FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

Bronte River Subdivision

Town of Oakville

Prepared for

Bronte River Limited Partnership

Project #: 20-657

March 2023

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1 INTRODUCTION

Urbantech Consulting has been retained as consulting engineers by the Bronte River Limited Partnership (BRLP) to complete a Functional Servicing Report (FSR) in support of zoning bylaw amendment and draft plan of subdivision applications for the proposed 12.12 ha development in the Town of Oakville.

As shown on Drawing **SLP-1**, the Subject Lands are bounded by the following:

- To the north by a future development site (Eaglewood Communities) adjacent Bronte Road and beside Bronte Creek Provincial Park (BCPP);
- To the south by a residential property;
- To the east by Bronte Road;
- To the west by the Bronte Creek valley and BCPP.

The site is comprised of municipal Lot 21, Concession 2, South of Dundas Street as shown on the October 7, 2021 survey prepared by J.D. Barnes.

The site falls within the Town of Oakville Liveable Oakville Plan and currently is partially occupied by the Enns Estate and a few single-family dwellings adjacent to Bronte Road.

The Subject Lands lie within both the Bronte Creek and 14 Mile Creek subwatersheds. Refer to **Drawing STM-1** for the delineation between the two subwatersheds. Drainage from the site within the Bronte Creek watershed exits the Subject Lands into a minor tributary of the Bronte Creek. The minor tributary is hereinafter referred to as BCT-1 (Bronte Creek Tributary). Lands tributary to 14 Mile Creek drain to the roadside ditch adjacent to Bronte Road.

1.1 Study Purpose

This FSR outlines the servicing details for the proposed storm drainage, sanitary sewer and water distribution systems required to service the Subject Lands. The recommended servicing plans have been prepared in accordance with design criteria and requirements of the Town of Oakville, Region of Halton, and Conservation Halton (CH).

The information in this report is intended to assist regulatory agencies in their review of the planning applications for the proposed development. Additionally, consideration is given to the future development site (Eaglewood Communities) situated to the north of the Subject Lands, which benefits from mutual services indicated within Street A.

1.2 Planning Context

Bronte River Limited Partnership is proposing to develop the Subject Lands with residential and open space uses consistent with the Livable Oakville Plan.

An Official Plan Amendment (OPA) was approved for the Subject Lands by the Ontario Municipal Board (OMB) (now Ontario Land Tribunal) in 2017 (Case no. PL141318). The OPA designated the Subject Lands Medium Density Residential, Low Density Residential, Natural Area, Parkway Belt and Greenbelt. The limits of the Natural Area, as designated through the

previous OPA, were determined through field staking prior to the OMB hearing and includes a 30 m buffer from the dripline of the woodlands. As part of the current planning application, the woodland dripline and physical top of bank of the main Bronte Creek valley and BCT-1 were recently re-staked with the Region of Halton and CH, respectively. These updated staked limits have been used when determining the overall constraint limits. In addition, a stable top of bank assessment was completed by Terraprobe as part of the previous OPA and the stable top of bank limit, as determined through that study, was used to establish constraint limits at that time. Given that CH completed an updated physical top of bank staking as part of the current application, Terraprobe has updated the stable top of bank assessment to reflect these minor revisions and the addition of the BCT-1 top of bank, that was not previously staked.

The Parkway Belt West Plan (PBWP) overlay applies to lands within the Medium Density Residential and Low Density Residential land use designations and the OP policy states that these lands form part of the PBWP and until such time that these lands are removed from the PBWP and come under the jurisdiction of the Town, the policies of the PBWP shall govern the use of land. All properties associated with the current planning application have been removed from the PBWP.

A pre-consultation meeting was conducted with Town of Oakville, Halton Region Planning staff and CH staff in May 2021 and a pre-consultation form was provided which outlined the submission requirements. A site walk was also conducted with CH and Town staff on August 18th 2021 and with Region staff on September 7, 2021.

A pre-consultation meeting was held with Engineering staff at Halton Region on October 15, 2021.

Although not within North Oakville, the FSS components of the standard North Oakville EIR/FSS Terms of Reference was adapted for the site and the Table of Contents has been mapped to the sections in each subconsultants report. Refer to **Appendix F** for the original North Oakville EIR/FSS Terms of Reference document.

1.3 Development Concept

The Subject Lands consists of:

1. 86 single detached dwellings including one existing dwelling to remain post-development.
2. 89 condominium town homes;
3. 6.57 ha of natural heritage features;
4. 0.05 ha of road widening;
5. 86.5 m of local ROW.
6. 1267.3 m of condo lane.

The development concept proposes Street A as a single access road, which aligns with the opposing Saw Whet Boulevard. Street A extends into Eaglewood Communities property and provides access to the property north of Eaglewood (North 2).

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1.4 Background Studies

The servicing plan and development concept presented within this report are an extension of the information contained in the following reports:

1. Consolidated Report on Preliminary Geotechnical Investigation, Proposed Residential Development, 1300-1350 Bronte Road (March 2023) by DS Consultants;
2. Hydrogeological Investigation 1300, 1316, 1326, 1342 and 1350 Bronte Road (March 2023) by DS Consultants.
3. Erosion Assessment (March 2023) by GEO Morphix;
4. Drainage and Stormwater Management Draft Detailed Design Report (March 2010) by McCormick Rankin Corporation.
5. Scoped Environmental Impact Assessment 1300, 1316, 1326, 1350 and 1354 Bronte Road (March 2023) by Beacon Environmental Limited
6. Bronte Green Development / Enns Property Stormwater Management Requirements (September 2016) by J.F. Sabourin and Associates

2 EXISTING CONDITIONS

2.1 Land Use

The existing development consists of single-family residential dwellings, a large expanse of lawn area, a farm pond and a woodlot in the south portion of the Subject Lands. Refer to Drawing **EXC-1** for a visual summary of the existing conditions.

2.2 Geotechnical and Hydrogeology

In support of the application, geotechnical and hydrogeological investigations were prepared by DS Consultants Ltd. The studies, dated March 2023 for 1300-1350 Bronte Road are reproduced in **Appendix E**.

The report outlines the following subsurface conditions:

- 75 mm to 150 mm of topsoil underlain by fill material extending to depths from 0.8 to 3 m below the ground surface.
- Under the fill material cohesionless deposits of silt, silty sand to sandy silt, gravelly sand to sand and gravel were encountered up to depth of 2.3 to 6 m below the ground surface.
- Cohesive deposits of silty clay and clayey silt till were encountered in all boreholes and extended to the maximum drill depths of BH20-1 to BH20-3.
- In boreholes BH20-4 to BH20-14 sandy silt deposits were encountered below the cohesive deposits and extended to depths of 6.0 to 8.2 m below the ground surface.

Groundwater levels were measured by DS Consultants between August 2020 and June 2021 which indicated that the groundwater ranged from 0.9 to 7.7 m below the ground surface. The mean hydraulic conductivity was found to be 7.6×10^{-6} m/s.

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3 GRADING DESIGN

3.1 Design Standards

The proposed grading design of the Subject Lands considers the following requirements and constraints:

1. Conforms to the Town of Oakville design criteria.
2. Provides appropriate cover on proposed servicing.
3. Achieves stormwater management and environmental objectives;
4. Provides overland flow conveyance for major storm conditions;
5. Addresses boundary drainage conditions where surrounding lands are not developing at the present time;
6. Matches existing vertical boundary conditions;
7. Optimizes cut and fill operations to minimize import/export;
8. Ensures compatibility with extensions of roads into surrounding lands; and,
9. Adheres to the recommendations of the EIA.

3.2 Grading Design

Table 3-1 summarizes key design features contained in the proposed grading design. Refer to **Drawings GR-1** and **SD-1** for complementary information, sections, and details.

Table 3-1: Grading Design

Matching Existing Ground	On portions of the north, south and west limits of development, retaining walls up to 1.5m high are required to match existing perimeter ground elevations. At the western limit, the retaining wall is needed to contain drainage within the built up lands to reduce surface flows over the Bronte Creek embankment to only those lands, outside of the development area, that currently flow to the valley. The north and west retaining walls are proposed within private property.
Private Streets	The private streets will be constructed without crowns (mono-sloped) with semi-mountable curb for driveway access.
Street A	The grading of Street A has been designed to provide compatible access to the adjacent developments and match existing ground elevations along the provincial lands from STN 80 to STN 140.
Compatibility with Bronte Road and Street A	The dual frontage townhouse units adjacent Bronte Road and Street A will require from 3-10 risers to make up the elevation difference between finished floor elevations and finished sidewalk elevation. The elevation difference will be made up by a combination of architectural elements inside the units and steps exterior to the buildings. Along the daylight triangle at Street A and

	Bronte Road, landscape elements will also be used to transition from sidewalk to finished floor elevations. All dual frontage units will have direct access to Bronte Road or Street A.
Bio-Filtration Facility (LID)	Stormwater from the site is discharged into a proposed bio-filtration system situated along the south limit of the development. The bio-filtration system is ~170m long with a trapezoidal shaped cross section, 3-6m bottom width, 3:1 side slopes, 17-22m top width with a varied bank height. Adjacent to the LID is a retaining wall, up to 1.5 m high, to be located in public property. Refer to Drawing **LID-1** for grading and section details.
Outfall Channel and BCT-1 Restoration	Downstream of the bio-filtration system will be a naturized outfall channel with pocket wetlands that ties into BCT-1. The outfall channel will be restored to a more natural state and restorative measures are proposed for BCT-1 downstream of the outfall channel and pocket wetlands.

3.3 Roads

The Subject Lands proposes typical road cross sections as follows.

a) Street A - Town of Oakville's STD 7-22A (17.0m Right-of-Way).
b) Private Street with a driving surface width of 7.5m for 2 lane traffic.
c) Private Street with driving surface width of 8.5m for 2 lane traffic and a parking lane.

The private streets utilize a mono sloped cross section with attached sidewalks and semi mountable curbs for driveway access.

Portions of the private street with an 8.5m driving surface will contain public storm sewer easements. The sections depict that the zone of influence of excavation (in the event that the public sewer is to be excavated) does not conflict with the private services that share the road.

Refer to **Drawing FIG 1** for typical road cross sections and **Drawing PP-1** for the Street A plan and profile.

4 STORM DRAINAGE AND STORMWATER MANAGEMENT

4.1 Drainage Criteria

In accordance with the Town of Oakville, Halton Region and CH standards, the design criteria for the site are as follows:

1. Provide erosion control and meet pre-development flows for Bronte Creek. For 14 Mile Creek meet the pre-development targets outlined in PCSWMM model for 14 Mile Creek received from DSEL (December 2022).
2. Provide extended detention for 24-48 hour drawdown for 14 Mile Creek and Bronte Creek, and ensuring the erosion threshold target flow rate established by GEO Morphix is met for Bronte Creek.
3. Ensure minimum MECP enhanced (Level 1) stormwater quality treatment of runoff is provided.
4. Endeavor to maintain pre-development water balance through the use of LID measures to the extent possible.
5. Provide safe overland flow conveyance of the 100-year event.

4.1.1 SWM Considerations

Three options were evaluated when identifying the appropriate outlet for the Subject Lands, Eaglewood, and North 2. The options were as follows:

1. Directing all flows from the Subject Lands (Bronte River), Eaglewood and North 2 to Bronte Creek via the Bronte Creek Tributary (BCT-1).
2. Directing all flows from the Subject Lands, Eaglewood and North 2 to Fourteen (14) Mile Creek via a pipe within the Bronte Road right of way (ROW) with an eventual outlet to 14 Mile Creek.
3. Directing a portion of the 14 Mile Creek drainage area (1.5 ha) from the Subject Lands to Bronte Creek via BCT-1 with the remainder of the 14 Mile Creek catchment area being directed to 14 Mile Creek via a pipe within the Bronte Road ROW with an eventual outlet to 14 Mile Creek. Flows from Eaglewood and North 2 will be maintained to 14 Mile Creek.

This evaluation has been provided in response to comments received from the Town, Region and Conservation Halton related to the proposed stormwater management approach as described in the Functional Servicing Report (Urbantech, 2021) and a request for a more holistic understanding of the thought process that went into selecting Option 3 as the preferred approach to stormwater for the Subject Lands, Eaglewood and North 2. Refer to **Table 4-1** below.

Table 4-1 : SWM Options Matrix

Metrics	Option 1 All Flows to Bronte Creek (3.78 ha from 14 Mile Creek to Bronte)	Option 2 All Flows to 14 Mile Creek (10.66 ha from Bronte Creek to 14 Mile)	Option 3 Bronte River Proposal (1.5 ha diversion from 14 Mile Creek to Bronte)
Outlet	• Bronte Creek Tributary (BCT-1).	• Pipe within Bronte Road ROW and ultimately 14 Mile Creek.	• BCT-1 and pipe within Bronte Road ROW and ultimately 14 Mile Creek.
Erosion	• Diversion of 3.78 ha likely exacerbates erosion. Requires analysis.	• Reduced flows to BCT-1 which should reduce existing erosion impacts; flows from upstream catchment area (BCPP lands) would still likely need to be directed through the site and into BCT-1 and may still require some restoration works within BCT-1. • Additional volumes will be directed to 14 Mile Creek which could exacerbate erosion.	• Erosion mitigated in BCT-1 through restoration plan. • Some flows diverted away from 14 Mile Creek which is considered beneficial to 14 Mile Creek, from an erosion perspective as well as flooding. • Extended detention considerations in 14 Mile Creek will be provided on a best efforts basis due to orifice size limitations.
Pond/LID	• Would be necessary to provide a SWM pond rather than an LID feature.	• Need for SWM Pond triggered due to drainage area. • SWM Pond will consume entire non-participating property along Bronte Road and some/all Valery lands. • Not considered to be an efficient use of land along the Bronte Road corridor.	• Enables the use of a treatment train approach to SWM including a bio-filtration swale/LID measures and underground storage. • Eliminates the need for a SWM Pond.
Urban Design/Land Use	• No impacts at Bronte Road. • SWM Pond required.	• Pond will be required adjacent to Bronte Road.	• No impacts at Bronte Road. • LID and underground storage can be used to minimize the impact on land use.

Metrics	Option 1 All Flows to Bronte Creek (3.78 ha from 14 Mile Creek to Bronte)	Option 2 All Flows to 14 Mile Creek (10.66 ha from Bronte Creek to 14 Mile)	Option 3 Bronte River Proposal (1.5 ha diversion from 14 Mile Creek to Bronte)
Storm Sewer On/Off-site	• May be too shallow to service non-participating landowner/Valery without pumps. • May require lowering of BCT-1 at upper extent in order to achieve outlet grade.	• Requires designated pipe or significant augmentation of existing Region Storm sewer on Bronte Road. • Diversion of NW external area in accordance with JFSA memo may cause conflict with 1200mm watermain on Bronte Road and preclude pipe.	• Requires designated pipe or augmentation of existing Region Storm sewer on Bronte Road. • Pipe can fit within Bronte Road with existing 1200 mm watermain.
Ecology	• Impacts to BCT-1 and Bronte Creek would need to be studied however, with proper SWM, negative impacts would not be anticipated.	• Ecological impacts in 14 Mile Creek to be studied if this option is pursued.	• The EIA has demonstrated no negative impacts to ecological functions within BCT-1/Bronte Creek as a result of the minor diversion of flows.
Earthworks	• May require filling or raising lands ascent to Bronte Road for storm sewer cover. • Street A would need to be steeper.	• Requires raising of some lands at northwest corner of Bronte River property to create cover for pipe collecting external area.	• Site requires some fill to create gravity outlet to Bronte Creek to minimize lowering of BCT-1.
Region Interests	• Eliminates reliance on a pipe within the Bronte Road ROW.	• Requires significant reliance on Bronte Road ROW and collaboration with Region.	• Requires reliance on Bronte Road ROW and collaboration with Region.
Town Interests	• If a traditional SWM Pond is required, maintenance requirements will be greater than that of an LID feature and OGS unit. • Reduced drainage to 14 Mile Creek watershed may be supported, given the existing constraints and on-going issues within the 14 Mile Creek watershed.	• Given existing constraints and issues within the 14 Mile Creek watershed, this is likely not the Town's preferred option.	• Smallest SWM facility to own and operate with less maintenance requirements than a traditional SWM Pond. • Reduced drainage to 14 Mile Creek watershed, which may be preferred by the Town given existing constraints and issues within the 14 Mile Creek watershed.

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Metrics	Option 1 All Flows to Bronte Creek (3.78 ha from 14 Mile Creek to Bronte)	Option 2 All Flows to 14 Mile Creek (10.66 ha from Bronte Creek to 14 Mile)	Option 3 Bronte River Proposal (1.5 ha diversion from 14 Mile Creek to Bronte)
CH interests	• Permit required for outfall to BCT-1. • Increased potential for erosion within BCT-1 may not be supported. • Reduced drainage to 14 Mile Creek may be supported, given the existing constraints and on-going issues within the 14 Mile Creek watershed.	• Permit required from CH for outfall to 14 Mile Creek. • Increased drainage to 14 Mile Creek may not be supported given existing constraints and on-going issues within the 14 Mile Creek watershed. • Reduced erosion potential within BCT-1 due to reduced flows however, upstream catchment area on BCPP lands will still need to be directed to top end of BCT-1, which may still necessitate restoration works within BCT-1.	• Permit required for outfall to BCT-1. • No increased erosion potential within BCT-1 based on proposed SWM approach. • Reduced drainage to 14 Mile Creek may be supported given existing constraints and on-going issues within the 14 Mile Creek watershed.
Cons	• Greatest impact on BCT-1 from an erosion perspective. • Results in marginal servicing accommodation. • Grading constraints for upstream lands. • Larger SWM facility to own and operate. • Largest diversion to the erosion sensitive BCT-1.	• Significant impact to land use along Bronte Road. • Significant impact on developable land area. • Largest SWM facility to own and operate. • Raised grades for sewer cover. • Re-direction of a significant area of flows to a watershed that has existing constraints and issues.	• Requires infrastructure within Region's ROW (either augmentation of existing pipe or construction of dedicated pipe).

The original SWM strategy, outlined by DSEL and JFSA as part of the Bronte Green hearing / approvals, involved the use of a conventional wet pond on the Subject Lands discharged to the Bronte Road sewer. The pond over-controlled the entire development area (including the Bronte Creek Provincial Park catchments) to the extremely low release rates for the Bronte Road sewer / Fourteen Mile Creek. The resulting pond required in excess of 20,000 m^3 to manage the Regional storm and would have had extremely long drawdown times due to the restricted release rate. The pond required to service the lands would have occupied a considerable portion of the Subject Lands.

As part of the current application, a SWM pond, as outlined in the DSEL/JFSA SWM strategy, as well as an alternative SWM option were considered for the Subject Lands. Option A is comparable to the DSEL/JFSA SWM strategy and consists of a conventional SWM pond which would collect drainage from the entirety of the BRLP, Eaglewood, and North 2 sites as well as a portion of the BCPP lands and would discharge all flows to 14 Mile Creek. Option B consists of a bio-filtration facility which would collect drainage from the north-west portion of the site and outlet to BCT-1, while a portion of the remaining drainage that cannot be directed to the bio-filtration facility will ultimately outlet to 14 Mile Creek uncontrolled from the subject site will require onsite control from Eaglewood and North 2. Refer to **Drawing STM-3** for the approximate footprint and location of the two SWM strategies.

Table 4-2: SWM Strategies

Metrics	Evaluated SWM Strategies	
	A SWM Pond	B Bio-filtration facility
Footprint	SWM pond would occupy approximately ~0.8 ha including access roads.[1]	Filtration facility will occupy approximately 0.25 ha including access roads.
Practicality and Function	Pond is significantly oversized to over control Bronte Creek drainage area and 14 Mile Creek drainage area to low release rates. Large facility for 5-ha area of developable land, estimated to be nearly double a typical regional control facility. This option dismisses the capacity of BCT-1 outlet. Single source of end of pipe quality control.	Balances the flows to each outlet to avoid significant Town owned infrastructure. Utilizes all available outlets with the smallest footprint. Uses LID measures to provided erosion mitigation, and treatment train approach to quality control (use of OGS, bio-filtration facility). Added benefit that the bio-filtration facility will improve water balance through evapotranspiration.
Maintaining Drainage Boundaries	Does not respect existing boundaries and does not maintain flows to Bronte Creek. Introduces more drainage area and runoff volume to the 14 Mile Creek environmental features and channel.	Drainage is continued to be conveyed to both 14 Mile Creek and Bronte Creek.

1 Based on Bronte Green Development / Enns Property Stormwater Management Requirements (September 2016) by J.F. Sabourin and Associates.

4.2 Existing Conditions

4.2.1 Bronte Creek

A Visual OTTHYMO 6.2 model (VO6) was created to model the drainage from the site to BCT-1. Based on the Town of Oakville Standards a 24-hour Chicago rainfall Distribution was used to simulate event-based rainfall on the site.

Under existing conditions, surface flows from approximately 3.77 ha of the site drains to the existing farm pond located to the west of the 14 Mile Creek/Bronte Creek watershed drainage divide. Flows from the farm pond discharge in one of two culverts under the driveway to the south-west corner of the site where they enter BCT-1. Flows from BCT-1 ultimately enter Bronte Creek. Additionally, 6.89 ha of external area north of the Subject Lands is also conveyed through the Subject Lands. 0.68 ha of the Subject Lands drains overland to the Bronte Creek valley, 0.47 ha downstream of the existing pond enters BCT-1 directly and 0.3 ha of the existing woodlot also drains to BCT-1.

Table 4-3 provides the total flows entering BCT-1 under existing conditions, including the 6.89 ha external area and the woodlot to the south. The pre-development drainage areas are shown on **Drawing STM-1**.

Table 4-3: Existing Flows to Bronte Creek Tributary

Outlet	Area	Storm	Flow (m^3/s)
Bronte Creek	12.11 ha	25 mm 4-hour	0.034
		5-year	0.270
		10-year	0.418
		25-year	0.605
		50-year	0.738
		100-year	0.892

4.2.2 14 Mile Creek

Urbantech was provided the current PCSWMM hydrology model for 14 Mile Creek which was run to establish the targets for the Subject Lands. The PCSWMM model utilized the 24 hour Chicago distribution.

Under existing conditions 3.26 ha of the Subject Lands drains to the east to Bronte Road where it is conveyed north by an existing ditch, approximately 245 m long, on the west side of the Bronte Road which outlets to 14 Mile Creek.

Table 4-4 provides flows entering 14 Mile Creek from the east portion of the site, Eaglewood, the existing house north of Eaglewood (referred to as North 2) and the adjacent provincial park lands under existing conditions. The pre-development drainage areas are shown on **Drawing STM-1**.

Table 4-4: Existing Flows to 14 Mile Creek

Outlet	Area	Storm	Flow (m^3/s)	Unit Flow Rate ($m^3/s/ha$)
14 Mile Creek (EENNS1 in PCSWMM)	3.78 ha	5-year	0.33	0.087
		10-year	0.42	0.111
		25-year	0.55	0.146
		50-year	0.64	0.169
		100-year	0.74	0.196
		Regional	0.48	0.127

4.3 Storm Sewer Design

Storm sewers within the subdivision are sized to convey the 5-year storm in accordance with Town of Oakville Standards. Local storm sewer pipes generally range in size from 300 mm to 750 mm diameter. There are two proposed outlets, one to each of the watersheds, 14 Mile Creek and Bronte Creek

See **Drawing STM-2** for drainage areas and pipe networks and **Appendix B** for storm design sheets. The following sections describe the key elements of the storm sewer system.

4.3.1 Bronte Creek Outlet

The Bronte Creek outlet is comprised of the following 3 elements:

1) 2 storm sewer outfalls into a bio-filtration facility
2) A bio-filtration facility
3) Removal of an existing pond and replacement with a naturalized channel outfall, with intermittent pocket wetlands, connecting the LID outfall to the upstream limit of BCT-1

Details of the bio-filtration facility are presented in Section 4.4.1 and 4.5.1. Restoration measures are described in detail in the GEO Morphix Report.

4.3.2 Clean Water System

A 750 mm clean water system pipe is designed to convey regional storm flows from the ~5.2 ha of the external area. The bypass pipe outlets to the restored channel at the downstream end of the bio-filtration facility. A flow splitter is located upstream of the outlet to convey the flows from approximately the 10 mm event to the LID to mitigate downstream erosion.

4.3.3 Bronte Road Storm Sewer

Bronte Road contains an existing storm sewer that ranges in size from 375 to 750 mm and receives flows primarily from the Bronte Road ROW. It has been indicated by Halton Region that the existing storm sewer does not have capacity to accommodate the Subject Lands, which currently drains to an existing ditch that flows adjacent to Bronte Creek.

Three scenarios were evaluated to service the stormwater flows from the development draining to 14 Mile Creek:

1. Within the existing ditch along the west side of Bronte Road
2. Within a dedicated pipe within the Bronte Road ROW (three locations considered)
3. Within the existing or augmented Regional pipe within the Bronte Road ROW

In all piped scenarios the sewer will be sized to convey the 10-year storm by gravity with pressurization under the 100-year event.

A detailed comparison of the drainage options were provided to Halton Region for review on February 7th, 2023, and are presented in **Appendix B**. The final placement of the pipe within the Bronte Road ROW will be subject to ongoing discussions with Halton Region and analysis of the results of a subsurface utility engineering (SUE) study that is under way.

Refer to **Drawings PP-3, PP-4,** and **PP-5** for the drainage scenarios.

4.3.4 Piped Outfall to Bronte Creek

The recommended stormwater outfall is as shown on **Drawing GR-1 and Drawing SD-1.** At the request of CH, consideration was to be given to installing a traditional piped outfall, via a drop structure, into the Bronte Creek valley as opposed to utilizing a restored outlet as described in Section 4.3.1. **Drawing PP-2** presents a conceptual piped outfall design in comparison to the design proposal **Table 4-5** provides an evaluation matrix comparing the two outfall scenarios.

Table 4-5: Evaluation Matrix-Outfall Options

Metric	Outfall Options	
	A Restored Outfall to BCT-1 plus Erosion Restoration with BCT-1	B Pipe to Bronte Creek
Construction Access	Entirely within the Subject Lands, minimal disturbance within vegetated areas, BCT-1 erosion restoration measures to be hand placed or with small machine within valley.	Construct a temporary access road consisting of numerous switchbacks to achieve a practical road gradient (5-10%) for machine access into the main Bronte Creek valley; will require access, grading and vegetation removal on BCPP lands.
Restoration	Outfall will involve the removal of an existing pond, immediately upstream of BCT-1, and replacement with a naturalized channel, refer to restorative measures proposed by GEO Morphix. **< 1** years to re-establish	Re-topsoil and re-vegetate disturbed area, extensive erosion protection until stabilized. Many decades required to re-establish the mature vegetation that

Metric	Outfall Options	
	A Restored Outfall to BCT-1 plus Erosion Restoration with BCT-1	B Pipe to Bronte Creek
	wetland vegetation. Minimal mature vegetation removed to implement this outfall (based on Figure 1 Tree Inventory and Preservation Plan, Kuntz Forestry, revised March 2023). In addition to the removal of the existing pond, existing erosion within BCT-1 will be addressed as outlined in the GEO Morphix (March 2023) report.	would be removed to gain access to the main valley.
Volume of Earthworks Required to Achieve Positive Drainage to SWM outlet	nil	50,000 m^3
Limit of Disturbance in Key Natural Heritage Features of the NHS	265 m^2	10,000 m^2
Technical Complexity	Minimal complexity.	Highly complex.
Maintenance of Infrastructure	Minimal; outfall and outfall channel would be on lands owned by the Town. Restored BCT-1 valley will also be owned by the Town.	Inspections of deep drop shaft and outfall pipe (Town) in perpetuity; outfall/headwall would be on BCPP lands.
Approvals	CH permit	CH permit, DFO, MECP, Ontario Parks
Current Land Ownership	Bronte River LP	Bronte Creek Provincial Park, Bronte River LP
Cost	$	**$$$$$**
Construction Duration	1 week	90 days
Ecological Impacts	Localized impact of low magnitude and short term; improvements to BCT-1 through removal of upstream ponds that are causing erosion within the valley; restoration of a naturalized channel in location of the existing man-made pond and mitigation of existing erosion impacts within the BCT-1 valley.	Widespread impact of high magnitude and long term; significant vegetation removal and grading required along valley slopes to access valley with equipment; fill within Bronte Creek required in order to get equipment from access road to outfall location; armouring required at outfall location

Metric	Outfall Options	
	A Restored Outfall to BCT-1 plus Erosion Restoration with BCT-1	B Pipe to Bronte Creek
Geomorphological Form and Function	Maintenance of flows to BCT-1, restoration of channel form and function through artificial pond removal, positive outcomes.	Loss of flows to ravine, armouring required within Bronte Creek, negative impact.
Geomorphological Impacts/Erosion	Impacts are mitigated through erosion threshold and localized erosion protection that addresses erosion that has been caused by existing conditions.	Requires localized erosion protection in creek and floodplain.
Interaction with Geomorphological Hazard	Impacts are mitigated through localized erosion protection.	Well within hazard envelope of Bronte Creek / not mitigated, given the size of Bronte Creek and access erosion hazard is harder to address initially and in the long-term.

Refer to reports by Beacon and GEO Morphix for further discussion regarding the natural heritage and natural hazard aspects of the Piped Outfall assessment.

As a result of the analysis, it is recommended that the restored outfall to BCT-1 is the preferred approach for the SWM outfall as it will result in significantly less disturbance to the NHS including the slopes and vegetation along the Bronte Creek valley, it is more cost effective, it will provide for easier maintenance access in the future and will not require the installation of an outfall on BCPP lands.

4.3.5 Hydraulic Grade Line and Sump Pumps

In support of the detailed design a hydraulic grade line (HGL) analysis will be undertaken to verify the performance of the proposed storm sewer systems that are tributary to Bronte Creek. Sump pumps may be required which will be confirmed through the HGL analysis.

4.4 Erosion and Quality Control

4.4.1 Bronte Creek

As identified in Section 4.1, 24-48 hours of drawdown is recommended for the 25 mm 4-hour storm event. Additionally, GEO Morphix has undertaken an erosion threshold analysis on the existing outfall from the site into BCT-1. The GEO Morphix study recommended an erosion threshold flow of 41 L/s. to mitigate post-development erosive impacts. The bio-filtration facility has been designed to fully contain runoff from the 25 mm event. Runoff will percolate through the floor of the bio-filtration facility through engineered topsoil (special topsoil/sand mixture). Beneath the engineered topsoil is a stone gallery with a perforated pipe under drain that collects

filtered flows. The flows in the underdrain will then be controlled with a 75 mm orifice prior to being released to BCT-1. Refer to **Drawing SD-1** for cross section of the proposed LID.

It has been indicated in the DS Consulting Geotechnical and Hydrogeological reports that there is high groundwater in the Subject Lands. As such an impervious liner is currently proposed beneath the facility due to proximity to the groundwater table. A drain can be added outside the bio-filtration facility liner to avoid upwelling forces. The requirement for this liner will be assessed after the existing pond has been removed and monitoring has been undertaken. If infiltration is deemed to be possible based on future studies (i.e., if the groundwater table is un-naturally high due to influence from the artificial pond), the proposed LID can be designed without a liner.

The total maximum flow from the site and external areas, post-development, to the area of erosion concern is 26 L/s for the 25 mm event which is less than the erosion threshold flow. Flows from the bio-filtration facility will have a drawdown of approximately 46 hours using the 75 mm orifice as indicated in VO6.

Two different rainfall simulations were run using VO6 continuous hydrologic model:

- Based on hourly rainfall data from the Oakville (data from HSP-F) from 1960 to 1999 (40 years). This assessment included the effects of temperature variation based on daily temperature data from the Toronto Pearson International Airport for the same years and analyzed the evaporation and snow melt components of the hydrologic cycle.
- Based on 5 minute rainfall data provided by Conservation Halton for the Glen Abbey rain gauge from July 2008 to August 2017 (9 years). Due to missing data in the Glen Abbey files, data from the Central Operations rain gauge was used for April 23-30 2010, October 19-22 2010, September 20-23 2011, July to December 2015, Jan to April 2016, August 2016 and December 2016. This assessment included the effects of temperature variation based on daily temperature data from the Toronto Pearson International Airport for the same years and analyzed the evaporation and snow melt components of the hydrologic cycle.

Light forest was used for the land cover of the external areas and existing woodlot, and grass for the existing conditions and Standhyds. A soil texture of silty clay was utilized based on the DS Geotechnical Investigation. Upon request from CH two pre-development scenarios were modelled, one with and one without the existing manmade pond on the Subject Lands. During the scenario with the pond it was assumed that the permanent pool of the existing pond is full to the lip of the overflow riser.

GEO Morphix has undertaken an analysis of the continuous model results for both sets of data which has verified that the number of erosive events has decreased in post development for both the existing conditions with pond and existing conditions without pond scenarios as shown in **Table 4-6** below.

Table 4-6: BCT-1 Continuous Erosion Analysis

Simulation		CED (m^3)	ω_{eff} (N/m^2)	t_{ex} (hrs)	# of Exceedances
Glen Abbey Data	**Pre**	32210.10	6784.65	312.75	119
2008-2017	**Post**	21267.90	4632.20	132.75	63
Pre with Pond	**Change (%)**	**-33.97**	**-31.73**	**-57.55**	**-47.06**
CH Data	**Pre**	42580.80	8180.10	310.00	172
2008-2017	**Post**	21267.90	4632.20	132.75	63
Pre w/o Pond	**Change (%)**	**-50.05**	**-43.37**	**-57.18**	**-63.37**
UT Data	**Pre**	309427.20	59546.03	2052.00	609
1960-1999	**Post**	285241.50	57875.58	1463.75	356
Pre with Pond	**Change (%)**	**-7.82**	**-2.81**	**-28.67**	**-41.54**
UT Data	**Pre**	365496.30	66292.00	1951.00	823
1960-1999	**Post**	285241.50	57875.58	1463.75	356
Pre w/o Pond	**Change (%)**	**-21.96**	**-12.70**	**-24.97**	**-56.74**

Refer to GEO Morphix study for more details on the erosion threshold analysis.

It was determined that diverting 10 mm of external area flows to the LID is required to decrease erosion potential in BCT-1.

Enhanced (Level 1) water quality protection through the removal of >80% of total suspended solids (TSS) will be provided through the use of two OGS's located upstream of the inlets of LID 1 and 2 with EFO10 and EFO12 devices, respectively (located at the south end of Street A and Lane A) and the bio-filtration system. The proposed Stormceptor OGS is ETV accredited for 60% TSS removal and a lined bio-filtration device provides a minimum 73% TSS removal per STEP guidelines. The total TSS removal for these BMPs in series can be calculated as 60% + (100%-60%) x (73%) = 89% (minimum) TSS removal.

Refer to **Appendix B** for the Stormceptor sizing report. Final sizing of the OGS will be provided at detailed design.

4.4.2 14 Mile Creek

Enhanced (Level 1) water quality protection will be achieved though the use of an ETV certified OGS located adjacent to MH25 which is located at the most downstream end of Street A and downstream of the outlet from the Eaglewood Communities site. A Stormceptor EFO8 device is proposed to provide quality control.

Refer to **Appendix B** for the Stormceptor sizing report. Final sizing of the OGS will be provided at detailed design.

4.5 Quantity Control

4.5.1 Bronte Creek

Visual Otthymo was used to determine the bio-filtration facility storage required to control the 25 mm 4-hour event release rate at the BCT-1 outlet to the GEO Morphix erosion threshold as well as to determine the placement and size of the overflow weir. All stormwater during the 25 mm 4-hour event will be stored in the bio-filtration facility and filtered through the engineered media and rock gallery to a 75 mm orifice plate.

Flows requiring surface storage deeper than 0.96 m will enter into a ditch inlet with a 150 mm orifice plate. An emergency overflow weir is proposed above the 100-year water elevation (at an elevation of ~130.15 m) and has been designed with 0.3 m of freeboard. As the 100-year flows (2.62 m^3/s) for the development into the bio-filtration facility are greater than the flows for the regional event (1.05 m^3/s), the weir has been sized to convey the 100-year flows in the event of back to back storms.

The weir size calculations can be found in **Appendix B**.

Table 4-7 summarizes the total flow downstream of the bio-filtration facility including external and uncontrolled areas, and storage values required in the LID based on the VO6 model.

Table 4-7: Flow and Bio-Filtration facility Storage Volumes

Storm Event	Existing Flow Rate (m^3/s) NHYD 14	Post Development Flows (m^3/s) NHYD 34	Bio-Filtration Facility LID WSEL (m)	Volume Required (m^3) NHYD 69
25 mm event	0.052	0.026	128.7	1,067
5-year	0.2	0.196	129.3	2,156
10-year	0.388	0.252	129.45	2,599
25-year	0.59	0.33	129.75	3,209
50-year	0.723	0.385	129.9	3,607
100-year	0.871	0.444	130.1	4,070

As the bio-filtration facility has a total volume of 4,438 m^3 up to the bottom of the weir and requires a volume of 4,070 m^3 for the 100-year event so the facility will be able to effectively

control the flows to BCT-1. Refer to the VO6 model output provided in **Appendix B** and see **Drawing SD-1** for a cross section of the bio-filtration facility.

4.5.2 14 Mile Creek

During post development conditions, 0.6 ha of drainage area is being directed to 14 Mile Creek from the Subject Property. As the area directed to 14 Mile Creek is significantly less during post development conditions as compared to pre-development, no quantity control is proposed for this portion of the site.

Table 4-8 below outlines the flows to 14 Mile Creek during pre-development (based on the unit flow rates in **Table 4-4**) and the post development uncontrolled flows.

Table 4-8: 14 Mile Creek Flow Rates - BRLP

Storm Event	Existing Flow Unit Rate ($m^3/s/ha$)	Target Flow Rate based on 2.04 ha (m^3/s)	Post Development Flows Bronte River - Uncontrolled (m^3/s)
5-year	0.087	0.18	0.18
10-year	0.111	0.23	0.22
25-year	0.146	0.30	0.26
50-year	0.169	0.35	0.3
100-year	0.196	0.40	0.33
Regional	0.127	0.26	0.09

The model also evaluated the flows from the Eaglewood development and North 2 as they will need to be accommodated for in the Bronte Road storm servicing.

The Eaglewood development will require a 75 mm orifice to provide extended detention with a 100 mm orifice plate located above the 25 mm storm volume. The tank is proposed to be 1.55 m in depth with an area of 200 m^2, subject to refinement based on the proposed site plan for Eaglewood. **Table 4-9** outlines the target flow rates and post development controlled release rates for the Eaglewood development which is overcontrolled to account for the 0.07 ha area associated with Street A. The Eaglewood tank will connect to Street A at proposed manhole 32. Drainage from North 3 (BCPP lands located west of Eaglewood) will continue to drain towards Bronte Road and will be captured in the Street A storm sewer.

Table 4-9: 14 Mile Creek Flow Rates - Eaglewood

Storm Event	Existing Flow Unit Rate ($m^3/s/ha$)	Target Flow Rate based on 0.47 ha (m^3/s)	Post Development Flows Eaglewood - Controlled (m^3/s)
5-year	0.087	0.041	0.038
10-year	0.111	0.052	0.051
25-year	0.146	0.068	0.054
50-year	0.169	0.080	0.066
100-year	0.196	0.092	0.068
Regional	0.127	0.060	0.07*

*Regional storm post development flow uncontrolled

North 1 + 2 will require a 75 mm orifice to provide extended detention with a 245 mm orifice plate located above the 25 mm storm volume. As the design of North 2 is not available, a 1.55 m tank with an area of 100 m^2, dimensions are to be refined by the North 2 engineers.

Table 4-10: 14 Mile Creek Flow Rates - North 1 + 2

Storm Event	Existing Flow Unit Rate ($m^3/s/ha$)	Target Flow Rate based on 0.92 ha (m^3/s)	Post Development Flows North 1 + 2 - Controlled (m^3/s)
5-year	0.087	0.08	0.079
10-year	0.111	0.10	0.095
25-year	0.146	0.13	0.117
50-year	0.169	0.16	0.131
100-year	0.196	0.18	0.145
Regional	0.127	0.12	0.13*

*Regional storm post development flow uncontrolled

Impacts to 14 Mile Creek were also evaluated at various locations downstream of the Subject Property, Eaglewood and North 2 (**Table 4-11**. This analysis included utilizing an uncontrolled regional flow to verify that regional control was not required for Eaglewood and North 1 + 2.

Table 4-11: 14 Mile Creek Downstream Flows

Junction	EBS1			E618			J7232.906		
Storm	Pre	Post Uncontrolled	Post Controlled	Pre	Post Uncontrolled	Post Controlled	Pre	Post Uncontrolled	Post Controlled
5	0.47	0.58	0.38	2.82	2.59	2.60	44.98	44.76	44.769
10	0.6	0.71	0.47	3.07	2.97	2.86	61.13	60.83	60.842
25	0.77	0.88	0.59	4.38	4.35	4.04	82.27	82.08	82.07
50	0.89	1.01	0.67	5.48	5.45	5.07	97.45	97.1	91.115
100	1.02	1.13	0.75	6.61	6.59	6.13	113.78	113.34	113.372
Regional	0.59	0.41	-	6.53	5.97	-	175.88	175.03	-

Refer to the SWM Calculations and PCSWMM model output provided in **Appendix B**.

4.5.3 Operations and Maintenance

The proposed design is consistent with Sustainable Technologies Evaluation Program (STEP) for bioretention systems which temporarily store runoff, specifically a biofilter design which includes an impermeable liner and underdrain. Design of a bioretention facility can include distributing concentrated flows from pipes between multiple inlets, pre-treatment using OGS devices, overflow outlets and underdrains.

The incorporation of the pre-treatment devices will mitigate the sediment build-up within the facility. STEP guidelines also recommend that the drainage area to the facility be 5 to 30 times the footprint area to avoid clogging. LID 1 has a footprint of 0.12 ha with a impervious drainage area of 1.52 ha so the drainage area is 10 times the size of the LID. LID 2 has a footprint of 0.13 ha with an impervious drainage area of 2.91 ha so the drainage area to be treated is 22 times the size of the footprint.

In accordance with the recommendations in the STEP LID guidelines, the proposed LID will require bi-annual inspections/maintenance in addition to cleanouts based on sediment accumulation in the OGS and LID facility. Access to the LID will be available from a private condo road and/or in conjunction within trails/paths in the NHS (access from Bronte Road). The LID floor will be designed with a permeable liner (ex. Georunner) that will support light machinery to remove sediment without impact the soil media below.

Inspection is the first step for the maintenance work. Based on the inspection reports, the necessity of the maintenance works can be decided and scheduled. Inspection of the trench can be broadly divided into two types. The details of the inspection types are described below.

A) **Construction Inspections** - During and following construction, the trench should be inspected to ensure that the construction process has not compromised its effectiveness. Construction inspections take place during several points in the construction sequence, specific to the type of LID BMP, but at a minimum should be done weekly and include the following:

1. During site preparation, prior to BMP excavation and grading to ensure the contributing drainage area is stabilized or that adequate ESCs or flow diversion devices are in place and confirm that construction materials meet design specifications.
2. At the completion of excavation and grading, prior to backfilling, ensure depths, slopes and elevations are acceptable.
3. After final grading, prior to planting to ensure depths, slopes and elevations are acceptable.
4. Prior to hand-off points in the construction sequence when the contractor responsible for the work changes (i.e., hand-offs between the storm sewer servicing, paving, building, and landscaping contractors).
5. After every large storm event (e.g., 15 mm rainfall depth or greater) to ensure ESCs and pretreatment or flow diversion devices are functioning and adequately maintained.

B) **Routine Inspections** - Regular inspections (twice annually, at a minimum) completed as part of routine maintenance tasks over the operating phase of the BMP life-cycle to determine if maintenance task frequencies are adequate. After the construction and after handing over the bio-filtration facility to the maintenance authority, the LID should be monitored regularly to identify the maintenance requirement and monitor the performance. The routine inspection works are done mainly by visual inspection. The maintenance work will be carried out based on the inspection report.

Table 4-12 describes routine maintenance tasks for the bio-filtration facility, organized by the BMP component.

Table 4-12: Bio-Filtration Facility Maintenance

Component	Maintenance Tasks
Contributing Drainage Area	• Remove trash, debris, and sediment from pavements • Replant or seed bare soil areas
Inlets	• Keep free of obstructions. • Remove trash, debris, and sediment • Measure sediment depth or volume during each cleaning or annually to estimate the accumulation rate and optimize the frequency of maintenance
Perimeter	• Remove trash, debris, and accumulated sediment • Repair the side slope if erosion occurs
Vegetation	• Water the sod on the first growing season • Remove weeds and undesirable plants • Replace dead plantings annually to achieve 80% cover by the third growing season • Do not apply chemical fertilizers
Filter Bed	• Remove trash bi-annually to quarterly; • Rake every 5 years to remove thatch and prevent sediment crusts; • Aerate and dethatch to maintain soil permeability and dense grass cover every 5 years. • Repair sunken areas when ≥ 10 cm deep and barren/eroded areas when ≥ 30 cm long; • Remove sediment when > 5 cm deep
Subdrain and Monitoring Port	• Flush out accumulated sediment with hose or pressure washer

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Cleanout requirements for the SWM BMPs would include a vacuum excavator to clean the OGS (every ~5 years) and sweeping out the inside of the LID/using a bobcat to remove accumulated sediment (every ~8 years). The estimated cost of the cleanout is as follows:

- OGS - $3,000 – including a vacuum truck and disposal of material.
- LID facility - $25,000 – including crew and equipment, sediment disposal, consulting/testing and camera inspection of the outlet pipes.

An Operation and Maintenance manual will be provided for the LID as part of detailed design.

Table 4-13 outlines the maintenance requirements for the proposed LID compared to a traditional SWM pond.

Table 4-13: Maintenance Requirements SWM Pond vs Bio-Filtration Facility

Metrics	Evaluated SWM Strategies	
	A SWM Pond	B Bio-filtration Facility
Annual Maintenance	Standard wet pond maintenance, bi-annual inspections of SWM ponds including landscaping, monitoring, cleanout, access road.	Remove trash and debris from LID, check vegetation cover.
Cleanout Requirements	Drain the pond, fish removal. Dredge out the silt and let dry. Load and haul away sediment.	Vacuum excavator to clean OGS. Sweep floor of LID or use bobcat to scrape accumulated sediment. Haul away.
Cleanout Frequency	Pond Decanting Area typically assumed to provide enough storage for cleanout to take place every 10 years.	Subdivision will generate 10.09 m^3/year of sediment based on annual loading rates for various levels of imperviousness in the MOE SWM Planning & Design Manual. 2 OGS' will remove 60% or 6 m^3/yr – OGS' have a storage of 26.57 m^3 requiring clean out every ~ 5 years Remaining 40% or 4 m^3/yr will enter LID – assuming 73% removal per STEP guidelines, the LID requires clean-out every 8 years assuming 5 cm sediment depth triggers cleanout.

Metrics	Evaluated SWM Strategies	
	A SWM Pond	B Bio-filtration Facility

Cleanout Cost	$200,000-$300,000 for pond cleanout every 10 years which includes:
	
	- Fish Rescue
	- Survey (pre and post)
	- Civil Consultant
	- Testing of sediment
	- Excavating and drying
	- Transport and disposal
		$3,000 OGS Cleanout which includes:
		
		- Vacuum truck
		- Disposal of material offsite
		
		$25,000 for LID cleanout which includes:
		
		- 2 Crew/equipment Days
		  - Sediment Disposal
		  - Consulting/Testing
		  - Camera Inspection of outlet pipes

Commentary	Post-development drainage area falls below the minimum threshold recommended by MECP of 5.0 ha. Wet pond is not warranted.	Bio-filtration facility requires reduced maintenance effort as private or public facility compared to a wet pond. Bio-filtration facility addresses requests by review agencies to implement more LID features in development applications

4.6 Water Balance

As part of the Hydrogeological Investigation, DS Consultants completed a monthly Water Balance Model for the pre-development and post-development hydrological conditions at the site. The water balance assessment indicated an unmitigated water balance deficit of 5,666 m^3.

As mentioned in Section 2.2 above, there are locations within the Subject Lands where the ground water is close to the ground surface which will preclude infiltration in those locations. To achieve water balance objectives on a best efforts basis **Table 4-14** outlines potential measures including filtration where infiltration is not feasible.

Table 4-14: Potential LID Measures

LID Measure	Notes
Rainwater Harvesting – Rain Barrels	A lot level measure that can be used to irrigate landscape areas, which can promote infiltration.
Downspout Disconnection	Enhanced groundwater recharge when used in conjunction with topsoil amendments.

LID Measure	Notes
Bio-filtration Facility[1]	Enhanced bioretention facility with filtration, attenuation and with an impervious liner. * Note 1
Grassed Swales	Conveyance LID to be located on continuous strips of green space. Promote infiltration and TSS removal.
Additional Topsoil	Minimum 200 mm of topsoil in landscaped areas enhances potential for groundwater recharge

Notes

1 The potential for infiltration through the floor of the bio-filtration facility (no liner) will be field determined following the decommissioning of the on-site man-made pond which may lower groundwater levels such that infiltration is feasible.

The bio-filtration facility is designed to retain and store the 25 mm rainfall event which will increase evaporation. As outlined in the hydrogeology report approximately 1.67 ha of roof area will be redirected to landscaped area with a minimum 200 mm of additional topsoil which will reduce the infiltration deficit from 5,666 m^3/year to 1,618 m^3/year. The post-development water balance with mitigation measures will be refined during detailed design.

5 WASTEWATER SERVICING

5.1 Design Criteria

The wastewater design criteria used in this report is in accordance with the Halton Region Water and Wastewater Linear Design Manual and Town of Oakville design standards:

Design Flow:

- Residential Flow = 0.275 m^3 per capita / day
- Harmon Peaking Factor: min = 2.0, max = 4.0
- Infiltration Allowance = 0.286 L/ha/s

Population Equivalents:

- Single Family = 55 pp/ha
- Townhouse, Maisonette = 135 pp/ha

5.2 Existing Conditions

The existing wastewater network in the vicinity of the site includes:

- A 300 mm dia. Sanitary Sewer on Bronte Road.
- A 200 mm Stub Sanitary Sewer located on Yellow Rose Circle

Refer to **Drawing SAN-1** for the location of the existing wastewater network in the vicinity of the site.

5.3 Proposed Wastewater

The site will be serviced through a network of 200 mm gravity sewers within the proposed public rights of way. Service stubs will be provided to the condominium block and the condominium blocks will be serviced with private sanitary sewers.

The site contemplates 86 single family units and 89 townhouse units with a total population of 394 people. The anticipated wastewater flow from the site including infiltration and peaking is 7.1 l/s.

A new outfall sewer is proposed within the west boulevard of the Bronte Road which ultimately crosses Bronte Road and connects to a stub within Yellow Rose Circle.

The proposed outfall sewer will cross in front of the adjacent Eaglewood Communities property.

The stub sewer was installed within Yellow Rose Circle and was intended to service the Subject Lands. The stub is appropriately sized.

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The proposed crossing of Bronte Road will likely intercept an existing 300 mm sewer hence diverting flows into the new outfall. The Bronte Road storm sewer design made accommodation for lands situated to the north of the Eaglewood Communities property.

The placement of the outfall sewer within the Bronte Road right of way is subject to ongoing review with Halton Region and the results of a SUE investigation.

Refer to **Drawing SAN-1** for drainage areas and the proposed sanitary sewer layout, **Drawing PP-2** for details of the outfall sewer within the Bronte Road right of way and to **Appendix C** for sanitary sewer capacity calculations.

6 WATER SERVICING

6.1 Design Criteria

The watermain design criteria used in this report is in accordance with the Halton Region Water and Wastewater Linear Design Manual and Town of Oakville design standards:

Water Demand Design Criteria:

- Average Daily Demand = 0.275 m^3 per capita
- Maximum Daily Demand Peaking Factor = 2.25
- Peak Hourly Demand Peaking Factor = 4

Population Equivalents:

- Single Family = 55 pp/ha
- Townhouse, Maisonette = 135 pp/ha

6.2 Existing Conditions

The existing water network in the vicinity of the site includes:

- A 300 mm dia. watermain on Bronte Road;
- A 1050 mm dia. Watermain on Bronte Road.

Refer to **Drawing WM-1** for the location of the existing watermains in the vicinity of the site.

6.3 Local Watermains

A water analysis was completed by MES in March 2023 (**Appendix D**) for the Subject Lands. The MES analysis modelled the average, maximum day, and peak hour flows as shown in **Table 6-1**.

Table 6-1: Water Demand

Development	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
BRLP	2.69	6.05	10.76

MES calculated preliminary fire flow requirements based on similar developments in Halton Region. Site specific fire demand requirements calculated once building design/configurations are finalized and will be included in support of detailed design.

The water analysis indicated the following:

- The service pressures are expected to range between 81.6 psi to 90.1 psi (563 kPa to 622 kPa) in 2021 and between 88.5 psi to 102.1 psi (610 kPa to 704 kPa) in 2031.
- The available fire flow meets the preliminary fire flow demands at the minimum pressure of 20 psi (140 kPa).
- The Subject Lands will be serviced with watermains ranging from 150 to 250 mm diameter on the condo lanes and 300 mm on Street A. The 300 mm will connect to the existing watermain on Bronte Road.

Refer to **Drawing WM-1** for details of the preliminary site watermain layout.

Water servicing will also be provided to the neighboring Eaglewood Communities property via a connection to the proposed watermain on Street A.

Final watermain sizes will be determined at the detailed design stage.

6.4 Watermain Connection Options

The Subject Lands are located at the upper end of Pressure Zone 2. As a result, when a hydrant flow test was conducted on an existing hydrant situated on the east side of Bronte Road north of Saw Whet Boulevard it showed a lower than typical available flow of 99.7 L/s @ 20 psi.

The model considered moving the zone boundary from Bronte Road near Yellow Rose Circle to south of Saw Whet Boulevard. The Bronte Road watermain north of the Bronte River connection would move to Zone O3 and the watermain to the south would remain on Zone O2. The final configuration of the watermains and zone separation in the are must be discussed and confirmed with the Region.

With a Zone O3 supply, the domestic and fire flow demands can be met though the pressures are estimated above the OBC limit of 80 psi (550 kPa) and maybe above the Region pressure limit of 100 psi (690 kPa). The units will require individual pressure reducing valves.

Halton Region has advised that that water pressure zones are being revised but the Subject Lands will not be impacted by the change.

7 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls will be implemented during all site construction works including topsoil stripping, bulk earthworks, foundation excavation, site servicing and stockpiling of materials and will conform to the **Erosion and Sediment Control Guide for Urban Construction (2019).** These measures will include:

1) Installing heavy duty silt control fencing along the perimeter of the site at strategic locations.
2) Installing a temporary mud mat at the construction site entrance.
3) Installing temporary cutoff swales or ESC ponds.
4) Wrapping the tops of all inlet structures with filter fabric and using install silt sacks after servicing.
5) Maintenance of flow from external lands during construction.
6) Inspecting all sediment and erosion controls to maintain them in good repair until such time as the Engineer or the Town approves their removal.
7) Appropriate dewatering of existing ponds in compliance with Agency discharge requirements.

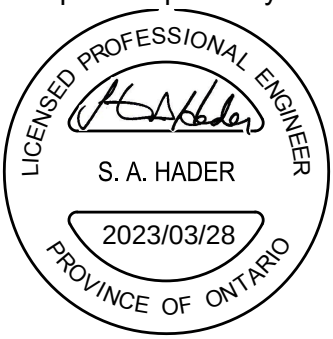
Refer to **Drawings ESC-1** and **ESC-2** for Erosion and Sediment control measures and details.

8 CONCLUSIONS

This report has demonstrated that:

- The Subject Lands can be graded to match to existing elevations at all property lines while generally adhering to Town of Oakville grading standards and specifications.
- Storm sewers are sized based on the 5-year Town IDF parameters within the Subject Lands and based on the 10-year Town IDF parameters for Bronte Road.
- The grading design provides for the safe conveyance of overland flows to the bio-filtration facility.
- Quality and erosion control for lands tributary to BCT-1 will be provided by two OGS' and a bio-filtration facility.
- Quantity control for lands tributary to BCT-1 will be provided in the bio-filtration facility with a 75 mm extended detention and 150 mm quantity control orifice.
- The outfall to BCT-1 involves restoration of an existing outlet (i.e., removal of man-made ponds) at the top end of BCT-1.
- A 750 mm clean water pipe will convey Regional Flows from an external drainage area and, with the exception of the 10 mm event, bypass the bio-filtration facility. The CWC will be situated in a public utility easement.
- Post development flows from the Subject Lands to 14 Mile Creek will be uncontrolled.
- Quality control for the flows being conveyed to 14 Mile Creek will be achieved through the use of an OGS.
- Opportunities for infiltration based LIDs are limited due to high groundwater in the vicinity of the LID. Subsequent groundwater measurements can be taken upon removal of the large artificial pond to determine if infiltration may be feasible.
- Wastewater servicing to the site will be provided by a new sewer to be installed along Bronte Road connecting to an existing sewer stub at Yellow Rose Circle that was designed to accommodate the Subject Lands.
- Water servicing to the site will be provided via a new water connection to existing infrastructure located within Bronte Road. The existing watermain on Bronte Road will be moved to PD3 by relocation of the PD boundary valving.
- Erosion and sediment control measures will be implemented during all construction works and will be maintained and inspected regularly.

Report Prepared by:



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