendix E-4. Results indicate the following:

- Simulation 1: The first iteration of post- to pre-development erosion control completed by GHD for the ES6-West EIR/FSS (2015) utilized an erosion threshold of 0.040 m^3/s. The analysis indicated that the number of exceedances would increase by 21% and the time of exceedance would increase by 133%. Note that the cumulative effective discharge (CED) and effective work (ω_{eff}) erosion indices were not calculated previously, but were calculated in this replication exercise, for reference. The resulting change in CED and ω_{eff} is 50% and 51%, respectively;

- Simulation 2: For the simulations using the original rating curve and SWM assumptions with the updated erosion threshold (0.098 m^3/s), exceedance hours, CED, and ω_{eff} were all predicted to increase less than under the original modelling. The number of exceedances was predicted to increase by 33%, due to a predicted relative decrease in pre-development exceedance events. As such, the increases to long-term erosion potential indicated in the *Final ES6-West EIR/FSS* (2015) may not be as significant as

previously suggested. These results serve as an updated "baseline" level of acceptability for post-development flows;

- Simulation 3: In the simulation using the updated erosion threshold (0.098 m^3/s) and proposed current development and SWM Plan (2023), there is little difference between the post- to pre-development changes in CED and ω_{eff}, relative to the "new baseline". CED and ω_{eff} are predicted to increase by 36% and 35% under the proposed conditions, which closely matches the 34% increases seen under the "new baseline" (simulation 2). Additionally, there is a reduction in the post- to pre-development change in time of exceedances (48%) when comparing to the prior analyses, regardless of the threshold adopted. The updated modelling predicts a general equivalence in post-development erosion relative to the previously accepted results. As such, the relative changes in erosion indices are considered acceptable within the local context of this system and the erosion control criteria noted above are recommended.

Table 7.3A – Summary of Pre and Post Development Erosion Indices

Simulation		CED (m^3)	ω_{eff} (N/m^2)	t_{ex} (hrs)	# of Exceedances
Stantec/GHD (2015)	(PRE)	769625.10	4334.88	1626.50	354
Q_{crit}: 0.040 m^3/s	(POST)	1151451.72	6550.25	3793.00	429
"Original"	**Change (%)**	**49.61**	**51.11**	**133.20**	**21.19**
Stantec/GHD (2015)	(PRE)	552273.66	2703.45	914.50	235
Q_{crit}: 0.098 m^3/s	(POST)	740160.54	3623.14	1445.50	312
"New Baseline"	**Change (%)**	**34.02**	**34.02**	**58.06**	**32.77**
Proposed EIR/FSS (2023)	(PRE)	552273.66	2703.45	914.50	235
	(POST)	750499.02	3646.83	1349.00	347
Q_{crit}: 0.098 m^3/s	**Change (%)**	**35.89**	**34.90**	**47.51**	**47.66**

7.7 Conveyance of Minor Storm Flows

The Subject Lands will be serviced by a conventional storm sewer system designed in accordance with Town of Oakville standards. The storm sewers have been sized for the 5-year return frequency based on the Town of Oakville IDF parameters. Detailed storm sewer

drainage areas and storm trunk design sheets are included in **Appendix E-1**. **Drawing 7.8A** illustrates the storm sewer network and individual drainage areas to each manhole.

As shown on **Figure 7.7R**, with a few exceptions, all storm flows from the Subject Lands and external lands north of Burnhamthorpe Road will be directed to the proposed stormwater management ponds. On the Subject Lands, for most rear lots, 100-year flows will be captured in the RLCBs and conveyed to Pond 9 through storm sewers. All proposed RLCBs and associated grading will be designed to avoid surcharging, and to convey 100yr flows to ponds without spilling into adjacent lands.

The following areas do not drain to the proposed SWM facilities:

- Uncontrolled drainage from rear-yard areas of lots immediately east of Neyagawa Boulevard will be directed westerly into the Neyagawa Blvd right-of-way and into the Neyagawa Boulevard storm sewer;

- The southwest portion of the Sherborne Lodge lands is low due to the proposed road connection to Neyagawa Boulevard and therefore cannot drain by gravity to SWM Pond 9. Surface runoff from the 1.08ha in the southwest portion of the Subject Lands will drain to PSW 3 to provide surface water contributions to this wetland. This area will be drained by a separate storm sewer system provided with an oil/grit separator and end of pipe stone core wetland to provide quality control and scour protection. Uncontrolled runoff from this area (from a quantity control perspective only) supports the PSW 3 water balance.

- As a conservative measure, the future MTO transitway corridor at the north end of the subcatchment is assumed (in the modelling) to drain uncontrolled into the Neyagawa Boulevard catchment; however, it is expected that MTO will provide water quality and quantity control for this area.

Quantity and quality controls are proposed in SWM facilities 9A, 9B and 9C to manage the release rates on site to avoid large pipes downstream to convey uncontrolled post-development flows from multiple external lands to the SWM Pond 9 (that would introduce servicing conflicts) and to ensure no uncontrolled flows across Burnhamthorpe Road. The external drainage area from future development north of Burnhamthorpe Road will be captured in the subdivision sewers at two locations and conveyed through the storm sewer network to Pond 9. The proposed storm sewers in the FSS Study Area have been sized to accommodate the greater of the existing / “interim” Regional flow or the ultimate uncontrolled Regional flow from lands north of Burnhamthorpe Road (based on the GAWSER model). The inlets to the proposed storm sewer system along the north side of Burnhamthorpe Road are set at a suitable depth to allow for future pond connections. Based on the relatively small size of the external drainage areas and short time to peak, the existing 100-year peak flow based on the Rational Method is higher than the Regional Storm flow and other NOCSS targets. The size of the pipe connections for the external properties north of Burnhamthorpe Road will continue to be coordinated with the

Town and owners of lands north of Burnhamthorpe Road through their planning/engineering work in support of Draft Plan approval and through detailed design for the Subject Lands.

Drawing 7.8C illustrates the interim drainage scenario (development south of Burhamthorpe Road only) and **Drawing 7.8A** illustrates the ultimate drainage scenario (development north and south of Burnhamthorpe Road). The external flows in these scenarios were compared to determine the appropriate flow to be used for sizing the internal subdivision storm sewers as follows:

Outlet	Ultimate (Regional Storm flows based on GAWSER model) (m^3/s)	Existing / Interim (Regional Storm flows based on GAWSER model) m^3/s)	Flow used for internal storm sewer sizing (m^3/s)
Dorham	0.182	0.089	0.182
Westerkirk	1.51	1.571*	1.51
Ashoe	1.265		1.265

*Note – under interim conditions, the Westerkirk and Ashoe drainage) share a common outlet

A portion of Burnhamthorpe Road slopes towards Neyagawa Boulevard. It was confirmed that the proposed CBs on this portion of Burnhamthorpe Road have sufficient capacity to capture the 100-year (major system) flows into the minor system and direct them to Pond 9. This was confirmed using the Rational Method to estimate the 100-year flows and the Regional flows (from the GAWSER model), PCSWMM to calculate the flow depth above the ROW section, and the MTO capture curves to determine flow capture (based on depth and flow spread). The analysis is included in **Appendix E** and has confirmed that no major system flow will drain from Burnhamthorpe Road to Neyagawa Boulevard.

Hydrologic analyses were updated to reflect the proposed controlled and uncontrolled drainage areas. Section 7.13 outlines the assessment and results showing that total flows from the EIR subcatchment at the outlet of PSW 3 are maintained at or below the existing NOCSS targets for the 2-year to 100-year events. The Regional Storm assessment concluded that future Regional Storm flows are consistent with the approved Regional Storm allowable release rates based on the findings of the past approved downstream assessment (ES6-West EIR/FSS, 2015).

To facilitate service and utility crossings, a minimum of 1.5m cover will be provided in all cases. Gravity house connections will not be provided where the storm sewer is not sufficiently deep or where the storm sewer will be subject to elevated water levels during infrequent storms. In these locations, sump pumps will be provided within the residential units. In all such cases, the sump pump must lift the foundation drainage above the critical hydraulic gradeline to prevent water from backing up into the unit.

The proposed storm infrastructure (sewers and SWM Pond 9) have been designed to provide ample capacity to accommodate groundwater discharge from the future high density sites. With

respect to groundwater contributions to the sewers and pond, these flows and volumes are typically a small fraction of the 5-year design flows and overall SWM facility volumes. The storm sewer design will be finalized through the detailed subdivision design when additional groundwater flow information is available. Based on the capacity of the preliminary sewer design, there is ample capacity to accommodate groundwater flows. Similarly, SWM pond 9 has more than 1000m^3 of additional storage. It is unlikely that in a given hour, the groundwater discharge from sump pumps and permanent dewatering from future high-rise blocks will exceed this capacity.

7.8 Conveyance of Major System Flows

Continuous overland flow routes have been provided through the FSS Study Area in order to safely convey major system flows in excess of the minor system up to the 100-year event to Pond 9. The excess flows will be contained within the local and collector road right-of-ways to lands in the Town's ownership (pond block). Laneways are designed to be higher than the connecting right-of-ways to ensure that overland flow from local and collector roads are not conveyed through them.

All overland flow routes will be directed to Pond 9 located in the Subject Lands with the exception of the southwest corner of the property, which will discharge directly to PSW 3. There is a high point on Street A that prevents the major storm system on Neyagawa Blvd from flowing into the internal 100-year capture point. As such Neyagawa Blvd flows will not enter the clean water system. Additionally, drainage conveyed to Street M from Burnhamthorpe Road is directed through the adjacent Docasa development towards SWM Pond 19 within the UWMC Study Area. This drainage area has been accommodated in the adjacent SWM facility design.

The overland flow routes lead to the stormwater management block where they will spill into the pond at Street K and Street H as shown on **Drawing 7.8B**. Details of the overland spillways into the pond from Streets K & H will be provided at detailed design. Should the major system flow exceed the conveyance capacity of any given road, the storm sewer will be sized to accommodate the excess flows such that the road capacity is not exceeded (i.e., 100-year capture areas). **Drawing 7.8B-R** shows overland flow routes through the Subject Lands. Major system flow calculations have been prepared to show that the major system location with the most flow and highest constraints (i.e., narrowest, 17m ROW section / flattest slope) can contain the 100-year less 5-year flows; see Appendix E. All inlet sizing calculations at all 100-year capture points will be provided at detailed design. The need for additional capture (through dynamic dual-drainage analysis at detailed design) will be determined at detailed design; this may result in reduced major system flow depths.

For all classes of roads, the product of depth of water (m) at the gutter times the velocity of flow (m/s) shall not exceed 0.65m^2/s.

Surface runoff from drainage areas north of Burnhamthorpe Road, shown on **Figure 7.7R**, will all drain towards the capture locations / stubs which will be sized to accommodate the 100-year pre-development flow as per the NOCSS targets.

7.9 Drainage Area Modifications

The Subject Lands lie substantially within the ES6-East subcatchment. The grading work undertaken as part of this study was guided by the NOCSS recommendation to minimize changes to overall drainage areas where feasible. Consistent with the drainage area changes presented in the *Final Drainage Area Exchange Report* (January 2017), changes to drainage boundaries between some subcatchments are proposed for practical grading or implementation reasons. **Figure 7.9R** presents these changes along the EIR Subcatchment Area boundary with the adjacent West Morrison Creek and Shannon's Creek subcatchments. These drainage areas changes do not result in substantive changes to overall drainage areas to each subcatchment, and have no implications to the functions of natural features within the subcatchments. **Table 7.4** presents the +/- changes to the ES6-East drainage boundary. They are generally consistent with the magnitude of changes identified in the *Final Drainage Area Exchange Report* (January 2017).

Changes along the ES6-East and West Morrison Creek drainage boundary reflect changes approved as part of the *Upper West Morrison Creek EIR/FSS* (2022). Regarding the timing of development along this boundary (Eno Investments and Docasa), the Docasa lands have an approved site alteration plan and earthworks are proceeding this year. Drainage will be directed east as part of this earthworks program. As such, no ES6-East interim conditions model scenario is required with respect this drainage area exchange.

Changes along the ES6-East/Shannon's Creek subcatchment reflect modifications to the delineation of the PSW 8 wetland catchment boundary.

The *Final Drainage Area Exchange Report* (January 2017) did not include an area exchange between SM1 and ES6-East. That report was a compilation of drainage area exchange recommendations from various EIR/FSS studies prepared at that time. Information was not available at that time regarding potential drainage area exchange(s) between ES6-East and SM1. As part of this EIR/FSS, the grading and servicing plans include proposed changes to drainage boundaries between the ES6-East and SM1 subcatchments (with a net 1.76ha to ES6-East) to conform to the future transitway corridor drainage boundary / property limits.

The previous southern boundary of ES6-East was reviewed and refined to address Conservation Halton comments regarding the existing site topography. Boundary updates resulted in a minor drainage area exchange from East Sixteen Mile Creek ES7 to ES6-East in the post-development condition in the vicinity of the SWM Pond 9 where a small area becomes a part of this SWM pond. The impact of this drainage exchange is a minimal reduction of 0.09

ha from the PSW 4 drainage area (0.5% reduction from the PSW 4 pre-development drainage area) into the ES6-East subcatchment.

Table 7.4 summarizes all area exchanges and compares them to the DAE numbers where applicable. As a result of all drainage area exchanges, the net reduction in area to ES6-East is 1.23 ha, thus establishing the "post-exchange" subcatchment drainage area of 93.90 ha (pre-development 95.45 – 1.55 = 93.90 ha). Note that the 93.90 ha includes the future transit corridor, which discharges to Neyagawa Road, and therefore this area is not representative of the post-development area draining to Pond 9 (89.9 ha).

Table 7.4 – Summary of Drainage Area Changes

Adjacent Subcatchment	Drainage Area Into or Out of Subcatchment ES6-East (ha)			
	ES6-East EIR/FSS			DAE Report
	Into	Out of	Net Change	Net Change
West Morrison Creek (UWM1)	1.54+0.29=1.83	1.02+4.95=5.97	-4.14	-4.8
Shannon's Creek (SC1)	0.74	0	+0.74	+0.8
Sixteen Mile Creek (SM1)	0.79+1.31=2.10	0.34	+1.76	N/A
East Sixteen Mile Creek (ES7)	0.09	0	+0.09	N/A
All Subcatchments	**4.76**	**6.31**	**-1.55**	**N/A**

7.10 PSW Drainage

7.10.1 PSW 3

There is one provincially significant wetland (PSW 3) located within the EIR Subcatchment Area. This small wetland lies in the southwest corner of the Subject Lands, east of Neyagawa Boulevard, downstream of the existing farm pond, within Core 5. There are other PSWs located in Core 5, south of the Subject Lands, and south of and outside the EIR Subcatchment Area.

Requirements to address potential development impacts on PSWs, discussed with CH in the past during the completion of other EIR/FSS reports in North Oakville, established the goal, "*to maintain features and functions of the PSW (as per the PPS) in a manner that is feasible from ecological, engineering and economical perspectives*". This goal was identified to direct analyses, servicing solutions and mitigation strategies for development located within the subcatchments of PSWs. This EIR/FSS has assessed the existing PSW 3 hydrological, hydrogeological and ecological conditions, and identified specific drainage measures to direct

surface runoff to this area under post development conditions to ensure that its form and functions are not negatively impacted.

Existing Conditions

PSW 3 consists of a small, 0.48ha, reed-canary grass meadow marsh (MAM2-2) with minimal tree cover limited to red ash, and broad-leaved cattail and wool grass forming the remaining ground cover representation, and a 0.16ha monoculture patch of exotic and invasive Phragmites (European common reed) (MAM2). Reed-canary grass is a native species but is aggressive and readily outcompetes most other wetland species and also is considered invasive as a result. Overall, these wetland habitats have low plant species diversity, and these species impair habitat conditions for a broader range of native species. These ELC units are maintained in part by low permeability soils causing surface water ponding from intermittent surface runoff, and overflow from the farm pond during periods of high water (e.g., spring freshet) as a concrete weir regulates pond discharge (see discussion, below, regarding flow to the wetland).

PSW 3 viewing east from Neyagawa Boulevard

PSW 3 viewing east from middle of PSW toward Phragmites colony

PSW 3 viewing west towards PSW 3 from farm pond outlet

The majority of the Core 5 boundary between Neyagawa Boulevard and east of Sixth Line, including the limits of PSW 3, was staked surveyed in the field and approved by the Town and CH as input into the *Preserve Phase 1 EIR/FSS*. PSW 3 was surveyed in November 2007, and

the final agreed limits of the wetland as included on a drawing submitted to the agencies in February 2008 (Drawing A (Revised), February 15, 2008). This boundary, along with other portions of Core 5 was reproduced in the *Final Consolidated Preserve EIR/FSS* (May 31, 2017).

Drawing 7.10A-R illustrates the existing drainage area to PSW 3. **Table 7.5** lists contributing drainage areas to this wetland. At first glance, it appears that the majority of the EIR/FSS Subcatchment Area drains to PSW 3, i.e., approximately 90.2ha from Subcatchment ES6-East to the farm pond, plus an additional 3.66ha surrounding and including the PSW. Upon closer examination of the existing farm pond outlet structure and surrounding grades, it is apparent that the farm pond cannot drain continuously into PSW 3 and only discharges during "overflow" events via the existing weir structure. Therefore, the frequent / majority of surface runoff to PSW 3 is from the adjacent 3.66ha area, as opposed to the larger area draining to the farm pond. Field inspections by LGL and Burnside have confirmed that the existing farm pond does not drain freely to the PSW despite the presence of small twin culverts beneath the spillway. The culverts are blocked / difficult to find on site and ponding was noted downstream of the weir (there is a high point of around 172.20m between the pond outlet and PSW 3). **Table 7.10A** summarizes the frequent flow drainage areas to the PSW. As shown, 53% of its drainage area is located in Core 5 and will not be altered; 47% of its drainage area is located north of the PSW on developable lands.

Flows into and out of PSW 3 are monitored at stations SS1-SL and SS3-14 respectively (**Figure 4.2R**). SS1-SL is located just downstream of both the pond and observed field tile outlets. The only significant flows recorded during the period of review were noted during snowmelt and spring conditions, or in response to major rainfall events. Ponded water is typically observed seasonally during the spring, after which the feature dries out with occasional small pools of standing water observed in places. It is noted that the flows into the feature are generally higher than the flows out of the feature, suggesting loss of flow as it spreads through the wetland.

To investigate the shallow groundwater conditions in the feature, a piezometer nest was installed in a low area near the outlet (PZ2-WNs/d; **Figure 4.1R**). It was not possible to drive the piezometers more than 1.3m deep, suggesting that the soils are very tight or the bedrock is very shallow beneath this feature. Water level data in these piezometers showed a recharge gradient in the fall of 2011 suggesting recharge occurs in the wetland. It was noted that the groundwater levels took considerable time to stabilize in the deep drive point piezometer showing just how low the hydraulic conductivity is for soils in this area. Data show both piezometers fill up to surface during spring conditions when there is surface water in the PSW, and then groundwater levels decline during the dry summer months. These data indicate the potential for minor seasonal groundwater discharge in the spring and it is likely that the high water table and tight soils contribute to the ponding of surface water in the wetland feature during spring conditions. While the seasonal discharge gradients will help to support high water table conditions beneath the PSW, the overall wetland observations and monitoring data do not indicate actual groundwater discharge in the feature or groundwater contributions to baseflow

from the feature. The deeper piezometer often goes completely dry suggesting that the deeper pipe may be at or near the more transmissive zone at the top of the shale. The differences in the shallow groundwater level responses result in the observed gradient reversals. The groundwater elevation data from nearby DP20 (Figure C-4-16, **Appendix C-4**) on the north side of the feature suggest groundwater in the area flows southwards under the PSW.

It is concluded that the wetland is primarily sustained by precipitation and surface water runoff, as well as high underlying water table conditions. In addition to groundwater flow from the north, seasonal standing water in the PSW increases the availability of water for infiltration into the underlying sediments and gives the feature a seasonal recharge function that will also help to support the high water table.

Proposed Drainage to PSW 3

Based on the proposed grading and drainage plan (see **Drawing 7.10B-R**), approximately 3.30ha of the lands within the developable area will continue to drain to PSW 3 directly; this includes approximately 1.08ha of developed area from the southwest corner of the Subject Lands which will discharge directly into the NHS / towards PSW 3 via a 750mm storm sewer with an oil/grit separator. Due to the proposed elevation of the Pond 9 permanent pool, which was set to avoid large fill import and retaining walls on the Subject Lands, it is not possible to drain the controlled flows from Pond 9 into the wetland. Only flows from the 1.08ha developed area at the southwest corner of the Subject Lands will drain towards the wetland.

For this 1.08ha area, the 750mm storm sewer will discharge into the wetland via a stone core pocket wetland located between the pipe outlet and PSW 3 to provide a treatment train that complements the stormwater management plan. Benefits of the stone core wetland will include organic inputs, temperature regulation, polishing, energy dissipation, and dispersion of flows. Additionally, the stone core wetland will provide opportunities for infiltration, evapotranspiration, and detention by retaining flows, and also will provide habitat enhancement and diversity in the vicinity of PSW 3. The stone core wetland will occupy the outer 20m of the PSW 30m buffer to direct flows into PSW 3. This area of the buffer currently is thicket. The conceptual stone core wetland design is shown on **Drawings GEO-3** and **DET-3** and **Drawing 7.11A**, the Preliminary Grading Plan.

The pocket wetland will be constructed as an over-excavated depression at the outfall, and lined with a mix of soil and granular materials to provide both depressional and subsurface storage (within the interstitial space of the sediment and soil). Filtration is provided as a result of flow through the soil medium between the pocket wetland, and receiving PSW 3. The short-term water retention function of the pocket wetland will help to polish the water and moderate the discharge and velocity of water into PSW 3. The pocket wetland should be designed to be stable under the range of predicted flow conditions. As such, the substrate within the stone core wetland will be hydraulically sized during detailed design to limit entrainment. A layer of topsoil will also be installed on top of the stone core to improve vegetation establishment.

An aggressive landscape restoration plan is proposed around the outlet features to provide shading. This planting plan also will reduce erosion potential. Live staking around the periphery will provide thermal mitigation through shade and also will provide a source of coarse organic matter. The incorporation of a native seed mix within the wetland will also promote polishing of flows once the vegetation has established. Details of the restoration plan will be prepared at detailed design.

As shown on **Drawing 7.12R**, Pond 9 will drain directly to the Neyagawa Boulevard ditch, bypassing PSW 3. As described in the following discussion, future flows from the proposed post-development area of 3.30ha will be sufficient to maintain the frequent flows to the feature.

Table 7.6 summarizes proposed frequent drainage areas to PSW 3.

Table 7.5 – Existing Drainage Area to PSW 3*

(refer to Drawing 7.10A)

Outside Core 5 Limits					Inside Core 5 Limits				Total
	Area ID	Area [ha]	Runoff Coeff.	Description	Area ID	Area [ha]	Runoff Coeff.	Description	
	3A	1.23	0.20	Area north of PSW	3C	0.29	0.20	Area north of PSW	
	3B	0.49	0.20	Area north of PSW	3D	0.26	0.20	Area north of PSW	
					3E	0.41	0.20	PSW 3	
					3F	0.78	0.20	Woodlot/field south of PSW	
					3G	0.2	0.20	Area of field southeast of PSW	
Total Area		**1.72**	**0.20**			**1.94**	**0.20**		**3.66**
Total AxC			**0.34**				**0.39**		**0.73**

*Excluding existing farm pond that discharges flow to PSW 3 infrequently

Table 7.6 – Proposed Drainage Area to PSW 3*

(refer to Drawing 7.10B)

Outside Core 5 Limits					Inside Core 5 Limits				Total
	Area ID	Area [ha]	Runoff Coeff.	Description	Area ID	Area [ha]	Runoff Coeff.	Description	
	3A	0.52	0.7	Developed area to PSW via storm sewer	3C	0.27	0.20	Area north of PSW	
	3B	0.56	0.5	Rear yards north of PSW	3D	0.33	0.20	Area north of PSW; slight increase in area to PSW as result of Pond 9 pond grading	
					3E	0.42	0.20	PSW 3	
					3F	0.81	0.20	Woodlot/field south of PSW; slight increase due to proposed Pond 9 berm grading	
					3G	0.39	0.20	Area of field southeast of PSW; increase due to proposed Pond 9 berm grading	
Total Area		**1.08**	**0.63**			**2.22**	**0.20**		**3.30**
Total AxC			**0.66**				**0.44**		**1.10**

*Excluding infrequent discharge of flows from Pond 9

For consistency with the erosion analysis, the proposed PSW 3 wetland drainage management strategy has been evaluated using the QUALHYMO model (adjusted to include only the lands draining to PSW 3 for pre- and post-development conditions). The QUALHYMO model files specific to PSW 3 are included in Appendix E-3.

The original / approved Stantec QUALHYMO model included a rating curve (storage / discharge) to represent the existing farm pond. Since the development of this rating curve was not described in the accompanying studies, the rating curve was verified against the actual topographic survey to confirm its' applicability. This included the review of the Stantec QUALHYMO model rating curve, a topographic analysis of the farm pond, and pond outlet calculations. Appendix E-3 includes the Stantec rating pond outlet curve, storage calculations above the pond weir, and outflow calculations based on various methodologies. These assessments concluded that:

- the Stantec pond rating curve is a reasonable representation of the farm pond storage and outlet characteristics;

- Based on the topographic review, the volumes in the rating curve are consistent with the volumes above the spillway. For the purposes of this EIR/FSS assessment, further detail was provided to the storage – discharge curve through interpolation;

- Storage volumes were also roughly confirmed by multiplying the surface area of the pond above 172.20m by various depth increments – this yielded similar volumes as represented in the Stantec rating curve; and

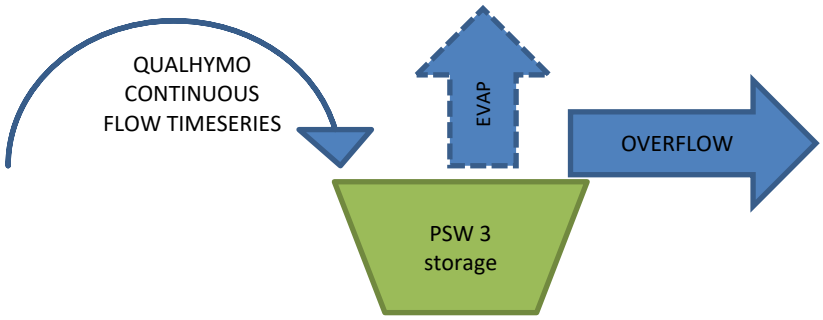
- The source of the flow data in Stantec's model was not clearly defined, however, it appears that the flow vs depth relationship in the rating curve follows the same relationship that a weir equation would. This is a reasonable conclusion, given that the functional outlet for the farm pond is the concrete spillway. Graphical presentation of the calculations (see Appendix E-3) indicate that the weir equation is clearly the "best fit" to the rating curve flows compared to other potential ways the discharge may have been calculated (i.e. orifice equation, Manning's equation, or some linear approximation).

As a result, the original QUALHMYO rating curve has been used in the updated hydrologic assessments of the farm pond.

PCSWMM Model

Since QUALHYMO does not simulate evaporation from the surface of the wetland, the pre- and post-development flow time series results from QUALHYHMO were used as input to a simplified PCSWMM model as shown in the schematic below. This approach simulates the pre- and post-development inflow and outflow (evaporation and overflow) from the "storage" component of the

wetland, and allows extraction of the resulting pre- and post-development wetland depths for comparison.



The following conditions are reflected in the model analyses.

Pre-Development Conditions

- Approximately 90.2ha drain into the farm pond.
- Additional / smaller areas contribute flow to PSW 3 downstream of the pond (i.e., portions of Core 5, PSW 3 area itself, etc.) totalling 3.66ha as per **Table 7.5.**
- QUALHYMO parameters, areas, and farm pond rating curve are consistent with previous GAWSER and QUALHYMO analysis (Stantec) for the ES6 catchment.
- For the purpose of establishing daily / monthly average water levels for the wetland water balance analysis, a nominal depth of 0.30m was assigned to the PSW 3 area to develop a storage rating curve.
- No infiltration from the bottom of the storage area was assumed.
- Based on the approved rating curve, the existing farm pond has approximately 14,580m^3 of active storage.
- Pond will overflow into the wetland when water levels exceed the spillway elevation. The spillway elevation (on the downstream side) is 172.20m.
- Consistent with field observations, the pond does not drain freely from the existing twin culverts beneath the weir.

Post Development Conditions

- Under proposed conditions, approximately 85.5ha drains into future Pond 9.
- Additional / smaller areas contribute flows directly to PSW 3 downstream of the pond (i.e., portions of Core 5, PSW 3 area itself, etc.) totalling 3.30ha as per **Table 7.6**.
- QUALHYMO parameters, areas, and Ponds 9A to 9C and Pond 9 pond rating curves are consistent with the proposed GAWSER and QUALHYMO analysis for the ES6 catchment.
- The catchment is mostly urbanized resulting in higher runoff coefficient/ imperviousness.
- External SWM facilities (9A, 9B, and 9C or combinations thereof) are included in model.

- Pond 9 does not drain to PSW 3 aside from overflow during emergency events (which do not occur in the continuous climate record and was not simulated in QUALHYMO).
- A small portion of the site (1.08ha) and a portion of the NHS drain to PSW 3.

Model Description and Results

- Similar to the erosion analysis, the QUALHYMO data set (hourly rainfall and temperature from 1986 to 1992) was used to generate inflows into the wetland area (30 minute interval). This was used in "simplified" models representing the PSW 3 drainage area only (under both pre- and post-development scenarios), as opposed to the complete model which terminates downstream of SMA-4.
- The existing and proposed model included the "wet" / depressed area of PSW 3 which can store water, which is measured as approximately 2,000m^2 based on the available survey information. The maximum depth of the storage area was assumed to be 0.3m. The bottom contour of the ponding area was assumed to be 1,000m^2. The total surface ponding volume of the feature is therefore the average of 1,000m^2 and 2,000m^2 multiplied by 0.3m depth = 450m^3. While this volume may overestimate the actual storage in PSW 3, it was confirmed that the model results are not overly sensitive to the PSW 3 storage area volume since it typically overflows / remains full for the critical growing season (i.e., there is enough runoff volume in both pre- and post-development conditions to fill a range of storage volumes).
- Above 0.3m depth, the wetland storage component will spill to downstream.
- The PSW 3 depression area was modelled in PCSWMM as a storage node to properly simulate evaporation and to enable reporting of continuous depth and volume results. This is not possible in QUALHYMO.
- A shallow weir of sufficient length was used to simulate the unrestricted discharge of flows that overtop the storage area during higher flow events (or when the PSW 3 storage area is already full).
- As **Graph 7.10** illustrates PSW 3 daily "average" monthly water levels for the year under both pre- and post-development conditions. This was based on the average of all January dates, the average of all February dates, etc. While this approach does not show the variation of water levels between different years, it shows the average water levels for each month of any given year. The following observations are made from these data:

    - The average pre- and post-development water levels approach the maximum possible water level of 0.30m, with the exception of summer months in which evaporation / drier periods result in a slight decrease (down to approximately 0.25m depth in proposed conditions);
    - The pre-development minimum and maximum monthly results are also shown on **Graph 7.10** to demonstrate that the post-development conditions results fall within the range of natural variability, particularly during the growing season;

- The average proposed conditions water levels show that the wetland does not completely dry out in the summer months. This is due to the hard surfaces that contribute to the wetland whenever it rains, as opposed to the existing conditions areas which have more infiltration/less runoff during small rainfall events;
- The average water levels under pre- and post-development conditions are generally within 0.05m of each other; and
- Daily water level results are available in **Appendix E-3**.

- **Table 7.6**A summarizes the monthly water levels (average, minimum, maximum) and the PSW 3 volumes.

Table 7.6A – Monthly PSW 3 Water Levels

Parameters	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Existing Avg Depth (m)	0.30	0.30	0.30	0.29	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.30
Existing Max Depth (m)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Existing Min Depth (m)	0.29	0.28	0.28	0.27	0.22	0.23	0.18	0.22	0.24	0.26	0.28	0.23
Existing Volume (m^3)	436	433	431	428	415	410	401	416	420	429	433	433
Proposed Avg Depth (m)	0.28	0.30	0.29	0.29	0.27	0.24	0.25	0.27	0.27	0.29	0.29	0.27
Proposed Max Depth (m)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Proposed Min Depth (m)	0.12	0.28	0.27	0.26	0.19	0.13	0.08	0.21	0.20	0.26	0.28	0.04
Proposed Volume (m^3)	409	432	428	423	387	353	357	398	394	426	430	392

The predicted ponding is similar to the existing average daily water level conditions during the all months. Under post-development conditions, results fall within the range of natural variability, particularly during the growing season.

As described above, PSW 3 is maintained by surface runoff, primarily from the immediate surrounding area, precipitation, and the high underlying water table. It comprises two wetland ecosites: MAM2-2 dominated by reed canary grass; and, a MAM2 monoculture of exotic/highly invasive Phragmites. The species present are extremely tolerant to fluctuations in moisture conditions as reed canary grass has a wetness coefficient of -1 (-1 to 1 coefficients are equally likely to occur in wetland or non-wetlands).

The predicted changes to water levels and volumes will not result in negative impacts to wetland. Wetland conditions will persist post-development. Further, the outfall design from the 1.08ha southwest drainage area may provide additional habitat opportunities.

Thus, the goal as stated at the beginning of this section, *to maintain features and functions of the PSW (as per the PPS)*, will be met by the proposed design, as described above. Based on

the foregoing model results and area comparison, as well as the hydrogeological and ecological interpretations of the existing and post-development conditions, it can be concluded that the proposed development, with the proposed mitigation, will not result in negative impacts to the features and functions of PSW 3.

Efforts have been made through the EIR/FSS work to balance the uncontrolled discharge to PSW 3 to maintain the water balance while ensuring that the majority of the study area is routed through and controlled by Pond 9 to ensure adequate quality, erosion and quantity control is provided in order to meet downstream. It is not recommended to direct more uncontrolled drainage to PSW 3 as it may result in exceedances of quantity and erosion control targets. As noted in the discussion regarding outlet options, the Pond 9 outlet is too deep to discharge to PSW 3.

Graph 7.10 - Proposed Average PSW 3 Water Levels vs. Existing Average, Minimum and Maximum PSW 3 Water Levels

7.10.2 PSWs 4, 7 and 8

PSWs 4, 7 and 8 are located outside of the ES6-East subcatchment in adjacent subcatchments to the south and east. The contributing surface drainage areas to these PSWs are partially delineated by the location of portions of the ES6-East subcatchment boundary. The pre- and post-development surface drainage catchment areas to each PSW have been assessed to identify if there are any potential changes to drainage to these PSWs in the future.

PSW 4 and 7

PSWs 4 and 7 are contiguous and are located within Core 5 along stream Reach SMA-5 in the Sixteen Mile Creek ES7 subcatchment to the south of the Subject Lands. Drainage through PSW 7 flows into PSW 4. As part of this EIR/FSS, the drainage boundaries to each PSW 4 and 7 have been established based on topographic interpretation. **Figure 7.1R** illustrates the pre-development drainage boundaries. As shown, the drainage areas to these wetlands lie entirely within Core 5.

Figure 7.7R illustrates post-development drainage areas. Under post-development conditions, the only proposed change in the PSW 4 catchment is a small area of grading within the Pond 9 SWM block that will direct drainage from 0.09ha to the pond, not southerly. No other changes will occur along the ES6-East /ES7 catchment boundary. As a result, a small reduction in PSW 4 drainage area will result from the construction of SWM Pond 9 (0.09 ha or ~0.5%); see **Table 7.6B**. This reduction is not expected to negatively impact PSW 4 as the change in area is very small and along the drainage boundary.

Table 7.6B – PSW 4 and 7 Pre and Post Development Drainage Areas

Location	Pre Development Area (ha)	Post Development Area (ha)
Point A upstream end of PSW 7	**3.83**	**3.83**
Point B downstream end of PSW7 and upstream end PSW 4	**13.98**	**13.89**
Point C downstream end of PSW 4	**17.81**	**17.72**

PSW 8

PSW 8 is located to the immediate east of the Subject Lands on the Preserve North Lands within the Shannon's Creek subcatchment. Due to the proximity of PSW 8 boundary to the Subject Lands, the EIR team inventoried this wetland in June and September 2022 and assessed potential implications of the proposed drainage plan to PSW 8.

Spatial/digital data was obtained from Land Information Ontario and attribute data was provided by MNRF (Steve Varga) October 14, 2022. PSW 8 includes a dug pond at its downstream end surrounded by cattail, willow, and abundant reed canary grass, as well as a swamp community further upstream within a wooded area dominated by bur oak with Freeman's maple with an understorey of fowl mannagrass, necklace sedge, and bladder sedge. The western portion of PSW 8 was reviewed with CH in the field on October 13, 2022. The MNRF (LIO) mapping of PSW 8 boundaries is reflected on EIR/FSS drawings.

The approved Preserve North EIR/FSS (2022) addressed the wetland water balance to PSW 8. It reported the PSW catchment area to be ~5.06 ha, comprising woodland and agricultural land within the NHS and future development area north of Core 5 on the Preserve North and Eno Investment Inc. lands. **Figure 8.2A** from the Preserve North EIR/FSS, provided in Appendix B-4, illustrates the PSW 8 drainage catchment.

The contributing drainage to PSW 8 is relatively small, and is located largely on the Preserve Lands. One area on the Eno Investment lands drains to PSW 8. **Drawing 7.10C** illustrates PSW 8 and its drainage area. This boundary was determined based on the review of past studies, field observations as well as detailed review of topographic mapping. The boundary shown on **Drawing 7.10C** is generally consistent with the PSW 8 catchment boundary shown in previous studies. Small deviations were noted in select areas. The western boundary of the catchment generally follows the west edge of the woodland although some small areas drain out of the woods. Drainage from a small area to the west of the woodland (dashed lines on **Drawing 7.10C**) drains internally to a low point in the agricultural field and/or flows southerly along the woodland edge in the farmed field. Evidence of surficial ponding in the agricultural field was observed in the field and is visible on historic airphotos. The drainage area to PSW 8 is 5.03 ha.

Water balance analyses for PSW 8 (and several other PSWs), were approved through the approved *Preserve Phase 1 EIR/FSS* (November 2011) and documented in the approved *Final Consolidated Preserve EIR/FSS* (May 2017). The approved water balance included an assessment of existing drainage areas to the wetlands and hydrologic modelling of average annual and monthly runoff volumes to each PSW for existing and future development conditions to confirm the proposed storm drainage concepts manage surface water sources to each PSW to maintain their functions. The approved *Preserve North EIR/FSS (2022)* refined the wetland water balance based on the Preserve North draft plan, SWM Plan and drainage area exchange between Shannon's Creek and ES6-East subcatchments. The SWM Plan for this catchment, illustrated on **Figure 7.1** and explained in Table 7.4 from the *Preserve North EIR/FSS* (included in Appendix B-4), includes:

- Directing drainage from 0.99 ha of the Preserve North development into Core 5 towards PSW 8. This will be accomplished through capturing drainage from the west portion of the Preserve North site and conveying it to an OGS (oil grit separator). The OGS will discharge to a level flow spreader on the west side of the road crossing of the core on

the Preserve North lands where existing topography will direct drainage towards PSW 8; and

- Directing drainage from approximately 15% (0.78 ha) of the wetland drainage area located north of Core 5 on the Eno Investment lands to future Pond 9.

Consistent with the past approved EIR/FSSs, this *ES6-East EIR/FSS* directs drainage from the small portion of the developing portion of the PSW 8 catchment on the Eno Investment lands to Pond 9. Based on the refined drainage area boundary delineation, this area is 0.74ha.

Figure 7.12R also shows the PSW 8 boundary, a 30m buffer from the wetland and the PSW drainage area catchment relative to the Core 5 boundary, and proposed SWM Pond 9 located partially in Core 5. As shown, no development or pond construction is proposed within the catchment area or 30m buffer to PSW 8.

Based on this review of past studies, the PSW 8 drainage area boundary and the approved post- development changes in the PSW catchment on the Subject Lands, no changes to the approved wetland water balance are warranted. The ES6-East SWM Plan (directing all drainage from the developing portion of the Eno Investments lands within the PSW 8 catchment to Pond 9) is consistent with the approved PSW 8 wetland water balance, and there is no development or grading proposed on the Subject Lands in the core in the western portion of the PSW 8 catchment area.

7.11 Preliminary Grading Plans

A Conceptual Grading Plan (**Drawing 7.11A-R**) was prepared for the FSS Study Area. **Drawings 7.11B-R** to **7.11F-R** illustrate key grading cross-sections through the Subject Lands. The preliminary design demonstrates compatibility with adjacent developments and provides overland flow routes that convey major system drainage towards the proposed stormwater management pond or to storm sewer capture points. At detailed design, additional lot grading details will be provided in accordance with Town standards that will meet criteria related to maximum slopes, ponding, and providing emergency spill routes.

This plan took into consideration the requirements for major and minor storm drainage, sanitary sewers, and boundary grading constraints including adjacent roads and the Core 5 NHS. The grading design has been coordinated with the adjacent developments. Retaining walls or non-standard grading are not required for the Subject Lands. These lands require fill to provide sufficient cover on infrastructure. This occurs because the proposed storm outlet (ditch along east side of Neyagawa Boulevard) is relatively shallow, which results a high normal water level in SWM Pond 9 and corresponding storm sewer depths / raised grades throughout the Subject Lands.

The objective for grading along the core boundary has been to match existing grades to minimize impacts to the core area in accordance with NOCSS grading objectives. This has been achieved for areas along the south limit of the SWM Pond within the Sherborne Lodge property, however an increase in the existing elevations along the core limits north of PSW 3 is required. This is driven by the difference in elevation across the proposed lots south of Street A abutting the core boundary. The elevation of Street A is set by the elevation of Neyagawa Boulevard, and minimum cover requirements over the storm sewers directed to SWM Pond 9 and PSW 3. The resulting elevation difference across these lots cannot be completely absorbed within the lots.

Sections 1 to 4, shown on **Drawing 7.11F-R**, show proposed grades at the core boundary. The core boundary elevation shown in Section 1 is set by a maximum trail grade of 5% which is a requirement of the AODA standards. Lots adjacent to the walkway are proposed to be graded as walkout units to minimize any grade transition into the core area. Sections 2 to 4 show proposed grading for a walkout lot type, and the corresponding grading for a "Typical Lot Grade" to demonstrate the elevation difference at the core boundary, and the reduction in grade raise that occurs as a result of implementing walkout lots along this boundary.

The NOCSS requires that grade transition at core boundaries be shared between the lots and core. Along the north side of PSW 3, to manage the grade difference from Street A to the core, the elevation difference is split between the core and lot by the use of sloping in the core and walkout lot types on the developable area.

Grading for Pond 9 in the core, shown on **Drawing 7.12-R**, is confined to a portion of the area set out as the allowable pond area in the August 13, 2007 Minutes of Settlement. The eastern portion of the allowable pond area is not currently shown as part of Pond 9, however, this area may be used if changes are needed to Pond 9 design at detailed design.

Drawing 7.11A-R shows conceptual grading for areas of the EIR Subcatchment Area outside of FSS Study area.

7.12 SWM Pond Operating Characteristics

7.12.1 Contributing Drainage Areas and Imperviousness

The contributing drainage area to each SWM facility is illustrated on **Figure 7.7R**.

The impervious coverage for each drainage area has been estimated based on the various land uses and their respective areas in the current plan. The imperviousness values in **Table 7.7R** were assigned to various future land uses in the EIR Subcatchment Area.

Table 7.7 - Land Use Imperviousness

Land Use	%IMP	Source
Burnhamthorpe Road	90%	Conservative value (measured %IMP from EA drawings is only ~75%)
Residential Singles	65%	Values consistent with other North Oakville studies
Townhouses	80%	
Back to Back and Street Townhouses		
Live/ work	100%	
Apartments and High Density	90%	Town Standards
Commercial	85%	
Future Development	100%	
Elementary School	70%	Suggested by agencies
17m ROW (Sherborne)	70%	Measured from ROW cross-section (hard surfaces vs. landscaped areas)
19m ROW (Sherborne)	64%	
22m ROW (Sherborne)	73%	
7.5m ROW (Eno)	100%	
17m ROW (Eno)	70%	
22m ROW (Sherborne)	73%	
Parks, Village Square, Open Space and Servicing	20%	Assumed level of hard surfaces within parks / open space blocks
Pond Block	100%	The Town requested a conservative value of 100% be used for the pond block due to the need of a pond liner. It is Urbantech's opinion that this value is excessively high and that 50% may be a better approximation since a liner will not be needed for the full SWM block. However, as requested, the conservative value of 100% was used in the analysis. This may be refined at detailed design once the extent of the liner is determined.
NHS	0%	

The runoff values and imperviousness noted in the preceding table and in the calculations / models are based on the current Oakville Standards or measured values (in the case of the proposed ROW sections), and are consistent with values used elsewhere in Oakville. Detailed design will be based on the runoff coefficients and imperviousness values outlined in this report.

To confirm that the Regional Storm control and erosion control recommendations from the *Final ES6-West EIR/FSS* remain applicable, the currently proposed subcatchment drainage areas and imperviousness values were identified for the lands north and south of Burnhamthorpe Road and compared to those used in the ES6-West EIR/FSS analyses. The imperviousness values noted in **Table 7.7** were applied to the proposed Sherborne Lodge and Eno Investments Draft Plans of Subdivision and the general land use types north of Burnhamthorpe Road. **Table 7.8** presents the comparison.

Supporting calculations for the ROW and other composite imperviousness values are included in **Appendix E**.

As shown in **Table 7.8**:

- The total area modelled in the EIR/FSS analysis is 89.9ha with an overall imperviousness is 71.62%, for a total impervious area of 64.39ha; and,

- The total area modelled in the previous Stantec analysis is 88.50ha based on the available drainage area information at the time of their analysis. The corresponding overall imperviousness was 66.5%, for a total impervious area of 58.9ha.

Stantec's model assumed a slightly smaller drainage area and imperviousness compared to the current EIR/FSS drainage plan and Draft Plan land use. As a result of these changes, the GAWSER model was updated to assess/confirm that the proposed SWM Plan satisfies SWM design criteria. This included the identification of future peak flows downstream to ensure previously downstream assessment of Regional Storm flood levels (based on the Stantec area / imperviousness) would not be impacted.

Table 7.8 – Weighted Imperviousness Based on Proposed Draft Plans of Subdivision and General Land Uses North of Burnhamthorpe Road

Land Use	Area	%Imperv.	Area	%Imperv.
	Current EIR/FSS		Stantec (2015)	
External Road				
Burnhamthorpe Road	3.43	90		
Subject Lands				
Residential Singles	11.94	65	**60.8** (Catchment 204)	**60**
Townhouses	1.76	80		
Back to Back and Street Townhouses	6.21	80		
Live/ Work	0.40	100		
Apartments and High Density	3.76	90		
Commercial	1.01	85		
Future Development	1.51	100		
Elementary School	2.44	70		
17m ROW (Sherborne)	2.08	70		
19m ROW (Sherborne)	0.63	64		
22m ROW (Sherborne)	0.62	73		
7.5m ROW (Eno)	0.34	100		
17m ROW (Eno)	5.44	70		
22m ROW (Sherborne)	2.51	73		
Parks, Village Square, Open Space & Servicing Block	4.26	20		
Weighted Total Subject Lands into Pond 9	**48.30**	**70.81**		
Rear Yard Area to Pond 9	0.50	47		
Pond 9 Block	3.10	100		
NHS South of Pond 9	2.50	0		
Weighted Total Subject Lands Out of Pond 9	**54.4**	**68.57**		
Uncontrolled Area (3A+3B=1.08ha@58.5% IMP)+PSW 3 (3C+D+E+F+G=2.22ha)	3.30	19.7		
NHS	1.1	0		
Total Subject Lands at Outlet to Neyagawa Boulevard	**58.8**	**64.55**		
Lands North of Burnhamthorpe Road				
External 1 (Dorham Holdings)	1.8	85	16.5 (Catchment 100)	85
External 2 (Westerkirk)	15.8	85		
External 3 (Ashoe High Speed)	13.5	85	11.2 (Catchment (203)	80
Weighted Total External	**31.1**	**5**	**27.7** (ADDHYD 8204)	**83**
Weighted Total Subject Lands at Outlet to Neyagawa Boulevard	**89.90**	**71.62**	**88.50** (ADDHYD 8205)	**66.5**
Total Impervious Area (ha)	**64.39**		**58.9**	

7.12.2 SWM Pond 9 Location

Pond 9 is located in the southern portion of the Subject Lands near the existing surface water outlet from the EIR Subcatchment Area in a location generally consistent with the NOCSS partially within Core 5. The pond extends westerly partially through the location of the Sherborne Lodge farm pond towards the subcatchment outlet location. **Drawing 7.12R** illustrates the pond location and design.

Several water resources related agreements were made between the Town, Conservation Halton and the Landowners during Ontario Municipal Board hearing mediation discussions. Minutes of Settlement were entered into between the Town, Conservation Halton, Region of Halton and the Landowners. The Eno Investments lands are bound by Minutes of Settlement (MOS) dated August 13, 2007 between Eno Investments, the Town of Oakville and Conservation Halton. The Minutes of Settlement outline agreements with respect to proposed development on the Subject Lands including the location of SWM Pond 9 to be located partially within Core 5. The relevant sections of the Minutes of Settlement (MOS) that are pertinent to this EIR/FSS include:

> "2. The Town and Conservation Halton agree that a Stormwater Management Pond including any grading and associated disturbance ("SWMP") will be permitted to encroach into Core 5 in the location generally shown as Pond 9 on Schedule C to the minutes of Settlement between the Parties hereto and others dated August 13, 2007, to which these Minutes of Settlement are attached as a Schedule (the "Comprehensive Minutes of Settlement"), only on the following basis:
>
> (a) The southerly limit of the SWMP can be no closer to the southerly limit of Core 5 than 250 metres;
>
> (b) The encroachment may not extend into any area which is within 10 metres of the dripline of the wooded areas; and,
>
> (c) A financial contribution is received by the Town of an amount equal to $10 per square metre for each square metre which the SWMP encroaches into Core 5. This contribution shall be used to assist in the establishment of a wooded area in Core 5, south of the proposed pond in the area which is currently open country. The payment will be indexed in accordance with the financial index established in the Comprehensive Minutes of Settlement to which these Minutes are attached as a Schedule."

SWM Pond 9 presented on **Drawing 7.12R** conforms to NOCSS, the Town's Master Plan and all MOS requirements. **Table 7.9** provides conformity discussion regarding each of the above MOS requirements.

Table 7.9 – Pond 9 Conformity with OMB Minutes of Settlement

OMB Minutes of Settlement Requirements (Clause 2, Eno MOS dated August 13, 2007)	Pond 9 EIR/FSS Design Conformity
2. The Town and Conservation Halton agree that a Stormwater Management Pond including any grading and associated disturbance ("SWMP") will be permitted to encroach into Core 5 in the location generally shown as Pond 9 on Schedule C to the Minutes of Settlement between the parties hereto and others dated August 13, 2007, to which these Minutes of Settlement are attached as a Schedule (the "Comprehensive Minutes of Settlement"), only on the following basis:	
(d) The southerly limit of the SWMP can be no closer to the southerly limit of Core 5 than 250 metres;	The approved Core 5 drawing (Stantec, 2011) includes the 250m line from the southerly limit of Core 5; see Appendix B-1. This line, along with the 10m from driplines adjacent to the open agricultural area in the core, is noted to be the, "Allowable SWM Pond Block in Core". This area is shown on **Drawing 3.2** (excerpt from the approved Core 5 drawing) and on **Drawing 7.12R** (SWM Pond 9 grading plan). **Drawing 7.12R** shows that the pond grading does not extend beyond the allowable pond area. While not a MOS requirement, Pond 9 grading does not extend outside of the ES6-East Subcatchment Area, as shown on **Drawing 7.12R**.
(e) The encroachment may not extend into any area which is within 10 metres of the dripline of the wooded areas, and	The Pond 9 design does not encroach into any area within 10m of the dripline of the wooded areas adjacent to the open agricultural area in the core. **Drawing 7.12R** illustrates 10m from the staked and surveyed dripline and the extent of pond grading.
(f) A financial contribution is received by the Town of an amount equal to $10 per square metre for each square metre which the SWMP encroaches into Core 5. This contribution shall be used to assist in the establishment of a wooded area in Core 5, south of the proposed pond in the area which is currently open country. The payment will be indexed in accordance with the financial index established in the Comprehensive Minutes of Settlement to which these Minutes are attached as a Schedule."	The "Allowable SWM Pond Block" in Core 5 including any grading and associated disturbance as noted in Clause 2, and the corresponding financial contribution to the Town will be identified based on the detailed design of Pond 9.

7.12.3 SWM Pond 9 Outlet Options

During the preliminary design of the proposed SWM Pond 9, alternative outfall locations were identified and evaluated. On June 21, 2019, a submission was made and discussed at a NOARM meeting with the Town and Conservation Halton regarding the preferred Pond 9 outlet location. The submission identified three alternative outlet locations that were evaluated based on the following criteria:

- Sufficient depth to service the Subject Lands and accommodate external drainage from lands north of Burnhamthorpe Road by gravity drainage;
- Minimize amount of fill required on tablelands;
- Minimize the need for, extent of and size of retaining walls;
- Accommodate PSW 3 water balance requirements; and,
- Minimize impacts to Core 5, specifically PSW 3 and woodland.

The three pond outfall locations (Options 1, 2 and 3) are shown on **Figure 7.12R** and their evaluations are presented in the June 21, 2019 submission provided in **Appendix B-2**.

The June 2019 submission concluded that Option 1 was not preferred due to the reduction in PSW area and potential additional impact to remaining wetland area and adjacent woodland. Option 3 was not preferred due to the length of the required outfall channel, the greatest environmental impact to the Core 5 features/woodland, the largest, most diverse core tableland woodland outside of the Sixteen Mile Creek system; and, loss of flow in Stream Reach SMA-6/PSW 2. Option 2 was preferred for the following reasons:

- the Neyagawa Boulevard ditch is the current outfall for surface flows from the 93.6ha EIR Subcatchment Area;
- the piped outfall design minimizes potential impacts to PSW 3 and has no impacts to Core 5 woodland;
- this option eliminates excessive fill required to properly drain and service the site, and eliminates the need for retaining walls along Neyagawa Boulevard;
- this option has the shortest outfall length and easiest access to maintain;
- the maintenance access can be used as a trail, reducing additional impacts to Core 5; and,
- preliminary engineering design confirms that grading requirements associated with Core features (woodland, wetland), and MOS are met.

These options were again discussed at the November 24, 2020 NOARM meeting. At that time, Conservation Halton inquired about two other potential outfall location alignments shown on **Figure 7.12R** as Options 4 and 5. Discussion regarding each of these additional options eliminated them from further review based on:

- Option 4: Approximately 265m of this outfall is aligned through the Core 5 forest, causing a significant negative impact to the core woodland. The degree of disturbance

to this forest is not supported ecologically. Further, flow to portions of reach SMA-6/PSW 2 would be reduced;

- Option 5: This option aligns an outfall partially through agricultural fields and partially through forested areas (~ 190m) in Core 5. It would outlet into PSW 4 and/or PSW 7. This option was not considered appropriate due to a subcatchment diversion that would introduce substantial increases in peak flows and runoff volumes into these treed swamp PSWs that do not currently receive any water from the EIR Subcatchment Area. These treed swamp areas are intolerant to water level changes and currently do not have any well-defined channel through them. Again, this would be a significant negative impact to the core woodland.

Based on the outcome of the June 2019 outfall evaluation and discussions at the November 2020 NOARM meeting, SWM Pond 9 is proposed to discharge to a lowered ditch on the east side of Neyagawa Boulevard via a storm sewer along the edge of the Core 5 NHS.

7.12.4 SWM Pond 9 Outfall Design and Neyagawa Boulevard Ditch Lowering

7.12.4.1 SWM Pond 9 Outfall Design

Consistent with the preferred outfall option, SWM Pond 9 is proposed to discharge to a storm sewer located in the outer 4m of the PSW 3 buffer that will outlet to the existing east Neyagawa Boulevard roadside ditch upstream of Reach SMA-6 near the new Street A entrance to the Sherborne Lodge lands. Its initial alignment (June 2019) was altered near the outlet based on input received from CH and the Town at the June 2019 NOARM meeting to keep the alignment as close to the Core 5 boundary as possible.

The extended detention volume within the pond will discharge through a reverse-sloped pipe. An orifice will be provided to discharge the water quality / erosion extended detention volume such that the minimum 48-hour period can be provided. Quantity control will be provided by an orifice / weir located in the outlet structure with invert at the extended detention level.

The pond outlet pipe is located near the northern limit of the wetland buffer on the north side of the PSW. The trail is proposed along the outfall alignment that also provides maintenance access to the Pond 9 outfall. The area along the outfall alignment is partially agriculture, cultural meadow and small thicket. Aside from the trail surface, this area would be restored with natural, non-woody cover.

The Pond 9 piped outlet will direct flows around PSW 3 so that increases in runoff volumes from the EIR Subcatchment Area will not negatively impact PSW 3. The pond outfall will outlet to a short outfall channel before entering the lowered east Neyagawa Boulevard ditch. **Drawing 7.12** illustrates the outfall headwall location, new outfall channel and where it will connect to the existing east Neyagawa Boulevard ditch.

7.12.4.2 Neyagawa Boulevard Ditch Design

Background

The Neyagawa Boulevard eastern ditch is the existing surface drainage outlet from the ES6-East EIR Subcatchment Area as well as drainage directly from a portion of the Neyagawa Boulevard ROW. It flows intermittently in response to rainfall events and in the spring during snowmelt conditions.

In June 2019, a submission was made to the agencies to identify three alternative outfall locations for the proposed SWM Pond 9 servicing a portion of the EIR Subcatchment. The three options are illustrated on **Figure 7.12R** and the evaluation of these options is summarized in Appendix B-2. At the request of CH, two additional options were identified and evaluated (see EIR section 7.12.3). The evaluation of alternatives concluded that Option 2 was preferred based on a number of servicing and environmental criteria. Option 2 proposes to drain the flows from the proposed SWM Pond 9 to the easterly ditch on Neyagawa Boulevard. A storm sewer outlet pipe is proposed to connect the SWM Pond located in the southwestern portion of the Sherborne Lodge Subdivision, to the easterly ditch on Neyagawa Boulevard. To accommodate flows from SWM Pond 9 and also to accept flows from SWM ponds north of Burnhamthorpe Road (William Halton Parkway), and minimize the amount of fill needed to service the Subject Lands, this easterly ditch would be lowered and erosion mitigative measures would be implemented. Option 2 from the June 2019 submission concluded that:

- the piped outfall design minimizes potential impacts to PSW 3 and Core 5 woodland;
- this option best replicates the existing overland flow patterns in this vicinity and requires no modifications to subcatchment boundaries;
- this option eliminates excessive fill required to properly drain and service the site;
- this option has the shortest outfall length and easiest access to maintain;
- the maintenance access can be used as a trail, reducing additional impacts to Core 5; and,
- preliminary engineering design confirms that grading requirements associated with Core features (woodland, wetland), and MOS are met.

The proposed SWM strategy, including the Option 2 pond outfall design, controls flows in the ditch to target rates and the proposed lowering has minimal impact on the nearby NHS trees.

During agency review of the EIR/FSR, several meetings and discussions were held with the Town, Region and Conservation Halton to discuss the SWM Pond 9 outlet location and design. In their comments on the ES6-East EIR/FSS submission (December 2, 2022), the Region's Public Works staff indicated that they would not support the proposal to discharge controlled flows from the development area into the ditch, even though the existing flows from the catchment currently drain into the ditch. Further, they noted that they would continue to work

with the applicant to resolve this matter and would provide further detail under separate cover following issuance of their letter.

Following site visits and further agency discussions, the Town, CH and the Region advised at the October 17, 2022 NOARM meeting, that they concurred with the preferred SWM Pond 9 outfall location along the Neyagawa Boulevard eastern ditch where natural drainage from the ES6-East subcatchment currently drains. Further inputs were provided by the Region, CH and the Town regarding requested ditch design modifications that are reflected herein. This includes the Region's request to shift the eastern ditch to the east further onto Town's property, remove the terrace (retaining walls) on the west side of the relocated ditch and CH's request to remove proposed erosion control works from PSW 2 and soften/pull back the erosion control works near its connection with PSW 2. With these revisions, the Town would become responsible for maintenance of the ditch and outfall.

This appendix describes the revised Neyagawa ditch design including its relocation, lowering design, capacity and implications to the adjacent Core 5.

Existing East Ditch Conditions

The existing Neyagawa roadside ditch was realigned during widening/reconstruction of Neyagawa Boulevard (2014). The realignment resulted in straightening of the ditch (based on air photo interpretation) extending into the western edge of Core 5, east of the road. Removal of Core 5 edge trees and shrubs were required to accommodate the widening.

The ditch currently conveys drainage from a portion of the EIR/FSS Subject Lands and existing Neyagawa Boulevard storm sewer infrastructure. The ditch is within the mapped Core 5 boundary and straddles Halton Region's Neyagawa Boulevard eastern right-of-way limit. It is located partially within the Neyagawa Boulevard right-of-way and partially on the Town's property east of the right-of-way. The ditch terminates at the confluence with SMA-6/PSW 2 where invasive species common reed (*Phragmites australis*) has colonized (see Photo A). MNRF/LIO mapping of PSW 2 (not field staked), shown on **Figure 5.2R** and **Drawing 7.11AAA**, illustrates the estimated extent of PSW 2 along stream reach SMA-6. Conservation Halton requested that a small area of wetland indicator plants be staked near the ditch outlet to SMA-6. This was completed with CH present on October 13, 2022. This delineation of phragmites within the ditch that extends approximately 1.7 metres upstream/beyond the MNRF PSW 2 boundary (both boundaries are illustrated on **Figure 5.2R and Drawing 7.11AAA**) does not represent the PSW 2 boundary but accurately identifies other riparian vegetation in the area.

Photo A - Viewing east from the downstream end of SMA-6/Neyagawa Boulevard culvert towards the ditch (left) and SMA-6 and PSW (centre-right).

The existing Neyagawa Boulevard east ditch is a V-shaped ditch with a variable depth (0.26m to 1.45m) and a longitudinal slope of 0.8%. The existing ditch is partially rip-rap lined along its length. There is evidence of erosion in several locations. Based on a hydraulic assessment completed by Urbantech, the existing ditch has capacity to accommodate the Regional Storm flows, although water levels extend into the NHS at some locations. Flows do not overtop Neyagawa Boulevard during any of the design events including the Regional Storm.

Proposed Ditch Design

The proposed ditch design and associated compensation plantings are illustrated on the following drawings:

- **Drawing 7.11AA** illustrates proposed grading of the ditch and cross section locations;
- **Drawings 7.11D-R and 7.11E-R** present Neyagawa Boulevard cross sections. Ditch cross sections illustrate ditch lowering, shown on **Drawings 7.11D-R** and **7.11E-R**, present existing and future ditch locations relative to the Region's ROW limit and the adjacent staked Core 5 tree dripline;

- **Drawing 7.11AAA** illustrates the proposed ditch connection to PSW 2;
- **Drawing 7.11H** shows ditch grading limits adjacent to Core 5;
- **Drawings GEO-1 and GEO-2** illustrate the proposed ditch planform and profile;
- **Drawings DET-1 and DET-2** illustrate ditch enhancement details;
- **Figure 5.2R** illustrates the trees that would be affected in Core 5 including removals and root pruning recommendations; and
- **Figures 7.12A to 7.12D** illustrate conceptual compensation plans.

As per the Region's request, the revised design of the eastern Neyagawa Boulevard ditch has been relocated entirely onto the Town's property. Lowering of the ditch is proposed/required to provide a positive drainage outlet for SWM Pond 9. The proposed ditch lowering starts near its downstream end and extends for approximately 215m upstream. The degree of lowering varies from approximately 0.15m at the downstream end to approximately 1.0m at the upstream end. Lowering at the downstream end starts 4.6 m outside of the MNRF PSW 2 boundary.

The cross section of the realigned ditch includes:

- 1.5m bottom width;
- longitudinal slope of 0.25%;
- bankfull cascade gradient of 0.25%;
- east side slopes of 1.5:1 (H:V) to minimize disturbance to adjacent Core 5 trees;
- west side slopes varying between 1.5:1(H:V) and 4:1(H:V); and
- variable depth relative to the Neyagawa Boulevard road elevation, from 2.4m to 3.0m.

The ditch realignment connects to the existing Neyagawa Boulevard storm sewer outfall at the north end and the proposed SWM Pond 9 outfall. A proposed retaining wall, 50m in length by 1m in height maximum, is required along the Neyagawa Boulevard ROW near the existing storm outlet, to accommodate the existing storm sewer elevation, and to prevent encroachment into PSW 3.

Drawings GEO-1 and **GEO-2** include planform/profile details of the proposed realigned ditch, and **Drawings DET-1** and **DET-2** provide details of erosion protection measures. The ditch design has integrated bed and bank treatments to address the potential for lateral migration and downcutting. There is a formal, well-stabilized bankfull channel consisting of hydraulically-sized materials and vortex rock weirs. Vegetated buttresses also have been proposed to stabilize the stone core wetland that is proposed to be constructed at the Pond 9 outfall and the restored Neyagawa ditch. A vegetated bank treatment is proposed which allows for greater energy dissipation and greater stability by reducing velocity, water depth, and shear stresses. This approach provides significantly greater protection to the road embankment than the approach of armouring within the current ditch. The channel will be hydraulically sized with no anticipated concern for potential erosion due to armouring. The design accounts for vegetation establishment on the banks and within the bankfull channel. Future channel maintenance is expected to be minimal.

The stone core wetland proposed at the Pond 9 storm sewer outlet will provide a treatment train that complements other elements of the stormwater management plan. The proposed wetland would be constructed as an over-excavated depression and lined with a mix of soil and granular materials, to provide both depressional and subsurface storage (within the interstitial space of the sediment and soil). The short-term water retention function of the pocket wetland will help to polish the water and moderate the discharge of water into the roadside drainage ditch.

A number of cascades are proposed downstream of the stone core wetland at the Pond 9 outfall. The cascade has an overall gradient of approximately 0.79%. Cascade geometries and flow conditions are provided in **Table 7.10.** The cascades will guide flow towards Reach SMA-6 and discharge into the Neyagawa Boulevard ditch just upstream of the PSW 2 limit.

Table 7.10 - Flow Conditions of the Neyagawa Boulevard Ditch Proposed Cascade

Channel Parameters	Cascade	Pool
Bankfull width (m)	2.50	2.90
Average bankfull depth (m)	0.21	0.32
Maximum bankfull depth (m)	0.30	0.45
Bankfull width-to-depth ratio	8.33	6.44
Channel gradient (%)	0.79	0.25
Manning's *n* roughness coefficient	0.04	0.03
Mean bankfull velocity (m/s) *	0.72	0.68
Bankfull discharge (m^3/s) *	0.38	0.64
Discharge to accommodate (m^3/s)	0.38	0.34
Tractive force at bankfull (N/m^2)	23	11
Stream power (W/m)	30	16
Unit stream power (W/m^2)	12	5
Froude Number (unitless)	0.50	0.39
Maximum grain size entrained (m) **	0.02	0.01
Mean grain size entrained (m) **	0.02	0.01

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not presented

** Based on Shields equation (Miller et al. (1977)), assuming Shields parameter equals 0.06 (gravel)

The cascade keystones were hydraulically sized to withstand the anticipated flow conditions during the Regional storm event of 7.66 m^3/s, corresponding to velocities ranging from 1.26 m/s to 2.34 m/s. Given the range of velocities in the ditch, cascade stone size within the roadside drainage feature will consist of 350 mm diameter stone. This stone is slightly oversized to provide for constructability.

Within the pools, stone sizes will range from 100 mm – 2000 mm diameter riverstone mixed with 30% Granular 'B', to provide a stable bed. Granular 'B' consists of a mix of stone where approximately 20% - 50% of the stone is greater than 0.005 m in diameter, but nothing larger

than 0.15 m in diameter. A range of techniques were utilized to determine the appropriate stone size, as summarized in the National Engineering Handbook (NRCS, 2007). These techniques are provided in **Table 7.11.**

Table 7.11 - Substrate Sizes for Cascade

Model	Formula	Velocity (m/s)	Stone Size* (mm)
Cascade			
Isbash Method (Isbash, 1936)	$D_{50} = (\frac{V_c}{C * \left(2 * g * \frac{\gamma_S - \gamma_w}{\gamma_w}\right)^{0.5}})^2$	2.30	265
USBR Method (Peterka, 1958)	$D_{50} = 0.0122 * V^{2.06}$	2.30	287
Maynord's Method (Maynord, 1988)	$D_{50} = C_s * C_v * C_T * d * [(\frac{\gamma_W}{\gamma_S - \gamma_w})^{0.5} * \frac{V}{\sqrt{K_1 * g * d}}]^{2.5}$	2.30	181

Additional protection is proposed along the ditch consisting of bioengineered bank protection, to be finalized at detailed design. Bank protection options include vegetated rock buttress, rootwad bank treatment, or brush mattress, which will improve stability given the steep banks adjacent to the existing infrastructure and provide thermal mitigation through shading. Other options also can be utilized at detailed design, if determined to be an appropriate treatment. Erosion protection design will include a factor of safety.

A vegetated rock buttress is proposed along the bank of the stone core wetland to provide additional stability given the proximity to the existing infrastructure. The vegetated rock buttress will consist of a constructed bank with container grown plants staggered between the stones and spaced horizontally 0.30 m apart. The strength of the vegetated rock buttress will be augmented through vegetation establishment. Plantings will provide additional thermal mitigation through shade, but also will provide a source of organic matter.

The current roadside drainage ditch conveys flow directly to PSW 2, and thus, is located in the PSW 2 wetland 30m buffer. It is within the mapped boundaries of Core 5. It accommodates drainage from existing road infrastructure and is the existing storm outfall for the EIR Subcatchment.

To utilize this existing subcatchment outlet and achieve positive drainage for the upstream proposed SWM pond/outfall, the ditch must be lowered and tied into SMA-6 and PSW 2. The proposed tie-in location was designed to avoid MNRF/LIO mapped boundaries of PSW 2 (**Drawing 7.11AAA**) and to minimize potential impacts on natural heritage features. No works are proposed within the Neyagawa Boulevard culvert plunge pool or PSW 2. The tie-in location is 2.6 m of the outer CH mapped area occupied by Phragmites and 4.6m from the MNRF PSW 2 boundary. This revised design isn't expected to result in negative impacts to the adjacent PSW 2 and is the lowest impact option as:

- It utilizes the existing general outlet alignment from the subcatchment;

- It is the preferred stormwater management outfall/alignment alternative supported by the Region, Town and CH as it has the least degree of impact on Core 5 of all options reviewed;

- It avoids the LIO-mapped PSW 2 boundary and additional wetland area as staked with CH (October 2022);

- East side slopes have been designed to minimize disturbance to the Core 5 woodlot to the extent possible; and

- West side slope design has been revised to an improved stable condition and will minimize erosion and sedimentation potential.

From policy and design perspectives, OPA 272 and NOCSS provide direction to works in the NHS and in buffers to wetlands:

- OPA 272 policy 7.4.7.3 outlines permitted uses in the NHS. Item c) specifically notes that potential permitted uses include development or land disturbance in accordance with directions from NOCSS, and any related EIR and federal, provincial and conservation authority policies that includes works, "…to accommodate a stormwater outfall", provided that any required reconstruction of a watercourse is completed in a way that utilizes bio-engineering principles and practices, and maintains, and where possible, improves the form, characteristics and functions of the watercourse.

- OPA 272 Policy 7.4.7.3 permits roads and related utilities in the NHS. It states the potential permitted uses include, "Roads and related utilities which shall:

    - use non-standard cross section designed to minimize any impacts on the natural environment;
    - only be permitted to cross the designation in the general area of the road designations shown on NOE2 and NOE4 or as defined through an Environmental Assessment; and,
    - be designed to minimize grading in accordance with the directions established in the North Oakville Creeks Subwatershed Study.

    Provided that such corridors shall:
    - be required as transit routes or utility corridors;

- be located outside natural features to the maximum extent possible, and where the applicable designation is narrowest and along the edge of applicable designations, wherever possible;
- provide for safe movement of species in accordance with the directions established in the North Oakville Creeks Subwatershed Study in the design and construction of any road or utility;
- be kept to the minimum width possible; and
- be designed to keep any related structure or parts of structures outside the High Constraint Stream Corridor Area designated on Figure NOE3 to the maximum extent possible or as defined through an Environmental Assessment.

- Policy 7.7.2.1 notes that, "…in accordance with Section 7.4.7.3b), wherever a transportation facility crosses a core or Linkage Preserve Area or a Medium Constraint Street Corridor Area and an Environmental Assessment has not been completed, the right-of-way width and design of the facility shall only be determined after the preparation of a study to the satisfaction of the Town, and the Region of Halton, where appropriate, in consultation with Conservation Halton, which will establish the appropriate balance between the need to minimize impacts on the natural environmental on the function of the transportation facility."

- OPA 272 Policy 7.4.12 states, "The Natural Heritage component of the Natural Heritage and Open Space System shall generally be managed in accordance with the directions established in the North Oakville Creeks Subwatershed Study Implementation Report." [underlining added].

- OPA 272 7.4.7.3 c) vi) states that grading in the Natural Heritage component of the Natural Heritage and Open Space System for facilities outside of, but adjacent to, the Natural Heritage component of the System, such as lots, roads and public facilities, shall be permitted in accordance with the directions established in the North Oakville Creeks Subwatershed Study or appropriate Environmental Assessment. NOCSS notes that grading is permitted in the outer 20m of a wetland 30m buffer.

The OPA and NOCSS do not specifically address modifications to existing infrastructure (i.e., the Neyagawa ditch) in the NHS, although the realigned design has been located, "outside natural features to the maximum extent possible, and where the applicable designation is narrowest and along the edge of applicable designations, wherever possible", and no structures are located in the High Constraint Stream Corridor, as per policy 7.4.7.3.

The alternative to tie into the existing ditch elevation further upstream, (e.g., 10m from PSW 2 as per NOCSS 6.3.5.3 permissions to work in the outer 20m of the buffer) was reviewed. It would require that the ditch match existing grade at a location where grades are higher than proposed ditch design thus eliminating the lowering required to provide a gravity outlet to the

stream. This option would raise the ditch invert, the pond permanent pool and grading across the Subject Lands. It would also increase the extent of the uncontrolled area (quantity only) in the southwest corner of the Subject Lands. This option would require even greater amounts of fill to service the Subject Lands than already required across large areas of development lands, and create undesirable grade transitions with existing boundary roads and the NHS.

In review of OPA policy 7.4.7.3 and 7.4.12, and consideration of the site specific nature of this ditch (e.g., existing storm drainage infrastructure that connects directly to PSW 2), the revised ditch design and tie-in location near the PSW 2 boundary is preferred. Potential impacts would be mitigated through:

- implementation of timing windows to protect downstream aquatic habitats;
- the construction of these works efficiently, implementing erosion and sedimentation control best practices;
- restoration of disturbed areas in a timely manner with principles of ecosystem restoration; and
- compensation plantings for natural area disturbances, as outlined below.

The proposed ditch lowering and tie-in location are design requirements to service the Subject Lands and can be achieved while minimizing and mitigating negative impacts to Core 5, PSW 2, and PSW 3 and adhering to NOCSS Core 5 management objectives.

Implications to Core 5

The realignment of the roadside ditch farther from the Region's road right-of-way places the entire ditch on the Town's property Core 5. The realignment requires the removal of 20 trees along the western limit of the Core 5 woodland, including white oak, red oak, bur oak, sugar maple, white pine, red ash, and ironwood, to a maximum diameter of 51 cm (sugar maple). This represents an additional 19 tree removals as compared to the previous 2021 ditch lowering design prior to the Region's request to shift the ditch to the east. In addition, root pruning is recommended for 20 trees (as opposed to 17 previously) where root zone disturbance/grading are expected for trees in proximity to construction. **Figure 5.2R** illustrates the proposed tree removals and root pruning. **Appendix D-2** lists inventoried trees and proposed management. Tree removals include:

- five (25%) of these trees are sugar maple with an average DBH of 27 cm to a maximum of 51 cm;
- four (20%) are red oak with an average DBH of 20 cm to a maximum of 28 cm;
- three (15%) are white pine with an average DBH of 21 cm (note one tree has no DBH value recorded) to a maximum of 30 cm;
- two (10%) white oak at 16 cm DBH each;
- two ironwood at 10 and 12 cm DBH; and
- one (5%) dead ash, one pear 12 cm DBH, one bur oak 12 cm DBH, and one apple 14 cm DBH.

All of these trees are situated along the edge of the Core 5 woodland east of Neyagawa Boulevard. None of these species are regulated by the Endangered Species Act. These trees are not typical edge trees, as the woodland edge was modified during the reconstruction of Neyagawa Boulevard. The largest trees in the inventory have been avoided by the proposed ditch works and have been recommended for mitigative root pruning to minimize impacts.

A conceptual edge management plan has been prepared to restore the 1.5 m temporary disturbance area at the top of the east side of the ditch/Core 5 interface and includes tree and shrub restoration components for community height variability and diversity, and an herbaceous cover crop to stabilize soils and minimize opportunities for invasive species colonization. See **Figure 7.12B**. The plan will be finalized at the detailed design to the satisfaction of the Town.

A conceptual compensation plan has been prepared to offset impacts arising from the 840m^2 area loss of Core 5 (dripline) due to ditch grading and will include tree and shrub restoration strategies similar to the Edge Management Plan. See **Figures 7.12Cand 7.12D**. Part of the crop field between Pond 9 and Core 5 (east of PSW 3) has been selected for the proposed compensation area and was generally agreed upon by the Town, as discussed during a September 26, 2023, meeting. The plan may be refined at the detailed design stage and prepared to the satisfaction of the Town.

A hydraulic model was completed to evaluate the water levels in the ditch under existing and proposed conditions. The modelled water levels are plotted on **Drawings 7.11D-R and 7.11E-R** illustrating the extent of the 100-year and Regional Storm water levels as it relates to the Region's property line / ROW limit. As shown, the proposed lowered ditch results in lower water levels compared to existing conditions. The proposed ditch can accommodate the post-development Regional Storm flows from the ES6-East and Neyagawa Boulevard drainage from the existing road storm sewer without overtopping Neyagawa Boulevard. Refer to **Appendix I** for the HEC-RAS model results (water levels) and digital model files.

Monitoring

Erosion monitoring is recommended along the reconstructed Neyagawa Boulevard ditch to assess general stability over time. Monitoring should include at least two (2) monumented cross-section surveys along the ditch and the installation of erosion pins on both banks at each of the two cross-section locations. Cross-section surveys should be completed twice annually (spring and fall) for at least three years following construction. A record of monumented photographs should also be collected during each visit to document ditch conditions (i.e., erosion/deposition, substrate characteristics, vegetation establishment). Monitoring requirements for the reconstructed ditch will be finalized as part of detailed design.

Summary

The proposed revised design of the Neyagawa Boulevard eastern ditch realignment addresses the Region's comments to realign the eastern road ditch entirely to the east onto Town lands. The design addresses ditch capacity requirements and erosion potential, and provides an appropriate outfall for servicing of the Subject Lands without an excessive amount of fill in upstream areas. Relocating the ditch easterly to satisfy the Region requires the removal of 20 trees and recommendations for the pruning of 20 trees. The realigned ditch will connect into the existing ditch 4.6 m from the LIO-mapped PSW 2 boundary, and 2.6m from the wetland area staked with CH (phragmites-dominated).

Mitigative measures associated with the proposed design have been proposed to address potential impacts to aquatic and terrestrial environs.

For aquatic environs, this includes best practices for in-water works (i.e., working in the driest months), erosion and sedimentation controls, and revisions to the tie-in location to a location outside of PSW 2 (i.e., bank treatment and vortex weirs) and outside of the additional wetland area as delineated with CH. At detailed design, opportunities to soften the tie-in design will be addressed.

Mitigation for terrestrial environs includes designing east slopes that balance the need for soil stability against intrusion into the Core 5 dripline, redesigning the west slopes to increase stability, designing the ditch centreline to avoid the Core 5 dripline where possible, and committing to an edge management plan and a compensation plan to restore or replace shrubs and successional trees in the disturbed areas of Core 5 dripline.

Engineering requirements for positive site drainage dictate that the tie-in location is not feasible further upstream due to existing grade conditions. Considerable effort has been given to avoid important natural heritage features such as Core 5, PSW 2 and the additional wetland area delineated with CH. Where encroachment or impacts cannot be avoided, impact offsetting such as restoration (Edge Management Plan) has been designed to restore forest edge components, with compensation to account for encroachment into the Core 5 dripline. Given the redesign, mitigation, and impact offsetting, the proposed tie-in location represents the best option to minimize impacts to natural heritage features and functions.

7.12.5 SWM Facility Design

Design and Operating Characteristics – Ultimate Conditions

Three multi-function ponds, referred to in this report as SWM Ponds 9, 9A and 9B as well as one (potential) underground storage facility, referred to as SWM Facility 9C are proposed within the EIR/FSS Subcatchment Area. The locations of the above facilities are illustrated in **Figure 7.7R**.

Summaries of the pond characteristics for Ponds 9, 9A and 9B, and Facility 9C under ultimate or full development in the EIR/FSS subcatchment are presented in **Tables 7.12** to **7.16**. Sizing calculations are provided in Appendix E-2.

The conceptual design of Pond 9 is presented in **Drawing 7.12R**. Storage / release rate targets for the facilities north of Burnhamthorpe Road have been provided, but the ultimate layout and design of these facilities will be completed by others as part of future EIR/FSS Addendums.

Table 7.12 –Stormwater Management Facility Drainage Areas and Sizes

Pond	Drainage Area (ha)	Imp. (%)	SWM Pond Block Area (ha)
Pond 9	54.4*	68.55	3.1
Pond 9A	15.8	85	TBD
Pond 9B	13.5	85	TBD
Facility 9C	1.8	85	TBD

* for purpose of water quality control design; reflects only the drainage area south of Burnhamthorpe Road. SWM Pond 9 drainage area includes external drainage areas and Facilities 9A to 9C. Total area to Pond 9 would be the sum of 9A, 9B, 9C, and Pond 9 drainage areas.

Table 7.13 - Pond 9 Inflow/Volume Characteristics (With Stacking Conditions)

Return Period	Area (ha)	Imp. (%)	Peak Inflow (m^3/s)	Target Release Rate[1, 2] (m^3/s)	Outflow (m^3/s)	Storage Requirements (m^3)	Storage Provided (m^3)	Stage Provided (m)
Perm. Pool	54.4	68.55	-	-	-	9,889	16,604	170.70
ED[3]				0.036 (based on continuous model)	0.036	12,951 (based on continuous model)	12,951	171.35
2			0.986	0.342	0.336	12,000	12,902	171.90
5			1.375	0.599	0.590	15,000	16,565	172.05
10			1.600	0.770	0.760	16,800	17,808	172.10
25			1.936	1.026	1.010	19,500	21,542	172.25
50			2.162	1.197	1.169	21,200	22,803	172.30
100			2.396	1.368	1.345	23,000	25,345	172.40
Regional			6.738	6.68	6.606	29,000[2]	33,134	172.70

[1] Target flow based on NOCSS unit flow rates with the exception of the ED release rate, which is based on iteration of the QUALHYMO model & erosion threshold analysis

[2] Regional Storm target flow selected through iterative process to ensure total flow downstream does not exceed Stantec's "allowable" flow of 10.6m^3/s at Node 2124. The noted volume is at the emergency overflow water level in the facility required to convey the uncontrolled Regional flow.

[3] Note – ED values reported in this table, but ED assumed to be full for evaluation of 2-year to Regional volume requirements (i.e., stacking conditions). A no-stacking scenario was completed to determine the rating curve for the continuous QUALHYMO model / to determine the ED requirements (since the model with stacking / full ED would not be useful in determining ED requirements).

Table 7.14 - Pond 9A Inflow/Volume Characteristics

Return Period	Area (ha)	Imp. (%)	Peak Inflow (m^3/s)	Target Release Rate[1,2] (m^3/s)	Outflow (m^3/s)	Storage Requirements (m^3)
Perm. Pool	15.8	85	-	-	-	3,318
ED			-	0.010	-	3,358
2			0.528	0.063	0.057	5,000
5			0.737	0.111	0.097	6,150
10			0.868	0.142	0.125	7,000
25			1.032	0.190	0.169	8,200
50			1.155	0.221	0.196	8,900
100			1.277	0.253	0.231	9,500
Regional			1.510	1.510	1.419	12,100[2]

[1] Target flow based on NOCSS unit flow rates with the exception of the ED release rate, which is based on iteration of the QUALHYMO model and erosion threshold analysis. A 75mm orifice was assumed with 0.7m depth of ED storage.

[2] Control to the NOCSS targets is not proposed for the Regional event. Uncontrolled Regional flows would not be permitted to spill across Burnhamthorpe Road or onto Neyagawa Boulevard based on the Region's position on accepting development flows. Therefore, the Regional flow will pass through the SWM facilities and discharge into the receiving storm sewer system, which has been appropriately sized for the greater of the existing or uncontrolled post-development Regional flow as described in Section 7.7. The target Regional flow for the purposes of modelling / design has been set to the Regional inflow into the facility. Similar to Pond 9, the routing of the Regional inflow hydrograph through the facility results in some minor attenuation, as the Regional runoff passes through the facility.

Table 7.15 - Pond 9B Inflow/Volume Characteristics

Return Period	Area (ha)	Imp. (%)	Peak Inflow (m^3/s)	Target Release Rate[1,2] (m^3/s)	Outflow (m^3/s)	Storage Requirements (m^3)
Perm. Pool	13.5		-	-	-	2,835
ED			-	0.01	-	2,869
2		85	0.427	0.054	0.048	4,300
5			0.596	0.095	0.080	5,300
10			0.701	0.122	0.105	6,000
25			0.834	0.162	0.146	6,800
50			0.932	0.189	0.173	7,300
100			1.031	0.216	0.202	7,950
Regional			1.265	1.265	1.209	9,750[3]

[1] Target flow based on NOCSS unit flow rates with the exception of the ED release rate, which is based on iteration of the QUALHYMO model & erosion threshold analysis. A 75mm orifice was assumed with 0.7m depth of ED storage.

[2] Control to the NOCSS targets is not proposed for the Regional event. Uncontrolled Regional flows would not be permitted to spill across Burnhamthorpe Road or onto Neyagawa Boulevard based on the Region's position on accepting development flows. Therefore, the Regional flow will pass through the SWM facilities and discharge into the receiving storm sewer system, which has been appropriately sized for the greater of the existing or uncontrolled post-development Regional flow as described in Section 7.7. The target Regional flow for the purposes of modelling / design has been set to the Regional inflow into the facility. Similar to Pond 9, the routing of the Regional inflow hydrograph through the facility results in some minor attenuation, as the Regional runoff passes through the facility.

Table 7.16 - Facility 9C Inflow/Volume Characteristics

Return Period	Area (ha)	Imp. (%)	Peak Inflow (m^3/s)	Target Release Rate[1,2] (m^3/s)	Outflow (m^3/s)	Storage Requirements (m^3)
Perm. Pool.	1.8	85	-	-	-	378
ED			-	0.005	-	383
2			0.072	0.007	0.007	540
5			0.101	0.013	0.010	720
10			0.119	0.016	0.014	820
25			0.141	0.022	0.018	960
50			0.158	0.025	0.022	1,050
100			0.175	0.029	0.025	1,150
Regional			0.182	0.182	0.175	1,400[2]

[1] Target flow based on NOCSS unit flow rates with the exception of the ED release rate, which is based on iteration of the QUALHYMO model & erosion threshold analysis. A flow rate of $0.005m^3/s$ was selected (to be lower than the 2-year NOCSS target). This can be achieved by a 75mm orifice and a 0.2m ED storage depth, or other equivalent combination of opening size and depth.

[2] Control to the NOCSS targets is not proposed for the Regional event. Uncontrolled Regional flows would not be permitted to spill across Burnhamthorpe Road or onto Neyagawa Boulevard based on the Region's position on accepting development flows. Therefore, the Regional flow will pass through the SWM facilities and discharge into the receiving storm sewer system, which has been appropriately sized for the greater of the existing or uncontrolled post-development Regional flow as described in Section 7.7. The target Regional flow for the purposes of modelling / design has been set to the Regional inflow into the facility. Similar to Pond 9, the routing of the Regional inflow hydrograph through the facility results in some minor attenuation, as the Regional runoff passes through the facility.

Interim Conditions

An interim conditions scenario was also simulated to ensure that Pond 9 functions to meet downstream flow targets with existing conditions north of Burnhamthorpe Road. This scenario assumes full development of lands south of Burnhamthorpe Road and no development for the external contributing properties located north of Burnhamthorpe Road. Refer to **Drawing 7.8C** for the interim drainage plan.

Table 7.17 presents Pond 9 operating conditions under interim conditions. As shown, the interim condition model results indicate that the ultimate pond control structure design requires adjustment to provide the required storage to meet the NOCSS target outflow rates and the allowable Regional Storm flow in downstream areas. The interim pond storage requirements are slightly higher than the ultimate storage requirements due to discretization of the pre-development catchment to represent the external areas. Discretization results in interim flows from these catchments that are slightly higher than future flows that are controlled to NOCSS targets. An interim control structure that provides slightly higher water level fluctuation under interim conditions will meet downstream flow targets. Detailed design should provide both interim and ultimate pond control structure designs.

To assess downstream erosion potential during interim conditions, a comparison of runoff volumes was made during the 25mm event (24,135m^3 for ultimate post development and 20,480m^3 for interim post development conditions). It can be concluded that there will be less volume (and therefore less exceedances and erosion impacts) under interim conditions compared to ultimate conditions.

Table 7.17 - Pond 9 Inflow/Volume Characteristics (Interim Conditions With Staking)

Return Period	Area (ha)	Imp. (%)	Peak Inflow (m^3/s)	Target Release Rate[1] (m^3/s)	Outflow (m^3/s)	Interim Storage Requirements (m^3)	Storage Provided (ultimate pond and ultimate stage with Stacking) (m^3)	Interim Stage** (m)	Interim Storage Provided (m^3)
Perm. Pool	54.4	68.57	-	-	-	9,889	16,604	170.70	16,604
ED			-	0.036 (based on continuous model)	0.036	12,951 (based on continuous model)	12,951	171.35	12,951
2			1.122	0.342	0.337	13,000	12,902	171.95	14,123
5			1.615	0.599	0.590	17,000	16,565	172.10	17,808
10			1.895	0.770	0.767	19,500	17,808	172.20	20,305
25			2.328	1.026	1.023	22,500	21,542	172.35	24,074
50			2.617	1.197	1.178	24,500	22,803	172.40	25,345
100			2.915	1.368	1.354	26,500	25,345	172.50	27,941
Regional			5.551	6.68	5.515	29,000	33,134	172.70	33,134

[1] Target flow based on NOCSS unit flow rates with the exception of the ED release rates, which is based on iteration of the QUALHYMO model & erosion threshold analysis, and the Regional Storm release rate; see Note 2.

[2] Regional Storm target flow selected through iterative process to ensure total flow downstream does not exceed Stantec's "allowable" flow of 10.6m^3/s at Node 2124. The noted volume is at the emergency overflow water level in the facility required to convey the uncontrolled Regional flow.

[3] Note – ED values reported in this table, but ED assumed to be full for evaluation of 2-year to Regional volume requirements (i.e., stacking conditions). A no-stacking scenario was completed to determine the rating curve for the continuous QUALHYMO model / to determine the ED requirements (since the model with stacking / full ED would not be useful in determining ED requirements).

** Stage increased to accommodate interim storage requirements where necessary

Stormwater Management Pond Design Elements

The stormwater management ponds have been designed in accordance with directions of the NOCSS, ES6-West hydrologic assessments and the MOE SWM Design Manual, and include the following features:

- **Sediment forebay**
  - Improves sediment removal and reduces influent velocities
  - Sized based on MOE forebay settling and dispersion length calculations

- **Permanent pool and water quality**
  - Provides water quality and erosion control to satisfy Enhanced Level of protection requirements (i.e., capture of 80 percent Total Suspended Solids) and reduction of Phosphorus levels

- Sized according to MOE Table 3.2 and corresponding imperviousness or resulting storage based on erosion control requirements

- **Erosion Control**

  External lands:
  - Ponds 9A and 9B to provide 250m^3/imp ha for ED storage while controlling flows to approximately 0.01 m^3/s (75mm orifice with 0.7m head assumed).
  - Facility 9C to provide 250m^3/imp ha for ED storage while controlling flows to 0.005 m^3/s
  - Detailed design of external facilities should be accompanied by an update to the QUALHYMO continuous model and erosion threshold analysis

  Subject Lands:
  - Pond 9 to provide approximately 346m^3/imp ha for ED storage while controlling flows to approximately 0.036 m^3/s (0.66 L/s/ha). This can be achieved with a 150mm orifice with 0.65m head.
  - The erosion threshold results and drawdown time are sensitive to the depth of storage and release rate. Detailed design of Pond 9 should be accompanied by an update to the QUALHYMO continuous model and erosion threshold analysis

- **Quantity Control - 2 Year to 100 Year**
  - Attenuates post development flows to the unit flow release rates as per the NOCSS for the 2 year through 100 year storms.
  - All ponds have been designed to convey the Regional Storm flows through the ponds (a small degree of peak flow attenuation occurs during the Regional Storm as a result of the volume provided in the 100 year pond design to convey the Regional Storm flows through the pond)
  - Storage volume requirements for all storms are based on the GAWSER model simulation of post-development drainage areas controlled to the NOCSS return period unit rates

- **Regional Storm**
  - SWM Pond 9 is designed to control quality, erosion, and the 2 year to 100 year events. It is designed with freeboard and an emergency spillway to convey the Regional Storm flows through the pond into downstream areas. By virtue of the presence of the emergency spillway design and associated additional active storage above the 100 year water level to pass the Regional Storm flows, the uncontrolled Regional Storm flows are slightly attenuated and meet the allowable Regional Storm release rate established in previous studies of downstream areas; and

  - SWM Ponds 9A, 9B and 9C (potentially a private facility, subject to future planning on the external lands) will control future flows to NOCSS target rates for the 2 year to 100 year events. Regional Storm flows will be conveyed through SWM facilities. Similar to above, these facilities will provide slight peak flow attenuation. Pond

outflows will be accommodated in storm sewers from these facilities so that uncontrolled flows do not flow across Regional roads.

Sediment Forebay

The stormwater management ponds must include a sediment forebay to improve the pollutant removal by trapping larger particles near the inlets of the pond.

The forebay for Pond 9 has been designed to be submerged below the normal water level, has a length to width ratio of approximately 3:1 and does not exceed one third of the permanent pool surface area, as required in the MOE SWMP Design Manual for wet SWM facilities.

Permanent Pool

The permanent pool ranges from 1.2m to 2.2m deep. The permanent pool has been sized to provide Enhanced Level protection in accordance with the MOE SWMP Design Manual. **Appendix E-2** summarizes the permanent pool requirements and associated calculations.

In accordance with the Town of Oakville SWM facility grading guidelines, 4:1 slopes will be provided below the 7:1 pond shelf down to the pond bottom. Slopes of 7:1 (H:V) have been be provided in the safety shelf (4 m wide below permanent pool and 4 m wide up to the extended detention level) on either side of the permanent pool wetted perimeter. These grading requirements are reflected in the pond design shown on **Drawing 7.12R**.

The permanent pool volume for each facility has been sized to provide Enhanced Level protection in accordance with the MOE SWMP Design Manual. Based on impervious coverage for the wet ponds, the required and provided permanent pool volumes are summarized in the **Table 7.18.**

Table 7.18 - Summary of Permanent Pool Volumes

Pond I.D.	Imp. (%)	Drainage Area (ha)	Unit Volume[1] (m^3/ha)	Volume Required (m^3)	Volume Provided (m^3)
Pond 9	68.6	54.4	182	9,889	16,604[2]
Pond 9A	85	15.80	210	3,318	TBD
Pond 9B	85	13.54	210	2,835	TBD
Facility 9C	85	1.80	210	378	TBD

[1]SWMP Manual Table 3.2 for wet ponds, less 40m^3/ha for erosion control.
[2]Volume provided is larger than volume required since the quantity control requirements govern the pond size and the permanent pool is deeper for thermal mitigation.

Slopes of 7:1 (H:V) will be provided for three metres (horizontally) on either side of the permanent pool wetted perimeter. Below this level, slopes will be graded at 3:1 (H:V).

Extended Detention Storage
The extended detention storage comprises two components; water quality and erosion control. The water quality requirements are based on Enhanced Level controls (formerly Level 1) as per the MOE SWMP Design Manual. The erosion control volume was determined based on analysis of critical downstream erosion thresholds using the continuous QUALHYMO model originally used by Stantec / GHD, 2015. Based on the results of the continuous model, a target storage volume of 250m^3/imp ha is required for all facilities. Release rates have been controlled to meet the erosion threshold requirements established by GEO Morphix and the resulting drawdown time is 164 hours / 6.8 days based on 0.65m extended detention storage depth and 150mm orifice size.

Flood Control Storage
The quantity control requirements for the 2-year through to 100-year events will be achieved with active storage depths of less the 2.0m depth recommended by the MOE SWMP Design Manual for 100-year flood control storage.

Slopes of 7:1 (H:V) will be provided for three metres (horizontally) on either side of the permanent pool wetted perimeter. Above this level, the extended detention and the 100-year flood control component will be graded at 4:1 (H:V).

Storm Stacking
Conservation Halton and the Town of Oakville require that “storm stacking” be considered for Regional Storm control facilities. Due to long extended detention drawdown times, it is recognized that the active storage in SWM facilities may be reduced during the Regional Storm event. Storm stacking was evaluated for all design events, despite the fact that Pond 9 is in the ES6-East subcatchment which does not require Regional control. Due to the long drawdown time, it is recommended (at detailed design) that the SWM facility is designed assuming that the ED storage is unavailable during the 2 year to 100 year storms. This was tested and Pond 9 was found to have sufficient active storage above the ED water level to manage the 100 year storm.

With respect to the emergency spillway design and to demonstrate that safe Regional Storm conveyance through SWM Pond 9 is possible, it has been assumed that the pond is full to the 100-year storm elevation.

Pond Outlets
An underground pipe will convey controlled flows from the SWM Pond 9 (extended detention and 2 year to 100 year) and Regional Storm flows through the SWM pond to the outfall location east of Neyagawa Blvd. The pond outfall pipe is located in the outer portion of the NHS (in outer 5m of the wetland 30m buffer) through areas that are currently cultural meadow/thicket. Due to limited cover, the outfall sewer is proposed to be insulated between MH58 and the outfall headwall.

A stone core wetland is proposed at the pond outfall pipe outfall located in the outer 20m of the wetland buffer (currently cropped field). The stone core wetland will receive and polish runoff and moderate the discharge of water into the Neyagawa Boulevard ditch. Vegetated rock buttresses are proposed along the bank of the stone core wetland to provide additional stability given the proximity to the existing infrastructure. Plantings will provide additional thermal mitigation through shade, and also will provide a source of organic matter.

Details of the proposed pond outlet orifices and outlet weirs will be provided at detailed design. A conceptual rating curve (stage, storage, discharge) for SWM Pond 9 only is included in **Appendix E-2** with a preliminary outlet structure design. Control structure design is subject to changes as required at the detailed design stage. Since there is no concept / configuration for the future external facilities, only the storage-discharge characteristics of Facilities 9A, 9B, and 9C are provided in **Appendix E-2**.

At detailed design, tailwater considerations on outlet structures should be considered in the pond outlet structure design. Tailwater assumptions do not impact the pond block size since outlet structures can be designed to reflect tailwater heights to outfall opening sizes.

Access Road
In accordance with the Town of Oakville standards, 3.0m wide access roads are provided above the active storage elevation. Access roads are provided in order to facilitate routine inspection and maintenance activities. The maximum slope of access roads is 10:1 (H:V). The access road will extend to the base of the pond, and not exceed a maximum slope of 10% which will be included at the detailed design stage.

For SWM Pond 9, an access road to facilitate routine inspection and maintenance activities is proposed with an entrance east of the Village Square on the Sherborne Lodge Draft Plan of Subdivision. A servicing block is also located between Lots 4 and 5 to access the pipe outlet to PSW 3 and the Pond 9 outfall.

Emergency Overflows
To ensure safe conveyance of flows in the event of a blockage of the outlet structure during the Regional Storm event, an emergency overflow weir will be provided above the high water level in the pond. **Drawing 7.12R** shows the extent of the formal spillway that will convey uncontrolled Regional Storm flows from Pond 9 to PSW 3. The emergency spillway will be sized for the uncontrolled Regional Storm flow and velocities and should be set a minimum of 0.10m above the high water (100-year) level. Appropriate materials and restoration will be addressed at detailed design.

Thermal Mitigation
Several mitigation measures are proposed for Pond 9, including those that research suggests will have an impact on the reduction of water temperature. Of specific interest is the Credit Valley Conservation (CVC) Study Report on *Thermal Impacts of Urbanization including*

Preventative and Mitigation Techniques (CVC, January 2011). The CVC Thermal Impacts Report identified five "zones" where thermal mitigation measures can be implemented, as presented below.

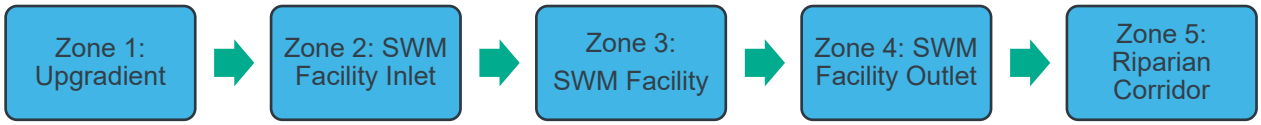


Table 7.19 outlines the thermal mitigation measures reviewed and those recommended for implementation in SWM Pond 9. It is recommended that the future external ponds implement similar measures. Opportunities for additional thermal mitigation may be identified at the detailed design stage. With respect to **Table 7.19**, if a measure is not applicable, a rationale for this recommendation is provided. The MNRF historically requested that cooling trenches and/or deeper permanent pools be provided for wet ponds. However, MNRF staff have since indicated that cooling trenches are ineffective for thermal mitigation, while deeper permanent pools show a relatively positive correlation with cooler effluent temperatures.

The proposed thermal mitigation measures are relatively low maintenance. Although difficult to quantify the effectiveness of the mitigation measures without monitoring data, the suggested measures can individually reduce thermal impacts and achieve a greater reduction in combination. The proposed LID measures including increased topsoil depth, directing roof drainage to pervious areas and use of tree pits will contribute to thermal mitigation.

With respect to Pond 9, the main thermal mitigation measures to be included in the pond design are:

- bottom draw outlet / reverse slope pipe
- permanent pool in the main cell will have a deep pool at the outlet
- landscaping to maximize shading of the pond surface.

In addition, flows from Pond 9, as well as Ponds 9A to 9C, will discharge to sub-surface storm sewers which have significant lengths prior to discharging to the wetland and Neyagawa Ditch. This is anticipated to enhance cooling.

Pond Liner and Perimeter Drains

The Soil Engineers Limited geotechnical report (March 2014) in Appendix G-2 notes that a liner will likely be required for Pond 9. In particular, where the sides or bottom of the cut pond will consist of fractured shale bedrock, the water lost through seepage through the fissured rock may have an impact on the effective storage capacity of the pond. In order to minimize this potential impact, an impermeable geosynthetic membrane, or a clay liner, 1.0 m thick, compacted to achieve at least 95% of its maximum Standard Proctor dry density, should be placed above the fractured bedrock. The extent of the clay liner and the necessity to implement

these measures should be assessed and confirmed during detailed design and construction of the pond.

The need for pond perimeter drains will be determined at detailed design.

Table 7.19 – Thermal Mitigation Measures for SWM Pond 9

Mitigation Measure	Zone	Proposed Measures for SWM Pond 9
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Downspout disconnection	Zone 1	✓[1]
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[2]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X
Reduce open water area	Zone 3	✓
Deep Permanent Pool (3.0 m)	Zone 3	X[3]
Increased L:W ratio	Zone 3	✓
Pond orientation to reduce solar inputs	Zone 3	X
Landscaped jetties for shading	Zone 3	X
Sub-surface SWM storage	Zone 3	X[4]
Sub-surface cooling trench	Zone 4	X[4]
Outlet shading	Zone 4	✓
Concrete outlet pipe	Zone 4	✓[5]
Reversed slope pond outlet / extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X
Night-time release	Zone 4	X[6]
Pocket wetland/stone core trench at outfall	**Zone 5**	✓[7]

1. Roof areas will discharge to pervious lawns, which will have additional topsoil depth
2. Not recommended due to grading, capacity, or maintenance constraints.
3. The permanent pool depth is 2.5m near the outlet.
4. Sub-surface storage not practical for subdivision. MNRF no longer recommends cooling trenches.
5. Long concrete outlet pipe from Pond 9's outfall structure to the headwall downstream of PSW 3
6. Night-time release requires complex control systems that would have to be maintained by the Town. These measures are therefore not recommended at this time.
7. Proposed BMP at outlet of uncontrolled area north of PSW 3

7.13 GAWSER and HEC-RAS Model Updates

To confirm that the proposed SWM facilities control flows to existing levels, a post-development GAWSER simulation was generated based on based on the proposed SWM facility rating curves. As shown in **Table 7.20**, it demonstrates that total flows from the EIR subcatchment at the outlet of PSW 3 are maintained at or below the existing NOCSS targets for the 2-year to 100-year events.

Table 7.20 – Post-development vs Pre-development Flows at Key Locations

		Return Period[1]					
		2	5	10	25	50	100
		Unit Rates ($m^3/s/ha$)					
NOCSS Unit Rates for East Sixteen Mile Creek (NOCSS Addendum, July 2007)		0.004	0.007	0.009	0.012	0.014	0.016
Location	**Area (ha)**	**Existing / Target Flow (m^3/s)**					
ES6 (East)	95.45	0.38	0.67	0.86	1.15	1.34	1.53
		Post-Development Flow (m^3/s)					
ES6 (East) GAWSER ID 8315	89.90	0.34	0.599	0.773	1.029	1.192	1.374

Note: SWM Pond 9 provides slight attenuation of Regional Storm flows as a result of storage above the 100 year water level to convey the Regional Storm flows through the pond)

Further, to verify that the proposed drainage areas and imperviousness discussed in Section 7.12.1 produce consistent results with the approved Stantec downstream analysis, a separate GAWSER model scenario was prepared for the Regional Storm. This scenario assumed no SWM facilities in the ES6-West and ES6-East catchments, similar to the Stantec model.

The peak Regional Storm flow results from the Stantec model are noted in **Table 7.21**, as well as the proposed ultimate and interim Regional Storm peak flows from the updated Urbantech model at the same locations. The results indicate that the proposed uncontrolled flows are below the rates simulated by Stantec despite a slight increase in the drainage area. This is attributed to routing through Pond 9 and the external ponds.

Table 7.21 – Uncontrolled Regional Storm Flow Comparison

Model Scenario	Drainage Area at downstream end of Neyagawa culvert (ha)	Peak Uncontrolled Regional Flow (m^3/s)
"Allowable" (Stantec node ESM-NG3) (GAWSER ID 2124)	134.9	10.6*
Ultimate Proposed With SWM (Urbantech node ESM-NG3) (GAWSER ID 2124)	136.90	10.530 (stacking) 10.55 (no stacking)
Interim Proposed with SWM** (Urbantech node ESM-NG3) (GAWSER ID 2124)	137.60	9.583
Ultimate Proposed – No SWM (Urbantech node ESM-NG3) (GAWSER ID 2124)	136.90	10.937

* Regional Storm uncontrolled flow from Stantec assessment (2015)
**With SWM Pond 9; no development north of Burnhamthorpe Road

Based on the foregoing analysis, the proposed Regional Storm flow based on the proposed Draft Plans of Subdivision and the proposed SWM Plan outlined in the EIR/FSS is slightly less than the peak flow value in the approved ES6-West EIR/FSS downstream assessment. This occurs since the 100 year SWM Pond 9 includes freeboard and an emergency spillway to convey the Regional Storm flows through the pond into downstream areas. By virtue of the presence of the emergency spillway design and associated additional active storage above the 100 year water level to pass the Regional Storm flows, the uncontrolled Regional Storm flows are slightly attenuated. As such, the revised SWM design is consistent with the approved Regional Storm allowable release rates based on the findings of the past downstream assessment.

As requested by Conservation Halton, the "No SWM" scenario was simulated to represent uncontrolled Regional flows for the Sherborne-Eno lands and external lands (i.e., all storage facilities are removed from the model). The post-development uncontrolled flow (without ponds) is $10.937m^3/s$ at GAWSER Node 2124 (located at the confluence of the lands west and east of Neyagawa Boulevard downstream of culvert ESM NG3). This uncontrolled flow is higher than the "allowable" Stantec uncontrolled flow of $10.60m^3/s$ at Node 2124, which was based on the original Stantec drainage area, land use, and impervious coverage with no SWM facilities in place. This is a hypothetical scenario which would not occur with the pond currently proposed in this EIR/FSS study, since the 100 year pond design slightly attenuates Regional Storm flows as noted above.

To assess the effects of the increased flows on the downstream water levels, an additional scenario was created in the original Stantec post-development HEC-RAS model in which the flows downstream were increased from $10.60m^3/s$ to $10.937m^3/s$ at Node 2124 (and all subsequent downstream flows were increased by $10.937m^3/s – 10.60m^3/s = 0.337m^3/s$).

Appendix A-6 contains the results of this hydrologic / hydraulic simulation. The additional flow (0.337 m^3/sec) slightly increased water levels downstream, with the changes ranging from 0 cm to 4 cm. As shown in the table accompanying the memo in **Appendix A-6**, the majority of the increases are 1 cm. Two short lengths of watercourse show 3 to 4cm increases in areas contained within well-defined valleys or on public lands. Negligible changes (+1 cm) result upstream of the access driveway to the Trafalgar Lawn Cemetery. The comparison table (**Appendix A-6**) summarizes the water level comparison between the original Stantec hydraulic analysis with uncontrolled post-development flow versus the updated Urbantech uncontrolled post-development flow analysis. Drawings 1 to 4 (by Stantec; **Appendix A-6**)) show the Stantec floodlines and cross section locations.

Note that these increases only estimated to occur when the proposed SWM ponds are completely removed from the hydrologic model. The SWM ponds are included in the SWM Concept and shown on the Sherborne and Eno Draft Plans of Subdivision. This information is included in this EIR/FSS so that CH and the Town can determine whether these ponds are considered to be Regional Storm control ponds. Regardless of the outcome, there is no impact to SWM pond designs, operation, maintenance, or modelling completed in this study.

7.14 Topographic Depressional Storage Assessment

As discussed in Section 7.1, the NOCSS Addendum recommendations require that the natural surface storage volumes in topographic depressions be identified and comparisons be made to SWM pond storage design. The Mediation Agreement on Depressional Storage (May 30, 2007) notes that the NOCSS existing conditions hydrologic modelling includes existing depression storage identified on NOCSS topographic mapping and that the resulting target unit flow rates reflect existing depression storage. At the EIR stage, depression storage is to be confirmed using more detailed mapping. The Mediation Agreement notes that, "*the calculated depression volume is to be compared to the SWM pond volume of the proposed SWM facility within the same drainage area. If the depressional volume is less than or equal to the SWM facility volume, no additional analysis or change to the SWM facility design is required. In the event that the depressional storage is greater than the SWM facility volumes, the SWM facility volume (as noted in item 5) is to be adjusted to be equal to the depressional storage volume*." It notes that the 2-year and 100-year or Regional Storm storage volumes should be compared to proposed SWM pond volumes. In the ES6-East subcatchment, the 100-year storage volume requirement applies.

Tables 7.22 and **7.23** summarize the volumes provided in depressions identified in NOCSS and shown on **Figure 2.1**, and the proposed SWM Ponds extended detention and 100-year volumes. Where topographic information was not detailed enough to calculate volumes, a depth of 300mm was assumed. This analysis concludes that the storage in existing depressions is substantially smaller than SWM pond extended detention and 100-year volumes and therefore, no adjustments are needed to the SWM pond designs.

The depressions located outside of the Subject Lands listed in **Table 7.22** and their volumes should be verified through future studies in support of development applications on their lands.

Table 7.22 – Topographic Depression Volumes on Subject Lands

Feature Type	Feature ID	Feature Area (m^2)	Bottom Elevation (m)	Top Elevation (m)	Volume (m^3)
HYDFB	Pit, Depression B-68	475	176.75	177.05*	143
DPP	Depression 71	1072	173.57	173.89	343
DPP	Depression 147	473	176.08	176.38*	142
DPP	Pit 69	173	177.50	177.80*	52
	Pit 70	145	177.89	178.00	16
Total volume of pits and depressions					**553**
Pond 9 Extended Detention Volume					**>12,944**
Pond 9 100 year Volume					**>25,598**

*0.3m depth assumed

7.15 Operation and Maintenance

A detailed operations and maintenance manual for stormwater management ponds and related infrastructure should be submitted to the Town at detailed design. The operations and maintenance manual should be prepared in conformance with the *Town of Oakville Standards* and Specifications, and the MOE SWMP Design Manual.

The typical operations and maintenance activities for the stormwater management features and the respective costs are set out in the MOE SWM Design Manual. Refer to Sections 6.0 of the *SWMP Design Manual, Operation, Maintenance and Monitoring*, and Section 7.0, *Capital and Operational Costs* for additional details. Additionally, the North Oakville SWM Monitoring Guidelines will be respected to determine operational performance and target adherence.

Table 7.23 - Topographic Depression Volumes Outside of Subject Lands

Feature Type	Feature ID	Feature Area (m^2)	Bottom Elevation (m)	Top Elevation (m)	Volume (m^3)
HYDFB	Depression 66	2714	186.00	186.22	597
HYDFB	Pit 62	153	191.24	191.54*	46
HYDFB	Pit 64	319	189.99	190.29*	96
DPP	Depression 67	890	177.93	178.00	62
DPP	Pit 19	129	191.98	192.00	3
	Pit 53	32	192.03	192.05	0.6
	Pit 55	62	191.69	191.99*	19
	Pit 56	39	192.03	192.33*	12
	Pit 57	50	192.13	192.21	4
	Pit 58	56	191.96	191.99	2
	Pit 59	164	191.84	191.99	25
	Pit 60	200	191.71	192.01*	60
	Pit 61	325	191.24	191.54*	98
	Pit 63	152	190.99	191.29*	46
	Pit 65	59	190.75	191.05*	18
Total volume of pits and depressions					**1088.6**
Pond 9 Extended Detention Volume					**>12,944**
Pond 9 100 Year Volume					**>25,598**
Pond 9A and 9B Extended Detention Volume					**>6,227**
Pond 9A and 9B 100 year Volume					**>17,450**

*0.3m depth assumed

7.16 Ecological Impacts and Mitigation Measures of Works Within the NHS

The SWM Pond 9 facility, comprising all its various infrastructure components, has been situated and designed to minimize both the short- and long-term natural heritage impacts to, and the extent within, the NHS. This included selection of the preferred outfall option. Portions of the trail system which are designated by the Oakville *Master Trails Plan* (see Section 6.2), are located in the outer areas of the NHS.

For those infrastructure components that are situated in the NHS (see **Figure 7.12R**), the potential ecological impacts and associated mitigation measures, described herein, are summarized below in **Table 7.24**. As presented in the table, based on the design and recommended mitigative measures to be followed during construction, no long term residual negative impacts are anticipated from all of these works. Thus, no negative impacts to the features and functions of Core 5 are anticipated.

Table 7.24 - Ecological Impacts and Mitigation Measures of Works in NHS

PROPOSED WORKS (see Fig. 7.12R)	DESCRIPTION	POTENTIAL ECOLOGICAL IMPACT	MITIGATION MEASURES	POTENTIAL RESIDUAL IMPACTS
TRAIL				
1A - East Segment in NHS Trail at eastern limit of Subject Lands, at north end of woodland	- Trail will be situated where there is a remnant farm lane through a hedgerow at the north end of the woodland. - Major trails are off-road, soft surface pathways 2.1-2.4 metres in width, with a compacted limestone screenings surface.	- Removal of 3 small trees, each less than 15 cm diameter. - Trail surface not expected to create a negative effect due to permeability and potential gas/water exchange with soil. - No impact to habitat and wildlife is anticipated. - Potential for erosion/sedimentation during construction.	- Primary mitigation is the strategic location on the farm access where disturbance to hedgerow currently exists. - Field-fit construction to refine trail crossing through hedgerow at detailed design stage will occur. - Controlled construction access only from north. - Temporary fencing to be erected along south limit of trail to isolate the woodland from construction. - Erosion control measures to be installed and maintained during construction along edge of trail disturbance area. - The graded trail area and the area between the trail and the development will be landscaped following the CH Guidelines for Landscaping and Rehabilitation. - Works in the NHS will be completed and restored as quickly as possible.	No residual impacts to the features or functions of the NHS are anticipated.
1B – West Segment of Trail Trail at western limit of Subject Lands, through outer edge of wetland buffer	- Situated within 4 m of the edge of the NHS in the outer 26m to 30m of PSW 3 wetland buffer, on top of SWM pond discharge pipe (see #6, below). - Area currently agriculture, cultural meadow and cultural thicket. - Major trails are off-road, soft surface pathways 2.1-2.4 metres in width, with a compacted limestone screenings surface - Alignment was walked with Town and CH staff, October 13, 2022 with agreement on location and design.	- Disturbance area limited to agricultural field /cultural meadow /thicket and removal of one small sweet cherry and one willow. - Trail surface not expected to create a negative effect due to permeability and potential gas/water exchange with soil - There will be no barrier to wildlife movement. - No impact to habitat and wildlife is anticipated. - Potential for erosion/sedimentation during construction.	- Erosion and sediment control measures, including temporary silt fencing, to be established and maintained along the south edge of trail disturbance; fencing will isolate construction zone from the adjacent features in the NHS, specifically the wetland. - Construction access only from north; no access, storage of materials or construction machinery staging area to be permitted south of the trail. - The graded trail area and the area between the trail and the development will be landscaped following the CH Guidelines for Landscaping and Rehabilitation. - Works in the NHS will be completed and restored as quickly as possible.	No residual impacts to the features or functions of the NHS are anticipated.
CLEAN WATER PIPE OUTFALL				
2 – Clean Water Pipe Outfall and Constructed Wetland located in the outer buffer to PSW 3	- Clean water pipe will discharge flows from small developed area (1.08ha) to PSW 3 to treat runoff and maintain surface water inputs to PSW 3. - A stone core wetland is proposed at the clean water pipe outfall located in the outer 20m of the wetland buffer (currently cropped field). The stone core wetland will receive and polish runoff and moderate the discharge of water into PSW 3. Vegetated rock buttresses are proposed along the bank of the stone core wetland to provide additional stability given the proximity to the existing infrastructure. Plantings will provide additional thermal mitigation through shade, and also will provide a source of organic matter.	- Temporary disturbance to currently cropped field. - Potential for erosion/sedimentation during construction. - Potential for accidental incursion into the adjacent PSW 3 and associated buffers beyond permitted area.	- Location of the proposed outfall is in a cropped field; therefore no change or negative impact to any natural area. - Clean water pipe to provide water source to PSW 3. - The location of the outfall will provide hydrologic benefit to the MAM2-2 portions rather than being intercepted by the Phragmites colony. - Current agricultural area will be naturalized. - Shading from tree/shrub plantings will provide thermal benefits and allochthonous inputs. - Erosion and sediment control measures, including temporary silt fencing, to be established and maintained along the perimeter of the construction zone along the PSW 3 plus 10m buffer limit. - Works in the NHS will be completed and restored as quickly as possible.	No residual impacts to the features or functions of the NHS are anticipated; hydrologic contributions to PSW 3 will be maintained.

PROPOSED WORKS (see Fig. 7.12R)	DESCRIPTION	POTENTIAL ECOLOGICAL IMPACT	MITIGATION MEASURES	POTENTIAL RESIDUAL IMPACTS
SWM POND 9				
3 – SWM Pond located partially in NHS	- The eastern portion of SWM Pond 9 is located in the active agricultural area in the NHS, outside of 10m buffer from the adjacent woodland, as permitted by the MOS.	- Potential temporary (during the construction period) noise impacts to fauna utilizing the edge of Core 5 forest during breeding periods. - No impacts associated with displacement of agricultural field. - Potential for dust dispersion during construction on nearby vegetation. - Potential for erosion/sedimentation during construction. - Potential for accidental incursion into the adjacent woodland or PSW 8 and associated buffers.	- Activities with excessive noise should be avoided during early May-late June between dawn to four hours after dawn (when many bird species are actively calling). - Habitat adjacent to the woodland will succeed from lawn to naturalized conditions, along the SWM pond slopes. All disturbed areas will be restored/planted. - Erosion and sediment control measures, including temporary silt fencing, to be established and maintained along the NHS portion of the perimeter of the construction zone (i.e., 10m from woodland or 30m from PSW 8) - A water truck to be employed to irrigate haul roads, fill piles, exposed soils in vicinity of Core 5 woodland to minimize dust dispersal into the NHS during construction.	No residual impacts to the features or functions of the NHS are anticipated.
SWM Pond 9 Outfall including: **4 – Pond Emergency Spillway** **5 – Pond Pipe Outfall to Neyagawa Ditch** **6 –Stone Core Wetland at Pond Pipe Outfall**	An emergency spillway will accommodate uncontrolled Regional Storm flows should the outfall become blocked. The emergency spillway will connect to pond overflow to PSW 3, terminating at 10m from the wetland edge downstream of the existing weir. This connection will be designed to accommodate Regional Storm flows and velocities. Appropriate materials and restoration will be identified at detailed design. The existing concrete weir in this location will be removed. An underground pipe will convey controlled flows from the SWM pond (extended detention and 2 year to 100 year) and Regional Storm flows to the SWM pond to the outfall location east of Neyagawa Blvd. The outfall pipe is located in the outer portion of the NHS (in outer 5m of the wetland 30m buffer) through areas that are currently cultural meadow/thicket. Extent of temporary disturbance for construction is limited to the outer 13m of the NHS. A stone core wetland will receive and polish runoff from Pond 9 and moderate the discharge of water into the Neyagawa ditch. Vegetated rock buttresses are proposed along the bank of the stone core wetland to provide additional stability given the proximity to the existing infrastructure. Plantings will provide additional thermal mitigation through shade, and also will provide a source of organic matter.	- Loss of thicket, mostly pear and buckthorn, which will be replaced by the stone core wetland and associated restoration plantings - Potential for dust dispersion during construction on nearby vegetation. - Potential for erosion/sedimentation during construction. - Potential for accidental incursion into the adjacent PSW and associated buffers beyond permitted area. - No barrier to wildlife movement and no anticipated impacts to habitat and wildlife. - Removal of existing concrete weir will be replaced by naturalized areas.	- Erosion and sediment control measures, including temporary silt fencing, to be established and maintained along the south edge of trail disturbance and along north and east sides of PSW 3 - Temporary fencing will isolate construction zones from the adjacent features in the NHS, specifically the wetland. - Construction access only from north; no access, storage of materials or construction machinery staging area to be permitted south of the outfall alignment with exception of work for the emergency spillway and secondary pipe outlet. - Along the pipe alignment, with the exception of where the trail will be constructed, the area will be graded, and landscaped following the CH Guidelines for Landscaping and Rehabilitation. - Works in the NHS will be completed and restored as quickly as possible.	No residual impacts to the features or functions of the NHS are anticipated.
7 - Improved Neyagawa Blvd ditch	- Realignment and lowering of existing eastern ditch, (the current outfall for ES6-East subcatchment) to address Region/Town/CH comments; for detailed description see Section 7.12.4 - Erosion protection provided along entire length of realigned ditch. - Ditch has capacity to convey Regional Storm flows from upstream drainage area without impeding on Regional right-of-way.	- Removal of 20 trees up to 51 cm diameter. - Potential for increased light pollution from road traffic and existing streetlights into Core 5 forest which may disrupt nocturnal fauna behaviour. - Potential reduction of habitat for edge nesting bird species. - Potential for erosion of the slopes and sedimentation transport to downstream (SMA-6) habitats during construction of the ditch. - Potential to enhance current edge conditions and long-term stability to woodland interior.	- Implementation of an edge management plan to restore the forest edge and provide a variety of vegetation height over the long term (i.e., addition of trees, shrubs, and herbaceous cover) to impede light penetration into the forest and to enhance stability to specimens located interior to edge, to address potential for light pollution and restore/enhance edge habitat - Timing windows to be implemented for construction of the ditch to avoid impacts to downstream aquatic habitats during sensitive life periods (i.e., spawning, rearing). - Isolation of work zones, working in the dry best practices, and erosion and sedimentation best practices to be employed to minimize or eliminate potential for erosion and sedimentation to downstream habitats. - Works in the NHS will be completed / restored as quickly as possible.	Removal of portion of woodland edge. Disturbed areas on east slope of ditch will be restored with edge plantings. With implementation of an Edge Management Plan residual long term impacts to features or functions of woodland are not anticipated.

8.0 WATER BALANCE

In order to assess potential land development impacts on the groundwater conditions within the EIR/ FSS Subcatchment Area, a water balance analysis has been completed to determine the pre-development recharge volumes based on existing land use conditions, and the post-development recharge volumes that would be expected based on the proposed land use plan.

8.1 Components of the Water Balance

A water balance is an accounting of the water resources within a given area. As a concept, the water balance is relatively simple and may be estimated from the following equation:

$$P = S + R + I + ET$$

where:
- P = precipitation
- S = change in groundwater storage
- R = surface water runoff
- I = infiltration
- ET = evapotranspiration/evaporation

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (e.g., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). Runoff, for example, occurs particularly during periods of snowmelt when the ground is frozen, or during intense rainfall events. Precise measurement or calculation of the water balance components is difficult and as such, approximations and simplifications are made to characterize the water balance of a study area. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important input considerations for the water balance calculations.

The water balance components considered for the current assessment are discussed below:

Precipitation (P) As noted in Section 4.4, the long-term average annual precipitation for the area is 897mm based on data from the Environment Canada Royal Botanical Garden climate station (Station 6153301 - 43°17'30''N, 79°54'30''W, elevation 102 masl) for the period between 1981 and 2010. The precipitation data are provided in Tables C-7-1 and C-7-2, **Appendix C-7**.

Storage (S) Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero so this term is dropped from the equation.

Evapotranspiration (ET) Evapotranspiration varies based on the land surface cover (e.g., type of vegetation, soil moisture conditions, impervious surfaces, etc.). Potential evapotranspiration (PET) refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. The actual rate of evapotranspiration (AET) is generally less than the PET under dry conditions (e.g., during the summer when there is a soil moisture deficit).

Water Surplus (R + I) The difference between the mean annual P and the mean annual ET is referred to as the water surplus. Part of the water surplus travels across the surface of the soil as surface or overland runoff (R) and the remainder infiltrates the surficial soil (I). Infiltrating water may either move downward through the surficial sediments to the water table (groundwater recharge) or move laterally through the topsoil profile as interflow. Weathering and fracture patterns in the relatively low hydraulic conductivity till soils of the Study Area may aid the vertical and lateral movement of water. The interflow moves relatively quickly and often re-emerges locally at the ground surface as seepage. So as opposed to the “direct” component of surface runoff that occurs during precipitation or snowmelt events, interflow becomes an “indirect” component of runoff. Since it is generally very difficult to distinguish between interflow and surface (overland) runoff, they are often considered together.

8.2 Approach and Methodology

The analytical approach to calculate a water balance for the EIR/ FSS Subcaatchment Area involved monthly soil-moisture balance calculations (based on the Thornthwaite and Mather methodology) to determine the evapotranspiration and the corresponding water surplus components. A soil-moisture balance approach was used for the current assessment and assumes that soils do not release water as “potential recharge” while a soil moisture deficit exists. During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Once the soil moisture deficit is overcome, any further excess water can then pass through the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

A soil moisture storage capacity of 100mm was used to represent the predominantly short-rooted vegetation in the open agricultural fields with clayey soils and a soil moisture capacity of 200mm was used to represent the more moderately deeply-rooted shrub and wooded areas with clayey soils. Tables C-7-1 and C-7-2 in **Appendix C-7** detail the monthly potential evapotranspiration calculations accounting for local latitude and climate, and then calculate the actual evapotranspiration and water surplus components of the water

balance based on the monthly precipitation and soil moisture conditions. The SWMP Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used and a corresponding runoff component was calculated for conditions (i.e., the agricultural and shrub/wooded areas). The monthly water balance component calculations are shown in Tables C-7-1 and C-7-2 in **Appendix C-7**.

As noted in Section 8.1, the infiltration component will divide into shallow interflow and deeper groundwater recharge components. Although there is no widely-accepted standard methodology for calculating this division of flow, reasonable estimates can be made based on the nature of the surficial soils. For example, for soils underlain by very permeable sand, it is considered that the interflow component would likely approach 0% with most of the infiltrating water recharging downwards to the water table. For soils underlain by very low hydraulic conductivity sediments, the interflow component would likely approach 100%, with most of the water infiltrating into the topsoil seeping laterally along the topsoil/till contact to re-emerge locally at surface. Although the topsoil is underlain by low hydraulic conductivity till sediments, weathering and fracturing of the shallow soils may improve the recharge capabilities. In the water balance analyses completed for the North Oakville East Subwatersheds Study (NOMI, 2004), an interflow component value of 50% was used in the soil moisture balance calculations and this was found to correlate very well with numerical modelling results of the regional groundwater flow conditions, as well as the study findings of the NOCSS (2006) and other regional modelling completed by the Region of Halton (1995). Therefore, this estimate has been used in this study also to calculate the direct and indirect runoff components of the water balance (Tables C-7-1 and C-7-2, **Appendix C-7**).

To evaluate the effects of development, the monthly water surplus component is also calculated for impervious surfaces on Table C-7-1 in **Appendix C-7**.

Using these calculated water balance components, the total annual infiltration and runoff water volumes for the EIR/FSS Subcatchment Area was then calculated for the pre-development conditions (based on the existing land use characteristics) and post-development conditions (based on the proposed development plan). The post-development water balance scenario is calculated assuming no mitigation strategies or use of Low Impact Development (LID) measures for stormwater management and infiltration. The post-development land uses have been broken down into land use categories and assigned an average percentage of imperviousness for the water balance calculations as summarized in **Table 8.1**. The detailed infiltration and runoff volume calculations are presented in Table C-7-4 in **Appendix C-7**.

Table 8.1 - Water Balance Land Use Categories

LAND USE CATEGORY	% IMPERVIOUSNESS
Agricultural/ Open Space	5
Commercial	85
Future Development	100
High Density Residential	90
Residential Singles	65
Townhouses	80
Live/ Work	100
Institutional (School)	70
7.5m ROW	100
17m ROW	70
19m ROW	64
22m ROW	73
NHS Wetland	0
Park	20
SWM Pond	100

8.3 Component Values

The detailed monthly calculations of the water balance components are provided on Tables C-7-1 and C-7-2 in **Appendix C-7**. The calculations show that a water surplus is generally available from November to May. The monthly water balance calculations illustrate how infiltration occurs during periods when there is sufficient water available to overcome the soil moisture storage requirements. In our winter climate, frozen conditions may affect when the actual runoff and infiltration will occur, however, the monthly balance calculations show the potential volumes available for these water balance components.

The monthly calculations are summed to provide estimates of the annual water balance component values (Tables C-7-1 and C-7-2; **Appendix C-7**). A summary of these values is provided in **Table 8.2** (note that the values from the tables in **Appendix C-7** have been rounded accounting for the minor variances in balance additions).

It is acknowledged that the infiltration, recharge and runoff values presented in **Table 8.2** are estimates. These values are used for the water balance calculations, but it is important to understand that infiltration rates are directly dependent upon the hydraulic conductivity of the surficial soils and this may vary over several orders of magnitude. As such, the margins of error for calculated infiltration and recharge rates are large. The margins of error are recognized, but for the purposes of this assessment, the numbers used in the water balance calculations are all considered reasonable estimates based on the site-specific conditions

and anticipated post-development conditions. It is noted further that the estimates for groundwater recharge are consistent with the previous subwatershed studies done for the area, including the NOCSS (2006) and NOMI (2004) studies, and a comprehensive hydrogeological study of aquifers throughout the Region of Halton that included regional groundwater flow modelling by Holysh (1995).

Table 8.2 - Water Balance Component Values

Water Balance Component	Agricultural/ Open Space	Woodlots
Average Precipitation	897 mm/year	897 mm/year
Actual Evapotranspiration	591 mm/year	626 mm/year
Water Surplus	306 mm/year	271 mm/year
Total Infiltration	107 mm/year	122 mm/year
Direct Runoff	199 mm/year	149 mm/year
Recharge (deep infiltration)	54 mm/year	61 mm/year
Interflow (indirect runoff)	54 mm/year	61 mm/year
Total Runoff	252 mm/year	210 mm/year

8.4 Pre-Development Recharge (Existing Conditions)

The pre-development water balance calculations for the EIR/FSS Subcatchment Area are presented in Table C-7-3 in **Appendix C-7**. As summarized on Table C-7-3, the developable portion of the FSS Study Area is approximately 58ha. Although much of the area is agricultural land, there are a few wooded areas within the ES6-East subcatchment (**Figure 4.1**). The buildings associated with the former riding school have been demolished and vegetation is re-growing in many areas. The site imperviousness in existing conditions has been adjusted to account for the absence of buildings. The total area for these land cover/land use types have been estimated and assigned appropriate water balance component values short-rooted vegetation for the agricultural lands and open space / former buildings (100mm soil moisture storage) or land covered by the existing farm pond. Based on these component values, the total pre-development recharge volume for the EIR/FSS Subcatchment Area is calculated to be about 29,500 m^3/year (Table C-7-3, **Appendix C-7**). It is again acknowledged that the recharge rates are directly dependent upon the hydraulic conductivity of the soils and may naturally vary over several orders of magnitude. Recognizing the wide margins of error associated with this analysis, the recharge volume presented above is considered simply as a reasonable estimate and not the precise volume of infiltration that may recharge the water table.

8.5 Potential Development Impacts to Water Balance

Development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (e.g., roads, parking lots, driveways, and rooftops). Impervious surfaces prevent infiltration of water into the soils and the removal of the vegetation removes the evapotranspiration component of the natural water balance. There is still an evaporation component from impervious surfaces as well as some losses of water through infiltration because of cracks, however, this is relatively minor (estimated to be 10% to 20% of precipitation) compared to the evapotranspiration component that occurs with vegetation (about 65% of precipitation in this area). So the net effect of the construction of impervious surfaces is that most of the precipitation that falls onto impervious surfaces becomes surplus water and direct runoff.

A calculation of the potential water surplus for impervious areas is shown at the bottom of Table C-7-1 in **Appendix C-7**. Assuming a maximum evaporation loss from impervious surfaces of up to 20% of the precipitation of 897 mm/year (i.e., 179 mm/year), there is a potential water surplus (runoff) from the impervious areas of 718 mm/year.

8.6 Post-Development Recharge

As described in Section 8.2, the EIR/ FSS Subcatchment Area has been broken down into proposed developed land use areas and each land use has been assigned an average percentage of imperviousness as summarized in **Table 8.1**. These data have been used to calculate potential post-development runoff and recharge volumes assuming no mitigation or LID measures are in place (Table C-7-3, **Appendix C-7**). These calculations allow the quantification of recharge targets for the implementation of LID measures into the stormwater management strategy for the developed area.

Based on the proposed land use analysis, the total post-development recharge (again with no LID measures) is estimated to be about 11,700 m^3/year. The calculations shows that there is potential for a decrease in recharge to the groundwater regime of about 60% (Table C-7-3, **Appendix C-7**). This results in a potential recharge deficit of 17,800 m^3/year, and this volume represents a target for the use of LID measures to promote infiltration throughout the developed area.

8.7 Water Balance Impact Assessment

8.7.1 Water Quantity

The increases in surface water runoff that will occur with urban development are typically addressed through the use of appropriate stormwater management techniques and best management practices to reduce the runoff volumes. Details of the proposed stormwater management plans for the FSS Study Area are provided in Section 7.

The predicted water balance for the proposed development suggests that, without mitigation, recharge will be about 40% of the average annual recharge that occurs under existing conditions (refer to Section 8.6). The natural recharge conditions are limited due to the low permeability surficial soils. Monitoring has shown that the surface water flows in drainage swales across the EIR Subcatchment Area are intermittent and groundwater discharge does not make a major contribution to the flows (the main source of water to the watercourses is surface water runoff). The reduction in recharge that may occur with land development is not expected to result in any significant impacts to the local groundwater flow patterns (the flow directions are related to the overall regional topography) but there is potential to lower the local water table and lower the recharge that reaches the shale bedrock. Discharge from the shale occurs along the watercourses in Core 5 south of the EIR Subcatchment Area. Although the groundwater discharge volumes are minor, it is important to maintain the local high water table conditions in the shale such that the discharge conditions are maintained. It is recommended to minimize potential changes to the natural water balance throughout the EIR Subcatchment Area where possible through the incorporation of Low Impact Development (LID) measures to promote recharge into the development design. Water balance mitigation measures are discussed in Section 8.8.

In addition to the loss of direct recharge, the construction of buried services below the water table has the potential to capture and redirect groundwater flow through more permeable fill materials typically placed in the base of excavated trenches. Over the long term, these impacts can lower the local groundwater table. Mitigation strategies to prevent this lowering are discussed in Section 11.5.

8.7.2 Water Quality

Depending on land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, bacteria and viruses. For the surface water, the SWM ponds will be designed to meet Enhanced Level quality controls (refer to Section 7). For groundwater, generally, with the exception of the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater transport through the soils. The potential for effects on groundwater quality from infiltration in the urban areas is

therefore expected to be limited. Any potential changes to the groundwater quality are not expected to influence conditions in surface water features given the limited discharge conditions.

LID measures recommended for the promotion of infiltration will involve the direction of clean roof runoff to pervious areas within the development and no impact to local groundwater quality would be anticipated.

8.7.3 Private Services

The proposed development within the Study Areas will be serviced by municipal water supply and waste water services. Therefore there will be no impact on the local groundwater or surface water quantity and quality conditions related to any on-site groundwater supply pumping or disposal of septic effluent. There are some existing groundwater supply wells and septic systems within the Study Areas, however, it is anticipated that all of these systems will be decommissioned or removed during the development process. Further discussion on interim monitoring and decommissioning of any active private wells is provided in Section 11.8.

8.8 Infiltration Mitigation Measures

Where feasible, LID measures for stormwater management will be incorporated into the development design to minimize development impacts on the natural water balance and control runoff.

The basic premise for LID is to try to manage stormwater to minimize the runoff of rainfall and increase the potential for infiltration through the use of various design techniques. The relatively low hydraulic conductivity of the surficial till and shale materials limit infiltration potential and there are no significant enhancement opportunities for infiltration in the EIR/ FSS Subcatchment Area. The use of large engineered subsurface infiltration measures are generally not considered suitable for the development. There are, however, as outlined in the SWMP Design Manual (2003), a number of surface techniques that can be used to increase the potential for post-development infiltration and mitigate the reductions in recharge that occur with urban land development.

Techniques to maximize the water availability at surface in pervious areas such as designing grades to direct roof runoff towards open space areas throughout the development where possible (e.g., yards, boulevards, landscaped areas, green space in parking lots, etc.) can increase recharge in the developed area. Where possible, increasing topsoil depths in pervious areas to more effectively ‘hold’ water can also help to reduce runoff volumes and increase the potential for infiltration. Incorporating such stormwater management techniques into development design can help to minimize development

impacts to the water balance by reducing the post-development groundwater recharge deficit.

For the EIR/FSS Subcatchment Area, LID techniques to be implemented are discussed in Section 7.4. This includes designing grades to direct roof runoff towards pervious areas (e.g., lawns, side and rear yard swales) throughout the development where possible, increased topsoil depths and tree pits on all roads. To demonstrate the effectiveness of directing roof runoff to pervious areas, the water balance components were re-calculated for areas where roof runoff is directed to grass (Table C-7-4, **Appendix C-7**). These areas would receive water from precipitation (897 mm/year) as well as extra water from roof runoff (718 mm/year), providing a total potential water supply of 1,615 mm/year. Under these conditions of increased water supply, evapotranspiration can occur at the potential rate, leaving a water surplus of 972 mm/year. Calculation of the potential recharge that could occur in pervious areas under these conditions of increased water supply is 194 mm/year (Table C-7-4, **Appendix C-7**). The pre-development recharge was calculated to be about 54 mm/year (Table C-7-1, **Appendix C-7**), therefore, the recharge in pervious areas receiving extra roof water could theoretically be more than 3.5 times higher than natural conditions.

An assessment of the impact of the above mentioned LID measures was completed as part of an analysis to demonstrate the impact of roof leader disconnection in reducing the deficit. It should be noted that the quantification of the impact of LID measures is challenging as there are no widely accepted methods or standards. Notwithstanding the above, the assessment was completed using methodology from the TRCA LID SWM Planning and Design Guide. In this approach a runoff reduction value of 25% on hydrologic soil group C soils was assumed across the development area. The reduction was applied to residential singles and townhouses except back-to-back townhouses (Table C-7-5, **Appendix C-7**). This reduction of runoff is regarded as equivalent to an increase in recharge and is estimated to be sufficient to overcome the post-development recharge deficit that was identified without the implementation of LID measures.

9.0 WATER AND WASTEWATER SERVICING

9.1 North Oakville East – Area Servicing Plan (ASP)

In support of the North Oakville East Secondary Plan, on behalf of the North Oakville Community Builders Inc. (NOCBI), the Area Servicing Plan (ASP) for North Oakville East has been prepared by MMM Group. The ASP is intended to satisfy the Secondary Plan requirement for a Master Servicing Plan.

The ASP provides a conceptual framework for the extension and development of water and wastewater systems to the North Oakville East Secondary Plan. The proposed water and wastewater servicing strategies outlined in this EIR/FSS have been prepared in accordance with the strategies put forth in the ASP, and comments received from the Region of Halton on the proposed water and wastewater servicing in North Oakville.

9.2 Wastewater Servicing

9.2.1 Wastewater Design Criteria

Wastewater infrastructure will be designed in accordance with the latest Region of Halton design standards and specifications, as follows:

Sewer Design Criteria

Average Dry Weather Flow	275 litres per capita per day
Infiltration	286 litres per second per hectare
Peaking Factor	Harmon Formula

Population Criteria

Single Family	55 persons/hectare
Semi-detached	100 persons/hectare
Townhouse	135 persons/hectare
Community Services	40 persons/hectare
Light Commercial Areas	90 persons/hectare
High-Density	285 persons/ha 1.655 people/unit (per Halton Region DC study where unit counts are available)

9.2.2 Existing Wastewater Services

An existing 450mm diameter trunk sewer is located on Neyagawa Boulevard, at the intersection of future Street A. This trunk has been designed to convey flows from the lands

west of the ASP drainage boundary limit shown on **Drawing 9.2** to the Sixteen Mile Creek wastewater pump station located further to the south, east of Neyagawa and north of Dundas Street. Lands east of the ASP Boundary drain east to the existing 525mm Preserve Drive sanitary trunk sewer which also drains to the Sixteen Mile Creek wastewater pump station. Flows are pumped from this location to a 2400mm diameter wastewater main located at Dundas Street and Third Line. In accordance with the Master Plan, the existing 2400mm diameter trunk main is proposed to function as the ultimate outlet for all lands located within the North Oakville East Secondary Plan.

9.2.3 External Wastewater Requirements

In accordance with the Region of Halton Master Plan Update (2008), the Region planned future wastewater infrastructure to service lands throughout South Halton. This will be achieved through a series of trunk mains, pump stations and forcemains. All projects required for servicing the EIR/FSS Subcatchment Area have been constructed and are now in service.

9.2.4 Proposed Wastewater Servicing

The Subject Lands will be serviced by a network of local gravity sewers designed in accordance with Region of Halton standards and specifications. The local sewers will convey flows into the existing 450mm diameter regional trunk wastewater main constructed within Neyagawa Boulevard, and a 525mm diameter regional trunk wastewater main constructed within Preserve Drive via a 450mm diameter trunk sewer through the Docasa lands to the east.

Previous coordination with the Region provided for a connection manhole at the future intersection with Street A and Neyagawa Blvd. for the lands west of the ASP drainage boundary limit. Recent coordination (2024) with the Region confirmed Street B through the Docasa Development lands as being the preferred route for sanitary drainage east of the ASP drainage boundary limit

Three service connections to the external lands are proposed to be extended across William Halton Parkway.

The wastewater servicing plan is illustrated in **Drawing 9.2**. Design sheets and tributary area plans are included in **Appendix F**. Interim wastewater servicing is not required for these lands.

9.3 Water Servicing

9.3.1 Water Supply Design Criteria

Water servicing for the Subject Lands will be designed in accordance with the latest Region of Halton standards and specifications such that adequate pressures and fire flows are achieved. Water design flows will be designed with the following criteria:

Water Design Criteria

Average Day Residential Demand	275 L/cap/day
Maximum Day Factor	2.25
Peak Hour Factor	2.25
Density - Detached and Semi-Detached	3.77 persons/unit
Density - Townhouse	2.85 persons/unit

9.3.2 Pressure Zone Boundaries

The Subject Lands are located within the Zone O4 pressure district of Halton's water distribution system, which is part of the area to be changed through the Region's Zone realignment. The proposed development is located near the boundary between the future Zones 223 and 250, which are to run along William Halton Parkway and Neyagawa Boulevard per the Region's plans. Refer to **Drawing 9.3R** for the zone boundary location.

A summary of the current zone elevations is provided in **Table 9.3A** below. The FSS Study Area elevations range from 172m to 182m.

Table 9.3A - Summary of Pressure Zone Elevations

Zone	Lower Elevation (m)	Upper Elevation (m)
O4	167	182

9.3.3 Existing Water Supply

Existing watermains are currently available in the vicinity of the lands shown in **Table 9.3B**. A 1200mm diameter CPP watermain is located on Neyagawa Boulevard and William Halton Parkway fronting the Subject Lands. The construction of this watermain provided for a 300mm connection point for the Subject Lands at the proposed intersections including Street 'A'. In addition, 300mm diameter watermain connections were constructed on William Halton Parkway to facilitate looping (at Street B and near the William Halton

Parkway / Burnhamthorpe intersection). The existing watermains are illustrated in **Drawing 9.3R**.

Table 9.3B - Summary of Existing Watermains

Street	Size (mm)	Location	Zone (Future Zone)
Neyagawa Blvd.	1200	North of Dundas Street	O4 (250)
William Halton Parkway	1200	East of Neyagawa Blvd. to Burnhamthorpe Road	O4 (250)
Burnhamthorpe Road	300	East of William Halton Parkway	O4 (250)

9.3.4 External Water Supply Requirements

The Region of Halton has completed an update to the Halton Water and Wastewater Master Plan. Through the Master Plan Update, the Region planned water infrastructure to service lands throughout Pressure Zone O4. This will be achieved through comprehensively planned infrastructure including transmission mains, pump stations, storage facilities, and distribution mains. The necessary infrastructure has been constructed and is now in service as shown on **Drawing 9.3R**.

9.3.5 Proposed Water Servicing

The Subject Lands will be serviced by a network of new local watermains designed in accordance with the Regional Municipality of Halton design criteria and MOE guidelines.

A watermain sizing and pressure zone boundary analysis was completed for the Subject Lands and adjacent areas in Neighbourhood 10 by MES. Refer to the Water Analysis Report dated April 2023 in Appendix F-2. The analysis includes calculations of average day demand, maximum day demand plus fire, and peak hour demand for the Subject Lands under future (2026) and 2031 conditions. Trunk and local watermains identified in the report are shown on **Drawing 9.3R**.

As outlined in the water analysis report, prior to the availability of watermain connections in the neighbouring developments to the east and to the south, the internal watermain is proposed to be connect to the existing 300mm watermains on Neyagawa Boulevard and William Halton Parkway that are located within Zone 250. Under the Zone 250 connection conditions, most of the development will have pressures above the Region's 100 psi criteria, The development units will require pressure reducing valves to meet he OBC limit while

being supplied by Zone 250. Locations for pressure reducing valves will be determined at detailed design.

When Zone 223 connections become available from the neighbouring developments to the east and to the south, the connections supplying development units from Zone 250 should be decommissioned. The lower pressures from the Zone 223 connections will not require the use of pressure reducing valves. The high-density blocks fronting William Halton Parkway will remain serviced from Zone 250.

Final watermain sizing and pressure zone boundary limits will be completed at the detailed design stage based on the actual development characteristics. The water distribution system will be looped in order to provide system security.

10.0 ROADS

Through the Secondary Plan process, alternate road allowance design standards were proposed by the Town of Oakville. The road allowance design was undertaken to establish preliminary right-of-way widths for various road types.

Since the time of the Secondary Plan, the road allowance design has continued to evolve in order to reflect the detailed requirements of the many stakeholders whose infrastructure is located within the road allowance. The proposed road allowances which have been approved by the Town of Oakville are included in **Figures 10A**, **10B**, **10C** and **10D**.

The proposed drainage strategy and SWM design has taken into account the ultimate William Halton Parkway design. “Issued for construction” drawings dated January 17th, 2022 for the ROW design were obtained from the Region and integrated into the EIR/FSS design. Available drawings for Neyagawa Boulevard were also reviewed and incorporated into the functional design.
The Draft Plans of Subdivision (**Figures 6.1AR** and **6.1BR**) reflect road allowance widths in general conformance with the Secondary Plan widths.

Sidewalks are proposed on both sides of all streets, see **Drawing 6.2B**.

There are no road crossings or servicing crossings of the NHS proposed.

11.0 CONSTRUCTION PRACTICES

This section of the EIR/FSS includes discussions on a number of construction related matters including geotechnical recommendations for construction, general construction phasing, erosion and sediment control requirements, the removal of the existing Sherborne Lodge farm pond, removal of a future temporary Region of Halton SWM facility associated with Burnhamthorpe Road construction, and construction related habitat protection and mitigation requirements.

11.1 Summary of Key Geotechnical Findings

The subsurface conditions within the FSS Study Area were evaluated through geotechnical investigations by Soil Eng. Two geotechnical reports were prepared; one for Sherborne Lodge and one for Eno Investments. These reports are provided in **Appendices G-1** and **G-2**. The key findings are summarized below.

- The undisturbed native deposits are likely not suitable house footings (subject to inspection upon excavation). Engineered fill is recommended in fill areas or where extended footings are required.

- Excavations for the footings and services, within the overburden deposits, could be carried out with conventional equipment and the possible occurrence of boulders and cobbles should also be anticipated when working within glacial till deposits. However, when the excavation is extended down into the weathered shale, increased effort in the form of use of hydraulic hammers and/or large backhoe and dozers equipped with ripping teeth, etc. would be required.

- Considering the groundwater conditions encountered at the borehole locations, the amount of seepage from the glacial clayey silt and sandy silt till deposits is expected to be small and manageable by sump pumps. However, increased seepage may be encountered from perched groundwater and/or surface run-off that should be manageable with increased sump pumps.

- Considering the occurrence of Queenston shale at the Subject Lands, some key geotechnical recommendations are provided below. This shale is susceptible to degradation and swelling when exposed to weather elements.

  Protection of Exposed Shale and Sewers Installed in Shale
  Shale has the characteristics of becoming soft or degraded after excavation and being exposed to weather, and the effects on trenching would be bottom heaving and squeezing. It would be prudent to minimize these effects during construction. The construction program should be well planned so that the excavation and construction of

the sewers and basement foundations would minimize the exposure time for the shale. Otherwise, the application of a thin layer of lean concrete or sprayed concrete may be required immediately after exposure. Suitable trench backfill materials, preferably sand for the protection of the sewers and manholes against squeezing shale, should be implemented. The geotechnical report includes specific recommendations for design and implementation of service trenches in shale areas.

Anti-seepage Collars

For sewer trenches dug in shale (weathered or un-weathered) and sewers installed below the groundwater table / within sandy soils, seepage between the trench backfill material and the trench wall may cause erosion of the backfill materials. Flow through the backfill can also affect local groundwater flow patterns. If sand or gravel is used as the backfill, it is recommended that nominal anti-seepage collars be provided to prevent erosion of the sand placed in the sewer trench and redirection of groundwater flow.

The anti-seepage collar may consist of a clay plug surrounding the sewer pipe. A typical clay plug will be about 1m thick and extends laterally to a minimum distance of 0.5m from the pipe circumference with a minimum of 0.3m embedment into the shale. The on-site native clayey till deposit may be suitable for such purpose, subject to additional sampling and testing.

Anti-seepage collars should also be considered for outlet works that direct flow out of the SWM ponds as they are subject to hydraulic heads directly from the ponds.

SWM Pond / Liner Requirements

The clay till dominates the subsurface findings at the proposed stormwater management pond location and is suitable for the construction of the pond. The downstream end of the bank of the control structure at the settlement cell must be lined with a gabion mat to prevent flow and eddy erosion which may affect the stability of the control structure. This recommendation is applicable to the outlet of the control structure of the wetland cell. The in situ silty clay till, due to its very low permeability, is suitable for berm construction.

The pond berms must be compacted to 95% or + of their maximum Standard Proctor dry density. The ground cut for the pond should be sloped to 1 vertical: 3 or more horizontal above the wet perimeter and 1 vertical: 4 or more horizontal below the wet perimeter. All the exposed side slopes must be vegetated and/or sodded to prevent erosion. A layer of rip-rap can be placed at the wet perimeter to protect against wave erosion.

The footings for all control structures for the stormwater management system must be placed onto the sound natural soils. The recommended soil pressures are provided in the geotechnical reports. The footings must be placed below the frost depth of 1.2m or

below the anticipated scouring depth, whichever is deeper. As noted, gabion mats must be placed at the upstream and downstream ends of the control structure to prevent bed scouring.

At detailed design, additional borehole tests will be advanced at the Pond 9 location. Considering the subsurface conditions encountered at the borehole locations, the base and/or walls of the SWM pond could occur in shale and should be further assessed prior to construction. Under such conditions, a liner may be recommended for the proposed pond to cover the shale surface in order to minimize groundwater infiltration into the pond or stormwater exfiltration from the pond.

11.2 Erosion and Sediment Controls

An Erosion and Sediment Control (ESC) strategy will be prepared and implemented in accordance with the Erosion and Sediment Control Guide for Urban Construction (TRCA, 2019) prior to any earthworks or grading activities on the Subject Lands. The ESC strategy will include the following:

- methods for constructing SWM and environmental features in the dry;
- methods to stabilize disturbed areas to minimize transfer of sediment;
- special measures for works in or adjacent to stream corridors, such as culvert crossings, wetland construction, etc.;
- environmental fencing;
- stone mud mat at all construction entrances;
- consideration for proper topsoil stockpiling (location, height, side slopes), exclusion of compaction activities, good site management control (i.e., no waste additions), and avoidance of dust control application that may adversely affect soil integrity (e.g., use of water only; no oil-based sprays, etc.);
- use of the permanent ponds as temporary silt basins during site construction activities;
- regular inspection of the ESC devices; and,
- removal and disposal of the ESC devices after the site has been stabilized.

11.3 Construction Phasing

As shown **in Drawing 11.3A**, the following construction sequence is proposed:

- Complete removal of existing farm pond (See Section 11.4 below).

- Following receipt of site alteration permits, install necessary erosion and sediment control measures including sediment ponds, traps, and diversion swales. The ultimate Pond 9 will be used as a temporary sediment pond.

- Pre-grade site in accordance with approved engineering plans. Through the

duration of grading and servicing, drainage to PSW 3 will be maintained and adequately treated to remove sediments prior to discharge to the wetland.

- Partial site servicing will occur prior to completion of the site grading to allow temporary William Halton storm outlets to connect to internal storm sewer system.

- Temporary ditches to be decommissioned and site grading completed following diversion of the William Halton flows to the sediment pond.

- Complete site servicing and ultimate SWM pond in accordance with approved designs.

11.4 Removal of Sherborne Lodge Farm Pond

The existing Sherborne Lodge farm pond will be removed to accommodate the new proposed SWM Pond 9. This section describes methods and proposed timing for the removal of this pond.

11.4.1 Introduction

There is no explicit mention of the Sherborne Lodge farm pond in either NOCSS or OPA 272. On Figure 6.3.15 of Section 6 of NOCSS, "Wet Features and Depressions" (revised September 5, 2007), the Sherborne Lodge farm pond is mapped as an "Artificial Pond", also referred to as Pond 47. In OPA 272, Figure NOE3 "Natural Heritage Component of Natural Heritage and Open Space System including Other Hydrological Features" (February 2008), the Sherborne Lodge farm pond is mapped as a "Hydrologic Feature B". Further, as explained in Section 2 of this EIR/FSS, this feature is identified on Figure A attached to *Mediation Item: Depression Storage* (May 30, 2007) as a pond, and constructed ponds do not have to be included in the assessment of depression storage or considered to be a Hydrologic Feature B (HYDFB). In addition, the North Oakville Master Plan (Appendix 7.3 of OPA 272) does not show the retention of the Sherborne Lodge farm pond. Thus, the removal of this pond is consistent with NOCSS, OPA 272 and the Town's Master Plan.

The Sherborne Lodge farm pond was constructed adjacent to agricultural field and a farm residence. Photo A illustrates the nature of this pond.

Photo A – Sherborne Lodge Farm Pond

The removal of this pond will require salvage of fish and wildlife and this in turn will require project phasing to dewater the pond to capture fauna as environmentally appropriate and efficiently as possible. In addition to that required to obtain a grading permit, this removal also will require that a number of other permits and/or permission from other agencies be obtained. The existing functioning and natural heritage conditions of the pond are described in Section 5. This section of the EIR/FSS addresses pond removal timing, methods and approvals.

The pond can be considered a short-term feature on the landscape; see Section 5.5 for historical air photography review. The primary ecological function of the pond is provision of habitat for fish and turtles. Most of the water within the pond can be considered 'dead storage', with surface water flow-through occurring during spring run-off and after major precipitation events. The pond is interpreted to be excavated into the bedrock and intercepts the local water table. Water ponded serves to recharge groundwater in the bedrock during low groundwater conditions and groundwater through flow to the overburden also occurs. The water ponded contributes to groundwater flow in the regional context and due to the base of the pond being lower in elevation than the nearby PSW 3, it has been concluded that the pond does not support the wetland.

With respect to timing the removal of the pond, a number of factors must be taken into consideration including amount and ease of water removal, implications to natural heritage features and functions, and site development and establishment of future drainage system/pattern for the area. It is important that the removal occur when flow-through conditions are less likely to occur and when pond levels are reduced. Potential negative impacts to specific wildlife functions also can be minimized by timing, for instance it occurring outside breeding bird and herptile nesting seasons.

In 2015, an application was made to Conservation Halton for the removal of this pond. Information included in that application addressed existing natural heritage, groundwater and fluvial geomorphological conditions and implications of pond removal to those existing conditions. In support of that application, an application to take water was made to the Ministry of the Environment and Climate Change (MECC). A Permit to Take Water (PTTW) was issued by MECC on January 16, 2015. That permit has been maintained and still is applicable to the draining of the pond. As well, permits from MNRF to relocate fish and turtles resident in the pond were obtained. These latter permits have lapsed and, as discussed below, further discussions with agencies will occur and new permits will be obtained.

After the initial submission to Conservation Halton, additional information was submitted to the agency, related to the potential impact of the pond removal to the flow regime under interim conditions, until development proceeded on-site.

Subsequent to these submissions and further meetings and discussions with the agencies, CH deemed it premature to proceed with pond removal in advance of a completed EIR/FSS.

Relevant data from this earlier application for removal of the Sherborne Lodge farm pond is incorporated herein. It has been updated as appropriate with current natural heritage other site data.

11.4.2 Overview of Pond Removal Works

Drawing 11.4 illustrates the works required to remove the Sherborne farm pond. Following receipt of all necessary approvals, these works involve:

- Installation of erosion and sediment controls;
- Construction of temporary diversion swales north and south of the pond to direct runoff from areas upstream of the pond around the pond to downstream locations;
- Drawdown pond water levels through pumping or other measures to facilitate fish and wildlife salvage;
- Completion of fish and wildlife salvage and release into approved offsite areas;
- Once water is removed from the pond and all rescues are complete, excavate sediments from the pond bottom and dispose in accordance with the Rules For Soil Management And Excess Soil Quality Standards (sediment is subject to sampling and analysis prior to selection of a suitable disposal site).
- Grade pond areas to elevation 173.0m. Subsequently, the temporary sediment pond (and ultimate Pond 9) will be constructed to the south of the filled-in pond as shown on **Drawing 11.3A**.

11.4.2.1 Approval Requirements

The removal of the existing pond will be completed as part of the earthworks program for the Subject Lands. Permits will be required from the following agencies:

- Town of Oakville (Site Alteration Permit);
- Conservation Halton (Permit under O. Reg. 162/06);
- MNRF (Scientific Collectors Permit) – A Scientific Collector Permit was obtained from MNRF (Authorization No. 1081004) for this work in 2015, however, it has expired. A new permit will be required prior to fish or wildlife salvage activities. Collected wildlife will be released into the Glenorchy Conservation Area as previously agreed;
- MECP (Permit To Take Water) - A PTTW was first received in 2015 and has been renewed as required since then. The current permit (Permit 0644-CEWPGH) was obtained in June 2022 and will expire in June 2024. It will be renewed / extended as necessary. Water pumped from the pond as outlined in the PTTW will be discharged to the Neyagawa Boulevard roadside ditch downstream of PSW 3. Conditions stipulated in the PTTW require monitoring water level and water quality changes in downstream or adjacent areas as well as implementing mitigation measures should agreed thresholds be exceeded; and,
- Under the previous authorization process through Fisheries and Oceans Canada (DFO), removal of online ponds on private property did not require permitting. With the recent changes in permitting under the Federal Fisheries Act, a request for DFO review is recommended. Given that the pond is artificial and isolated from the downstream system, it is possible that the pond removal can be completed with a Letter of Advice only from DFO. Consultation with Fisheries and Oceans Canada (DFO) is recommended.

11.4.2.2 Erosion & Sediment Controls

Erosion and sediment controls will be implemented prior to undertaking any site grading or drainage alterations, and maintained and monitored throughout the pond decommissioning period. These would include, at a minimum:

- Identification of construction limits (with silt fence or construction fence where suitable);
- Protection of PSW 3 and the surrounding NHS with silt fence or filter socks prior to commencement of any work;
- Diversion of runoff from contributing areas to the pond to prevent the pond from re-filling during the dewatering phase (i.e., to reduce overall duration of dewatering

works);

- Protection of the pump outfall to ensure sediment is not released into the Neyagawa Boulevard ditch. Both erosion protection and quality treatment in the form of a sediment trap or filter bags are recommended;
- Pumping rates should be controlled to the acceptable PTTW limits or lower, if additional scour protection downstream is required (subject to visual inspection during dewatering);
- Install effective erosion and sediment control measures prior to beginning work in order to stabilize all erodible and exposed areas;
- Regularly inspect and maintain the erosion and sediment control measures and structures during all phases of the project;
- Regularly monitor for any evidence of sedimentation during all phases of the work and take corrective action;
- Dewatering shall have discharge directed to a sediment containment system (sediment basin, sediment bag, Enviro-Tank, etc.) prior to release to the watercourse;
- Daily monitoring of discharge water for TSS and turbidity as required by the PTTW;
- Apply seed and mulch, tackifier and/or erosion control blanket in areas of soil disturbance to provide adequate slope protection and long-term slope stabilization;
- Keep the erosion and sediment control measures in place until disturbed areas are permanently stabilized;
- Use biodegradable sediment control materials whenever possible;
- Remove all sediment control materials once the site is stabilized;
- Schedule works to avoid wet, windy and rainy periods that may result in high flow volumes and/or increase erosion and sedimentation; and,
- Operate machinery on land in stable dry areas.

11.4.2.3 Timing

Dewatering / decommissioning will be one of the first site alteration components to be completed to ensure that the temporary sediment facility (and eventually, Pond 9) can be installed. Ideally, dewatering and decommissioning works should be conducted in the dry (i.e., summer), however, this is subject to the overall project and approval process timing as well as timing requirements for fish and wildlife capture and release. Based on consideration of all of the above factors, it is recommended that the pond removal occur late August to end September-mid October, 2022.

The magnitude of effects to the local aquatic habitat and communities is related to the extent, timing and duration of the project. The following mitigation measures are recommended:

- Construction should be staged to minimize the duration of in-water work. Any in-water works will occur inside the fisheries timing window of July 1 – March 15 (work permitted during this period) to protect any downstream warmwater fish community

and habitat; and, outside of breeding/nesting times of other potentially affected resident wildlife, especially turtles;

- Pond drawdown is expected to require 1 to 2 weeks of pumping with multiple 6" diameter pumps. Precipitation may influence the effectiveness and duration of pumping. Preferred drawdown timing is late summer to early fall when wetland bird species have ceased nesting activities and when turtles hatchlings generally emerge. A geotechnical consultant should be present during the dewatering works to confirm if the dewatering should be phased;
- Wildlife salvage should occur periodically (once or twice per day) during the pond drawdown period to relocate turtles that may attempt to migrate from the pond. Timing for these activities is discussed below; and,
- Fish salvage should occur once the water level is less than 1m depth to improve the effectiveness of the use of seine nets.

11.4.2.4 Direction to Fish and Wildlife Salvage

As described in Section 5, fish, turtles and amphibians were found in the farm pond during site investigations. Capture and release of species present should be undertaken prior to filling activities. Direction to capture and release are discussed below:

- **Amphibian**s - These species were found in low numbers only. Amphibians may disperse from the wetland after breeding season and ample suitable habitat is present in the vicinity (PSW 3, PSW 8) after the pond is removed. Thus, there are no special requirements for them provided the timing of removal of the pond is suitable for turtles. If amphibians are collected collaterally with the collection of turtles, they would be separated from other species and relocated to suitable habitat in the immediate vicinity.

- **Turtles** - In 2014, MNRF recommended that the Midland painted turtles be captured and relocated to a suitable environment. At that time, in consultation with CH, it was determined that the specimens from the pond could be relocated to the Glenorchy Conservation Area which supports similar suitable habitat for turtles. Discussions with CH will be required to confirm that this is still acceptable.

  Discussions with MNRF will occur to determine the requirements for a collection permit.

  The turtles typically nest from late May to early July and hatchlings generally emerge by late August through early September. Wildlife salvage should be timed to capture emerged hatchlings, (e.g., September).

  The turtles may be captured with several techniques, including:

- Baited hoop nets should be set, anchored (with rebar and rope) in shallow water with the top of the net exposed to air to allow turtles to breath;
- Seine nets during fish capture;
- Set traps will be checked a minimum of once/24 hours. Traps shall not be left unchecked for greater than 24 hours;
- Captured turtles of similar size shall be placed in a plastic bin and immediately relocated;
- Several Painted Turtles can be placed in a bin, but Snapping Turtle (if encountered) shall be placed in a bin with no other turtles (to avoid harm due to size discrepancy with smaller turtles);
- Labels shall be affixed to any set traps and labelled "Scientific Research – Please do not disturb", or similar messaging;
- Turtles captured during dewatering shall be placed in bins and relocated in a timely manner;
- Due to the presence of turtles, any work in areas where turtles may be hibernating are likely to be permitted only between July 1 and September 29 of any year;
- Exclusionary fencing should be installed where work is required within suitable turtle nesting habitat to ensure turtle nesting within this area does not take place. The fencing should be monitored appropriately by a qualified biologist; and,
- Due to the possible presence of species at risk (SAR) turtles, special provisions should be in place in case they are encountered during construction. Specifically these provisions should require contact with applicable agencies if these are encountered during construction to determine how best to proceed.

- **Fish** - Through discussions with MNRF in 2014, it was determined that the catfish, after capture, should be released into a suitable environment, along with any other native fish species that may be encountered during the capture. The agency also recommended the humane euthanasia of non-native fish. A fish collection permit will be obtained from MNRF and will stipulate methods of capture (e.g., multiple pass seine netting and electrofishing), transportation, and release sites. The timing for these activities can coincide with the requirements for turtles.

  In consideration of its proximity to the Subject Lands, the ease of access/release, along with consultations with MNRF/CH/DFO, it is proposed that the fish be released to 16 Mile Creek in the vicinity of Dundas Street.

- **Birds** – The Migratory Bird Convention Act for this area identifies the breeding bird nesting window to be March 15th to August 15th. The preferred timing of pond removal is late summer/early fall. This is outside of the breeding bird nesting window**.** Regardless, the environs would be examined in advance of the start of

pond removal to ensure that no nesting activity is occurring. If nesting is found, the pond removal activities would have to be delayed until nesting/fledging finished, or applicable permits obtained.

11.4.2.5 Pond Drawdown

The main goal for draw-down of the pond should be to release water in a way that does not result in downstream impacts, particularly with regards to sediment release. As such, decommissioning of the Sherborne Lodge farm pond requires specific attention to a controlled draw-down.

At detailed design, a phasing plan should be developed for the controlled draw-down of the pond, including removal of the concrete weir structure. If possible, a sequenced draw-down would be beneficial, as it would allow for small areas to be exposed and drained before proceeding with additional lowering. Ultimately, the draw-down methodology should be based on the condition of the concrete control structure, the ability to create a controlled release, and drawdown mechanics. Drawdown could be completed through a range of techniques: pumping, pumping with notching of the weir, siphon, or siphon with notching of the weir. Ultimately, a combination of these techniques would be appropriate for draining down the pond. Water levels should be lowered by 0.25m to 0.50m increments, and after each increment of lowering, the pond should be reviewed for stability and to facilitate wildlife removal. If deemed stable and sediment is not being released, the lowering activities can continue.

Completion of the draw-down at an earlier stage would provide additional time for dewatering of pond sediments. This would result in cleaner construction activities during the fisheries window. It may also allow for most of the work to be completed in the dry. The pump or siphon intakes should be designed in a way that limits the amount of sediment transported downstream. In most cases, a surface draw or a draw that is sheathed with either gravel or filter cloth can be used to avoid sediment intake. Fish screens should also be used to on all pump/siphon equipment.

Water should also be pumped to a sediment filtration system located at least 30m from the pond and then released to a well-vegetated surface or diffuser before entering the downstream receiving watercourse. This will allow particles to settle before reaching the watercourse.

It is anticipated that the overall drawdown will be a 1 to 2 week process. Water in the pond could be physically removed faster, but mobilization efforts and the installation of appropriate erosion and sediment control measures will require additional time. Also, wildlife collection efforts will require staggered timing as the pond water levels are lowered.

11.4.2.6 Good Housekeeping Measures

The following general measures should be implemented as part of the pond decommissioning works:

- There should be no deposit of deleterious substances (sediment or contaminants) into the water;
- Develop a Spill Response Plan in the case of a spill of deleterious substances;
- Cease operations if sediment-laden water and/or other deleterious substances are entering the water and prevent any further migration;
- Keep an emergency spill kit on site during the work, undertaking or activity;
- Report any spills of deleterious materials near or into the water;
- Maintain all machinery on site in a clean condition and free of fluid leaks; and,
- Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.

11.4.2.7 Downstream Implications of Pond Removal

Geomorphological change usually occurs over long periods. In geomorphological terms, the Sherborne Lodge farm pond has only been in existence for a short period of time (~37 years). Bankfull channel geometry usually scales to the 1.5 to 2-year return flow event. The development of this geometry occurs over tens to hundreds of years. As such, the downstream channel geometry and sedimentology is likely a product of long-term hydrology, pre-pond construction. Although vegetation may have encroached on the historical bankfull channel in some locations, it is expected that the channel geometry is scaled to the historical hydrology. It is possible that the channel sediments were historically coarser. It is anticipated that the removal of the farm pond will restore the pre-pond hydrology and sedimentology conditions in the downstream receiving system. From the perspective of the channel, this shift would be similar to a drought followed by wet years.

As noted in Section 7.3, NOCSS established target unit peak flows for the 2-year to 100-year events and the Regional Storm using the GAWSER model (NOCSS Addendum, 2007) for this and other subcatchments. It is also noted that further modelling of existing conditions target flows was not required at the EIR/FSS or detailed design stages. NOCSS hydrology and peak flow rates were determined through OMB mediation and all agencies agreed to the peak flow rates to be used for SWM design in all catchments. NOCSS recognized the farm pond as a man-made feature and did not include it in hydrology models to set target flow rates for this subcatchment. As such, no changes to the mediated NOCSS targets are required.

Design and mitigative measures associated with all works in the NHS are summarized in Table 7.24 and as described in Section 11.4. The review of potential impacts, designs and mitigation concluded that no residual impacts are expected to the NHS.

Given the relatively short-term existence of the pond, the recent historical functions of the natural heritage features in the area, the proposed design and location of the SWM pond, upgrades to the Neyagawa Boulevard ditch design and other mitigative measures (maintained and monitored erosion and sediment controls, timing and length of construction, good housekeeping practices, restoration works, etc.), no negative impacts are anticipated to occur to Stream Reach SMA-6, PSW 2, or PSW 3, either during the short-term period of the Sherborne Lodge Farm pond removal, the interim construction period, or the post-construction period, as summarized below. PSW 8 lies within a different subcatchment than the Sherborne Lodge Farm pond, therefore, pond removal will have no implications to PSW 8.

Stream Reach SMA-6 and PSW 2

The Neyagawa Boulevard east ditch discharges to Reach SMA-6, approximately 200 m south of where the flows from PSW 3 enter the ditch. The Final Davis-Minardi EIR/FSS (2015) identified the fluvial geomorphological, vegetation characteristics, and aquatic habitat conditions along this stream reach. As summarized in Section 5.3.2, Reach SMA-6 flows south entirely within the wooded Core 5 where undercut banks and exposed rooting systems of adjacent trees are common throughout the entire length of the stream reach. The reach is classified as being important fish habitat, and no fish refugia or barriers to movement have been identified. Silt, gravel, and cobble bed material are present along with a substantial amount of vegetation litter. It is expected that the channel geometry is scaled to the historical hydrology.

A narrow band of vegetation, more-or-less coincident with the location of Stream Reach SMA-6, has been classified by MNDMNRF (MNRF) as PSW 2. The wetland is categorized as a forb marsh, dominated by lance leaved aster and spotted jewelweed. Essentially, it is riparian vegetation along the banks and shoulders of the reach.

Following implementation of erosion and sediment control measures and construction of a temporary bypass outlet from the pond area, the farm pond will be removed through a short period of pumping to drawdown the pond and remove pond sediments. This will be followed by the construction of the temporary sediment pond, then the ultimate SWM pond. The pond pumping rate will be at the higher end but within the range of the erosion thresholds for the downstream receiving system. Under the current pond arrangement, there is no water in the creek through July and August unless there is a substantive flow event, i.e., greater than 25mm. Therefore, late summer is a preferred time to pump the pond from a downstream flow perspective. This aligns with the late summer/early fall preferred timing for wildlife removal.

The farm pond has modified the natural hydrology, trapping the majority of smaller storm events. This is not the natural condition and has only occurred since the pond was

constructed (~1985). It is recognized that during the temporary bypass period there may be more frequent outflows from the subcatchment than experienced through the relatively short period of time that this pond has been in place. This would be reflective of the natural pre-pond conditions.

The time between pond pump out, temporary outfall and sediment basin construction, and the ultimate SWM pond construction will be minimized, erosion/sediment controls will be implemented, maintained and monitored, and good housekeeping measures outlined above will be implemented during this period. While some discussion on the staging of these works is included herein, further details regarding staging of pond removal, and temporary and ultimate pond and pond outfall construction will be provided at site alteration stage as part of detailed design. Particular attention will be given to staging works to minimize during construction impacts to the adjacent PSW 3 and downstream areas.

Under post development conditions, the SWM plan will provide appropriate levels of water quality control, quantity control, erosion control and thermal mitigation designed specifically recognizing the Stream Reach SMA-6 conditions downstream of the farm pond and the subcatchment outfall location at Neyagawa Boulevard. Along with these controls, the realignment, stabilization and restoration of the proposed Neyagawa Boulevard east ditch design is proposed. The east ditch will be rehabilitated to increase its resilience and resistance to erosion. The proposed restoration will provide greater stability and protection for existing infrastructure and provide an appropriate outlet for SWM flows associated with the upstream development.

The proposed SWM Plan outlined in Sections 7.6 to 7.12 has been designed to address downstream erosion thresholds and meet allowable SWM release rates established for the ES6-East subcatchment for water quality and quantity controls. Given that there will be erosion controls in place and that the Neyagawa Boulevard ditch will be rehabilitated to increase its resilience and resistance to erosion, the relative changes in erosion indices in downstream areas are considered acceptable within the local context of this system. In addition to erosion controls, the SWM Ponds proposed in the subcatchment will provide the required peak flow controls as established in the NOCSS and the ES6-West EIR/FSS.

Therefore, no negative impacts to the adjacent woodlot or fisheries habitat along Stream Reach SMA-6 are expected post-development. The reach will continue to function as it currently does, exhibiting bank erosion, permitting sediment transport, and continuing to provide fisheries habitat.
The Neyagawa Boulevard ditch flows into Stream Reach SMA-6 and PSW 2. Ditch lowering outside of the PSW 2 limits, with the implementation of the timing, erosion sediment control and restoration recommendations outlined in Section 7.12.4 are not expected to negatively impact PSW 2. As Reach SMA-6 is anticipated to continue to

function more-or-less as it currently does during both the interim and post construction periods, no changes are anticipated to the features or functions of this PSW.

PSW 3

The existing, interim, and post-development environment and conditions of PSW 3 are discussed in detail in Section 7.10.1.

PSW 3, in the southwestern corner of the EIR Subcatchment Area within Core 5, is a small, 0.48ha, reed-canary grass meadow marsh (MAM2-2) with minimal tree cover limited to red ash, broad-leaved cattail and wool grass forming the remaining ground cover representation, and a 0.16ha monoculture patch of exotic and invasive Phragmites (European common reed) (MAM2). Reed-canary grass is an aggressive species and readily outcompetes most other wetland species and is considered invasive as a result. Overall, these wetlands have low plant species diversity, and these species impair habitat conditions for a broader range of native species. PSW 3 receives overland and tile drainage flow from the north and, during major events, from the constructed farm pond to the east when flow may overtop the weir at the downstream end of the pond. There are no groundwater contributions from the farm pond to PSW 3 as the wetland is at a higher elevation than both the pond bottom and the main groundwater transmitting layers.

The initial stage of construction, prior to commencement of any work onsite, will include the implementation, maintenance and monitoring of erosion and sediment control measures to capture sediments onsite. ESC measures will be in place through the construction period. During removal of Sherborne Lodge Pond, water would be pumped from the pond at a rate within the receiving stream erosion threshold limit and as outlined in the PTTW. Flows will be discharged to the Neyagawa Boulevard roadside ditch downstream of PSW 3, so as not to negatively affect the wetland. During this period, surface flows from the localized area north of the PSW 3 wetland will continue to direct surface flows to the PSW.

Once the Sherborne Lodge farm pond has been removed, a temporary sediment basin and a stabilized temporary bypass (channel or stabilized outlet at downstream end of pond) will be maintained in its place to distribute flows into the flow-through area of the wetland. Erosion within the wetland is not anticipated, as the design will involve a level spreader.

The temporary sediment pond will be constructed within the ultimate pond footprint. Rough grading of the ultimate SWM Pond 9 footprint, often done as part of the temporary sediment basin construction, would function as the temporary sediment basin providing a large storage area for flow attenuation and quality control. Temporary swales will direct surface runoff from the Subject Lands to the temporary sediment basin. Where appropriate, additional sediment basins or other measures will be put in place to ensure any flow directed to PSW 3 receives suitable treatment during and post-construction.

Extensive wetland water balance analyses have directed the design of the post-development drainage plan to ensure no negative impacts to the wetland. The SWM Pond 9 piped outlet will direct flows around PSW 3 so that increases in runoff volumes from the EIR Subcatchment Area will not negatively impact PSW 3. The pond outfall will outlet to a short outfall channel before entering the lowered northeastern Neyagawa Boulevard ditch. In addition, to manage surface water inputs to PSW 3, a separate pipe is proposed to direct water to PSW 3 from an area of 1.08ha north of this wetland. This 750mm storm sewer will discharge into the wetland via a stone core pocket wetland located between the pipe outlet and PSW 3, outside the 10m buffer area contiguous with the wetland, to provide a treatment train that complements the stormwater management plan. Benefits of the pocket wetland feature will include organic inputs, temperature regulation, polishing, energy dissipation, and dispersion of flows. Additionally, the pocket wetland can provide opportunities for infiltration, evapotranspiration, and detention by retaining flows, and will provide habitat enhancement and diversity in the vicinity of PSW 3.

The predicted changes to water levels and volumes will not result in negative impacts to wetland. Wetland conditions will persist post-development. Based on the model results and drainage design and restoration, proposed mitigative measures, as well as the hydrogeological and ecological interpretations of the existing and post-development conditions, it has been concluded that the proposed development design with the proposed mitigation will not result in negative impacts to the features and functions of PSW 3.

PSW 8

As noted in Section 7.10.2, the contributing drainage to PSW 8 is relatively small, and is located largely on the adjacent Preserve North lands. One area on the Eno Investment lands drains to PSW 8. Figure 7.10C illustrates PSW 8 and its drainage area. This boundary was determined based on the review of past studies, field observations as well as detailed review of topographic mapping. The boundary shown on Figure 7.10C is generally consistent with the PSW 8 catchment boundary shown in previous studies. Small deviations were noted in select areas.

The western boundary of the catchment generally follows the west edge of the woodland. As a result, the PSW 8 catchment area is independent from the areas draining to the Sherborne Lodge farm pond, and removal of the farm pond has no implications to PSW 8.

11.5 Removal of Temporary William Halton Parkway SWM Pond

As part of the William Halton Parkway design, the Region of Halton will be constructing a temporary SWM pond on the Eno Investments lands. It will be a temporary pond to manage runoff quality and quantity from a portion of the new road until SWM Pond 9 and internal storm sewers are in place on the Eno Investments lands. Once Pond 9 and

municipal services are constructed within the Subject Lands, the Region's temporary pond will be removed.

The Region of Halton's future temporary stormwater management pond is proposed on the Eno Investments lands. It will service William Halton Parkway (roadway only) until such time as the ultimate stormwater management facility on the Sherborne/Eno lands is constructed and operational. The temporary pond is expected to be constructed in late 2021/early 2022. **Drawing 11.5A** illustrates the location and design of this temporary facility that will provide extended detention and quantity control for William Halton Parkway drainage. The downstream vegetated swale will provide additional quality treatment. The temporary facility is designed as a dry pond to treat runoff from William Halton Parkway only. The quantity control is designed to provide extended detention volume and control post-development flows to pre-development NOCSS Mediation Letter allowable release rates for 2-year through and including Regional Storm events in accordance with the Stormwater management Design Report, William Halton Parkway – Trafalgar Street to Neyagawa Boulevard (Stantec).

As shown, this pond, as well as a Region constructed swale to the east and south of the pond, will discharge flows from a portion of the William Halton Parkway to an existing swale on the Eno Investments lands until the Sherborne/Eno lands develop. Once the storm drainage system is constructed on the Sherborne/Eno lands, the temporary pond and swale will be removed and flows will be directed into the future storm sewer system. SWM Pond 9 has been designed to accommodate drainage from a portion of William Halton Parkway. The drainage area from William Halton Parkway that is accounted for in SWM Pond 9 is illustrated on **Drawing 7.8A**.

This temporary stormwater management pond will be located in a temporary easement adjacent to William Halton Parkway (currently Burnhamthorpe Road). The proposed location of the temporary pond and easement is in conflict with Street A (the extension of Carding Mill Trail) on the Eno Investments Draft Plan of Subdivision. The conflict has been discussed with the Region of Halton, and an approach has been agreed to in principle that will involve pre-burying a section of the future storm sewer from the south limit of William Halton Parkway right-of-way, under the pond through the temporary pond easement, to the south limit of the easement. This will allow the ultimate stormwater management pond to be constructed, and the associated storm sewers extended from the ultimate pond to the south limit of the temporary pond in the 'dry'. Once SWM Pond 9 is constructed and the future storm sewers installed on the Eno Investments lands, the pre-buried sewer in the temporary pond will be connected to the storm sewer system in William Halton Parkway. The pre-buried pipe allows the connection from William Halton Parkway to the storm sewer network in the Eno Investments lands to be made without digging up the temporary pond. This is beneficial as it allows the temporary pond to remain in operation until such time as flows from William Halton Parkway are flipped to the storm sewer network in Eno Investments

lands and SWM. The temporary pond can then be removed and the area remediated as required by the Region of Halton.

The temporary pond, proposed ultimate SWM Pond 9 and future storm sewer is illustrated on **Drawing 11.5A**. The preliminary servicing depths of the sewers on William Halton Parkway, and the pre-buried sewer in the temporary pond easement are illustrated on **Drawing 11.5B**.

On a number of occasions, the Owner's have requested that the Region of Halton consider burying the infrastructure in William Halton Parkway shown in **Drawing 11.5B** as part of their road project (correspondence dated July 22, 2021). The Region of Halton has denied this request and as a result, William Halton Parkway (currently Burnhamthorpe Road) will need to be disturbed to install the infrastructure shown in **Drawing 11.5B**. The Owner's have requested that the Region of Halton keep the Owner's informed of project progress, and if at all possible bury the infrastructure in **Drawing 11.5B** prior to top-course asphalt installation to limit the amount of disturbance caused by the infrastructure installation being done after the road project has commenced.

It is the Owner's position that top-asphalt installation, or the William Halton Parkway project, shall not be an obstacle to the timely infrastructure installation that will allow for development of the Subject Lands, as they have attempted to avoid this potential situation. The Owner's will continue to make every effort to coordinate with the Region of Halton on this infrastructure.

11.6 Habitat Protection/Mitigation Requirements

Where works are proposed in close proximity to natural areas, including treed areas/trees that have bat habitat potential, and which also may provide habitat for other wildlife, the following recommendations should be followed:

- Delineation of the disturbance limits within work areas should be clearly defined on construction drawings and on site prior to construction;
- The Site Supervisor shall be familiar with these recommendations and be cognizant of the purpose and function of Tree Protection Zones (TPZ);
- Tree protection hoarding/fencing shall be installed in locations as prescribed and to specification of Town requirements. All supports and bracing used to safely secure the barrier should be located outside the TPZ;
- Tree protection hoarding/barrier must be erect prior to commencement of work;
- Any area inside the TPZ must be left undisturbed (including overhead) to protect tree trunks, branches, and roots. No altering of grade, excavating, trenching, scraping, dumping or disturbance of any kind shall occur within this zone without approval by the Town;
- Tree clearing of the Subject Lands should ensure compliance of the Migratory Bird

Convention Act (MBCA) which identifies timing restrictions for vegetation clearing during breeding bird season (early April to late August for nesting Zone C2- see General Nesting Periods of Migratory Birds in Canada www.ec.gc.ca);

- Tree clearing is preferred during October to March, to avoid impacts to most wildlife, particularly summer roosting bats and nesting birds;
- Construction materials, equipment, soil, construction waste or debris are not to be stored within the TPZ or dripline of trees in Core 5;
- No movement or parking of vehicles, equipment or pedestrian traffic should occur within the TPZ in Core 5;
- Any tree pruning or root cutting required for the proposed Neyagawa Boulevard ditch is to be conducted by a Certified Arborist or Town Forester and shall comply with ANSI A300 Pruning Standard or suitable equivalent;
- No signs or objects should be displayed or affixed to any trees identified for protection;
- Disposal of any liquids shall not occur within the TPZ; and,
- Should any additional, incidental or accidental tree injuries occur during construction, a qualified Arborist or Town forester should be consulted to determine if additional mitigation measures should be employed.

11.7 Dewatering Requirements

There are areas of high water table within the surficial till and shale bedrock units. Dewatering may be required where sewer trench grades and excavations encounter groundwater. As noted in Section 11.1, no significant or extensive dewatering is anticipated in the FSS Study Area. The amount of seepage from the clayey silt and sandy silt till deposits is expected to be small and manageable by sump pumps.

There may be areas where heavily fractured sediments or bedrock may have higher hydraulic conductivity and groundwater seepage may be more appreciable. Should such permeable zones be encountered during construction, more active dewatering may be required. The undertaking of dewatering, according to industry standards and in accordance with MECP processes, will ensure that adequate attention is paid to potential adverse impacts to the environment.

Currently the MECP allows for construction dewatering of less than 400,000 L/d to proceed under the Environmental Activity Sector Registry (EASR) process. If dewatering is to be above this threshold, then the standard Permit to Take Water (PTTW) process applies. In both cases, a scientific study is required in support of EASR registration or PTTW application. This scientific study must review the potential for environmental impacts and provide mitigation and monitoring measures to the satisfaction of the MECP or other review agency. The requirements for construction dewatering will be confirmed by geotechnical/hydrogeological investigations completed in support of detailed design.

The proposed storm infrastructure (sewers and SWM Pond 9) have been designed to provide ample capacity to accommodate groundwater discharge from the future high density sites.

11.8 Private Water Wells

The proposed development will be municipally serviced and therefore, in the long term, it is expected that any existing domestic water supply wells in the area will no longer be used. In the interim, however, it is important to ensure that construction does not adversely affect local groundwater supplies while the private water supply wells are still in use. Prior to construction activities, it will be necessary to complete a house-to-house survey to determine the precise well locations and uses of local groundwater supply wells.

For any active and accessible water supply wells, the water levels will be measured in each well during non-pumping conditions prior to the commencement of site construction activities, and a water sample will be collected from each well for analysis of background water quality. The water analysis will include general water quality indicator parameters including chloride, nitrate, turbidity and conductivity. The recommended monitoring program for the local private wells includes quarterly water level measurements throughout the earthworks period (if the wells remain in use). At the end of the construction period, a water sample will again be collected from each of the monitored supply wells to confirm the water quality has not been affected.

11.9 Well Decommissioning

Prior to construction, it will be necessary to ensure that all inactive water supply wells within the development footprint have been located and properly decommissioned by a licensed water well contractor according to Ontario Regulation 903. In addition, all groundwater monitoring wells and standpipes installed for this study must be decommissioned in accordance with provincial regulations prior to or during the site development, unless they are maintained throughout the construction for monitoring purposes.

11.10 Topsoil Management

Increased topsoil depths are one of the proposed LID measures for implementation throughout the FSS Study Area. Topsoil should be carefully managed to ensure its viability for use for LID purposes. This should be considered during the Site Alteration process.

12.0 MONITORING

12.1 OPA 272 Monitoring Requirements

Policy 7.9.5.2 of OPA 272 requires that an annual monitoring program be completed as follows:

> *"A program shall be established by the Town in consultation with the Region of Halton and Conservation Halton to monitor the development in the Planning Area on an annual basis. The monitoring program shall be in accordance with directions established in the North Oakville Creeks Subwatershed Study and shall also consider such factors as:*
>
> 1. *relationship and level of population and employment growth;*
> 2. *supply of existing lots and number of building permits granted;*
> 3. *the general achievement of housing mix targets;*
> 4. *the functioning of stormwater management facilities to ensure they are constructed and operate as designed,*
> 5. *stream alterations/relocations to ensure that natural channel designs were implemented and operate as designed;*
> 6. *erosion and operation of sediment controls during construction;*
> 7. *utilization of wastewater treatment and water supply system capacity; and,*
> 8. *development application status".*

12.2 NOCSS Monitoring Requirements

The NOCSS includes monitoring requirements for:

- Erosion and sediment control;
- SWM facilities;
- Monitoring of modified streams; and,
- Monitoring of SWM works, municipal services and trails installed by a landowner within the NHS.

With respect to the above monitoring components, the principles of monitoring, for which the landowners are responsible, include the following, as set out in OMB Monitoring Mediation Agreement dated July 27, 2007.

Erosion and Sediment Control

1. An ESC plan will be required to be submitted to the Town. The plan must be reviewed and approved by the Town prior to any clearing and grading.

2. The ESC requirements will follow applicable approved guidelines and bylaws in effect at the time of development. Deliverables will include a site alteration design report, an existing site conditions survey plan, an ESC plan, and a schedule of monitoring and reporting.

3. The ESC plan will include inspection, sampling for total suspended solids at all outlets from the site and reporting of results.

4. Remedial action to correct deficiencies of ESC practices and facilities may be required based on either inspection or sampling results

Stormwater Management Facilities

1. SWM facilities constructed in the conveyance system and at the end-of-pipe will be included in the monitoring program, which applies to the period prior to the assumption of the facilities by the Town. The monitoring plan will include monitoring of the receiving system for the effectiveness of the SWM facilities at the location of the outfall for the purpose of water quality monitoring, and at a location or locations to be determined through the EIR for the purpose of erosion control. Monitoring will follow applicable approved guidelines in effect at the time of development. These guidelines will replace Appendix KK – Stormwater Pond Monitoring Protocol from the Subwatershed Study. The Town and CH will consult with the North Oakville landowners in the preparation of such guidelines. Monitoring requirements will be reflected in subdivision agreements.

2. Privately owned SWM facilities are not included in this mediation document and will be subject to site specific requirements at the time of application.

3. All SWM facilities to be assumed by the Town will be monitored by the owner for design conformance, maintenance of function and hydraulic performance. Monitoring and reporting requirements are to be reviewed and approved by the Town.

4. Facilities with water quality function(s) will be monitored by the owner for performance in meeting the specific pond design target for total suspended solids (80% removal). Total phosphorus and temperature sampling will also be required.

5. Facilities subject to Ontario Water Resources Act approval may be required to do additional monitoring as a condition of the Certificate of Approval.

Monitoring of the Modified Neyagawa Boulevard Roadside Ditch

1. A multi-disciplinary monitoring program, approved by the Town and CH, will be implemented for the proposed ditch modifications. The monitoring program will be implemented by the proponent of the ditch modification.

Monitoring in Relation to SWM Works, Municipal Services and Trails Installed by an Owner within the NHS

1. A monitoring program will be implemented for all municipal services such as roads, watermains, sanitary sewers, SWM works or trails within the NHS.

2. A monitoring program, approved by the Town and CH, is to be developed based on the natural features and functions potentially affected by the specific works noted above.

3. The details of the monitoring program are to be included in the EIR.

4. The monitoring program will be implemented by the landowners installing the SWM works, municipal services and trails.

12.3 Proposed Monitoring

Consistent with the monitoring principles set out above, the following monitoring will be undertaken by the landowners.

12.3.1 Erosion and Sediment Control

Section 11.2 of this report discusses the need for an ESC strategy in accordance with Town and CH guidelines and sets out typical components of the strategy. Recent guidelines endorsed by CH entitled, *Erosion and Sediment Control Guidelines for Urban Construction* (December 2006), will be applied to site construction plans at the detailed design stage to identify specific details of an ESC strategy, including the type and location of control measures to be implemented, timing of implementation, details of responsibilities for monitoring, reporting and maintenance needs. Deliverables will include a site alteration design report, an existing site conditions survey plan, an ESC plan and a schedule of monitoring and reporting.

12.3.2 Stormwater Management Facilities

SWM facilities to be assumed by the Town will be monitored by the owner for design conformance and hydraulic performance. Monitoring and reporting requirements are to be reviewed and approved by the Town and CH.

The Town has prepared comprehensive monitoring requirements for SWM ponds, as set out in *Town of Oakville Guidelines for Operation, Maintenance, and Monitoring of Stormwater Management Facilities South of Dundas Street.* Furthermore, the Town has prepared monitoring guidelines for North Oakville. All monitoring will be prepared in accordance with the final, approved version of "*North Oakville Monitoring Program for Stormwater Management Facilities*".

The North Oakville Monitoring Program Guidelines requires "*Baseline temperature and TSS monitoring be undertaken in the receiving watercourse upstream and downstream of the anticipated SWM pond outlet; temperature monitoring be undertaken during the months of July, August and September prior to construction of the SWMF. Temperature monitoring should be carried out as per Section 5 of the Ontario Stream Assessment Protocol; and the TSS monitoring should be undertaken during 3 dry weather sampling events and during at least 4 wet weather events prior to the construction of the SWMF*".

Baseline water quality monitoring was previously established by GHD Limited in association with the development of the Davis-Minardi North Lands west of Neyagawa Boulevard (GHD Limited, 2019). Various instream water quality sites were established and monitored between 2013 and 2019 based on the methodology outlined in the North Oakville Monitoring Program Guidelines. One water quality site ("Site 4") was established along reach SMA-6 east of Neyagawa Boulevard, immediately downstream of the Neyagawa Boulevard east ditch. Water quality data, including water temperature and TSS, were collected at the site annually between 2015 and 2019. **Appendix H** includes the monitoring location plan from the GHD report. The site was established to monitor both construction and post-construction conditions associated with the Davis-Minardi North Lands to the west. However, given its location downstream of the Neyagawa Boulevard east ditch, the monitoring activities at Site 4 provide baseline data for the ES6-East subcatchment and the Subject Lands. As such, baseline water quality data requirements for the Subject Lands and associated SWM Pond 9 have been fulfilled in accordance with the North Oakville Monitoring Program Guidelines. Water quality monitoring at Site 4 will be re-instated as part of post-construction monitoring works for the Subject Lands. This will allow for direct comparison of pre- and post-development water quality conditions within the downstream receiving watercourse.

Baseline geomorphic monitoring was also established by GHD Limited to support work completed for the Davis-Minardi North Lands (GHD Limited, 2019). Several geomorphic monitoring cross-sections were established and observed along SMA-3, SMA-4, and SMA-6

between 2015 and 2019. These geomorphic sites established by GHD are also situated downstream of the Subject Lands (see **Appendix H** for monitoring locations). Monitoring was conducted to identify existing geomorphic conditions. As such, the monitoring data collected to date provides baseline geomorphic data for development within the Subject Lands. At minimum, the geomorphic sites along SMA-6 and SMA-4 will be re-established as part of post-construction monitoring works for the Subject Lands. This will allow for direct comparison of pre- and post-development geomorphic conditions within the downstream receiving watercourse.

At detailed design, a monitoring plan is typically prepared that includes an outline of monitoring locations, frequency, parameters, etc. Baseline data usually are collected/summarized as a prerequisite of site alteration and as part of the detailed design process. In keeping with previous EIR's and the development process on other North Oakville projects, the past monitoring data will be compiled at detailed design as part of developing the monitoring requirements moving forward. This will keep the most current information together within the overall monitoring project. This requirement is also noted in Section 13.2.

12.3.3 Monitoring of the Outfall to PSW 3

The outfall and proposed wetland and bioswale should be monitored annually for a period of three years following construction. Monitoring should include general observations around the outfall and constructed wetland, identification of any local erosion issues, and an annual survey of all prescribed plant materials at the outfall location. General observations should also be collected during construction of the outfall and after the first large flooding event to identify any areas of potential erosion concern. General clean-up and litter and debris removal also should occur. It is not recommended that invasive species removal be undertaken, as the entire adjacent PSW 3 is dominated by invasive species, and it is expected that the removal exercise would not be successful.

Monitoring requirements for the outfall to PSW 3 will be finalized as part of detailed design.

12.3.4 Monitoring of Neyagawa Boulevard Ditch Modifications

A post-construction monitoring program is recommended to assess the stability of the reconstructed ditch along Neyagawa Boulevard from the outlet of SWM Pond 9 to the confluence with SMA-6. Monitoring activities should include general observations of the SWM Pond 9 outfall and ditch works during and after construction completion. Observations should also be collected after the first large flooding event to identify stability concerns with the installed outfall pocket wetland and ditch. See Section 7.12.4.2 for further details.

12.3.5 Monitoring in Relation to Municipal Services and Trails Installed by an Owner within the NHS

With the exception of certain SWM plan infrastructure as discussed above, all municipal services are located within ROWs and/or outside the NHS. Therefore, no NHS-related monitoring will be required.

This EIR/FSS identifies future trail locations in a portion of the northern perimeter of Core 5. The locations of the trails are shown on **Figure 6.3**. The monitoring requirements associated with trail design will be finalized at the time the trail design is completed. This will be undertaken as a condition of Draft Plan approval. The primary focus of this monitoring is associated with the construction and the naturalization/planting requirements for locations where disturbance to the natural cover would occur. Specifically, monitoring should occur to ensure that:

- the habitat protection requirements outlined in Section 11.0 are implemented and maintained in good working order until construction is completed;
- drainage swales are stabilized with (seeding, matting, as finalized in the detailed trail design);
- disturbed zones adjacent to trails/swales, primarily between the edge of these features and the NHS Core boundary, and in the vicinity of any other works within the NHS (e.g., in the vicinity of flow spreaders) are landscaped with native indigenous species and in consultation with CH and Town (Parks); and,
- during the plantings warranty period, all planted materials would be managed appropriately, in consultation with CH and Town (Parks).

13.0 SUMMARY OF RECOMMENDATIONS

This EIR/FSS identifies and characterizes the natural heritage features and functions within the Study Areas and recommends measures to mitigate any potential impacts of the proposed development applications and associated servicing requirements on the NHS within the EIR Subcatchment Area. It also identifies servicing requirements related to roads, water supply, storm drainage, SWM, sanitary sewage and site grading. The EIR/FSS provides a link between the Town's NOCSS Management and Implementation Report, the North Oakville East Secondary Plan and the required planning approvals for the FSS lands.

Table 13.1 summarizes main report findings and recommendations and notes the Section(s) of this report that can be referenced for more details.

13.1 Direction to Future EIR/FSS Addendums for Lands North of Burnhamthorpe Road

This *ES6-East EIR/FSS* has addressed the required environmental and engineering matters set out in the EIR/FSS Terms of Reference (May 2013) in support of Draft Plans of Subdivision for the Sherborne Lodge, Eno Investments and Ankara Realty Limited lands south of Burnhamthorpe Road lands. This work also has anticipated the development of lands within the EIR Subcatchment Areas north of Burnhamthorpe Road. In those areas, EIR/FSS matters have been addressed to the level of detail possible without having specific development plans (draft plans of subdivision) and without access permissions.

For the non-participating lands within the EIR Subcatchment Area (i.e., Dorham Holdings, Westerkirk Developments. Peter Sum and Ashoe High Speed Solutions) where the same degree of EIR/FSS analyses has not been included in this EIR/FSS, additional studies are required in support of their future planning applications including the following:

- Confirmation of servicing, grading and SWM pond design, and erosion and sediment control, consistent with recommendations within the EIR/FSS. This includes the confirmation of the number and design of SWM Ponds 9A and 9B, and SWM Facility 9C. Where future studies deviate from recommendations, the rationale for changes from this EIR/FSS must be provided in keeping with the design objectives set out herein;
- Assessment of topographic depressions;
- Assessment of Species at Risk potential; and
- Confirmation of consistency with EIR/FSS objectives.

13.2 Summary of Requirements at Detailed Design, Sherborne Lodge/Eno Investments/Ankara Realty Lands

This EIR/FSS supports the draft plan applications submitted for the Sherborne Lodge, Eno Investments and the Ankara Realty Limited lands south of Burnhamthorpe Road and addresses EIR/FSS requirements for these and other lands that do not currently have Draft Plans of Subdivision applications. The EIR/FSS identifies the following specific design matters to be addressed at detailed design of the submitted draft plans of subdivision:

a) Reference Plans illustrating final NHS boundaries will be prepared on a draft plan by draft plan basis and will be submitted to the Town and CH;

b) Detailed restoration/planting plans associated with the trails as outlined in Section 6.3;

c) The monitoring requirements associated with the trail design, SWM Pond 9, pond outfall/stone core wetland and the Neyagawa ditch realignment will be established;

d) The form and type of LID techniques, including disconnected roof leaders, and grassed swales in side yard and rear yard areas, bioswales in parking lots, and rooftop and parking lot storage, as appropriate depending upon various building forms, is to be finalized at detailed design;

e) The proposed SWM measures including the SWM Pond 9 design will be refined at detailed design. The detailed design considerations shall include:

    i. Sizing of the proposed oil/grit separator and design of outfall BMPs;

    ii. The need and design of a perimeter drainage system to convey groundwater seepage around the pond toward the downgradient NHS;

    iii. Confirmation if a pond liner is required; additional boreholes and tests will be advanced at the Pond 9 location. A liner may be recommended for the SWM Pond 9 in order to minimize groundwater seepage into the pond or stormwater exfiltration from the pond;

    iv. Confirmation that the stone core wetland at the pond outfall will withstand flow velocities during the Regional Storm;

    v. Identification of sizing, materials and restoration of the pond emergency spillway;

    vi. Coordination of drainage and grading with adjacent developments and ROWs including the Region’s property;

    vii. Requirements for restoration of proposed works in the regulated area, edge

management, and compensation concepts presented in this EIR/FSS will be addressed at detailed design; and

viii. A detailed operations and maintenance manual for the SWM ponds and related infrastructure.

f) A monitoring plan will be prepared for the SWM facilities constructed in the conveyance system and at the end-of-pipe. Water quality and erosion monitoring will be undertaken at the location of the outfall for the purpose of water quality monitoring and erosion control. The past monitoring data would be compiled as part of developing the monitoring requirements;

g) The requirements for construction and/or dewatering will be confirmed by geotechnical/ hydrogeological investigations completed in support of detailed design;

h) An Erosion and Sediment Control (ESC) strategy will be prepared and implemented in accordance with the Town and CH's *"Erosion and Sediment Control Guideline for Urban Construction* prior to any earthworks or grading activities on the Subject Lands. This strategy should employ a multi-barrier approach where appropriate to prevent soil erosion and sedimentation. The plan must be reviewed and approved by the Town prior to any clearing and grading;

i) Areas within the development requiring sump pumps will be determined at the detailed design stage. Further evaluation of lots requiring sump pumps will be provided at detailed design and will be based on refined hydrogeological analysis (upon confirmation of maximum depth of footings and underground parking depth in higher density blocks);

j) In the event that Regional water projects are not completed at the time of development, interim water servicing alternatives will be investigated to meet the servicing requirements for the initial phases of the Subject Lands.

k) Details regarding the staging of pond removal, and temporary and ultimate pond and pond outfall construction will be provided at site alteration stage as part of detailed design. Particular attention will be given to staging works to minimize during construction impacts to the adjacent PSW 3 and downstream areas. .As part of the farm pond removal, the proposed pumping rate out of the existing farm pond will be confirmed;

l) A detailed operations and maintenance manual for the stormwater-related infrastructure will be prepared;

m) Additional information regarding substrate sizing along the realigned Neyagawa ditch may be required. Opportunities to soften the tie-in design at the ditch outfall to PSW 2

will be addressed at detailed design;

n) Confirmation that overland flows can be self-contained within the road ROWs. Additional capture points and larger sewers may be required if major system flows cannot be contained in ROWs;

o) Completion of hydraulic grade line analyses of the storm sewer system; and

p) Geotechnical investigations and inputs to detailed design including storm sewer and pond design will consider the groundwater data obtained through this EIR/FSS work and available at detailed design.

Table 13.1 - Summary of EIR/FSS Addendum Recommendations and Mitigative Measures

Topic	Recommendations	Report Section
Area Studied	In accordance with OPA 272 requirements, the Sixteen Mile Creek ES6-East subcatchment was studied as part of this *EIR/FSS*. This Sherborne/Eno EIR/FSS Addendum addresses all applicable EIR/FSS study requirements in support of the Sherborne Lodge and Eno Investments Draft Plans of Subdivision.	1.2
Draft Plans of Subdivision	The Sherborne Lodge and Eno Investments/Ankara Realty Draft Plans of Subdivision are illustrated on **Figures 6.1A** and **6.1B**.	6.1
Subcatchment Drainage Boundaries	This EIR/FSS assessed and refined ES6-East subcatchment boundaries and predevelopment flows. Subcatchments boundary delineation from adjacent subcatchments UWMC1, SC1, SM1 that were approved through recent EIR/FSSs for adjacent lands are reflected in the delineation of the ES6-East subcatchment where appropriate. Only a small portion of the ES6-East subcatchment boundary was not addressed in previous EIR/FSSs. This area was reviewed and a comparison of NOCSS and more recent LiDAR mapping was made to determine its boundary. The resulting EIR/FSS boundary is a combination of approved subcatchment boundaries from other EIR/FSSs and confirmation of a portion of the subcatchment boundary through LiDAR review. This assessment concluded that ES6-East subcatchment boundary changes were minor (NOCSS versus EIR/FSS). As a result, the NOCSS target unit flow rates for ES6-East subcatchment are valid for SWM pond design. Target unit flow rates and subcatchment target flows are noted in **Table 7.2**.	5.2 and 7.3
Previous EIR/FSSs or Other Relevant Studies	As part of the *Final ES6-West EIR/FSS* (2015) for the Davis-Minardi North Lands, an evaluation of the need for Regional Storm controls in the ES6-West and ES6-East subcatchments was undertaken by Stantec Consulting. Hydrology and hydraulic assessments of uncontrolled Regional Storm flows on downstream areas in the subcatchment were completed for existing, interim and ultimate development conditions. The assessment concluded that no Regional Storm controls were recommended in the ES6 subcatchments. As part of the *Final ES6-West EIR/FSS* (2015) for the Davis-Minardi North Lands, an evaluation of the erosion threshold and erosion analyses were completed by GHD. The purpose of this assessment was to determine appropriate erosion control criteria to inform the design of SWM facilities. It included determination of a theoretical critical erosion threshold, field verification of erosion thresholds, continuous hydrologic modelling of pre- and post-development flows and an assessment of potential geomorphic adjustments due to potential changes in the flow regime. Study findings that apply to developing areas within both the ES6-West and ES6-East subcatchments, include erosion control volume control requirements.	

Topic	Recommendations	Report Section
NHS Framework and Associated Components	Components of the NHS framework presented on **Figure 2.1** include: ▪ A portion of Core 5 in the southern part of both Draft Plans; ▪ No high, medium or low constraint streams or Hydrologic Features A are present; ▪ PSW 3 is located north of Core 5, east of Neyagawa Boulevard; and ▪ Five Hydrologic Features B are present in the Subcatchment Area; only two of these are located on the Subject Lands. While not within the EIR Subcatchment Area, several PSWs are present in adjacent subcatchments. This includes PSWs 2, 4, 5, 7 and 8. Drainage conditions to these adjacent PSWs were reviewed under pre-development and post development conditions to address potential impacts and mitigation where required.	2.1 and 3.0 7.10
NHS Boundaries, Core 5	The boundary of Core 5 on the Subject Lands was finalized through the completion of the Final Consolidated Preserve EIR/FSS (May 2017). The core boundary is presented on **Drawing 3.2R**.	3.0
Species At Risk	A SAR screening of Subject Lands has been completed using background information and field investigations. Based on screening and site investigations to date, currently SAR present no constraints to development of the Subject Lands due to avoidance of and protective setbacks applied to Core 5, and provided timing windows for vegetation removals are implemented for the balance of the Subject Lands.	5.6
Trail System	A Major Trail partially within the NHS, and a Multi-Use Trail outside of the NHS, have been sited on the Subject Lands in accordance with OPA 272 NOE4 and the North Oakville East Trails Plan. Trail alignment was reviewed in the field with the Town and CH (October 13, 2022), and preliminary grading requirements are presented on **Drawings 6.3R** and **7.11A**.	6.3
Erosion Threshold Analysis	The *Final ES6-West EIR/FSS* (2015) for the Davis-Minardi North Lands included an evaluation of the erosion threshold and erosion analyses completed by GHD. The purpose of this assessment was to determine appropriate erosion control criteria to inform the design of SWM facilities. The erosion threshold analysis has been updated by GEO Morphix based on the current development concepts, refined imperviousness values and continuous hydrologic modelling of the current EIR/FSS SWM design (by Urbantech). The results of this analysis have updated the erosion control design criteria for various SWM ponds in the subcatchment. See Sections 7.6 and 7.12 for erosion control criteria. The GEO Morphix Erosion Exceedance Analysis is provided in Appendix E-4.	7.6

Topic	Recommendations	Report Section
SWM Strategy – End-of-Pipe Facilities and LID Measures	The SWM plan for the Subject Lands is generally consistent with the NOCSS SWM Strategy. This EIR/FSS describes the preliminary design of Pond 9 as well as the conceptual design of 3 potential external ponds (9A, 9B, and 9C). Regional Storm controls are not required for these facilities. Proposed LID measures include designing grades to direct roof runoff towards pervious areas (e.g., lawns, side and rear yard swales) throughout the development with 300mm topsoil depths, where possible, as well as construction of tree pits along all roads, where technically feasible.	7.1, 7.7 and 7.12
SWM Facilities	SWM wet ponds are proposed to provide an Enhanced level of water quality control, erosion control, and quantity controls for a full range of storm events up to and including the 100-year event for all developing lands in the EIR Subcatchment Area. This includes Pond 9 south of Burnhamthorpe Road and up to three facilities north of Burnhamthorpe Road (Ponds 9A and 9B and Facility 9C). Ponds 9A and 9B (wet ponds), and Facility 9C (underground storage) could be combined into one facility as shown in NOCSS, subject to participation by the various owners. **Pond 9** is designed to provide Enhanced Level quality control, erosion control volume outlined in Section 7.12 and control of the 2 to 100-year storms to target flow rates established in the EIR/FSS based on NOCSS unit target release rates. This pond is located partially within Core 5 as permitted through OMB Minutes of Settlement. Conformity with MOS requirements is summarized in **Table 7.9**. **Drawing 7.12** presents the Pond 9 design; operating characteristics are presented in **Tables 7.12** and **7.13**. The proposed facility will discharge to the Neyagawa Road ditch via a box culvert outlet located within the NHS buffer. Realignment of the east ditch to address comments from the Region, Town and CH is presented; see Appendix I. **Ponds 9A** and **9B**, and **Facility 9C** are shown schematically on **Figure 7.7**. External facilities 9A, 9B and 9C are proposed to drain into Pond 9. Refer to **Tables 7.12**, **714**, **7.15** and **7.16** for the conceptual pond characteristics. Future EIR/FSS Addenda will finalize facility requirements north of Burnhamthorpe Road.	7.12
Pond 9 Outfall Design	An evaluation of alternative SWM Pond 9 outfall locations was completed and discussed with agencies on several occasions. Based on agency input, SWM Pond 9 is proposed to discharge to a lowered ditch on the east side of Neyagawa Boulevard via a storm sewer along the edge of the Core 5 NHS. Section 7.12.4.2 describes the revised Neyagawa ditch design including its relocation, lowering design, capacity, implications to the adjacent Core 5 and compensation measures.	7.12.4.2

Topic	Recommendations	Report Section
PSW 3 Wetland Water Balance	This EIR/FSS has assessed the existing PSW 3 hydrological, hydrogeological and ecological conditions, and identified specific drainage measures to direct surface runoff to this area under post development conditions to ensure that its form and functions are not negatively impacted. PSW 3 is maintained by surface runoff, primarily from the immediate surrounding area, precipitation, and the high underlying water table. It comprises two wetland ecosites: MAM2-2 dominated by reed canary grass; and, a MAM2 monoculture of exotic/highly invasive Phragmites. Based on the proposed grading and drainage plan, surface drainage from approximately 1.08ha in the southwest portion of the Subject Lands and a portion of the NHS will drain directly to PSW 3 via a storm sewer outfall. At the outfall, a small constructed wetland pocket will direct flows into PSW 3. Continuous modelling of the existing and proposed contributing drainage areas to the PSW 3 ponding area concludes that the predicted ponding is similar to the existing average daily water level conditions during the all months. Under post-development conditions, results fall within the range of natural variability, particularly during the growing season. The species present are extremely tolerant to fluctuations in moisture conditions. The predicted changes to water levels and volumes will not result in negative impacts to wetland. Wetland conditions will persist post-development. The outfall design from the 1.08ha southwest drainage area may provide additional habitat opportunities.	7.10
Preliminary Grading Plan	A Conceptual Grading Plan is illustrated on **Drawing 7.11A and 7.11AA**. Grading in the NHS will be done in accordance with NOCSS requirements. Grading in the NHS includes a portion of SWM Pond 9 and its outfall, the clean water pipe outfall, trails and some sloping to accommodate grade transition. **Drawings 7.11B** to **7.11F** present grading cross-sections.	7.11
Sanitary Servicing	The Subject Lands will be serviced by a network of local gravity sewers designed in accordance with Region of Halton standards and specifications. The local sewers will convey flows into the existing 450mm diameter regional trunk wastewater main constructed within Neyagawa Boulevard, and a 525mm diameter regional trunk wastewater main constructed within Preserve Drive via a 450mm diameter trunk sewer through the Docasa lands to the east. Three future service connections to the external lands are proposed to be extended across Willam Halton Parkway. These will be constructed by the future landowners when required. The wastewater servicing scheme is illustrated in **Drawing 9.2**.	9.2

Topic	Recommendations	Report Section
Water Servicing	The Subject Lands will be serviced by a network of new local watermains designed in accordance with the Regional Municipality of Halton design criteria and MECP guidelines. Trunk watermain sizing (300mm diameter and larger) was obtained from the Area Servicing Plan prepared by WSP. Local watermains (150mm and 200mm diameter) will be provided throughout the balance of the development lands. The watermain sizing is illustrated in **Drawing 9.3**.	9.3
Removal of Existing Farm Pond	The removal of the existing Sherborne farm pond is proposed, consistent with NOCSS, OPA 272 and the Town's Master Plan. The EIR/FSS includes discussion on the approach to pond removal, approval requirements, erosion and sediment controls measures, proposed timing of removal, direction regarding fish and wildlife salvage, and pond drawdown, as well as a discussion on the implication of pond removal to downstream areas.	11.4
Construction Practices	This report includes discussion of key geotechnical findings, erosion and sediment control requirements, general guidance on construction phasing, dewatering requirements, implications of development on private water wells, well decommissioning and topsoil management. Key recommendations include: • Erosion and Sediment Controls are to be implemented prior to construction and remain in working condition for the duration of construction activity. Erosion and Sediment Control plans are to be submitted and approved by the Town and CH and MECP as it relates to the existing pond decommissioning / PTTW • Municipal services below the water table will be constructed to prevent lowering and redirection of groundwater flow; and, • Prior to construction, all inactive wells (including both water supply and monitoring wells) within the development footprint are to be decommissioned in accordance with Ontario Regulation 903. Geotechnical investigations were completed for the Subject Lands. Reports are provided along with a summary of fieldwork, subsurface conditions and geotechnical recommendations.	11.1
Baseline SWM Pond Monitoring	Baseline water quality and fluvial geomorphological monitoring within the ES6-West and ES6-East subcatchments was completed by GHD Limited in association with the development of the Davis-Minardi North Lands west of Neyagawa Boulevard. Data including water temperature and TSS and conditions at several geomorphic cross sections were collected annually between 2015 and 2019 for several locations along reaches SMA-3, SMA-4 and SMA-6. These locations, downstream of the ES6-East subcatchments provided relevant	12.3.2

Topic	Recommendations	Report Section
	baseline data for development of the Subject Lands.	
Post Construction SWM Pond Monitoring	The monitoring program will include performance assessments of SWM facilities and erosion and sediment control measures. A detailed monitoring program will be provided for Pond 9 and outfall at the time of detailed design.	12.3
Future EIR Study Requirements	As noted herein, lands north of Burnhamthorpe Road are not participating landowners in the preparation of this ES6-East EIR/FSS. While there is no NHS present north of Burnhamthorpe Road in this EIR Subcatchment Area, future EIR/FSS Addenda will be required to provide further details regarding SWM and topographic depressions, as well as address compatibility with the recommendations made in this EIR/FSS.	13.1
Detailed Design Requirements	Specific design requirements to be addressed at detailed design are provided.	13.2