Draft: January 12, 2022
Revised Draft: March 2, 2022
CT3058.00

Bridge Brook Corporation,
7681 Highway 27, Unit #16
Woodbridge, ON L4L 4M5

Attention: John Spina,

Re: Lake Simcoe Region Conservation Authority Comments – Hydrogeological Investigation, Water Balance, and Catchment-Based Water Balance
7370 Centre Road, Uxbridge, Ontario

Dear Mr. Spina:

Terrapex Environmental Ltd. (Terrapex) is pleased to submit this letter summarizing additional information requested by the Lake Simcoe Region Conservation Authority (LSRCA) as part of comments received, dated August 18, 2021. The comments provided to Terrapex were directed toward the report completed by Beacon Environmental Ltd. (*Hydrogeological Investigation, Water Balance, and Catchment-Based Water Balance – 7370 Centre Road, Uxbridge, Ontario* released in February of 2021).

Consultation toward the comments was carried out as a conference call with LSRCA, and Shelly Cuddy in attendance on August 31, 2021. As indicated in the appended matrix responses (as amended, originally released September 13, 2021), the LSRCA deferred several comments that rely upon the release of detailed design plans, including: H1, H4, H5, H6, H9, H12, H13, and NH4, below.

The following addresses additional information requested as part of Comments H2, H7, H8, H10, and H11. Additional hydrogeological comment are provided upon request for Comments NH1, NH3, and NH4.

H2

Please provide geological cross section(s), including elevations of grades and groundwater levels across the site.

Response:

Please find the appended cross sections.

H7

a) The source and period of record of the climate data used and why it varies from the annual average for the subwatershed;

The report (Beacon, 2021) sources historical Environment Canada data available for Uxbridge West weather station located approximately 5 km northeast of the subject property, using an average of three years (2018 through 2020) for the estimates. Precipitation volumes were used from 2015, 2016, 2017, 2018, 2019, and 2020 to compensate for incomplete datasets from the weather station.

b) Source of ET or how it was calculated/determined;

The report calculates the evapotranspiration using the Penman-Monteith Evapotranspiration (FAO-56 Method). Local solar radiation, incoming solar radiation, sunset hour angles, and solar declination conditions were sourced from the National Aeronautical and Space Administration Langley Research Center (NASA 2018) to estimate the monthly site-specific evapotranspiration rate.

c) Rate of precipitation (i.e. mm/yr.);

Based on the information sources above, the rates of precipitation (mm/month/m2 and mm/year/m2) are as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	YEAR
60.2	55.6	40.7	129.7	80.8	42.4	78.6	79.1	22.2	75.6	85.1	67.1	597.2

d) Rate of ET (mm/yr.) based on each land use type (e.g. SWM pond, forest, grass, impervious areas);

Evapotranspiration is calculated by the footprint and global position of the area, and is not based on land use (except perhaps albedo), in accordance with the Penman-Monteith Evapotranspiration (FAO-56 Method). The sources above provided the following variables to determine the ET/m2:

Mean Daily Temperature
Incoming Solar Radiation
Local Albedo (includes variation for snow months)
Wind Speed
Atmospheric Pressure
Actual Vapour Pressure
Solar declination
Sunset hour angle
Extraterrestrial Radiation

Clear Sky Solar Radiation
Net shortwave solar radiation
Net outgoing long-wave radiation

The estimated rate of evapotranspiration (mm/month/m^2) for each month as follows:

Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**YEAR**
29.2	29.1	58.5	61.6	79.6	103.5	120.2	106.0	41.0	48.9	33.5	20.2	731.3

e) Annual surplus (mm/yr.) based on each land use type

There are actually three answers for this question, because of the way it is calculated. The following are included below, for completeness:

a) Total run-off, including snowmelt surplus from the previous month
b) Total run-off, including snowmelt surplus from the previous month, and with frozen snow held until the next month
c) Total run-off, with no consideration for stored surplus

For the purposes of the water balance estimates, the three estimate parameters provide a range where: a) is most conservative, b) is most 'realistic', and c) is most simplistic.

a) Total run-off, including snowmelt surplus from the previous month:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo	m^3/mo
Catchment 201	22,915	27,426	25,863	43,626	24,618	6,384	11,840	11,905	3,343	11,375	15,393	18,329
FOD4-A	40	38	0	66	7	0	0	0	0	0	45	47
MAS2-1 and SWT-2	44	42	0	73	7	0	0	0	0	0	49	53
Catchment 202	583	629	323	1,053	376	80	148	149	42	142	493	561
FODs	140	135	0	240	32	0	0	0	0	0	142	157
Catchment 203 (Wet SMP)	1,398	1,656	1,494	2,649	1,440	369	684	688	193	766	965	1,142
Catchment 204	3,849	4,615	4,382	7,334	4,164	1,082	2,006	2,017	566	1,927	2,574	3,068
Catchment 205 (Dry SMP)	376	445	399	712	385	99	183	184	52	176	260	308
Catchment 208	146	173	153	277	148	38	70	71	20	67	102	120
NHS (marsh and swamp)	193	186	0	331	44	0	0	0	0	0	196	216
NHS (FODs)	445	420	0	733	74	0	0	0	0	0	498	530
Total	**30,129**	**35,764**	**32,616**	**57,093**	**31,295**	**8,051**	**14,931**	**15,013**	**4,215**	**14,454**	**20,716**	**24,531**

b) Total run-off, including snowmelt surplus from the previous month, and with frozen snow held until the next month:

	Jan m^3/mo	Feb m^3/mo	Mar m^3/mo	Apr m^3/mo	May m^3/mo	Jun m^3/mo	Jul m^3/mo	Aug m^3/mo	Sep m^3/mo	Oct m^3/mo	Nov m^3/mo	Dec m^3/mo
Catchment 201	4,248	5,746	10,273	30,442	24,618	6,384	11,840	11,905	3,343	10,843	8,928	4,939
FOD4-A	7	8	0	46	7	0	0	0	0	0	26	13
MAS2-1 and SWT-2	8	9	0	51	7	0	0	0	0	0	29	14
Catchment 202	108	132	128	735	376	80	148	149	42	135	286	151
FODs	26	28	0	167	32	0	0	0	0	0	82	42
Catchment 203 (Wet SMP)	259	347	594	1,849	1,440	369	684	688	193	730	559	308
Catchment 204	714	967	1,741	5,118	4,164	1,082	2,006	2,017	566	1,837	1,493	827
Catchment 205 (Dry SMP)	70	93	159	497	385	99	183	184	52	167	151	83
Catchment 208	27	36	61	193	148	38	70	71	20	64	59	32
NHS (marsh and swamp)	36	39	0	231	44	0	0	0	0	0	113	58
NHS (FODs)	82	88	0	511	74	0	0	0	0	0	289	143
Total	**5,585**	**7,493**	**12,955**	**39,838**	**31,295**	**8,051**	**14,931**	**15,013**	**4,215**	**13,778**	**12,015**	**6,610**

c) Total run-off, with no consideration for stored surplus:

	Jan m^3/mo	Feb m^3/mo	Mar m^3/mo	Apr m^3/mo	May m^3/mo	Jun m^3/mo	Jul m^3/mo	Aug m^3/mo	Sep m^3/mo	Oct m^3/mo	Nov m^3/mo	Dec m^3/mo
Catchment 201	1,959	2,052	2,434	15,314	12,166	6,384	11,840	11,905	3,343	10,843	8,928	3,343
FOD4-A	5	5	0	29	0	0	0	0	0	0	26	11
MAS2-1 and SWT-2	5	6	0	32	0	0	0	0	0	0	29	12
Catchment 202	57	60	30	388	152	80	148	149	42	135	286	114
FODs	15	16	0	93	0	0	0	0	0	0	82	34
Catchment 203 (Wet SMP)	121	127	141	994	703	369	684	688	193	730	559	211
Catchment 204	328	344	412	2,573	2,061	1,082	2,006	2,017	566	1,837	1,493	558
Catchment 205 (Dry SMP)	33	34	38	251	188	99	183	184	52	167	151	57
Catchment 208	13	13	14	98	72	38	70	71	20	64	59	22
NHS (marsh and swamp)	21	23	0	128	0	0	0	0	0	0	113	47
NHS (FODs)	54	58	0	326	0	0	0	0	0	0	289	120
Total	**2,611**	**2,739**	**3,070**	**20,225**	**15,342**	**8,051**	**14,931**	**15,013**	**4,215**	**13,778**	**12,015**	**4,530**

H8

It appears these areas maybe based on a figure in another report (Beacon, 2020) which is not include here, therefore it is unclear how each land use type corresponds to the subject site.

Please provide a pre- development figure clearly indicating all land use types used within the water balance assessments.

Response:

Please find the appended figure from Beacon, 2020.

H10

It was noted that infiltration factors of 0.5 and 0.6 were used within the assessment however it is unclear which areas they correspond to and if the same factors were applied to both pre- and post-development conditions. Please provide a breakdown of pre- and post-development areas in which the infiltration factors correspond to.

The infiltration factors used in the pre- development conditions are indicated in the following table:

Pre-Development Catchment Land Use	**General Topography** (A)	**Soil Classification** (B)	**Cover Factor** (C)	**Infiltration Factor** (A+B+C)
Principle Area – (corn fields)	0.2	0.2	0.1	0.5
Mature Forest Areas (areas defined as FOD 1)	0.2	0.2	0.2	0.6
Marshes and Swamp Areas (areas defined as MAS2-1 1 and SWT-2 1)	0.2	0.2	0.1	0.5
Driveway (4 metres wide by 732 metres long)	-	-	-	-

The infiltration factors used in the post- development conditions are indicated in the following table:

Proposed Land Uses [1, 2]	**General Topography** (A)	**Soil Classification** (B)	**Cover Factor** (C)	**Infiltration Factor** (A+B+C)
Catchment 201	0.2	0.2	0.1	0.5
FOD4-A	0.2	0.2	0.2	0.6
MAS2-1 and SWT-2	0.2	0.2	0.1	0.5
Catchment 202	0.2	0.2	0.1	0.5
FODs	0.2	0.2	0.2	0.6
Catchment 203 (Wet SMP)	0.2	0.2	0.1	0.5
Catchment 204	0.2	0.2	0.1	0.5
Catchment 205 (Dry SMP)	0.2	0.2	0.1	0.5
Catchment 208	0.2	0.2	0.1	0.5
NHS (marsh and swamp)	0.2	0.2	0.1	0.5
NHS (FODs)	0.2	0.2	0.2	0.6

H11

The post-development water balance results reported in Table 8 do not match the table within the appendix. Please amend as appropriate.

Table 8 (Beacon, 2021), referring to the Global Site-Specific Water Balance should read as follows, as indicated in **Appendix D** of the same report.

Component	**Pre-Development Conditions**	**Post-Development Conditions**	
	(m^3 per annum)	(m^3 per annum)	**Relative Difference from Pre-Development** (m^3 per annum)
(P) Precipitation	329,905	329,905	no change
(ET) Evapotranspiration	292,285	150,568	-141,717
(Q_G) Infiltration	60,883	31,668	-29,215
(Q_S) Run-off	59,532	258,987	+199,455

Additional comments:

Comment on the following additional items was requested, and are limited to a hydrogeological point of view.

NH1

Section 8.5
As per Policy 2.3.15 in the Durham Regional Official Plan (Durham OP), development and site alteration are not permitted in key natural heritage and/or hydrologic features and their associated vegetation protection zones except for the listed exceptions.

Similarly, Policy 2.3.3.3.iii.a) in the Township of Uxbridge Official Plan (Uxbridge OP), does not permit development in key natural heritage and/or hydrologic features.

As per the Durham OP and Uxbridge OP, key natural heritage features include significant habitat of endangered species, fish habitat, wetlands, significant woodlands and significant wildlife habitat, and key hydrologic features include permanent and intermittent streams, wetlands, seepage areas and springs.

Please revise the site plan to ensure all development and site alteration (including grading) is located outside the key natural heritage features, key hydrologic features, and their associated buffers on the subject property, such as the on-site wetland communities (MAM2-10, SWT2-5, MAS2-1, SWT2-2), intermittent streams (headwater drainage feature (HDF) 1, 2 and 4), and the buffers to the significant woodland, wetlands, and watercourses.

Headwater drainage features are generally defined as “non-permanently flowing drainage features that may not have defined bed or banks; they are first-order and zero-order intermittent and ephemeral channels, swales and connected headwater wetlands, but do not include rills or furrows.” (TRCA,2014)

It is provided in the Wetland Function Assessment (WFA) carried out by Terrapex (2020), that features HDF2 through HDF4 are interpreted to not be influenced by groundwater, and as such, any water found in these features would be required to come from surface water sources. In contrast, HDF1 is understood to have groundwater influence, which may be permanent, and not ephemeral or intermittent. It is posited that this may remove this feature from the definition of an HDF, as provided above.

NH3

Section 6, Table 5
Please confirm whether a seep feature is present in the southwestern portion of the subject property, north of the houses on Galloway Cres. Photos of this area need to be submitted to the LSRCA or a site visit with the LSRCA should be scheduled to confirm the presence/absence of this key hydrologic feature.

The location indicated in the question is relatively proximal to the feature designated HDF1. It is provided in the Wetland Function Assessment (WFA) carried out by Terrapex (2020), that no groundwater seepage was observed on the subject property during site visits. As indicated in that report, groundwater in that area has an upward vertical gradient.

NH4

Section 7.4
As per Comment #NH1 above, wetlands, intermittent streams and seeps are considered key hydrologic features under the Durham OP and Uxbridge OP.

Please update the site plan and associated catchment-based water balance to ensure the existing hydrologic inputs supporting these sensitive hydrologic features are maintained post-development.

As discussed in the conference call with the LSRCA (August 31, 2021), further updates to the catchment-based water balance will be provided with the forthcoming detailed designs. As indicated in the above comment, a catchment-based water balance will be provided for HDF1 through HDF4.

Sincerely,

Terrapex Environmental Ltd.

DRAFT

Zen Keizars, P.Geo., FGC
Senior Hydrogeologist

Appended:

H2 - Cross-sections
H8 - Matrix Response
Matrix Response Document

Site Location	Figure 1
7370 Centre Road Uxbridge	
BEACON ENVIRONMENTAL	Project: 217431 Last Revised: September, 2020
Client: Mediterra Corp.	Prepared by: BD Checked by: JM
N 1:8,100	Inset Map:1:50,000

C:\Dropbox\Dropbox (Beacon)\All GIS Projects\2017\217431 7370 Centre Road Uxbridge EIS\MXD\2020-09-02_Figure01_SiteLocation_217431.mxd

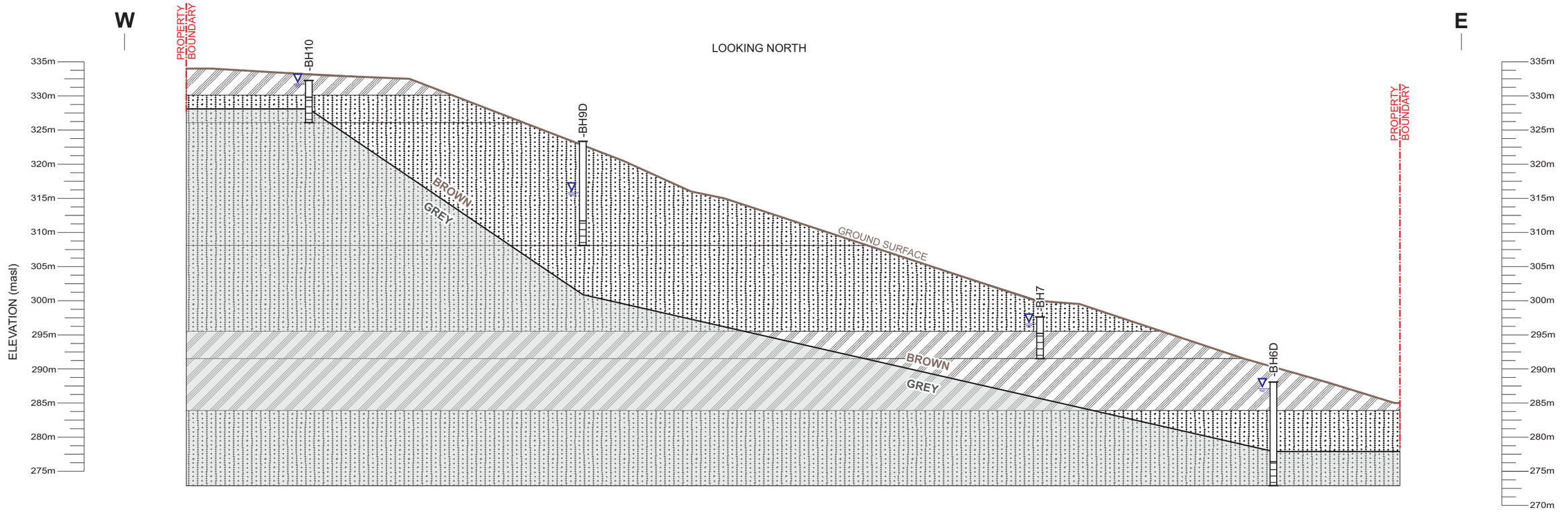
TERRAPEX

CROSS SECTION A-A' (WEST TO EAST)

7370 CENTRE ROAD
UXBRIDGE, ONTARIO

CLIENT

BRIDGE BROOK CORPORATION



LEGEND

- SILTY CLAY
- SILTY SAND
- MW104 - MONITORING WELL DESIGNATION
- STATIC WATER LEVEL- (March 16, 2020)
- SCREENED ZONE
- BOREHOLE

HORIZONTAL SCALE:

0 50m 100m

(APPROXIMATE)

PROJECT #	*CT3058.00*
SCALE	*AS SHOWN*
DATE	*AUGUST 2021*
DRAWN	*SW*
CHECKED	
DRAWING #	*FIGURE 5*

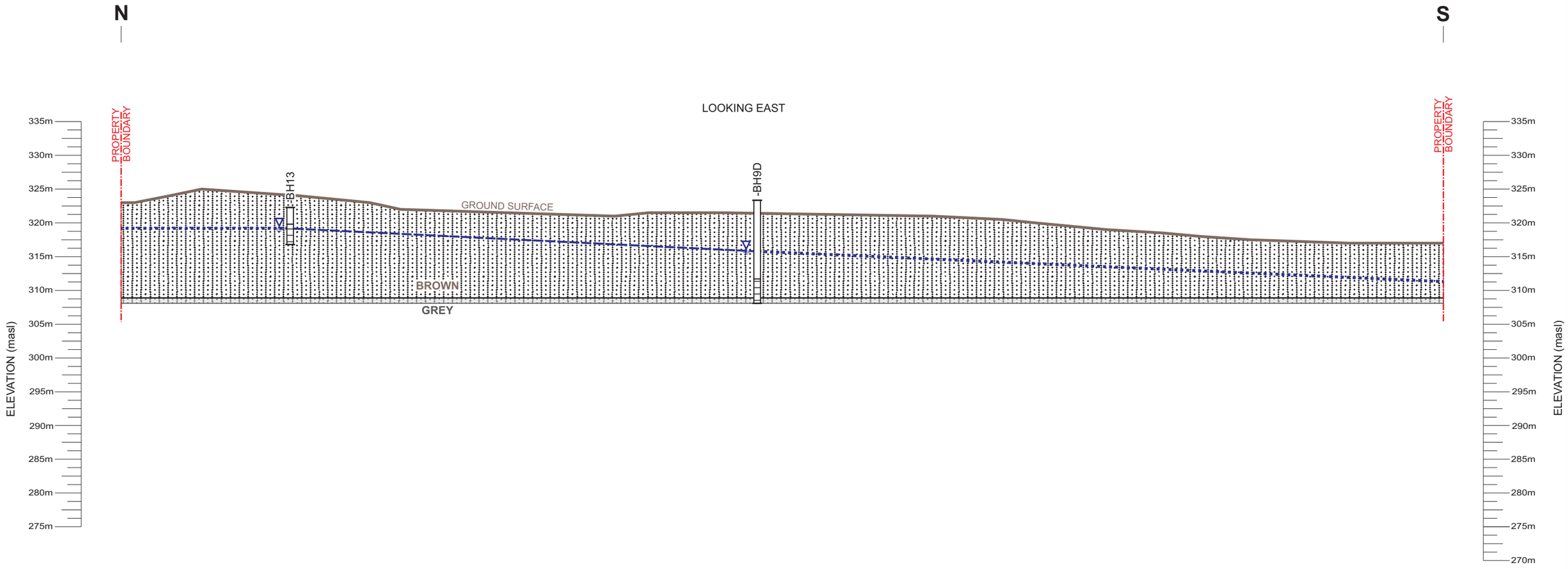
TERRAPEX

CROSS SECTION B1-B1' (NORTH TO SOUTH)

7370 CENTRE ROAD
UXBRIDGE, ONTARIO

CLIENT

BRIDGE BROOK CORPORATION



LEGEND

- SILTY CLAY
- EXTRAPOLATED GROUNDWATER LEVEL
- INTERPOLATED GROUNDWATER LEVEL
- STATIC WATER LEVEL- (March 16, 2020)
- MW104 - MONITORING WELL DESIGNATION
- SCREENED ZONE
- BOREHOLE

HORIZONTAL SCALE:

0 25m 50m

(APPROXIMATE)

PROJECT #	*CT3058.00*
SCALE	*AS SHOWN*
DATE	*OCTOBER 2021*
DRAWN	*SW*
CHECKED	
DRAWING #	*FIGURE 6*

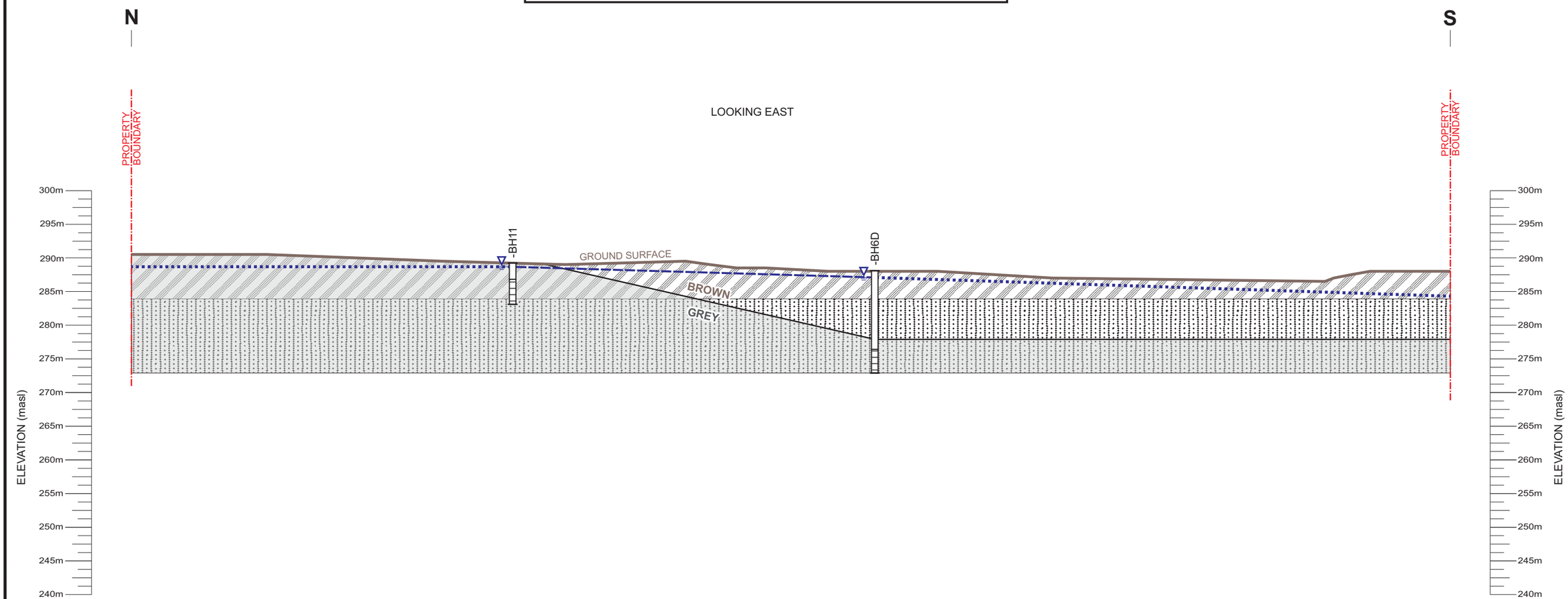
TERRAPEX

CROSS SECTION B2-B2' (NORTH TO SOUTH)

7370 CENTRE ROAD
UXBRIDGE, ONTARIO

CLIENT

BRIDGE BROOK CORPORATION



LEGEND

- SILTY CLAY
- SILTY SAND
- EXTRAPOLATED GROUNDWATER LEVEL
- INTERPOLATED GROUNDWATER LEVEL

STATIC WATER LEVEL- (March 16, 2020)

MW104
- MONITORING WELL DESIGNATION
- SCREENED ZONE
- BOREHOLE

HORIZONTAL SCALE:

0 25m 50m

(APPROXIMATE)

PROJECT #	*CT3058.00*
SCALE	*AS SHOWN*
DATE	*OCTOBER 2021*
DRAWN	*SW*
CHECKED	
DRAWING #	*FIGURE 7*

C:\Dropbox\Dropbox (Beacon)\All GIS Projects\2017\217431 7370 Centre Road Uxbridge EIS\MXD\2020-08-12_Figure02_ExistingConditions_217431.mxd

Existing Conditions

Figure 2

7370 Centre Road Uxbridge

Legend

- Subject Property
- ELC Communities
- Staked Dripline (LSRCA July 24, 2020)
- Staked Wetland (LSRCA July 24, 2020)
- Staked Top of Bank (LSRCA July 24, 2020)
- Section Divide
- Wetlands (Beacon 2020)
- Watercourse (Beacon 2020)

Headwater Drainage Feature

- Intermittent
- Ephemeral

Code	Community Description
	Wetland Communities
SWD3-4	Manitoba Maple Mineral Deciduous Swamp
SWD4-3	White Birch - Poplar Mineral Deciduous Swamp
MAS2-1	Cattail Mineral Shallow Marsh
SWT2-2	Willow Mineral Thicket Swamp
	Forest Communities
CUW1	Mineral Cultural Woodland
FOD3-1	Dry - Fresh Aspen Deciduous Forest
FOD4-2	Dry - Fresh White Ash Deciduous Forest
FOD7	Fresh - Moist Lowland Deciduous Forest
FOD7-2	Fresh - Moist Ash Lowland Deciduous Forest
FOD7-4	Fresh - Moist Black Walnut Lowland Deciduous Forest
	Cultural Communities
CUM1	Mineral Cultural Meadow
CUM1-1	Dry - Moist Old Field Meadow
CUP3-3	Scotch Pine Coniferous Plantation
CUT1	Mineral Cultural Thicket
	Other Communities
AG	Agricultural
ANT	Anthropogenic

BEACON ENVIRONMENTAL

Project: 217431
Last Revised: August 2020

Client: Mediterra Corp.

Prepared by: BD
Checked by: TDH
DRAFT

N

1:4,100

0 80 160 m

1	**H1** The FSSR indicates the site area is 39.9 ha whereas the Hydrogeological Investigation indicates 40.3 ha. Please ensure site areas are consistent within all the reports.	Terrapex	Have confirmed this area with team, and forthcoming reports with detailed design will be updated with the 39.9 ha value.

2	**H2** Please provide geological cross section(s), including elevations of grades and groundwater levels across the site.	Terrapex	Cross-sections will be included in subsequent reports. A Letter has been completed by Terrapex (2022) which includes this information.

3	**H3** The report notes that as a result of a site visit on August 22, 2019 no obvious groundwater-dependent features or seepage areas were observed on the site. an impact assessment on both the north-central and southeast features have not been included within the report. However, there is reference made regarding the assessment of wetland functions in a report by Terrapex (2020). This report was not provided with the 1st submission and therefore it's unclear if it adequately addresses the potential impact to both these features in post-development conditions. Please provide a groundwater assessment for all natural features on the site.	Terrapex	It is understood that the Wetland Function Assessment (Terrapex, 2020) will be included in subsequent submissions. The Terrapex report provides a groundwater assessment of the following four features, to determine if features are functioning as groundwater headwaters or as surfacewater collection areas: (1) HDF1 (2) HDF2 (3) HDF3 (4) HDF4 As indicated in the Terrapex report, only HDF1 (south-central property line) was found to have an upward vertical gradient from groundwater.

4	**H4** A water balance was completed for the entire site, however the FSSR indicates that the development will consist of 2 phases. As such, the water balance for each phase will need to be completed and addressed through each application separately.	Terrapex	To be addressed at detailed design, per call with LSRCA (31Aug2021)

5	**H5** A catchment-based water balance was provided for the watercourse at the SE corner of the site. The catchment used in the assessment appears to coincide with drainage catchment 101 from the FSSR and the general groundwater flow direction across the site. From the information provided it is unclear which drainage catchment supports the wetland at the north end of the site. A pre- and post-development catchment-based (a.k.a. feature-based) water balance is required for all features that will remain on the site and should include an impact assessment of changes to those features. Please clearly identify the drainage catchments for all natural features on the site and quantify the amount of groundwater/surface water which supports them.	Terrapex	Additional FBWBs to be addressed, if required, at detailed design, per call with LSRCA (31Aug2021)

6	**H6** The majority of both groundwater and surface flows are shown to be directed to the wetland and water course at the southeast corner of site. There is no assessment on how the proposed infrastructure (e.g. large impervious stormwater management pond) may change local groundwater flow patterns or impact discharge (baseflow) or overland flow to these features. Please provide more information on how the flow to the features will be maintained post-development without having an impact on the current function.	Terrapex	To be addressed, at detailed design, per call with LSRCA (31Aug2021)

7	**H7** Section 4.1 It appears some information regarding the climate data source has been omitted or accidently clipped from the report. The annual average precipitation for Uxbridge Brook subwatershed is 892 mm/yr. which appears to vary from the rate used within the assessment. Please provide more information on the source climate data used in the water balance assessment, including: a) The source and period of record of the climate data used and why it varies from the annual average for the subwatershed; b) Source of ET or how it was calculated/determined; c) Rate of precipitation (i.e. mm/yr.); d) Rate of ET (mm/yr.) based on each land use type (e.g. SWM pond, forest, grass, impervious areas); and e) Annual surplus (mm/yr.) based on each land use type	Terrapex	As requested, datasources will be outlined in greater detail in the next release. A Letter has been completed by Terrapex (2022) which includes this information.

8	**H8** Table 6 Table 6 provides a breakdown of land use types used within the pre-development water balance assessment. It appears these areas maybe based on a figure in another report (Beacon, 2020) which is not include here, therefore it is unclear how each land use type corresponds to the subject site. Please provide a pre-development figure clearly indicating all land use types used within the water balance assessments.	Terrapex	As requested, a figure indicating the landuse types will be outlined in greater detail in the next release. A Letter has been completed by Terrapex (2022) which includes this information.

9	**H9** Table 7 Table 7 provide a breakdown of impervious/pervious areas as sourced from the FSSR (SCS, 2020). Please provide an additional preliminary breakdown (to be further refined at detailed design) of the types of land uses (e.g. roads, driveways, roofs, parks, lawns, NHS, stormwater ponds, etc.) along with a post-development figure clearly indicating all land use types.	Terrapex	To be addressed, at detailed design, per call with LSRCA (31Aug2021)

10	**H10** It was noted that infiltration factors of 0.5 and 0.6 were used within the assessment however it is unclear which areas they correspond to and if the same factors were applied to both pre- and post-development conditions. Please provide a breakdown of pre- and post-development areas in which the infiltration factors correspond to.	Terrapex	As requested, this will be outlined in greater detail in the next release. A Letter has been completed by Terrapex (2022) which includes this information.

11	**H11** Table 8 The post-development water balance results reported in Table 8 do not match the table within the appendix. Please amend as appropriate.	Terrapex	As requested, this will be addressed in the next release. A Letter has been completed by Terrapex (2022) which includes this information.

12	**H12** Both the FSSR and balance assessment indicate the stormwater management blocks (203 and 205) are 50% pervious. However, the elevations shown on FSSR Figures 2.4 and 2.5 indicate both ponds are several metres lower than the groundwater levels (obtained from the closest monitoring wells BH7 & BH11). Ponds intercepting the water table should have an impermeable liner which would make them 100% impervious within the water balance assessment. Please clearly show pervious/impervious areas on a water balance figure as noted above and adjust the water balance calculations as necessary.	Terrapex	This will require input from the FSSR team, and will be addressed in detailed design releases.

13	**H13** Table 9 Table 9 notes that infiltration-based LIDs will increase infiltration by 99,363 m3/yr. There is no information on how this volume was determined. Preliminary calculations on BMP sizing within the FSSR shows that approximately 1/3 of the infiltration deficit can be mitigated through the various infiltration trenches proposed for the site. Please provide more information including calculations demonstrating how much infiltration is achieved by each LID.	Terrapex	This will require input from the FSSR team, and will be addressed in detailed design releases.

14	**H14** It was indicated that downspout disconnection will be utilized to offset some of the infiltration in post-development conditions. LID guidelines (CVC, 2012) indicate that for C & D type soils, up to 25% of runoff from roof areas can be considered as additional infiltration if specific LID parameters are met. Please identify: a) the area(s) of where downspout disconnect is being applied in the water balance assessment; b) the quantity of mitigation achieved; and c) how these LID criteria will be met	Terrapex	This will require input from the FSSR team, and will be addressed in detailed design release

15	**H15** Three infiltration tests were completed at Bh6, Bh7 and BH11 indicating rates of 42 to 49 mm/hr. Once the site plan has been confirmed further testing will need to be conducted at the location(s) and bottom elevation(s) of all proposed infiltration -based facilities.	Terrapex	To be addressed, at detailed design, per call with LSRCA (31Aug2021)

16	**H16** Example cross sections have been provided for infiltration LID (i.e. Rear yard infiltration trenches), however it is unclear how these relate to the soils and the seasonally high groundwater levels across the site. Please provide cross sections of all proposed infiltration LIDs including proposed ground elevations, highest groundwater elevations, dimensions and materials.	Terrapex	This will require input from the FSSR team, and will be addressed with detailed design release

Environmental Impact Study		
Section 8.5 As per Policy 2.3.15 in the Durham Regional Official Plan (Durham OP), development and site alteration are not permitted in key natural heritage and/or hydrologic features and their associated vegetation protection zones except for the listed exceptions. Similarly, Policy 2.3.3.3.iii.a) in the Township of Uxbridge Official Plan (Uxbridge OP), does not permit development in key natural heritage and/or hydrologic features. As per the Durham OP and Uxbridge OP, key natural heritage features include significant habitat of endangered species, fish habitat, wetlands, significant woodlands and significant wildlife habitat, and key hydrologic features include permanent and intermittent streams, wetlands, seepage areas and springs. Please revise the site plan to ensure all development and site alteration (including grading) is located outside the key natural heritage features, key hydrologic features, and their associated buffers on the subject property, such as the on-site wetland communities (MAM2-10, SWT2-5, MAS2-1, SWT2-2), intermittent streams (headwater drainage feature (HDF) 1, 2 and 4), and the buffers to the significant woodland, wetlands, and watercourses.		In keeping with the general definition of HDFs as "non-permanently flowing drainage features that may not have defined bed or banks; they are first-order and zero-order intermittent and ephemeral channels, swales and connected headwater wetlands, but do not include rills or furrows." (TRCA,2014) It is provided in the Wetland Function Assessment (WFA) carried out by Terrapex (2020), that features HDF2 through HDF4 are interpreted to not be influenced by groundwater, and as such, any first-order or zero-order water found in these features would be required to come from surface water sources. It is provided in the Wetland Function Assessment (WFA) carried out by Terrapex (2020), that features HDF2 through HDF4 are interpreted to not be influenced by groundwater, and as such, any water found in these features would be required to come from surface water sources. In contrast, HDF1 is understood to have groundwater influence, which may be permanent, and not ephemeral or intermittent. It is posited that this may remove HDF1 from the definition of an HDF, as provided above.

3	Section 6, Table 5 Please confirm whether a seep feature is present in the southwestern portion of the subject property, north of the houses on Galloway Cres. Photos of this area need to be submitted to the LSRCA or a site visit with the LSRCA should be scheduled to confirm the presence/absence of this key hydrologic feature.		It is understood that the location indicated in the question is relatively proximal or to the west of the feature designated HDF1. It is provided in the Wetland Function Assessment (WFA) carried out by Terrapex (2020), that no groundwater seepage was observed on the subject property during site visits. As indicated in that report, groundwater in that area has an upward vertical gradient.

4	Section 7.4 As per Comment #NH1 above, wetlands, intermittent streams and seeps are considered key hydrologic features under the Durham OP and Uxbridge OP. Please update the site plan and associated catchment-based water balance to ensure the existing hydrologic inputs supporting these sensitive hydrologic features are maintained post-development.		As discussed in the conference call with the LSRCA (August 31, 2021), further updates to the catchment-based water balance will be provided with the forthcoming detailed designs. It is understood that this reiterates the need communicated by the LSRCA for a catchment-based water balance to be provided for each of HDF1 through HDF4.

347 Pido Road , Unit #29
Peterborough, Ontario K9J 6X7
Canada
www.ghd.com

28 May 2021

Mr. John Spina
MDTR Group
7681 Highway 27, Unit 16
Woodbridge, Ontario
L4L 4M5

Re: 7370 Centre Road
Plan of subdivision application
Town of Uxbridge

Bat Habitat Assessment Memo

1. Introduction

GHD Limited was asked to conduct a bat cavity tree assessment on the property at 7370 Centre Road in the Town of Uxbridge. The Environmental Impact Study conducted previously here by another consulting firm noted that bat roosting habitat may be present in the wooded areas on the property. As some tree removal is proposed in the development plan for this site, GHD biologists conducted a thorough search for suitable cavity trees on the property on April 27, 2021.

2. Methodology

The Methodology used in the bat habitat survey was based on protocols set out in *Bats and Bat Habitats: Guidelines for Wind Power Projects (OMNR 2011)* and *Bat and Bat Habitat Surveys of Treed Habitats* (OMNRF- Guelph District 2016). The wooded areas on the site where small and GHD biologists were able observe all trees growing/standing in these areas. Most of the site was open agricultural fields with extensive treed fence rows running east to west along the north and south property lines. These lines were walked, and any potential bat roosting trees were identified and evaluated. The wooded areas checked are shown on figure 1 in orange shading.

3. Results

Transects through the wooded areas of site reveled no candidate bat roosting trees. The coniferous forested areas were composed primarily of young healthy Scot's pine (*Pinus sylvestris*) and similarly most of the deciduous trees were young and in good health. These characteristics do not provide for suitable bat roosting habitat. Those types of trees have small diameters and do not have knot holes or cavitites. Several butternut trees (>25cm. dbh) were identified here in various stages of decline but none showed any evidence of peeling bark, cracks, or cavities. Twelve trees (>25cm dbh) scattered along the periphery of the property were identified as potential bat roosting habitat (Figure 1). Ten of these trees were recently deceased white ash (*Fraxinus alba*) and were starting to show some peeling bark. One black walnut (*Juglans nigra*), also recently deceased, displayed

patches of loose bark. None of these trees contained open cavities, knot holes or fissures. One Manitoba maple (*Acer negundo*) containing cavities was located within a fence line. This individual tree was in late stages of decay and had broken off at the four-meter mark. Surrounded by buckthorn (*Rhamnus cathartica),* this individual tree was providing shelter to a raccoon (*Procyon loter*).

4. Conclusions

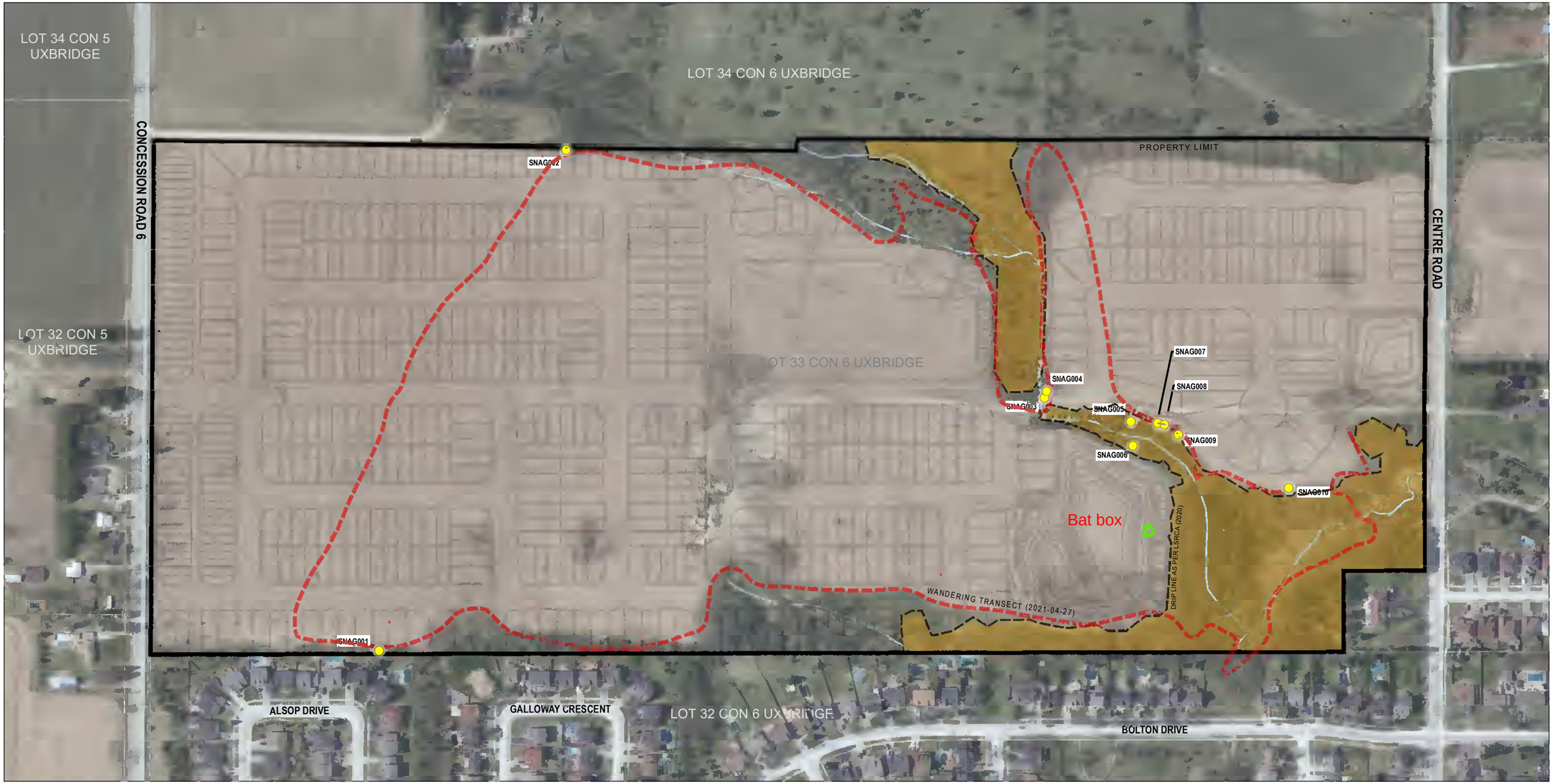
While no minimum number of snags per hectare exists to qualify an area as important habitat to species at risk bats, MNRF suggests that more than10 snags per hectare may be considered high quality candidate maternity roost habitat. Snag density calculations for this property do not support this parameter. The individual snag trees identified on the site appeared to be of poor quality (no cavities, cracks or fissures, only some loose bark, or cavities that were low on the tree) to be suitable as candidate trees for maternity colonies. Hazard trees, example the dead ash or walnut, should be removed as they can pose a hazard during construction and for residents. Several of the trees were on the road alignment for the connector roadway. In addition, it is recommended that one Rocket brand bat boxes be installed around the natural areas, eg. adjacent to the stormwater pond, to provide an opportunity for roosting bats.

Sincerely,

GHD

Chris Ellingwood
Sr. Biologist

705-931-3929
Chris.ellingwood@ghd.com



LEGEND

Background Data

- Staked Dripline — LSRCA (2020-07-24) via Beacon Environmental (2020).,
- Watercourse/Drainage — Derived from Beacon Environmental (2020) Includes Headwater Drainage Features
- Wooded Area — Extent of Staked Dripline, CLOCA 2021.
- Proposed Development — Derived from Beacon Environmental (2020)

Administrative

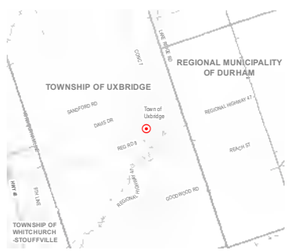
- Property Limit
- Geographic Lot Fabric Boundary

GHD Surveys

- Snag Tree — Decay Codes 4 and 5.
- Wandering Transect — 2021-04-27

CITATIONS

- Beacon Environmental. Proposed Development (GIS Layer). Derived from Figure 4; Proposed Development. 2021.
- Beacon Environmental. Watercourse and Headwater Drainage Features (GIS Layer). Derived from Figure 3: Environmental Constraints.
- Beacon Environmental. Staked Dripline (GIS Layer). Derived from Figure 3: Environmental Constraints.
- Service Layer Credits: © 2020 Regional Municipality of Durham; 2020 Orthophotography provided by © First Base Solutions Inc.; © Queen's Printer for Ontario, 2020.



REVISION & WORK HISTORY

REV	BY	DATE	DESCRIPTION	REQUEST
0	W.P.	2021-05-12	Initial map creation.	J.B.
1	W.P.	2021-06-10	Wandering transect and additional snag trees added.	J.B.

DATA DISCLAIMERS

- Produced by GHD Limited under Licence with the Ontario Ministry of Natural Resources and Forestry© Queen's Printer for Ontario, 2021(2020).

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

SCALE
1 cm : 30 meters
0 10 20 30 40
Meters

PROJECT NAME
7073 Centre Road, Uxbridge
Pt Lot 33, Con 6 Geo. Township of Uxbridge
Town of Uxbridge, Region of Durham
Lake Simcoe Region Conservation Authority

BAT MEMO
SNAG TREE LOCATIONS

Project No. **11227711**
Revision No.
Date **6/10/2021**

FIGURE 1

Document Path: Q:\gis2\GIS\PROJECTS\11227000s\11227711\Layouts\202105_RPT001\11227711_202105_RPT001_GIS001 - Snag Tree Locations.mxd
Date Saved: 6/10/2021 5:06:31 PM


COMMUNITY HOUSING
DURHAM REGION PARTNERSHIP
0.14 ha
SWM POND
0.51 ha
PARK
2.70 ha
(incl. Environmental Areas)
SWM POND
1.50 ha
8 UNITS
6 UNITS
4 UNITS
BOLTON
DRIVE
CRESCENT

RESPONSE TO COMMENT E11

Dry SWM Pond
Extended Detention Sizing

7370 Centre Road
Project Number: 2099
Date: September 2021
Designer Initials: C.M.D.

EXTENDED DETENTION

Using the 25mm - 4 hour Chicago Storm

Erosion Control Volume (V) = Runoff Depth (mm) x Drainage Area (ha) x 10 (m^3) / (mm)(ha)

Erosion Control Volume (V) = 21.68 mm x 6.24 ha x 10 m^3 / mm·ha

Erosion Control Volume (V) = 1353 m^3

Using 40m^3/ha

Extended Detention Volume (V) = 40m^3/ha x Drainage Area (ha)

Extended Detention Volume (V) = 40 m^3/ha 6.24 ha

Extended Detention Volume (V) = 249.6 m^3

Governing Volume (V) = 1353 m^3

OUTFLOW SUMMARY
DRY SWM POND 1

7370 Centre Road
Project Number: 2099
Date: September 2021
Designer Initials: C.M.D.

RESPONSE TO COMMENT E11

Starting Water Level (m) = 284.17
Elevation Increment (m) = 0.02

Shading represents Storage-Discharge pairings used in VO modelling

Upstream Elevation (m)	Orifice 1 Outflow (cms)	Emergency Spillway Outflow (cms)	Weir 1 Outflow (cms)	Stage (m)	Total Flow (cms)	Storage (m^3)	Detention Time (hrs)	4 Hour Chicago Storm	12 Hour SCS Storm
284.17	0.000	0.000	0.000	284.17	0.000	0	0.0	Orifice 1	
284.19	0.000	0.000	0.000	284.19	0.000	0	0.0		
284.21	0.001	0.000	0.000	284.21	0.001	0	0.0		
284.23	0.002	0.000	0.000	284.23	0.002	0	0.0		
284.25	0.003	0.000	0.000	284.25	0.003	0	0.0		
284.27	0.004	0.000	0.000	284.27	0.004	0	0.0		
284.29	0.005	0.000	0.000	284.29	0.005	2	0.1		
284.31	0.005	0.000	0.000	284.31	0.005	4	0.3		
284.33	0.006	0.000	0.000	284.33	0.006	9	0.5		
284.35	0.006	0.000	0.000	284.35	0.006	17	0.9		
284.37	0.007	0.000	0.000	284.37	0.007	28	1.3		
284.39	0.007	0.000	0.000	284.39	0.007	42	1.8		
284.41	0.008	0.000	0.000	284.41	0.008	58	2.5		
284.43	0.008	0.000	0.000	284.43	0.008	77	3.1		
284.45	0.008	0.000	0.000	284.45	0.008	99	3.8		
284.47	0.009	0.000	0.000	284.47	0.009	123	4.6		
284.49	0.009	0.000	0.000	284.49	0.009	149	5.4		
284.51	0.009	0.000	0.000	284.51	0.009	177	6.2		
284.53	0.010	0.000	0.000	284.53	0.010	205	7.1		
284.55	0.010	0.000	0.000	284.55	0.010	234	7.9		
284.57	0.010	0.000	0.000	284.57	0.010	264	8.7		
284.59	0.011	0.000	0.000	284.59	0.011	293	9.5		
284.61	0.011	0.000	0.000	284.61	0.011	323	10.2		
284.63	0.011	0.000	0.000	284.63	0.011	353	11.0		
284.65	0.012	0.000	0.000	284.65	0.012	384	11.7		
284.67	0.012	0.000	0.000	284.67	0.012	414	12.4		
284.69	0.012	0.000	0.000	284.69	0.012	445	13.2		
284.71	0.012	0.000	0.000	284.71	0.012	477	13.9		
284.73	0.013	0.000	0.000	284.73	0.013	508	14.6		
284.75	0.013	0.000	0.000	284.75	0.013	540	15.3		
284.77	0.013	0.000	0.000	284.77	0.013	573	16.0		
284.79	0.013	0.000	0.000	284.79	0.013	605	16.7		
284.81	0.013	0.000	0.000	284.81	0.013	638	17.4		
284.83	0.014	0.000	0.000	284.83	0.014	671	18.0		
284.85	0.014	0.000	0.000	284.85	0.014	704	18.7		
284.87	0.014	0.000	0.000	284.87	0.014	738	19.4		
284.89	0.014	0.000	0.000	284.89	0.014	772	20.0		
284.91	0.015	0.000	0.000	284.91	0.015	806	20.7		
284.93	0.015	0.000	0.000	284.93	0.015	841	21.3		
284.95	0.015	0.000	0.000	284.95	0.015	875	22.0		
284.97	0.015	0.000	0.000	284.97	0.015	911	22.6	2 Year	
284.99	0.015	0.000	0.000	284.99	0.015	946	23.3		
285.01	0.016	0.000	0.000	285.01	0.016	982	23.9		
285.03	0.016	0.000	0.000	285.03	0.016	1018	24.6		
285.05	0.016	0.000	0.000	285.05	0.016	1054	25.2		
285.07	0.016	0.000	0.000	285.07	0.016	1090	25.8		2 Year
285.09	0.016	0.000	0.000	285.09	0.016	1127	26.5		
285.11	0.017	0.000	0.000	285.11	0.017	1164	27.1		
285.13	0.017	0.000	0.000	285.13	0.017	1202	27.7		
285.15	0.017	0.000	0.000	285.15	0.017	1240	28.3	Weir 1	
285.17	0.017	0.000	0.007	285.17	0.024	1278	28.9		
285.19	0.017	0.000	0.019	285.19	0.036	1316	29.2	5 Year	
285.21	0.017	0.000	0.034	285.21	0.052	1355	29.5	Extended Detention	
285.23	0.018	0.000	0.053	285.23	0.070	1393	29.6		
285.25	0.018	0.000	0.074	285.25	0.091	1433	29.8	10 Year	5 Year
285.27	0.018	0.000	0.097	285.27	0.115	1472	29.9		
285.29	0.018	0.000	0.122	285.29	0.140	1512	30.0		
285.31	0.018	0.000	0.149	285.31	0.167	1552	30.0		
285.33	0.018	0.000	0.178	285.33	0.196	1592	30.1	25 Year	
285.35	0.019	0.000	0.215	285.35	0.233	1633	30.2		10 Year
285.37	0.019	0.000	0.248	285.37	0.266	1674	30.2		
285.39	0.019	0.000	0.282	285.39	0.301	1715	30.2		
285.41	0.019	0.000	0.318	285.41	0.337	1757	30.3		
285.43	0.019	0.000	0.356	285.43	0.375	1798	30.3		25 Year
285.45	0.019	0.000	0.426	285.45	0.446	1841	30.3		
285.47	0.020	0.000	0.470	285.47	0.489	1883	30.4		
285.49	0.020	0.000	0.514	285.49	0.534	1926	30.4	100 Year	
285.51	0.020	0.000	0.561	285.51	0.580	1969	30.4		
285.53	0.020	0.000	0.608	285.53	0.628	2012	30.4		

OUTFLOW SUMMARY
DRY SWM POND 1

7370 Centre Road
Project Number: 2099
Date: September 2021
Designer Initials: C.M.D.

Starting Water Level (m) = 284.17
Elevation Increment (m) = 0.02

Shading represents Storage-Discharge pairings used in VO modelling

Upstream Elevation (m)	Orifice 1 Outflow (cms)	Emergency Spillway Outflow (cms)	Weir 1 Outflow (cms)	Stage (m)	Total Flow (cms)	Storage (m^3)	Detention Time (hrs)	4 Hour Chicago Storm	12 Hour SCS Storm
285.55	0.020	0.000	0.683	285.55	0.703	2055	30.4		
285.57	0.020	0.000	0.735	285.57	0.755	2099	30.5		
285.59	0.020	0.000	0.788	285.59	0.809	2143	30.5		100 Year
285.61	0.021	0.000	0.842	285.61	0.863	2188	30.5		
285.63	0.021	0.000	0.898	285.63	0.919	2232	30.5		
285.65	0.021	0.000	0.965	285.65	0.986	2278	30.5		
285.67	0.021	0.000	1.024	285.67	1.045	2323	30.5		
285.69	0.021	0.000	1.083	285.69	1.105	2368	30.5		
285.71	0.021	0.000	1.144	285.71	1.165	2414	30.6		
285.73	0.022	0.000	1.206	285.73	1.227	2460	30.6		
285.75	0.022	0.000	1.276	285.75	1.297	2507	30.6		
285.77	0.022	0.000	1.340	285.77	1.362	2554	30.6		
285.79	0.022	0.000	1.405	285.79	1.427	2601	30.6		
285.81	0.022	0.000	1.472	285.81	1.494	2648	30.6		
285.83	0.022	0.000	1.539	285.83	1.561	2696	30.6		
285.85	0.022	0.000	1.608	285.85	1.630	2744	30.6		
285.87	0.022	0.000	1.677	285.87	1.700	2792	30.6		
285.89	0.023	0.000	1.747	285.89	1.770	2840	30.6		
285.91	0.023	0.000	1.819	285.91	1.841	2889	30.6		
285.93	0.023	0.000	1.891	285.93	1.914	2938	30.7		
285.95	0.023	0.000	1.964	285.95	1.987	2988	30.7		
285.97	0.023	0.000	2.038	285.97	2.061	3037	30.7		
285.99	0.023	0.000	2.113	285.99	2.137	3087	30.7		
286.01	0.023	0.000	2.189	286.01	2.213	3137	30.7		
286.03	0.024	0.000	2.266	286.03	2.290	3188	30.7		
286.05	0.024	0.000	2.344	286.05	2.367	3239	30.7		
286.07	0.024	0.000	2.422	286.07	2.446	3290	30.7		
286.09	0.024	0.000	2.502	286.09	2.526	3341	30.7		
286.11	0.024	0.000	2.582	286.11	2.606	3393	30.7		
286.13	0.024	0.000	2.663	286.13	2.687	3445	30.7		
286.15	0.024	0.000	2.745	286.15	2.769	3497	30.7		
286.17	0.024	0.000	2.828	286.17	2.852	3550	30.7		
286.19	0.025	0.000	2.911	286.19	2.936	3603	30.7		
286.21	0.025	0.000	2.996	286.21	3.020	3656	30.7		
286.23	0.025	0.000	3.081	286.23	3.106	3709	30.7		
286.25	0.025	0.000	3.167	286.25	3.192	3763	30.7		
286.27	0.025	0.000	3.254	286.27	3.279	3817	30.7		
286.29	0.025	0.000	3.341	286.29	3.366	3871	30.8		
286.31	0.025	0.021	3.429	286.31	3.476	3926	30.8	Emergency Spillway Invert (286.30)	
286.33	0.025	0.112	3.519	286.33	3.656	3981	30.8		
286.35	0.026	0.247	3.608	286.35	3.881	4037	30.8		
286.37	0.026	0.419	3.699	286.37	4.144	4093	30.8		
286.39	0.026	0.626	3.790	286.39	4.442	4149	30.8		
286.41	0.026	0.866	3.882	286.41	4.774	4205	30.8		
286.43	0.026	1.138	3.975	286.43	5.140	4262	30.8		
286.45	0.026	1.443	4.069	286.45	5.538	4319	30.8		
286.47	0.026	1.780	4.163	286.47	5.969	4377	30.8	100 Year Uncontrolled	
286.49	0.026	2.149	4.258	286.49	6.433	4435	30.8		
286.51	0.026	2.753	4.354	286.51	7.133	4493	30.8		
286.53	0.027	3.221	4.450	286.53	7.698	4552	30.8		
286.55	0.027	3.725	4.547	286.55	8.299	4611	30.8		
286.57	0.027	4.264	4.645	286.57	8.936	4670	30.8		
286.59	0.027	4.840	4.743	286.59	9.610	4730	30.8		
286.61	0.027	5.416	4.843	286.61	10.285	4790	30.8		
286.63	0.027	6.060	4.942	286.63	11.030	4850	30.8		
286.65	0.027	6.742	5.043	286.65	11.812	4911	30.8		
286.67	0.027	7.461	5.144	286.67	12.633	4972	30.8		
286.69	0.027	8.219	5.246	286.69	13.492	5034	30.8		
286.71	0.028	8.892	5.348	286.71	14.268	5096	30.8		
286.73	0.028	9.716	5.452	286.73	15.195	5158	30.8		
286.75	0.028	10.577	5.555	286.75	16.161	5220	30.8		

Wet SWM Pond
Permanent Pool and Extended Detention Sizing

7370 Centre Road
Project Number: 2099
Date: September 2021
Designer Initials: C.M.D.

RESPONSE TO COMMENT E11

PERMANENT POOL

Level of Protection = Enhanced (Level 1)

Weighted Impervious = 58 %

Drainage Area = 27.26 ha

SWMP Type = 4. Wet Pond

Required Permanent Pool (including 40m^3/ha for extended detention)= 198.0 m^3/ha
Required Permanent Pool (minus 40m^3/ha for extended detention)= 158 m^3/ha

Required Permanent Pool = 4307 m^3

TABLE 3.2 - WATER QUALITY STORAGE REQUIREMENTS
(FROM MOE SWM PLANNING AND DESIGN MANUAL - 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced (Level 1)	1. Infiltration	25	30	35	40
	2. Wetlands	80	105	120	140
	3. Hybrid Wet Pond/Wetland	110	150	175	195
	4. Wet Pond	140	190	225	250
Normal (Level 2)	1. Infiltration	20	20	25	30
	2. Wetlands	60	70	80	90
	3. Hybrid Wet Pond/Wetland	75	90	105	120
	4. Wet Pond	90	110	130	150
Basic (Level 3)	1. Infiltration	20	20	20	20
	2. Wetlands	60	60	60	60
	3. Hybrid Wet Pond/Wetland	60	70	75	80
	4. Wet Pond	60	75	85	95
	5. Dry Pond (Continuous Flow)	90	150	200	240

EXTENDED DETENTION

Using the 25mm - 4 hour Chicago Storm

Erosion Control Volume (V) = Runoff Depth (mm) x Drainage Area (ha) x 10 (m^3) / (mm)(ha)

Erosion Control Volume (V) = 21.46 mm x 27.26 ha x 10 m^3 / mm·ha

Erosion Control Volume (V) = 5850 m^3

Using 40m^3/ha

Extended Detention Volume (V) = 40m^3/ha x Drainage Area (ha)

Extended Detention Volume (V) = 40 m^3/ha 27.26 ha

Extended Detention Volume (V) = 1090.4 m^3

Governing Volume (V) = 5850 m^3

OUTFLOW SUMMARY
WET SWM POND

7370 Centre Road
Project Number: 2099
Date: September 2021
Designer Initials: C.M.D.

RESPONSE TO COMMENT E11

Starting Water Level (m) = 295.50
Elevation Increment (m) = 0.02

Shading represents Storage-Discharge pairings used in VO modelling

Upstream Elevation (m)	Orifice 1 Outflow (cms)	Emergency Spillway Outflow (cms)	Weir 1 Outflow (cms)	Stage (m)	Total Flow (cms)	Storage (m^3)	Detention Time (hrs)	4 Hour Chicago Storm	12 Hour SCS Storm
295.50	0.000	0.000	0.000	295.50	0.000	0	0.0	Orifice 1	
295.52	0.000	0.000	0.000	295.52	0.000	100	0.0		
295.54	0.002	0.000	0.000	295.54	0.002	201	0.0		
295.56	0.003	0.000	0.000	295.56	0.003	302	11.3		
295.58	0.006	0.000	0.000	295.58	0.006	405	17.4		
295.60	0.009	0.000	0.000	295.60	0.009	508	21.2		
295.62	0.009	0.000	0.000	295.62	0.009	613	24.4		
295.64	0.018	0.000	0.000	295.64	0.018	719	26.5		
295.66	0.024	0.000	0.000	295.66	0.024	825	27.9		
295.68	0.028	0.000	0.000	295.68	0.028	932	29.1		
295.70	0.032	0.000	0.000	295.70	0.032	1041	30.1		
295.72	0.036	0.000	0.000	295.72	0.036	1150	31.0		
295.74	0.039	0.000	0.000	295.74	0.039	1260	31.8		
295.76	0.042	0.000	0.000	295.76	0.042	1371	32.5		
295.78	0.045	0.000	0.000	295.78	0.045	1483	33.3		
295.80	0.047	0.000	0.000	295.80	0.047	1596	33.9		
295.82	0.050	0.000	0.000	295.82	0.050	1710	34.6		
295.84	0.052	0.000	0.000	295.84	0.052	1825	35.2		
295.86	0.054	0.000	0.000	295.86	0.054	1941	35.8		
295.88	0.056	0.000	0.000	295.88	0.056	2058	36.4		
295.90	0.059	0.000	0.000	295.90	0.059	2176	37.0		
295.92	0.061	0.000	0.000	295.92	0.061	2294	37.5		
295.94	0.062	0.000	0.000	295.94	0.062	2414	38.1		
295.96	0.064	0.000	0.000	295.96	0.064	2535	38.6		
295.98	0.066	0.000	0.000	295.98	0.066	2656	39.1		
296.00	0.068	0.000	0.000	296.00	0.068	2778	39.6		
296.02	0.070	0.000	0.000	296.02	0.070	2902	40.1		
296.04	0.071	0.000	0.000	296.04	0.071	3026	40.6		
296.06	0.073	0.000	0.000	296.06	0.073	3151	41.1		
296.08	0.075	0.000	0.000	296.08	0.075	3276	41.6		
296.10	0.076	0.000	0.000	296.10	0.076	3402	42.0		
296.12	0.078	0.000	0.000	296.12	0.078	3529	42.5		
296.14	0.079	0.000	0.000	296.14	0.079	3657	42.9		
296.16	0.081	0.000	0.000	296.16	0.081	3785	43.4		
296.18	0.082	0.000	0.000	296.18	0.082	3914	43.8	2 Year	
296.20	0.084	0.000	0.000	296.20	0.084	4044	44.3		
296.22	0.085	0.000	0.000	296.22	0.085	4175	44.7		
296.24	0.086	0.000	0.000	296.24	0.086	4306	45.1		
296.26	0.088	0.000	0.000	296.26	0.088	4438	45.5		
296.28	0.089	0.000	0.000	296.28	0.089	4571	46.0		
296.30	0.091	0.000	0.000	296.30	0.091	4704	46.4		
296.32	0.092	0.000	0.000	296.32	0.092	4839	46.8		2 Year
296.34	0.093	0.000	0.000	296.34	0.093	4974	47.2	Weir 1	
296.36	0.094	0.000	0.011	296.36	0.105	5109	47.6		
296.38	0.096	0.000	0.030	296.38	0.125	5246	47.9		
296.40	0.097	0.000	0.055	296.40	0.152	5383	48.2		
296.42	0.098	0.000	0.084	296.42	0.182	5521	48.4		
296.44	0.099	0.000	0.118	296.44	0.217	5659	48.6	5 Year	
296.46	0.101	0.000	0.155	296.46	0.255	5799	48.8	Extended Detention	
296.48	0.102	0.000	0.195	296.48	0.297	5939	48.9		
296.50	0.103	0.000	0.238	296.50	0.341	6079	49.0		
296.52	0.104	0.000	0.284	296.52	0.388	6221	49.1		
296.54	0.105	0.000	0.343	296.54	0.449	6363	49.2	10 Year	5 Year
296.56	0.106	0.000	0.396	296.56	0.503	6506	49.3		
296.58	0.107	0.000	0.451	296.58	0.559	6649	49.4		
296.60	0.109	0.000	0.509	296.60	0.618	6793	49.4		
296.62	0.110	0.000	0.569	296.62	0.679	6938	49.5		
296.64	0.111	0.000	0.682	296.64	0.793	7083	49.6	25 Year	
296.66	0.112	0.000	0.752	296.66	0.863	7228	49.6		10 Year
296.68	0.113	0.000	0.823	296.68	0.936	7375	49.7		
296.70	0.114	0.000	0.897	296.70	1.011	7522	49.7		
296.72	0.115	0.000	0.973	296.72	1.088	7670	49.7		
296.74	0.116	0.000	1.093	296.74	1.209	7818	49.8		
296.76	0.117	0.000	1.176	296.76	1.293	7967	49.8		
296.78	0.118	0.000	1.261	296.78	1.379	8116	49.8		
296.80	0.119	0.000	1.348	296.80	1.467	8267	49.9		25 Year
296.82	0.120	0.000	1.437	296.82	1.557	8417	49.9		

OUTFLOW SUMMARY
WET SWM POND

7370 Centre Road
Project Number: 2099
Date: September 2021
Designer Initials: C.M.D.

Starting Water Level (m) = 295.50
Elevation Increment (m) = 0.02

Shading represents Storage-Discharge pairings used in VO modelling

Upstream Elevation (m)	Orifice 1 Outflow (cms)	Emergency Spillway Outflow (cms)	Weir 1 Outflow (cms)	Stage (m)	Total Flow (cms)	Storage (m^3)	Detention Time (hrs)	4 Hour Chicago Storm	12 Hour SCS Storm
296.84	0.121	0.000	1.544	296.84	1.665	8569	49.9		
296.86	0.122	0.000	1.638	296.86	1.760	8721	49.9		
296.88	0.123	0.000	1.733	296.88	1.856	8873	50.0	100 Year	
296.90	0.124	0.000	1.830	296.90	1.954	9027	50.0		
296.92	0.125	0.000	1.929	296.92	2.054	9180	50.0		
296.94	0.126	0.000	2.041	296.94	2.167	9335	50.0		
296.96	0.127	0.000	2.144	296.96	2.271	9490	50.1		
296.98	0.128	0.000	2.249	296.98	2.376	9646	50.1		
297.00	0.129	0.000	2.355	297.00	2.484	9802	50.1		
297.02	0.130	0.000	2.463	297.02	2.592	9959	50.1		
297.04	0.130	0.000	2.572	297.04	2.703	10117	50.1		100 Year
297.06	0.131	0.000	2.683	297.06	2.815	10275	50.1		
297.08	0.132	0.000	2.796	297.08	2.928	10434	50.2		
297.10	0.133	0.000	2.910	297.10	3.043	10593	50.2		
297.12	0.134	0.000	3.026	297.12	3.160	10754	50.2		
297.14	0.135	0.000	3.143	297.14	3.278	10914	50.2		
297.16	0.136	0.000	3.261	297.16	3.397	11076	50.2		
297.18	0.137	0.000	3.381	297.18	3.518	11238	50.2		
297.20	0.138	0.000	3.503	297.20	3.640	11400	50.2	Emergency Spillway	
297.22	0.138	0.078	3.626	297.22	3.842	11563	50.2		
297.24	0.139	0.224	3.750	297.24	4.113	11727	50.3		
297.26	0.140	0.420	3.876	297.26	4.436	11892	50.3		
297.28	0.141	0.661	4.003	297.28	4.805	12057	50.3		
297.30	0.142	0.942	4.131	297.30	5.215	12222	50.3		
297.32	0.143	1.264	4.261	297.32	5.667	12389	50.3		
297.34	0.144	1.623	4.392	297.34	6.159	12556	50.3		
297.36	0.144	2.022	4.524	297.36	6.690	12723	50.3		
297.38	0.145	2.458	4.658	297.38	7.261	12891	50.3		
297.40	0.146	2.932	4.793	297.40	7.871	13060	50.3		
297.42	0.147	3.444	4.929	297.42	8.520	13230	50.3		
297.44	0.148	3.994	5.067	297.44	9.209	13400	50.3		
297.46	0.148	4.583	5.206	297.46	9.937	13570	50.3		
297.48	0.149	5.210	5.346	297.48	10.705	13742	50.3		
297.50	0.150	5.718	5.487	297.50	11.355	13913	50.4		

Manufactured Treatment Device

A manufactured treatment device can contribute to the treatment train approach for water quality control. Per Township of Uxbridge criteria, a Vortech oil-grit-separator (OGS) Unit (or approved equivalent) will be provided to treat runoff before it enters the wet pond and the underground storage facility.

Table 2.3 below summarizes the recommended stormwater management Best Management Practices (BMPs) for the subject development.

Table 2.3: Summary of the Recommended Stormwater Best Management Practices (BMPs)

Stormwater Management Control	Recommended BMP
Lot Level Controls	Increased Topsoil Depth
	Roof Leader to Grassed Areas
	Rear Yard At-Surface Infiltration Trenches
Conveyance System Controls	Catchbasin Infiltration/Filtration Systems
	Grassed Filter Strip
End Of Pipe Controls	Wet Pond
	Dry Pond
	Manufactured Treatment Device (OGS)

2.4 Proposed Storm Drainage

The proposed storm drainage plan is shown on **Figure 2.2**.

Runoff from Catchment 201 will be initially conveyed to local rear yard at-surface infiltration trenches and catchbasin infiltration/filtration facilities, where feasible, or otherwise captured in the minor system (refer to **Figure 2.3** for LID location plan). A wet SWM pond (Wet SWM Pond 1) will provide quantity, quality and erosion control for runoff up to and including the 100 year storm event before outletting to the Uxbridge Brook tributary. As per Uxbridge design criteria, an OGS will provide pre-treatment upstream of the wet SWM Pond. Major system flows will be conveyed by the proposed road right-of-ways to an overland flow route in the wet SWM pond block which doubles as the wet SWM pond access road. In an emergency spill scenario, runoff will be conveyed via an emergency spillway in the wet SWM pond to the Uxbridge Brook Tributary. A plan view of Wet SWM Pond 1 and associated infrastructure has been provided on **Figure 2.4**.

Runoff from Catchment 202 will be conveyed overland to a proposed 600 mm diameter bypass storm sewer and will outlet directly to the Uxbridge Brook tributary.

Runoff from Catchment 203 will be conveyed overland directly to the proposed wet SWM pond.

Runoff from Catchment 204 will initially be conveyed to local rear yard at-surface infiltration trenches and catchbasinfiltration facilities (refer to **Figure 2.3**), followed by conveyance via storm sewers and overland flow along road right of ways to an end of pipe stormwater attenuation facility. The catchbasin filtration facilities will provide the quality control requirements for Catchment 204. A dry SWM pond (Dry SWM Pond 1) will provide quantity and erosion control for runoff up to and including the 100 year storm event before outletting to the Uxbridge Brook tributary. An OGS will provide pre-treatment upstream of the dry SWM pond. Outflow from the control manhole will be directed to a grassed filter strip before outletting to the Uxbridge Brook Tributary via a trapezoidal outlet swale. Major system flows will be conveyed by the proposed road right-of-ways to an overland flow route on Street 'M' (west overland flow route) and Street 'J' (north overland flow route). In an emergency spill scenario, runoff will be conveyed via an emergency spillway in the dry SWM pond to the Centre Road ditch which conveys flows to the Uxbridge Brook Tributary. A plan view of the Dry SWM Pond 1 has been provided on **Figure 2.5**.

Runoff from Catchment 205 will be conveyed overland directly to the proposed dry SWM pond.

Runoff from Catchment 206 and 208 will be conveyed to local at-surface rear yard at-surface infiltration trenches, where able, or otherwise drain uncontrolled to the Centre Road ditch and Uxbridge Brook tributary, respectively.

Runoff from Catchment 207 will be conveyed to local at-surface rear yard at-surface infiltration trenches, where able, or otherwise drain uncontrolled to the Centre Road CSP culvert.

2.5 Proposed Stormwater Management Plan

2.5.1 Quantity Control and Erosion Control

The allowable release rates to the existing wetland and the north Centre Road CSP culvert for each design storm are presented in **Table 2.2** above.

Wet SWM Pond 1 will control proposed peak flows to the Uxbridge Brook tributary from the proposed development west of the NHS. Dry SWM Pond 1 will control proposed peak flows to the Uxbridge Brook tributary from the proposed development east of the NHS. Each quantity control facility is discussed in greater detail below. The active storage facilities above will control peak flows from the proposed development to existing peak flows for the 2 through 100 year storm events.

Proposed hydrology modelling was completed using the VO6 model to determine the required wet SWM pond and dry SWM Pond active storage volumes. A summary of modelling parameters and a proposed VO6 schematic are provided in **Appendix C**. A USB containing the VO6 hydrology model is also provided in **Appendix C**.

2.5.2 Quality Control

Quality control will be provided for the proposed development to meet MECP Enhanced Level Protection (80% TSS Removal) requirements. The solutions for each development area are discussed below.

West of the NHS

Quality control for Catchment 201 and 203 will be provided by the proposed wet SWM pond located adjacent to the existing wetland. The wet SWM pond has been sized for a minimum of 80% TSS removal (MECP Enhanced Level), this corresponds to a required permanent pool volume of 4,307 m^3. The preliminary grading of the wet SWM pond will provide a permanent pool volume of 5,310 m^3,calculations are provided in **Appendix D**. Additional removal of sediment from the runoff will be provided by upstream BMPs such as catchbasin infiltration/filtration trenches, rear yard at-surface infiltration trenches, and an OGS (Vortech Unit) located upstream of the wet SWM pond. The design of these additional facilities is discussed further in the following sections.

Quality control for Catchment 202 is not required. It is noted that the drainage associated with Catchment 202 is from roofs and rear yards which is generally considered clean. The runoff will have an opportunity to infiltrate in rear yard at-surface infiltration trenches and as it crosses grassed surfaces before sheet flowing to the NHS.

East of the NHS

Quality control for Catchment 204 will be provided by proposed catchbasin filtration trenches sized for a minimum of 80% TSS removal (MECP Enhanced Level), this corresponds to a required filtration volume of 182.7 m^3. The preliminary catchbasin filtration trench layout and design for Catchment 204 will provide a filtration volume of 188.0 m^3, calculations are provided in **Appendix E**. The design of the catchbasin filtration trenches is discussed further in the followings sections. Additional removal of sediment from the runoff will be provided by upstream BMPs such as rear yard at-surface infiltration trenches, an OGS (Vortech Unit) upstream of the dry SWM Pond, and a grassed filter strip downstream of the dry SWM Pond.

Quality control for Catchments 205, 206, and 207 is not required. It is noted that the drainage associated with these catchments is from roofs and rear yards and the SWM block which is generally considered clean. The runoff will have an opportunity to infiltrate in rear yard at-surface infiltration trenches and as it crosses grassed surfaces before sheet flowing to the NHS or to grass roadside ditches.

Other Pollutants

In accordance with the LSRCA Technical Guidelines for Stormwater Management Submissions, road grades have been minimized to the extent feasible to reduce the necessity of winter salting. To assist in temperature mitigation, shading will be included via plantings around the wet SWM Pond.

As the land use of the proposed development is residential, the proposed development is considered to be a low risk for contamination by other pollutants such as bacteria and pesticides. The proposed quality control measures have been designed in series to constitute a

treatment train that is capable of treating the anticipated contaminants such as oil, grease, gas, and heavy metals. Regular inspection of the manufactured treatment devices, catchbasin infiltration/filtration trenches, and SWM pond facilities will assist in maintaining their effectiveness.

2.5.3 Volume Control

The proposed development will include more than 0.5 ha of new impervious surface, therefore, per LSRCA criteria, the post-development runoff volume from a 25 mm rainfall event from impervious surfaces must be retained on-site unless the site is considered a "site with restrictions". Volume control was calculated for each development area as outlined below.

Volume control for the proposed development will be provided through rear yard at-surface infiltration trenches, and catchbasin infiltration/filtration trenches. Rear yard at-surface infiltration trenches will be provided on all split draining lots where feasible. Catchbasin infiltration trenches will be provided wherever there is adequate clearance to the seasonally high groundwater. Catchbasin filtration trenches will be provided where infiltration trenches are not feasible. Catchbasin infiltration/filtration trenches cannot be provided where they would have to cross an intersection or where it would interfere with lot servicing connections. The design of the infiltration and filtration facilities is discussed further in the following sections.

The combined volume provided based on the preliminary BMPs above is 1,229.4 m^3 which corresponds to an equivalent depth of rainfall over the total impervious area of 6.4 mm. This achieves Alternative #2 criteria for volume control. Additional volume control cannot be provided due to the high seasonal groundwater conditions, generally low infiltration rate across the site (to be confirmed through detailed design).The number and size of rear yard infiltration trenches has been maximized. The size of the catchbasin infiltration/filtration trenches have been maximized to still achieve relevant sizing criteria and not interfere with required service connections and utilities in the right-of-way. Calculations are provided in **Appendix E**.

2.5.4 Water Budget

Where feasible, measures to minimize impacts on the water budget will be incorporated into the development design. As noted in the Hydrogeological Study, the estimated existing infiltration volume on the proposed development is approximately 60,883 m^3. Without mitigation the proposed development infiltration volume is approximately 31,668 m^3. It is anticipated that a proposed infiltration volume of approximately 160,246 m^3 can be achieved through the proposed mitigation measures outlined above.

2.5.5 Phosphorus Budget

Under the Lake Simcoe Protection Plan, a stormwater management plan must demonstrate how phosphorus loadings are minimized between existing and proposed. The MECP database application *Lake Simcoe Phosphorus Loading Development Tool* (v2, 01-April-2012 update) was used to complete the phosphorus budget for the proposed development. Due to the complex treatment train provided by the SWM measures outlined above, a spreadsheet based on the MECP database application was developed to determine the existing and proposed phosphorus budget.