Town of Oakville - Halton Region

Sixth Oak Inc. Upper West Morrison Creek
UWM1 EIR/FSS Addendum #2
1st Submission

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1.0 INTRODUCTION

This Environmental Implementation Report (EIR) and Functional Servicing Study (FSS) Upper West Morrison Creek Sixth Oak Inc. UWM1 Addendum (herein referred to as the *Sixth Oak UWM1 Addendum*) is an update to the *EIR/FSS Addendum, Upper West Morrison Creek, Subcatchment UWM1*, prepared by Jennifer Lawrence and Associates Inc., Urbantech Consulting et. al. dated September 2021 (*UWM1 Addendum*). The *UWM1 Addendum* was prepared in support of those developments generally located north and south of Burnhamthorpe Road and east and west of Sixth Line but excluded the Subject Lands as they were non-participants at the time. The *UWM1 Addendum* built upon the original *UWM1 EIR/FSS*, prepared by Stonybrook Consulting, RAND Engineering, et. al, dated November 2017.

Although this document is an Addendum to the *UWM1 Addendum*, there are many components of the previous report that remain valid. To facilitate the timeline associated with the development of the Subject Lands, the content of this *Sixth Oak UWM1 Addendum* has been scoped in consultation with approval agency staff. The content for this interim submission, and agency input, can be found in **Appendix A-1** with a final report to be provided later in 2022.

Within the text of the report, when references to section numbers, appendices and/or drawings/figures are presented in **bold** font, this refers to items that can be found within this *Sixth Oak UWM1 Addendum*. When references to section numbers, appendices and/or drawings/figures are presented in regular font, this refers to items that can be found within the *UWM1 Addendum*. For ease of reference, those figures/drawings from the *UWM1 Addendum* that are referenced in this report have been included in **Appendix E**. Also, where appropriate, and for ease of reference, the figure and drawing numbers have maintained the numerical chronology as presented in the *UWM1 Addendum.*

1.1 STUDY PURPOSE

This *Sixth Oak UWM1 Addendum* has been prepared as an Addendum to the *Upper West Morrison Creek, Subcatchment UWM1 Addendum, Final Environmental Implementation Report and Functional Servicing Study (EIR/FSS)* prepared by Urbantech Consulting and Jennifer Lawrence and Associates et. al. dated September 2021 for the lands south of Highway 407 in the vicinity of Burnhamthorpe Road and Sixth Line as indicated in **Figure 1.1**. The scope of the work applies to the lands owned by Sixth Oak, as shown on **Figure 1.2**. The Halton District School Board (HDSB) requires these lands for a high school and associated uses including childcare facilities and office space. Due to the construction schedule for the school, this study has been scoped such that this first submission will provide sufficient information to define a Limit of Development (LOD) to enable the HDSB to begin the layout and design of the school campus. Additional details related to items such as post-development feature-based water balances will be provided in a subsequent submission. Details that have been left to a future submission will not impact the LOD.

The lands are within subcatchment UWM1 of the Upper West Morrison Creek as indicated in **Figure 1.3**. Non-participating landholdings also within the subcatchment include:

- Ashoe High Speed Solutions Inc. (north of Burnhamthorpe Road, west of Mattamy SGGC); and
- Several small parcels on the south side of Burnhamthorpe Road, west of Sixth Line.

The purpose of this interim *Sixth Oak UWM1 Addendum* is to characterize the natural heritage features and functions within the Study Area in order to define a LOD for the HDSB and to identify preliminary servicing requirements related to roads, water supply, sanitary sewers, storm drainage and site grading. The proposed content of this interim report was provided to the agencies in November 2021 (**Appendix A-1**). In order to meet the School Board's timeline, the intention is that this interim report will provide sufficient information to enable the agencies to issue conditions of draft plan approval with the requirement to complete the remaining portions of the Addendum as a condition of approval. Conservation Halton (CH) provided comments on the proposed report content and format in an email dated January 25, 2022 (**Appendix A-1**). The requested information in CH's January 25, 2022, email has been incorporated to the extent possible in this interim submission, with any remaining information, such as wetland water balance, to be provided in a subsequent submission. To date, comments have not been received from the Town of Oakville on the proposed report content/format. The purpose of the final *Sixth Oak UWM1 Addendum* will be to fulfill the remaining requirements of the EIR/FSS Terms of Reference (ToR) (**Appendix A-2**).

This interim *Sixth Oak UWM1 Addendum* has been prepared in accordance with the requirements of the Town's Official Plan Amendment 272 (OPA 272) as well as the content and format as outlined in the *Sixth Oak Inc., Interim EIR/FSS Addendum Submission Details* (**Appendix A-1**). The interim report is intended to support the LOD, as determined through the Core boundary stakings and delineation of the LPA between Cores 6 and 8 and Cores 6 and 7, with preliminary grading and servicing details.

As outlined in the *UWM1 Addendum*, field verification of Core 6 NHS boundaries, storm drainage outlet designs, confirmation of servicing, grading, SWM pond design and consistency with the *UWM1 EIR/FSS* and *UWM1 Addendum* was to be provided through an Addendum when the Subject Lands came forward for development. As required by the approval agencies, prior to the preparation of this *Sixth Oak UWM1 Addendum*, the specific scope of study was discussed with the Town, Region and Conservation Halton (**Appendix A-1**).

The work completed as part of this interim *Sixth Oak UWM1 Addendum*, was guided by requirements set out in the EIR/FSS ToR (**Appendix A-2)** approved by the Town and CH and is intended to satisfy the majority of the NOESP policy requirements with the understanding that a final report will be submitted once additional fieldwork and analysis has been completed. In addition, Section 14.1 of the *UWM1 EIR/FSS* provided direction to future EIR/FSS Addendums within the UWM1 catchment area. This *Sixth Oak UWM1 Addendum* has been prepared to address those items that are applicable to the Study Area.

1.2 EIR SUBCATCHMENT AREAS AND FSS STUDY AREA

1.2.1 EIR Subcatchment Area, UWM1

The entire UWM1 EIR Subcatchment Area is defined to be the subcatchment upstream of Sixth Line. Separate EIR/FSSs have been prepared for the Lower West Morrison Creek (i.e.,

downstream of Sixth Line) in support of development in the southern portions of the subcatchment. **Figure 1.3** presents the boundaries of the subcatchment study area for the purpose of this *Sixth Oak UWM1 Addendum*. Two EIR/FSS reports have previously been prepared for the Lower West Morrison Creek subcatchment and two have been prepared for the Upper West Morrison Creek. They are:

Lower West Morrison Creek:

- The EIR/FSS, Lower West Morrison Creek and the Timsin/Arrassa Lands, North Oakville East, initiated in 2007 and approved in 2010, supported development of these lands west of Sixth Line, south of the Sixth Line creek crossing; and,

- The approved EIR/FSS, Lower West Morrison Creek and East Morrison Creek, Sixth Line Corporation, North Oakville, EIR/FSS by Urbantech et al (November 2016).

Upper West Morrison Creek:

- Upper West Morrison Creek, Final EIR/FSS, prepared by Stonybrook Consulting, RAND Engineering et.al., November 2017;
- Upper West Morrison Creek, EIR/FSS Addendum, prepared by Urbantech Consulting, Jennifer Lawrence and Associates et.al., September 2021.

This *Sixth Oak UWM1 Addendum* was prepared and coordinated with the subcatchment limits and recommendations from the previous EIR/FSS's noted above.

1.2.2 Functional Servicing Study Area

The FSS Study Area is defined to be the portion of the Subject Lands south of William Halton Parkway, as illustrated on **Figure 1.3**.

1.3 EIR/FSS STUDY OBJECTIVES

The objectives, to be fulfilled by the EIR/FSS, are set out in the approved ToR (**Appendix A-2**). 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;
- 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;
- ensure servicing requirements, as determined in the FSS for the areas external to the Draft Plan, are adequate;
- identify details regarding any potential development constraints or conflicts and how they are to be resolved;
- provide any further implementation details as required; and,
- streamline the Draft Plan approval process..

For the purpose of this interim submission, the objectives to be fulfilled are set out in the interim submission details (**Appendix A-1**). They are to:

- Establish the limit of development for the HDSB in order to advance the design of their campus;
- Provide sufficient level of detail to ensure that the various components of the NHS and infrastructure can be implemented, as envisaged in NOCSS and the NOESP and to ensure that the draft plan is consistent with this conceptual design;
- Provide preliminary servicing, grading and stormwater management details;
- Provide an outline of further information to be included in the final Addendum submission; and,
- Facilitate the preparation of draft plan conditions.

1.4 EIR/FSS STUDY TEAM

A multi-disciplinary study team has investigated the ecological character and servicing requirements for the purposes of the *Sixth Oak UWM1 Addendum*. The various team members and their respective responsibilities are:

- **RAND Engineering** – stormwater management, site grading and servicing design;
- **Jennifer Lawrence and Associates Inc.** – study management/integration and report co-ordination, environmental planning;
- **GEI** and **Ecosystem Research and Management (ERM)** - terrestrial ecology; and
- **R. J. Burnside & Associates Limited** – geology and hydrogeology

1.5 PREVIOUS RELATED STUDIES/REPORTS

The following approved studies/guidelines/documents were reviewed in preparation of this EIR/FSS Report:

- Town of Oakville Draft North Oakville Creeks Subwatershed Study, August 2006;
- Town of Oakville Draft North Oakville Creeks Subwatershed Study Addendum (Draft), September 2007;
- Town of Oakville Official Plan Amendment 272, August 2007;
- Region of Halton Official Plan Amendment 25;
- Ontario Municipal Board Minutes of Settlement, August 2007;
- Ontario Municipal Board Mediation Agreements, 2007;
- North Oakville Environmental Implementation Report and Functional Servicing Study Terms of Reference, August 2007;
- North Oakville East Subwatershed Study, prepared for the North Oakville Landowners' Group, August 2004;
- South Halton Water and Wastewater Master Plan Update, Region of Halton, 2007 (Master Plan Update);

- North Oakville Secondary Plan – Area Specific Servicing Plan, Oakville Ontario, MMM Group, June 2008;
- Conservation Halton's Policies and Guidelines for the Administration of Ontario Regulation 162/06 (April 27, 2006, revised 2020);
- Stormwater Management Planning and Design Manual, Ministry of Environment, March 2003 (SWMP Design Manual);
- Development Engineering Procedures & Guidelines Manual, Town of Oakville, January 2011;
- Design Criteria, Contract Specifications and Standard Drawings, Region of Halton, February 2001 (updated 2007);
- North Oakville Monitoring Guidelines, January 2012;
- Erosion and Sediment Control Guidelines for Urban Construction, Conservation Halton et al, December 2006;
- EIR/FSS, Lower West Morrison Creek and the Timsin/Arrassa Lands, North Oakville East, Stonybrook Consulting et al, April 2010;
- Final Upper West Morrison Creek Subcatchment UWM1 EIR/FSS, prepared by RAND Engineering et. al., November 2017;
- Final Sixteen Mile Creek EIR/FSS, prepared by Stonybrook Consulting et al., April 2018;
- Lower West Morrison Creek and East Morrison Creek, EIR/FSS, Sixth Line Corporation, North Oakville, prepared by Urbantech et al, November 2016;
- UWM1 EIR/FSS Addendum, Urbantech Consulting, Jennifer Lawrence and Associates Inc., et. al., September 2021.
- Final North Oakville East Drainage Area Exchange Report, prepared by Stonybrook Consulting et al, January 2017.

2.0 NATURAL HERITAGE SYSTEM FRAMEWORK

2.1 NATURAL HERITAGE SYSTEM COMPONENTS

The Natural Heritage and Open Space System (NHOSS) for North Oakville East is part of a larger system designed to protect, preserve, and enhance key features and functions of the natural environment throughout North Oakville. The primary purpose of the Natural Heritage component of the NHOSS is to protect, preserve and enhance the natural environment; the main purpose of the Open Space component is to provide for active recreational needs and community facilities, and where possible, to connect to and enhance the Natural Heritage component.

The North Oakville East Secondary Plan (OPA 272) provides the framework for the Natural Heritage component of the NHOSS, with the North Oakville Creeks Subwatershed Study (NOCSS), the North Oakville Creeks Subwatershed Study Addendum (NOCSS Addendum), Ontario Municipal Board Minutes of Settlement and Mediation Agreements providing the basis for its establishment and technical guidance for its implementation.

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 was developed to provide guidance for the future management of the North Oakville Creeks Subwatershed and specifically to meet the goals and objectives within the context of future land use and other activities within the watersheds. (NOCSS, 2006). The management strategy outlines specific requirements with respect to the following:

- lands restricted from development;
- lands with development limitations or constraints;
- SWM; and;
- input to land use policies and servicing requirements.

The Implementation Plan provides the requirements for the recommended management strategy components, including environmental reporting requirements, Agency responsibilities, and the approval process with the Town, the Region and CH, and, where applicable, the Ministry of Natural Resources (MNR) and the Federal Department of Fisheries and Oceans (DFO).

The EIR Subcatchment Area for this Addendum contains Core Preserve Areas and Linkage Preserve Areas (LPA). The EIR Subcatchment Area for the overall UWM1 subcatchment includes Core Areas, LPAs, an Optional LPA (OLPA), Medium Constraint Stream Corridors and Other Hydrologic Features (**Figure 2.1**).

Core Preserve Areas

These 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 NHS. Core Preserve Areas are comprised of Environmentally Significant Areas (ESAs), Areas of Natural and Scientific Interest (ANSIs),

Provincially Significant Wetlands (PSW) and significant woodlands. The following Core Preserve Areas are located with the overall UWM1 EIR Subcatchment Area depicted on **Figure 2.1**:

- Core Preserve Area 5 extends from west of Neyagawa Blvd. easterly, to between approximately 170m and 200m west of Sixth Line. It encompasses several watersheds, including East Sixteen Mile Creek Tributary, Shannon's Creek, Osenego Creek, and West Morrison Creek subcatchments.
- Core Preserve Area 6 is located north of Burnhamthorpe Road and west of Sixth Line.
- Core Preserve Area 7 is bounded on the north by Burnhamthorpe Road West, on the west and south by agricultural lands and on the east by Sixth Line.
- Core Preserve Area 8 South is located east of Sixth Line and north of Burnhamthorpe Road West. The Core Area straddles the subcatchment boundary between Upper West Morrison Creek, East Morrison Creek, Sixteen Mile Creek and Joshua's Creek. The northern portion of this Core Area (Core Preserve Area 8 North) lies within the adjacent Sixteen Mile Creek watershed.

The EIR subcatchment area for the purpose of this report has been further refined and only includes Core 6 and a portion of Core 7. As such, discussion on the character of Cores 6 and 7 and boundary delineation is provided in **Section 3.0** of this report. Discussion pertaining to Cores 5 and Core 8 can be found in Section 3.0 of the *UWM1 Addendum*.

Linkage Preserve Areas and Optional Linkage Preserve Areas

Linkage Preserve Areas (LPA) and Optional Linkage Preserve Areas (OLPA) are defined in the NOCSS as areas that connect Core Preserve Areas together, following natural features where existing and/or feasible, with the intention of protecting, and where possible, enhancing the Core Preserve Area features and their functions. They are intended to be of sufficient size and character, including buffers, to ensure the functionality and sustainability of the NHS.

According to Figure NOE3 of OPA 272, there are two LPAs located within the overall EIR subcatchment area and one OLPA. They are:

Linkage Preserve Areas

- A 100m wide LPA connecting Core Preserve Area 8 South to Core Preserve Area 6; and,
- A 100m wide LPA connecting Core Preserve Area 6 to Core Preserve Area 7.

Optional Linkage Preserve Area

- A 100m wide OLPA is identified connecting Core Preserve Area 7 to Core Preserve Area 5.

Further discussion regarding the LPAs is provided in **Section 4.0** of this report. The OLPA is outside of the EIR subcatchment area that is the subject of the *Sixth Oak UWM1 Addendum*. As such, details pertaining to the OLPA can be found in Section 4.0 of the *UWM1 Addendum*.

High Constraint Stream Corridor Areas

High Constraint Stream Corridors (Red Streams) typically 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 and LPAs but are also found outside such areas. They must be protected in their existing locations for hydrological and ecological reasons.

There are no Red Streams in this EIR Subcatchment Area.

Medium Constraint Stream Corridor Areas

Medium Constraint Stream Corridors (Blue Streams) include watercourses and adjacent riparian lands, including buffers measured from the stable top-of bank or meander belts. These areas are located primarily inside Core and LPAs but are also found outside such areas. These watercourses may be deepened and/or relocated in accordance with subsection 7.4.7.1 (d) of OPA 272.

As identified in Figure NOE3 of the OPA 272, there are two Blue or Medium Constraint Streams located within the overall UWM1 EIR Subcatchment Area referred to as stream reaches MOC-W2 and MOC-W3 (**Figure 2.1**) however, there are no Medium Constraint Streams within the *Sixth Oak UWM1 Addendum* Study Area. As such, no further discussion is provided in this report related to the Medium Constraint Stream Corridors. For information pertaining to the Medium Constraint Stream Corridors within the EIR Subcatchment Area, please refer to the *UWM1 Addendum*.

Other Hydrological Features

This classification includes a number of other hydrological features that have been identified in the NOESP that also form part of the NHS to the extent that they are maintained after development occurs. These features include Low Constraint Streams, Hydrologic Features A and Hydrologic Features B. Topographic depressions have also been identified that are not associated with the NHS. **Table 2.1** summarizes the location and general description of topographic depressions, and their locations are shown on **Figure 5.2**. The hydrological features include:

- Low Constraint Stream Corridors (Green Streams) – These streams are not required to be maintained; however, their function must be maintained in accordance with the directions established in the NOCSS and Federal, Provincial and Conservation Authority regulations. There is one Green Stream in the northern portion of the overall UWM1 EIR Subcatchment Area referred to as Stream Reach MOC-W5 (NOCSS, Figure 6.3.16) however, there are no Green Streams within the *Sixth Oak UWM1 Addendum* Study Area. As such, no additional discussion is provided in this report related to Green Streams. For information pertaining to the Green Streams within the overall EIR Subcatchment Area, please refer to the *UWM1 Addendum*.

- Hydrologic Features A – Hydrologic Features "A" are defined in the NOCSS to be hydrologic features associated within Blue or Red streams. The NOCSS further defines Hydrologic Features A as having hydrological functions and consequently both their

form and function must be considered through a hydrological and hydrogeological assessment as part of an EIR. This review must 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 (NOCSS, 2006). In addition, OPA 272 identifies Hydrologic Features A as serving a key hydrological purpose and that the form and function of these features are to be retained or enhanced. OPA 272 further states that the modification of or reconstruction of Hydrologic Features A is to be carefully considered as part of the EIR and that this assessment is to also include any ecological benefits of this Feature (North Oakville East Secondary Plan, 2008).

There is one Hydrologic Feature A located within the overall UWM1 EIR Subcatchment Area that is associated with Blue Stream MOC-W3. This feature is referred to as PND-43 however, there are no Hydrologic Feature A within the *Sixth Oak UWM1 Addendum* Study Area. For information pertaining to PND-43, please refer to the *UWM1 Addendum*.

- Hydrologic Features B – According to the NOCSS, Hydrologic Features B are not associated with the NHS and can be relocated and consolidated with other wetlands, water features or SWM facilities provided the hydrologic function of the feature is maintained (NOCSS, 2008). According to Figure NOE3 of OPA 272, there are seven Hydrologic Features B identified within the overall UWM1 EIR Subcatchment Area however, none of them are located on the Subject Lands. For information pertaining to the Hydrologic Features B, please refer to the *UWM1 Addendum*.

- Topographic Depressions – These depressions do not form part of the NHS; however, the NOCSS requires that topographic depressions, ponds and pits be addressed as part of the SWM system design. Constructed ponds do not have to be included in the assessment of depression storage. As listed in **Table 2.1**, there are numerous topographic depressions in the overall UWM1 EIR Subcatchment Area including one within the Subject Lands (Depression 30 within Core 6). In addition to topographic depressions, pits have also been identified through NOCSS. There is one Pit (Pit 29 within Core 6) within the Subject Lands. For information pertaining to the topographic depressions and pits outside of the Subject Lands, please refer to the *UWM1 Addendum*.

Provincially Significant Wetlands

In 2011, the Ministry of Natural Resources (now Ministry of Natural Resources and Forestry) updated their mapping of the North Oakville – Milton East Wetland Complex, which includes wetland units within the UWM1 Subcatchment Area. Numerous PSW wetland units of various types are present within Cores 5, 6, 7 and 8 South within the overall UWM1 EIR Subcatchment Area as follows:

- Core 5 – PSW 9, 10 and 13;
- Core 6 – PSW 83 to 89;
- Core 7 – PSW 14 to 15; and,
- Core 8 South – PSW 71 to73, 75 to 78 and 82.

Figure 2.1 illustrates the location of these PSWs. In total, there are 20 wetland units of the North Oakville – Milton East Wetland Complex that will be protected within Core Areas 5 through 8 within the UWM1 subcatchment. Other PSWs are present in these Cores but are located in adjacent EIR Subcatchment Areas. Specific to the *Sixth Oak UWM1 Addendum* Study Area, there are seven PSWs within Core 6 (PSWs 83-89) and one PSW within Core 7 (PSW 15).

Table 2.1 Pits, Ponds and Depressions

Feature Type and Number*	Hydrologic Feature A or B	Comment
North of Burnhamthorpe Road, west of Sixth Line		
Pits 20, 21 22, 23, 24, 25, 26, 27, 28, 29	Not applicable	With the exception of Pit 26, the storage function of these depressions will be accommodated in Pond 16. Pit 26 is to be addressed in the Sixteen Mile Creek EIR/FSS Addendum. Pit 29 is within Core 6 on the Subject Lands and will therefore be protected as is.
Depression 30	Not applicable	This depression is located within Core 6 on the Subject Lands and therefore will be protected as is.
North of Burnhamthorpe Road, east of Sixth Line		
P*	Not applicable	Natural depression not identified in NOCSS. Storage function accommodated in SWM design.
South of Burnhamthorpe Road, west of Sixth Line		
Depression 145	Not applicable	This depression sits on a drainage boundary as shown on Figure 5.2. Confirmation of pond origin was provided by DSEL. This facility is man-made, and no further consideration is required.
Ponds 20, 21, 23, 94 (Pit 31)	HDFB	These ponds were man-made and have since been removed (with Agency approvals). There are no specific requirements to be addressed as part of this EIR/FSS.
Pond 43 (also shown as Depression 32)	HDFA	Feature is located within the existing stream reach MOC-W3. This EIR addresses its modification and incorporation into the new channel corridor.
South of Burnhamthorpe Road, east of Sixth Line		
Ponds 24, 27 and 28	HDFB	Ponds 24 and 28 are located on TWKD Developments Inc.'s property and Pond 27 is

Feature Type and Number*	Hydrologic Feature A or B	Comment
		located on the EMGO III (Putica) lands. These ponds are man-made and, as such, no further consideration is required.

*Source of data – NOCSS, 2007

2.2 PERMITTED ACTIVITIES IN THE NATURAL HERITAGE SYSTEM

OPA 272, Policy 7.4.7.3, provides guidance with respect to potential permitted uses within 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 adaptive use institutional buildings. **Table 2.2** summarizes policy direction related to permitted uses and notes the 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 each of the Cores within the EIR Subcatchment Area are listed in **Section 2.4**.

Sections 6.3.5.2 of NOCSS, OMB Minutes of Settlement (MOS) and some Mediation Agreements also address permitted uses in the NHS.

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

Table 2.2 Permitted Activities in the Natural Heritage System

OPA 272 Policy Section	Potential Permitted Use and Policy Direction	Report Section of EIR/FSS Addressed
7.4.7.3 c) i)	<u>Development or Land Disturbance</u> Permitted in accordance with the directions of the NOCSS and any related Environmental Implementation Reports, Federal, Provincial and Conservation Authority Regulations for required flood and stream bank erosion control; for fish, wildlife and conservation	Section 8.0

OPA 272 Policy Section	Potential Permitted Use and Policy Direction	Report Section of EIR/FSS Addressed
	management; to accommodate a stormwater outfall; or in Medium Constraint Stream Corridor Areas.	
7.4.7.3 c) ii)	Roads and Related Utilities Permitted 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; and be designed to minimize grading in accordance with the directions established in the NOCSS. 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 edges of applicable designations, wherever possible; provide for the safe movement of species in accordance with the directions established in the NOCSS in the design and construction of any road or utility; be kept to the minimum width possible; and be designed to keep any related structures or part 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.	Not applicable to this EIR/FSS
7.4.7.3 c) iii)	Expansion to existing Water and Wastewater services Permitted 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 7.2
7.4.7.3 c) v)	SWM facilities Permitted in accordance with the directions in the NOCSS provided that the final number, size and configuration of such facilities will be determined through any related Environmental Implementation Report or Functional Servicing Study and as shown conceptually on Figure NOE3.	Not applicable to this EIR/FSS
7.4.7.3 c) vi)	Grading Permitted in accordance with the directions established in the NOCSS or appropriate Environmental Assessment.	Section 8
7.4.7.3 c) vii)	Private Driveways Permitted across the LPA joining the north and south area of the Core Preserve Areas located north of Burnhamthorpe Road and West of Trafalgar Road.	Not applicable to this EIR/FSS
7.4.7.3 c) viii)	The adaptive re-use of Heritage Buildings Art gallery and art school permitted in the LPA associated with Reach JC-7.	Not applicable to this EIR/FSS

2.3 RESULTS OF OMB MEDIATION AND MINUTES OF SETTLEMENT

Several water resources related agreements were made between the Town, CH and the Landowners during Ontario Municipal Board hearing mediation discussions. Also, MOS were entered into between the Town, CH, 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 Addendum.

Some development proposals within the overall UWM1 EIR Subcatchment are bound by MOS dated June 15, 2006, and August 13, 2007. The MOS outline agreements with respect to proposed development within the UWM1 subcatchment 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:

August 13, 2007, MOS, Sections regarding Natural Heritage Lands

Section 10(b) states that, "*subject to Sections 12 to 15, the Natural Heritage Lands shall be dedicated on an "as-is, where-is" basis. 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 proposed Secondary Plan (which is intended to "groundtruth", but not substantially revise, the boundaries).*"

Section 13 states that, "*…the Town will not require the Landowners to undertake or fund, directly or indirectly,*

- *any maintenance after dedication;*
- *any works to enhance the Natural Heritage Lands, other than the restoration/enhancements as identified in Section 4 and 5; and,*
- *any monitoring of the Natural Heritage Lands, other than in respect of the Landowners' stormwater management facilities."*

Section 14 notes, "The Town and Landowners agree that Sections 10(b) and 13 shall not apply:

a) *in respect of any restoration and/or enhancement works provided for in paragraphs 4 and 5 of these Minutes of Settlement;*

b) *respect of lands identified as "Medium Constraint Stream Corridors" on Figure NOE 3 in the Town's Proposed Secondary Plan 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 Proposed Secondary Plan and the Town's Subwatershed Study;*

c) *in respect of lands designated "Natural Heritage System Area" on Figure NOE 2 in the Town's Proposed Secondary Plan in respect of which the Landowner locates stormwater management facilities in accordance with the provisions of the Town's Proposed Secondary Plan and the Town's Subwatershed Study; and*

d) 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)."

Mediation Agreements include:

- Stage-Storage-Discharge Characteristics dated February 21, 2007;
- Infiltration dated February 22, 2007;
- Depressional Storage dated May 30, 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;
- 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;
- SWM - Temperature and Dissolved Oxygen Targets dated July 12, 2007;
- Monitoring dated July 26, 2007;
- EIR/FSS TOR dated August 2, 2007; and,
- Grading and the NHS, undated.

2.4 MANAGEMENT RECOMMENDATIONS FROM NOCSS FOR CORE AREAS

The NOCSS Addendum, as well as OPA 272, identifies environmental features to be protected and studied further during the EIR/FSS process. NOCSS Section 7.6 and Table 7.6.1 outline the management recommendations for each of the Core Preserve Areas identified within their Study Area. The following provides a summary of these recommendations for the Cores within the overall UWM1 EIR Subcatchment Area.

Core Preserve Area 5 (Neyagawa Woodlot)

- The existing woodlands and wetlands are recommended for retention.
- The north and south linkages associated with West Morrison Creek are 100m wide.
- Management of the landfill portion of the Core is recommended to be a balance of created and forested connection in the south margin and continued open country habitat.

Core Preserve Area 6 (Woodlot Northwest of Burnhamthorpe/Sixth Line) and Core Preserve Area 7 (Woodlot Southwest of Burnhamthorpe/Sixth Line)

- The existing woodland and associated wetlands are recommended for retention.
- Cores 6 and 7 are proposed to be linked to one another over a fairly short span (approximately 100m); although this includes a major roadway.
- Connection of the southern Core to West Morrison Creek and to Core 5.
- Cores 6 and 8 are proposed to be linked, again across a major roadway.

- The connectivity of these two cores will likely be more a function of proximity. This may help to explain the presence of some forest interior bird species in the smaller northern Core, despite it only providing marginal habitat at 200m by 200m large.

Core Preserve Area 8 (Earth Science Woodlots)

- The existing woodlands and wetlands are recommended for retention.
- Highway 407 will create a substantial barrier to many species.
- As noted under Core Preserve Area 6, the linkage from Core Preserve Area 8 to the south will also be affected by major roads and considerable distances. The proximity of the Core Preserve Areas 6 and 7 is seen as a potential connectivity opportunity for some species in these Cores. Direct, forested linkages beyond the Core itself are fairly limited.

3.0 CORE AREAS

As noted previously, there are four Core Areas located either entirely or partially within the overall UWM1 EIR Subcatchment Area – Cores 5, 6, 7 and 8 South (**Figure 1.3**). Detailed information pertaining to Cores 5, 7 and 8 is provided in the *UWM1 Addendum* however, only limited information pertaining to Core 6 (i.e., western Core boundary limit and PSW limits in proximity to the western Core boundary) was provided in the *UWM1 Addendum* given that the lands on which Core 6 are situated (i.e., the Subject Lands) were non—participating at the time. Please refer to the *UWM1 Addendum* for the detailed description of Core 5. The descriptions of Cores 7 and 8, as provided in the *UWM1 Addendum*, have been included in this report given that the LPAs within the Subject Lands connect to these two Core Areas and a portion of Core 7 is within the *Sixth Oak UWM1 Addendum* Study Area.

3.1 CORE 6

3.1.1 General Description

Core Area 6 is located north of Burnhamthorpe Road and west of Sixth Line and is approximately 6.06 ha in size. Core Area 6 is dominated by a Fresh-Moist Sugar Maple-Hardwood Deciduous Forest (FOD6-5) and is dotted with seven small wetland pockets that are part of the North Oakville – Milton East Wetland Complex (wetlands 83-89). Some of these pockets form communities in their own right, such as Reed-canary Grass Mineral Meadow Marsh (MAM2-2, or PSW86) and Cattail Mineral Shallow Marsh (MAS2-1, or PSW 85), others are inclusions within the deciduous forest matrix (e.g., Mixed Mineral Meadow Marsh MAM2-2 or PSW 84, as well as PSW 87 and 88) and, finally, the remaining ones are at the edge of the woodlot, such as man-made ponds with Duckweed Floating-leaved Shallow Aquatics (SAF1-3, or PSW83) and Open Aquatic Ecosite (OAO, or PSW89). ELC units are shown on **Figure B1-1, Appendix B-2**.

The northwest corner of the woodlot is composed of a Buckthorn-Hawthorn Cultural Thicket (CUT1-7) and the northeast corner consists of a small and disturbed area of Fresh-Moist Old Field Meadow (CUM1-1).

The woodlot is entirely surrounded by agricultural lands: crop fields to the west, north and east, and horse pastures on the south side, next to the existing residence.

The NOCSS recommended that the existing woodland and wetlands be retained, with Core 6 to be linked with Core 7 over a fairly short span of approximately 100m. The NOCSS further recommended that Core 6 be linked to Core 8 to the east across Sixth Line.

3.1.2 Core Boundary Delineation

The western boundary of Core 6 was established through the *UWM1 Addendum*; it was staked in the field with the Town and CH on September 30, 2010. The field survey was prepared and subsequently approved by CH on August 29, 2012. The southern, eastern and northern woodland

dripline was staked with the Region of Halton staff on September 9, 2021. Wetland limits (Wetlands 83, 84, 85 and 86) were staked with Conservation Halton staff on September 16, 2021. This Core boundary staking in 2021 completed the Core 6 boundary limits. The approved woodland dripline and wetland boundaries are shown on **Figure 3.1** which is an amalgamation of the previously approved western Core boundary limit and the newly staked northern, eastern and southern Core boundary limits. CH provided sign-off on the Core 6 boundary limits in an email dated January 25, 2022 (**Appendix A-1**).

Table 3.1 provides brief descriptions of the vegetation communities associated with Core 6. Ecological Land Classification (ELC) mapping and botanical survey was completed on October 28, 2021.

Table 3.1 Core Preserve Area 6 ELC Vegetation Community Descriptions

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
FOREST		
Deciduous Forest		
FOD6-5 Fresh-Moist Sugar Maple-Hardwood Deciduous Forest	• Dominated by Sugar Maple (*Acer saccharum*), with several associate species including American Beech (*Fagus grandifolia*), Shagbark Hickory (*Carya ovata*), Red Oak (*Quercus rubra*), Bur Oak (Q*. macrocarpa*), Black Cherry (*Prunus serotina*), Large-tooth Aspen (*Populus grandidentata*), White Pine (*Pinus strobus*), and several others. • Saplings and Sugar Maple and White Ash (*Fraxinus americana*) form most of the shrub layer. • Herb cover is composed of Pennsylvania Sedge (*Carex pensylvanica*), Large-leaved Aster (*Eurybia macrophylla*), White Avens (*Geum canadense*), Herb Robert (*Geranium robertianum*), and several others.	S5
CULTURAL		
Cultural Meadow		
CUM1-1 Fresh-Moist Old Field Meadow	• A small and disturbed open community of native species and exotics. • The main species are Smooth Brome (*Bromus inermis*) and Tall Goldenrod (*Solidago altissima*). • Secondary plants are numerous, for example Grass-leaved Goldenrod (*Euthamia graminifolia*), Tufted	NA

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
	Vetch (*Vicia cracca*), Garlic Mustard (*Alliaria petiolata*), Teasel (*Dipsacus fullonum*), Common Milkweed (*Asclepias syriaca*) and New England Aster (*Symphyotrichum novae-angliae*). • Occasional cover of shrubs, e.g., Common Buckthorn (*Rhamnus cathartica*), Hawthorn (*Crataegus* sp.) and Red Raspberry (*Rubus idaeus*).	
CUT1-7* Buckthorn-Hawthorn Cultural Thicket	• Dense and tall (5-7m) thicket of mostly Hawthorn and Common Buckthorn. • Scattered but constant presence of tree saplings or small trees, such as White Ash, American Beech, Trembling Aspen (*Populus tremuloides*), Sugar Maple, Ironwood (*Ostrya* virginiana) and Shagbark Hickory.	NA
MARSH		
Meadow Marsh		
MAM2-2 Reed-canary Grass Mineral Meadow Marsh	• Small meadow dominated by Reed-canary Grass (*Phalaris arundinacea*). • Secondary species are Tall White Aster (*Symphyotrichum lanceolatum*), Blue Vervain (*Verbena hastata*), Purple Loosestrife (*Lythrum salicaria*), Pennsylvania Smartweed (*Persicaria pensylvanica*) and Devils' Beggarticks (*Bidens frondosa*).	S5
MAM2-11* Mixed Mineral Meadow Marsh	• Wetland inclusion within the deciduous forest, located in a long depression/vernal pool. • Composed of several herbaceous species, such as Fowl Meadow Grass (*Glyceria striata*), Devil's Beggarticks, Tuckerman's Sedge (*Carex tuckermanii*), Sensitive Fern (*Onoclea sensibilis*) and Hemlock Water-parsnip (*Sium suave*).	NA
Shallow Marsh		
MAS2-1 Cattail Mineral Shallow Marsh	• Tall herb community of densely growing Broad-leaved Cattail (*Typha latifolia*). • Associate species are Reed-canary Grass, Purple Loosestrife and Bristly Sedge (*Carex comosa*).	S5

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
OPEN WATER		
OAO Open Aquatic Ecosite	• Open water of a large dug pond, plankton dominated.	S5
SAF1-3 Duckweed Floating-leaved Shallow Aquatic	• Small dug pond, with floating cover of Lesser Duckweed (*Lemna minor*), developing later in the growing season.	S5

*Denotes a type not listed in the Southern Ontario ELC Guide

The Fall 2021 botanical inventory identified a total of 108 species of vascular plants. Of that number, 70 (or 65%) are native and 38 (or 35%) are exotic. A full species list is included in **Table B2-1 (Appendix B-2).**

The majority of the native species (93%) are ranked S5 (secure in Ontario), with 5 species (7%) ranked S4 (apparently secure in Ontario; NHIC, 2013).

Four regionally uncommon plants were observed, as per the Halton Region rarity rankings (Crins et al. 2006). None of the regionally rare species are considered rare in Ontario. None of the species recorded from the Subject Lands had a co-efficient of conservation value of 9 or 10.

The uncommon-in-Halton species are summarized below:

- White Spruce (*Picea glauca*) – planted;
- Smooth Goldenrod (*Solidago gigantea*) – rare in the deciduous forest FOD6-5;
- Pennsylvania Smartweed (*Persicaria pensylvanica*) – occasional in unit MAM2-2;
- Tuckerman's Sedge (*Carex tuckermanii*) – abundant in wetland inclusion MAM2-11 in the deciduous forest FOD6-5.

3.2 CORE 7

The following information was presented in the *UWM1 Addendum* and is repeated here for information purposes and to provide context as it relates to the LPA between Cores 6 and 7. No updates to wildlife observations have been completed as part of this interim report.

3.2.1 General Description

Vegetation Communities

Site surveys (Savanta Inc., 2008 and 2012) characterize the dominant forest community as FOD6-5 Fresh-Moist Sugar Maple – Hardwood, with wetland units represented by MAM2-2 Reed-Canary Grass Mineral Meadow Marsh at the northern and western ends, and MAM2-4 Fowl Manna Grass Mineral Meadow Marsh. Both wetland communities are included in the North Oakville-Milton East Provincially Significant Wetland Complex. **Table 3.2** provides a detailed description of the vegetation communities associated with Core 7.

Table 3.2 Core Preserve Area 7 ELC Vegetation Community Descriptions

Vegetation Type	Description
DECIDUOUS FOREST (FOD)	
FOD6-5 Fresh-Moist Sugar Maple – Hardwood Deciduous Forest	Dominated by sugar maple and several other hardwood species, including shagbark hickory, bitternut hickory, beech, white oak, red oak and ironwood. There are also scattered stems of white pine, trembling aspen and white ash. In small depressions, green ash and white elm are present. The regeneration is mostly maple, hickory and ash. Depending on the location and management history, the forests vary from more disturbed with weedy species (garlic mustard, herb Robert), to more naturally-looking patches where native species dominate.
MARSH	
MAM2-2 Reed-canary Grass Mineral Meadow Marsh	(Polygon #15 of the North Oakville-Milton East Provincially Significant Wetland Complex.)
MAM2-4 Fowl Manna Grass Mineral Meadow Marsh	Dominated by Fowl Manna grass with occurrences of spotted jewelweed. Two inclusions (vegetation communities <0.5 ha); a floating manna grass marsh and common jewelweed and an inclusion of panicled aster mineral marsh. (Polygon #14E of the North Oakville-Milton East Provincially Significant Wetland Complex. Chorus frog (low call level) was heard by Stantec (2006).

One hundred and seventy eight (178) species of vascular plants were identified across Cores 7, 8 and 9, of which 33% (58) were non-native. No nationally or provincially rare plant species were recorded for the Subject Lands. Two (S4) species were identified with Core Preserve Area 7 and are considered to be uncommon (apparently secure) in Ontario. Both of these species were found

within the forested portions of Core 7 and are described in more detail in the following (Stantec, 2006):

- American pennyroyal (*Hedeoma pulegoides*) (S4), is common in the central portion of FOD6-5 woodlot at the southwest corner of Burnhamthorpe Road and 6th Line; and,
- Bristly greenbriar (*Smilax hispida*) (S4) is common and scattered throughout all forest patches.

Wildlife Observations

Amphibians

During field investigations completed for their EIS, Stantec (2006) recorded the presence of Western Chorus Frog in one location within Core 7 with a low call frequency of 1-2 individuals. The Great Lakes/St Lawrence – Boreal population of this frog species, to which the individuals in this Study Area belong, has recently been assigned a "federally threatened" status by COSEWIC (2008). Western Chorus Frog are not listed as being at risk on the Species at Risk in Ontario (SARO) list however, they are identified as an S3 (vulnerable) species (NHIC, 2016). No other amphibians were observed within Core 7. Amphibians generally observed and recorded, within the NOCSS (2006) and Stantec (2006) reports, include Gray Treefrog, Spring Peeper, American Toad, Green Frog and Eastern Redback Salamander. All of these species are ranked S5 (common, widespread, abundant and secure in Ontario) (NHIC, 2009).

Birds

Stantec recorded 27 bird species observed across Cores 7, 8 and 9; 25 of which were assumed to breed within these areas. None of the bird species recorded by Stantec were designated as rare at a national or provincial level. Two bird species are ranked S4 (uncommon in Ontario; apparently secure); Northern Mockingbird and Vesper Sparrow. All other bird species observed are ranked S5 (common, widespread, abundant and secure in Ontario) (NHIC, 2009). One species of Conservation Concern was noted within the Study Area, Eastern Wood-Pewee, which is listed as being of Special Concern by both COSEWIC and on the SARO list. Hairy Woodpecker and White Breasted Nuthatch, while common and abundant in Ontario, are classified as area sensitive species requiring 10ha of interior forest habitat to breed successfully. The Stantec EIS notes that the low number of area sensitive birds observed is most likely due the limited amounts of interior forest habitat available (Stantec, 2006).

Bird species of Conservation Concern noted from the NOCSS (2006) include Wood Thrush (listed as Threatened by COSEWIC and of Special Concern on the SARO list) and Scarlet Tanager; a Level Two Priority Species for Halton (Couturier, 1999).

Reptiles

The NOCSS identifies the occurrence of the following reptile species within the broad North Oakville area: Eastern Garter Snake, Northern Redbelly Snake, Brown Snake, Eastern Milksnake, Northern Ribbonsnake and Midland Painted Turtle. Two species, Eastern Milksnake and Northern Ribbonsnake, are designated as Special Concern nationally (COSEWIC, 2009), and Northern Ribbonsnake is considered to be of Special Concern on the SARO list however, Eastern Milksnake

was recently assessed as being Not at Risk by COSSARO. All other reptile species are ranked S5 (common, widespread, abundant and secure in Ontario) (NHIC, 2009).

Mammals

Stantec (2006) identified five mammal species within the Study Area; these species include Eastern Cottontail, Eastern Chipmunk, Grey Squirrel, Raccoon and White-tailed Deer. All of these species are ranked S5 (common, widespread, abundant and secure in Ontario) (NHIC, 2009).

Insects

The NOCSS identifies one rare butterfly species, the Monarch, to be located within North Oakville (Halton Region, 2006). Monarch are listed as Special Concern on the SARO list, and are designated as endangered nationally (COSEWIC, 2016).

Potential Presence of Species at Risk

An updated Information Request Form was submitted to the Ministry of Natural Resources and Forestry (MNRF) in 2017 to request updated information on occurrences of species at risk. The response received in October 2017 identified occurrences of Butternut, Bobolink, Grey Fox, Eastern Ribbonsnake, Snapping Turtle and Canada Warbler in the vicinity of the Subject Lands. A subsequent email from MNRF dated February 28, 2018, confirmed that it was not necessary to undertake fieldwork related to Grey Fox as it is considered to be historic as this species is essentially restricted to Pelee Island in southern Ontario. In addition to the recorded observations identified above, they noted the potential presence of endangered bats to occur on the Subject Lands.

Although formal, targeted surveys were not completed during the original field inventories, Savanta Inc. has considered the potential for Species at Risk (SAR) to be present within the UWM1 subcatchment based on subsequent field observations. During the Stantec breeding bird surveys, no Bobolink, Eastern Meadowlark or Barn Swallow were noted as occurring on the two Star Oak lands. Field observations of the type and extent of vegetation on these lands suggests that appropriate habitat is not occurring here.

As a general comment, the majority of the UWMC subcatchment does not contain suitable Bobolink or Eastern Meadowlark habitat, as these lands are primarily comprised of active row crops (i.e., typically corn or soy has been present for the years during which the *UWM1 EIR/FSS* and the *UWM1 Addendum* was prepared in the fields to the south of Core 7). Areas where potentially suitable habitat for these species is present are discussed below:

- There is an approximately 1.6 ha block of cultural meadow/cultural thicket on the Argo (West Morrison) Lands that fronts on to Sixth Line, however this is predominantly comprised of weedy species and is generally considered too small to support breeding of either species. Surveys completed in this area in 2017 did not identify any breeding of either species within this area.

- An approximately 1.5 ha, L-shaped block of cultural meadow/hayfield is present on the TWKD Development Lands and extending onto the EMGO III lands that fronts on to Burnhamthorpe Road, however this area is generally too small and narrow (at approximately 50 m wide) to be considered optimal habitat for breeding of either species. Surveys completed in this field in 2018 did not identify any evidence of breeding of either species.

In 2017 and 2020, Barn Swallow were recorded foraging over the open agricultural fields, however a search of the structures on the Digram Developments Oakville Inc. lands and the EMGO III lands did not identify any active Barn Swallow nests.

Eastern Wood-Pewee is designated as Special Concern by COSEWIC, and Wood Thrush and Canada Warbler are designated as Threatened by COSEWIC, and all species are designated as Special Concern on the SARO list. Potential habitat for these species may be found within the Core Areas on the Subject Lands but are not expected outside of these areas.

In terms of other SAR, such as Butternut or Redside Dace, the botanical surveys completed up to and including 2020 did not identify any Butternut present on the Subject Lands and Redside Dace are not found in West Morrison Creek.

Western Chorus Frog are designated as Threatened by COSEWIC and Not at Risk on the SARO list. Western Chorus Frog was recorded in Core Area 8 South during the original Stantec field inventories but was not recorded within Core 7. With regard to the Core 8 areas within the 16 Mile Creek subcatchment, the creation of the "West Restoration Area" adjacent to Core 8 South has been specifically designed to include pool habitats that are anticipated to promote breeding activity.

Eastern Ribbonsnake and Snapping Turtle are designated as Special Concern by COSEWIC and on the SARO list. Suitable habitat for either species was not identified during the 2018 surveys on the Subject Lands.

In addition, a search of the trees within the catchment outside of the Core Preserve Areas determined that several of the trees contained features (i.e., cavities, loose/peeling bark, etc.) that may be used by bat species listed as Endangered on the SARO list. Given that these trees are not situated within woodlands, and the presence of the large Core Preserve Areas, these features do not represent key habitat features for this species.

Consultation with MNRF/MECP is underway regarding SAR species.

3.2.2 Core Boundary Delineation

The following information was presented in the *UWM1 Addendum* and is provided here for information purposes.

Star Oak Developments Limited and Mel-Oak Developments Inc. retained Savanta Inc. and Rady-Pentek & Edward Surveying Ltd. to delineate the boundaries of Cores 7. Bird and Hale Limited, the consultant acting for the broader group of Landowners, was also engaged by Star Oak

Development Limited and Mel-Oak Developments Inc., to ensure the core delineation approach was consistent with the approach utilized for other core delineation exercises in North Oakville.

The boundaries were established based upon direction from the Town in the North Oakville Creeks Subwatershed Study (NOCSS, 2006), and in the case of Core Area 8, along with MOS (August 13, 2007).

The Core boundaries were investigated in the field on the Star Oak lands by members of the Landowners' consulting team on the following dates: July 17, 2007, September 24/25, 2007, November 6, 2007, September 2008; and, November 27, 2012.

On September 29/30, 2008, field investigations were completed jointly with Town and CH staff to confirm the southern and western Core 7 limits on the Star Oak lands, and on October 25, 2010, on the Docasa lands. The original survey lines, established by the Landowners and their consulting team, served as a reference point to facilitate a field review by CH and the Town during these field visits. The Core 7 limits on the Star Oak lands, illustrated on Figure 3.1, of the *UWM1 Addendum* (see **Appendix E**) reflect the final survey points placed in the field by CH.

The above noted site investigations resulted in the identification of the southern and western limit of Core 7 however, the northern limit of Core 7, and the limits of PSWs 14 and 15 were not staked in 2008 or 2010. Subsequent to the first submission of the *UWM1 Addendum*, discussions took place between the Town, CH and the Addendum Study Team to reach an agreement on the delineation of the northern limit of Core 7. Jennifer Lawrence and Associates Inc. provided a memo to the Town and CH dated February 10, 2020, that provided an outline of the Minutes of Settlement, NOCSS and NOESP policies in relation to the Core 7 northern boundary (Appendix B-1 of *UWM1 Addendum*). After some discussion, the agreed upon resolution was documented in emails from the Town, dated September 14, 2020, and Conservation Halton dated August 26, 2020, and September 16, 2020 (Appendix B-1 of *UWM1 Addendum*). The agreement acknowledges that, as per Figure 6.3.9 of the NOCSS Management Report, the Core 7 boundary will follow the rear property lines of 14, 30 and 38 Burnhamthorpe Road West and extend east and west in a straight line from there. Further, as per Figure 7.6.1 (Proposed Management of Natural Heritage System) in the NOCSS Implementation Report, the lands north of the Core 7 boundary and south of Burnhamthorpe Road are considered outside of the Core boundary and the North Oakville Master Plan indicates that these lands are to be developed as 'General Urban Area'. Further, as it relates to the Core 7 northern boundary:

1. If either PSW 14 or 15 extends north of the Core 7 boundary (as described above), CH will continue to regulate the wetland plus 30m however, CH will not require that portion of the wetland beyond the Core 7 boundary to remain on the landscape when development of those lands advances.
2. Further, if either of PSW 14 or 15 is contained fully within Core 7, CH will continue to regulate 30m from the outer limit of the wetland, which may extend the regulated area north of the Core 7 boundary.
3. Notwithstanding the above, when the lands north of Core 7 come forward for development, a Permit will be required from CH to either (1) remove that portion of the wetland which extends north of the Core 7 boundary and/or (2) allow for development within 30m of the limit of the wetland, CH and the Town will support the removal of the

portion of the wetland which extends beyond the Core 7 boundary / development within the 30m regulated area provided that impacts to the wetland within the Core 7 boundary and its hydrologic function can be mitigated to the satisfaction of the Town and CH. This mitigation may include a wetland water balance assessment, management of drainage to the wetland both during and after construction, and other mitigation measures deemed appropriate to protect and support the wetland within the Core 7 boundary.

4. The Town will not require a 10m dripline setback from the limit of Core 7 and grading will be permitted to the edge of Core 7 provided that the site-specific development can demonstrate no negative impact to the NHS. A tree preservation plan will be a requirement of any development along this edge.
5. In addition to the above, development of the lands abutting the northern limit of Core 7 will be subject to the following requirements to the satisfaction of the Town and CH:
    a. Site-specific stormwater management, grading and servicing plan to demonstrate no negative impacts to the NHS;
    b. The grading shall not impact the existing NHS features including trees along the limit of Core 7 due to proposed grading/cutting, erosive flows and consideration should include cross slope drainage and spreader swales; and,
    c. The management of drainage including spreader swales will be located outside of the NHS and may have implications on the rear-yard setback described by the future zoning by-law.

On September 17, 2020, staff from CH, the Town and Region attended on-site with Savanta, Jennifer Lawrence and Associates Inc., and Rady-Pentek & Edward Surveying Ltd. to stake the northern limits of PSWs 14 and 15 (Figure 3.1, *UWM1 Addendum, see* ***Appendix E***). Access to the properties at 14 and 30 Burnhamthorpe Road was not available and, as such, the northern portion of PSW 15 could not be staked and will need to be confirmed in the field if/when that property comes forward for development. This requirement has been included in **Section 14.1**.

The Core 7 limits, which have either been surveyed or are based on existing property boundaries, as is the case with a portion of the northern Core 7 boundary, are depicted on Figure 3.1, *UWM1 Addendum* (see **Appendix E**) and achieve the Town's and CH's desired outcomes in terms of the criteria applied for core delineation and buffer establishment. These criteria are summarized as follows:

1. The conservation of Core areas, as defined in the NOCSS, August 2006;

2. The inclusion of buffers around Cores, as required of:

    a) 10m from dripline of trees for the woodland areas;
    b) 30m from edge of agency identified wetlands; and,
    c) 0m from cultural woodlands, thickets, hedgerows and cultural meadows.
    d) 0m from the dripline of woodlands along the northern Core 7 boundary (subject to demonstration of no negative impacts to the woodlands as outlined above) and 0m from edge of PSWs 14 and 15 (subject to obtaining a Permit from CH and demonstrating no negative impact to the hydrologic function of the wetland as outlined above)

The Core boundary extends beyond the forest feature limits to include an area of about 1.5ha of cultural communities, e.g., Old Field Meadow CUM1-1. The northern limit of Core 7 follows the rear property line of individual private lots along the south side of Burnhamthorpe Road as shown on Figure 3.1, *UWM1 Addendum* (see **Appendix E**).

The northwestern edge of the Core Area lies on the Docasa lands. This northwestern edge of the Core was staked in the field with the Town and CH on October 25, 2010. The field survey was prepared and subsequently approved by CH on July 10, 2013. The approved Core boundary was included in Appendix B-1 within the *UWM1 EIR/FSS*. The depiction of the Core boundaries in this *Sixth Oak UWM1 Addendum* is consistent with the approved Core boundaries.

The Town has requested a review of the feasibility of maintaining a few trees located in or near Core 7. These are discussed in Sections 7.2 and 8.8 of the *UWM1 Addendum*.

During the review of the *UWM1 EIR/FSS*, the agencies raised a question with respect to whether surface drainage from lands east of Sixth Line enters Core 7 and/or PSW 15. On May 25, 2015, Conservation Halton and Town of Oakville staff met on-site with the *UWM1 EIR/FSS* consulting team to review the drainage pattern in this area. At that time, it was confirmed that drainage from the lands southeast of Sixth Line and Burnhamthorpe Road is conveyed southerly via a road ditch located on the west side of Sixth Line and does not enter Core 7 or PSW 15.

3.3 CORE 8

3.3.1 General Description

The following information was presented in the *UWM1 Addendum* and is repeated here for information purposes and to provide context as it relates to the LPA between Cores 6 and 8.

Savanta Inc. completed confirmatory observations for characterization of aquatic and terrestrial features within Core 8 South as part of the *UWMC EIR/FSS*. In September of 2008 and November 2013, Savanta Inc. mapped the vegetation communities through dominant species and soil coring and ELC units were finalized. The vegetation communities associated with Core 8 South are described in more detail below.

Vegetation Communities

There are two vegetation communities in Core Preserve Area 8 South, which are described in detail in **Table 3.3**.

Table 3.3 Core Preserve Area 8 South ELC Vegetation Communities

Vegetation Type	Description
DECIDUOUS FOREST (FOD)	
FOD2-2 Fresh Dry-Fresh Oak-Hickory Deciduous Forest	Dominated by red and bur oak, followed by shagbark hickory, with associate species being sugar maple, bitternut hickory, beech, green ash, basswood and ironwood. There are also scattered stems of white pine, trembling aspen and white ash. In small depressions, green ash and white elm are present. The regeneration

Vegetation Type	Description
	is mostly maple, hickory and ash. Depending on the location and management history, the forests vary from more disturbed with weedy species (garlic mustard, herb Robert), to more naturally-looking patches where native species dominate. There are twenty-one PSW polygons within this community in Core Preserve Area 8 South. Vegetation types include Red maple swamp, Bur oak/Green Ash swamp, sedge meadow marsh, bulrush marsh, and herb meadow marsh. (Polygons 61, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 75, 76, 77, 78, 79, 80, 81, 82, 99 of the North Oakville-Milton East Provincially Significant Wetland Complex). Chorus frog (low call levels) were heard by Stantec (2006) in the southwest woodlot.
Marsh (MAM)	
MAS2-1 Cattail Mineral Shallow Marsh	Cattails dominate this community, with species of pondweed present in the open water. Both the cattail marsh and the open water wetland are part of Polygon 62E of the North Oakville-Milton East Provincially Significant Wetland Complex).

One hundred and seventy eight (178) species of vascular plants were identified across Core 7, 8 and 9, of which 33% (58) were non-native. No nationally or provincially rare plant species were recorded. One S4 (uncommon in Ontario; apparently secure) was found within Core Preserve Area 8 South. Bristly greenbriar (*Smilax hispida*), is common and scattered throughout the forest.

During field investigations completed for their EIS, Stantec (2006) recorded the presence of Western Chorus Frog in two locations within Core 8 South with a low call frequency of 1-5 individuals. The Great Lakes/St Lawrence – Boreal population of this frog species, to which the individuals in this Study Area belong, has recently been assigned a "federally threatened" status by COSEWIC (2008). The Carolinian population in Ontario has been assessed as "Not at Risk". Other amphibians observed within Core Preserve Area 8 South include Gray Treefrog, Spring Peeper, American Toad, and Green Frog (Stantec 2006). The NOCSS records the presence of Eastern Redback Salamander within their study area (NOCSS, 2006). All of these species are ranked S5 (common, widespread, abundant and secure in Ontario) (NHIC, 2009).

3.3.2 Core Boundary Delineation

The following information was presented in the *UWM1 Addendum*.

The boundaries have been established based upon direction from the Town, in the NOCSS (2006) and in the case of Core Area 8, along with MOS (August 13, 2007).

The Core Preserve Area boundaries were investigated in the field by members of the Landowners' consulting team, on the following dates: July 17, 2007, September 24/25, 2007, November 6, 2007, November 27, 2012, and March 22, 2013.

On September 29/30, 2008, field investigations were completed jointly with Town and CH staff to confirm Core limits. The original survey lines established by the Landowners and their consulting team served as a reference point to facilitate a field review by CH and the Town during these field visits. The Core Preserve Area limit, illustrated on **Figure 3.1**, reflects the final survey points placed in the field by CH.

The Core Preserve Area limits surveyed and depicted on **Figure 3.1** achieve the Town's desired outcomes in terms of the criteria applied for core delineation and buffer establishment. These criteria are summarized as follows:

1. The conservation of Core Preserve Areas as defined in the NOCSS, August 2006, and Minutes of Settlement dated August 13, 2007;

2. The inclusion of buffers around Core Areas, as required of:

    a) 10m from dripline of trees for the woodland areas;
    b) 30m from edge of agency identified wetlands; and,
    c) 0m from cultural woodlands, thickets, hedgerows and cultural meadows.

This relatively large deciduous forest achieves a number of Core delineation criteria. Included within this Core boundary is an area of about 0.25 ha of cultural communities, located along the northwest corner of the larger woodland (adjacent to the Region's water reservoir site). The smaller of these two woodland units, also includes an open water feature (i.e., constructed irrigation/livestock watering pond). This pond has developed some natural wetland edge conditions (i.e., narrow band of cattail marsh). As a constructed feature, the limits of the wetland are easily defined and are contained within a soil berm (approximately 2m in height).

Many of the feature limits and buffers for this Core have been established through MOS. A wetland buffer of 30m is depicted around the naturalized pond; woodland limits are depicted with a 10m buffer. One area along the eastern edge of the southernmost and larger woodland patch within Core 8 South, includes a 15m buffer; the extra 5m over the standard 10m woodland buffer defined in the MOS, is intended to afford some additional buffering of a small wetland unit internal to the woodland limit (wetland unit 72 of the North-Oakville-Milton East Wetland Complex). That unit is a tiny unmappable pocket of red maple swamp (0.04ha in size).

4.0 LINKAGE PRESERVE AREAS

The following information was presented in the *UWM1 Addendum* and has been updated as necessary.

4.1 LINKAGE PRESERVE AREAS BETWEEN CORES 6, 7 AND 8

As per the requirements of NOCSS, LPAs between Cores 6 and 7 and Cores 6 and 8 are 100m wide. Both LPAs are located on the Subject Lands, with a portion of the Core 6/8 LPA located on the Region's Reservoir lands east of Sixth Line. The section of the Core 6-8 LPA that arches east towards Sixth Line is currently under active agricultural use.

The LPA between Cores 6 and 7 follows the westerly property limit of the Subject Lands southerly from Core 6 to Burnhamthorpe Road. This LPA currently consists of the existing house and associated structures on the Subject Lands, with old field meadows and horse pastures next to Burnhamthorpe Road.

During the November 15, 2021, pre-consultation meeting for the *Sixth Oak UWM1 Addendum*, questions were raised with respect to the proposed location of the LPA between Cores 6 and 8 as shown on the Concept Plan that was shared during the meeting. For context, the LPA on the Concept Plan was shown connecting closer to the southern limit of Core 8 whereas the location of the connection in NOCSS is to the northern limit of Core 8. As shown on **Figure 3.1A**, northern limit of the proposed LPA connects to Core 8 approximately 76 m further south than as shown in NOCSS. This means that 24m (or 25%) of the proposed LPA overlaps with the NOCSS LPA limits with the remainder of the proposed LPA occurring slightly further south than NOCSS anticipated. As a result, a detailed review of NOCSS was undertaken to determine whether the location that the LPA connects into Core 8, as shown on NOCSS Addendum Figure 6.3.9, was purposefully situated towards the northern portion of Core 8.

Based on a review of NOCSS, there is no specific discussion pertaining to the LPA connection points between Cores 6 and 8. The following information, from NOCSS, is pertinent to any discussion related to the connection points.

Section 6.3.3.4 (Linkages) states the following:

> *The optimum design of the movement corridor must be a balance between ecological factors and realistic space and financial constraints (Adams and Dove, 1989).*
>
> *……*
>
> *Ecological linkages must be designed or identified with an understanding of the species that are anticipated to use the connection.*
>
> *……*

Some authors, such as Noss (1987) and Hickman (1990) report that even narrow clearings such as roads, utility corridors, and nature trails can create breaks large enough to produce edge effects. However, connectivity between habitat patches can occur simply as a result of proximity (without a direct physical connection). In these cases plant and wildlife species that can tolerate gaps or use saltatory movements (e.g., flying over gaps) are able to benefit from this type of connection. In effect, habitats that are close to each other can be used as 'stepping stones' (Dramstad et al., 1996)

The provision of suitable culverts and bridges should be considered on a site specific basis. As well, considerations to prevent wildlife and vehicular interactions should also be considered (Langton, 1989; Collinge, 1996).

The above text from NOCSS reflects the importance of balancing ecological factors with other land use and financial constraints and the need to design / locate linkages with those species in mind that are anticipated to use the linkage.

Section 6.3.3.5 (Preferred Management Approach to Terrestrial Features) of NOCSS, provides an overview of the components that went into identifying Core Areas and, as a result, the LPAs. The connection between Cores and LPAs is highlighted in the following text:

The analysis of Cores includes recommendations regarding the linkages between the Cores. Based on the identified Cores, the description of linkages (Section 6.3.3.4), linkages were identified associated with the Cores. Two main types of linkages are considered:

1. *Primary linkages to provide connections of suitable habitat between Cores. Recommended habitat of the linkage is to be the same as the Cores it connects, which is forested in almost all cases. Linkage width is 100m, other than a few exceptions, which are discussed in the Core descriptions below; and,*
2. *Secondary linkages where widths and habitat types are more variable and widths are driven by other factors especially stream corridor and floodline dimensions.*

……

From a location perspective the following factors were considered:

- *Existing linkages (primarily associated with riparian habitats and hedgerows, but including some existing field linkages);*
- *Potential linkages which take advantage of some pockets of vegetation, hedgerows or other natural features; and*
- *General locations of potential linkages where no existing natural feature currently exists, generally associated with the shortest distance between end habitats.*

Based on the descriptions above, the LPA between Cores 6 and 8 would be considered a Primary linkage (i.e., 100m in width, not associated with a stream corridor). To understand the location of the LPA between Cores 6 and 8, the following text is provided later in Section 6.3.3.5:

> ***Core#8: Earth Science Woodlots (Figure 6.3.9)***
>
> *Description*
>
> *This Core Area is comprised of two rectangular woodlots roughly 200m apart. The small hummocks and pits found in the area have resulted in the development of numerous small wetland pockets, many of which contain locally significant vegetation communities, as well as one provincially significant community (bur oak swamp).*
>
> *Like Cores #6 and #7, these two woodlots are fairly narrow and provide little potential forest interior (<1 ha). Despite this, a number of forest birds of conservation concern were reported from the two woodlots (especially the southern one). Few open country birds and wetland birds were reported from the woodlots. On the other hand, a fair number of significant plant species were reported from the wetlands in these stands, as well as a diversity of amphibians.*
>
> *The delineation of the Core considered the forest interior conditions as well as the presence of the rarity and diversity associated with the wetlands. The Core is defined by the woodlands with a 10m buffer from the dripline. A linkage between the two woodlots of 100m in width is recommended.*
>
> *Management Recommendations*
>
> - *The existing woodlands and wetlands are recommended for retention*
> - *The proximity of the Cores #6 and 7 is seen as a potential connectivity opportunity for some species in these Cores. Direct forested linkages beyond the Core Area itself are limited.*

Based on the description provided in the Management Recommendations above, it appears that it is the proximity of Core 8 to Cores 6 and 7 that is driving the linkage, and not necessarily the presence of an existing linkage (i.e., primarily associated with riparian habitats and hedgerows) or even a potential linkage (i.e., which take advantage of some pockets of vegetation, hedgerows or other natural features).

Finally, Section 7.4.2.4 (Verification of Locations and Width of Linkages) in NOCSS states the following:

> *In some cases, potential linkages were recommended where no existing natural feature currently exists. These locations were generally selected with the shortest distance between end habitats. At the EIR stage, the locations of these features would be detailed (taking into account the connections to suitable end habitats and a width of 100m).*

There is no additional discussion in NOCSS with respect to the specific connection between Cores 6 and 8. Based on the text above, the EIR is to detail the location of the LPA connections and should be based on the shortest distance between end habitats. As shown on **Figure 3.1A,** the centreline of the NOCSS LPA is approximately 490m between Cores 6 and Core 8 whereas, the centreline of the proposed LPA is approximately 447m between Cores 6 and 8. As such, the proposed LPA is a shorter distance between Cores by 43m, thereby better achieving the NOCSS objective of providing the shortest distance between Cores than the location of the NOCSS LPA.

During the pre-consultation meeting, agency staff hypothesized that perhaps the LPA connection at the northern portion of Core 8, through the Region's reservoir lands, was due to the presence of wetlands within the northwest corner of Core 8. There is no specific text within NOCSS to indicate that this was a consideration when delineating the LPA connection to Core 8. Further if that was a consideration, it would presumably be to provide for a connection of wetland species (i.e., amphibians) from Core 8 to Core 6 however, there is no culvert within the NOCSS LPA across Sixth Line in this area and, as such, it is unlikely that connecting to the northwest corner of Core 8 in NOCSS Figure 6.3.9 was related to the presence of wetlands in that portion of the Core.

As noted in the Management Recommendations associated with Core 8 in NOCSS, the LPA between Cores 6 and 8 is a function of the proximity of these features with Core 7 and the potential for connectivity for some species (although the specific species are not mentioned). Given the presence of Sixth Line and Burnhamthorpe Road between Cores 6, 7 and 8, and the lack of culvert crossings within the LPA between Cores 6 and 8, it could be assumed that the intention was not necessarily for amphibian movement between these two Cores but rather, other species such as birds that would not be inhibited by these major roads.

Finally, regardless of where the LPA connects to Core 8 through the Region's reservoir lands, the entirety of the reservoir lands is available for wildlife movement (i.e., there will be no hinderance to wildlife movement through the reservoir lands at the outer limit of the LPA boundary). In effect, the LPA boundary through the reservoir lands is provided for illustrative purposes to demonstrate that a 100m wide linkage is available however, there is nothing that will prevent wildlife from utilizing the entirety of the reservoir lands, if needed, for movement.

Additional information pertaining to the LPA between Cores 6 and 8 is provided in **Section 7.1.2**.

5.0 GEOLOGY AND HYDROGEOLOGY

5.1 SCOPE OF WORK

The scope of work completed for the hydrogeological component of the *UWM1 EIR/FSS* as well as the *UWM1 Addendum* was designed to address the technical requirements as set out in the EIR Hydrogeological Terms of Reference for North Oakville (2007). For the *Sixth Oak UWM1 Addendum* the scope of work was modified to target site specific information that was not provided in the previous studies.

Specifically, the hydrogeological work program for the *UWM1 EIR/FSS* and *UWM1 Addendum* 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 water balance conditions;
- identify hydrogeological opportunities and constraints to maintaining the water 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 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 for the previous studies included the following. Specific details pertaining to the findings from these studies can be found in Appendix C of the *UWM1 Addendum* and *UWM1 EIR/FSS*: The previous work was augmented by site specific studies on the Subject Lands completed in 2020 and 2021 by Landtek Limited. The work completed by Landtek included:

1. Phase 1 Environmental Site Assessment, 103 Burnhamthorpe Road West, Oakville, ON L6M 4K5 (December 2020)
2. Geotechnical Investigation Proposed Mixed Use Development, 103 Burnhamthorpe Road West, Oakville, ON L6M 4K5 (February 2021)
3. Hydrogeological Investigation Proposed Development,103 Burnhamthorpe Road West, Oakville, ON L6M 4K5 (July 2021)

The information available for the Subject Lands and augmented by information from previous studies was used to complete the following tasks. New tasks that are proposed for the current assessment are included for clarity:

1. Review of Ministry of the Environment, Conservation and Parks (MECP) water supply well records and available geotechnical reports for the *Sixth Oak UWM1 Addendum* EIR Subcatchment Area to assess the regional hydrogeological setting and soil conditions.

2. The installation of groundwater monitoring wells was completed by Landtek and were used to supplement information from the previously constructed monitoring wells in the broader UWM1 catchment area and investigate the site specific soil and groundwater conditions (monitoring well locations are shown on **Figure 5.1**).

3. Single well response testing was conducted in three on-site wells by Landtek to estimate the in-situ hydraulic conductivity of the geological units. The Landtek information was compared to results from the previous studies.

4. Monitoring of groundwater levels to measure the depth to the water table and assess the horizontal and vertical groundwater flow conditions. Groundwater monitoring was conducted by Landtek in 2021 and will be continued on a monthly basis in 2022. Updated groundwater monitoring data will be provided as part of a final report submission.

5. Spot-flow measurements of surface water flow will be conducted monthly in 2022 at three (3) road culvert locations within the Sixth Oak UWM1 Subcatchment Area. Updated surface water flow data is not available for this interim submission but will be provided with the final report.

6. A groundwater sample was collected from one (1) monitoring well to characterize the groundwater quality. The sample was collected on January 28, 2021 and was submitted to an accredited laboratory for analyses of physical quality indicators (e.g., pH and total suspended solids) total metals, various contamination indicators (including Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons) and bacteria.

7. Pre-development water balance calculations (based on existing land use conditions) and post-development water balance calculations (based on the proposed development plan) for the Sixth Oak UWM1 EIR Subcatchment Area to assess the potential impacts of development on the local groundwater resources will be completed as part of the final report. Water balance calculations are not included as part of this interim submission.

5.2 PHYSIOGRAPHY AND TOPOGRAPHY

The Sixth Oak UWM1 EIR Subcatchment Area is located on the upper south slope of the Trafalgar Moraine, a 'till moraine' originally mapped by Chapman and Putnam (1951, 1984) and, more recently, by the Ontario Geological Survey (Barnett, 1992a). The Trafalgar Moraine consists of a belt of gently undulating topography extending across the North Oakville area. The crest of the Moraine crosses the northern portion of the Subject Lands and forms the regional surface water divide with all subcatchment areas on the south slope draining towards the southeast. North of the surface water divide, the Subject Lands drain to the Sixteen Mile Creek SM1 catchment.

South of the surface divide, the land surface across the Sixth Oak UWM1 EIR Subcatchment Area slopes to the south and east and is characterized by a low relief undulating till surface. Analysis of the detailed topography indicates that naturally, the highest ground elevations (up to 194 masl - metres above mean sea level) are found at the surface water drainage at the north boundary of the Sixth Oak EIR Subcatchment Area (**Figure 5.2**). The natural relief across the area is about 15 m, with the lower elevations of about 179 masl, found at the south boundary of the subcatchment (**Figure 5.2**).

5.3 DRAINAGE

The drainage area for the Sixth Oak UWM1 EIR Subcatchment Area is illustrated on **Figure 5.2**. Following the ground topography, surface water runoff flows generally towards the south via sheet flow over the majority of the Subject Lands. South of Burnhamthorpe Road, surface flow for the northern portion of the Subject Lands enters Core 7 via two culverts under Burnhamthorpe Road (MWB4 and MWB5 on **Figure 5.2**). Flow at MWB4 is directed into PSW 15 and the outflow from this wetland crosses Sixth Line, south of the Subject Lands at culvert MWS5 (see **Figure 5.2**).

Surface water flow monitoring for this Addendum will be conducted monthly at the three (3) culvert locations in 2022 and the monitoring data will be provided in the final report. It is anticipated that this monitoring will confirm intermittent versus perennial flow conditions at the culverts as part of the groundwater/surface water interaction assessment. Therefore, when possible, the flow monitoring will be completed during dry weather conditions. The *Sixth Oak UWM1 Addendum* monitoring data will supplement spot flow monitoring data collected as part of the *UWM1 EIR/FSS* and other previous studies.

Previous studies in the area have indicated that other than occasional runoff events there is no measurable flow at the culverts. Monthly precipitation recorded at the Royal Botanical Gardens (RBG) climate station (the closest station with daily precipitation records) was used to evaluate the relationship between flow and precipitation and found that even in wet months with higher than normal precipitation, the culverts were either dry or the flow was too low to measure. These observations and data indicate the ephemeral nature of the drainage, the lack of baseflow contribution from groundwater in the subcatchment and the surface water runoff conveyance function of the culverts.

The *UWM1 EIR/FSS* indicates that flow at MWS5 is due to the discharge of overflow water originating from the municipal water storage facility (Moore Reservoir) north of Burnhamthorpe Road.

In 2020, as part of the *UWM1 Addendum* a staff gauge was installed at PSW 87 located north of Burnhamthorpe and within Core 6. The staff gauge was installed in an existing wetland and a datalogger was also installed at this location however, when Burnside staff returned to retrieve the data later in 2020, all monitoring equipment had been removed by the current tenant on the property. The piezometer and staff gauge have been reinstalled and monitoring will occur at this location in 2022.

5.4 CLIMATE

CH has requested that data from the Hamilton RBG climate station be utilized for water balance calculations for EIR studies in the North Oakville area. The average annual precipitation and temperature data for the period between 1981 and 2010 from the Hamilton RBG climate station (Station 6153300 - 43°16.8'N, 79°52.8'W, elevation 102.1 masl) will be used in the water balance analysis. The average annual precipitation is 898mm, with 780mm of rainfall and 118mm of snowfall. The reported daily average temperature is 8.6 C.

A graph of the total annual precipitation from 1950 to 2021 has been prepared to illustrate the long-term climate trends (**Figure C-6-1** in **Appendix C-6**). The data show there was an 8-year period between 1997 and 2004 when precipitation levels were consistently below average. The data also shows that 2007 was a very dry year. In more recent years, the precipitation has returned to levels that fluctuate randomly around the normal with no consistent long-term trend being identified.

The monthly precipitation data for the EIR study period (2008 to 2021) have been graphed and compared to the average monthly data on **Figures C-6-2A, C-6-2B and C-6-2C**, **Appendix C-6**. The typical seasonal trends in precipitation that are expected include higher spring/fall levels, with drier conditions in winter and summer periods. The monthly normal data show the peaks tend to occur in May and September, with the lowest precipitation levels generally occurring in January and February (**Figures C-6-2A, C-6-2B and C-6-2C**, **Appendix C-6**). Wet summer periods occurred in 2008, 2009, 2010, 2014 and 2017. A very dry spring and summer period occurred in 2012 and 2015.

To aid in the interpretation of the groundwater and surface water monitoring data, daily precipitation data are also provided on the hydrographs in **Appendix C-4**.

5.5 GEOLOGY

5.5.1 Stratigraphy

The 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 well locations are plotted on **Figure 5.1**. It is noted that the well locations, listed in the MECP records, are approximations only and may not be representative of the precise well locations in the field. They also do not necessarily represent existing wells or active well usage; however, the records still provide useful information to understand the local geology and groundwater conditions. Along with site-specific geological information obtained from geotechnical boreholes and groundwater observation wells drilled within and adjacent to the EIR Subcatchment Area (described below in **Section 5.5.2**), the data from the MECP records have been utilized to help assess the regional stratigraphy.

To illustrate the geological conditions, four (4) schematic cross-sections through the EIR Subcatchment Area have been prepared. The cross-section locations are provided on **Figure 5.1** and the interpreted cross-sections are shown on **Figures 5.3**, **5.4**, **5.5** and **5.6**. The cross-sections illustrate the basic stratigraphy typical of the North Oakville area, with glacial till overburden sediments overlying shale bedrock. The characteristics of the overburden sediments and shale bedrock are described in the following two sections.

5.5.2 Surficial Geology

Surficial geology mapping, published by the Ontario Geological Survey, indicates that the Sixth Oak EIR Subcatchment Area is generally covered by glacial deposits of clayey silt till. Detailed geological work in the North Oakville East area by Eyles & Eyles (2003) identified two layers of

glacial till within the overburden deposits: 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 North Oakville area so that in most places, the Wildfield till directly overlies the shale bedrock. The presence of the two tills in the northern portions of the Upper West Morrison Creek Subcatchment Area was noted in a series of deep boreholes drilled by Beatty & Associates Limited in 2002 ("BA" well locations illustrated on **Figure 5.1**; borehole logs are provided in **Appendix C-2**). The estimated extent of the two types of till based on the well logs are provided on the schematic cross-sections (**Figures 5.3, 5.4, 5.5 and 5.6**).

Additional shallow borehole drilling has been completed for geotechnical purposes and groundwater monitoring in the Sixth Oak UWM1 Subcatchment Area and the data confirm that thick clayey silt till blankets the subcatchment area (refer to **Figures 5.3, 5.4, 5.5 and 5.6**). On the Sixth Oak lands, a geotechnical investigation was completed by Landtek in February 2021. The borehole locations are provided on **Figure 5.1**. A total of fourteen (14) boreholes were completed at depths of approximately 6 m with four (4) of the boreholes being completed as monitoring wells. The drilling records indicate a layer of topsoil ranging from 250 mm to 430 mm thick across the Subject Lands. The underlying surficial geological material is clayey silt till interpreted here as Wildfield till.

5.5.3 Bedrock Geology

Published bedrock geology mapping of the area indicates the Sixth Oak EIR Subcatchment Area is underlain by shale bedrock of the Queenston Formation. This late-Ordovician aged bedrock consists of relatively soft, friable, red and green shale containing thin (< 30cm) interbeds of fine sandstone and siltstone. Within the EIR Subcatchment Area, the bedrock elevation is generally between about 170 masl to 175 masl (**Figures 5.3, 5.4, 5.5 and 5.6**). As noted in **Section 5.5.2**, the overburden sediments tend to be relatively thick in the area north of Burnhamthorpe Road such that the depth to bedrock is between 10 m to 25 m thick. The overburden thins to the south of Burnhamthorpe Road with bedrock encountered at depths from about 1.1 m to 5.4 m below ground surface as indicated in the *UWM1 Addendum*.

5.6 HYDROGEOLOGY

5.6.1 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. A review of MECP water well records (**Appendix C-1**) indicates that local supply wells generally tap the upper portions of the Queenston shale bedrock. The low hydraulic conductivity till and shale materials are considered as relatively poor aquifers and the local water yields are typically very low (less than 0.15 L/s).

Municipal water supply for the Town is surface water obtained from Lake Ontario. 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 10.2** 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 Subject Lands. It is important that the development does not disrupt these local water supplies and monitoring of the local supply wells before, during and after construction will be required (refer to **Section 10.2** for details of the proposed monitoring of local private water supply wells still in use during development).

5.6.2 Groundwater Levels

Groundwater monitoring has been on-going in the North Oakville area since 2008. Monitoring has been conducted as part of various studies and at locations in proximity to the Subject Lands. Monitoring locations in the vicinity of the Subject Lands are shown on Figure 5.1 and the associated groundwater monitoring data are included in **Table C-4-1**, **Appendix C-4**. From January to July 2021, manual groundwater levels were recorded in monitoring wells located on the Subject Lands (MW1, MW4 and MW10). These data are also included in **Table C-4-1** and hydrographs for all monitoring wells are provided on **Figures C-4-1** through **C-4-5** in **Appendix C-4**. Groundwater monitoring data from piezometers are provided in **Table C-4-2** and hydrographs are provided as **Figures C-4-6** through **C-4-9** in **Appendix C-4**.

Additional data will be collected from the network of monitoring wells and piezometers in 2022 to further characterize the groundwater behaviour in this area. The data available from previous studies indicates the following which will be verified by the data collected in 2022:

- Typically, shallow groundwater levels tend to respond to seasonal climatic conditions, with highest levels observed in the spring, declining throughout the drier summer months, and rising again in the late fall/early winter. The seasonal water level fluctuations range from less than 1m to about 3.9 m.

- The depth below grade to the water table generally ranges from surface to about 6 m. The water table tends to be deeper under the higher topographic areas at the top of the subcatchment and rises to at or close to grade in areas around watercourses or wetland features.

- At the nested well locations, the water levels in the shallow wells are generally higher than the water levels in the deep wells. This indicates that there is a downward hydraulic gradient, i.e., groundwater recharge conditions.

- The detailed water level measurements provided by automatic dataloggers in various monitoring wells illustrate that the water level in the wells appears to respond to precipitation events. This is interpreted to be due to potential fracturing in the overburden sediments that allows for the rapid percolation of water. It is interpreted that fracturing decreases with depth of cover and hence the response is expected to be less significant with depth.

- Water levels in some monitoring wells take a long time after construction to stabilize to static conditions. This long period for stabilization illustrates the very limited movement of groundwater that occurs through these 'tight' soils.

- Drive point piezometers were installed at three locations in December 2021 in order to investigate groundwater and surface water interactions. Piezometers were installed in wetlands on the south side of Burnhamthorpe Road within PSWs 14 and 15 (**Figure 5.1**). Groundwater levels will be monitored at piezometers in 2022 to record water level fluctuations and observations of wetland hydroperiod will be conducted.

5.6.3 Groundwater Flow Conditions

Groundwater elevation data from June 2018 were used to map groundwater flow conditions for the UWM1 EIR Subcatchment area and are provided on **Figure 5.7.** The groundwater contour lines were drawn using basic hydrogeological principles. Water levels in the local observation wells were used along with groundwater information from adjacent subcatchment areas. Topographic elevation data, groundwater gradients and surface water feature elevations were also considered where appropriate to guide the interpretation of the groundwater flow conditions. The arrows on **Figure 5.7** indicate the interpreted direction of lateral groundwater movement, with flow from the highest topographical area along the northern boundary of the subcatchment moving generally towards the south. The groundwater flow conditions on the Subject Lands will be updated using groundwater data to be collected in 2022.

A groundwater flow divide is interpreted to be roughly coincident with the surface water divide between the Sixteen Mile Creek (SM1) and the Sixth Oak UWM1 Subcatchment Areas (**Figure 5.7**). Groundwater north of the groundwater divide is interpreted to flow north towards Highway 407.

5.6.4 Hydraulic Conductivity

During previous subwatershed studies of the North Oakville East area (NOMI, 2004), samples of the shallow surficial till sediments were collected and tested for grain-size. The analyses confirmed the silty clay nature of the surficial till, and these data suggest that the hydraulic conductivity of the till is very low (estimated to be less than 1×10^{-6} cm/sec). As part of the *UWM1 Addendum*, single well tests were conducted at nine monitoring wells that are located in similar geology to the Subject Lands. The hydraulic conductivities for those wells located in the vicinity of the Subject Lands are summarized in **Table 5.1**. In addition to the previous studies, single well tests were conducted by Landtek at MW1, MW4 and MW10 located on the Subject Lands. The hydraulic conductivities for all wells are provided in **Table 5.1**.

Table 5.1 Single Well Response Testing Results

Monitoring Well	Formation Screened	Estimated Hydraulic Conductivity (cm/sec)
BA2s	Clayey Silt Till	1.3×10^{-7}
BA3	Sandy Silt Till	1.9×10^{-5}

Monitoring Well	Formation Screened	Estimated Hydraulic Conductivity (cm/sec)
UCW6	Clay Silty Till	3.2×10^{-6}
UHW1	Silt Clayey and Sandy Till	1.0×10^{-6}
MW1	Silty Clay	3.4×10^{-9}
MW4	Silty Clay	8.7×10^{-9}
MW10	Silty Clay	1.9×10^{-9}

The hydraulic conductivity data compiled indicates a range of hydraulic conductivity of between 1.9×10^{-5} and 8.7×10^{-9} which is in keeping with the interpretation of low hydraulic conductivity for the soils in this area. It is noted that conditions, such as the degree of weathering and fracturing, may increase the overall effective hydraulic conductivity of the overburden till deposits. Typically, the hydraulic conductivity decreases with depth, reflecting the trend to less fracturing with depth. Bail-down tests conducted as part of previous studies indicated that hydraulic conductivity at MW4s and MW4d (located at the intersection of Sixth Line and Burnhamthorpe Road), completed at depths of 5.4 m and 10.7 m respectively, and screened in clayey silt till both showed that the hydraulic conductivity of the till is in the order of 1×10^{-6} cm/s, i.e., fracturing is likely only a factor in increasing hydraulic conductivity in much shallower deposits.

In areas where the till soils are relatively thin (e.g., less than 2 m or 3 m) and underlain by shale bedrock, the 'secondary' hydraulic conductivity created by weathering and fractures may result in potentially higher recharge rates than the primary hydraulic conductivity of the till would suggest. The weathered upper portions of the bedrock may also be weathered and fractured and are generally considered to have more moderate hydraulic conductivity than the deep shale layers.

In-situ infiltration tests using an infiltrometer were conducted at selected locations to assess the local infiltration capacity in selected areas. All locations tested were south of the Subject Lands and were completed as part of the *UWM1 Addendum*. The results are outlined in **Table 5.2.** The infiltration testing previously completed suggests that the native soils are of low hydraulic conductivity and that low rates of infiltration can be expected in this area. As part of the current assessment infiltrometer testing will be conducted at select locations on the Subject Lands and those results used to update this assessment.

Table 5.2 Infiltrometer Testing Results

Location	Soil at surface	Infiltration (mm/hour)
TP1	Clayey silt	2.8
TP2	Silty Clay till	1.0
TP3	Silty Clay till	1.5

5.6.5 Recharge and Discharge Conditions

As noted in **Section 5.6.2**, groundwater recharge conditions (downward vertical flow of water) are expected throughout the Sixth Oak EIR Subcatchment Area. The interpreted groundwater conditions from the *UWM1 Addendum* suggests that surface water infiltrates across the Sixth Oak EIR Subcatchment Area and will move vertically downwards with components of lateral flow to the south and east (**Figure 5.7**). The lateral flow gradient is very low (less than 0.01). Information from the *UWM1 Addendum* shows that well nests on the crest of the moraine show downward vertical gradients between the overburden and the shale ranging from about 0.04 to 0.07. At MW4s/d, the water levels show a downward gradient through the overburden following rainfall events (**Figure C-4-6, Appendix C-4**). These data suggest that the groundwater movement is predominantly vertically downward through the overburden (likely effected by fractures within the relatively low hydraulic conductivity till sediments) to recharge the underlying shale. Lateral flow conditions will occur in the shale, particularly along the upper weathered section of the bedrock.

The low gradients and the relatively low hydraulic conductivity of the till and shale suggest that the groundwater flux (quantity of groundwater flow through the subsurface) that occurs in the Sixth Oak EIR Subcatchment Area is generally limited. The vertical flow downwards through the overburden to the shale may be several orders of magnitude higher than the lateral flows, particularly on the moraine where the vertical gradient is higher than the lateral gradient to the south across the area. Generalized Darcy flux calculations using the estimated range of hydraulic conductivities of the till and shale suggest the recharge would be less than about 0.4 L/s in the upland areas. It is noted however, that such calculations are only considered as an illustration of the limited water movement that may occur through the subsurface, not as the actual value.

5.7 WATER QUALITY

5.7.1 Groundwater Quality

The groundwater quality in the North Oakville area is considered to be relatively poor in terms of drinking water supplies. In a regional water resources study of the area in 1979, the MOE 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 MOE study reported minimum, maximum and mean concentrations of these parameters (based on 14 samples). Chloride concentrations, for example, were highly variable and ranged from 6 mg/L to 495 mg/L, with a mean of about 150 mg/L (MOE, 1979). 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 UWM1 Subcatchment Area, groundwater samples were collected on November 14, 2008, from one shallow and one deep observation well (MW-4s and MW-4d), as part of the *UWM1 EIR/FSS*. Both wells are screened in the clayey silt till overburden (refer to well logs in **Appendix C-2**). The samples were analyzed for general water quality indicator parameters (pH, conductivity, hardness, total suspended solids (TSS), etc.), basic ions such as chloride and nitrate, and selected metals. The groundwater chemistry results are summarized in **Table C-5-1, Appendix C-5**.

To supplement the previous data, an additional water quality sample was collected and analyzed for MW4 as part of the investigations conducted by Landtek in 2021.

The local groundwater is hard and mineralized with high total dissolved solids and conductivity. **Table 5.3** summarizes the concentration for these three groundwater quality indicator parameters.

Table 5.3 Summary of Groundwater Quality Indicator Data

Well	Screened Formation	Total Hardness (mg/L)	Total Dissolved Solids (mg/L)	Conductivity (µS/cm)
MW-4s	till	1,290	1,700	2,360
MW-4d	till	895	1,620	2,010
BA-2s	till	330	630	910
BA-1s	till	180	330	530
BA-1d	shale	170	390	590
PGMN Well 124-1	till	460 to 524	808 to 1040	1140 to 1290
MW4	till	549	812	1370

The groundwater test results also show the following:

- The reported chloride concentrations in the observation wells ranged from 6.2 mg/L to 233 mg/L. The PGMN well reported chloride in the 7.5 mg/L to 10.5 mg/L range. At the nest (MW4s/4d), the shallower well had a significantly higher chloride concentration (210 mg/L) than the deeper well (73 mg/L). This well nest is located at the intersection of Burnhamthorpe Road and the Sixth Line, and the higher chloride found in the shallow well may be a result of road salt (sodium chloride) applied for road de-icing purposes.

- None of the groundwater samples reported dissolved phosphorus concentrations (orthophosphate). The total phosphorus levels ranged from 0.13 mg/L in the deep well MW-4d to 2.37 mg/L in the shallow well, MW-4s. The PGMN data reported orthophosphate concentrations in the 0.02 mg/L to 0.34 mg/L range and total phosphorus in the 0.4 mg/L to 10.8 mg/L range.

- The PGMN and observation well data show that nitrogen levels (nitrate and nitrite) were generally low (<0.01 mg/L to 0.15 mg/L) compared to the ODWQS of 10 mg/L. The presence of these parameters at these concentrations suggests some anthropogenic impacts to the area which may be due to previous farming practices. Ammonia in the PGMN and observation wells ranged from 0.04 mg/L to 0.77 mg/L, which suggests some minor impact from the agricultural land use activities.

- Dissolved metal concentrations are generally low and within the ODWQS with the exception of iron. The iron concentrations in the PGMN well are reported between 0.006 and 0.8 mg/L, and are generally above the ODWQS of 0.3 mg/L. An elevated iron concentration of 2.31 mg/L was reported at MW-4d. The values exceeding the ODWQS are considered to be naturally occurring, reflecting the soil chemistry. Manganese concentrations of 0.037 mg/L and 0.047 mg/L at UDOW8 and UAW4 respectively are close to the ODWQS of 0.05 and are regarded as confirming the natural occurring mineralization within the groundwater.

6.0 STREAMS AND AQUATIC HABITAT

There are no streams on the Subject Lands. For details pertaining to streams and aquatic habitat within the broader UWM1 Subcatchment Area, please refer to Section 6.0 of the *UWM1 Addendum.*

6.1 OVERVIEW

Upper West Morrison Creek has an upstream drainage area of approximately 213 ha at Dundas Street and 163ha at Sixth Line. The majority of the catchment area lies to the west of Sixth Line; although the main portion of the creek, with a defined and vegetated riparian zone, is found downstream of this EIR Subcatchment Area on the east side of Sixth Line, where it flows in a meandering pattern southward to Dundas Street.

The majority of West Morrison Creek, stream reach MOC-W3, is associated with the Sixth Line road corridor, with relatively minor flow contributions associated with drainages arising north of Burnhamthorpe Road. One of these drainages, MOC-W5, shown on *UWM1 Addendum* Figure 6.1 (see **Appendix E**), consists of an ephemeral drainage path that is typically dry during the spring planting period and is cropped over during the growing season. Additional drainage is received from Reach MOC–W2, which arises in association with Core Area 5 west of Sixth Line. Similar to MOC-W5, this drainage flows very infrequently and usually during spring freshet; for the remainder of the year, outside of Core 5, it is cultivated and cropped over. As outlined in the NOCSS, it is deemed to have no fisheries potential. Savanta Inc. has observed both of these reaches during the late spring of 2010 and confirmed the ephemeral nature of these drainage features.

Some flow within West Morrison Creek appears to be derived from overflow discharge from the Moore Reservoir, a water storage facility located to the north of Burnhamthorpe Road. Both Savanta Inc. and R. J. Burnside staff have observed this flow under varying seasons and during several years (2009-2012; refer to Section 5.3). Observations of flow conditions along Sixth Line, during various times of the year, indicate that when the reservoir is discharging at the headwall located south of Burnhamthorpe Road, flow is generally present in the creek. Flow subsides and becomes quite discontinuous when the discharge from the reservoir is not occurring. The discharge from the reservoir is also chlorinated, which may impact on fish habitat potential throughout the upper reaches of West Morrison Creek; although it is likely that the chlorine photo-degrades fairly rapidly once exposed in the open channel.

The creek has been impacted by various land use activities, primarily agriculture, as well as by local infrastructure related to Sixth Line and its various culvert crossings. In the vicinity of culvert MW-S3, (Figure 6.1, *UWM1 Addendum*, see **Appendix E**), the channel has been deepened and reconstructed to resemble a municipal drain profile and cross-section. Both upstream and downstream of this location, the creek flows within the roadside ditch channel and is subject to impacts associated with road operation and maintenance. In spring of 2013, it appeared that a

portion of the roadside ditch between culverts MW-S3 and MW-S2 had been cleaned out (dredged), perhaps to facilitate improved drainage and ditch function.

Additional description of the drainage area and stream reaches is provided in Section 6.0 of the *UWM1 Addendum*.

6.2 COMPARISON OF EIR/FSS DRAINAGE AREA TO NOCSS DRAINAGE AREA

The *UWM1 EIR/FSS* and *UWM1 Addendum* provided a comparison of the EIR/FSS drainage area to the NOCSS drainage area. This *Sixth Oak UWM1 Addendum* has adopted the approved drainage area boundaries from the previous reports with no changes.

6.3 HYDROLOGIC FEATURES

As discussed in **Section 2.0**, summarized in **Table 2.1** and illustrated on **Figure 5.2**, there are no Hydrologic Features within the Subject Lands and, as such, no further information is provided in this *Sixth Oak UWM1 Addendum*. Information pertaining to Hydrologic Features A and B is available in the *UWM1 Addendum*.

6.4 UPPER WEST MORRISON CREEK PRELIMINARY NATURAL CHANNEL DESIGN

Through the NOCSS Management Strategy, Reaches MOC-W2 and MOC-W3 were identified as Medium Constraint Stream Corridors. These watercourses may be deepened and/or relocated in accordance with subsection 7.4.7.1 (d) of OPA 272. The following sections discuss channel design objectives, constraints and the preliminary design concept for the relocation, lowering and restoration of stream reaches MOC-W2 and MOC-W3. The design considerations and constraints are detailed in the *UWM1 Addendum* and are not discussed further in this report. The stormwater from Pond 17 will discharge to a stormwater pipe and flow to the realigned MOC-W2 channel south of Burnhamthorpe Road. The preliminary natural channel design was approved through the *UWM1 Addendum,* and no changes are proposed as part of this *Sixth Oak UWM1 Addendum*. Please refer to Section 6.4 of the *UWM1 Addendum* for information pertaining to the natural channel design for the realigned watercourse.

7.0 LAND USE

7.1 GENERAL DESCRIPTION OF DRAFT PLAN

7.1.1 Overall Subcatchment Area

Appendix 7.3 of the North Oakville East Secondary Plan (NOESP) provides for the general land use and road pattern for the lands within the Upper West Morrison Creek EIR/FSS.

The boundary of the *Sixth Oak UWM1 Addendum* study area is provided on **Figure 7.1**.

Figure 7.1 illustrates the Town's Master Plan land uses which consist of lands designated NHS Area, SWM Facility, Neighbourhood Park Area, Village Square, Elementary School Site, General Urban Area, Sub Urban Area, Neighbourhood Centre Area, Transitional Area and Employment Area.

7.1.2 Description of Draft Plan

The draft plan, as shown on **Figure 7.2**, consists of the following:

- One NHS Block (Block 4), containing Core 6;
- Two NHS Blocks (Blocks 5 and 6), containing the LPAs between Cores 6 and 8 and Cores 6 and 7, respectively;
- One Secondary School Block (Block 2);
- One SWM Pond Block – Pond 17 (Block 3); and,
- One Employment Block (Block 1)
- Two Road Widening Blocks along Burnhamthorpe Road and Sixth Line, respectively (Blocks 7 and 8)

The Employment Block is located within both the Upper West Morrison Creek subcatchment as well as the Sixteen Mile Creek (SM1) subcatchment. Discussion pertaining to maintaining the UWMC drainage is provided in **Section 8.9.3** of this Addendum however, development of this block will also require additional information pertaining to the ES subcatchment which will be addressed in the next submission of the *Sixth Oak UWM1 Addendum*.

7.2 TRAIL PLANNING

The trails within the UWM1 subcatchment area are to comply with the principles set forth in the approved "North Oakville Trails Plan" (May 2013). These principles are as follows:

- The trails plan network should provide connections between neighbourhoods and different land uses and provide links to schools and parks.
- The trails plan network should support connections to major transit stations and transportation hubs.
- The trails plan network should be suitable for a variety of users.
- The trails plan network should encourage alternative modes of transportation.
- The trails plan network should limit the impacts to the Natural Heritage System.

The trail proposed within the UWM1 subcatchment area is identified in the approved "North Oakville Trails Plan" as a Major Trail (Type A). **Drawing 7.2** illustrates the trail alignment. Major Trails (Type A) have the following criteria:

- Passive use only, not part of active transportation plan (ATMP)
- Similar to trails south of Dundas Street
- Generally located on outer edges of NHS or within top of bank setback
- Soft surface treatment (screenings) with natural edge treatment if required
- Boardwalks, bridges or hard surfaces where required only
- Width of trails is 2.4 m, with 0.5 m adjacent clearances
- Seasonal use only, no lights, no winter maintenance
- Detail locations and design subject to Watershed and EIR studies and approvals prior to installation, with re-vegetation plantings
- Accessibility where possible
- Funded by development

A typical cross-section of a Major Trail is provided in **Figure 7.3.**

Details with respect to the trail alignment on those lands south of Burnhamthorpe Road are provided in Section 7.2 of the *UWM1 Addendum*. For the purpose of the *Sixth Oak UWM1 Addendum*, the focus of the trail alignment discussion is related to the lands north of Burnhamthorpe Road and west of Sixth Line.

The trail south of Burnhamthorpe Road connects to the Subject Lands at a future intersection. North of Burnhamthorpe Road, the trail is located within Core 6, then falls within a future street R.O.W and crosses Sixth Line at a future intersection north of Burnhamthorpe Road. Where the trail crosses arterial roads, the crossing should occur at proposed full movement access points related to the road fabric. East of Sixth Line, the trail follows the future east-west road to the southwest corner of Core 8 South, where it heads northerly within Core 8 South. The trail alignment within Core 8 South was staked in the field with the Town of Oakville, Conservation Halton and the Region of Halton representatives on September 18, 2014. The proposed trail leaves the Upper West Morison Creek Subcatchment Area and continues into the Sixteen Mile Creek Subcatchment Area. Along the west side of Core 8 South, the trail abuts the Moore Reservoir. In this location, just south of the interface between the two Subcatchment Areas, the removal of a grouping of existing trees (Hawthorns and Poplars) and the occasional tree ranging from 250-590 mm caliper is required to accommodate a portion of trail. The trail alignments associated with Core 8 have already been approved through previous studies.

Preliminary grading design information for the proposed trail within the Sixth Oak Inc. property is provided on **Drawing 8Z** – Preliminary Grading Plan. The implementation of the trails will be achieved through the subdivision review process and other major development applications. The 10m buffer from the woodland dripline, in addition to the trail, will also accommodate a proposed drainage swale that will originate at Sixth Line, follow the southern limit of the LPA and wrap around the woodland's east and south sides, as shown on **Drawing 8Z**. The purpose of this swale is to collect clean water from the LPA and Core and direct it to a clean water pipe, to avoid mixing with on-site stormwater. The swale will be located between the trail and the woodland

dripline, with an average width of 2.4-2.5 m, and a depth of up to 1 m. Over its entire section along the woodland, the swale will be a minimum of 1m beyond the dripline, as required by NOCSS, and therefore outside of the bulk of the major root zones. Therefore, no adverse impact on the health and survival of the edge trees is anticipated as a result of the swale.

8.0 GRADING, DRAINAGE AND STORMWATER MANAGEMENT

8.1 OPA 272 AND NOCSS RECOMMENDATIONS

Preparation of the SWM 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 Subwatersheds 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, SWM, 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.

The recommended NOCSS Management Strategy addresses the development of an approach to SWM 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 8.1** (from Table 6.2.1 of NOCSS, modified in the Addendum dated September 5, 2007).

The NOCSS Section 6.3.6 discusses the SWM 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 8.1 Meeting the Subwatershed Goals and Objectives – Target Setting (NOCSS)

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 stormwater management plan to replicate flow-frequency-duration from existing conditions. • Meet threshold tractive force targets.
	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 stormwater management protection (80% TSS Removal) for all reaches of streams supporting resident redside dace populations (14 Mile Creek (14W-1, 14W-1a, 14W-2 and 14W-12) and East Morrison Creek (MOC-4)). • For all other stream reaches, achieve 'normal' level of stormwater management 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 erosion 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 to 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.

Goals	Objectives	Targets
	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 or alterations require permitting or authorization. Adopt a conservative target of maximum daily temperature of 20 degrees C for 14 Mile (14W-1, 14W-1a, 14W-2 and 14W-12) and East Morrison Creeks (MOC-4). A conservative dissolved oxygen target of 6mg/L should also be adopted which is the Provincial Water Quality Objective for coldwater fisheries associated with a water temperature of 20 degrees C. • The existing temperature and dissolved oxygen regime of these creeks have not yet been determined. It may be that existing maximum daily temperatures in the above mentioned creeks already exceed 20 degrees C and the dissolved oxygen is below 6mg/L. If this is the case, it would be reasonable to adopt a target based on the existing conditions. In other words, the target would be to keep temperatures below the existing maximum daily temperature and the dissolved oxygen above the existing concentrations. • A temperature and dissolved oxygen monitoring program should be established for these systems and initiated prior to development to establish a baseline against which the recommended targets of 20 degrees C and 6mg/L can be assessed, and modified, where appropriate.
	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.

Goals	Objectives	Targets
	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 season fluctuations normally experienced. • Maintaining the groundwater contribution to stream health (groundwater quantity and quality), where it currently exists.
	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 14 Mile Creek (14W-1, 14W-1a, 14W-2 and 14W-12) and East Morrison Creek (MOC-4)). • 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 the 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 valley lands 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.

Goals	Objectives	Targets
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).
	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.

Goals	Objectives	Targets
	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.

As discussed at the November 18, 2019, NOARM, the NOESP (Policy 7.4.7.3(c)(vi)) and NOCSS (Section 6.3.5.3) both allow for consideration of grading within the NHS buffers subject to certain parameters. Within this Addendum, minor grading is proposed within the 30m buffer to install a clean water swale, to capture and convey flows leaving the Core and the northern LPA and a 2.4m wide trail, as required by the Trails Master Plan. As shown on Drawing 8Z, the encroachment will occur within the 30m setback from PSW 84 and within 10m setback from the dripline (i.e., approximately 6m encroachment from the outer limit of the buffer).

The grading strategy is consistent with the Town's standards and compatible with the NOCSS recommendations for grading adjacent to the NHS. In this regard, preliminary grading of all lots adjacent to Cores match existing grades at the proposed lot line where possible. Grading within the NHS buffers is required in localized areas where trails are proposed, or where swales are required to manage drainage.

In particular:

Core 6 – proposed swales along south and west sides to manage / collect drainage from Core; minor transition grading along east side to support trail. The grading details on the east side of Core 6 are provided on **Drawing 8Z**.

Also, as discussed at the November 18, 2019, NOARM, potential/assumed grading along Burnhamthorpe Road, which may be within the 30m buffer to PSWs 14 and 15, is not shown on any drawings. As noted during the preparation of the *UWM1 Addendum*, grading will likely be required along Burnhamthorpe Road when it is widened by the Town however, for the purpose of the *UWM1 Addendum*, and this *Sixth Oak UWM1 Addendum*, the extent of this grading has been assumed based on the anticipated Burnhamthorpe Road centerline elevation but will need to be confirmed by the Town through a future EA process.

The NOCSS Management Strategy presents 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 modeling 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 8.3 of the *UWM1 Addendum* addresses drainage boundaries and presents target peak flows for the Upper West Morrison Creek for a full range of storm events. No changes to the drainage boundaries or target peak flows are proposed as part of this *Sixth Oak UWM1 Addendum*.

OPA 272 Policy 7.4.13.2 and the NOCSS Addendum identify, that within West Morrison Creek, Regional Storm controls are necessary. However, it notes that future land use applications may carry out an investigation of the potential increase to flood risk to confirm if Regional Storm controls are necessary. This analysis is to include the increase in risk to life and to private, municipal, regional, provincial and federal property under Regional Storm conditions.

Through discussions with the Town, it has been agreed, in principle, that SWM facilities can be used to control the Regional Storm by providing additional runoff storage above the 100 year extended detention elevation. As a result, the incremental pond block sizing has been deemed manageable by the affected owners.

Based on the foregoing, the proposed SWM requirements will include control of peak flows to the pre-development unit flow rates prescribed in the NOCSS, or as updated in the EIR/FSS, for the 2 year to 100 year, as well as the Regional Storm.

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 recommended approach to erosion threshold analyses is set out in the NOCSS Addendum and downstream erosion impact assessment in Appendix E-4 of the *UWM1 Addendum*.

Section 8.6 and Appendix E-4 of the *UWM1 Addendum* presents the erosion threshold analyses required to address the NOCSS erosion control requirements. A target drawdown time ranging from 48 to 72 hours was recommended and control of the 25 mm storm to the drawdown time was targeted. Both scenarios resulted in similar volume requirements and pond block sizes.

Water Quality Control – The NOCSS recommendations for water quality control focus on the management of phosphorus, suspended solids, chloride, dissolved oxygen and temperature. The focus on these water quality parameters is, "… *intended to provide controls to 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 6.2.1.

With respect to each of these water quality parameters, the following are NOCSS recommendations, specific to the UWM1 Subcatchment:

- Provide Enhanced Level of water quality protection. This level of control provides for the removal of 80% of suspended solids, will meet the target of no net increase in phosphorus loading and will provide the recommended control for overall water quality protection. 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 analyses in the EIR/FSS.

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 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 that the "*infiltration targets are very difficult to meet*". As such, best efforts are to be made to address maintenance of groundwater recharge.

Section 9.0 of this Addendum will address the post-development water balance and will discuss Low Impact Development (LID) techniques for promoting groundwater recharge, where feasible, in the next submission.

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. NOCSS Figure 7.4.6 illustrates six potential SWM ponds in the EIR Subcatchment Area, west of Sixth Line.

In addition to NOCSS, one OMB Mediation Agreement deals with SWM ponds outside of linkages and cores. This agreement includes five potential SWM ponds west of Sixth Line (Ponds 16, 17, 17a, 19 and 21) and notes the potential for an additional pond north of Core 5 (Pond 20). The above documents were reviewed as part of the *UWM1 Addendum* assessment to determine the recommended number and locations of SWM ponds to service the EIR Subcatchment Area.

Floodplain Mapping - The NOCSS analyses included preliminary floodline mapping along each of the watercourses in North Oakville. However, recommendations were made that final floodlines were to be determined through the EIR/FSS. It was acknowledged in the NOCSS that the existing conditions hydrology (peak flows) could be utilized for the determination of existing conditions floodlines. If Regional Storm controls were concluded not to be necessary, future conditions hydrology models would be prepared to calculate uncontrolled Regional Storm flows for use in establishing future floodlines. Regional Storm controls are necessary for the West Morrison Creek subcatchment.

Floodplain mapping for the Medium Constraint stream reaches was completed as part of the *UWM1 Addendum* and the flood plain is contained entirely within the realigned watercourse corridor / OLPA.

Evaluation of SWM Measures, LIDs and Source Pollution Prevention – While the 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 8.5** herein presents the evaluation of preliminary alternative SWM measures.

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) and stream riparian corridors in the formulation of the recommended NHS and SWM systems. These reports also identified numerous topographic depressions across the landscape in North Oakville. The NOCSS GAWSER hydrologic model accounted for the storage function of these topographic depressions in the simulation of existing conditions peak flows and the setting of target unit flow rates for SWM facility design. The NOCSS Addendum recommends that the storage functions of these depressions be confirmed through the completion of the EIR/FSS when more detailed topographic information would be available.

Some topographic depressions that are wetland or pond features were noted to be Hydrologic Features A and B. Wetlands or ponds that were located online or within the stream corridor of a Medium or High Constraint Stream generally were defined to be a Hydrologic Features A; all others were defined to be Hydrologic Features B.

The NOCSS recommended that the form and function of Hydrologic Features A be carefully considered as part of the EIR studies. If relocating these features, the form and function must be maintained.

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 the SWM facility design. Requirements for the replacement of storage were further clarified in the Mediation Agreement on Depression Storage dated May 30, 2007. All Hydrologic Features B, on the participating landowner's properties, are proposed for removal. See **Table 2.1** for further details.

In accordance with the NOCSS Addendum requirements and depression storage mediation agreement, the *UWM1 Addendum* identified the location of these features (*UWM1 Addendum* Figure 5.2, see **Appendix E**). **Table 2.1** provides recommendations with respect to those features.

8.2 MEDIATION AGREEMENTS

As noted in Section 2.3, several water resources related agreements were made between the Town, CH and the Landowners during the OMB hearing mediation discussions. Also, MOS were entered into between the Town, CH, 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.

Mediation Agreements reviewed and addressed, as appropriate, include:

- Stage-Storage-Discharge Characteristics dated February 21, 2007;
- Infiltration dated February 22, 2007;
- Depressional Storage dated May 30, 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;
- 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;
- SWM - Temperature and Dissolved Oxygen Targets dated July 12, 2007;
- Monitoring dated July 26, 2007;
- EIR/FSS TOR dated August 2, 2007; and,
- Grading and the Natural Heritage System, undated.

8.3 UPDATED SUBCATCHMENT BOUNDARIES

In accordance with the EIR/FSS TOR, existing subwatershed drainage boundaries determined in the NOCSS should be verified utilizing detailed topographic mapping. In 2007, the topographic mapping for the entire NOCSS Study Area was completed utilizing LiDAR technology. The mapping prepared, based on the data provided by Terrapoint, was obtained from Rady-Pentek & Edward Surveyors.

As discussed in Section 6.2 of the *UWM1 Addendum*, the final verification and refinement of the UWM1 boundaries was conducted utilizing the LiDAR mapping, review of engineering drawings for the major roads and site inspection of the Study Area.

Figure 6.1 of the *UWM1 Addendum* (see **Appendix E**) illustrates the updated existing drainage boundaries for Subcatchment UWM1. A comparison was made in that report between the drainage area determined in the NOCSS (172.4ha) and the drainage area determined using LiDAR technology (162.8ha) for the entire Upper West Morrison Creek at Sixth Line. The difference is a minor increase of 5.6% which has no implications to the determination of target flows that are identified utilizing NOCSS recommendations. No revisions to drainage boundaries have been made as a result of the *Sixth Oak UWM1 Addendum*.

8.4 PRE-DEVELOPMENT FLOWS, EXISTING CULVERTS AND DRAINAGE PATTERNS

The following text is taken from the *UWM1 Addendum*. No changes have been made to the pre-development flows, existing culverts or drainage patterns as presented in the previous Addendum.

8.4.1 Pre-development Flows

Recommendations of the NOCSS require that each subwatershed maintains pre-development runoff rates per hectare under post development conditions. In accordance with these requirements, post-development flows from Subcatchment UWM1 are to be controlled to the established target unit peak flows for the 2 year to 100 year storms and the Regional Storm event. For culverts, the flow targets applied in the EIR/FSS are based on unit rates determined from the existing drainage area and the flows presented in NOCSS Table 5.4.1, at the culvert location. For SWM facilities, the flow targets are based on those that were calculated at Dundas

Street, utilizing the GAWSER computer model and originally provided in NOCSS Table 7.4.1 "Revised Target Unit Area Peak Flow Rates 07.06.27". For the purpose of the *UWM1 Addendum*, the drainage area at the downstream end of the EIR Subcatchment Area was established at Sixth Line (162.80ha), as illustrated on Figure 6.1 of the *UWM1 Addendum* (see **Appendix E**).

West Morrison Creek crosses Sixth Line from west to east through a 2400 mm X 900mm concrete box culvert (culvert MW-S2 on *UWM1 Addendum* Figure 6.1, see **Appendix E**) then flows southward toward Dundas Street. Error! Reference source not found. (taken from the *UWM1 Addendum*) provides a summary of the pre-development unit flow rates applied at culverts located at, and upstream of, MW-S2. **Table 8.2B** provides a summary of the pre-development unit flow rates applied in the SWM design for this Subcatchment Area.

Table 8.2A Pre-Development Unit Flow Rates at Culvert MW-S2 (Sixth Line)

Storm Event	Unit Flow Rate[a] ($m^3/s/ha$)
2 Year	0.0053
5 Year	0.0085
10 Year	0.010
25 Year	0.013
50 Year	0.015
100 Year	0.017
Regional	0.046

[a] Unit flow rates determined from contributing drainage area to Sixth Line Culvert MW-S2 and flow rates at MW-S2 presented in NOCSS Table 5.4.1 – Hydrologic Cycle, Return Period Peak Flow Rates

Table 8.2B Pre-Development Unit Flow Rates at Dundas Street (MW-D3)

Storm Event	Unit Flow Rate[a] ($m^3/s/ha$)
2 Year	0.0060
5 Year	0.0094
10 Year	0.011
25 Year	0.015
50 Year	0.017
100 Year	0.019
Regional	0.048

[a] All unit flow rates from Revised Target Unit Area Peak Flow at Dundas Street E. Rates 07.06.27 (originally from NOCSS Table 7.4.1)

8.4.2 Existing Culverts, Capacities and Drainage Patterns

As documented in the *UWM1 Addendum*, there are several existing road culverts within Subcatchment UWM1, along Sixth Line, as set out in Figure 6.1 of the *UWM1 Addendum* (see **Appendix E**). They include:

- Sixth Line Culvert MW-S5 – 600mm diameter CSP culvert;
- Sixth Line Culvert MW-S3 - 600mm diameter CSP culvert; and,
- Sixth Line Culvert MW-S2 - 900mm X 2400mm concrete box culvert.

Table 8.3 provides the pre-development flow rates for the estimated upstream drainage area at these culverts for the listed storm events. Estimated storm conveyance for each culvert is based on an assessment of the culvert location from available Region drawings and Haestad Methods Culvert Master computer program. The estimated storm conveyance included in **Table 8.3** for each culvert, is projected to occur at or below the obvert elevation.

Table 8.3 Pre-Development Flows to Sixth Line Culverts

Storm Event	Unit Flow Rate[a] ($m^3/s/ha$)	Pre-Development Flow (m^3/s)	
		MW-S4/S5 2x600mm CSPs[b] DA=28.3ha	MW-S2 900X2400 Conc. Box DA= 162.8 ha
2 Year	0.0053	0.15	0.87
5 Year	0.0085	0.24	1.38
10 Year	0.010	0.28	1.69
25 Year	0.013	0.37	2.16
50 Year	0.015	0.42	2.48
100 Year	0.017	0.48	2.8
Regional	0.046	1.30	7.44
Estimated Storm Conveyance[c]		10 Year	100 Year

[a] Unit flow rates determined as described in Table 8.2A
[b] Culverts in close proximity but not twin
[c] Based on available Halton Region drawings and Haestad Methods Culvert Master; MW-S2 also based on HEC-RAS hydraulic model

At Burnhamthorpe Road/Sixth Line intersection, the lands drain to intermittent ditches, which flow south to a ditch along the north side of Burnhamthorpe Road, before continuing south through culverts under Burnhamthorpe Road. A portion of the lands north of Burnhamthorpe Road west of Sixth Line, drain to the woodlot (Core 7) south of Burnhamthorpe Road, while the areas to the west drain to a ditch that flows west of the woodlot.

The lands northeast of the Burnhamthorpe Road/Sixth Line intersection, including the existing woodlot in Core Area 8, drain by intermittent ditches south to a ditch on the north side of Burnhamthorpe Road. Two culverts, east of Sixth Line, carry the runoff across Burnhamthorpe Road, and the drainage continues south via farm ditches.

An existing Region water supply reservoir is located at the east side of Sixth Line, approximately 450m north of Burnhamthorpe Road. As part of the operating system for the reservoir, a 900mm diameter pipe carries overflow drainage south along the east side of Sixth Line. The pipe outlets to the drainage ditch along the east side of Sixth Line, approximately 30m south of Burnhamthorpe Road, and continues as part of the surface drainage regime for the subwatershed.

An area of approximately 9.5ha immediately southeast of the Burnhamthorpe Road/Sixth Line intersection currently drains southwest via ditches to the ditch along the east side of Sixth Line. Existing drainage from the southeast corner of Sixth Line and Burnhamthorpe Road outlets through culverts MW-S5 and MW-S4 into the well-defined ditch on the west side of Sixth Line near the south end of Core 7. During a site visit with the Town and CH on May 25, 2015, it was confirmed that no drainage from lands in the southeast corner of Sixth Line and Burnhamthorpe Road enters Core 7 or PSW 15.

The NOCSS report identifies the two Medium Constraint Streams in this subwatershed as MOC-W3, and MOC-W2 and one Low Constraint Stream, MOC-W5.

The upstream section of the North Branch of Upper West Morrison Creek is identified in the NOCSS report as MOC-W5, which is considered to have low hydrologic function as defined in the NOCSS. The downstream section of the same watercourse, labeled MOC-W3, is considered to have a high hydrologic function. MOC-W3 is classified in the NOCSS as a 'blue' stream, with medium constraints under proposed land use conditions.

Stream reach MOC-W2, extends west from the existing culvert at Sixth Line and includes a portion of Core Area 5. This watercourse is a 'blue' stream, with a medium constraint level, and has a medium hydrologic function as noted in the NOCSS.

The detailed characteristics of each of the above watercourse reaches, including meander variations, soil and vegetation conditions, and reach delineations, are described in Section 6 of the *UWM1 Addendum* however, since none of the watercourse features are located within the Subject Lands, no further description is provided in this report.

8.5 STORMWATER MANAGEMENT PLAN SELECTION PROCESS

The SWM plan for the UWM1 subwatershed was originally identified through the *UWM1 EIR/FSS*, further refined in the *UWM1 Addendum* and has been prepared with the ultimate goal of incorporating recommendations set out in the NOCSS as they relate to storm drainage.

The objective of the SWM plan is to address any impacts of proposed development within the Study Area, influencing the receiving watercourse and associated terrestrial features. Through the *UWM1 Addendum*, it is to be demonstrated that the susceptibility to flooding and erosion within the Study Area and within the downstream watercourse is not increased as a result of the proposed land uses and corresponding increased runoff rates.

As outlined in **Section 8.1**, the NOCSS provides goals, objectives and targets for the design of the storm drainage systems in Subcatchment UWM1. In accordance with these requirements, the lands within Subcatchment UWM1 were screened for the suitability of various SWM practices to provide water quality, erosion and quality control. Consideration was given to criteria such as

the physical suitability of the site, environmental objectives, pollutant removal objectives, aesthetics, cost effectiveness and safety.

The selection of the appropriate practices involved assessment of various at-source, conveyance and end-of-pipe control facilities. As recommended in the NOCSS, special consideration was given to the potential implementation of the LID BMPs to maximize SWM at the site level.

Recognizing the environmental objectives, site location and type of the proposed development, the following practices were recommended in the *UWM1 Addendum*.

- Implementation of five extended detention wet ponds (Ponds 16, 17, 17a, 19 and 21). The *UWM1 EIR/FSS* suggested that opportunities to combine Ponds 17 and 17a may be possible, but it was determined through the *UWM1 Addendum* that this is not feasible based on the current plan and drainage constraints. Pond 20 was formerly introduced to provide a SWM outlet to service the Mattamy Preserve lands north of Core 5 in the event that the lands containing Pond 21 were not participating / developing in the same time period. Since Pond 21 is now located on a participating parcel, Pond 20 is no longer required.

- As a result of the proposed drainage area exchanges, modifications to the size and design of Pond 27 were required and have been accommodated in the Mattamy Petgor Phase 2 subdivision; and,

- Implementation of LID measures including increased topsoil depths in landscaped areas, in accordance with the Town's design standards, discharge of roof runoff to increased topsoil depths on lots; and, the use of tree pits in road rights-of-way.

The potential use of LID measures has been assessed based on site conditions and proposed land uses as well as the Town of Oakville's preference for siting such measures. Tree pits of specific size and design are required by the Town of Oakville. These tree pits provide for water retention as well as interception, evapotranspiration and some infiltration however, the exact effect of tree pits on the stormwater system is difficult to model for such a large subcatchment with currently unknown numbers of trees, potential sharing of trenches, variable contributing surface drainage areas and potential design changes that may occur to address some current issues with tree pit drainage. Street trees and the associated tree pits will be provided as per Town of Oakville requirements resulting in approximately 30 cubic metres of soil per tree. Generally, one tree per lot plus trees along open space blocks consistent with Town standards will be provided that will result in a substantial number of new trees within the EIR Subcatchment Area that will provide benefits associated with water retention, evapotranspiration and infiltration. Tree pit design details will be addressed with the Town at detailed design. As a part of previous development approvals in North Oakville (EMGO, Petgor Phase 2, StarOak North), an assessment of tree pit performance was undertaken. It was found that the Town standard tree pits perform similarly to a LID design tree pit with respect to reducing annual runoff volumes. While not considered in the SWM design for the Subject Lands, it should be noted that the tree pits reduce the runoff coefficient of tributary drainage areas, and this will provide additional benefits for quality and erosion control.

Storm drainage from the proposed development will be managed utilizing minor and major conveyance systems. Details of the drainage system are indicated on Drawings 8.5A (minor

system) and 8.5B (major system) of the *UWM1 Addendum* (see **Appendix E**). The general layout of the post development drainage system servicing the development is provided in Drawings 8.5C of the *UWM1 Addendum*. Additional design information related to the lands located within the *Sixth Oak UWM1 Addendum* study area is shown on **Drawing 8.5D** – Preliminary Storm Drainage Plan.

As noted in **Section 8.1**, 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. NOCSS Figure 7.4.6 illustrates six potential SWM ponds in the EIR Subcatchment Area.

In addition to NOCSS, one OMB Mediation Agreement deals with SWM ponds outside of Linkages and Cores and MOS dated August 5, 2007, address SWM ponds in Linkages or Cores.

The Mediation Agreement on Ponds Outside of Cores and Linkages, dated June 19, 2007, was prepared to address SWM pond requirements for incorporation into the NOCSS. It includes graphics and commentary on each proposed pond location illustrated on NOCSS Figure 7.4.6. With reference to this EIR Subcatchment Area, the Mediation Agreement indicates five proposed SWM ponds in the EIR Subcatchment Area, west of Sixth Line (Ponds 16, 17, 17a, 19 and 21) with the potential for an additional pond north of Core 5 (Pond 20). The Mediation Agreement acknowledges that the ponds shown are conceptual only, illustrating the general number and location of ponds. It concluded that the number, location and size of ponds will be finalized through EIR studies. With regard to the ponds noted in the Mediation Agreement:

- Preliminary sizing for Pond 16 was completed as part of the *UWM1 Addendum* for the area north of Burnhamthorpe Road and west of Core 6. The outlet from Pond 16 will be provided via a proposed "clean" storm sewer installed across Burnhamthorpe Road, through the internal roads south of Burnhamthorpe Road for ultimate discharge into the upstream end of the UWM1 channel.

- Ponds 17 and 17A will discharge into the UWM1 channel via the proposed "clean" storm trunk sewer installed along Burnhamthorpe Road and Sixth Line. These ponds were noted in the Mediation Agreement as facilities that may be consolidated through EIR analyses. However, consolidation of these facilities was not feasible due to ownership boundaries and servicing challenges. Consolidation was not proposed as part of the *UWM1 Addendum* and both Pond 17 and Pond 17A are required. Since Pond 17 was on a non-participating landowner's property at the time of the *UWM1 Addendum*, the design details presented in the *UWM1 Addendum* were considered preliminary and additional details are provided as part of this *Sixth Oak UWM1 Addendum*.

- Ponds 19 and 21 are located partially in the 100m wide OLPA connecting Cores 5 and 7, as per the MOS dated August 5, 2007. In this regard, Ponds 19 and 21 will encroach into the non-woodland portions of the OLPA in accordance with MOS requirements (i.e., 50m width and at lengths of 275m and 150m for Ponds 19 and 21, respectively). Ponds 19 and 21 will discharge directly into the UWMC channel.

- Pond 20 was assessed as part of the Preserve Phase 1 EIR/FSS in a separate submission dated March 5, 2013, regarding drainage to PSW 9, 10 and 13 and documented in the

Final Consolidated Preserve Phases 1, 2 and 3 EIR/FSS (May 2017). Pond 21 provides a consolidation of Ponds 20 and 21 as presented in the NOCSS.

A number of drainage area exchanges were proposed, as outlined in the *Final DAE Report* (January 2017) and discussed in Section 8.7 of the *UWM1 Addendum*. This included the direction of some future flows from the UWWM1 subcatchment north of Burnhamthorpe Road to Pond 27 in the EM1 subcatchment.

The proposed drainage area exchange plan was included in Figure 8.7 of the *UWM1 Addendum* (see **Appendix E**) and remains unchanged as part of this *Sixth Oak UWM1 Addendum*.

8.6 EROSION ANALYSIS

The following information is taken from the *UWM1 Addendum*. No changes have been made to the erosion analysis that was completed as part of that study.

8.6.1 Downstream Analyses

A detailed downstream erosion analysis was completed as part of the *UWM1 Addendum* (see Section 8.6.1 of the *UWM1 Addendum*). The analysis included a comprehensive assessment of downstream impacts of development north of Dundas Street and included an assessment of peak flows changes in various locations in the WMC subcatchment, the performance of future SWM facilities in the WMC upstream of Dundas Street and the performance of several existing SWM facilities located downstream of Dundas Street, and the risk of increased erosion in downstream stream reaches based on available background studies and analyses completed to date. The scenarios evaluated included existing (pre-development) conditions, interim conditions (development east of Sixth Line only), ultimate conditions (without the drainage area exchanges between the Upper West Morrison Creek subcatchment to EM1), and ultimate conditions (with the proposed drainage area exchanges).

For additional details regarding the erosion analysis, please refer to Section 8.6 and Appendix E-4 of the *UWM1 Addendum*.

8.7 DRAINAGE AREA EXCHANGES

Several drainage area modifications were proposed as part of the *UWM1 EIR/FSS, UWM1 Addendum* and other immediately adjacent subcatchments. The report entitled *North Oakville East Final Drainage Area Exchange Report* (DAE) prepared by Stonybrook Consulting et al, (January 2017) was prepared to:

- consolidate all currently proposed changes to existing drainage area boundaries to comprehensively identify all proposed changes in one report;
- identify the rationale for the exchanges of drainage areas in the subcatchments; and,
- identify specific EIR/FSS documents where implications of drainage area exchanges to SWM plans and the NHS within each of the above noted subcatchments is documented.

Since the submission of the DAE (January 2015), two additional submissions were made to provide clarifications/revisions to address agency comments on the DAE (January 2015). These submissions included:

- *North Oakville East Drainage Area Drainage Area Exchange Mapping and Response to Agency Drainage Area Comments*, Stonybrook Consulting Inc. et al, July 31, 2015; and,
- *North Oakville East Drainage Area Exchange Response Document #2*, Stonybrook Consulting Inc. et al, October 6, 2015.

As a part of these submissions, drainage area boundaries were reviewed by RAND, DSEL and Urbantech prior to the preparation of the revised DAE Drawing 1. As a result, in the submissions noted above, minor changes were made to the DAE Drawing 1 to consolidate inputs from current individual EIR/FSS analyses. Drawing 1 (October 2015) presents finalized drainage boundary changes.

All DAE submissions are documented in the *Final Drainage Area Exchange Report* (January 2017). No changes to the previously approved DAE are proposed as part of the *Sixth Oak UWM1 Addendum*. For additional details regarding the previously approved drainage area exchanges, please refer to Section 8.7 of the *UWM1 Addendum*.

8.7.1 Summary of Pre and Post Development Drainage Areas

Pre and post development drainage areas to several locations within the UWM1 Subwatershed are noted in **Table 8.4A**, as presented in the *UWM1 Addendum*. Three land use conditions were presented – existing, interim and ultimate, defined as follows:

- **Existing Conditions** are defined to be predevelopment (existing) drainage areas and land uses within UWM1 subcatchment upstream of MW-S2 culvert on Sixth Line. Pre-development or existing drainage areas are based on drainage boundaries shown on Figure 6.1 in the *UWM1 Addendum* (see **Appendix E**).

- **Interim Conditions** assume that the approximate drainage area of 16 ha containing the portion of UWM1 within proposed development located northeast of Burnhamthorpe Road and Sixth Line, plus a portion of the Burnhamthorpe Road ROW has been directed to EM1 and all other areas in the UWM1 Subwatershed are existing conditions. This is shown in **Table 8.4A** from Node D2 and nodes further downstream.

- **Ultimate Conditions** reflect all future land uses in the UWM1 Subwatershed and drainage conditions as presented on Figure 8.5C of the *UWM1 Addendum* (see **Appendix E**). The ultimate conditions post development drainage area limits were determined based on the storm drainage design information for the adjacent developments provided in the EIR/FSS studies for Shannon's and Munn's Creeks, East Morrison Creek and Lower West Morrison Creek.

As part of the *Final DAE Report,* the *UWM1 Addendum* and coordination of drainage patterns with adjacent EIR/FSS documents, future drainage boundaries upstream of Sixth Line and Dundas Street were reviewed and the associated drainage is shown below in **Table 8.4A** and **Table 8.4B**

and illustrated on Figures 6.1 and 8.7 of the *UWM1 Addendum* (see **Appendix E**). The proposed exchanges are generally consistent with the original *UWM1 EIR/FSS* but have been summarized in **Table 8.4A1** in terms of overall change to each watercourse rather than total areas at the nodes as per **Table 8.4A**, which facilitates review of the potential impacts to each watershed (recognizing that it is not necessary to match the areas precisely at nodes internal to the Neighbourhood 10 lands, but rather demonstrate the impacts on the surrounding watersheds).

Table 8.4A Drainage Areas in Upper West Morrison Creek Subwatershed

Node*	Location	Drainage Areas (ha)	
		Existing**	Ultimate***
H	Culvert MWS4/MWS5	**28.3**	**10.98**
D3	Upper limit of MOC-W3 under existing/interim conditions; upper limit of realigned MOC-W3 under ultimate	**65.1**	**64.67**
D2	South limit of Star Oak Lands south of Burnhamthorpe Road under existing/interim conditions; approx. location of outlet of Pond 19 under ultimate conditions	**114.3**	**102.4**
D1	Approximate Location of Pond 21 outlet	**142.1**	**132.61**
D'	Outlet of stream reach MOC-W2 upstream of confluence with MOC-W3	**19.4**	**8.15**
	Upstream end of Sixth Line Culvert MW-S2 at outlet of UWM1 Subwatershed (MW-D3)	**162.8**	**152.78**
	Total	**215.7**	**219.07**

Table 8.4A1 Drainage Areas in Upper West Morrison Creek Subwatershed

Watershed	Drainage Areas (ha)					
	IN	OUT	NET	PRE	POST	%
West Morrison Creek (WM1)	**34.9**	**34.3**	**0.6**	**215.70**	**216.3**	**+0.3%**
vs. East Morrison Creek (EM1)	15.5	23.6	-8.1			
vs. Shannon's Creek (SC1)	5.7	0	5.7			
vs. Munn's Creek (MC2)	7.3	7.5	-0.2			
vs. East Sixteen Mile Creek (ES6)	6.4	1.6	4.8			
Dundas Street ROW		1.6	-1.6			

Note: PSW 13 drainage assumed to be split 50% between WM1 and SC1 under pre- and post-development conditions.
* Nodes are illustrated in Figures 6.1 and 8.1 of the *UWM1 Addendum*
** Existing Conditions are defined to be predevelopment drainage areas and land uses within UWM1 subcatchment upstream of MW-S2 culvert on Sixth Line.
*** Ultimate Conditions reflect all future land uses in the UWM1 Subwatershed.

Table 8.4B Burnhamthorpe Road and Sixth Line Drainage to SWM Ponds

Roads	Road Drainage to SWM Ponds (ha)			
	Pond 17	**Pond 17A**	**Pond 19**	**Pond 21**
Sixth Line	0	~2.59	-	-
Burnhamthorpe Road	~0.43	~0.87	1.62	0

8.7.2 Impacts of Drainage Area Exchanges

The impact of the proposed drainage area exchanges on the UWM1 Subwatershed were assessed in the *UWM1 Addendum*, considering the proposed drainage area and flow changes resulting under both interim and ultimate development conditions. As a result, implications to potential SWM design, erosion, flooding, fish habitat and fluvial processes within the UWM1 Subwatershed have been addressed.

The *Lower West Morrison Creek, Hydrologic Modelling Update and Downstream Impact Assessment, Sixth Line Corporation*, was prepared by Urbantech Consulting and GEO Morphix Ltd., September 8, 2015 (see Appendix E-4 of the *UWM1 Addendum*). This submission comprehensively addressed downstream erosion and flooding impacts of various development scenarios upstream of Dundas Street (existing, interim and ultimate, with and without the drainage area exchanges). Design flow rates from this assessment are being used for the detailed design of the new channel downstream of Sixth Line. Hence, flows from development upstream of Sixth Line have been established and are being reflected in the downstream channel design that includes wetland features in the floodplain that address Hydrologic Features A replacement requirements. As such, no negative impacts of future flows are expected in the new channel downstream of Sixth Line.

8.7.2.1 Ultimate Conditions

Figure 8.5C of the *UWM1 Addendum* (**Appendix E**) illustrates the proposed drainage plan for the UWM1 Subwatershed. Based on the comparison of the existing and ultimate post development drainage conditions, drainage area changes, reflected in **Table 8.4A** show:

a) The reduction in drainage area and flows to MW-S2 from 162.8 ha to 152.78 ha. Note that the ultimate channel realignment east of Sixth Line was designed based on the larger / existing drainage area as it generated more conservative flows.
b) At the outlet of the Lower West Morrison Creek (Dundas Culvert MW-D3), the drainage area is approximately equal to pre-development conditions. Coordination of analyses with recommendations from the *Lower West Morrison Creek EIR/FSS* (Urbantech, 2016) was undertaken as part of the *UWM1 Addendum*. The cumulative drainage area modifications in UWMC and LWMC at Dundas Street change from 215.7ha (including MW-D1 and MW-D2 drainage areas) under existing conditions to 218.38 ha under ultimate post

development conditions (including the Pond 22 drainage area). This 1.2% change is considered insignificant in the overall SWM scheme for this subwatershed.

The proposed drainage exchange presents potential impacts to the sediment regime and channel function of Upper West Morrison Creek. Reach MOC-W2 and MOC-W3 have different extents of alteration and function due to the differences in watershed size. Both features are headwater, low-order streams with reasonably low gradients. As such, their existing sediment contribution to the downstream system is predominately washload with limited bed material/suspended load inputs. MOC-W2 likely only contributes washload and this supply is minor in context of the watershed. Concerns regarding channel geomorphology and sediment transport are not anticipated with the proposed change in flows and drainage area.

With regards to MOC-W3, the entire channel is being realigned; and through the design, hydraulic and sediment regime changes are being addressed. With regards to sediment transport, materials proposed are hydraulically sized to provide stability while still allowing for sediment transport. The design also intends to provide future supplies of sediment within the floodplain as the channel migrates. Given the aspects of the proposed channel design, changes to sediment supply and hydrology associated with the drainage area exchange are addressed.

With regards to MOC-W2, the existing channel has limited definition and reasonably small peak flows in comparison to MOC-W3. Given that it is a table land, headwater channel with limited flow, sediment contributions are likely very minor, consisting almost entirely of washload. The main function of MOC-W2 is likely the retention and detention of flows. That function has been compromised by agricultural practices. Bioswale design has been proposed for MOC-W2 to help retain flow on the landscape and facilitate infiltration.

As noted in **Section 8.6.1**, results of the downstream erosion and flooding assessments concluded that downstream watercourses will not be subject to an increased erosion and flood risk due to future development within the UWM1 Subcatchment Area, as peak flow attenuation will be provided for all rainfall events from the 2 to 100 year storm and the Regional Storm, using stormwater quantity control facilities, accounting for the proposed drainage areas and patterns. SWM facilities are designed to detain the 25mm event for a target of approximately 72 hours. Characteristics of the SWM facilities, including locations, functions, and design criteria, are discussed further in **Section 8.9**.

Recommendations of the NOCSS stipulate that each subwatershed maintain pre-development runoff rates per hectare under post development conditions. For the West Morrison Creek watershed, the existing peak flows per hectare, are presented in **Table 8.2B.** Each of the SWM facilities proposed within the UWM1 EIR Subcatchment Area is to provide peak flow attenuation to these levels, for each of the respective drainage areas serviced by the ponds.

8.7.3 Impacts of Drainage Area Exchanges, ES6 Subcatchment

The impacts of the proposed drainage area exchanges on the ES6 Subcatchment were assessed through the *UWM1 Addendum* and are not repeated in this report. For details with respect to this drainage area exchange, please refer to Section 8.7.4 of the *UWM1 Addendum*.

8.8 PRELIMINARY GRADING PLAN

Drawing 8Z provides the preliminary grading plan, including centreline grades for roads, within the FSS Study Area. The plan was prepared based on the preliminary site plan information for the school block and in conjunction with the proposed storm and sanitary servicing design and considered grading information provided for the existing and future developments adjacent to and within the UWM1 Subcatchment. Preliminary grading for SWM Pond 17 and the immediate surrounding areas is provided on **Drawing 8Z**. The sections below highlight grading and study requirements for Cores 6, 7 and 8.

8.8.1 Core 6

As required by the EIR/FSS Terms of Reference, field investigations were conducted to establish the limits of environmental features within Core 6 and appropriate buffers were applied to these features to establish the Core 6 boundary. The grading and drainage plans for the study area have been prepared with a consideration of the Core 6 limits.

The proposed grading along the NHS limits meets the NOCSS recommendations and the overall grading design is in accordance with the Town of Oakville standards. As shown on **Drawing 8Z**, the grading for the Subject Lands has been designed such that the proposed grades match existing grades at the limit of NHS.

As shown on **Drawings 8Z** and **8.5D**, clean water from the eastern part of Core 6 and LPA between Cores 6 and 8 will be conveyed southeasterly via a swale installed within the 10m woodland dripline buffer towards a proposed ditch inlet catchbasin located outside Core 6 and its associated buffers. Ultimately, the drainage will be conveyed southerly via a proposed storm sewer system installed within the school block drainage easement and along Burnhamthorpe Road with a storm outlet located south of the road to continue to send clean water flows to PSW 15 downstream. As shown on **Drawing 8.5D**, the storm outlet will be located in the vicinity of the existing 450mm CSP culvert crossing Burnhamthorpe Road.

Drawing 8Z shows the proposed grading within the 30m buffer from PSW 84 and within the 10m dripline buffer (i.e., approximately 6m from the outer limit of the buffer). This minor grading is required to install the swale and to accommodate the 2.4m wide trail.

8.8.2 Core 7

Through the completion of the *UWM1 Addendum*, it was agreed that, along the northern limit of Core 7, grading and drainage plans, including a feature based water balance, as well as a tree preservation plan will be required for those lands owned by Star Oak south of Burnhamthorpe Road as a condition of draft plan approval to demonstrate no negative impacts to the woodlands and wetlands within the Core. Similarly, as either a draft plan condition, or as part of a future EIR Addendum, the non-participating landholdings along the south side of Burnhamthorpe Road will also need to provide this same information to demonstrate no negative impacts to the woodlands and wetlands within the Core.

8.8.3 Core 8 South

The following information was presented in the *UWM1 Addendum* and is provided only in so much as it may be relevant when determining the LPA connection point to Core 8 from Core 6.

The preliminary grading and drainage system design adjacent to and within the NHS boundary are provided on Drawings 1 and 2 of the *UWM1 EIR/FSS* (see **Appendix E**).

Core 8 contains several PSWs largely with internal drainage; some surface runoff from Core 8 drains southerly. The proposed drainage plan includes implementation of swales within the southern portion of the NHS boundary to convey the drainage from Core 8 South into the storm sewer system. The grading and number of swales have been minimized in accordance with the NOCSS grading criteria. The design details along the NHS boundary representing typical conditions and points of maximum constraint are provided in Figures 8.15 and 8.16 of the *UWM1 EIR/FSS* (see **Appendix E**). Best efforts are to be made at detailed design to ensure that the proposed road grades do not increase the potential impact of grading on the NHS.

As illustrated on Drawing 2 (*UWM1 EIR/FSS*) (see **Appendix E**), clean water from Core 8 South will be conveyed via two ditch inlet catchbasins, to be installed outside the Core 8 South limit, into the storm sewer system within the Star Oak development. The drainage from Core 8 South and the Star Oak lands will be conveyed southerly to SWM Pond 27 located within the Petgor Phase 2 Draft Plan. The swales are located along the southern boundary within the Core buffer or outside of the Core depending upon location. Where the swales are located within the Core, they are located adjacent to the Core boundary within current agricultural areas. As shown on Figures 8.15 and 8.16 (*UWM1 Addendum*) (see **Appendix E**), grading in the NHS is limited to small areas immediately adjacent to the Core boundary, consistent with NOCSS requirements. Due to the natural topography within the Core, no swales are proposed along the west and east boundaries of the Core. On the east side of the Core, near its southern boundary, a short swale is shown to capture any drainage that may occur from PSW 72 in the spring.

The Core swale drainage will be conveyed via the future storm sewer system across Burnhamthorpe Road to Pond 27, designed to convey the major peak flows without overtopping the road (i.e., peak flows greater of the 100-year or Regional Storm event).

8.8.4 Core Collector / Conveyance Swales

Collector / conveyance swales proposed within the NHS buffer, which are required to manage flows entering or exiting the Core, will be designed as enhanced swales to promote infiltration. This design will include the provision of check dams and vegetation but will not include any form of infrastructure such as underdrains.

8.9 SWM PONDS

8.9.1 NOCSS Pond Locations

Figure 8.1 of the *UWM1 EIR/FSS* (see **Appendix E**) illustrates five SWM facilities within the UWM1 subwatershed boundaries:

- Ponds 16 and 17 are intended to service the west section of the employment lands northwest of the Burnhamthorpe Road/Sixth Line intersection. The east sections of these employment lands will be serviced by Pond 17, located on the Subject Lands.
- Pond 17A is intended to service lands south of Burnhamthorpe Road and east of Sixth Line.
- Pond 19 will service the northern portion of the lands south of Burnhamthorpe Road and west of Sixth Line.
- Pond 21 is located near the downstream end of the subwatershed and would receive storm drainage from the southern portion of the subcatchment west of Sixth Line.
- Pond 22A - drainage from approximately 5.5 ha of development located within the UWM1 Subcatchment, on the west side of Sixth Line, east of the realigned channel, will be conveyed via proposed storm sewer system within the adjacent Sixth Line Corporation development to Pond 22A. The design of Pond 22A and servicing of the 5.5 ha development was addressed in the approved November 2016 EIR/FSS for Lower West Morrison Creek and East Morrison Creek prepared for Sixth Line Corporation. The proposed servicing plan provided in the *UWM1 Addendum* was coordinated with recommendations from the Lower West Morrison Creek EIR/FSS.
- Pond 27 was designed to accommodate the proposed drainage area exchanges between the UWM1 and EM1 subcatchments that were identified in the *Final DAE Report* (January 2017).

8.9.2 Design Criteria

In accordance with the NOCSS requirements, the SWM ponds will be sized to provide stormwater quality, erosion and quantity control based on the following design criteria:

- Each pond will include permanent storage for water quality control determined in accordance with the "Enhanced" protection level for the receiving watercourse as defined in the March 2003 MOECC guidelines and required by NOCSS;
- All ponds have been designed based on detention of the 25 mm rainfall event for target of approximately 48 to 72 hours consistent with the recommendations in the updated downstream erosion assessment by GEO Morphix (Appendix E-4 of the *UWM1 Addendum*). It is recognized that the ideal / preferred drawdown time is between 48 and 72 hours; and that the 72-hour drawdown time scenario should generate the most conservative pond block sizing, however the difference in volume requirements between the 48-hour and 72-hour drawdown time scenarios is negligible. As the Town has stated that their preference if for a shorter drawdown time, it is suggested that the optimal / achievable drawdown time (based on the detailed pond geometry and outlet structure design) be evaluated as part of the on-going GAWSER model verification exercise. Note that both modelling scenarios have been completed (48 and 72 hour drawdown and results were provided in Appendix E-2 of the *UWM1 Addendum*);

- At detailed design the emergency overflows for ponds that do not have conventional spillways (i.e., Pond 17) should be designed to consider 50% blockage of all outlets, or 100% blockage of the orifice openings with the emergency spillway fully open;
- Adhere to Town of Oakville SWM facility design guidelines and grading criteria;
- Provision of maintenance access entrance to the ponds from a local road rather than external / boundary roads. The proposed access road to the pond bottom shall be designed for easy maneuverability of large trucks into the sediment forebay and main cell at detailed design;
- It is likely that liners and / or sub-drain systems will be required for the ponds due to groundwater elevations or to mitigate potential for impacts to adjacent features (wetlands, etc.). The need for liners will be confirmed through additional geotechnical analyses and test pits at the detailed design state;
- Facilities that are adjacent to a channel or are otherwise 'bermed up' to retain storage volumes require additional geotechnical analyses to confirm berm stability.
- Post development peak flows will be controlled to NOCSS allowable release rates based on the unit flow equations for the 2 year to 100 year storm events and the Regional Storm event; refer to **Table 8.2B**.

Table 8.5, prepared for the *UWM1 Addendum* and provided below, provides the post development target flow rates to be achieved by the design of the SWM ponds for the listed storm events. The target flow rates are based on the contributing drainage areas to each SWM pond conceptually illustrated on Drawings 8.5A and 8.5C of the *UWM1 Addendum* (see **Appendix E**).

Table 8.5 Post Development Target Flows For SWM Pond Design

		Return Period						
		2	5	10	25	50	100	Regional
		Unit Rates [$m^3/s/ha$]						
NOCSS Unit Rates at MW-S2		0.0053	0.0085	0.010	0.013	0.015	0.017	0.046
SWM Facility	**Area [ha]**	**Target Flow [m^3/s]**						
Pond 16	21.19	0.112	0.180	0.212	0.275	0.318	0.360	0.975
Pond 17	9.14	0.048	0.078	0.091	0.119	0.137	0.155	0.420

Pond 17A	Uncontrolled Area 3.64	0.122	0.171	0.202	0.241	0.269	0.298	0.343
Pond 17A	Controlled Area 7.34	0.039	0.062	0.073	0.095	0.110	0.125	0.338
	Total 10.98	0.161	0.233	0.275	0.336	0.379	0.423	0.681
Pond 19	36.35	0.193	0.309	0.364	0.473	0.545	0.618	1.672
Pond 21	30.74	0.163	0.261	0.307	0.400	0.461	0.523	1.414

- Storm Stacking (Regional Event) - the Town and CH have expressed concern that long extended detention drawdown time may result in reduced active storage volume available during the Regional event (i.e., Hurricane Hazel). The Town and CH staff have slightly different approaches to evaluation of storm stacking as described below:

Town of Oakville	**Conservation Halton**
Assume entire extended detention volume is unavailable.	Assume storage within the pond after 48 hours of drawdown during the 2-year design storm is not available
• The extended detention volumes for the Ponds in the Study Area drain within 48 hours • The "dead" storage equivalent to the extended detention volume must be subtracted from the provided storage for all the other storms to evaluate the effect of reduced storage on the Regional storm. • The extended detention volume in the GAWSER rating curves have been set to approximately 0m^3 to reflect the unavailable extended detention storage.	• The 2-year storm volume drains faster than the extended detention volume. • This scenario would result in less "dead" storage than the Town's scenario as it assumes 48 hours of drawdown have already occurred prior to the Regional storm (there would be "some" volume available between the 2-year level and the extended detention level, in contrast to the Town's approach in which there is zero volume available at the extended detention level).
It should be noted that while a portion of the pond rating curve is unavailable and storage volumes are reduced during the stacking scenario, flow begins to enter the pond at a higher point in the rating curve and therefore discharges faster. The reduction of the extended detention volume is balanced by the sooner / higher release rates during the beginning of the Regional storm hydrograph (i.e., volume does not accumulate as quickly since it can drain faster at high water levels, as opposed to slowly through the extended detention outlet).	

A separate GAWSER model scenario was completed as part of the *UWM1 Addendum* to evaluate stacking during the Regional Storm as described in the Town's approach. The Regional Storm volume requirements (both with and without stacking) are summarized in the following sections.

8.9.3 Conveyance of Minor and Major System Flows

Storm drainage from the proposed development will be managed utilizing minor and major conveyance systems. The general layout of the post development drainage system servicing the development within the UWM1 subwatershed is provided on Drawings 8.5A (minor) and 8.5B (major) in the *UWM1 Addendum* (see **Appendix E**).

The internal minor drainage system consists of storm sewers sized to accommodate the 5 year peak flow calculated using the Rational Method and Town's design criteria.

Flows exceeding the capacity of the storm drainage system (minor system) will be conveyed along streets and storm easements within the proposed development and directed to the SWM facilities. Roadways will be designed to provide overland flow routes for the 100-year less 5-year storm, in accordance with the Town's design criteria.

Surface drainage from the Region of Halton Reservoir will remain within the West Morrison Creek subwatershed. It is currently proposed by the Region that flow in the existing 900mm storm sewer from the reservoir that currently outlets to the Sixth Line east side ditch south of Burnhamthorpe be directed into a proposed storm sewer to be located within the Sixth Line ROW and discharge to future Pond 17A east of Sixth Line. The drainage area associated with the reservoir has been included in the design flows for the pipe; however, the infrequent "flushing" / maintenance flows from the reservoir have not been accounted in the Pond 17A design since it is assumed that maintenance will occur during dry weather. The ultimate receiver of the reservoir flows is the proposed watercourse west of Sixth Line. Additional details regarding the storm sewer flows and volume released from the reservoir will be addressed during the Pond 17A and Sixth Line detailed design.

Drawing 8.5A (*UWM1 Addendum*, see **Appendix E**) illustrates the proposed drainage to Cores 6 and 7.

The details of the recommended drainage system for the *Sixth Oak UWM1 Addendum* subcatchment area are provided on **Drawing 8.5D**. As shown on **Drawing 8.5D**, the majority of the Study Area (approximately 19.0 ha) is located within the UWM1 subwatershed. The balance of the Study Area (approximately 4.6 ha) is located within the Sixteen Mile Creek Subcatchment SM1.

Post-development drainage from the future school block will be serviced within the water quality and quantity control Pond 17, located approximately 250m west of the Burnhamthorpe Road and Sixth Line intersection. Pond 17 will discharge to the UWM1 channel, located south of Burnhamthorpe Road and west of Sixth Line, via the proposed storm sewer system installed along Burnhamthorpe Road and Sixth Line.

The area north of Core 6 and the LPA between Cores 6 and 8 will be developed as an employment block. The post-development drainage will be directed north via a future storm sewer system

within the Sixteen Mile Creek Subcatchment SM1. The drainage system and stormwater control will be determined at the time when the development plans for the employment blocks south and north of William Halton Parkway are available. As shown on **Drawing 8.5D**, part of the UWM1 subcatchment area (approximately 2.5 ha), located within the employment block will be serviced via a future drainage system within Sixteen Mile Creek Subcatchment SM1. It is expected that the drainage diversion of 2.5 ha from UWM1 to SM1 will be compensated via directing roof runoff from the employment block towards Core 6. The future employment block development will be subject to the EIR/FSS Addendum for Sixteen Mile Creek Subcatchment SM1.

8.9.4 Performance Characteristics

This section describes the design and performance of SWM Pond 17. **Drawing 8.5D** illustrates the overall SWM strategy / drainage to the pond.

The proposed SWM pond controls all storm events to pre-development flow rates based on the *UWM1 Addendum* updated unit flow rates; therefore, no adverse impact is expected for the existing downstream infrastructure.

The conceptual design of the SWM pond is illustrated in **Drawing 8.5D**. The pond operating characteristics are presented in **Tables 8.7** and **8.8**. Preliminary pond sizing calculations are provided in **Appendix E-3**. The proposed Pond 17 length-to-width ratio is 4:1 which is consistent with Town and MOECC guidelines.

As shown on **Drawing 8.5D**, Pond 17 is located west of the northwest corner of Burnhamthorpe Road and Sixth Line, with a pond block size of 1.30 ha. Pond 17 has been designed to service a drainage area of 7.84 ha with an average impervious level of 70.7% (total drainage area of 9.14 ha including the pond block). A permanent pool volume of 1,666 m^3 is required to meet the MOE Level 1 "Enhanced" quality control treatment. Pond 17 provides 5,308 m^3 of permanent pool volume at an elevation of 182.25 masl. The extended detention volume was designed such that the pond has a minimum drawdown time of 48 hours. This is based on the downstream erosion assessment by GEO Morphix (Appendix E-4 of *UWM1 Addendum*) which recommended drawdown times between 48 to 72 hours for all facilities north of Dundas Street. A 110 mm orifice has been designed to produce a drawdown time of 53.1 hours at a release rate of 0.014 m^3/s. This requires an extended detention volume of 1,500 m^3. The design provides an extended detention volume of 1,649 m^3 at 182.60 masl. Pond 17 has been sized to detain the 2 through 100 year storm events as well as the Regional Storm event. Catchbasins will be sized to capture the emergency flow during detailed design (to be sized based on 50% blockage at detailed design). **Table 8.6** summarizes the characteristics of Pond 17. The MOE requires that each pond have a minimum

forebay length to width ratio of 2:1 and a minimum overall length to width ratio of 3:1. The length to width ratio for the forebay is 2:1. The overall length to width ratio for Pond 17 is 4:1.

Table 8.6 Pond 17 Characteristics

Storm Event	Elevation (m)	Required (GAWSER) Storage (m^3)	Provided Storage (m^3)	Target Discharge, Q (m^3/s)	Proposed (GAWSER) Discharge, Q (m^3/s)
Bottom of Pond	179.90	-	-	-	-
Permanent Pool	182.25	1,666	1,649	-	-
Extended Detention	182.60	1,500	1,649	0.014	0.013
2-yr	182.80	2,500	2,661	0.048	0.042
5-yr	182.95	3,200	3,443	0.078	0.068
10-yr	183.00	3,500	3,709	0.091	0.085
25-yr	183.10	4,100	4,245	0.119	0.112
50-yr	183.20	4,500	4,791	0.137	0.128
100-yr	183.25	4,80	5,068	0.155	0.149
Regional	184.30	11,100	11,402	0.420	0.417

A tailwater analysis was completed as part of the *UWM1 Addendum* and concluded that, for Pond 17, the permanent pool level is higher by nearly 8m above the Regional water level in the channel and that hydraulic gradeline impacts should be confirmed at detailed design.

Table 8.7 Pond Water Level vs. Proposed Channel Tailwater Conditions

Pond ID	Pond Water Levels (m)			Outlet Location	Channel water levels (m)	
	Perm. Pool	2-year	REG		100-year	REG
Pond 16	182.2	183.1	184.95	Clean water pipe (~1 km away from channel)	173.63	173.93

8.9.5 Thermal Mitigation

Pond 17 discharges to sub-surface storm sewers which have significant length prior to discharging to the open channel downstream. This is anticipated to provide sufficient cooling without the need for additional thermal mitigation measures in the pond design.

8.9.6 Pond Construction Considerations

As outlined in the *UWM1 Addendum*, the native soils are expected to consist primarily of very stiff to hard silty clay till that is underlain by weathered shale bedrock. The native very stiff to hard silty clay till would be suitable for construction of the ponds. However, if the base of the ponds is to be founded in the weathered shale bedrock, lining of the pond base and sidewalls with a clay or geosynthetic liner will be required.

The pond side walls may be excavated in the native silty clay soils, which are expected to be stable at a maximum proposed slope of 2 horizontal to 1 vertical (2H:1V). If sidewall berm construction is required to establish an elevated pond, the berms may be constructed using the on-site silty clay till. The constructed berms are expected to be stable at a maximum proposed slope of 3 horizontal to 1 vertical (3H:1V). On-site shale bedrock materials are not considered acceptable for use in constructing the pond berms as seepage through the shale bedrock constructed berms would be excessive and may cause berm instability. If shale bedrock must be used to construct the pond berms, the shale bedrock must be moistened during placement and completely pulverized. In addition, a liner along the sidewalls will also be required. The materials used to construct the berms must be placed in maximum 300mm loose lifts and compacted to 95 percent of the material's SPMDD. At detailed design, specific pond lining requirements will be addressed by a qualified professional geotechnical engineer. If the invert of the pond is below the elevation of the groundwater, some form of dewatering during the excavation of the pond may be required (refer to **Section 12.4**).

Adequate vegetation cover will be required to provide erosion protection for the exposed pond slopes and the installation of temporary erosion control measures may be required until the permanent erosion protection is fully established.

8.9.7 Sump Pumps

Due to the relatively shallow depth of storm sewers required to service the proposed development, it is anticipated that sump pumps will be included in the storm drainage design for residential units, south of Burnhamthorpe Road, to provide protection from basement flooding in areas where the 100-year hydraulic grade line approaches basement elevations. Town policy allows sump pumps to be connected to storm sewers or ground (if no other option is available). No basements are anticipated as part of the school block development.

8.10 PSW DRAINAGE

Specific design consideration has been given during the preparation of the SWM Plan for drainage into and out of PSWs. **Drawings 8.5D** illustrates the location, contributing surface drainage to and from each of the PSWs located within Cores 6 and 7. This includes 7 wetlands in Core 6 and 2 wetlands in Core 7. **Table 8.8** provides information on wetland size, contributing drainage areas, planned development within catchments, need for wetland water balance analyses, and where development design should address the potential for drainage out of wetlands through future development areas.

The wetlands are supported by surface water drainage, and ponded surface water in the features recharges the shallow soils and maintains high water table conditions in these areas. Therefore,

it is important to maintain the contributing surface water drainage conditions. The majority of wetlands and their contributing drainage areas are located entirely within Core areas. However, as noted in **Table 8.8**, there are some exceptions to this including:

- Core 6 – drainage to PSW 89 will be affected by the proposed development within the Mattamy (Hulme/SGGC) lands. A wetland water balance will be completed for this feature; however, at the time of the *UWM1 Addendum*, the wetland was on a non-participating property (now the Subject Lands) and, while monitoring equipment within PSW 89 was installed as part of the *UWM1 Addendum* fieldwork, it was subsequently removed by the tenant and, as a result, detailed monitoring could not be completed. This monitoring equipment has now been re-installed and monitoring is on-going. Potential sources of clean water including drainage areas from rear-yards / roofs and clean-water sewer alignments were identified on the SGGC lands as part of the *UWM1 Addendum*. Under interim conditions, the employment lands north of William Halton Parkway (WHP) and east of Street A (on the Mattamy Hulme/SGGC Draft Plan) may not be developed when the residential lands south of WHP proceed. A clean water pipe will be installed south of WHP from the outlet location and extend to the north limit of WHP and stubbed. A ditch inlet catchbasin will be installed at the north limit of WHP for the future employment lands on the east side of Street A. The DICBs will be connected to the clean water pipe. To mimic the pre-development condition, approximately 2.6 ha of undeveloped drainage that currently drains towards Street A from east of Street A and south of WHP will drain to the clean water pipe (2.2 ha from Mattamy SGGC lands + 0.4 ha from Subject Lands). An additional 2.6 ha from north of WHP that currently drains towards WHP will be captured in a DICB and the clean water pipe, for a combined undeveloped area of 5.2 ha under interim conditions.

- Core 6 - a wetland water balance analyses will be completed for those wetlands that have catchment areas that extend into the developable area, as part of the final *Sixth Oak UWM1 Addendum* submission. The purpose of the analysis will be to determine if mitigative measures are required and how drainage into/out of this PSW will be incorporated into development.

- Core 7 - Pre-development drainage to PSW 15 and PSW 14 from the Subject Lands will be maintained via the existing 450mm culvert under Burnhamthorpe Road. The *UWM1 Addendum* noted that, should the Burnhamthorpe Road urbanization proceed in advance of the development of the Subject Lands, the existing 450mm culvert shall be extended to the ultimate right-of-way limit to ensure that pre-development drainage to Core 7 is maintained. The *UWM1 Addendum* further noted that, when the Subject Lands and the holdout properties south of Burnhamthorpe Road and the two StarOak parcels on the south side of Burnhamthorpe Road proceed with development, the wetland water balance will need to be updated based on proposed development and demonstration of no negative impacts to the wetlands will need to be provided. Refer to **Drawing 10.3** for the preliminary servicing and drainage concept.

Localized swales and dedicated storm sewer system will be used to intercept and capture overland flows draining out of Core 6 and onto/through developable lands. Minor grading within the Core 6 buffer will be required to capture overland drainage and direct flows to appropriate outlets.

Table 8.8 Wetland Drainage and Water Balance Requirements

PSW #	Wetland Area (ha)	Description of Wetland Drainage Patterns	Wetland Water Balance Required?		Development Design Considerations
			Yes	No*	
Core 6					
83	0.03 ha	• Contributing drainage area to PSW = 0.17 ha • Drainage area is entirely contained in Core 6 • No development is proposed in its catchment • If capacity of wetland is exceeded, flows from PSW may drain easterly through future development area and then drain to PSW 15	-	✔	• Potential overflow from PSW 83 to PSW 15 to be determined at detailed design • Potential overflow location is shown on Drawings 8.10B1 and B2
84	0.07 ha	• Contributing drainage area to PSW = 0.65 ha • Drainage area is entirely contained in Core 6 • No development is proposed in its catchment • If capacity of wetland is exceeded, flows from PSW may drain easterly through future development area and then drain to PSW 15	-	✔	• Potential overflow from PSW 84 to PSW 15 to be determined at detailed design • Potential overflow location is shown on Drawing 3 (**Appendix E**)
85	0.13 ha	• Contributing drainage area to PSW = 0.60 ha • Drainage area to PSW is largely contained in Core 6; approximately 19% (0.13 ha) is located on undeveloped lands to north of the core • If capacity of wetland is exceeded, flows from PSW may drain westerly through Core 6 to PSW 86 or PSW 88	✔	-	• Water balance to be prepared when Scoped EIR/FSS Addendum is prepared for lands north of Core 6 • Potential overflow from PSW 85 to PSW 86 or PSW 88 to be determined at detailed design
86	0.11 ha	• Contributing drainage area to PSW = 2.01 ha (1.41 ha + 0.60 ha), including drainage area of PSW 85 • Drainage area to PSW is partially contained in Core 6; approximately 40% (0.76 ha) is located on undeveloped lands to north of Core • If capacity of wetland is exceeded, flows from PSW drain southerly through future development area and then drain to PSW 89	✔	-	• Water balance to be prepared when Scoped EIR/FSS Addendum is prepared for lands north of Core 6 • Drainage from PSW 86 will be captured in a swale within the buffer through the Mattamy SGGC lands
87	0.03 ha	• Contributing drainage area to PSW = 0.209 ha, including	-	✔	• Drainage from PSW 87 will be captured in a swale within the

PSW #	Wetland Area (ha)	Description of Wetland Drainage Patterns	Wetland Water Balance Required?		Development Design Considerations
			Yes	No*	
		drainage area of PSW 88 • Drainage area is entirely contained in Core 6 • No development is proposed in its catchment • If capacity of wetland is exceeded, flows from PSW drain southerly through future development area and then drain to PSW 89			buffer through the Mattamy SGGC lands
88	0.01 ha	• Contributing drainage area to PSW = 0.15 ha • Drainage area is entirely contained in Core 6 • No development is proposed in its catchment • Flows from PSW may drain southerly through Core 6 to PSW 87	-	✔	• See above for PSW 87 details
89	0.12 ha	• Contributing drainage area to PSW = 8.32 ha, (including drainage areas of PSW 85, 86, 87 & 88) • Drainage area to PSW is predominantly outside of Core 6; approximately 60% (5.02 ha) is located on developable lands to northwest of Core	✔	-	• Water balance to this wetland to be maintained through collection of upstream PSW overflow drainage in a swale within the buffer and a clean water collection system.
Core 7					
14	0.15 ha	• Contributing drainage area to PSW = 0.96 ha • Drainage area to PSW is partially contained in Core 7; approximately 48% (0.46 ha) is located on existing residential properties along Burnhamthorpe Road north of core • If the capacity of the PSW is exceeded, flows from PSW drain southerly through proposed development area although there is no visual evidence of this occurring	✔	-	• Water balance to be prepared to address proposed development south of Burnhamthorpe Road north of PSW 14
15	0.26 ha	• Contributing drainage area to PSW = 14.2 ha, including drainage areas of PSW 83 & 84 • No drainage contributions from east of Sixth Line • Drainage area to PSW is predominantly outside of Core 7; approximately 95% (13.5 ha) is	✔	-	• Water balance to be prepared when Scoped EIR/FSS Addendum is prepared for lands north of Core 7 • Proposed channel design has accommodated existing flows from wetland

PSW #	Wetland Area (ha)	Description of Wetland Drainage Patterns	Wetland Water Balance Required?		Development Design Considerations
			Yes	No*	
		located on developable lands to north of core including 86% (12.2 ha) located north of Burnhamthorpe Road; approximately 9% (1.3 ha) is located within Core 7. • Flows from PSW 15 drain southerly along Sixth Line roadside swale under existing conditions; flows will drain to proposed realigned channel of Upper West Morrison Creek under proposed conditions			
Core 8 South					
71	0.04 ha	• Contributing drainage area to PSW = 0.10 ha • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment	-	✔	-
72	0.04 ha	• Contributing drainage area to PSW = 0.39 ha, including drainage area of PSW 71 • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment • If the capacity of this PSW is exceeded, flows from PSW may drain southwesterly through Core 8 South and potentially into future development area	-	✔	• Potential overflow from PSW 72 through future development area to be determined at detailed design; potential overflow location is shown on Drawing 3 (**Appendix E**)
73	0.05 ha	• Contributing drainage area to PSW = 0.50 ha • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment	-	✔	-
75	0.02 ha	• Contributing drainage area to PSW = 0.19 ha • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment	-	✔	-
76	0.04 ha	• Contributing drainage area to PSW = 0.17 ha • Drainage area is entirely contained in Core 8	-	✔	-

PSW #	Wetland Area (ha)	Description of Wetland Drainage Patterns	Wetland Water Balance Required?		Development Design Considerations
			Yes	No*	
		• No development is proposed in its catchment			
77	0.02 ha	• Contributing drainage area to PSW = 0.24 ha • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment	-	✔	• Potential flow discharge location as shown on Drawing 3 (**Appendix E**) will be reviewed at the detailed design of the proposed trail
78	0.02 ha	• Contributing drainage area to PSW = 0.10 ha • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment	-	✔	• Potential flow discharge location as shown on Drawing 3 (**Appendix E**) will be reviewed at the detailed design of the proposed trail
82	0.02 ha	• Contributing drainage area to PSW = 0.23 ha • Drainage area is entirely contained in Core 8 • No development is proposed in its catchment	-	✔	-

*No water balance required where there is no proposed development in the wetland catchment

9.0 GROUNDWATER BALANCE

A water balance analysis was completed as part of the *UWM1 Addendum* to determine the pre-development groundwater recharge volumes within the UWM1 EIR Subcatchment Area (based on existing land use conditions) and the post development recharge volumes that would be expected, based on the proposed land use plans that were advanced during the *UWM1 Addendum* submission (refer to Section 7.0 of the *UWM1 Addendum* for land uses proposed beyond the Subject Lands). The calculations were completed on a monthly basis and summed to provide total annual water volumes. The groundwater balance calculations are provided in **Appendix C-7**. While significant changes are not expected to the post-development water balance calculations, an updated post-development water balance will be provided with the next submission.

9.1 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 of some 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 are discussed below.

Precipitation (P)

As noted in **Section 5.4,** the average annual precipitation for the area is 893mm based on data from the Environment Canada Hamilton RBG (Station 6153300 - 43°17'00N, 79°53'00W, elevation 102 masl) for the period between 1981 and 2010. The average monthly precipitation data are set out in **Tables C-6-1 and C-6-2, Appendix C-6**.

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). The mean annual ET has been calculated for this study using a monthly soil-moisture balance approach considering the local climate conditions.

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). Infiltration is comprised of two components: shallow infiltration that migrates laterally through the topsoil profile and discharges to surface at some short time following cessation of precipitation and a deeper infiltration that reaches the water table and recharges the groundwater flow system. The shallow infiltration component may be referred to as interflow or throughflow and the deeper component may be referred to as percolation, deep infiltration or net recharge. The interflow moves relatively quickly and often re-emerges locally as seepage at the ground surface. Typically, the horizontal hydraulic conductivity of the soil profile tends to be higher than the vertical hydraulic conductivity, aiding the lateral interflow movement. Fracture patterns in the relatively low hydraulic conductivity till that blankets the EIR Subcatchment Area are also interpreted to affect the vertical and lateral water movement.

Interflow is closely associated with runoff because of its relatively short residence time (i.e., "delayed runoff". As such, the interflow is considered an "indirect" component of runoff, as opposed to the "direct" component of surface runoff (overland flow) that occurs across the ground surface during precipitation or snowmelt events. The ability to precisely separate interflow from direct runoff is a not a simple task and there has been a lack of adoption of a standard separation or partitioning method. This is related to the complexity of subsurface geological and hydrogeological environments. Since it is generally very difficult to distinguish between indirect and direct runoff, they are often considered together as the total runoff component. Reasonable estimates of the total runoff can be reached 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 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 just seeping along the topsoil/till contact to re-emerge locally at surface. High water table conditions also seasonally

limit the infiltration of surface water and can result in higher runoff contributions to the watercourses.

Although the topsoil in the Study Area is underlain by relatively low hydraulic conductivity glacial till, fracturing likely improves the recharge capabilities (refer to **Section 5.6.4**). In water balance analyses completed for the North Oakville East Subwatersheds Study (NOMI, 2004), a recharge component estimate of 50% was applied in the soil moisture balance calculations and this was found to correlate well with numerical modeling results of the regional groundwater flow. Therefore, 50% has been utilized in this study also to calculate the groundwater recharge component of the water balance (refer to **Table C-7-1, Appendix C-6**).

The water balance analysis in the NOMI (2004) study was completed by Dr. K.W.F. Howard specifically to address the North Oakville area including the West Morrison Creek subcatchment area. His work involved a detailed water balance analysis using daily soil moisture balance calculations for both long- and short-rooted vegetation based on 26 years of daily meteorological data over a period of 31 years (1971 to 2001). A finite element groundwater flow model was also used to confirm the reliability of the recharge estimates from a quantitative standpoint. The results of this work are summarized in Appendix G of the NOMI (2004) report.

9.2 APPROACH AND METHODOLOGY

The analytical approach to calculate a water balance for the subcatchment involved monthly soil-moisture balance calculations (e.g., Thornthwaite and Mather) to determine the evapotranspiration and the corresponding water surplus components. A soil-moisture balance approach 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).

The water holding capacity of the surficial soils depends on the types of soil as well as the type of vegetation and rooting depths. A soil moisture storage capacity of 100mm was used for the Upper West Morrison Creek Subcatchment Area to represent the predominantly short-rooted vegetation in fields and agricultural areas. A soil moisture capacity of 200mm was used to represent the more deeply-rooted wooded Core areas within the Subcatchment. **Tables C-6-1 and C-6-2 in Appendix C-7** detail the monthly potential evapotranspiration calculations accounting for 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 infiltration volumes for the EIR Subcatchment Area were then assessed for the pre-development (based on the existing land use). Post-development water balance will be completed as part of the final report. The MOE SWMP Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was applied, and a corresponding runoff component was calculated for pre- development conditions. The monthly water balance component calculations are summarized in **Tables C-6-1 and C-6-2 in Appendix C-7.**

The calculated water balance components are then used to calculate the groundwater recharge volumes for pre-development conditions.

9.3 COMPONENT VALUES

The detailed monthly calculations of the water balance components are provided on **Tables C-6-1 and C-6-2 in Appendix C-6**. The calculations indicate that a water surplus is generally available from December 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 winter, the frozen climate conditions affect when the actual runoff and infiltration will occur; however, the monthly balance calculations in **Tables C-6-1 and C-6-2** 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-6-1 and C-6-2, Appendix C-6**). A summary of these values is provided in **Table 9.** (note that the values from the table in **Appendix C-6** have been rounded accounting for the minor variances in balance additions).

Table 9.1 Water Balance Component Values

Water Balance Component	Agricultural/ Open Space	Woodland Area
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	138 mm/year	122 mm/year
Direct Runoff	168 mm/year	149 mm/year
Recharge (deep infiltration)	69 mm/year	61 mm/year
Interflow (indirect runoff)	69 mm/year	61 mm/year
Total Runoff (direct and indirect components)	237 mm/year	210 mm/year

It is acknowledged that the infiltration and runoff values presented in **Table 9.1** are estimates. Single values are utilized 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 rates are large. The margins of error are recognized, but for the purposes of this assessment, the numbers applied in the water balance calculations are all considered reasonable estimates based on the site-specific conditions. It is noted further that the estimates for groundwater recharge are consistent with previous subwatershed studies completed for the area, including the NOCSS (2006) and NOMI (2004) studies, and a comprehensive hydrogeological study of aquifers throughout the Region that included groundwater flow modeling by Holysh (1995).

9.4 PRE-DEVELOPMENT WATER BALANCE

The pre-development water balance calculations for the Sixth Oak UWM1 Subcatchment Area are presented in **Table C-6-3 in Appendix C-6**. The total area of the Subcatchment is

approximately 21.3 ha. The total pre-development groundwater recharge volume in this area is calculated to be approximately 14,000 m^3/year (**Table C-6-3, Appendix C-6**). It is noted that the numerical calculations are based on estimated average component values and assumed consistent soil and drainage conditions across the Study Area. The calculated volume is considered as a reasonable representation of the magnitude of the recharge volume and not a precise volume that will occur within the Study Area.

9.5 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; however, this is relatively minor (estimated to be 10% to 20% of precipitation) compared to the evapotranspiration component that occurs with vegetation (65% to 70% 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. For the purposes of the water balance calculations in this study, a maximum evaporative loss from impervious surfaces was estimated at 20% of precipitation. The water balance calculation of the potential water surplus for impervious areas (718 mm/year) is provided at the bottom of **Table C-6-1 in Appendix C-6**.

9.6 POST-DEVELOPMENT WATER BALANCE

The post-development water balance for the Sixth Oak UWM1 Subcatchment Area will be calculated based on a land use breakdown that will be developed as part of the next submission.

9.7 WATER BALANCE IMPACT ASSESSMENT

9.7.1 Water Quantity

The increases in surface water runoff that will occur with urban development are typically addressed through the use of appropriate SWM techniques and BMPs to control the runoff volumes. Details of the proposed SWM plans for the FSS Study Area are provided in **Section 8**.

The loss of recharge that may occur with development can lead to lower water table conditions. Under the existing conditions, the natural recharge volumes in the subcatchment are limited due to the low permeability surficial soils and there is not a significant volume of groundwater flow moving through the subsurface till and shale materials (these geological units are generally considered as very poor aquifers). Nevertheless, it is important to ensure that in general groundwater resources are supported.

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. Groundwater may also infiltrate into joints in storm sewers and manholes.

9.7.2 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 pond will be designed to meet Enhanced Level quality controls (refer to **Section 8.9**). 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 local 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.

9.7.3 Private Services

The proposed development will be serviced by municipal water supply and wastewater services. As a result, there will be no impact on the water balance and 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 Sixth Oak EIR Subcatchment Area; however, it is anticipated that 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 12.6**.

9.8 WATER BALANCE MITIGATION MEASURES

Where feasible, LID measures to minimize development impacts on the water balance will be incorporated into the development design. The magnitude of the expected impacts and suggested mitigation measure will be developed based on the calculated post-development water balance. As this is unavailable at the time of writing this interim report, proposed mitigation measures will be presented in the final report.

The basic premise of LID measures is to manage stormwater to minimize the runoff of rainfall and increase the potential for infiltration through the use of various techniques. Constructed subsurface infiltration facilities such as trenches, basins and galleries have been evaluated for other proposed development in North Oakville and due to the low infiltration capacity of the soils in this area, these storage and infiltration methods are not able to significantly reduce the volume of stormwater runoff. In general, the MOE suggests a minimum infiltration rate guideline for constructed infiltration facilities of 15 mm/hour, and the infiltration rate into the till soils and shale is likely less than about 4 mm/hour based on the hydraulic conductivity of these materials. The experience in the area is that therefore there are really no significant opportunities for stormwater runoff reduction through enhanced recharge via constructed subsurface infiltration facilities.

There are, however, a number of other LID measures that can be utilized to increase the potential for post-development infiltration to mitigate the reductions in recharge that occur with land development. Techniques to maximize the water availability in pervious areas such as increasing topsoil depths to improve the potential for water storage and designing grades to direct roof runoff towards lawns and gardens, side and rear yard swales, boulevards, parks, and other open space areas throughout the development, where feasible have been selected as viable options

for LID implementation in North Oakville. These techniques promote natural infiltration by providing additional water volumes in pervious areas. This is particularly effective in the summer months, when natural infiltration would not generally occur because the additional water overcomes the natural soil moisture deficit.

10.0 WASTEWATER AND WATER SERVICING

The proposed wastewater and water servicing plans were prepared in accordance with the finding and recommendations of the April 2011 Area Servicing Plan (ASP) for North Oakville East prepared by MMM Group and based on discussions with the Region of Halton and Town of Oakville engineering staff. The MMM Group study was prepared on behalf of the North Oakville Community Builders Inc. in support of the North Oakville East Secondary Plan. Additional servicing information was obtained from the June 2008 "*South Halton Water and Wastewater Master Plan Update"*, prepared by KMK Consultants Limited for the Region.

10.1 WASTEWATER SERVICING

10.1.1 Wastewater Design Criteria

All proposed developments within the UWM1 subwatershed are to meet current Region design specifications and standards for sanitary servicing. As the developing lands within the EIR Subcatchment Area do not lie within areas serviced with existing wastewater infrastructure, new facilities are a prerequisite to the implementation of any development plans.

The following design criteria and standards were utilized in the preparation of the preliminary Wastewater Servicing Plan for the FSS Study Area and surrounding areas:

- Infiltration/Inflow Allowance: 286 L/s/ha
- Peaking Factor Harmon Formula
- Minimum Sewer Cover: 2.75m at the centreline of road

  1.4m from ground surface at any other location
- Minimum and Maximum Velocity: minimum of 0.6m/s at actual flow

  maximum of 3.0m/s at full flow
- Average Day Flow Residential 365L/p/day
- Average Day Flow Institutional $11m^3$/ha/day
- Population Criteria

Single Family	55 persons/ha
Semi-detached	100 persons/ha
Townhouse	135 persons/ha
Community Services	40 persons/ha
Commercial Areas	90 persons/ha

10.1.2 Existing Wastewater Services

The farm residences along Burnhamthorpe Road and Sixth Line are serviced with private septic systems. As shown on Drawing 10.1A of the *UWM1 Addendum* (see **Appendix E**), there is an existing 525mm diameter sanitary sewer on Sixth Line, in the vicinity of the Study Area.

The existing wastewater infrastructure on Dundas Street, including a pumping station, forcemains, and trunk sewers, will service Subcatchment UWM1 and other areas of the North Oakville East Secondary Plan.

As illustrated in Drawing 10.1A of the *UWM1 Addendum* (see **Appendix E**), the existing 900mm diameter wastewater trunk sewer located on the north side of Dundas Street will provide the ultimate outlet for the Study Area.

10.1.3 Proposed Wastewater Servicing

As shown on Drawing 10.1A of the *UWM1 Addendum* (see **Appendix E**), the east sewershed will be serviced by the existing 525 mm diameter sub-trunk sewer within Sixth Line and the existing developments east of Sixth Line. Drawing 10.1A of the *UWM1 Addendum* (see **Appendix E**) illustrates the existing services on Sixth Line.

The west sewershed will drain via an extension of the existing 525 mm sanitary trunk within Preserve Drive the Mattamy Preserve as shown in Drawing 10.1A of the *UWM1 Addendum* (see **Appendix E**). Lands north of Burnhamthorpe Road, with the exception of the Study Area, will drain to a future sanitary sewer along Burnhamthorpe Road, which connects to the sanitary sewer on Preserve Drive south of Burnhamthorpe Road. Refer to Drawing 10.1A of the *UWM1 Addendum* (see **Appendix E**) for details. As shown on **Drawing 10.3**, the Study Area will be serviced via a proposed 250 mm diameter connection to the existing 525 mm diameter sewer within Sixth Line.

As shown on **Drawing 10.3**, the StarOak lands will drain to the east sanitary trunk outfall via a dedicated sanitary sewer connection within the road right of way, south of Core 7. The remaining lands west of the realigned channel, south of Core 7, will drain to the west sanitary outfall through the Mattamy Preserve lands.

10.2 WATER SERVICING

10.2.1 Water Supply Design Criteria

Proposed developments within the UWM1 subwatershed are to meet current Region design specifications and standards for water supply and distribution. The proposed water servicing plan for the Study Area will be designed based on the following criteria:

- Average Day Residential Demand 275 L/cap/day
- Maximum Day Factor 2.25
- Peak Hour Factor 4.0
- Density – Detached and Semi-Detached 3.5 persons/unit

- Density – Townhouse 2.6 persons/unit
- School 90 persons/ha

10.2.2 Pressure Zone Boundaries

The EIR Subcatchment Area, including the Study Area, is situated entirely within Pressure Zone O4 of the South Halton Water Master Plan. Water supply for this pressure zone is provided by the Eighth Line Pumping Station and includes storage in the Pressure Zone O4 elevated tank, which has a capacity of 5.7ML and a top water level of 236.22m (as per the South Halton Water and Wastewater Master Plan Update, Halton Region, June 2008, by KMK Consultants Limited). The EIR Subcatchment is currently part of the Region's zone adjustment. Ultimately, the Study Area will be located in the new Pressure Zone 250.

10.2.3 Existing Water Supply

As shown on **Drawing 10.3**, there are the following existing water services in the vicinity of the Study Area;

- A 1200 mm diameter feedermain along Burnhamthorpe Road;
- A 600 mm diameter watermain on Sixth Line from Dundas Street to Burnhamthorpe Road;
- A 400 mm diameter watermain on Sixth Line from Burnhamthorpe Road to William Halton Parkway;
- A 300 mm diameter watermain on Loyalist Trail with a 300 mm diameter stub connection available on the west side of Sixth Line; and,
- A 300 mm diameter watermain on Burnhamthorpe Road between Sixth Line and Eternity Way.

10.2.4 Proposed Water Servicing

As shown on **Drawing 10.3**, the Study Area will be serviced by a connection to the proposed 300 mm watermain installed on the south side of Burnhamthorpe Road, between Preserve Drive and Sixth Line. The 300 mm diameter watermain will be connected to the existing 600mm diameter watermain on Sixth Line. Internal watermain services will be confirmed at the detailed design stage.

11.0 ROADS

The UWM1 Subcatchment area is in close proximity to the existing six lane Highway 407 to the north and the existing four lane Dundas Street to the south. Within the EIR Subcatchment Area, Burnhamthorpe Road and Sixth Line are the only existing roads, both of them rural, paved roads. A new collector road (William Halton Parkway) is being built and will traverse the Subject Lands in an east-west direction, north of Burnhamthorpe Road.

The Town has completed two Municipal Class Environmental (EA) Studies for Sixth Line and Burnhamthorpe Road.

The Municipal Class EA for improvements to Sixth Line from Dundas Street to Highway 407 addresses the existing operational deficiencies, need for the additional north-south transportation capacity in the area and widening to four lanes.

The Municipal Class EA Character Road Study for Burnhamthorpe Road addresses the current road uses and future road design for the section between Ninth Line and Sixteen Mile Creek. The study was initiated due to the fact that William Halton Parkway replaces the road functions of existing Burnhamthorpe Road and future east-west travel demands. Sixth Line and Burnhamthorpe Road will be upgraded as required to service proposed developments with the Study Area.

The *UWM1 Addendum* provided preliminary grading plans, including centreline grades for the roads and the proposed realigned creek corridor. These plans were prepared in conjunction with the proposed storm and wastewater servicing design and considered the existing and proposed grading information for the existing and future developments. The grading information is provided on Drawings 8.8A to 8.8I in the *UWM1 Addendum*. Details of the proposed drainage system are provided on Drawings 8.5A, 8.5B and 8.5C of the *UWM1 Addendum* (see **Appendix E**). Additional grading and storm drainage information for the Study Area is provided on **Drawings 8Z** and **8.5D**, respectively.

The storm servicing design for the Study Area conforms to the drainage system recommended in the *UWM1 Addendum*. The post-development drainage from the Study Area will be conveyed to Pond 17. The controlled flows from the facility will be conveyed via a proposed clean storm trunk sewer installed along Burnhamthorpe Road and Sixth Line with an outlet to the UWM1 channel. As discussed in the *UWM1 Addendum*, Pond 17 will provide water quality and quantity for a section of Burnhamthorpe Road right-of-way (approximately 0.31 ha).

It is further confirmed that there are no revisions to the drainage control system for Sixth Line and Burnhamthorpe Road, as presented as in the *UWM1 Addendum.*

Through comments received on the *UWM1 Addendum*, the *Sixth Oak UWM1 Addendum* Study Team is aware that the Town has requested that best efforts be made, through an update to the SWM Pond Verification Memo by Urbantech, to control the 3.64 ha of uncontrolled drainage north of Burnhamthorpe Road (see Drawing 8.5A, **Appendix E**). Specifically, the comment from the Town, dated January 21, 2022, related to the *UWM1 Addendum*, states the following:

The Town's interpretation of the NOCSS Implementation Strategy is that SWM Ponds 17 and 17A were intended to provide SWM control for development as well as an external drainage area comprising of Sixth Line drainage north of Burnhamthorpe Road. This EIR/FSS and SWM strategy successfully demonstrated that passing the external drainage area (3.64 ha) through SWM Pond 17A in addition to controlling the subject lands (Crosstrails and TWKD Lands) can achieve NOCSS target release rates at Dundas Street in concert with the remaining SWM Ponds in the Upper West and Lower West Morrison Creek subcatchment areas.

In light of the future development of the Sixth Oak Inc. lands (formerly William Kutynec) and requirement for another EIR/FSS (Addendum #2), we believe it is worthwhile to consider an additional SWM scenario whereby the management of the external area is shared in-part by Pond 17. Consideration of this new scenario may include the use of retaining wall within Pond 17 and/or suitable measures to increase storage volume at the discretion of the Town. In consultation with the Town, consideration may also include storage within the Sixth Line right-of-way and/or Burnhamthorpe Road right-of-way to the extent feasible. Please note that Pond 17A storage requirements are fixed based on this EIR/FSS (Section 8.9.4.3) and while some pond optimization may be possible through detailed design, the new scenario should assume no design change to Pond 17A. Implementation of the new scenario will be at the discretion of the Town after review of the future EIR/FSS Addendum #2. This EIR/FSS should be updated as follows:

a. *Section 14.1 should direct the future EIR/FSS to evaluate the above-mentioned scenario and determine the additional storage requirements for Pond 17, Sixth Line and optimization of Pond 17A.*
b. *The EIR/FSS Section 14.2 should be updated to note that the detailed design of the Crosstrails and SWM Pond 17A should refine the pond design to the extent possible based on the most current and accepted SWM pond requirements.*

The uncontrolled drainage referred to in the above comment is predominantly from the Region's reservoir lands and the Town's Sixth Line right-of-way. A small area of uncontrolled drainage is from the front yards of the townhouses east of Sixth Line. This drainage, although uncontrolled, does pass through Pond 17A, as noted in the Town's comment, and it was the *Sixth Oak UWM1 Addendum* Study Team's understanding that, until recently, all agencies had accepted this approach to stormwater management. Given the timelines associated with the HDSB's construction, it was not feasible for the *Sixth Oak UWM1 Addendum* to wait for the completion of the requested update to the SWM Verification Memo nor was it possible to include the analysis referred to within subsection (a) above however, there are several constraints on the Sixth Oak lands that limit the ability to expand Pond 17, calling into question whether it is reasonable to require the *Sixth Oak UWM1 Addendum* to complete the analysis requested in subsection (a) above. For example, Pond 17 is surrounded by NHS on two sides (Core 6 to the north and LPA to the west), Burnhamthorpe Road to the south and a driveway into the high school site to the east.

Through discussions with the transportation consultant (CGH Transportation) it has been confirmed that the proposed driveway is approximately 165 m west of Sixth Line, measured centreline to centreline, or 150 m measured from stop bar to the edge of the access. The minimum spacing for a right in/right out access along a Regional Road is 115 m however, this is a minimum spacing and additional spacing is better. Additionally, while the site plan is currently contemplating a right in/right out, since Burnhamthorpe Road is currently a Regional road, in the fullness of time, the Town will assume this road. At that time, the School Board may want to have the flexibility to apply to convert the right in/right out access to a full movement access. The current placement of the access maximizes the distance from Sixth Line, improving the viability of a future full moves access and allowing the School Board to have that discussion with the Town at a later date, upon the Town's assumption of Burnhamthorpe Road. In addition, the proposed access location allows for a ring road around the school, providing a simple circulation route around the site and allows adequate space for a drop off loop in front of the main entrance of the school, including a pick up and drop off area and parking. If the access were required to move to the east, to accommodate a larger SWM pond, this would hinder the ability to create this internal circulation and would be a detriment to the site from a transportation perspective.

Based on the above, any expectation that Pond 17 will accommodate some of the Sixth Line drainage (either directly or through over-control), that would result in the requirement to expand the footprint of Pond 17, would not be possible unless the approval agencies are willing to allow the expansion of the Pond to the west (i.e., into the LPA). There are other examples of SWM ponds encroaching into the LPA in North Oakville (i.e., Ponds 19, 21 and 27) however, it is acknowledged that these encroachments were agreed to as part of the Minutes of Settlement. Upon confirmation that the review agencies are willing to consider the expansion into the LPA, the *Sixth Oak UWM1 Addendum* Study Team can complete the analysis requested in subsection (a) above.

Based on the above, the *Sixth Oak Addendum* Study Team anticipates that the update to the SWM Pond Verification Memo will confirm that there is no ability to expand the size of Pond 17 unless the review agencies permit the expansion to the west into the LPA. As such, the *Sixth Oak UWM1 Addendum* Study Team is confident that the limits of development, as determined through this Addendum, will not change, regardless of the outcome of the SWM Pond Verification Memo update.

11.1 ROAD CROSSING LOCATIONS

The February 2008 Official Plan Amendment 272 to the Official Plan of the Town of Oakville provides Policy (Section 7.4.7.3) for the provision of roads in the Natural Heritage System of North Oakville East Secondary Plan. The policy states that:

Roads and related utilities shall:

- *use non-standard cross-sections designed to minimize any impacts on the natural environment;*
- *only be permitted to cross the designation in the general area of the road designation shown on Figures NOE2 and NOE4 or as defined through an Environmental Assessment; and,*

- *be designed to minimize grading in accordance with the directions established in the NOCSS.*

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 edges of applicable designations wherever possible;*
- *provide for the safe movement of species in accordance with the directions established in the NOCSS in the design and construction of any road or utility;*
- *be kept to the minimum width possible; and,*
- *be designed to keep any related structures or part of structures outside of High Constraint Stream Corridor Areas designated on Figure NOE3 to the maximum extent possible or as defined through an Environmental Assessment.*

With the exception of Burnhamthorpe Road and Sixth Line (i.e., existing road crossings within the future NHS), there are no new NHS road crossings identified within OPA 272 within the Subject Lands. Any design provisions related to Burnhamthorpe Road and/or Sixth Line, where they cross the future LPAs between Cores 6, 7 and 8, would be the responsibility of the Town when they design and construct the road improvements along those two roadways. No enhanced wildlife ecopassages were identified within the LPAs along Sixth Line or Burnhamthorpe Road within NOCSS and, as such, neither EA has identified the need for such ecopassages.

Road crossings within other portions of the UWM1 catchment area are discussed in Section 11.1.1 of the *UWM1 Addendum*.

11.2 BOUNDARY ROADS

To aid in the coordination of the on-going Sixth Line urbanization works by the Town and the future Burnhamthorpe Road improvements, detailed plan and profiles and cross-sections illustrating the existing / future road grades and existing / future servicing have been prepared. These details help to inform the grading and servicing constraints for the Subject Lands and have been based on the latest information coordinated with the Town and their consulting teams.

Drawings 11.6A and 11.6B, within the *UWM1 Addendum* (see **Appendix E**), illustrate the proposed Burnhamthorpe Road plan and profiles. Figure 11.8B within the *UWM1 Addendum* (see **Appendix E**) includes the associated cross-sections.

Drawings 11.7A, 11.7B and 11.7C, within the *UWM1 Addendum* (see **Appendix E**), provide the proposed Sixth Line plan and profiles. Figure 11.8A within the *UWM1 Addendum* (see **Appendix E**) includes the associated cross-sections.

12.0 CONSTRUCTION CONSIDERATIONS

12.1 SUMMARY OF KEY GEOTECHNICAL FINDINGS

A geotechnical investigation was completed for the portion of FSS Study Area. The report entitled, Geotechnical Investigation Proposed Mixed Use Development 103 Burnhamthorpe Road West, Oakville Ontario L6M 4K5, was prepared by Landtek Limited Consulting Engineers, dated February 24, 2021.

Among the findings of this report are the following:

- 14 boreholes were completed on the Subject Lands with the predominant soil type encountered being organic soils of up to 430 mm thick overlying silty clay till. The silty clay till was encountered to the base of investigation in all boreholes which was approximately 6.5 m below existing grade;
- Bedrock was not encountered in any of the boreholes at the depth of investigation;
- Groundwater level was observed to vary between 0.54 m and 3.7 m below grade;
- Bearing conditions to support the proposed structure can be provided by the native soils underlying the site;
- The soils are considered sensitive to water and frost and their physical and mechanical properties are dependent on moisture content;
- It is anticipated that loads will be moderate intensity and as such associated settlements are not expected to be large; and,
- Assuming the elevation of the base of the pond that is no deeper than 5 m, a clay liner will be required at the SWM Pond.

Additional geotechnical studies are required to support the detailed design studies.

12.2 EROSION AND SEDIMENT CONTROLS

Erosion and sediment control plans will be prepared and implemented in accordance with the "Erosion and Sediment Control Guidelines for Urban Construction" (Greater Golden Horseshoe Conservation Authorities, 2006) prior to any earthworks or grading activities. The plans 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 crossing, wetland construction, etc.;
- Environmental fencing;
- Stone mud mat at all construction entrances;
- Use of permanent ponds as temporary silt basins during site construction activities;
- Regular inspection of the erosion and sediment control device; and,

- Removal and disposal of the erosion and sediment control devices after the site has been stabilized; and,
- Conservation Halton recommends that ESC plans should be prepared by qualified professional (i.e., CISEC, CPESC or an approved equivalent).

Through the preparation of erosion and sediment control plans, consideration will be given to both erosion control measures and minimizing disturbances to existing vegetation and appropriate phasing wherever feasible. A conceptual phasing plan should be prepared, as part of a site alteration application, that minimizes the period of time that soil will lay bare in order to minimize the risk of sediment entering natural heritage features.

12.3 CONSTRUCTION PHASING

Construction phasing, if carried out, has not yet been finalized but a general approach is summarized as follows:

- Install all silt control measures (fences, sediment basins, etc.) as required.
- Commence earthworks in accordance with industry standards.
- Upon phasing, if any being determined, applicable phasing and dynamic erosion and sedimentation plans will be proposed and implemented.
- Phasing plans and necessary supporting documentation/analysis will consider interim conditions and impacts to the NHS prior to bulk earthworks.

12.4 DEWATERING REQUIREMENTS

Dewatering may be required where sewer trench grades and excavations encounter groundwater. There are no significant shallow aquifers in the development area and the till and shale materials have relatively low hydraulic conductivity. As such, no significant high-volume dewatering is anticipated to be required for construction excavations. It is noted however that should the construction contractor need to pump at rates exceeding 50,000 L/d, an online registration on the Environmental Activity Sector Registry (EASR) will be required for construction dewatering.

12.5 CONSTRUCTION BELOW WATER TABLE

The construction of buried services below the water table has the potential to capture and redirect groundwater flow through more permeable fill materials placed in the base of excavated trenches. Services below the water table will be constructed to prevent redirection of flow and overall lowering of the water table. This will involve the use of anti-seepage collars or clay plugs surrounding the pipes to provide barriers of flow to prevent groundwater flow along granular bedding and erosion of the backfill materials. Backfill around manholes and catchbasins will also be of low permeability material.

12.6 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. It will be necessary to complete a house-to-house survey to determine the locations and uses of local groundwater supply wells.

For any active and accessible water supply wells, the water levels will be measured at each well location during non-pumping conditions prior to the commencement of site construction activities, and a water sample will be collected at each well for analysis of background water quality. The water analysis will include general water quality indicator parameters including chloride, nitrate, turbidity and E-coli. The recommended monitoring program for the local private wells includes quarterly water level measurements throughout the site construction 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 post-development water quality.

12.7 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 observation wells 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.

13.0 MONITORING PROGRAM

13.1 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:*
>
> *a) relationship and level of population and employment growth;*
> *b) supply of existing lots and number of building permits granted;*
> *c) the general achievement of housing mix targets;*
> *d) the functioning of stormwater management facilities to ensure they are constructed and operate as designed,*
> *e) stream alterations/relocations to ensure that natural channel designs were implemented and operate as designed;*
> *f) erosion and operation of sediment controls during construction;*
> *g) utilization of wastewater treatment and water supply system capacity; and,*
> *h) development application status.*

13.2 NOCSS MONITORING REQUIREMENTS

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 (ESC)

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 TSS at all outlets from the site, and reporting of results.

4. Remedial action to correct deficiencies of erosion and sediment control 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. The current form of these guidelines is the *Town's Stormwater Monitoring Guidelines, North of Dundas Street* (January 2012). The Town of Oakville and Conservation Authority 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 TSS (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 in Relation to Stormwater Management Works, Municipal Services and Trails Installed by an Owner within the Natural Heritage System

1. A monitoring program will be implemented for all municipal services such as roads, watermains, sanitary sewers, SWM works or trails within the Natural Heritage System;

2. A monitoring program approved by the Town and Conservation Halton 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; and,

4. The monitoring program will be implemented by the Landowners installing the SWM works, municipal services and trails.

13.3 PROPOSED MONITORING

Consistent with the monitoring principles set out above, the following monitoring will be undertaken by the Landowner.

13.3.1 Erosion and Sediment Control

Section 12 discusses the need for an erosion and sediment control strategy in accordance with Town and CH guidelines and sets out typical components of the strategy. 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 erosion and sediment control 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.

13.3.2 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 the Town's 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 *Stormwater Monitoring Guidelines North of Dundas Street* (January 2012).

A detailed monitoring program will be provided for the SWM facilities at the time of detailed design.

13.3.3 Baseline Monitoring

Baseline monitoring of the West Morrison Creek, in-keeping with the Town's Stormwater Monitoring Guidelines North of Dundas Street (2012), began in May 2014 and continued through 2015, 2016 and 2017. Through the preparation of *UWM1 Addendum*, GEO Morphix provided the agencies with three monitoring reports (December 8, 2014, April 18, 2016, and April 20, 2017). The final monitoring report (2017) is included in Appendix H of the *UWM1 Addendum*. The monitoring area extends from Core 7 south to the Sixth Line creek crossing. Three monitoring locations were selected for their proximity to proposed SWM Ponds 19 and 21 as well as the proposed channel realignment design. All three locations were also established in such a way that, once West Morrison Creek is realigned, their locations can be shifted west into the new channel while maintaining the same north-south positioning. The monitoring locations can be found in Appendix H of the *UWM1 Addendum,* and a general description of the monitoring parameters can be found in Section 13.3.3 of the *UWM1 Addendum*.

Monitoring conforms to the baseline monitoring requirements outlined by Conservation Halton and the Town of Oakville and follows guidelines outlined in the NOCSS. All sampling adheres to the Ontario Stream Assessment Protocol prepared by MNRF.

Water level, water quality and water temperature data for the 2016 and 2017 sampling period are provided in the Appendix H of the *UWM1 Addendum*. Monitoring data represents baseline conditions within the UWMC subcatchment. This data will be used in the future to compare post development to predevelopment conditions.

14.0 SUMMARY OF RECOMMENDATIONS

The *UWM1 EIR/FSS* and the *UWM1 Addendum* identify and characterize the majority of the natural heritage features within the Upper West Morrison Creek Subcatchment UWM1. These reports provide a link between the Town's NOCSS Management and Implementation Reports, the NOESP and the required planning approvals. **Table 14.1** summarizes main report findings and recommendations from this *Sixth Oak UWM1 Addendum* and notes the Section(s) of this Addendum that can be referenced for more details.

Table 14.1: Summary of Sixth Oak UWM1 Addendum Findings and Future Commitments

Topic	EIR/FSS Recommendations	Report Section for Reference
Subject Lands	The Subject Lands associated with this Addendum are located north of Burnhamthorpe Road and west of Sixth Line in the North Oakville East Secondary Plan Area. One proposed draft plan of subdivision is within the Subject Lands, as shown on **Figure 1.1** of this Addendum. The majority of the Subject Lands, also shown on **Figure 1.2,** lie within the Upper West Morrison Creek UWM1 Subcatchment with a small portion within the Sixteen Mile Creek (SM1) Subcatchment. This *Sixth Oak UWM1 Addendum* builds on previous information, data and conclusions provided in the *UWM1 EIR/FSS* and *UWM1 Addendum*. The draft plan for the Subject Lands is presented on **Figure 7.2.**	1.0
Subcatchment Drainage Boundaries	As illustrated on **Figure 1.3**, the EIR Subcatchment Area is defined to be the Upper West Morrison Creek subcatchment upstream of Sixth Line. As required, the drainage boundaries were updated based on LiDAR mapping through the *UWM1 EIR/FSS*. As a result of this review, the drainage area to Sixth Line varies from the NOCSS drainage area by a reduction of 9.6ha or 5.6% from the NOCSS drainage area. This is in good agreement with the NOCSS analyses; hence the target peak flow rates from NOCSS are applicable for use for the design of the storm drainage system and SWM ponds. Applicable unit flow rates are presented in **Tables 8.2A** and **8.2B.**	1.2, 6.2 and 8.4
NHS Framework and Components	**Figure 2.1** within this Addendum illustrates the NHS framework within the Sixth Oak EIR Subcatchment Area. It includes: • A portion of Core 6 and Core 7; • Two Linkage Preserve Areas; • No high, medium or low constraint streams; • One Hydrologic Feature A and seven Hydrologic Features B; and, • 8 Provincially Significant Wetlands – seven within Core 6 and one within Core 7.	2.0

Topic	EIR/FSS Recommendations	Report Section for Reference
NHS Boundaries	The boundary of Core 6 has now been completed with the northern, eastern and southern limits staked as part of the *Sixth Oak UWM1 Addendum*. The western limit of Core 6 was established through the *UWM1 EIR/FSS*. The Core boundaries are based on the greater of 10m from woodland dripline (as staked by the Region) and 30m from PSWs (as staked by CH). Along the northern limit of Core 6, the width of the Core is 200m from the western property line, as shown on NOCSS Figure 6.3.9. The Core 7 boundary was established through the UWM1 Addendum however, beyond the northern limit of the Core 7 boundary, the upper limit of PSW 15 will need to be staked in the field when the non-participating landowners advance for development. The 100m LPA between Core 6 and Core 7 has been delineated as shown on NOCSS Figure 6.3.9. The 100m LPA between Core 6 and Core 8 connects to Core 6 as shown on NOCSS Figure 6.3.9 but is proposed to connect into Core 8 slightly further south (approximately 76 m further south) than what was shown on NOCSS Figure 6.3.9. An analysis of NOCSS reveals that there was no specific reason given for connecting the LPA into the northern portion of Core 8 rather than the southern portion There is no culvert across Sixth Line in this area which suggests that the NOCSS LPA location was not predicated on the safe movement of small wildlife species. NOCSS indicates that Core locations were chosen to provide for the shortest distance between Cores. The proposed connection into the southern limit of Core 8 is a shorter distance than that proposed in NOCSS (i.e., shorter by 43 m) and it is the Study Team's recommendation that the slightly revised connection to Core 8 does not negatively affect the functionality or effectiveness of the LPA.	3.0, 4.0
Existing Regulatory Floodplain	There are no watercourse corridors within the Subject Lands. Hydraulic modeling for the existing MOC-W3 channel and MW-S2 culvert was performed utilizing HEC-RAS as part of the *UWM1 Addendum*, to determine the existing floodplain and existing riparian storage south of Burnhamthorpe Road.	n/a
Management of Hydrologic Features A/B	There are no Hydrologic Features A or B in the Sixth Oak EIR Subcatchment Area.	n/a

Topic	EIR/FSS Recommendations	Report Section for Reference
Upper West Morrison Creek Natural Channel Design	The design of the UWMC channel, south of Burnhamthorpe Road, was addressed in the *UWM1 Addendum*.	n/a
Trail System	**Figure 7.2** illustrates the conceptual trail alignment within the LPA, Core Areas and through the school lands. The trail will connect into the Subject Lands from the sidewalk along Burnhamthorpe Road where it will be within the eastern limit of the LPA and then connect into the SWM pond maintenance access road along the northern limit of the pond. At the eastern limit of the SWM pond the trail will travel north, within the 10m woodland dripline setback and then be directed east, through the school lands, to the intersection with Loyalist Trail at Sixth Line.	7.2
SWM Plan	Recognizing the environmental objectives, site location and type of the proposed development, the following practices are recommended: • Implementation of one wet extended detention pond (Pond 17), in-keeping with the principles established in the *UWM1 Addendum*; • Increasing topsoil depths in landscaped areas, in accordance with the Town's design standards; • Use of the Town of Oakville's standard tree pits along all roads; and, • Discharge of roof runoff to increased topsoil depths. At the site alteration stage, a conceptual phasing plan should be prepared that minimizes the period of time that soil lays bare (topsoil stripped off) to minimize risk of sediment entering natural heritage features. Collector / conveyance swales proposed within the Core, which are required to manage flows entering or exiting the Core, will be designed as enhanced swales to promote infiltration. This design may include the provision of check dams and vegetation but will not include any form of infrastructure such as underdrains.	8.5 12.2

Topic	EIR/FSS Recommendations	Report Section for Reference
	As a condition of draft plan approval, grading and drainage plans, including a feature-based water balance, as well as a Tree Preservation Plan for the two Star Oak parcels with frontage on the south side of Burnhamthorpe Road will be required to demonstrate no negative impact to the hydrologic function of the wetland and no negative impact to the trees along the northern edge of the Core 7 boundary. This information will also be required either as part of a future EIR/FSS Addendum and/or as a condition of draft plan approval for the current non-participating lands along the south side of Burnhamthorpe Road.	
Erosion Control Analyses	The SWM Plan has been designed to be consistent with the erosion control analysis completed by GEO Morphix as part of the *UWM1 Addendum*. As part of that previous work, GEO Morphix evaluated the continuous GAWSER results against the downstream erosion thresholds. Their findings indicated that in order to mitigate the increased volume and duration resulting from development, a 48 hour to 72 hour extended detention drawdown time was recommended for future SWM facilities in the Upper and Lower West Morrison Creek subcatchments. As required by the *UWM1 EIR/FSS*, GEO Morphix also updated the Downstream Erosion Assessment, based on the details available through the *UWM1 Addendum*, and confirmed that 48-72 hour drawdown times are appropriate for Ponds 16, 17, 17A, 19 and 21. All detailed designs should be accompanied by GAWSER verification models to confirm that targets continue to be met.	8.6
Drainage to PSWs	**Table 8.8** presents data on all PSWs located with the Sixth Oak UWM1 Subcatchment. This includes 7 wetlands in Core 6 and 1 wetland in Core 7. This table provides information on wetland size, contributing drainage areas, planned development within catchments, need for wetland water balance analyses, and where development design should address the potential for drainage out of wetlands through future development areas.	8.10
Drainage Area Exchanges	The drainage areas presented in this *Sixth Oak UWM1 Addendum* are consistent with those presented in the *UWM1 Addendum*. No additional drainage area exchanges are proposed.	8.7

Topic	EIR/FSS Recommendations	Report Section for Reference
Preliminary Grading Plan	**Drawing 8Z** provides a preliminary grading plan including centreline grades for the roads. The plan was prepared in conjunction with the proposed storm and sanitary servicing design and considered grading information provided for the existing and future developments adjacent to and within the UWM1 Subcatchment.	8.8
SWM Pond Design	SWM Pond 17 will be sized to provide stormwater quality, erosion and quantity control based on the following design criteria: • The pond will include permanent storage for water quality control determined in accordance with the "Enhanced" protection level for the receiving watercourse as defined in the March 2003 MOE guidelines and required by NOCSS; • Extended detention times for the 25 mm rainfall event were assessed as part of the downstream erosion assessment in the *UWM1 Addendum*. SWM pond detention times of approximately 48 to 72 hours were noted to provide required erosion control. SWM Pond 17 presented herein satisfies this criterion; and, • Post development peak flows will be controlled to NOCSS allowable release rates based on the unit flow equations for the 2 year to 100 year storm events and the Regional Storm event (**Table 8.2B**). Preliminary grading plans and operating characteristics of SWM Pond 17 are presented. The conceptual design of the SWM pond is illustrated in **Drawing 8.5D**. The pond operating characteristics are presented in **Tables 8.6 and 8.7**. Pond 17 was not designed with 3m deep pools near the outlets given that it discharges to a concrete pipe system of sufficient depth and length to mitigate thermal impacts. The need for other thermal mitigation measures will be addressed at detailed design. The requirement for a pond liner should be reviewed at detailed design.	8.9
Water Balance	A post-development water balance analysis will be completed, as part of the next submission, to determine the post development recharge volumes that would be expected, based on the proposed land use plan. The water balance impact assessment will address	9.0

Topic	EIR/FSS Recommendations	Report Section for Reference
	groundwater quantity (infiltration), quality, and private services, and mitigation measures for the incorporation of LID measures into the stormwater management plans to address any infiltration deficit and/or any requirement to send flows to PSW 15.	
Water and Wastewater Servicing	The conceptual wastewater servicing plan for the EIR Subcatchment Area is provided on **Drawing 10.3**. **Drawing 10.3** also illustrates the conceptual watermain servicing plan for the Sixth Oak EIR Subcatchment Area.	10.0
Road Design	The proposed development does not include any new road crossings of the NHS. Burnhamthorpe Road and Sixth Line are existing roads that will cross the future NHS at the LPAs between Cores 6 and 7 and Cores 6 and 8 respectively.	11.0
Monitoring	Monitoring requirements are presented for erosion and sediment control and SWM facilities.	13.0

14.1 DIRECTION TO FUTURE EIR/FSS ADDENDUMS

This Addendum supports the proposed draft plan of subdivision as described in **Section 7.1.2** and as shown on **Figure 7.2**. Further study, including potential future Addendums to the *UWM1 EIR/FSS,* the *UWM1 Addendum* and/or this *Sixth Oak UWM1 Addendum*, will be required to support draft plan approval of other lands within the UWM1 catchment area that are currently non-participating (i.e., the non-participating landholdings at 14, 30, 38 and 62 Burnhamthorpe Road). Based on the extent of environmental and servicing work completed as part of the *UWM1 EIR/FSS*, the *UWM1 Addendum* and this Addendum, this further study may only require confirmation that information contained in the previous studies remains current and is consistent with the draft plan applications. Where these draft plans may deviate from the development plans shown in the previous reports, an update to servicing plans may be required. For other lands where the same degree of EIR/FSS analyses has not been included in the previous reports, depending upon location in the EIR Subcatchment Area, additional study may include environmental analyses addressing field verification of NHS boundaries, confirmation of servicing, grading, stormwater management, and consistency with the previous reports. Prior to the preparation of further studies, the specific scope of study should be addressed with the Town and Conservation Halton.

Section 14.1 of the *UWM1 EIR/FSS* and *UWM1 Addendum* outlined a number of specific requirements for future Addendum(s). These requirements are highlighted below in dark grey, with an explanation as to how/if this requirement has been addressed in this *Sixth Oak UWM1 Addendum* or whether it was already addressed in the *UWM1 Addendum*:

a) **Core 5 Boundary** - The limits of Core 5 west of Sixth Line are considered final with the exception of the Core boundary on the Marchetti/Columbo property in the northeast portion of the Core. This property is a non-participating Owner in this Final EIR/FSS and therefore features staking of this site has not occurred with the Agencies. Staking of this area will be necessary when this Owner prepares an update to this EIR/FSS in the future.

   The Marchetti/Columbo property referred to above is now owned by Argo (West Morrison Creek) Limited. The northern boundary of Core 5 was staked with Conservation Halton, Region of Halton and the Town of Oakville on October 31, 2017. The survey was provided to agency staff and approved by Conservation Halton staff on December 21, 2017. All figures and drawings within this *Sixth Oak UWM1 Addendum* reflect the approved staked boundary as confirmed through the *UWM1 Addendum*.

b) **Core 5 Crossing** - Preliminary road crossing design of Core 5 on the Preserve lands was addressed in the *Final Consolidated Preserve Phases 1, 2 and 3 EIR/FSS*. Further review and detail of road grades and water/wastewater servicing to be provided in the Core 5 road right-of-way should be completed prior to draft plan approvals for lands west of Sixth Line, north of Core 5. If such grades are not provided, a confirmation should be provided that there will be no conflicts or future constraints with respect to the lands north of Burnhamthorpe Road.

   The road crossing design was addressed in the *Final Consolidated Preserve Phases 1, 2 and 3 EIR/FSS*. The grades were incorporated into the design of draft plans north of Core 5 as part of the *UWM1 Addendum*.

c) **Core 6 Boundary** - The limits of west boundary of Core 6 north of Burnhamthorpe Road are final. Properties to the east of the S. G. C. C. site are non-participating Owners in this Final EIR/FSS and therefore features staking of the north, east and south sides of Core 6 has not occurred with the Agencies. Staking of these areas will be necessary when this Owner prepares an update to this EIR/FSS in the future.

The property east of the Mattamy Homes (Hulme/SGGC) lands, referred to in the comment above, are the lands that are subject of this *Sixth Oak UWM1 Addendum*. Staking of the remaining limit of Core 6 has been completed as part of this *Sixth Oak UWM1 Addendum*.

d) **Linkage Preserve Areas** - The exact locations of the Linkage Preserve Areas connecting Cores 6, 7 and 8 have not been determined. This will be required when Owners of lands north of Burnhamthorpe Road west of Sixth Line proceed with development applications.

As with item (c) above, the exact locations of the Linkage Preserve Areas connecting Cores 6, 7 and 8 have been determined as part of this *Sixth Oak UWM1 Addendum*.

e) **MOC-W2 Floodplain Mapping** - Preliminary floodplain mapping for stream reach MOC-W2 has been prepared as part of the *Final Consolidated Preserve Phases 1, 2 and 3 EIR/FSS*. This mapping should be updated prior to draft plan approval of future developments south of Burnhamthorpe Road, west of Sixth Line to confirm flows and floodlines, and provide input to design of the realignment of MOC-W2.

Preliminary flood plain mapping for stream reach MOC-W2 was prepared as part of the Final Consolidated Preserve Phases 1, 2 and 3 EIR/FSS and has been approved by the agencies.

f) **SWM Plan** – The following matters should be addressed:

a. **Updated GAWSER and Downstream Assessments** –

- Updated GAWSER predicted flow rates for the entire WMC from Core 7 to downstream of Oak Park Pond, incorporating the actual SWM plan, are required along with impact assessments and discussion with respect to the implications of these predicted flow rates on the flood plain analysis, erosion, ecology and fluvial geomorphology. Modelled (GAWSER) instream flow rates must be confirmed to demonstrate that the instream flow regime is appropriate from an ecological and fluvial geomorphological perspective, as well as to confirm the natural channel designs.
- From downstream erosion and SWM detention time perspectives, the downstream assessments are to be updated by the first proceeding landowner in the UWMC subcatchment to understand the design implications of a 48 hour detention time on Ponds 16, 17, 17A, 19 and 21. This assessment should be completed as part of an EIR/FSS Addendum prior to draft plan approval of development in the UWMC catchment and finalized prior to registration of the developing lands. If this assessment has implications to pond size, the Town has advised that it is willing to consider an adjustment in the outlet of Pond 22A. However, the assessment, modification to the pond outlet and a minimum

2 years of monitoring to demonstrate hydraulic performance would be the responsibility of the proceeding landowner.

It is understood that the Town prefers a 48-hour drawdown time and that this was recommended to be further evaluated for the EIR/FSS Addendum; however, for the purposes of conservatively sizing the pond blocks in Neighbourhood 10, a longer (72-hour) drawdown time was considered. The downstream erosion assessment, prepared as part of the *UWM1 Addendum*, confirmed that drawdown times in the range of 48-hours to 72-hours are acceptable. At detailed design, further iterations of the drawdown time and consideration of drawdown times closer to 48-hours can be considered without impacting the pond block size or conclusion erosion. No changes to Pond 22A are recommended at this time as it currently provides a 52-hour drawdown time.

b. **ES6-East/UWM Drainage Area Exchange** - Section 8.7.4 addresses the impact assessment of ultimate conditions with the drainage area exchange from ES6-East to UWM1. It concluded that impacts can be mitigated through appropriate SWM as outlined herein and in the ES6 EIR/FSS. Due to the uncertainty on timing of development in these subcatchments and completion of supporting EIR/FSS for the ES6-East subcatchment, the requirement for an Interim Conditions assessment was deferred to future analyses on the basis that development within Star Oak South and the UWM1 catchment area does not proceed prior to development within the ES6 East catchment area. If anticipated development timelines change and development within UWM1 proceeds first, an interim conditions assessment will be required.

It continues to be anticipated that development will proceed in the ES6-East subcatchment prior to development of the Subject Lands. As a result, an interim conditions assessment was not included in the *UWM1 Addendum* or this *Sixth Oak UWM1 Addendum.* If, however, anticipated development timelines change and development within UWM1 appears to be proceeding in advance of ES6-East, an interim conditions assessment will be required.

c. **Roof Drainage Collector System North of Core 5** – Regarding the design of a Roof Drainage Collector System north of Core 5 that outlets to PSW 13, if Star Oak South lands proceed in advance of the adjacent Mattamy development, the temporary interim drainage condition resulting in a loss of drainage to the PSW 13 will need to be assessed.

It was not anticipated that development on the Star Oak South lands will proceed in advance of the Mattamy Preserve North development and, as such, an interim drainage condition scenario was not assessed as part of the *UWM1 Addendum*. If, however, anticipated development timelines change, a temporary interim drainage condition resulting in a loss to PSW 13 will need to be assessed.

d. **Pond 21 Design Adjacent to Core 5** - Additional Pond 21 grading detail is required prior to draft plan approval for lands adjacent to Core 5. Additional grading information should demonstrate conformance with NOCSS requirements.

The *UWM1 Addendum* provided the additional grading details associated with Pond 21 to demonstrate that the grading adjacent to Core 5 is in compliance with NOCSS.

e. **Pond Length-to-Width Ratios** – Sediment forebay L:W ratios to be confirmed to be 2:1 or greater, consistent with MOECC requirements; total pond L:W ratios to be minimum 3:1, consistent with MOECC and Town requirements.

Within the *UWM1 Addendum*, with the exception of Pond 17A, the SWM Pond sediment forebay L:W ratios were confirmed to be 2:1 or greater. Due to the grading constraints in the vicinity of Pond 17A (5m grade differential and property limitations), a SWM Shield has been designed to replace the forebay. Total SWM pond L:W ratios are confirmed to be a minimum of 3:1 for all SWM ponds. Within this *Sixth Oak UWM1 Addendum*, the L:W ratio for Pond 17 has been confirmed as 4:1.

f. **Ponds 19 and 21 Location in Linkage** - The design, configuration and extent of encroachment of SWM Ponds 19 and 21 into the NHS linkage are subject to CH's acceptance of the design of the MOC-W3 and MOC-W2 channels west of Sixth Line.

The *UWM1 Addendum* presented the Pond 19 and 21 encroachments into the OLPA as per the design in the *UWM1 EIR/FSS*. The encroachments are in conformance with the permissions as outlined in the Minutes of Settlement.

g) **MOC-W2 and MOC-W3 Channel Design** – This Final EIR/FSS provides preliminary design of realigned stream reaches MOC-W2 and MOC-W3. As part of any required EIR/FSS Addendum, channel design should include:

a. Confirmation of the MOC-W3 channel bottom of 23m at the north end of the stream reach based on updated flow regime in MOC-W3;

Within the *UWM1 Addendum*, GEO Morphix confirmed that the MOC-W3 channel bottom width of 20m at the north end of the stream reach is appropriate, based on an updated flow regime in MOC-W3.

b. Confirmation of the GAWSER instream flow rates (see f) i) above)

The GAWSER instream flow rates have been confirmed through an updated analysis and the continuous simulation results were shared with GEOMorphix as part of the *UWM1 Addendum*.

c. Revised the 'discharge to accommodate' in the natural channel design

The revised discharge to accommodate values were confirmed by GEOMorphix and the basis for the bioswale design were provided within the *UWM1 Addendum*.

d. A basis for the bioswale design and profile view of proposed MOC-W2 channel/bioswales drawn to scale.

This information was provided on Drawings GEO-4 and DET-1 within the *UWM1 Addendum.*

e. Conceptual details of services under the creek are required to demonstrate that this minimal coverage (1.5m above invert) is feasible.

Conceptual details for the services under the creek were provided in the *UWM1 Addendum* to confirm that a minimum distance of 1.5 m above pipe obverts is achieved. This information was provided on Drawing No. 8.8Y.

f. Provide a pocket wetland at the upstream end of MOC-W2 outside of the 30m buffer to PSW 13 as long as appropriate flood storage and conveyance can be provided.

The pocket wetland at the upstream end of MOC-W2 was removed from within the buffer associated with Core 5 as requested by Conservation Halton, as part of the *UWM1 Addendum*.

g. When the lands north of Core 7 advance for development (i.e., Kutynec property and 14, 30, 38 and 62 Burnhamthorpe Road) a grading and drainage plan, including a feature based water balance, as well as a tree preservation plan will need to be prepared to demonstrate no negative impact to the woodlands and no negative impact to the hydrologic function of the wetlands within Core 7. A Permit from CH, pursuant to Ontario Regulation 162/06, will be required for development within that portion of PSW 14 outside of Core 7 and within 30m of PSWs 14 and 15.

As part of the next submission of the *Sixth Oak UWM1 Addendum*, a post-development feature based water balance for PSW 15 will be provided. The post-development water balance requirements will not affect the limit of development on the Sixth Oak lands, which is the intent of this interim submission.

PSW 14's catchment area is not affected by the development of the Sixth Oak lands and will need to be addressed when the properties south of Burnhamthorpe Road advance for development. Similarly, the tree preservation plan can only be prepared when those lands advance for development.

14.2 DETAILED DESIGN REQUIREMENTS

The *UWM1 EIR/FSS* and *UWM1 Addendum* provided direction to detailed design on SWM, water, wastewater, grading, trail design, channel design and road crossing design at the EIR/FSS level of detail. In addition to typical detailed design requirements, the following should be addressed at detailed design. This list has been modified as necessary, from that which was provided in the *UWM1 EIR/FSS* and *UWM1 Addendum* to only include those items that would be specific to the Sixth Oak lands:

a) **Grading In Cores** to accommodate core drainage will be in accordance with NOCSS requirements for grading in Cores.

b) **Development of Star Oak properties north of Core 7 (south of Burnhamthorpe Road) and 14, 30, 38 and 62 Burnhamthorpe Road** will require the preparation of a grading and drainage plan, including a feature-based water balance, as well as a tree preservation plan to demonstrate no negative impact to the woodlands and no negative impact to the hydrologic function of the wetlands within the Core. A Permit from CH, pursuant to Ontario Regulation 162/06, will be required for development within that portion of PSW 14 outside of Core 7 and within 30m of PSWs 14 and 15.