REPORT

Water Balance Report
Bradford Highlands Golf Course Redevelopment

Submitted to:

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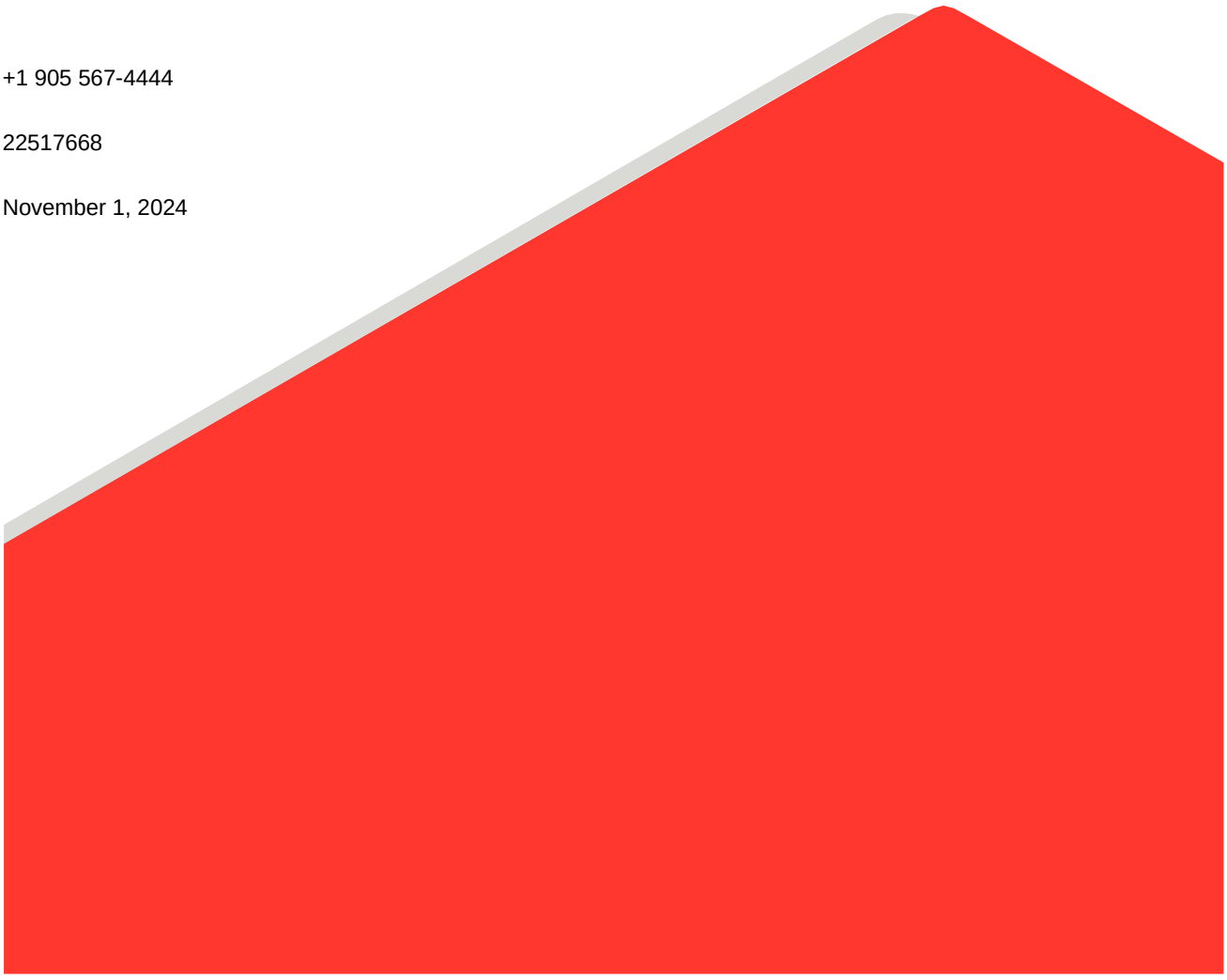

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1.0 INTRODUCTION

Bayview Bradford Highlands Joint Venture Inc. ('Bayview' the 'Client') has retained WSP to produce geotechnical, hydrogeological and environmental reports to accompany the Client's application for Draft Plan approval for the proposed redevelopment of the Bradford Highlands Golf Course in Bradford, Ontario (the Site). The purpose of this report is to present the water balance analysis for the pre-development and proposed post-development conditions.

2.0 BACKGROUND

The proposed residential development, hereafter referred to as the Site, is located southeast of the intersection of Concession Road 6 and Brownlee Drive, in the Town of Bradford, Ontario (Figure 1). The site was previously the location of the Bradford Highlands Golf Club; this water balance assessment is focused on the 60 ha proposed for the new development.

The proposed development falls within the Lake Simcoe watershed and within the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA). The southwestern Site area flows directly to the Holland River which then discharges to Lake Simcoe. The remainder of the Site first discharges to existing drainage features which connect to the Holland River east of the Site.

A water balance assessment was carried out to compare pre-development, post-development (no mitigation) and post-development (mitigated) water balance conditions, including estimates of average annual infiltration and runoff volumes from the site. All assumed areas and land uses were based on the drainage area information provided by SCS by email in October 2024 (Attachment 2), with infiltration contribution assumed to follow surface catchment contribution. In addition, feature-based water balances were carried out for two surface water features crossing the site and the wetland in the southeast corner of the site.

3.0 METHODOLOGY

The water balance assessment was based on meteorological data from the Meteorological Service of Canada Thornthwaite water budgets (Egbert MOE, Ontario between 1989 to 2016), watershed boundaries, land use data and the existing soil types.

Water balance calculations are based on the following equation:

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

Where:

P = precipitation;

S = change in groundwater storage;

ET = evapotranspiration;

R = surface runoff; and

I = infiltration (groundwater recharge).

Short-term or seasonal changes in soil moisture storage (S) occur during dry conditions in the summer months and relatively saturated conditions in the winter and spring. Long-term changes (e.g., year to year) in soil moisture storage are generally small and have been assumed to be zero.

Precipitation data collected at the Environment Canada (EC) Egbert MOE monitoring station (1989 to 2016) indicated a mean annual precipitation (P) of 786 mm/yr. Evapotranspiration (ET) refers to water losses from soil surfaces to the atmosphere. The term combines evaporation (i.e., water lost from the soil surface) and transpiration (i.e., water lost to plants and trees) because of the difficulties involved in separating these processes. Potential ET refers to the loss of water from a vegetated surface to the atmosphere under conditions of an unlimited water supply. The actual rate of ET is typically less than the potential rate under dry conditions (e.g., during the summer months when there is a soil moisture deficit). The mean annual potential ET for the area in question is approximately 607 mm/year based on data (Thornthwaite water budget for Egbert meteorological station) provided by Environment Canada (EC).

Annual water surplus is the difference between the annual P and the annual actual ET and represents the total amount of water, the sum of surface runoff (R) and infiltration (I), that would flow from the catchment area on an annual basis. On a monthly basis, surplus water remains after actual evapotranspiration has been removed from the sum of rainfall and snow-melt and maximum soil storage is exceeded. Maximum soil storage is quantified using a water holding capacity (WHC) specific to the soil type and land use and conceptually represents the difference in water content between the field capacity and the wilting point. The total water surplus is calculated by summing the surplus available from each WHC within the watershed. Tables following the text of this report include the EC water budget for Egbert EC information, considered for the water balance assessment.

Infiltration rates were estimated using the Ontario Ministry of Environment (MECP) Stormwater Management Planning and Design (SWM) Manual (2003). There are three factors which are considered in estimating the fraction of the total annual surplus that infiltrates beyond the surficial soil layer, the factors are topography, soil type and ground cover. The sum of the fractions representing each of these characteristics establishes the total percentage of surplus, which can be infiltrated in areas with sufficient downward gradient. Wetlands and water bodies are assumed to have an upward or negligible downward gradient, resulting in all surpluses being contained in these areas, which provide increased evaporation and limited infiltration.

3.1 Site Water Balance Inputs

The site was assessed based on a single 60 ha catchment, reflecting the land use mapping provided by SCS (Attachment 2). The water balance analysis was completed for three scenarios:

- Pre-development examined the existing drainage patterns and mapped land uses on the study area.
- Post-development (no mitigation) condition based on the proposed land use.
- Post-development considering mitigation measures (i.e., Downspout disconnection and Infiltration Trenches) proposed by SCS.

Based on the borehole logs from the WSP Hydrogeological report (WSP, 2022), the soils below the topsoil layer within the footprint under pre-development conditions were generally silty clay to clayey silt. WHC and infiltration factors for the various land uses were taken from the MOE SWM Manual (MOE, 2003).

Pre-Development Site Land Uses

The pre-development land use for the Site is shown in Table 1. The pre-development Site reflects the recent golf-course land use.

- Forested areas were assigned a WHC of 400 mm and infiltration factor of 0.6, representing flat land, clay loam, and forested land use.
- Pasture and shrub areas were assigned a WHC of 250 mm and infiltration factor of 0.5, representing flat land, clay loam, and cultivated land use.
- Golf course areas were assigned a WHC of 100 mm and an infiltration factor of 0.4, representing rolling land, clay loam, and cultivated land use.
- Impervious areas (paved and roof areas) were assumed to lose 10% of annual precipitation as evaporation, with the remainder assumed as runoff (based on guidance in from the Ontario Conservation Authorities "Hydrogeological Assessment Submissions (Ontario CAs, 2013)), with no infiltration from Paved areas and an infiltration factor of 0.25 for roof areas (assuming roof downspout disconnections for buildings).
- Pond areas were assumed to always have water available at surface for evaporation, and the annual surplus was thus assumed as annual precipitation minus potential evaporation with no infiltration.

Table 1: Pre-Development Site Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Forest	3.4	Clay Loam	400	0.2	0.2	0.2	0.6
Pasture/Shrub	6.8	Clay Loam	250	0.2	0.2	0.1	0.5
Golf Course	48.6	Clay Loam	100	0.1	0.2	0.1	0.4
Paved Road	0.6	Clay Loam	(90% Precip) [1]	-	-	-	0
Roof to Downspout Disconnect	0.1	Clay Loam	(90% Precip) [1]	-	-	-	0.252
Pond	0.5	Clay Loam	(Precip-PET)[3]	-	-	-	0

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Post-Development– No Mitigation Site Land Uses

The post-development land use for the site without mitigation is shown in Table 2. The post-development Site reflect a mix of residential and park land uses, which has been further divided into forest, Grassland (pasture/shrub), landscaped (urban lawn), paved, roof to downspout disconnection, and pond areas.

- Forested areas were assigned a WHC of 400 mm and infiltration factor of 0.6, representing flat land, clay loam, and forested land use.

- Pasture and shrub areas were assigned a WHC of 250 mm and infiltration factor of 0.5, representing rolling land, clay loam, and cultivated land use.
- Landscaped areas were assigned a WHC of 100 mm and an infiltration factor of 0.4, representing rolling land, clay loam, and cultivated land use.
- Impervious areas (paved and roof areas) were assumed to lose 10% of annual precipitation as evaporation, with the remainder assumed as runoff (based on guidance in from the Ontario Conservation Authorities "Hydrogeological Assessment Submissions (Ontario CAs, 2013)), with no infiltration from Paved areas or roof areas.
- Pond areas were assumed to always have water available at surface for evaporation, and the annual surplus was thus assumed as annual precipitation minus potential evaporation with no infiltration

Table 2: Post-Development – No Mitigation Site Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Forest	1.7	Clay Loam	400	0.2	0.2	0.2	0.6
Grassland (pasture/shrub)	6.8	Clay Loam	250	0.2	0.2	0.1	0.5
Landscaped	18.9	Clay Loam	100	0.1	0.2	0.1	0.4
Paved	19.7	Clay Loam	(90% Precip) [1]	-	-	-	-
Roof	10.5	Clay Loam	(90% Precip) [1]	-	-	-	-
Pond	2.6	Clay Loam	(Precip-PET)[2]	-	-	-	-

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Post-Development – Mitigated Land Uses

The post-development mitigated land use for the site is shown in Table 3. The post-development mitigated site reflects the same land uses as the post-development (no mitigation) site, with the addition of downspout disconnections for the rooftop and infiltration trenches for select areas were groundwater elevations allow.

- For downspout disconnected roof areas, an infiltration factor of 0.25 was used based Table 4.3.1 of the TRCA LID Manual (TRCA, 2010).
- The current development plan proposes to collect and infiltrate the first 25 mm of collected rainfall from 0.1 ha of rooftops. The runoff capture and infiltration for these features was estimated by taking the daily precipitation at the Egbert station for the available period of record (2001 to 2021), estimating daily rainfall (assumed as precipitation on days when the mean temperature was above zero), subtracting an initial 1 mm initial abstraction, and assuming the capture of up to 25 mm for any assumed rainfall above that 1 mm amount. The results suggested that a system designed to thus capture and infiltrate the first 25 mm of runoff event would provide approximately 473.6 mm/yr infiltration for that area.

- Pond areas were assumed to always have water available at surface for evaporation, and the annual surplus was thus assumed as annual precipitation minus potential evaporation with no infiltration

Table 3: Post-Development - Mitigated Site Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Forest	1.7	Clay Loam	400	0.2	0.2	0.2	0.6
Grassland (pasture/shrub)	6.8	Clay Loam	250	0.2	0.2	0.1	0.5
Landscaped	18.9	Clay Loam	100	0.1	0.2	0.1	0.4
Paved	19.7	Clay Loam	(90% Precip) [1]	-	-	-	-
Roof to downspout disconnection	10.4	Clay Loam	(90% Precip) [1]	-	-	-	0.252
Roof to Infiltration	0.1	Clay Loam	(90% Precip) [1]	-	-	-	N/A3
Pond	2.6	Clay Loam	(Precip-PET)[4]	-	-	-	-

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

[3] Infiltration for impervious areas assumed based on capture of 25 mm of historical daily rainfall

[4] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

3.2 Site Water Balance Results

Results from the pre-development and post-development scenarios are described below.

Pre-Development Scenario

Results from the pre-development scenario for the site are shown in Table 4 below. Of the 473,000 m^3/yr precipitation over the Site, 325,000 m^3/yr is lost as evapotranspiration, with the remaining 144,000 m^3/yr surplus being divided into 59,000 m^3/yr infiltration and 86,000 m^3/yr runoff.

Post-Development Scenario - No Mitigation

Results from the post-development scenario are shown in Table 5 below. The precipitation is the same as the pre-development scenario, however the increase in hard surfaces results in decreased evapotranspiration losses and increase in surplus to 280,000 m^3/yr (an increase of 136,000 m^3/yr or 94% compared to the pre-development scenario. The increase in hard surfaces likewise results in a decrease in post-development infiltration to 27,000 m^3/yr (a decrease of 32,000 m^3/yr or 54% compared to the pre-development scenario). The post-development runoff meanwhile increases to 253,000 m^3/yr (167,000 m^3/yr or 194% above pre-development conditions).

Post-Development Scenario - Mitigated

Results from the post-development with mitigation scenario are shown in Table 6 below. The precipitation is roughly the same as the pre-development scenario, however the increase in hard surfaces results in decreased evapotranspiration losses and increase in surplus to 280,000 m^3/yr (an increase of 136,000 m^3/yr or 94%

compared to the pre-development scenario). Despite the downspout disconnection (which provide 18,000 m^3/yr infiltration), the increase in hard surfaces likewise results in a decrease in post-development infiltration to 45,000 m^3/yr (a decrease of 14,000 m^3/yr or 24% compared to the pre-development scenario). The post-development runoff meanwhile increases to 235,000 m^3/yr (149,000 m^3/yr or 173% above pre-development conditions).

Table 4: Pre-Development Site Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Forest	3.4	400	786	27,000	605	21,000	177	6,000	106	4,000	70.8	2,000
Pasture/Shrub	6.8	250	786	54,000	593	41,000	192	13,000	96.0	7,000	96.0	7,000
Golf Course / Urban Lawn	48.6	100	786	382,000	536	260,000	245	119,000	98.0	48,000	147	71,000
Paved Road and Other Impervious	0.6	(90% Precip[1])	786	5,000	78.6	0	707	4,000	0	0	707	4,000
Roof to Downspout Disconnect	0.1	(90% Precip[1])	786	1,000	78.6	0	707	1,000	177[2]	0	531	1,000
Pond	0.5	(Precip-PET[3])	786	4,000	607	3,000	179	1,000	0	0	179	1,000
Total	**60.0**			**473,000**		**325,000**		**144,000**		**59,000**		**86,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Table 5: Post-Development – No Mitigation Site Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Forest	1.7	400	786	13,000	605	10,000	177	3,000	106	2,000	70.8	1,000
Pasture/Shrub	6.8	250	786	54,000	593	41,000	192	13,000	96.0	7,000	96.0	7,000
Golf Course / Urban Lawn	18.9	100	786	148,000	536	101,000	245	46,000	98.0	18,000	147	28,000
Paved Road and Other Impervious	19.7	(90% Precip[1])	786	154,000	78.6	15,000	707	139,000	0	0	707	139,000
Roof	10.5	(90% Precip[1])	786	82,000	78.6	8,000	707	74,000	0	0	707	74,000
Pond	2.6	(Precip-PET[2])	786	20,000	607	16,000	179	5,000	0	0	179	5,000
Total	**60.0**			**471,000**		**191,000**		**280,000**		**27,000**		**253,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Table 6: Post-Development - Mitigated Site Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Forest	1.7	400	786	13,000	605	10,000	177	3,000	106	2,000	71	1,000
Pasture/shrub	6.8	250	786	54,000	593	41,000	192	13,000	96	7,000	96	7,000
Landscaped	18.9	100	786	148,000	536	101,000	245	46,000	98	18,000	147	28,000
Paved Road	19.7	(90% Precip)[1]	786	154,000	79	15,000	707	139,000	0	0	707	139,000
Roof to Downspout Disconnect	10.4	(90% Precip)[1]	786	82,000	79	8,000	707	74,000	177[2]	18,000	531	55,000
Roof to Infiltration	0.1	(90% Precip)[1]	786	1,000	78.6	0	707	1,000	474[3]	0	234	0
Pond	2.6	(Precip-PET)[4]	786	20,000	607	16,000	179	5,000	0	0	179	5,000
Total	**60.0**			**471,000**		**191,000**		**280,000**		**45,000**		**235,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

[3] Infiltration for impervious areas assumed based on capture of 25 mm of historical daily rainfall

[4] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

3.3 Feature-Based Water Balance Inputs

The site was assessed based on feature catchments, reflecting the land use mapping provided by SCS. The features are two watercourses, the North Feature (HDF-D) and the South Feature (HDF-E), and a wetland. The water balance analysis of the features was completed for three scenarios:

- Pre-development examined the existing drainage patterns and mapped land uses on the study area.
- Post-development (no mitigation) condition based on the proposed land use.
- Post-development considering mitigation measures (i.e., Downspout disconnection and Infiltration Trenches) proposed by SCS.

Based on the borehole logs from the WSP Hydrogeological report (WSP, 2022), the soils below the topsoil layer within the footprint under pre-development conditions were generally silty clay to clayey silt. WHC and infiltration factors for the various land uses were taken from the MOE SWM Manual (MOE, 2003).

Pre-Development Land Uses

The pre-development land use for the watercourses is shown in Table 7, Table 8, and land use for the wetland is shown in Table 9.

- Agricultural areas were assigned a WHC of 200 mm and infiltration factor of 0.4, representing rolling land, clay loam, and cultivated land use.
- Pasture and shrub areas were assigned a WHC of 250 mm and infiltration factor of 0.5, representing flat land, clay loam, and cultivated land use.
- Golf course areas were assigned a WHC of 100 mm and an infiltration factor of 0.4, representing rolling land, clay loam, and cultivated land use.
- Impervious areas (paved and roof areas) were assumed to lose 10% of annual precipitation as evaporation, with the remainder assumed as runoff (based on guidance in from the Ontario Conservation Authorities “Hydrogeological Assessment Submissions (Ontario CAs, 2013)), with no infiltration from Paved areas and an infiltration factor of 0.25 for roof areas (assuming roof downspout disconnections for buildings).
- Pond areas were assumed to always have water available at surface for evaporation, and the annual surplus was thus assumed as annual precipitation minus potential evaporation with no infiltration.

Table 7: Pre-Development HDF-D Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	12.56	Clay Loam	200	0.1	0.2	0.1	0.4
Golf Course	12.99	Clay Loam	100	0.1	0.2	0.1	0.4
Paved	1.99	Clay Loam	(90% Precip) [1]	-	-	-	0
Rooftop	1.05	Clay Loam	(90% Precip) [1]	-	-	-	0.25

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 8: Pre-Development HDF-E Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	39.00	Clay Loam	200	0.1	0.2	0.1	0.4
Golf Course	3.05	Clay Loam	100	0.1	0.2	0.1	0.4

Table 9: Pre-Development Wetland Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	57.2	Clay Loam	200	0.1	0.2	0.1	0.4
Golf Course	28.1	Clay Loam	100	0.1	0.2	0.1	0.4
Forest	3.40	Clay Loam	200	0.2	0.2	0.1	0.5
Pasture/Shrub	6.8	Clay Loam	250	0.2	0.2	0.2	0.6
Pond	0.5	Clay Loam	(Precip-PET)[2]	-	-	-	0
Paved	2.0	Clay Loam	(90% Precip) [1]	-	-	-	0
Rooftop	1.2	Clay Loam	(90% Precip) [1]	-	-	-	0.25[3]

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

[3] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Post-Development – No Mitigation Land Uses

The post-development land use for the watercourses is shown in Table 10, Table 11 and land use for the wetland is shown in Table 12. The post-development features reflect a mix of residential and park land uses, which has been further divided into Agricultural, forest, grassland (pasture/shrub), landscaped (urban lawn), paved, roof, roof to downspout disconnection, and pond areas.

- Agricultural areas were assigned a WHC of 200 mm and infiltration factor of 0.4, representing rolling land, clay loam, and cultivated land use.
- Pasture and shrub areas were assigned a WHC of 250 mm and infiltration factor of 0.5, representing flat land, clay loam, and cultivated land use.
- Golf course areas were assigned a WHC of 100 mm and an infiltration factor of 0.4, representing rolling land, clay loam, and cultivated land use.
- Impervious areas (paved and roof areas) were assumed to lose 10% of annual precipitation as evaporation, with the remainder assumed as runoff (based on guidance in from the Ontario Conservation Authorities "Hydrogeological Assessment Submissions (Ontario CAs, 2013)), with no infiltration from Paved areas and an infiltration factor of 0.25 for roof areas (assuming roof downspout disconnections for existing buildings).
- Pond areas were assumed to always have water available at surface for evaporation, and the annual surplus was thus assumed as annual precipitation minus potential evaporation with no infiltration.

Table 10: Post-Development – No Mitigation HDF-D Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	12.56	Clay Loam	200	0.1	0.2	0.1	0.4
Golf Course	7.8	Clay Loam	100	0.1	0.2	0.1	0.4
Paved	2.0	Clay Loam	(90% Precip) [1]	-	-	-	0
Rooftop	1.0	Clay Loam	(90% Precip) [1]	-	-	-	0.25[2]
Rooftop	0.3	Clay Loam	(90% Precip) [1]	-	-	-	0

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 11 : Post-Development – No Mitigation HDF-E Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	39.00	Clay Loam	200	0.1	0.2	0.1	0.4
Rooftop	0.2	Clay Loam	(90% Precip) [1]	-	-	-	0
Landscaped	0.3	Clay Loam	100	0.1	0.2	0.1	0.4

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

Table 12: Post-Development Wetland Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	57.2	Clay Loam	200	0.1	0.2	0.1	0.4
Forest	1.7	Clay Loam	200	0.2	0.2	0.2	0.6
Pasture/Shrub	6.8	Clay Loam	250	0.2	0.2	0.1	0.5
Paved	7.7	Clay Loam	(90% Precip) [1]	-	-	-	0
Rooftop	1.2	Clay Loam	(90% Precip) [1]	-	-	-	0.25[2]
Landscaped	20.4	Clay Loam	100	0.1	0.2	0.1	0.4
Rooftop	6.2	Clay Loam	(90% Precip) [1]	-	-	-	0
Pond	2.6	Clay Loam	(Precip-PET)[3]	-	-	-	0

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Post-Development – Mitigated Land Uses

The post-development mitigated land use for the watercourses is shown in Table 13, Table 14 and land use for the wetland is shown in Table 15. The post-development mitigated site reflects the same land uses as the post-development (no mitigation) site, with the addition of downspout disconnections for the rooftops.

- For downspout disconnected roof areas, an infiltration factor of 0.25 was used based Table 4.3.1 of the TRCA LID Manual (TRCA, 2010).

Table 13: Post-Development – Mitigated HDF-D Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	12.56	Clay Loam	200	0.1	0.2	0.1	0.4
Golf Course	7.8	Clay Loam	100	0.1	0.2	0.1	0.4
Paved	2.0	Clay Loam	(90% Precip) [1]	-	-	-	0
Rooftop	1.3	Clay Loam	(90% Precip) [1]	-	-	-	0.25[2]

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 14: Post-Development – Mitigated HDF-E Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	39.00	Clay Loam	200	0.1	0.2	0.1	0.4
Rooftop	0.2	Clay Loam	(90% Precip) [1]	-	-	-	0.25[2]
Landscaped	0.3	Clay Loam	100	0.1	0.2	0.1	0.4

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 15: Post-Development -- Mitigated Wetland Land Use

Land Use	Area (ha)	Soil	Water Holding Capacity (mm)	Infiltration Coefficient			
				Slope Factor	Soil Factor	Vegetation Factor	Total
Agricultural	57.18	Clay Loam	200	0.1	0.2	0.1	0.4
Forest	1.7	Clay Loam	200	0.2	0.2	0.2	0.6
Pasture/Shrub	6.8	Clay Loam	250	0.2	0.2	0.1	0.5
Paved	7.7	Clay Loam	(90% Precip) [1]	-	-	-	0
Rooftop	7.4	Clay Loam	(90% Precip) [1]	-	-	-	0.25[2]
Landscaped	20.4	Clay Loam	100	0.1	0.2	0.1	0.4
Pond	2.6	Clay Loam	(Precip-PET)[3]	-	-	-	0

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

3.4 Feature-Based Water Balance Results

Average annual water balance assessments were carried out for the portions of the site contributing to i) the north feature watercourse (HDF-D) sub-watershed, ii) the south feature watercourse (HFD-E) sub-watershed and iii) the Wetland. The results for the pre-development, post-development, and mitigated post-development scenarios are presented in this section for each of the three assessments.

Pre-Development Scenario

Watercourses

Results from the pre-development scenario for the watercourses are shown in Table 16 and Table 17 below. Of the 225,000 m^3/yr precipitation over the north feature watercourse (HDF-D) catchment, 146,000 m^3/yr is lost as evapotranspiration. The estimated average annual runoff from the North feature catchment is approximately 54,000 m^3 and the average annual infiltration within this catchment is 25,000 m^3.

Of the 331,000 m^3/yr precipitation over the south watercourse (HDF-E) catchment, 243,000 m^3/yr is lost as evapotranspiration. The estimated average annual runoff from the south feature is approximately 51,000 m^3 and the average annual infiltration within this catchment is approximately 35,000 m^3.

Wetland

Results from the pre-development scenario for the wetland are shown in Table 18 below. Of the 781,000 m^3/yr precipitation over the wetland catchment, 552,000 m^3/yr is lost as evapotranspiration. The estimated average annual runoff contributing to the Wetland is approximately 141,000 m^3 and the average annual infiltration is approximately 87,000 m^3.

Post-Development – No Mitigation Scenario

Watercourses

Results from the post-development scenario for the watercourses are shown in Table 19 and Table 20 below. Of the 186,000 m^3/yr precipitation over the north feature watercourse (HDF-D) catchment, 118,000 m^3/yr is lost as evapotranspiration, with the remaining 67,000 m^3/yr surplus being divided into 20,000 m^3/yr infiltration and 47,000 m^3/yr runoff.

Of the 311,000 m^3/yr precipitation over the south feature watercourse (HFD-E) catchment, 227,000 m^3/yr is lost as evapotranspiration, with the remaining 83,000 m^3/yr surplus being divided into 32,000 m^3/yr infiltration and 51,000 m^3/yr runoff.

Wetland

Results from the post-development scenario for the wetland are shown in Table 21 below. Of the 816,000 m^3/yr precipitation over the wetland catchment, 522,000 m^3/yr is lost as evapotranspiration, with the remaining 294,000 m^3/yr surplus being divided into 77,000 m^3/yr infiltration and 217,000 m^3/yr runoff.

Post-Development – Mitigated Scenario

Watercourses

Results from the post-development with mitigation scenario for the watercourses are shown in Table 22 and Table 23 below. Of the 186,000 m^3/yr precipitation over the north feature watercourse (HDF-D) catchment, 118,000 m^3/yr is lost as evapotranspiration, with the remaining 67,000 m^3/yr surplus being divided into 20,000 m^3/yr

infiltration and 47,000 m^3/yr runoff (a decrease of 20% and 13%, respectively, compared to pre-development conditions).

Of the 311,000 m^3/yr precipitation over the south feature watercourse (HFD-E) catchment, 227,000 m^3/yr is lost as evapotranspiration, with the remaining 83,000 m^3/yr surplus being divided into 32,000 m^3/yr infiltration and 51,000 m^3/yr runoff (a decrease of 9% and 0%, respectively, compared to pre-development conditions).

Wetland

Results from the post-development with mitigation scenario for the wetland are shown in Table 24 below. Of the 815,000 m^3/yr precipitation over the wetland catchment, 522,000 m^3/yr is lost as evapotranspiration, with the remaining 293,000 m^3/yr surplus being divided into 88,000 m^3/yr infiltration and 205,000 m^3/yr runoff (an increase of 1% and 45%, respectively, compared to pre-development conditions).

Table 16: Pre-Development HDF-D Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	12.56	200	786	99,000	582	73,000	202	25,000	80.8	10,000	121	15,000
Golf Course / Urban Lawn	12.99	100	786	102,000	536	70,000	245	32,000	98.0	13,000	147	19,000
Paved Road and Other Impervious	1.99	(90% Precip) [1]	786	16,000	78.6	2,000	707	14,000	0	0	707	14,000
Roof	1.05	(90% Precip) [1]	786	8,000	78.6	1,000	707	7,000	177[2]	2,000	531	6,000
Total	**28.6**			**225,000**		**146,000**		**78,000**		**25,000**		**54,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 17: Pre-Development HDF-E Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	39.00	200	786	307,000	582	227,000	202	79,000	80.8	32,000	121	47,000
Golf Course / Urban Lawn	3.05	100	786	24,000	536	16,000	245	7,000	98.0	3,000	147	4,000
Total	**42.1**			**331,000**		**243,000**		**86,000**		**35,000**		**51,000**

Table 18: Pre-Development Wetland Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	57.2	200	786	449,000	582	333,000	202	116,000	80.8	46,000	121	69,000
Forest	3.4	400	786	27,000	605	21,000	177	6,000	106	4,000	70.8	2,000
Pasture/Shrub	6.8	250	786	54,000	593	41,000	192	13,000	96.0	7,000	96.0	7,000
Golf Course / Urban Lawn	28.1	100	786	221,000	536	151,000	245	69,000	98.0	28,000	147	41,000
Paved Road and Other Impervious	2.0	(90% Precip) [1]	786	16,000	78.6	2,000	707	14,000	0	0	707	14,000
Roof to Downspout Disconnect	1.2	(90% Precip) [1]	786	10,000	78.6	1,000	707	9,000	177[2]	2,000	531	7,000
Pond	0.5	(Precip-PET)[3]	786	4,000	607	3,000	179	1,000	0	0	179	1,000
Total	**99.3**			**781,000**		**552,000**		**228,000**		**87,000**		**141,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)
[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Table 19: Post-Development – No Mitigation HDF-D Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	12.6	200	786	99,000	582	73,000	202	25,000	80.8	10,000	121	15,000
Golf Course / Urban Lawn	7.8	100	786	61,000	536	42,000	245	19,000	98.0	8,000	147	11,000
Paved Road and Other Impervious	2.0	(90% Precip) [1]	786	16,000	78.6	2,000	707	14,000	0	0	707	14,000
Roof	0.3	(90% Precip) [1]	786	2,000	78.6	0	707	2,000	0	0	707	2,000
Roof to Downspout Disconnect	1.0	(90% Precip) [1]	786	8,000	78.6	1,000	707	7,000	177[2]	2,000	531	6,000
Total	**23.7**			**186,000**		**118,000**		**67,000**		**20,000**		**47,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 20: Post-Development – No Mitigation HDF-E Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	39.0	200	786	307,000	582	227,000	202	79,000	80.8	32,000	121	47,000
Roof	0.2	(90% Precip) [1]	786	2,000	78.6	0	707	2,000	0	0	707	2,000
Golf Course / Urban Lawn	0.3	(90% Precip) [1]	786	2,000	78.6	0	707	2,000	0	0	707	2,000
Total	**39.5**			**311,000**		**227,000**		**83,000**		**32,000**		**51,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013

Table 21: Post-Development – No Mitigation Wetland Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	57.2	200	786	449,000	582	333,000	202	116,000	80.8	46,000	121	69,000
Forest	1.7	400	786	13,000	605	10,000	177	3,000	106	2,000	70.8	1,000
Pasture/Shrub	6.8	250	786	54,000	593	41,000	192	13,000	96.0	7,000	96.0	7,000
Golf Course / Urban Lawn	20.4	100	786	161,000	536	110,000	245	50,000	98.0	20,000	147	30,000
Paved Road and Other Impervious	7.7	(90% Precip) [1]	786	60,000	78.6	6,000	707	54,000	0	0	707	54,000
Roof	6.2	(90% Precip) [1]	786	49,000	78.6	5,000	707	44,000	0	0	707	44,000
Roof to Downspout Disconnect	1.2	(90% Precip) [1]	786	10,000	78.6	1,000	707	9,000	177[2]	2,000	531	7,000
Pond	2.6	(Precip-PET)[3]	786	20,000	607	16,000	179	5,000	0	0	179	5,000
Total	**103.8**			**816,000**		**522,000**		**294,000**		**77,000**		**217,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)
[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

Table 22: Post-Development – Mitigated HDF-D Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	12.6	200	786	99,000	582	73,000	202	25,000	80.8	10,000	121	15,000
Golf Course / Urban Lawn	7.8	100	786	61,000	536	42,000	245	19,000	98.0	8,000	147	11,000
Paved Road and Other Impervious	2.0	(90% Precip) [1]	786	16,000	78.6	2,000	707	14,000	0	0	707	14,000
Roof to Downspout Disconnect	1.3	(90% Precip) [1]	786	10,000	78.6	1,000	707	9,000	177[2]	2,000	531	7,000
Total	**23.7**			**186,000**		**118,000**		**67,000**		**20,000**		**47,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 23: Post-Development – Mitigated HDF-E Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	39.0	200	786	307,000	582	227,000	202	79,000	80.8	32,000	121	47,000
Roof to Downspout Disconnect	0.2	(90% Precip) [1]	786	2,000	78.6	0	707	2,000	177[2]	0	531	1,000
Golf Course / Urban Lawn	0.3	(90% Precip) [1]	786	2,000	78.6	0	707	2,000	0	0	707	2,000
Total	**39.5**			**311,000**		**227,000**		**83,000**		**32,000**		**51,000**

[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)

Table 24: Post-Development Wetland Water Balance Results

Land Use	Area (ha)	WHC (mm)	Precipitation		Actual Evap.		Surplus		Infiltration		Runoff	
			(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Agricultural	57.2	200	786	449,000	582	333,000	202	116,000	80.8	46,000	121	69,000
Forest	1.7	400	786	13,000	605	10,000	177	3,000	106	2,000	70.8	1,000
Pasture/Shrub	6.8	250	786	54,000	593	41,000	192	13,000	96.0	7,000	96.0	7,000
Golf Course / Urban Lawn	20.4	100	786	161,000	536	110,000	245	50,000	98.0	20,000	147	30,000
Paved Road and Other Impervious	7.7	(90% Precip) [1]	786	60,000	78.6	6,000	707	54,000	0	0	707	54,000
Roof to Downspout Disconnect	7.4	(90% Precip) [1]	786	58,000	78.6	6,000	707	52,000	177	13,000	531	39,000
Pond	2.6	(Precip-PET)[3]	786	20,000	607	16,000	179	5,000	0	0	179	5,000
Total	**103.8**			**815,000**		**522,000**		**293,000**		**88,000**		**205,000**

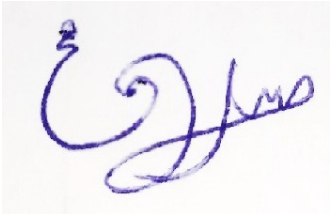
[1] 90% of the total precipitation is available as surplus for impervious areas based on Ontario CAs 2013
[2] 25% of runoff from roof downspouts assumed to infiltrate based on Table 4.3.2 in the TRCA LID manual (TRCA, 2010)
[3] Surplus for open water areas assumed as Precipitation minus Potential Evapotranspiration

4.0 CONCLUSIONS

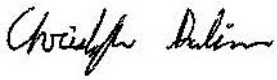
The water balance assessment for the pre-development, post-development and post-development with mitigation scenarios for the Bradford Highlands Site demonstrates that the proposed development will result in a 32% decrease in average annual infiltration and 194% increase in average annual runoff from the Site in the post-development condition without any mitigation. However, by introducing proposed downspout disconnection and infiltration trenches, the proposed development will result in a 24% decrease in average annual infiltration and 173% increase in average annual runoff from the Site. With respect to the features, the mitigated post-development conditions will results in a 20% and 9% reduction in average annual infiltration for HDF-D and HDF-E, respectively, and a 1% increase in infiltration to the wetland.

Signature Page

WSP Canada Inc.



Mohammadreza Mahdavi
Water Resources Specialist



Christopher Davidson, PEng
Water Resources Engineer

MM/CD/mp

https://wsponline.sharepoint.com/sites/gld-159365/project files/6 deliverables/5.0 - water balance/report/22517668-r-rev2-bradford highlands water balance report-01nov2024.docx

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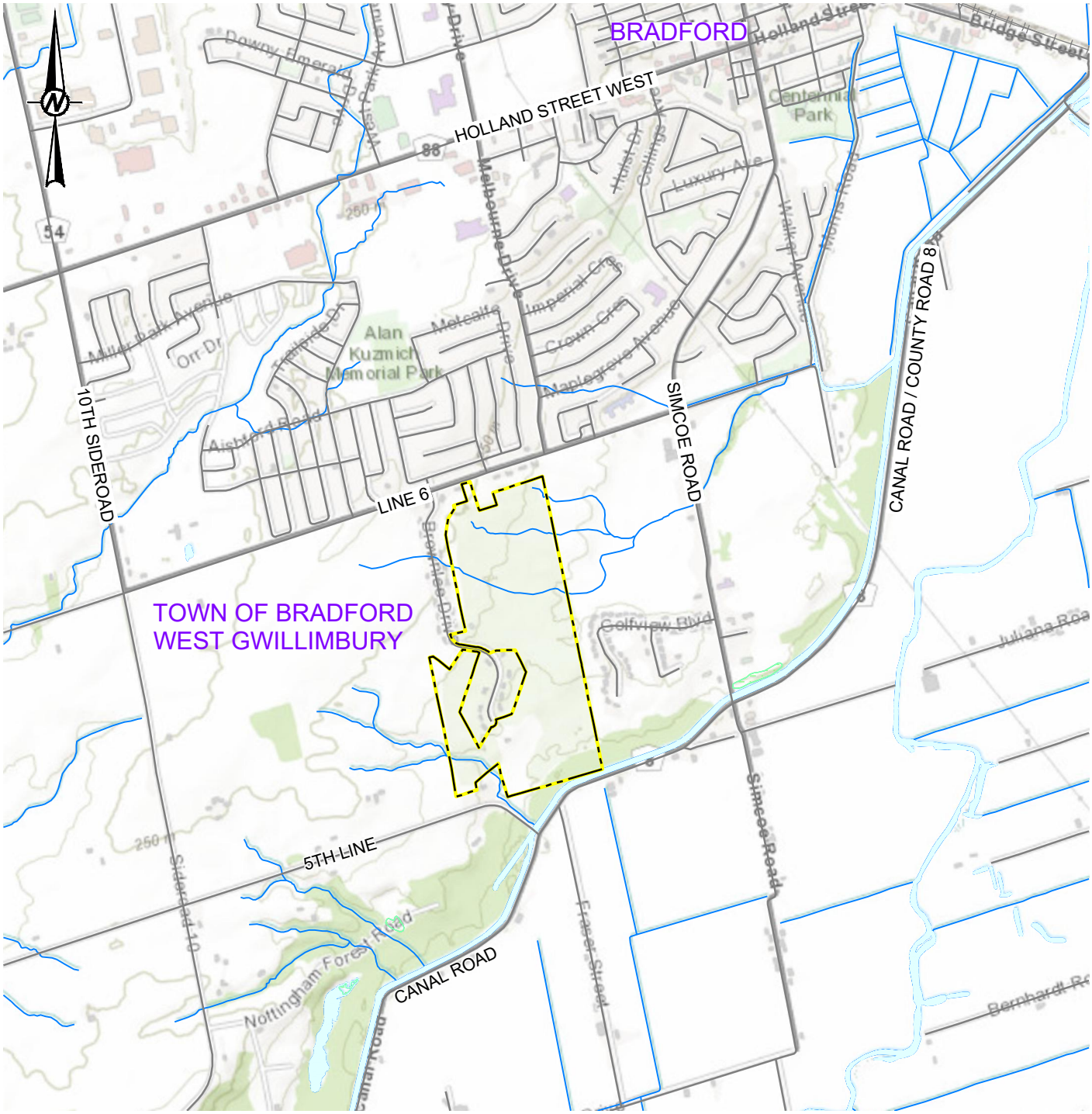
Ontario Ministry of the Environment (MECP), “Stormwater Management Planning and Design Manual”, 2003.

Toronto and Region Conservation Authority (TRCA), “Low Impact Development Stomrwater Management Planning and Design Guide”, 2010

WSP, “Preliminary Hydrogeological Assessment, Proposed Residential Subdivision, Bradford Highlands Golf Course”, October 2022.

FIGURE



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LEGEND

- APPROXIMATE PHASE TWO PROPERTY
- ROAD
- RAILWAY
- WATERCOURSE
- WATER AREA, PERMANENT
- WOODED AREA

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2015
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2015
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
BRADFORD HIGHLANDS

PROJECT
BRADFORD HIGHLANDS GOLF COURSE REDEVELOPMENT
2789 LINE 6 AND 23 BROWNLEE DRIVE
TOWN OF BRADFORD WEST GWILLIMBURY, ONTARIO

TITLE
KEY PLAN

CONSULTANT

YYYY-MM-DD	2024-10-30
PREPARED	JPR
DESIGN	
REVIEW	
APPROVED	DPD

PROJECT No.	CONTROL	Rev.	FIGURE
22517668	0004	----	1

ATTACHMENT 1

Water Balance Tables

TABLE 1A
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1989-2016 (EGBERT, ON DC 20492)
BRADFORD HIGHLANDS

	Thonthwaite (1948) - 100mm WHC							
Month	Mean Temperature (Deg.C)	Heat Index	Protential Evapotranspiration (mm)	Daylight Correction Value	Actual Evapotranspiration (mm)	Total Precipitation (mm)	Surplus (mm)	Defecit (mm)
January	-6.9	0	1.0	0.76	1.0	49.0	33.0	0.0
February	-6.6	0	1.0	0.85	1.0	44.0	37.0	0.0
March	-1.4	0	9.0	0.98	9.0	49.0	64.0	0.0
April	5.7	1.2	32.0	1.11	32.0	63.0	42.0	0.0
May	12.4	4.0	76.0	1.22	76.0	69.0	10.0	0.0
June	17.5	6.7	111.0	1.27	107.0	82.0	5.0	-4.0
July	19.9	8.1	129.0	1.24	107.0	79.0	0.0	-22.0
August	19.2	7.7	114.0	1.15	82.0	79.0	4.0	-32.0
September	15.2	5.4	78.0	1.02	66.0	78.0	2.0	-12.0
October	8.9	2.4	40.0	0.89	39.0	68.0	2.0	-1.0
November	2.8	0.4	13.0	0.78	13.0	69.0	21.0	0.0
December	-3.4	0	3.0	0.73	3.0	57.0	25.0	0.0
TOTAL	6.9	35.9	607.0		536.0	786.0	245.0	-71.0

TOTAL WATER SURPLUS 179.0 mm

NOTES:

1) Water budget adjusted for latitude and daylight
2) Deg.C represents calculatged mean of dialy temperatures for the month
3) Precipitation and Temperature data from the Egbert MET station located at 44.23N 79.78W
4) Total Water Surplus (Thorthwaite, 1948) is caluclated as total precipitation minus adjusted potential evapotranspiration
5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calcualted as total precipitation minus actual evapotranspiration for 1989-2016 using a 100mm Water Holding Capacity

TABLE 1B
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1989-2016 (EGBERT, ON DC 20492)
BRADFORD HIGHLANDS

	Thonthwaite (1948) - 250mm WHC							
Month	Mean Temperature (Deg.C)	Heat Index	Protential Evapotranspiration (mm)	Daylight Correction Value	Actual Evapotranspiration (mm)	Total Precipitation (mm)	Surplus (mm)	Defecit (mm)
January	-6.9	0	1.0	0.76	1.0	49.0	16.0	0.0
February	-6.6	0	1.0	0.85	1.0	44.0	30.0	0.0
March	-1.4	0	9.0	0.98	9.0	49.0	56.0	0.0
April	5.7	1.2	32.0	1.11	32.0	63.0	42.0	0.0
May	12.4	4.0	76.0	1.22	76.0	69.0	10.0	0.0
June	17.5	6.7	111.0	1.27	111.0	82.0	5.0	0.0
July	19.9	8.1	129.0	1.24	128.0	79.0	0.0	-1.0
August	19.2	7.7	114.0	1.15	106.0	79.0	4.0	-9.0
September	15.2	5.4	78.0	1.02	73.0	78.0	2.0	-5.0
October	8.9	2.4	40.0	0.89	40.0	68.0	2.0	0.0
November	2.8	0.4	13.0	0.78	13.0	69.0	10.0	0.0
December	-3.4	0	3.0	0.73	3.0	57.0	15.0	0.0
TOTAL	6.9	35.9	607.0		593.0	786.0	192.0	-15.0

TOTAL WATER SURPLUS 179.0 mm

NOTES:

1) Water budget adjusted for latitude and daylight
2) Deg.C represents calculatged mean of dialy temperatures for the month
3) Precipitation and Temperature data from the Egbert MET station located at 44.23N 79.78W
4) Total Water Surplus (Thorthwaite, 1948) is caluclated as total precipitation minus adjusted potential evapotranspiration
5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calcualted as total precipitation minus actual evapotranspiration for 1989-2016 using a 250mm Water Holding Capacity

TABLE 1C
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1989-2016 (EGBERT, ON DC 20492)
BRADFORD HIGHLANDS

	Thonthwaite (1948) - 400mm WHC							
Month	Mean Temperature (Deg.C)	Heat Index	Protential Evapotranspiration (mm)	Daylight Correction Value	Actual Evapotranspiration (mm)	Total Precipitation (mm)	Surplus (mm)	Defecit (mm)
January	-6.9	0	1.0	0.76	1.0	49.0	13.0	0.0
February	-6.6	0	1.0	0.85	1.0	44.0	26.0	0.0
March	-1.4	0	9.0	0.98	9.0	49.0	52.0	0.0
April	5.7	1.2	32.0	1.11	32.0	63.0	40.0	0.0
May	12.4	4.0	76.0	1.22	76.0	69.0	9.0	0.0
June	17.5	6.7	111.0	1.27	111.0	82.0	5.0	0.0
July	19.9	8.1	129.0	1.24	129.0	79.0	0.0	0.0
August	19.2	7.7	114.0	1.15	114.0	79.0	4.0	-1.0
September	15.2	5.4	78.0	1.02	76.0	78.0	2.0	-1.0
October	8.9	2.4	40.0	0.89	40.0	68.0	2.0	0.0
November	2.8	0.4	13.0	0.78	13.0	69.0	10.0	0.0
December	-3.4	0	3.0	0.73	3.0	57.0	14.0	0.0
TOTAL	6.9	35.9	607.0		605.0	786.0	177.0	-2.0

TOTAL WATER SURPLUS 179.0 mm

NOTES:

1) Water budget adjusted for latitude and daylight
2) Deg.C represents calculatged mean of dialy temperatures for the month
3) Precipitation and Temperature data from the Egbert MET station located at 44.23N 79.78W
4) Total Water Surplus (Thorthwaite, 1948) is caluclated as total precipitation minus adjusted potential evapotranspiration
5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calcualted as total precipitation minus actual evapotranspiration for 1989-2016 using a 400mm Water Holding Capacity

ATTACHMENT 2

SCS Drawings

Water Balance
Site Area Summary

Bradford Highlands
Project Number: 1791
Date: October 2024
Designer Initials: H.Y.

Total Site Area Summary

Site Area	60.00 ha
Open Water / Canal / SWM Pond	2.56 ha
Post Development Pervious Area	27.34 ha
Post Development Impervious Area	30.10 ha
Post Development Imperviousness	50.17 %

Rear Yard Infiltration Trecnh (RYIT) Lot Type Area Breakdown

Lot Type	No. of Units	Roof Area per Unit (m^2)	Total Roof Area (m^2)
Detached	2	110.25	220.50
Semi Detached	10	62.40	624.00
Total	**12**	**172.65**	**844.50**

Roof Area to RYIT (ha) =	**0.08**

Roof to Grass Lot Type Area Breakdown

Lot Type	No. of Units with no RYIT	No. Units with Front Roof Only (Rear to RYIT)	Roof Area (ha)
Detached	297	2	6.57
Semi Detached	172	10	2.21
Townhouses (1/2 roof to grass)	208	-	1.59
Total	**677**	**12**	**10.37**

Impervious Area & LID Treatment Breakdown

Low Impact Development	Contributing Impervious Area (ha)
Rear Yard Infiltration Trenches	0.08
Roof Leader to Grass	10.37
No LID	19.65
Total	**30.10**

LINE 6

15.03ha
1203 | 7.9%

2.73ha
1202 | 16%

9.31ha
1107 | 30%

EXISTING
RESIDENTIAL

1.39ha
1204 | 13%

12.56ha
1102 | 0%

EXISTING
EXTERNAL

BROWNLEE DRIVE

INVERNESS WAY

EXISTING
BRADFORD CAPITAL
HOLDINGS INC.

39.00ha
1103 | 0%

29.53ha
1201 | 0%

3.39ha
1110 | 0%

1.39ha
1111 | 12%

EXISTING
RESIDENTIAL

BROWNLEE DRIVE

1.15ha
1108 | 21%

26.42ha
1101 | 0%

INVERNESS WAY

EXISTING
RESIDENTIAL

2.76ha
1104 | 0%

EXISTING
EXTERNAL

0.41ha
1109 | 14%

2.86ha
1105 | 0%

2.09ha
1106 | 0%

0.35ha
1018 | 0%

NORTH CANAL

CANAL ROAD

LINE 5

LINE 6

LINE 6

15.03ha
1203 | 7%

BROWNLEE DRIVE

0.11ha
2301 | 45%

2.73ha
2102 | 16%

STREET A

STREET G

STREET A

STREET D

STREET E

STREET F

STREET G

STREET G

STREET B

INVERNESS WAY

EXISTING
BRADFORD CAPITAL
HOLDINGS INC.

9.31ha
1107 | 30%

EXISTING
RESIDENTIAL

1.39ha
1204 | 13%

12.56ha
1102 | 0%

39.00ha
1103 | 0%

EXISTING
EXTERNAL

STREET A

STREET I

STREET H

STREET I

INVERNESS WAY

23.25ha
2201 | 66%

1.44ha
2202 | 74%

STREET C

STREET K

STREET K

STREET K

STREET A

STREET L

STREET M

STREET N

STREET O

STREET K

GREEN CATCHMENTS
DRAIN TO SWM POND.
SWM POND OUTFALL
CHANNEL TO DRAIN
TO NORTH CANAL

RED CATCHMENTS DRAIN
UNCONTROLLED
DIRECTLY TO WETLAND

EXISTING
RESIDENTIAL

GOLFVIEW BOULEVARD

1.39ha
1111 | 12%

9.31ha
1107 | 30%

2.76ha
1104 | 0%

0.15ha
2107 | 27%

BROWNLEE DRIVE

1.15ha
1108 | 21%

22.04ha
2101 | 63%

STREET P

0.51ha
2106 | 48%

0.41ha
2109 | 34%

STORMWATER
MANAGEMENT POND

EXISTING
EXTERNAL

STREET A

0.51ha
2105 | 48%

11.13ha
2102 | 0%

2.86ha
1105 | 0%

2.09ha
1106 | 0%

0.39ha
2103 | 63%

NORTH CANAL

CANAL ROAD

LINE 5

SEE FIG. X.1

HDF-D2 catchments

HDF-E catchments

LEGEND:

- LIMIT OF DEVELOPMENT
- × 223.91 PROPOSED ELEVATION
- × 224.35EX EXISTING ELEVATION
- 0.5% ROAD SLOPE
- MAX 3:1 SLOPE
- 236.25 EXISTING ELEVATION AND CONTOUR

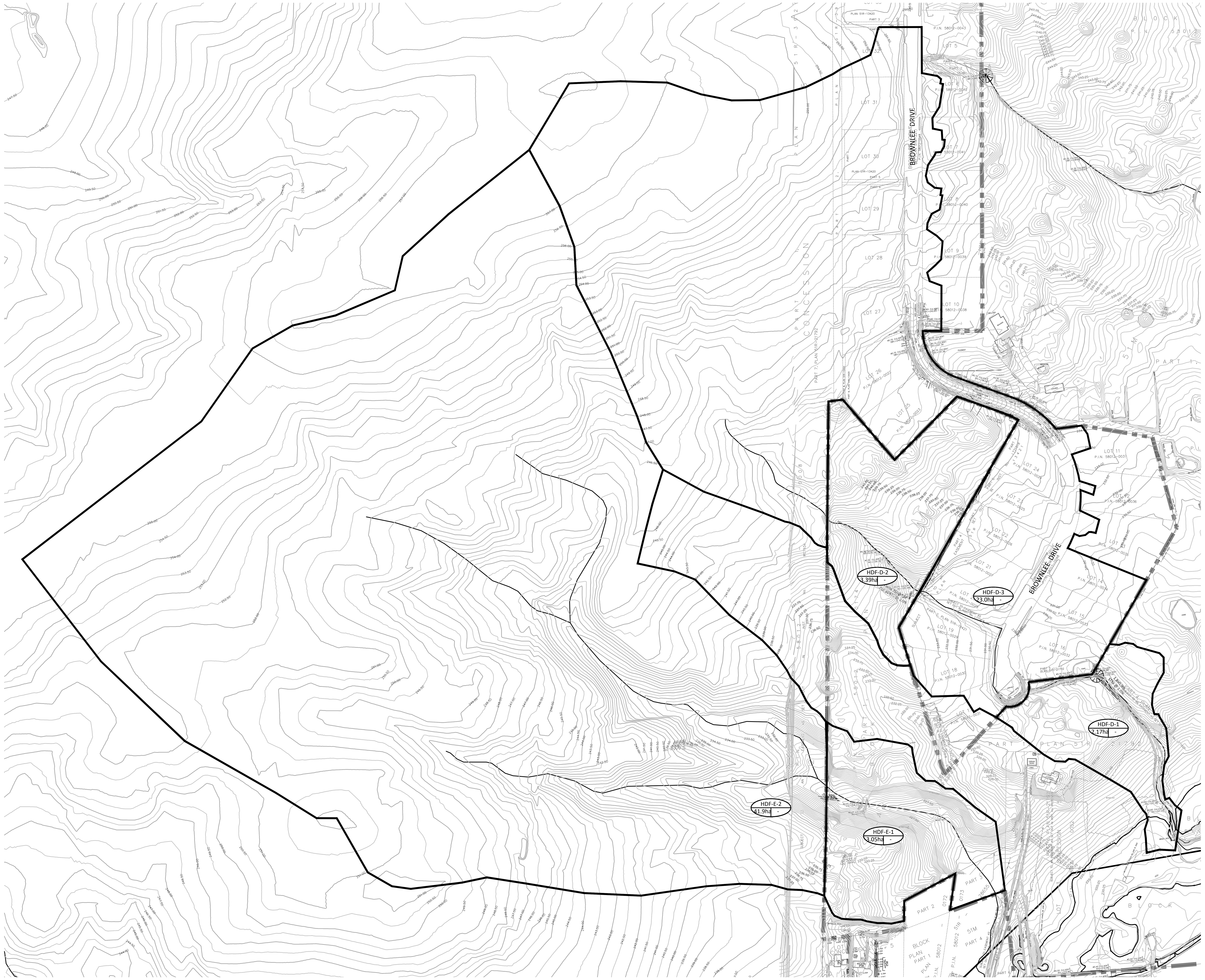
*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

BRADFORD HIGHLANDS

PRELIMINARY GRADING PLAN 2

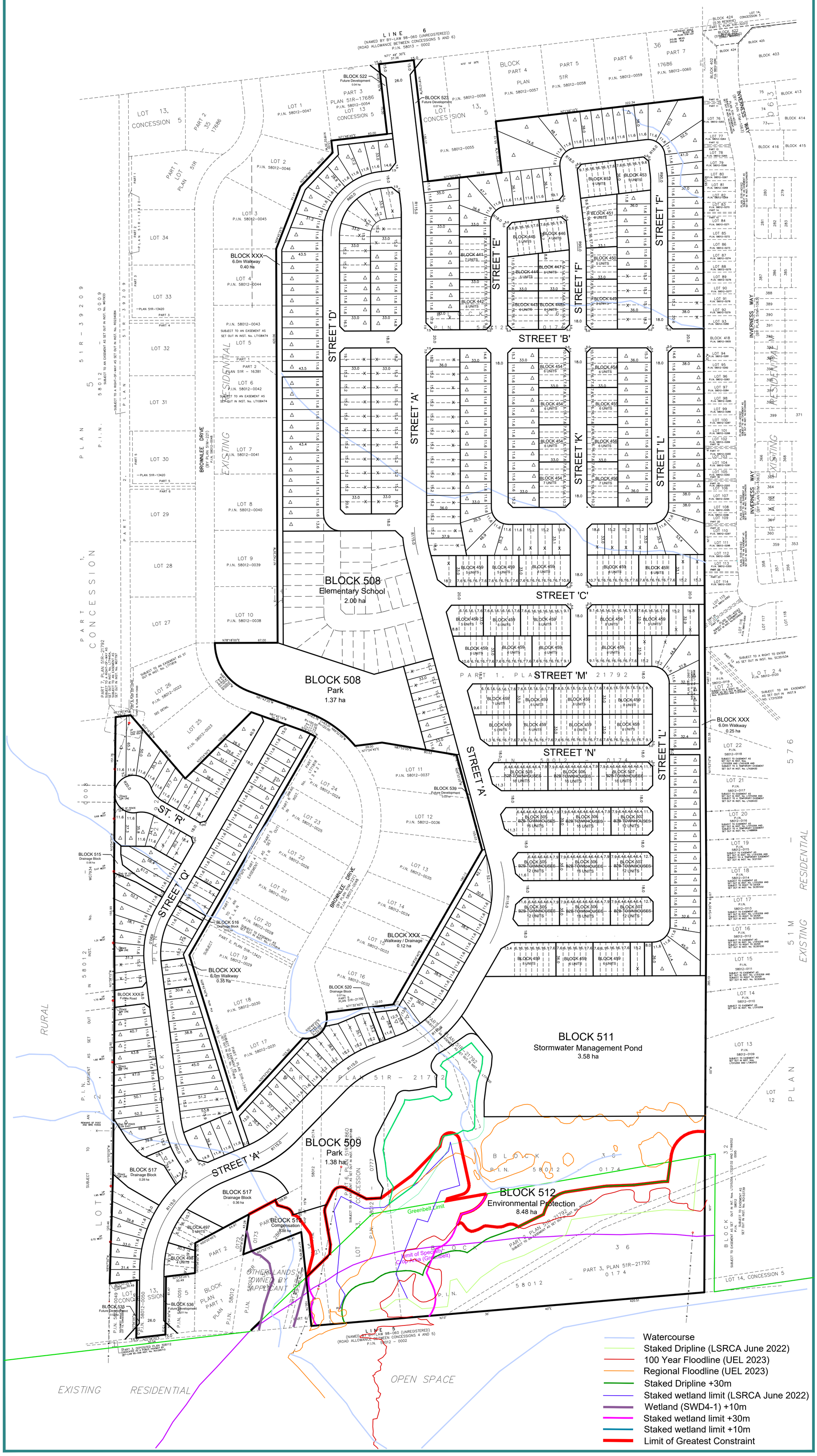
DESIGNED BY:	H.Y.	CHECKED BY:	P.S.
SCALE:	1:1500	DATE:	SEPTEMBER 2024
PROJECT No:	1791	FIGURE No:	X.2



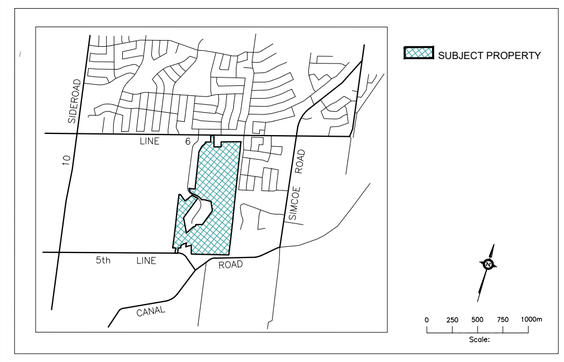
BROWNLEE DRIVE
HDF-D-2
3.39ha -
HDF-D-3
23.0ha -
HDF-D-1
2.17ha -
HDF-E-2
41.9ha -
HDF-E-1
3.05ha -

DRAFT PLAN OF SUBDIVISION
OPTION 1

Part of Block 36, Plan 51M-221 and
Part of Lot 13,
Concession 5
(Geographic Township of West Gwillimbury)
Town of Bradford-West Gwillimbury
County of Simcoe



KEY PLAN



SCHEDULE OF LAND USE

Lot/Block	Land Use		Units	Area(ha)
1-440	Single Detached min. 11.6m (38ft)		299	22.13
	Semi Detached min. 7.6m (25ft)		180	
441-498	Street Townhouses min. 6.1m (20ft)		300	7.89
499-507	B2B Townhouses min. 6.4m (21ft)		172	1.35
508-509	Parks			3.06
510-511	Stormwater Management Ponds			4.76
512	Environmental Protection			7.48
513	Compensation			0.42
514	Pumping Station			0.06
515-521	Drainage Blocks			0.24
522-540	Future Development			1.11
Public Roads	Street 'A'	26.0m ROW 1,550m		13.60
	Streets 'B'-'C'	20.0m ROW 570m		
	Streets 'D'-'S'	18.0m ROW 4,540m		
Total		6,660m	951	60.00

Approved subject to conditions in accordance with section 51(31) of the Planning Act, RSO, Chap. P. 13, as amended

This___day of_____, 20__

Director of Planning, Development and Tourism, County of Simcoe

OWNER'S AUTHORIZATION

We, ICG Golf Inc., Bayview-Wellington (Highlands) Inc. and 2523951 Ontario Inc. hereby authorize Malone Given Parsons Ltd. to prepare and submit this Draft Plan of Subdivision to the County of Simcoe.

ICG Golf Inc. — Date

Bayview-Wellington (Highlands) Inc. — Date

2523951 Ontario Inc. — Date

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands to be subdivided as shown on this Plan and their relationship to the adjacent lands are accurately and correctly shown.

ALOKA KUMARANAYAKE — October 2, 2023

R-PE Surveying Ltd.
Ontario Land Surveyors — Date

ADDITIONAL INFORMATION

AS REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT, CHAPTER P.13 (R.S.O. 1990).

(a),(e),(f),(g),(j),(l) - As shown of the Draft Plan.

(b),(c) - As shown on the Draft and Key Plan.

(d) - Land to be used in accordance with the Schedule of Land Use.

(i) - Soil is sands, silts, clay and tills.

(h),(k) - Full municipal services to be provided.

NOTE: Contours relate to Canadian Geodetic Datum.
Contour interval is 1m with .25m interpolated.

Scale: 1:2000

0 25 50 100 150 200m

Date	Revision	By

Prepared For:
ICG Golf Inc.
Bayview-Wellington (Highlands) Inc.
2523951 Ontario Inc.
October 7, 2024
MGP File: 15-2422

MGP Malone Given Parsons.
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L3R 6B3 | 905 513 0170 | mgp.ca

wsp.com