ENVIRONMENTAL IMPLEMENTATION REPORT AND FUNCTIONAL SERVICING STUDY ADDENDUM

FOR

GREEN GINGER PHASE 2

EAST MORRISON CREEK – MAIN BRANCH NORTH OAKVILLE EAST

PROJECT NO. 15-797

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1.0 INTRODUCTION

1.1 STUDY PURPOSE AND CONNECTION TO NOCSS

The purpose of this report is to provide an update to the relevant information pertaining to Green Ginger Phase 2 lands as previously described in the EIR/FSS for North Oakville Main East Morrison Creek prepared by Sernas Associates et. al., dated December 2013 as amended July 2015 (EM1 EIR/FSS), and the EM1 Addendum by Stonybrook Consulting et. al. dated November 2015 as amended July 2017. This report will herein be referenced as the Green Ginger Phase 2 Addendum report.

The Green Ginger Phase 2 Addendum report is prepared with consideration for the realignment of MOC-2 channel realignment from the EM4 catchment, and assumes the drainage area exchange (DAE) with the Star Oak lands. It should be noted that the development of the Green Ginger Phase 2 lands as presented in this report are not impacted by the proposed DAE proceeding, and are relatively self-contained from a drainage perspective.

This Green Ginger Phase 2 Addendum addresses EIR/FSS requirements in support of the Green Ginger Phase 2 Draft Plan of Subdivision not already presented in the aforementioned EM1 Reports. Additional work, including potentially addendums to the EM1 EIR/FSS, EM1 Addendum, or this Green Ginger Phase 2 Addendum will be required for any current non-participating landowners within the EM1 subcatchment.

The Green Ginger Phase 2 Addendum will serve as an update to the EM1 EIR/FSS, and EM1 Addendum and should be read in conjunction with those reports. The following sections require only minor updates to provide additional information on the latest Green Ginger Phase 2 Draft Plan as described below:

- 1.0 Introduction
- 5.0 Stream Systems, Fish Habitat and Fish Communities
- 6.1 General Description of Draft Plans
- 6.2 Trail Planning
- 8.0 Water Balance
- 13.0 Monitoring Requirements

The following sections have been **re-written or are new**, and are presented in this Green Ginger Phase 2 Addendum report specifically for the subject property:

- 7.0 Grading, Drainage and Stormwater Management
- 10.0 Wastewater and Water Servicing
- 11.0 Roads

Appendix A-1 MNRF Correspondence

Appendix G Stormwater Design Sheets and Drainage Plan

Appendix H-2 Pond Sizing (Pond 30 Only) & Target Release Rate Calculations

Appendix H-3 SWMHYMO Model – SWM Facility Sizing (POND 30 ONLY)

Appendix Q-1 Green Ginger Phase 2 Tree Inventory and Preservation Plan Report

Appendix I-1 Sanitary Design Sheets and Drainage Plan

Appendix I-2 Alternative Trafalgar Trunk Option

Appendix R Green Ginger Phase 2 – Town Comment Response Matrix

Appendix S Green Ginger Phase 2 - Conservation Halton Comment Response Matrix

Additionally, figures throughout the EM1 EIR/FSS and EM1 Addendum have been updated to include the new alignment of stream reach MOC-2 within the Lower East Morrison as it affects Green Ginger Phase 2 lands. For Section 1.0, this includes Figure 1.2 from the EM1 EIR/FSS (2013). For all other Section 1.0 figures refer

to the EM1 EIR/FSS (December 2013 as amended July 2015) and EM1 Addendum (November 2015 as amended July 2017).

1.2 STUDY AREAS AND PROPOSED DRAFT PLANS

The EIR Subcatchment Area for the EM1 EIR/FSS included the entire EM1 subcatchment regardless of the land ownership. The focus of the EM1 EIR/FSS was on the proposed Green Ginger Phase 1 development (refer to **Figure 1.2** from the EIR/FSS), and also demonstrated servicing feasibility for other lands in the Subcatchment Area in accordance with the Terms of Reference for the EIR/FSS. The EM1 Addendum focused on the Draft Plan of Subdivision for Mattamy Petgor Phase 2, the EMGO lands, as well as a portion of the Star Oak Developments lands that lie to the north of Burnhamthorpe Road. This Green Ginger Phase 2 Addendum focuses on the Green Ginger Phase 2 lands as illustrated on **Figure 1.2**. The Green Ginger Phase 2 Draft Plan area is approximately **39.44 ha**.

1.4 NORTH OAKVILLE EAST SECONDARY PLAN

The Subject Lands are subject to the detailed planning framework established through the North Oakville East Secondary Plan (NOESP) – OPA 272. The requirements of the NOESP are detailed in the EM1 EIR/FSS (December 2013 as amended July 2015). There are no changes to Section 1.4 as a result of the updated Draft Plan for Green Ginger Phase 2. For details related to the North Oakville East Secondary Plan refer to the EM1 EIR/FSS (December 2013 as amended July 2015).

1.5 PREVIOUS STUDIES, REPORTS AND PLANNING DOCUMENTS

The following studies/guidelines/documents were reviewed during the preparation of this Green Ginger Phase 2 Addendum:

- Environmental Implementation Report and Functional Servicing Study North Oakville Main-East Morrison Creek, Sernas Associates et. al., December 2013 as amended July 2015 (EM1 EIR/FSS);
- EM1 EIR/FSS Addendum, GHD, March 2015;
- EM1 EIR/FSS Addendum, Stonybrook Consulting. Et al, November 2015 as amended July 2017;
- Final Environmental Implementation Report and Functional Servicing Study, East Morrison Subcatchment EM4, Dundas-Trafalgar Inc. and Shieldbay Developments Inc., North Oakville, Stonybrook Consulting Inc. et al, February 2015 (DTI/SBI Final EIR/FSS)
- North Oakville East Drainage Area Drainage Area Exchange Report, January 2015
- North Oakville East Drainage Area Drainage Area Exchange Mapping and Response to Agency Drainage Area Comments, Stonybrook Consulting Inc. et al, July 31, 2015
- North Oakville East Drainage Area Exchange Response Document #2, Stonybrook Consulting Inc. et al, October 6, 2015.
- Upper West Morrison Creek UWM1, EIR/FSS, Star Oak Developments, North Oakville, Stonybrook Consulting Inc. et al, September 2013;
- Upper West Morrison Creek UWM1, EIR/FSS Response Document, Star Oak Developments, North Oakville, Stonybrook Consulting Inc. et al, December 2014;
- Upper West Morrison Creek UWM1, EIR/FSS Response Document #2, Star Oak Developments, North Oakville, Stonybrook Consulting Inc. et al, October 9, 2015;
- Sixteen Mile Creek SM1, EIR/FSS, Star Oak Developments Limited, North Oakville, Stonybrook Consulting Inc. et al, September 2013;
- Sixteen Mile Creek SM1, EIR/FSS Response Document, Star Oak Developments Limited, North Oakville, Stonybrook Consulting Inc. et al, November 2014;

- Sixteen Mile Creek SM1, EIR/FSS Response Document, Star Oak Developments Limited, North Oakville, Stonybrook Consulting Inc. et al, July 20, 2015;
- East Branch of East Morrison Creek Upper Subcatchment EM4, Scoped EIR/SWM Report Stonybrook Consulting Inc. et al, June 2017 (Upper EM4 EIR/FSS);
- East Branch of East Morrison Creek Upper Subcatchment EM4, Scoped EIR/SWM Report Response Document, North Oakville, Stonybrook Consulting Inc. et al, February 2015 (Upper EM4 EIR/FSS); and,
- Town of Oakville Master Trails Plan, May 2013.
- MNRF Correspondance, Redside Dace Absence & East Morrison Creek, September 2016

Those studies/guidelines/documents reviewed initially as part of the EM1 EIR/FSS are listed below:

- Town of Oakville North Oakville Creeks Subwatershed Study, August 2006;
- Town of Oakville DRAFT North Oakville Creeks Subwatershed Study Addendum, September 2007;
- Ontario Municipal Board Mediation Agreements, 2007;
- Town of Oakville Official Plan Amendment 272 (August 2007);
- North Oakville Environmental Implementation Report and Functional Servicing Study Terms of Reference, August 2, 2013;
- Green Ginger Property, North Oakville Natural Heritage Assessment, Beacon Environmental, 2006;
- North Oakville Milton East Wetland Complex, MNR, 2006;
- Redside Dace Habitat Monitoring and Assessment Program, Gartner Lee Limited 2005;
- Ecological Assessment, Green Ginger Developments Inc., Gartner Lee Limited 2002;
- North Oakville Natural Heritage Inventory and Analysis, LGL Limited, 2000;
- Stormwater Management Planning and Design Manual, Ministry of Environment, March 2003 (SWMP Design Manual);
- Stormwater Monitoring Guidelines North of Dundas Street Town of Oakville, January 2012;
- Town of Oakville Development Engineering Procedures and Guidelines Manual, January 2011;
- Design Criteria, Contract Specifications and Standard Drawings, Region of Halton, February 2001 (updated February 2012);
- Area Servicing Plan prepared by MMM Group for North Oakville Community Builders Inc. (NOCBI), April 2011; and,
- MNRF Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat, July 2015.

1.6 EIR/FSS ADDENDUM LAYOUT

The sections and information provided in this report are based on the Town of Oakville "North Oakville Environmental Implementation Report and Functional Servicing Study Terms of Reference" (August 2013) and remains the same format as that which was presented in the EM1 EIR/FSS (December 2013 as amended July 2015) and EM1 Addendum (November 2015 as amended July 2017).

2.0 NATURAL HERITAGE SYSTEM FRAMEWORK

OPA 272, the Town of Oakville North Oakville Creeks Subwatershed Study (NOCSS) and the North Oakville Creeks Subwatershed Study Addendum (NOCSS Addendum) provide policies and/or directions with respect to the protection and management of the North Oakville East Natural Heritage/Open Space System. The NOCSS is divided into four sections, which follow the four phases of a subwatershed management approach. They include Characterization (Section 4.0), Analysis (Section 5.0) Management Strategy (Section 6.0) and Implementation (Section 7.0). For the undertaking of the EIR/FSS and this Addendum, the NOCSS Management Strategy and Implementation sections provide the framework and primary direction for how environmental features are to be addressed with respect to specific development plans.

The Management Strategy outlines requirements with regard to lands that are restricted from development, lands with development limitations or constraints, stormwater management, input to land use policies and servicing requirements. The Implementation Plan outlines the implementation requirements for the recommended management strategy, studies needed in subsequent stages of the development process, environmental reporting requirements, agency responsibilities, and the approval process with the Town of Oakville, Halton Region and Conservation Halton, and, where applicable, the MNRF and DFO.

The information related to the Natural Heritage System Framework, as presented in the EM1 EIR/FSS, remains valid and has not changed. Please refer to the EM1 EIR/FSS (December 2013 as amended July 2015) for the Natural Heritage System characterization.

3.0 CORE 9 – TRAFALGAR WOODLOT AND LINKAGE

The Core 9 - Trafalgar woodlot and linkage are discussed in detail in the EM1 EIR/FSS. The information related to these items has not changed. All figures associated with Section 3.0 remain unchanged from the EIR/FSS with the exception of Sections 3.1 and 3.2.2 which were updated as a part of the EM1 Addendum (November 2015 as amended July 2017). Refer to the EM1 EIR/FSS (December 2013 as amended July 2015) and the EM1 Addendum (November 2015 as amended July 2017) for details related to Core 9. Additional trails information located within the Linkage has been provided in Section 6.

4.0 GEOLOGY AND HYDROGEOLOGY

Geology and hydrogeology, including scope of work, physiography and topography, drainage, climate, geology, water quality and geotechnical investigations are discussed in detail in the EM1 EIR/FSS. All figures associated with Section 4.0 remain unchanged from the EIR/FSS.

A preliminary geotechnical report has been prepared by Soil Engineers Ltd. to discuss the subsoil and groundwater conditions on the site. This report has been provided in **Appendix S**. Recommendations and geotechnical details will be provided once the fieldwork has been completed.

5.0 STREAM SYSTEMS, FISH HABITAT AND FISH COMMUNITIES

The Stream Systems, Fish Habitat and Fish Communities were assessed and evaluated in detail in the *North Oakville Main East Morrison Creek EM1 EIR/FSS (December 2013* as amended July 2015) and the *EM1 Addendum (November 2015* as amended July 2017). Section 5.2.1 was modified to address the current fisheries status of East Morrison Creek. Refer to the EM1 Addendum (November 2015 as amended July 2017) for the remainder of Section 5.0.

5.2.1 REDSIDE DACE

The Ministry of Natural Resources and Forestry (MNRF) conducted eDNA testing in East Morrison Creek in the summer of 2015. The testing came back positive for Redside Dace and it is understood that the MNRF continued conducting additional field surveys in the area.

In February 2016, MNRF advised that they found eDNA evidence of Redside Dace in East Morrison Creek downstream of Dundas Street. As a result, they completed electrofishing of the creek downstream of Dundas Street in the summer of 2016. No Redside dace were found at that time. To complete their assessment of East Morrison Creek, MNRF planned to conduct electrofishing again in 2017. In the meantime, MNRF has advised that East Morrison Creek is not regulated habitat for Redside Dace and they will not be involved in any development application reviews or approvals at this time (see **Appendix A-1** for email dated September 22, 2016 from MNRF). Based on discussions with MNRF, if Redside Dace were found in 2017, only the habitat north of Dundas Street would be considered contributing habitat. Under those circumstances, MNRF advised that they would only be involved in the review of future SWM Ponds 29 and 30, future road crossings and channel works not under construction by then, as outlined in meeting notes from February 11, 2016 (**Appendix A-1**).

The pond has been designed to be in compliance with the MNRF *Draft Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat, similar to SWM Pond 31 in Green Ginger Phase 1.* Please refer to Section 7.0 for the revised pond design. This section should be updated in the final EIR/FSS for East Morrison Creek based on the most recent information from the MNRF.

6.0 LAND USE

The Green Ginger Phase 2 lands (Subject Lands) are proposed to be developed for residential and open space uses consistent with the North Oakville East Secondary Plan (NOESP). The following sections describe the draft plan of subdivision associated with this Addendum Study, and how the proposed draft plan follows or varies from the Secondary Plan policies. The draft plan is illustrated on **Figure 6.2**

The EIR Subcatchment Area for this Addendum Study is consistent with the EM1 EIR/FSS Addendum (November 2015 as amended July 2017), and extends beyond the Subject Lands draft plan. As such, for the purpose of demonstrating logical coordination with lands extending beyond the draft plan limits, planning details in those areas have been prescribed in accordance with that of the Secondary Plan Master Plan and include:

- Land use designations;
- Natural Heritage System;
- Major Roads;
- Major Services;
- SWM Blocks; and,
- Trails.

The proposed draft plan for the Green Ginger Phase 2 lands differs from the road layout that was shown in the EM1 EIR/FSS (December 2013 as amended July 2015). The draft plan is generally in keeping with the same principle layout in the aforementioned EIR/FSS report and Master Plan with the exception of a few modifications:

- A road crossing through the NHS has been eliminated, which is consistent with the draft plans submitted as part of the EM1 EIR/FSS Addendum (November 2015 as amended July 2017). It should also be noted that the crossing was not illustrated on the EM1 EIR/FSS Addendum figures, or included in the hydraulic modeling.
- There are fewer intersections with Trafalgar Road than were illustrated on the Master Plan

Section 6.1 has been revised to include a detailed description of the Green Ginger Phase 2 draft plan; all other draft plans are described in the EM1 EIR/FSS Addendum (November 2015 as amended July 2017). Section 6.2.1 has been updated to discuss pedestrian connectivity between Green Ginger Phase 2 and Petgor Phase 2 to the west; and a tree inventory for the trail system located within Green Ginger Phase 2 lands to address updated requirements of the EIR/FSS Terms of Reference (May 2013). The remainder of Section 6.2 of the EM1 EIR/FSS (December 2013 as amended July 2015) remains unchanged. In addition, the majority of the figures in this section remain unchanged with the exception of **Figures 6.2** (Green Ginger Draft Plan) and **Drawing 6.6A** (Trails Plan). Refer to the EM1 EIR/FSS (December 2013 as amended July 2015) for **Figures 6.5 – 6.9** and the EM1 EIR/FSS Addendum (November 2015 as amended July 2017) for **Figure 6.1**.

6.1 GENERAL DESCRIPTION OF DRAFT PLAN

The North Oakville East Master Plan forms the basis for the Green Ginger Developments Inc. (Great Gulf) Phase 2 draft plan.

This draft plan proposes to develop the Subject Lands for uses consistent with the NOESP, Master Plan, and OMB Minutes of Settlement. This draft plan is provided in **Figure 6.2**.

The street network proposed in the draft plan provides the framework for the urban form and is integral for ensuring efficient multi-modal traffic flow. The road pattern, a modified grid, is generally consistent with that illustrated in the Master Plan street network with the exception of the removal of one road crossing of the NHS and fewer local road intersections with Trafalgar Road.

The lands associated with the Green Ginger draft plan are designated as Trafalgar Road Urban Core which permits medium and high density residential uses and associated public uses, as well as a full range of employment, commercial, institutional, cultural, health/medical, and entertainment uses. In accordance with the NOESP and OPA 272, the Green Ginger draft plan proposes freehold townhouse units and three Trafalgar Urban Core blocks located within interior of the Subject Lands with four medium-to-high density blocks adjacent to Trafalgar Road that is able to accommodate higher density development and mixed use buildings. The development details of the Trafalgar Urban Core blocks have been provided with the site plan application stage.

Access to the Draft Plan will be provided by two right-of-way intersections with Trafalgar Road. Access will also be available via two road crossings of the NHS from the Green Ginger Phase 1 lands. Two access points are provided to the future development north of the Subject Lands.

The Stormwater Management facility block located at the southern edge of the Subject Lands is consistent with the SWM pond location identified in the NOESP Figure NOE 3.

Table 6.1 below has been updated to include the change in land uses defined within the Green Ginger Draft

 Plan.

	Area (ha)	Units
Street Townhouses (min. 5.5m)	6.19	376
Rear Access Townhouses (min. 6.7m)	0.56	23
Rear Access Townhouses (min. 6.1m)	1.32	92
Trafalgar Road Urban Core	9.24	
Secondary School	0.69	
Urban Squares	0.97	
Storm Water Management Facility	2.25	
Natural Heritage System	9.01	
Road Widening	0.38	
Public Accessible Walkway	0.12	
8.0m Servicing Block	0.02	
Walkway	0.02	
0.3m Reserves	0.01	

TABLE 6.1:GREEN GINGER DEVELOPMENT DRAFT PLAN PRELIMINARY DEVELOPMENT
YIELDS (PHASE 2)

Roadways	8.66	
	39.44	491

6.1.1 CONFORMANCES / VARIANCES FROM SECONDARY PLAN

The subject Draft Plan, as described above, is consistent with the designation and policies specified in the NOESP. The only minor variations from the Secondary Plan are proposed in the Draft Plan and are associated with the Linkage boundary. The Linkage shown within the Green Ginger Phase 2 Draft Plans is consistent with OPA 272 policies except for minor boundary refinements. In particular:

- The Linkage is reflective of a modified version of the NOESP boundary shown on the Master Plan and consistent with OPA 272 policies for Linkage Preserve Area.
- The Medium Constraint Stream is planned for deepening consistent with the Medium Constraint Stream OPA 272 policies.

The land uses and densities proposed for the Subject Lands are consistent with the policies of OPA 272. **Table 6.4** below compares the land uses and densities permitted in the Secondary Plan with those proposed in the draft plan. Refer to the EM1 EIR/FSS (December 2013 as amended July 2015) for the comparison for the Green Ginger Phase 1 Draft Plan as it has not changed.

Trafalgar Urban Core Area (Section 7.6.4.6, 7.6.4.7 & 7.6.4.8 b)	Secondary Plan	Draft Plan
Land Use	Trafalgar Urban Core Area (Core Areas 3 &4): medium and high density residential, office, and institutional	Medium and high density residential, office, and institutional
Minimum density	25 units per net hectare	62.3 upph
Maximum density	75 units per net hectare	02.5 upili
Minimum Height	5 - Commercial and Industrial 3 – other development	TBD
Maximum Height	15 Storeys 20- Storeys at intersection of Major Arterial/Transit Corridors and Avenue/Transit Corridors with Trafalgar Road	TBD

TABLE 6.4:LAND USE AND DENSITY CONFORMITYGREEN GINGER DEVELOPMENTS INC. PHASE 2 DRAFT PLAN

TBD: To be determined through Site Plan Approval

6.2.1.1 IMPACT ASSESSMENT OF TRAIL SYSTEM – GREEN GINGER PHASE 2

The trail impact assessment is discussed in detail in the EM1 EIR/FSS (December 2013 as amended July 2015). A revised terms of reference for trail impact assessment has been updated since the EM1 EIR/FSS (December 2013 as amended July 2015), and as a result a tree inventory has been undertaken to comply with the new terms of reference and is included in this EIR/FSS Addendum. The tree inventory report has been prepared for the trail within the Green Ginger Phase 2 draft plan limits. This report has been included in **Appendix Q-1**.

A trail is proposed along the western boundary of the subject lands, within the NHS, from Marvin Avenue to Wheat Boom Drive. Additionally, through discussions with Town of Oakville Planning Staff it has been determined that a pedestrian crossing of the realigned MOC-5A channel should be provided. There is currently a pedestrian trail on the west side of the channel block (along the outer edge of Pond 27) that will connect to the proposed trail on the east side of the channel block at Threshing Mill Drive, through the adjacent sidewalks, to provide pedestrian crossing of the MOC-5A channel. These pedestrian trails are consistent with the North Oakville Trails Master Plan. This has been depicted in the modified **Figure 6.6A**.

A description of the Green Ginger Phase 2 trail system is outlined in Section 6.2 and Section 6.2.1 of the EM1 EIR/FSS (December 2013 as amended July 2015)), and is described as Sector 1 to Sector 3. As such, no additional impact assessment has been carried out for the pedestrian crossing as its intended location will be part of the roadway.

7 GRADING, DRAINAGE AND STORMWATER MANAGEMENT

With the exception of Sections 7.8, 7.9, 7.11 and 7.13, all other Sections remain unchanged. Refer to the EM1 EIR/FSS and the EM1 EIR/FSS addendum reports dated December 2013 and November 2015 respectively for remainder of Section 7.0. Figures 7.1, 7.6 and Drawing 7.7 have been revised as a result of the latest Green Ginger Phase 2 draft plan and have been included in this report.

7.8 CONVEYANCE OF MINOR STORM FLOWS

The Subject Lands will be serviced by a conventional storm sewer system designed in accordance with Town of Oakville standards. The storm sewers will be sized using a 5 year return frequency and Town of Oakville IDF curves. **Figure 7.1** which shows the post development drainage areas for the FSS Study Area along with the areas immediately outside but adjacent to the study area has been updated with the latest Draft Plan. The storm servicing shown in **Figure 7.1A** reflects the proposed direction of minor system flows. Conceptual storm design sheets have also been updated and provided in **Appendix G**.

As illustrated on **Figure 7.1A**, the runoff from the rear lots abutting the NHS are generally captured in rearyard catch basins and will be directed to SWM Pond 30. There is a 0.85 Ha area of rear roofs and rear lots that will be directed to the channel. Given that the rear roof and rear yard runoff is from townhouses the runoff coefficient is assumed to be 0.75, for a total AxC to the channel of 0.64. This area an imperviousness has been accounted for in the overall watershed modeling.

7.9 CONVEYANCE OF MAJOR STORM FLOWS

All storm flows over the 5 year storm up to the Regional Storm event will be conveyed along the public roads to SWM Pond 30. **Figure 7.1** reflects the overland flow paths with the revised grading which has been coordinated with adjacent lands grading.

7.11 PRELIMINARY GRADING PLANS

A Preliminary Grading Plan, **Drawing 7.7**, prepared for the FSS Study Area and updated with the EM1 EIR/FSS Addendum, has been revised based on the latest Draft Plan. This plan took into consideration the requirements for major and minor storm drainage; wastewater sewers; grading associated with the NHS Lands; and the Town's grading standards (i.e. road grades at a minimum of 0.5% slope). The Preliminary Grading Plan also takes into consideration the proposed grading of the adjacent lands outside the FSS Study Area where plans have been coordinated with adjacent land owners, in order to demonstrate that the proposed grading does not compromise the future developability of these adjacent lands. The grading design will be refined at detailed design, and may reduce cut and fill requirements.

7.13 SWM FACILITY OPERATING CHARACTERISTICS

Pond 30 is proposed within the Subject Lands. The location of the pond is illustrated in **Figure 7.1**. Although the pond location has not changed since the EM1 EIR/FSS, **Figure 7.6** has been updated with the Draft Plan.

The stormwater management pond has been designed in accordance with directions of the NOCSS and the MOE SWM Design Manual, and includes the following features:

Sediment Forebay	 to improve pollutant removal
Permanent Pool and	• to provide water quality control; to satisfy Enhanced Level
Extended Detention Storage	of protection requirements (i.e. 80% TSS removal)
	 to attenuate post development flows from the 25mm rainfall event for a period of 7 days for erosion control
Quantity Control Storage	 to attenuate post development flows to the unit flow release rates as per the NOCSS for the 2 year through 100
	year storms and the Regional event

The drainage area for Pond 30 is generally consistent with that defined in the *EM1 EIR/FSS* (December 2013). A summary of Pond 30 characteristics is presented in Tables 7.15. The unit flow rates were updated as a part of the *EM1 Addendum* (November 2015 as amended July 2017) due to the drainage area exchange. The revised target release rates (outflow) are presented in Table 7.17A along with the Pond 30 inflow/volume characteristics. It should also be noted that no additional drainage from Trafalgar Road has been accounted for in Pond 30.

TABLE 7.15 SUMMARY OF STORMWATER MANAGEMENT FACILITY 30 CHARACTERISTICS¹

Pond	Pond Type	Drainage Area (ha)	lmp. Coverage (%)	Required Permanent Pool Volume (m ³)	Provided Permanent Pool Volume (m ³)	Required Erosion Control Volume (m ³)	Provided Erosion Control Volume (m ³)	Provided Regional Flood Volume (m ³)	SWM Pond Block Area (ha)
Pond 30	Wet Pond	34.76	86	7358	12889	7081	7276	50040	2.24

¹ Refer to **Appendix H-2**

Based on the post-development drainage area for the proposed SWM facility, the storage volumes required to control post-development flows to the target release rates (as provided in Table 7.3 of the *EM1 Addendum*, November 2015) were determined using SWMHYMO for the 2 through 100 year and Regional Storm events. Storage – discharge relationships for Pond 30 were determined through conceptual pond control structure sizing in SWMHYMO. The Pond 30 outlet structure conceptual design has been verified in SWMHYMO to meet NOCSS targets as outlined in Table 7.17. The Pond 30 stage-storage-discharge relationship is included in **Appendix H-2**; with SWMHYMO model files in **Appendix H-3**.

TABLE 7.17A POND 30 INFLOW/VOLUME CHARACTERISTICS

Return Period (Yr)	Area (ha)	Imp. ¹ (%)	Peak Inflow (m³/s)	Target Outflow (m³/s)	Outflow ² (m³/s)	Water Level (m)	Storage Requirements (m³)
2	34.76	86%	4.309	0.174	0.126	168.10	10660
5	34.76	86%	6.492	0.278	0.254	168.30	13370
10	34.76	86%	8.007	0.348	0.309	168.46	15600
25	34.76	86%	10.021	0.452	0.372	168.67	18550
50	34.76	86%	11.633	0.521	0.435	168.80	20450
100	34.76	86%	13.109	0.556	0.516	168.93	22410
Regional	34.76	86%	4.813	1.529	1.515	170.68	50230

¹ Imperviousness value used to size Pond 30 is the average imperviousness calculated from runoff coefficients on Figure 7.3.

² Outflow from Pond 30 provided in Table 7.17 based on SWMHYMO model results.

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The design information presented in this Addendum supports the Pond 30 block size, demonstrates conformance with NOCSS target release rates for Pond 30 in SWMHYMO.

Storm Stacking

Conventional wet storm facilities are generally designed with a 24 hour to 48 hour extended detention drawdown for the 25mm storm event, as required from the MOECC SWMP Design Manual to provide adequate water quality based on the Enhanced protection level. Should a Regional storm event occur within 48 hours of a 25mm storm event for a conventional pond, there will likely be flows that will discharge through the emergency spillway and consequently exceed downstream target release rates.

SWM Pond 30 is designed to release the 25mm storm event over 7.00 days, which increases the risk of stormstacking as the extended detention volumes persist ~5 days longer than a conventional pond. So, the pond has been designed to accommodate storm stacking by adding the Region storm storage volume (e.g. **50,040** m³) to the remaining extended detention storage volume after 2 days of drawdown (e.g. **3,692** m³ of volume at day 5). The resulting water level from the stacked storm is **170.89** m at a total volume of **53,733** m³. The emergency spillway elevation is set above the water level of the stacked storm (e.g. **170.90 m**). The pond berm is set 0.2m above the water level of the emergency spillway. (e.g. **171.10m**). Please see **Appendix H-2** for the SWM Pond 30 drawdown table.

7.13.1 POND DESIGN ELEMENTS

Sediment Forebay

The revised conceptual design of Pond 30 includes one inlet and one sediment forebay in order to improve the pollutant removal by trapping larger particles near the inlet of the pond. The forebay has been designed with a minimum length to width ratio of approximately 2:1 and do not exceed one third of the permanent pool surface area for wet ponds, as required in the *MOE SWMP Design Manual*.

Permanent Pool

The permanent pool is approximately 3 m deep in accordance with the *MNRF Thermal Mitigation Checklist* for Stormwater Management Ponds Discharging into Redside Dace Habitat. Permanent pool sizing is based on *MOE SWMP Design Manual*. Additionally, the permanent pool provides the required equivalent volume of the 10mm storm event stored 1.5 m below the permanent pool surface in keeping with the *MNRF Thermal Mitigation Checklist*. Both of these measures provide thermal mitigation to improve water quality being discharged to the downstream system. It should be noted that per correspondence with the MNRF, there is no evidence Pond 30 is within Redside Dace habitat as described in Section 5.3.1 and per correspondence provided in **Appendix A-1**. At the time of writing this addendum, thermal mitigation measures can be incorporated for the Pond, however if it thermal mitigation measures are deemed not required by the MNRF, a best-efforts approach will be applied with the limit of the Pond block being the governing factor.

The permanent pool has been sized to provide Enhanced Level protection in accordance with the *MOE SWMP Design Manual*. Based on impervious coverage of the contributing drainage area for the wet ponds, the required and provided permanent pool volumes are summarized in the **Table 7.19**.

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TABLE 7.19 SUMMARY OF PERMANENT POOL VOLUMES

Pond I.D.	lmp. (%)	Drainage Area (ha)	Unit Volume ¹ (m³/ha)	Volume Required (m³)	Volume Provided (m³)
Pond 30 ¹	86	34.76	211.6	7358	12889

¹ Unit Volume SWMP Manual Table 3.2 for wet ponds

For three metres (horizontally), slopes of 7:1 (H:V) will be provided on either side of the permanent pool wetted perimeter. Below this level, slopes will be graded at 4:1 (H:V). The main cell of the pond has been designed with a minimum length to width ratio of approximately 3:1.

Extended Detention Storage

The 25 mm extended detention storage requirement was determined by modelling of a 25 mm 4 hour Chicago Storm using Visual OTTHYMO, for the entire EM1 and EM4 catchment, which is released over a 7-day drawdown time. The extended detention and related erosion analysis is provided in the EM1 Addendum. The 25mm extended detention storage and 7-day drawdown time have been provided in Pond 30. Refer to **Appendix H-2** for the revised stage-storage-discharge curve, and draw-down time calculation for the extended detention storage.

Flood Control Storage

The quantity control requirements for the 2-year through to 100-year events will be achieved with active storage depths less the 2.0 m depth recommended by the *MOE SWMP Design Manual* for 100-year flood control storage. The Regional Storm flood control storage will be achieved through the use of ponding depths up to 3.48m above permanent pool.

The depth is summarised in Table 7.20 below for Pond 30 SWM facility.

TABLE 7.20 SWM FACILITY EXTENDED DETENTION / REGIONAL FLOOD CONTROL DESIGN STORAGE DEPTHS

Pond	Design Stora	ge Depths (m)
	Extended Detention	Regional Flood Control
30	0.65	2.83 (3.48m total)

Table 7.22 summarizes the required and proposed stage / volume characteristics for Pond 30.

TABLE 7.22 POND 30 STAGE / VOLUME SUMMARY¹

Pond Component	Design Stage	Total Required Volume (m ³)	Total Provided Volume (m³)			
Permanent Pool	164.20 - 167.20	7,358	12,889			
Extended Detention	167.20 - 167.85	7,081	7,276			
Regional	167.85 - 170.675	N/A	50,230			
¹ Refer to Appendix H-2 (Please note numbers are rounded)						

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Emergency Overflow Weir

The pond design includes an emergency overflow spillway set at a minimum of 0.1m above the predicted Regional Storm elevation. Pond 30 has a Regional Storm water level of approximately 170.675 m and the emergency overflow spillway is set at an elevation of 170.90 m as seen in Table 4 of **Appendix H-2**. At the request of the Town of Oakville, the emergency spillway elevation is set to control the Regional Storm event 48 hours after the 25mm storm event (i.e. storm stacking). The design of the emergency spillway is to be provided at detailed design, and maintain the 0.1m freeboard from the Regional Storm water level. The pond berm is set at 171.10, which is 0.425m above the Regional Storm water level.

Thermal Mitigation

Correspondence with the MNRF stating that there is no evidence Pond 30 is within Redside Dace habitat is previously described in Section 5.2.1 and per correspondence provided in **Appendix A-1**

Nonetheless, we have demonstrated in the conceptual design of Pond 30 that we are able to meet MNRF Thermal Mitigation Checklist recommendations. These design features for Pond 30 include:

- Bottom draw outlet from a deep permanent pool at 3.0m deep
- The average permanent pool depth is 3.0m deep
- Equivalent storage of the 10mm design storm event runoff at a depth greater than 1.5m from permanent pool surface
- A 3.0m shelf around the perimeter of the pond at 0.3m depth for planting. The vegetation that is planted at the permanent pool edge, and below it, provide shading of the shallow water at the perimeter of the pond. The strategy of planting the pond perimeter with emergent aquatic vegetation is intended to shade water that is 0.3 m in depth or less to assist in mitigation of temperature increases of shallow water.

These combined measures will provide thermal mitigation. The Pond 30 design demonstrates these thermal mitigation measures can be provided in the proposed pond block size.

Slope Stability

A slope stability analysis will be completed at detailed design to ensure that the SWM pond berm has been designed adequately to resist uplift pressure from groundwater.

7.13.2 Operations and Maintenance

A detailed operations and maintenance manual for the SWM ponds and related infrastructure will be submitted at the time of detailed design. The operations and maintenance manual will be prepared in conformance with the *Town of Oakville Stormwater Monitoring Program for Ponds located in North Oakville*, and the *MOE SWMP Design Manual*.

The typical operations and maintenance activities for the SWM features and the respective costs are set out in the SWMP Design Manual. Refer to Sections 6.0 of the SWMP Design Manual, Operation, Maintenance and Monitoring, and Section 7.0, Capital and Operational Costs for additional details.

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A water balance assessment was prepared as part of the EM1 EIR/FSS (December 2013 as amended July 2015) to understand potential land development impacts on the groundwater conditions within the EIR Subcatchment Area. The water balance analysis determined the pre-development recharge volumes for the 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 plan. Section 8.0 of the EM1 EIR/FSS (December 2013 as amended July 2015) does not change as a result of the new Green Ginger Phase 2 draft plan. As such, refer to the EM1 EIR/FSS (December 2013 as amended July 2015) for the water balance analysis. The EM1 Addendum (November 2015 as amended July 2017) updated Section 8.7.1 to further discuss the use of LIDs. The revised Section 8.7.1 speaks to the LID measures that are anticipated to be utilized in the Green Ginger Phase 2 lands. Refer to Section 8.7.1 in the EM1 Addendum (November 2015 as amended July 2017).

9.0 POTENTIAL IMPACTS AND MITIGATION MEASURES

Section 9.0 of the EM1 EIR/FSS (December 2013 as amended July 2015) discusses the assessment of potential impacts of the proposed draft plan on the features and function of Core Area 9 and the Linkage. Sections 9.1 through 9.4 remain valid and unchanged.

9.5 DRAINAGE AREA EXCHANGE

The Drainage Area Exchange Report (Final DAE Report, January 2017) and EM1 EIR/FSS Addendum (July 2017) were approved and as a result this section remains unchanged. The flooding, erosion, and water balance impacts will be updated below based on the Green Ginger Phase 2 subdivision design.

9.5.1 IMPACTS ON FLOODING

The East Morrison Creek watershed GAWSER model is being updated to confirm that target peak flow rates are maintained at Dundas Street. Final GAWSER modelling results will be submitted for agency review in a subsequent package.

9.5.2 IMPACTS ON EROSION

The East Morrison Creek watershed QUALHYMO model is being updated to confirm that erosion results within East Morrison are acceptable. Final QUALHYMO modelling will be submitted for agency review in a subsequent package.

9.5.3 IMPACTS ON WETLANDS

The wetland impact assessment is being completed to analyze the impact on PSW 17 and PSW 74 in conformance with methods outlined in the *Proposed Approach for Wetland Water Balance Assessment* (Geo Morphix, May 2023). Final PSW 17 and 74 impact assessment will be submitted for agency review in a subsequent package.

Conservation Halton staff agreed on the wetland impact assessment methods outlined in the *Proposed Approach for Wetland Water Balance Assessment* (Geo Morphix, May 2023) via email on June 1, 2023, and provided in Appendix H-6.

10.0 WASTEWATER AND WATER SERVICING

Section 10.0 in the EM1 EIR/FSS (December 2013 as amended July 2015) provides information related to the Area Servicing Plan for North Oakville East, wastewater servicing, and water servicing for the FSS Study Area. The overall wastewater and water servicing figures have been updated from the EM1 EIR/FSS (December 2013 as amended July 2015), as Figure 10.1 and 10.5 respectively, to reflect the updated draft plan. The Green Ginger Phase 2 internal wastewater and water servicing has been depicted in Figures 10.2A and 10.5A, respectively. The remainder of figures remain unchanged and reference should be made to the EM1 Addendum (November 2015 as amended July 2017) for these figures.

10.1 AREA SERVICING PLAN

In 2011, MMM group prepared an Area Servicing Plan (ASP) for the North Oakville East Secondary Plan Area on behalf of the NOCBI landowners. The ASP included a proposed servicing plan for the Sixth Line and Trafalgar Road trunk sewers, which discharge to Dundas Street through the Green Ginger Phase 1 subdivision. The ASP estimated a population of 8,230 persons from the Sixth Line Sewer (Node 3-G to 3-H) and a population of 24,673 persons from the Trafalgar Road Sewer (Node 3-D to 3-H – through the Green Ginger Phase 2 lands). The ASP accounted for a total population of 34,114 persons through the Green Ginger Phase 1 trunk sewer (Node 3-H to 3-I).

10.2 WASTEWATER SERVICING

10.2.1 Wastewater Design Criteria

Wastewater infrastructure will generally be designed in accordance with the latest Region design standards and specifications. Through the detailed design of subdivisions and site plans in North Oakville, particularly Dundas Urban Core (DUC) blocks, it has been found that these medium and high-density blocks have generally been approved and constructed with populations in excess of the Region's Linear Design Manual density (285 person / hectare). Through draft plan feedback from the Town of Oakville our understanding is that developments are strongly encouraged to provide increased density within draft plans, and that there is potential for increasing high-rise developments along the Trafalgar Urban Core (TUC). As such a population density of 500 persons/ hectare has been assumed for the TUC blocks tributary to the Trafalgar Road trunk sewer.

10.2.2 Existing Wastewater Services

The existing wastewater sewers near the FSS study area include the sewers located within constructed subdivisions Green Ginger Phase 1, Petgor Phase 2 as well as sanitary sewers on Dundas Street. As noted in Section 10.1, the ASP was designed such that flows from the Trafalgar Road trunk Sewer (including the Green Ginger Phase 2 lands) would be conveyed through the Green Ginger Phase 1 lands to Dundas Street. The trunk sewer within the Green Ginger phase 1 lands was designed and approved in 2014 based on the applicable Region's standards using the latest draft plan information for Green Ginger Phase 1 and the latest available information for external lands. As such, the existing sanitary sewer within the Green Ginger Phase 1 lands is 675mm, discharging to the existing 900mm sanitary sewer on Dundas Street.

As a result of the potential increased density noted in Section 10.2.1, a preliminary sanitary capacity check was completed for the existing sanitary sewer system downstream of the Green Ginger Phase 2 lands (i.e. through Green Ginger Phase 1 to Dundas Street). The majority of the lands tributary to the Sixth Line sewer have been constructed

or are in the process of being constructed. Through draft plan approvals (by others) of these lands, the actual populations in the Sixth Line sewer (Node 3-G to 3-H) have increased by approximately 8,000 people. This has resulted in downstream sanitary sewer legs near 99% capacity (assuming lands tributary to the Trafalgar Road trunk sewer remain at ASP populations).

The impact of these potential increases in population to the Trafalgar Road trunk sewer, and potential solutions, are discussed further in 10.2.4 and 10.2.5.

10.2.3 External Wastewater Requirements

As discussed in Section 10.1, the ASP envisioned a sanitary trunk sewer from Trafalgar Road, routed through Green Ginger Phase 1 subdivision, that discharges to the existing sanitary trunk on Dundas.

10.2.4 Proposed Wastewater Servicing

Green Ginger Phase 2 (FSS study lands) will be serviced via a series of local sanitary sewers generally flowing from the north FSS study limits (Marvin Avenue), to the south FSS study limits (Wheatboom Drive). The proposed wastewater servicing is presented on Figure 10.2A.

10.2.5 <u>Trafalgar Road Trunk Sewer</u>

As discussed in Section 10.2.1 there is potential for a large population increase of the Trafalgar Urban Core (TUC) lands. The sanitary capacity constraints of the Trafalgar Road trunk sewer, and downstream sanitary trunk sewers, were identified to the Region of Halton through correspondence dated January 25, 2022.

DSEL has identified that increased densities within future TUC blocks will result in flows that are in excess of the downstream sewer capacity. The Region of Halton has advised that alternative sanitary solutions for future development will not be investigated, and that the Trafalgar Road sanitary trunk sewer will be designed and constructed per the ASP.

10.3 WATER SERVICING

10.3.1 <u>Water Design Criteria</u>

Due to the potential increase in density of the Trafalgar Urban Core (TUC) blocks as described in Section 10.2.1, a watermain analysis will be required at detailed design. This analysis will further evaluate serviceability to the subject lands, refine the proposed watermain sizes, and determine whether all the creek crossings for the watermain are required.

The conceptual watermain servicing for the Green Ginger Phase 2 lands is presented on Figure 10.5.

11.0 ROADS

Roads were assessed and evaluated in detail in the North Oakville Main East Morrison Creek EM1 EIR/FSS (December 2013 as amended July 2015). The majority of the information in Section 11 remains valid. Sections 11.0 and 11.1 were been modified in the EM1 EIR/FSS Addendum (November 2015 as amended July 2017) to reflect removal of one road crossing of the NHS linkage. These sections have been replicated below.

11.1.1 ROAD CROSSING LOCATIONS

Road crossing locations of East Morrison Creek are all shown on the Green Ginger Draft Plan (Figure 6.2). The locations shown generally follow the layout from the Master Plan, with the exception of one crossing location at Street A being removed as noted in Section 11. There are three crossings through the Linkage:

- Wheat Boom Drive is the first road crossing north of Dundas and is a minor arterial road over a high-constraint (Red) stream;
- Threshing Mill Boulevard is a collector road over a medium-constraint (Blue) stream where the existing channel will be re-aligned;
- Marvin Avenue is a collector road through the Linkage where the proposed re-aligned stream will terminate immediately to the south of the Street.

11.1.2 RECOMMENDED CREEK CROSSING SIZING

The proposed crossings of East Morrison Creek at Wheat Boom Drive, Threshing Mill Boulevard and Marvin Avenue have been designed in accordance with requirements of OPA 272 and NOCSS, including the assessment of fluvial geomorphologic, hydraulic and wildlife passage factors. The opening sizes for the crossings were governed by the factor that resulted in the largest required opening size. While all factors were assessed, fluvial geomorphology governed the opening width for two of the three creek crossings while wildlife passage governed for Marvin Avenue. On this basis, the opening of crossings for Wheat Boom Drive and Threshing Mill Boulevard will have an opening width of 8.54 m, (three times bankfull width). Site grading will permit for a consistent 2.74 m height for these two crossings to facilitate wildlife passage. Marvin Avenue is at the upstream end of the re-aligned channel and thus a height of 1.52 m is provided to facilitate wildlife passage as well as a width of 2.44 m. Recommended designs are summarized in Table 11.1.

Crossing	Width (m)	Height (m)	Length (m)	Downstream Invert (m)	Upstream Invert (m)	Top of Road Elevation (m)
Wheat Boom Drive	8.54	2.74	27	167.50	167.75	171.70
Threshing Mill Boulevard	8.54	2.74	28.5	170.13	170.23	174.70
Marvin Avenue	8.54	1.52	20	172.30	172.43	177.12

Table 11.1: Design Recommendation for East Morrison Creek Street Crossings

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Plan view and cross sections for each of the road crossings are shown in Figures 11.1 – 11.8 of the EM1 EIR/FSS. The design considerations that led to these recommendations are summarized in the following sections.

11.1.3 ROAD CROSSING FLUVIAL GEOMORPHOLOGY DESIGN REQUIREMENTS

Culvert crossings are proposed over an existing section of East Morrison Creek and over sections that will be reconstructed using principles of natural channel design. Culvert sizing needs to consider the requirements for hydraulics, aquatic and terrestrial passage, and fluvial geomorphology. Fluvial geomorphology considerations are required to: 1) prevent an erosion hazard, 2) maintain channel function for the transport of water and sediment, and 3) to enhance fish habitat.

The Threshing Mill Boulevard crossing occurs over a section of channel that will be reconstructed using natural channel design principles. The Wheat Boom Drive crossing occurs over a section of existing channel. Marvin Avenue crosses the corridor at the upstream end of the re-aligned creek. As there is no defined channel through or upstream of Marvin Avenue, there are no geomorphic considerations for this crossing and the crossing size should be based on the requirements of the other disciplines.

The following recommendations are made with respect to crossing location and size from a fluvial geomorphic perspective. In the case where the crossing is over an existing channel, the crossing site selection should follow these recommendations. In the cases where the crossing is over a designed channel, aspects of the channel planform should be designed to accommodate these criteria.

- The crossings should be over a straight section of channel, where possible.
- The crossings should be perpendicular to the channel, where possible.
- The channel designs associated with the crossings should assure that there are no large or sharp meander bends immediately upstream of the crossings.
- All crossings should be open bottomed. Open bottom crossings do not restrict sediment transport processes and natural adjustments to channel inverts. They also reduce development of scour pools which often form downstream of closed bottom culverts. Scour pools can lead to development of elevated culverts which block fish passage and fragment channel function.
- To accommodate limited adjustment of the channel, at a minimum, crossing width should be three times the bankfull channel width. This will account for some migration of the channel.
- A low flow channel should be defined through the crossing to maintain fish passage. Low flow channel banks in fine sediments are normally stabilized by vegetation. In long crossings there is potential for low light penetration limiting establishment of vegetation. Without this vegetation the channel will be unstable and flow will spread over the width of the culvert. In these cases, a constructed low flow channel may be required to maintain fish passage.

In the case of designed channels, aggressive bioengineering should be used to direct the channel towards the center of the culvert. This provides a habitat complementary method to train the channel and limit potential hazards.

Recommended minimum crossing width to account for fluvial geomorphology for each of the streets is given below.

- Wheat Boom Drive: Existing bankfull width is 1.75 m. Crossing width: 1.75 m x 3 = 5.25 m
- Threshing Mill Boulevard: Designed channel bankfull width is 2.85 m. Crossing width: 2.85 m x 3 = 8.55 m
- Marvin Avenue: No defined channel at this location. Crossing sizing will need to consider requirements of the other disciplines.

11.1.4 ROAD CROSSING REQUIREMENTS FOR WILDLIFE

As identified in Section 3.6 of the EIR/FSS Terms of Reference, road design within the NHS should minimize impacts on ecopassage to the best extent possible. Passage functions that are addressed in design through the linkage are both terrestrial and aquatic. For Wheat Boom Drive and Threshing Mill Boulevard road design has considered the movement and passage of fish associated with East Morrison Creek, as well as terrestrial wildlife, i.e. mammals. For the Marvin Avenue crossing of the linkage, only terrestrial wildlife passage was considered.

For fish movement within the creek corridor, primary design consideration was a culvert width that spanned three times the bank full width while maintaining an open bottom culvert. These design considerations resulted in the need for an 8.54 m wide arch-culverts for Wheat Boom Drive and Threshing Mill Boulevard. The second consideration was the culvert length, with a shorter length design being preferred. For the design, culvert length is primarily driven by other road design requirements; however to the extent possible culvert length was shortened by grading at the culvert location and design of the parapet wall and wing retaining walls. As a result of these design considerations, culvert length was reduced to between 27 m and 28.5 m, for road crossings that have an overall footprint width of 50 m. The final consideration was culvert height. Though culvert height is not directly critical for fish movement within a creek, culvert height can influence the length of culvert that is "day lighted". For the culvert design, culvert height of 2.74 m was identified for Wheat Boom Drive and Threshing Mill Boulevard. This relatively high arch-culvert design promotes the day lighting of a significant length of the upstream and downstream ends of the culvert. In addition, placement of substrate through the length of the culvert will be detailed in detailed design to promote fish passage.

For the passage of terrestrial wildlife at road crossings within the linkage, factors that were considered in the culvert and road design to meet wildlife requirements included:

- Passage through the linkage by urban tolerant large mammals (i.e. deer) at road crossings would occur over the road crossing;
- Passage by small urban tolerant small mammals (i.e. raccoon, skunk, voles etc.) through the linkage would be under the road crossing via culverts located at road creek crossings;
- Passage by amphibians and reptiles would be under the road crossing via culverts located at road creek crossings; and
- Town of Oakville road design standards are the primary factors to be addressed in the development of road design. For the passage of large mammals through the linkage over roads at the road crossings, primary road design features were developed included the following:
- The focus of passage within the linkage to occur in the creek floodplain at culvert crossings;
- Road side grading at culvert crossing to have a maximum slope of 4:1 (H:V) from the valley floor to the road platform except at Wheat Boom Drive where to reduce grading into PSW 3 to 1 slopes will be used; and,
- Narrowing of sidewalks at culvert crossing.

For passage of small mammals, amphibians and reptiles under the road crossing via the culvert the primary design features were developed for promoting fish passage, i.e. culvert, length, width and height for Wheat Boom Drive and Threshing Mill Boulevard. For these crossings during low flow conditions, much of the culvert will be dry and thus provide a width of 2 m or more along the creek bank. For the culvert at Marvin Avenue, the entire 2.44 m width would be dry during low flow conditions.

Culvert designs which address passage by small mammals typically require a physical opening of 1.5 m X 1.5 m, and smaller dimensions for amphibians and reptiles. For the urban tolerant small mammals that can be expected to utilize the linkage corridor, many, such as raccoon, skunk, rabbit, can be expected to cross over the roads and movement through the culverts by mammals can be expected to occur for smaller species such as voles and shrews.

The 'Openness Index' for culverts planned for wildlife use is a general guide that can be used to determine if a culvert will provide some level of passage function. The formula is the width of culvert multiplied by the culvert height, with the product divided by the length of the culvert. Index values near the value of 1 are considered adequate for promoting passage by many mammal species. For Wheat Boom Drive and Threshing Mill Boulevard, the culverts have a length of 27 m to 28.5 m, width of 8.54 m and height of 2.74 m, resulting in an openness index of 0.82 and 0.87, respectively, and is therefore considered adequate for small species of mammals, snakes and amphibians that can be expected to cross the roads through the culverts. For the Marvin Avenue crossing, the culvert is 20.0 m in length, has a width of 2.44 m and height of 1.52 m, resulting in an Open Index of 0.19. Though this value is at the lower end of what is considered functional for most mammals, the value is acceptable for use of the culvert by the small mammals that can be expected to utilize the linkage corridor. It is recommended that an open grate manhole cover be used in the manhole at the confluence of the clean water sewer from the woodlot and this culvert. This will provide a source of light to the middle of the culvert.

Based on the above, to the extent possible, design mitigation features have been developed to mitigate impacts of the aquatic and terrestrial corridor function of the Linkage. Other features, such as post construction vegetation plans that will naturalize the areas where road crossings occur, will also mitigate the impacts to the corridor function of the linkage lands.

11.1.5 ROAD CROSSING HYDRAULIC DESIGN REQUIREMENTS

Hydraulically, the proposed creek crossings were analyzed with HEC-RAS. The recommended culvert sizes based on fluvial geomorphologic and wildlife passage requirements were found to be more than adequate to accommodate future flows. Under future conditions for the Regional Storm flows, the water levels on the upstream side of the crossings were found to be 3.2 m and 3.1 m below the top of road for Wheat Boom Drive and Threshing Mill Boulevard, respectively. Appendix D includes the HEC-RAS model which incorporates the proposed road crossing sizes.

12.0 CONSTRUCTION PRACTICES

Section 12.0 in the EM1 EIR/FSS (December 2013 as amended July 2015) provides information related to Key Geotechnical Findings, Erosion and Sediment Control, Construction Phasing, Dewatering Requirements, Construction Below Water Table, Private Wells, Well Decommissioning and Topsoil Reuse. This information remains unchanged as a result of the revisions to the Green Ginger Phase 2 Draft Plan. Refer to the EM1 EIR/FSS (December 2013 as amended July 2015) for Section 12.0.

13.0 MONITORING PROGRAM

Section 13.0 in the EM1 EIR/FSS (December 2013 as amended July 2015) outlines the OPA 272 Monitoring Requirements, the NOCSS Monitoring Requirements and the Proposed Monitoring. The information related to the OPA 272 and NOCSS monitoring requirements remain unchanged as a result of the revised Green Ginger Phase 2 draft plan. Refer to the EM1 EIR/FSS (December 2013 as amended July 2015) for Sections 13.1 and 13.2. With respect to the proposed monitoring, outlined in Section 13.3, there were minor changes and adjustments to the proposed program as a part of the EM1 Addendum dated November 2015 as amended July 2017. Refer to the EM1 Addendum (November 2015 as amended July 2017) for the revised Section 13.3.