Barrie Lakeshore Developments

Functional Servicing and Stormwater Management Report

Rezoning and Official Plan Amendment

August 2020

Submitted by:

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SUBMISSION HISTORY

Submission	Date	In Support Of	Distributed To
1st	December, 2019	Official Plan Amendment & Rezoning	City of Barrie, Lake Simcoe Region Conservation Authority
2nd	August, 2020	Official Plan Amendment & Rezoning	City of Barrie, Lake Simcoe Region Conservation Authority

1.0 INTRODUCTION

SCS Consulting Group Ltd. has been retained by Barrie Lakeshore Developments to prepare a Functional Servicing and Stormwater Management Report for a proposed mixed use high density residential and commercial development at 51, 53, 55 &75 Bradford Street and 20 Checkley Street located in the City of Barrie.

1.1 Purpose of the Report

The Functional Servicing and Stormwater Management Report has been prepared in support of the Official Plan Amendment and Amendment to the Zoning By-Law applications for the proposed development. The preliminary Site Plan, which is proposed to consist of 3 Phases, is provided in **Appendix A**. The proposed development will consist of the following:

- A proposed 6m wide private laneway with access from Bradford Street and Checkley Street;
- One 22 story high rise residential development (Tower 1), consisting of 332 residential units and 152 hotel units and 5 levels of above ground parking with access from Lakeshore Drive;
- One 42 story-high-rise residential development (Tower 2), consisting of 569 residential units and 5 levels of above ground parking with access from the proposed 6m wide private laneway;
- One 40 story high rise residential development (Tower 3), consisting of 535 residential units and 5 levels of above ground parking with access from the proposed 6m wide private laneway; and
- One 38 story high rise residential development (Tower 4), consisting of 419 residential units and 7 levels of above ground parking with access from the proposed 6m wide private laneway;

The purpose of this report is to demonstrate that the proposed development can be graded and serviced in accordance with the City of Barrie, Lake Simcoe Region Conservation Authority, the Ministry of Environment, Conservation and Parks (MECP) and Ontario Building Code design criteria.

A Regulatory Floodplain Analysis of Bunkers Creek has been completed by SCS Consulting Group Ltd. and is submitted with this package. The resulting existing and proposed Regulatory (100 year) floodplain limits are illustrated on the grading, servicing and stormwater drainage figures of this report. Refer to the Bunker's Creek Regulatory Floodplain Analysis dated August 2020 by SCS Consulting Group Ltd. for details.

1.2 Study Area

The subject lands are 3.5 ha in size and located within the Barrie Creek Watershed. They are comprised of open space, an existing vacant parking area and a vacant car dealership that is to be demolished. Existing access to the subject lands is provided from Bradford Street and Checkley Street. As shown on **Figure 1.1**, the study lands are bound by:

- Existing condominiums (Grand Harbour Condominiums) and commercial development to the north;

- Bunker's Creek Eco-Park, an existing pond and existing condominiums and commercial development to the south;
- Lakeshore Drive to the east; and
- Bradford Street to the west.

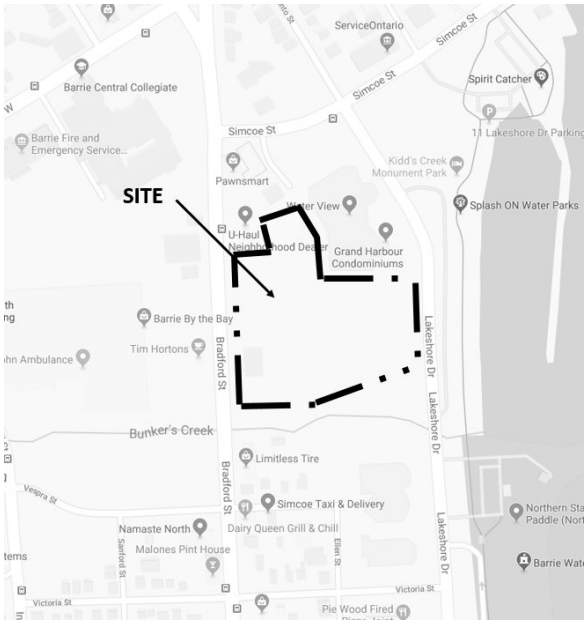


Figure 1.1: Site Location Plan

1.3 Background Servicing Information

In preparation of the servicing and SWM strategies, the following design guidelines and standards were used:

- City of Barrie Engineering Design Specifications and Standard Drawings;
- Ministry of Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (March 2003);
- Lake Simcoe Protection Plan;
- City of Barrie Low Impact Development Screening Process;
- The Ontario Building Code (2012); and
- LRSCA Technical Guidelines for Stormwater Management Submission (September 1, 2016).

The site servicing and SWM strategies in this report are based on the following reports:

- Water Distribution Modelling Draft, MES (December 2019) (**Appendix G**)
- Draft Hydrogeological Assessment, prepared by GHD (December 2019);
- Functional Servicing Report – Barrie Central Redevelopment, prepared by Pearson Engineering Ltd. (June 2019);
- Bunker's Creek Regulatory Floodplain Analysis, prepared by SCS Consulting Group Ltd. (August 2020); and

- Preliminary Geotechnical Report, prepared by McClymont & Rak (December 2019).

The site servicing and SWM strategies are also based on the following approved Engineering Drawings:

- Storm Drainage Plan – Bradford Street Reconstruction, Drawing STM1, prepared by City of Barrie Engineering Department, dated May 23, 2003;
- Storm Drainage Plan – Simcoe Street Reconstruction Bradford St. to Mary St., Drawing STM1, prepared by City of Barrie Engineering Department, dated May 5, 2006;
- Sanitary Drainage Plan – Bradford Street Reconstruction, Drawing SAN1, prepared by City of Barrie Engineering Department, dated May 23, 2003;
- Sanitary Drainage Plan – Kidd's Creek Culvert Improvements, Drawing SAN1 prepared by City of Barrie Engineering Department, dated August 5, 2005.
- Sanitary Drainage Plan – Lakeshore Trunk Sanitary Sewer Reconstruction, Drawing SAN1 prepared by City of Barrie Engineering Department, dated April 23, 2006.
- Sanitary Drainage Plan – Simcoe Street Reconstruction Bradford St. to Mary St., Drawing SAN1, prepared by City of Barrie Engineering Department, dated April 28, 2006;
- Bradford Street STA. -0+010 to 0+150 – Bradford Street Reconstruction, Drawing PP1, prepared by City of Barrie Engineering Department, dated May 23, 2003;
- Bradford Street STA. 0+150 to 0+310 – Bradford Street Reconstruction, Drawing PP2, prepared by City of Barrie Engineering Department, dated May 23, 2003;
- Bradford Street STA. 0+310 to 0+470 – Bradford Street Reconstruction, Drawing PP3, prepared by City of Barrie Engineering Department, dated May 23, 2003;
- Bradford Street STA. 0+470 to 0+630 – Bradford Street Reconstruction, Drawing PP4, prepared by City of Barrie Engineering Department, dated May 2, 2003;
- Bradford Street STA. 0+630 to 0+790 – Bradford Street Reconstruction, Drawing PP5, prepared by City of Barrie Engineering Department, dated May 2, 2003;
- Bradford Street at Simcoe Street STA. 0+0400 to 0+190 – Simcoe Street Reconstruction (Bradford St. to Mary St.), Drawing PP4, prepared by City of Barrie Engineering Department, dated May 5, 2006;
- Simcoe Street at Bradford Street STA. -0+060 to 0+080 – Simcoe Street Reconstruction (Bradford St. to Mary St.), Drawing PP1, prepared by City of Barrie Engineering Department, dated May 5, 2006;
- Simcoe Street at Bradford Street STA. 0+080 to 0+220 – Simcoe Street Reconstruction (Bradford St. to Mary St.), Drawing PP2, prepared by City of Barrie Engineering Department, dated May 5, 2006;
- Lakeshore Drive STA. 0+140 to 0+290 – Heritage Well 14 to Centennial Well 15 Trunk Watermain, Drawing PP2, prepared by Ainley Group, dated January 2003;

- Lakeshore Drive STA. 0+290 to 0+440 – Heritage Well 14 to Centennial Well 15 Trunk Watermain, Drawing PP3, prepared by Ainley Group, dated January 2003;
- Lakeshore Drive at Toronto Street STA. 0+000 to 0+070 – Lakeshore Drive Reconstruction Toronto Street to Tiffin Street, Drawing PP1, prepared by City of Barrie Engineering Department, dated April 28, 2014;
- Lakeshore Drive at Toronto Street STA. 0+070 to 0+170 – Lakeshore Drive Reconstruction Toronto Street to Tiffin Street, Drawing PP1, prepared by City of Barrie Engineering Department, dated April 28, 2014;
- Lakeshore Drive at Bunker's Creek STA. 0+170 to 0+290 – Lakeshore Drive Reconstruction Toronto Street to Tiffin Street, Drawing PP3, prepared by City of Barrie Engineering Department, dated April 28, 2014;
- Lakeshore Drive STA. 0+290 to 0+390 – Lakeshore Drive Reconstruction Toronto Street to Tiffin Street, Drawing PP4, prepared by City of Barrie Engineering Department, dated April 28, 2014;
- Lakeshore Drive at Victoria Street STA. 0+390 to 0+540 – Lakeshore Drive Reconstruction Toronto Street to Tiffin Street, Drawing PP4, prepared by City of Barrie Engineering Department, dated April 28, 2014;
- High Street South Sanitary Sewer Reconstruction – Simcoe Street to Southern Limit, Drawing 88-24, prepared by City of Barrie Engineering Department, dated September 7, 1988; and
- High Street South of Simcoe Street STA. -0+020 to 0+080 – Simcoe Street Reconstruction (Bradford St. to Mary St.), Drawing PP10, prepared by City of Barrie Engineering Department, dated May 5, 2006.

The above listed drawings have been included in **Appendix B**.

2.0 STORMWATER MANAGEMENT

2.1 Stormwater Runoff Control Criteria

The following stormwater runoff control criteria have been established based on the design guidelines and standards listed in **Section 1.3**. The stormwater over-riding runoff criteria from each agency are summarized below in **Table 2.1**.

Table 2.1: Stormwater Runoff Control Criteria

Criteria	Control Measure
Quantity Control	Not required as the proposed development outlets directly adjacent to Bunker's Creek and immediately upstream of Lake Simcoe.
Volume Control	Proposed runoff volume from a 25 mm rainfall event over the total impervious area shall be captured and retained/treated on-site or in accordance with LRCA's Flexible Treatment guidelines if full compliance with the 25mm guideline is not possible. (LSRCA).
Quality Control	MECP Enhanced Level Protection (80% TSS Removal).
Erosion Control	Erosion Control is not required as the proposed development outlets immediately upstream of Lake Simcoe.
Water Budget	Maintain existing groundwater recharge rates and appropriate distribution, ensuring the protection of related hydrology ecologic functions (LSRCA). At a minimum retain the equivalent of 5 mm of rainfall over the development block (City of Barrie).
Phosphorus Budget	Per the Lake Simcoe Protection Plan, proposed phosphorus loading cannot exceed existing phosphorus loading, to the extent feasible. Per the LSRCA SWM Criteria, 80% of the proposed phosphorus loading is to be retained on-site. All remaining phosphorus exported is required to be offset per the LSRCA Phosphorus Offsetting program to meet the target of "zero" loading.

2.2 Existing Drainage

As shown on **Figure 2.1**, overland flow drainage from Catchment 102 (1.10 ha, **Figure 2.1**) outlets to the existing pond located within the Bunker's Creek Eco-Park which outlets to Lake Simcoe via Bunker's Creek. Overland flow drainage from the remainder of the development, Catchment 101 (2.41 ha, **Figure 2.1**) outlets via overland flow to Bunker's Creek and ultimately to Lake Simcoe.

2.3 Allowable Release Rate

As noted in **Table 2.1**, due to the proximity to Lake Simcoe, the proposed development is not required to provide quantity controls.

2.4 Stormwater Best Management Practices Selection

In accordance with the MECP Stormwater Management Planning and Design Manual (2003), and the LRSCA Technical Guidelines for Stormwater Management Submission (September 1, 2016) a review of stormwater management best practices was completed using a treatment train approach, which evaluated lot level, conveyance system and end-of-pipe alternatives.

The following study area characteristics were taken into consideration:

- Based on the Geotechnical investigation, soils consist of silt, sandy silt to sand with clayey silt to silty clay layers;
- percolation hydraulic conductivity test was completed and indicates that the native soils have a hydraulic conductivity ranging from 1.39E-5 to 6.42E-5 m/s;
- Within the installed site wells, groundwater was observed at depths ranging between 0.27 m to 2.85 m below existing grade;
- The proposed development drains west to Bunker's Creek and ultimately to Lake Simcoe.

The following are examples of at-source, and conveyance controls that will be evaluated for use in the proposed development at the site plan application stage. While evaluating the following controls at the site plan application stage, cost, feasibility, groundwater and grading constraints will be taken into consideration.

<u>At-Source Controls</u>

At-source controls are that reduce runoff prior to stormwater entering the conveyance system are to be utilized, such as:

- Increased topsoil depth;
- Bioretention;
- Pervious pavements;
- Filtration trenches; and
- Infiltration trenches/soak-away pits.

<u>Conveyance Controls</u>

Conveyance controls provide treatment of stormwater during the transport of runoff from individual lots to the receiving watercourse. Examples of conveyance controls include:

- Grassed Swales;
- Filtration trenches; and
- Infiltration Trenches.

A comprehensive assessment of LID practices will be provided in support of the Site Plan Application stage. Since the site has high groundwater levels, the opportunity for LIDs are limited, and as such, filtration-based LIDs should be considered where feasible. At the site plan application stage, a water balance evaluation will be incorporated into the detailed stormwater management report that discusses the selection of LIDs in accordance with the City of Barrie Low Impact Development Screening Process document and quantify the proposed rainwater retention volume.

2.5 Proposed Storm Drainage

A proposed storm drainage plan (**Figure 2.2**) has been prepared for the proposed development. The proposed drainage patterns have been designed to convey the runoff to Lake Simcoe via Bunker's Creek. Minor system drainage from the majority of the proposed development, Catchment 201 (2.06 ha **Figure 2.2**) will be captured via a proposed internal storm sewer system and outlet to the existing pond located within the Bunker's Creek Eco-Park which outlets to Lake Simcoe via Bunker's Creek. Major system drainage from majority of the proposed development, Catchment 202 (0.65 ha, **Figure 2.2**) will outlet overland into the existing pond located within the Bunker's Creek Eco-Park which outlets to Lake Simcoe via Bunker's Creek. A portion of the proposed development, Catchment 203 (0.25 ha, **Figure 2.2**) will drain uncontrolled to Bradford Street which will outlet into Bunker's Creek and ultimately outlet to Lake Simcoe. The remainder of the drainage from the proposed development, Catchment 204 (0.54 ha, **Figure 2.2**) is proposed to outlet to the existing pond located within the Bunker's Creek Eco-Park which outlets to Lake Simcoe via Bunker's Creek. A small portion of the drainage (Catchment 205, 0.01 ha, **Figure 2.2**) will drain uncontrolled to Lakeshore Drive.

Based on our correspondence with City Staff, we understand that the Bunkers Creek Eco-Park pond is not a stormwater management pond and was constructed as an educational feature of the park.

2.5.1 Quantity Control

Quantity control for the proposed development is not required due to the proximity to Bunker's Creek and Lake Simcoe.

2.5.2 Volume Control

As outlined in **Table 2.1**, runoff from a 25 mm rainfall event from new or reconstructed impervious surfaces must be retained/treated on-site or in accordance with LRCA's Flexible Treatment guidelines if full compliance with the 25mm guideline is not possible. Where feasible, best efforts will be made to retain runoff from the 25 mm rainfall event. Proposed infiltration trenches within the private laneway will accept drainage from the private laneway which will be sized to retain runoff from the 25 mm rainfall event over the impervious surface. Proposed infiltration trenches will accept roof drainage from all future Towers which will be sized to retain runoff from the 12.5 mm rainfall event. If full compliance of retaining runoff from a 25 mm rainfall event from impervious surfaces is not possible, the infiltration trenches will be sized in accordance with LRCA's Flexible Treatment guidelines.

2.5.3 Quality Control

Quality control for the proposed development will be provided on-site. A treatment train approach involving infiltration trenches and manufactured treatment devices will be proposed and sized to provide 80% TSS removal, refer to preliminary calculation in **Appendix C**. In addition a manufactured treatment device, a Jellyfish unit is proposed in order to achieve the required MECP Enhanced Level Protection (80% TSS Removal). Details will be provided at the Site Plan application stage.

2.5.4 Quality Control (Other Pollutants)

It is important to note that the existing site may have history of contamination. Risks of contamination will be considered at detailed design to ensure that there will not be any impact on stormwater management features.

Quality control measures such as those mentioned in **Section 2.5.3**, including a Jellyfish unit will provide quality control up to 80% TSS removal.

2.5.5 Erosion Control

As noted in **Section 2.1**, erosion control is not required as the proposed development outlets immediately upstream of Lake Simcoe.

2.5.6 Water Balance

As discussed in **Section 2.1**, the proposed development is required to match the existing annual runoff volume per LSRCA or at a minimum retain the 5 mm event per City of Barrie standards. To achieve this objective, the LID measures as mentioned in **Section 2.4** was incorporated into a preliminary water balance assessment for the proposed development.

Based on the ultimate water balance assessment prepared by Beacon, the existing infiltration rate for the overall development is 11,344 m^3/yr. The proposed overall development infiltrate rate without LIDs is 3,789 m^3/year. With the proposed preliminary LIDs and infiltration measures, the proposed overall development infiltrate rate is 20,642 m^3/yr. Therefore, the proposed overall development with LIDs is increasing infiltration by 45% of existing and therefore is maintaining and improving existing infiltration rates.

Refer to excerpts of the water balance assessment prepared by Beacon in **Appendix B**.

2.5.7 Phosphorus Budget

Under the Lake Simcoe Protection Plan (LSPP), a stormwater management plan must demonstrate how phosphorus loadings are minimized between existing and proposed. The LSPP states that:

> "*Best efforts shall be employed such that any increase in loading (post development compared to pre development) is kept to a minimum. The target is "zero" increase in loading*."

The MECP database application *Lake Simcoe Phosphorus Loading Development Tool* (v2, 01-April-2012 update) was used to complete the phosphorus budget for the proposed development.

<u>Existing Phosphorus Loadings</u>

The existing phosphorus loading was calculated based on the existing land uses as determined from topographic survey and satellite imagery. Existing land uses are classified as High Intensity Development, for the commercial portion of the lands, and Low Intensity

development for the open space area as shown on **Figure 2.3**. The existing annual phosphorus loadings were calculated to be 1.11 kg/year for the area proposed to be disturbed. Refer to **Appendix E** for the phosphorus loading tool output.

Proposed Phosphorus Loadings

The proposed land uses are shown on **Figure 2.4**. The proposed development is considered High Intensity Development with small sections of Low Intensity Development for landscaped areas per the land classifications available in the MECP Phosphorous Tool. The proposed phosphorus loading with no best management practices (BMPs) was calculated to be 3.39 kg/year. Refer to **Appendix E** for the phosphorus loading tool output.

Opportunities to reduce the proposed phosphorus loadings will be explored at the detailed design stage via the use of LID's as outlined in **Section 2.4**.

A preliminary phosphorous calculation has been completed for the overall development with the LIDs outlined in **Section 2.4**. Further details and analysis to be completed at the site plan application stage. The proposed phosphorous loading with BMPs (infiltration trenches and Jellyfish unit) was calculated to be 1.09 kg/yr for the Phase 1 development (**Appendix E**).

It is noted that the overall proposed with BMP's annual phosphorus loading of 1.09 kg/year is less than the existing annual phosphorus loading of 1.11 kg/yr. However, as the resulting reduction of annual phosphorus loading is greater than zero, phosphorus offsetting is required. Based on the current Phosphorous Offsetting Policy, and the proposed annual loading of 1.09 kg/yr results in an offsetting fee of $109,681.25, per the following equation:

Annual Loading (kg/yr) * 2.5 * $35,000 * 1.15 (15% admin fee)

2.5.8 Floodplain Analysis

A floodplain analysis of Bunker's Creek has been completed in support of the proposed development. The Bunker's Creek Regulatory Floodplain Analysis is provided with this submission package. The Bunker's Creek Regulatory Floodplain Analysis illustrates the current Regulatory (100 year) floodplain conditions based on the existing configuration of Lakeshore Drive and the Bunker's Creek and Kidd's Creek crossings, and also demonstrates the proposed floodplain conditions based on proposed cutting and filling in the floodplain associated with the proposed development. The Bunkers Creek Floodplain Analysis has been incorporated into the preliminary grading, servicing and stormwater strategies demonstrated in this report and inform the delineation of the proposed development limits. .

3.0 STORM SERVICING

3.1 Existing Storm Sewer System

The location and sizes of the existing municipal storm sewers surrounding the proposed development are indicated in the City Record Drawings (**Appendix B**) and the Storm Servicing Figure (**Figure 3.1**) and summarized below:

- Two 2500 mm diameter CSP culverts located under Bradford Street which conveys Bunker's Creek east to Lake Simcoe;
- A series of storm sewers ranging in size from 300 mm to 450 mm flowing south on Bradford Street, ultimately outletting to the two existing 2500 mm CSP culverts;
- A 250 mm diameter concrete storm sewer flowing north on Checkley Street;
- A series of storm sewers ranging in size from 375 mm to 675 mm flowing south on Lakeshore Drive, ultimately outletting to Bunker's Creek under the existing Lakeshore Drive box culvert; and
- Four 1.5 m x 3.0 m concrete box culverts located under Lakeshore Drive which conveys Bunker's Creek east to Lake Simcoe.

Based on the City Record Drawings and the information available to us, there are no existing storm service connections provided for the subject lands.

A subsurface utility investigation will be completed prior to the detailed design stage to confirm the sizes, inverts and geometry of the existing municipal storm sewers surrounding the subject lands.

3.2 Proposed Storm Sewer System

Conveyance of stormwater flows from the proposed development are not accounted for in any of the existing storm sewers surrounding the proposed development. Storm drainage for the proposed development will be captured and continue to be conveyed to the existing pond within the Bunker's Creek Eco-Park via a private storm sewer network. The existing pond within Bunker's Creek Eco Park ultimately outlets to Lake Simcoe via Bunker's Creek. **Figure 3.1** shows the preliminary layout, pipe sizes and inverts of the proposed private storm sewer system for the proposed development.

The private storm sewer system (minor system) within the proposed development (**Figure 3.1**) will be designed for the minimum 5 year return storm per the Municipality standards. The depth of the proposed storm sewer system is constrained by the existing elevation at the proposed outlet point to the existing Bunker's Creek Eco-Park pond and the floodplain elevation of 220.58 m (Bunker's Creek Regulatory Floodplain Analysis, prepared by SCS Consulting Group Ltd.). As a result of these constraints, the proposed private storm sewer system will be shallow and therefore will require insulation and will be designed with grades ranging from 0.2% to 1.5%.

The storm sewer system will be designed in accordance with the City of Barrie design standards, Ontario Building Code and the MECP guidelines, including the following:

- Minor System Conveyance: 5 Year
- Time of Concentration: 10 minutes
- Minimum Velocity: 0.0.75 m/s (where possible)
- Maximum Velocity: 4.0 m/s
- Runoff coefficient for impervious area: 0.95

The rainfall intensity will be calculated using the A, B, and C values listed in **Table 3.1**:

Table 3.1 – Rainfall Intensity Parameters

Return Period Storm	A	B	C
5 Year	853.608	4.699	0.766
100 Year	1426.408	5.273	0.759

4.0 SANITARY SERVICING

4.1 Existing Sanitary Sewer System

The location and sizes of the existing municipal sanitary sewers surrounding the proposed development are indicated in the City Record Drawings (**Appendix B**) and the Sanitary Servicing Figure (**Figure 4.1**) and summarized below:

- 300 mm diameter PVC sanitary sewer flowing north on Bradford Street ultimately outletting to the existing 750 mm diameter sanitary trunk sewer on High Street;
- An abandoned 350 mm diameter A/C sanitary sewers on Bradford Street;
- A 250 mm diameter PVC sanitary sewer flowing north on Checkley Street outletting to the existing 825 mm diameter sanitary trunk sewer on Simcoe Street; and
- A 1350 mm sanitary sewers and one 1.8 m x 1.0 m sanitary box culvert flowing south on Lakeshore Drive, ultimately outletting to the Barrie Wastewater Treatment Facility located at Lakeshore Drive and Tiffin Street.

Based on the City Record Drawings (**Appendix B**), there are three existing 150 mm diameter sanitary service connections provided for the proposed development from Bradford Street. A subsurface utility investigation will be completed during the detailed design stage to confirm the sizes, inverts and geometry of the existing municipal sanitary sewers surrounding the subject lands.

City of Barrie Staff have requested that sewer capacity analyses be completed for the Bradford Street sanitary sewer and Lakeshore drive sanitary trunk sewer under free flow and backwater conditions. A sewer capacity and hydraulic grade line (HGL) analysis of the existing downstream municipal sanitary sewer system on Bradford Street and sanitary trunk sewer system on Lakeshore Drive have been completed using the City of Barrie's sanitary design criteria, the approved Sanitary Drainage Plans (**Appendix B**), plan and profile record drawings (**Appendix B**) and starting downstream HGL elevations provided by Nathanael Couperus of the City of Barrie's Corporate Asset Management department (**Appendix B**).

The existing sanitary sewers included in the Bradford Street analyses begin at existing manhole SAC01029 on Bradford Street and end at the 750 mm sanitary trunk sewer on High Street at existing manhole SAC1006. The existing sanitary sewers included in the Lakeshore Drive analyses begin at existing manhole SAL01029 at the Barrie Wastewater Treatment Facility and end at existing manhole SAL01016 on Lakeshore Drive.

City of Barrie Staff have requested that the proposed Barrie Central Development located at 34-50 Bradford Street be included in the Bradford Street capacity and HGL analyses of the existing downstream municipal sanitary sewer system. Since the development schedule of the Barrie Central Development is unknown at this time, two versions of the existing capacity and HGL analyses were completed to demonstrate existing conditions with and without the Barrie Central Development.

Bradford Street Sanitary Sewer

The Bradford Street existing conditions sanitary sewer capacity analysis (under free flow conditions) excluding the Barrie Central Development demonstrates that there is residual capacity in the existing sanitary sewers on Bradford Street with the most constrained run of sewer flowing 12% full with a maximum d/D value of 0.231.

The Bradford Street existing conditions sanitary sewer capacity analysis (under free flow conditions) including the Barrie Central Development demonstrates that there is residual capacity in the existing sanitary sewers on Bradford Street with the most constrained run of sewer flowing 32% full with a maximum d/D value of 0.390. The introduction of the Barrie Central Development increases the "existing" flow by 20% and the maximum d/D value by 0.159 downstream of the proposed Barrie Central Development. Refer to the Bradford Street Existing Conditions Sanitary Sewer Design sheets (**Appendix F**) and supporting City record drawing Bradford Street Reconstruction Sanitary Drainage Plan (**Appendix B**) for details.

City of Barrie Staff have requested that a hydraulic grade line (HGL) analysis be completed on the Bradford Street existing sanitary sewer system due to a downstream surcharge condition at the Barrie Wastewater Treatment Facility. The following criteria was applied to the Bradford Street Sanitary Sewer HGL analyses:

- Existing basement elevations are 1.9 m below the Centerline of the road
- Allowable distance from basement elevation to HGL is 0.5m
- Starting downstream HGL elevation of 219.00 at existing manhole SAC1006.

Based on the Bradford Street Reconstruction Plan and Profile record drawings (**Appendix B**) there are approximately 17 lateral sanitary service connections connected to the sanitary sewer between existing manholes SAC01029 and SAC1006. Depths of the existing sanitary service connections are not provided on the record drawings except for one at manhole SAC01028 which has a depth of 1.46 m to obvert.

The Bradford Street existing conditions sanitary sewer HGL analysis, excluding the Barrie Central Development demonstrates that the existing sanitary sewers on Bradford Street are under surcharge conditions from existing manholes SAC01025 to SAC1006.

While the analysis identifies the sanitary sewer as surcharged from manholes SAC01029 to SAC01027, this is due to the sewer being at an elevation that is higher than the assumed depth of the existing basements however the depth of flow still remains confined within the pipe.

A maximum HGL of 0.374 m above the obvert of the sanitary sewer is identified at manhole SAC01023 however the distance between the HGL elevation and the assumed underside of existing basements is greater than 0.5 m therefore we conclude that the theoretical surcharge condition does not have any adverse impact on the Bradford Street sanitary sewer system that was analysed.

The Bradford Street existing conditions sanitary sewer HGL analysis, when including the Barrie Central Development, demonstrates an increase in the maximum HGL by 0.002 m (0.376 m) above the obvert of the sanitary sewer at manhole SAC01023. The distance between the HGL elevation and the assumed underside of existing basements still remains greater than 0.5 m therefore we conclude that the theoretical surcharge condition does not have any adverse impact on the Bradford Street sanitary sewer system that was analysed.

Lakeshore Drive Sanitary Trunk Sewer

The Lakeshore Drive existing conditions sanitary trunk sewer capacity analysis (under free flow conditions), excluding the Barrie Central Development demonstrates that there is residual capacity in the existing sanitary sewers on Lakeshore Drive with the most constrained run of sewer flowing 27% full with a maximum d/D value of 0.354.

The Lakeshore Drive existing conditions sanitary trunk sewer capacity analysis (under free flow conditions), including the Barrie Central Development demonstrates no change in the percentage full and a slight increase of 0.002 (0.356) in the maximum d/D value. Refer to the Lakeshore Drive Existing Conditions Sanitary Sewer Design sheets (**Appendix F**) and supporting Lakeshore Drive Sanitary Drainage record drawings (**Appendix B**).

City of Barrie Staff have requested that a hydraulic grade line (HGL) analysis be completed on the Lakeshore Drive existing sanitary sewer system due to a downstream surcharge condition at the Barrie Wastewater Treatment Facility. The following criteria was applied to the Lakeshore Drive Sanitary Trunk Sewer HGL analyses:

- One analysis with basements was completed. Presence of basements requested to be confirmed by the City of Barrie. Existing basement elevations are 1.9 m below the Centerline of the road.
- One analysis without basements was completed. Presence of basements requested to be confirmed by the City of Barrie.
- Starting downstream HGL elevation of 218.97 at existing manhole SAL01029.

Based on the Lakeshore Drive Sanitary Trunk Sewer Reconstruction Plan and Profiles and Sanitary Drainage Plan record drawings there are only three sanitary lateral service connections connected to the sanitary trunk sewer between existing manholes SAL01016 and SAL01029. Depths of the existing sanitary service connections are not provided on the record drawings. Based on the abbreviations provided on the sanitary drainage plan the connections are for public washrooms located along the lake front, a single story building belonging to the marina along the lakefront and Grand Harbour Condominiums at 2 Toronto Street (adjacent to the subject development). Analyses of the existing sanitary trunk system with and without basements have been prepared to demonstrate the existing HGL conditions along Lakeshore Drive. The presence for basements are requested to be confirmed by the City of Barrie.

The Lakeshore Drive existing conditions sanitary sewer HGL analysis, excluding the Barrie Central Development demonstrates that the existing sanitary sewers on Lakeshore Drive are under surcharge conditions.

A maximum HGL of 2.315 m above the obvert of the sanitary trunk sewer is identified at the Wastewater Treatment Facility at manhole SAL01028. The distance between the HGL elevation and finished grade (manhole top) is 0.82 m therefore we conclude that the surcharge condition does not have any adverse impact on the Wastewater Treatment Facility if the facility does not have a basement. With a single level basement elevation of 1.9m below finished grade, the HGL elevation is 1.08 m above the basement slab.

The HGL at the existing Grand Harbour Condominium (manhole SAL01017), Marina building (manhole SAL01020) and lakefront public washrooms (manhole SAL01021) is 0.736 m, 1.061

m and 1.285 m respectively above the obvert of the sanitary trunk sewer. The distance between the HGL elevation and finished grade at each manhole is 1.40 m, 1.51 m and 1.74 m respectively, therefore we conclude that the surcharge condition does not have any adverse impact on the identified existing developments if the existing developments do not have basements. With a single level basement elevation of 1.9m below finished grade, the HGL elevation is 0.72 m (manhole SAL01017), above 0.57 m (manhole SAL01020) and 0.31 m (manhole SAL01021) above the basement slab.

The Lakeshore Drive existing conditions sanitary sewer HGL analysis, including the Barrie Central Development does not increase the HGL elevation at the Wastewater Treatment Plant and only increases the HGL at the Grand Harbour Condominium, Marina building and public washrooms by 0.002 m. The change in the HGL elevation is negligible and therefore we concluded that the addition of the Barrie Central development does not have an adverse impact on the portion of the downstream Lakeshore Drive sanitary trunk sewer system that was analysed if the existing developments do not have basements. With a single level basement elevation of 1.9m below finished grade, the HGL elevations above the basement slab at the Grand Harbour Condominium, Marina building and lakefront public washrooms also remains unchanged.

There do not appear to be any other lateral service connections along the Lakeshore sanitary trunk sewer which was analysed. We therefore conclude that the existing surcharge condition does not have any adverse impact on the portion of the existing sanitary trunk sewer system that was analysed if basements are not present. Should basements exist, the surcharge condition which exists in the Lakeshore sanitary trunk sewer would cause an existing flooding condition in the basements of the existing developments mentioned above. The presence of basements along Lakeshore Drive from manholes SAL01029 to SAL01016 is requested to be confirmed by the City of Barrie.

4.2 Proposed Sanitary Sewer System

Towers 2 through 4 will outlet to the existing 300 mm diameter sanitary sewer on Bradford Street via three separate proposed 250 mm diameter sanitary service connections. Tower 1 will outlet to the existing 1350 mm diameter sanitary trunk sewer on Lakeshore Drive via a proposed 250 mm diameter sanitary service connection.

The sanitary service connections for each of the four proposed towers will have slopes ranging between 0.5% and 2% (typically) and will be provided at 1.0 m to 3.0 m deep. The sanitary service connections have been designed in accordance with the City of Barrie criteria, including but not limited to:

- Residential Sanitary Generation Rate: 225 L/cap/day
- Residential Population Density:
  - 3.13 persons/unit (Low Density)
  - 2.34 persons/unit (Medium Density)
  - 1.67 persons/unit (High Density)
- Peaking Factor: Harmon's Equation (Min = 2.0)
- Infiltration Rate: 0.10 L/s/ha
- Minimum Pipe Size: 200 mm
- Minimum Full Flowing Velocity: 0.60 m/s

- Maximum Velocity: 3.0 m/s

. The three existing 150 mm diameter service connections from Bradford Street will not be utilized by the proposed development and will be decommissioned to the satisfaction of the City of Barrie The proposed service connections will be designed with slopes between 0.5% and 2.0% having a full flow capacity of 42 L/s and 84 L/s respectively and a full flow velocity of 0.86 m/s and 1.71 m/s respectively. The total sanitary flows generated by Tower 1 are 6.53 L/s, by Tower 2 are 9.36 L/s, by Tower 3 are 8.81 L/s and by Tower 4 are 7.26 L/s. Therefore each of the proposed sanitary service connections servicing their respective towers have been designed with adequate capacity to convey each building's proposed generated flows.

The size and location of the proposed sanitary service connections for each of the proposed buildings are indicated on the Preliminary Sanitary Servicing Figure (**Figure 4.1**).

The proposed sanitary flows generated by proposed development were added to the existing conditions sanitary sewer capacity (under free flow conditions) and HGL analyses for the Bradford Street sanitary sewer and Lakeshore Drive sanitary trunk sewer. Refer to the Proposed Bradford Street and Lakeshore Drive Sanitary Drainage Plans (**Figure 4.2 and 4.3** respectively) and the Bradford Street and Lakeshore Drive Proposed Conditions Sanitary Sewer Design and HGL Sheets (**Appendix F**) for details.

Bradford Street Sanitary Sewer

The results of the Bradford Street proposed conditions sanitary sewer capacity analysis (under free flow conditions), including the Barrie Central Development demonstrates that there is residual capacity in the existing sanitary sewers on Bradford Street with the most constrained run of sewer flowing 69% full with a maximum d/D value of 0.610.

Should the Barrie Central Development not move forward prior to the proposed subject development at 51-75 Bradford Street, the most constrained run of sewer would flow 51% full with a d/D value of 0.506.

City of Barrie Sanitary design criteria requires that sanitary sewer 375 mm in diameter and smaller are required to be upsized when the d/D value exceeds 0.500. Although the proposed sanitary sewer capacity analysis indicates a d/D value greater than the City's threshold, the most constrained downstream sanitary sewer has residual capacity to accommodate an additional 16.39 L/s of flow (equal to a residential population of approximately 6,294) in addition to both the Barrie Central Development and the proposed subject development at 51-75 Bradford Street. Therefore we maintain that upgrades to the existing downstream sanitary sewer on Bradford Street are not required. We understand through our correspondence with City of Barrie staff, that an Exemption could be discussed and coordinated through Development Services in regards to the upsizing of the existing Bradford Street sanitary sewer and therefore our client will pursue these discussions with the City at a later date.

The Bradford Street proposed conditions sanitary sewer HGL analysis, including the Barrie Central Development demonstrates a maximum HGL of 0.382 m above the obvert of the sanitary sewer at manhole SAC01023. This is an increase of only 0.008 m from the existing condition noted above.

The sanitary service connections from Towers 2, 3 and 4 of the proposed development connect upstream of the surcharge condition and does not consist of any basements or underground parking structure therefore we conclude that there are no adverse impacts on the proposed development.

The distance between the HGL elevation and the assumed underside of existing basements remains greater than 0.5 m therefore we conclude that the surcharge condition does not have any adverse impact on the Bradford Street sanitary sewer system that was analysed.

While the proposed conditions HGL analysis identifies the sanitary sewers as surcharged from manholes proposed manhole SANMH1 to SAC01027, this is due to the sewer being at an elevation that is higher than the assumed depth of the existing basements used for the analysis however the depth of flow still remains confined within the pipe.

Lakeshore Drive Sanitary Trunk Sewer

The results of the Lakeshore Drive proposed conditions sanitary sewer capacity analysis (under free flow conditions), including the Barrie Central Development demonstrates that there is residual capacity in the existing sanitary sewers on Lakeshore Drive with a slight increase in the maximum percentage full of 0.9% and an increase in the maximum d/D value of 0.005 (0.359). Therefore no upgrades to the existing sanitary trunk sewer on Lakeshore Drive are required.

The Lakeshore Drive proposed conditions sanitary sewer HGL analysis, including the Barrie Central Development demonstrates a minimal change of 0.001 m to the maximum HGL, bringing it to 2.316 m above the obvert of the sanitary trunk sewer at the Wastewater Treatment Facility at manhole SAL01028 on Lakeshore Drive.

The HGL at the existing Grand Harbour Condominium (manhole SAL01017), marina building (manhole SAL01020) and lakefront public washrooms (manhole SAL01021) has a negligible increase of 0.008 m (0.744 m), 0.007 m (1.068 m) and 0.006 m (1.291 m) respectively, above the obvert of the sanitary trunk sewer. Therefore we conclude that the minor change in surcharge condition will not have any adverse impact on the identified exiting developments if the existing developments do not have basements. With a single level basement elevation of 1.9 m below finished grade, the HGL elevations above the basement slab at the Grand Harbour Condominium, Marina building and lakefront public washrooms increases by 0.01 m and therefore should the developments mentioned above have basements, the change to the existing flooding condition is negligible. The presence of basements along Lakeshore Drive from manholes SAL01029 to SAL01016 is requested to be confirmed by the City of Barrie.

The sanitary service connection from Tower 1 of the proposed development will connect to existing manhole SAL01018. The HGL at the proposed control manhole MH5A of the proposed development is 0.328 m above the obvert of the proposed sewer. The distance between the HGL elevation and finished grade (manhole top) is 0.91 m. The proposed development does not consist of any basements or underground parking structures therefore we conclude that there are no adverse impacts on the proposed development. A backflow preventer will be installed upstream of proposed control manhole MH5A to add a factor of safety against sanitary effluent backing up into the development.

5.0 WATER SUPPLY AND DISTRIBUTION

5.1 Existing Water Distribution

The proposed development is located within the City of Barrie Water System Zone 1 which is designed to service a water elevation up to 281.20 m. There is currently no water consumption from the existing site. The location and sizes of the existing municipal watermains surrounding the proposed development are indicated on the Preliminary Water Distribution Plan (**Figure 5.1**) and the City of Barrie Record Drawings (**Appendix F**) and summarized below:

- Abandoned 200 mm diameter municipal cast iron watermain on Bradford Street;
- 300 mm diameter municipal watermain on Bradford Street;
- 150 mm diameter watermain on Checkley Street;
- 300 mm diameter HDPE watermain on Lakeshore Drive; and
- 450 mm diameter HDPE watermain on Lakeshore Drive

Based on the City Record Drawings (**Appendix B**) and the information available, there are four existing 25 mm diameter water service connections provided for the proposed development from Bradford StreetA subsurface utility investigation will be completed during the detailed design stage to confirm the sizes, depths and geometry of the existing municipal watermains surrounding the subject lands.

A hydrant flow test was completed on October 29, 2019 by Watermark to determine existing flows and pressures for the Bradford Street, Checkley Street and Lakeshore Drive watermains. Municipal Engineering Solutions (M.E.S.) prepared the Watermain Analysis for the proposed development by utilizing the hydrant flow tests to model existing boundary conditions and hydraulic grade lines for the Average Day, Maximum Day and Maximum Hour (Peak Flows). To better understand the operation of the City's watermain system in this area M.E.S. has requested that the City of Barrie provide boundary conditions in order to confirm the results of the hydrant flow tests and if additional water supply can be made available to the site. The boundary conditions were not yet available for the preparation of this report however the City of Barrie has confirmed that they will be provided to M.E.S. at which time the existing conditions modelled in the Watermain Modeling analysis will be updated. The results of the hydrant flow tests can be found in the appendices of the Watermain Analysis dated December, 2019, found in **Appendix G** of this report.

5.2 Proposed Water System

A Watermain Analysis dated December 2019 has been completed by Municipal Engineering Solutions (M.E.S.) and can be found in **Appendix G** of this report. The report concludes that the existing surrounding watermains provide adequate flows and pressures to service the proposed development based on the City of Barrie's Water Transmission and Distribution Policies and Design Guidelines however, based on recent comments received from the City of Barrie we understand that the Watermain Analysis should demonstrate that the minimum fire flow requirements are met as set out in the City of Barrie Water Storage and Distribution Master Plan Update dated April 2019 by WSP. Based on table 4-9 in section 4.2.1 in the report (**Appendix B**) the minimum Fire Flow required to be met for a high density residential development is 200 L/s. The initial water modelling analysis completed for the site (based on

hydrant tests data only) indicates that the existing system can provide approximately 194 L/s at 20 psi, close to City's requested fire flow of 200 L/s. Upon receiving the boundary conditions from the City of Barrie and updating the original modeled flows (based on the hydrant flow tests only), an improvement in flows is anticipated meeting the minimum fire flow of 200 L/s.

Further to meeting the minimum fire flow requirement as set out in the City of Barrie Water Storage and Distribution Master Plan Update, the City of Barrie has requested that F.U.S. calculations be completed for the proposed development. Smart Centres and Greenwin are currently in the process of advancing the detailed design for the buildings therefor final design information is not yet available to complete final F.U.S. calculations. However, preliminary F.U.S. calculations have been completed based on the latest architectural design drawings and the results show that the potential F.U.S. fire flow requirements for the proposed development could be close to, or possibly greater than the Master Plan fire flow requirement of 200 L/s therefore further discussion with the City is welcomed to determine what fire flow(s) could be accepted for this development.

. The existing 25 mm diameter service connections on Bradford Street will not be utilized by the proposed development and will be decommissioned to the satisfaction of the City of Barrie. The layout of the proposed water service connections to each building within the proposed development are indicated on the Preliminary Water Distribution Figure (**Figure 5.1**). Sizing of the proposed watermains is provided by M.E.S.

Tower 1 will be provided with a combined 300 mm diameter fire and 150 mm diameter domestic water service connection from the existing 300 mm diameter watermain on Bradford Street. Tower 2 will be provided with a single 200 mm diameter fire service connection and a combined 200 mm diameter fire and 200 mm diameter domestic water service connection from the existing 300 mm diameter watermain on Bradford Street. Tower 3 will be provided with a single 200 mm diameter fire service connection and a combined 200 mm diameter fire and 150 mm diameter domestic water service connection from the existing 300 mm diameter watermain on Bradford Street. Tower 4 will be provided with a single 200 mm diameter fire service connection and a combined 200 mm diameter fire and 150 mm diameter domestic water service connection from the existing 300 mm diameter watermain on Bradford Street. Tower's 2, 3 and 4 have been provided with two fire service connections based on the criteria set out in the Ontario Building Code for buildings meeting or exceeding a height of 84 m.

The service pressures provided by the existing 300 mm diameter municipal watermain on Bradford Street and Lakeshore Drive are within the City of Barrie's required operating range but will exceed the operating range set by the Ontario Building Code, therefore a pressure reducing valve may be required for the proposed development and is to be confirmed by the mechanical engineer at the detailed design stage.

The proposed watermain service connections are designed in accordance with the City of Barrie Water Transmission & Distribution Policies and Guidelines.

6.0 GRADING

6.1 Existing Grading Conditions

The existing topography has slopes in the range of 0.50% to 5%. The ground surface elevations through the study area range from approximately 219.50 m in the southeast corner to approximately 222.50 m in the northwest corner.

The existing development topography is indicated on the Topographical Survey dated November 27, 2019 by Schaeffer Dzaldov Bennett Ltd. (**Appendix C**).

6.2 Proposed Grading Concept

A preliminary grading design has been completed for the proposed 6 m wide private laneway from Bradford Street to Checkley Street and the proposed Tower 1 parking area. Preliminary finished floor elevations are also indicated on the Preliminary Grading Plan (**Figure 6.1**)

As discussed in **Section 3.2** of this report, the proposed private storm sewer system from the proposed development will outlet storm flow to the existing pond in the Bunker's Creek Eco-Park. The preliminary grading of the proposed 6 m wide private laneway has been designed in a manner which helps maintain cover over the proposed storm sewer system and results in an outlet elevation at or above the Bunker's Creek floodline elevation, based on the Bunker's Creek Regulatory Floodline Analysis, prepared by SCS Consulting Group Ltd. (August 2020). In order to achieve the proposed preliminary grading design along the 6 m wide private laneway, approximately 50 m of the proposed Checkley Street municipal right-of-way (which currently slopes towards the private development) must be regraded. The preliminary grading design proposes to slope Checkley Street away from the private development at 0.5% beginning at the property boundary shared with Checkley Street. Based on the existing survey data provided by Schaeffer Dzaldov, the required revisions to the existing road grades will not have a negative impact on the existing developments located along Checkley Street. The approximate extent of the grading revisions required on Checkley Street is indicated on the Preliminary Grading Plan (**Figure 6.1**). Upon completion of the final Bunker's Creek Regulatory Floodplain Analysis being completed by SCS Consulting Group Ltd., the preliminary grading design will be revisited and revised if necessary.

In general, the proposed development has been graded in a manner which satisfies the City of Barrie's Lot Grading and Drainage Standards and Design Manual.

At the site plan application stage, the preliminary grading shown on **Figure 6.1** will be subject to a more in-depth analysis in an attempt to balance the cut and fill volumes and minimize slopes and retaining walls.

7.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

Erosion and sediment control measures will be designed and may include temporary sediment control fencing, a construction access driveway, check dams and temporary sediment control facilities where required. These measures will be designed and constructed as per the GGHCA "Erosion and Sediment Control Guideline for Urban Construction" document (December 2006), the City of Barrie Engineering Standards, and the LRSCA Technical Guidelines for SWM Submissions (2016). The detailed erosion and sediment control plan will be approved by the Municipality prior to any site alteration being undertaken. The plan will address phasing, inspection and monitoring aspects of erosion and sediment control. All reasonable measures will be taken to ensure sediment loading to the adjacent properties and storm sewers is minimized both during and following construction.

8.0 SUMMARY

This Functional Servicing and Stormwater Management Report has outlined the means by which:

- The proposed development can be serviced with a combination of the existing municipal services and proposed internal storm sewer system services (i.e. storm, sanitary and water) within the proposed R.O.W.;
- The stormwater management criteria can be achieved; and
- The proposed development can be graded in a manner which satisfies the City of Barrie grading criteria and the stormwater management requirements for this development.

Respectfully Submitted:

SCS Consulting Group Ltd.

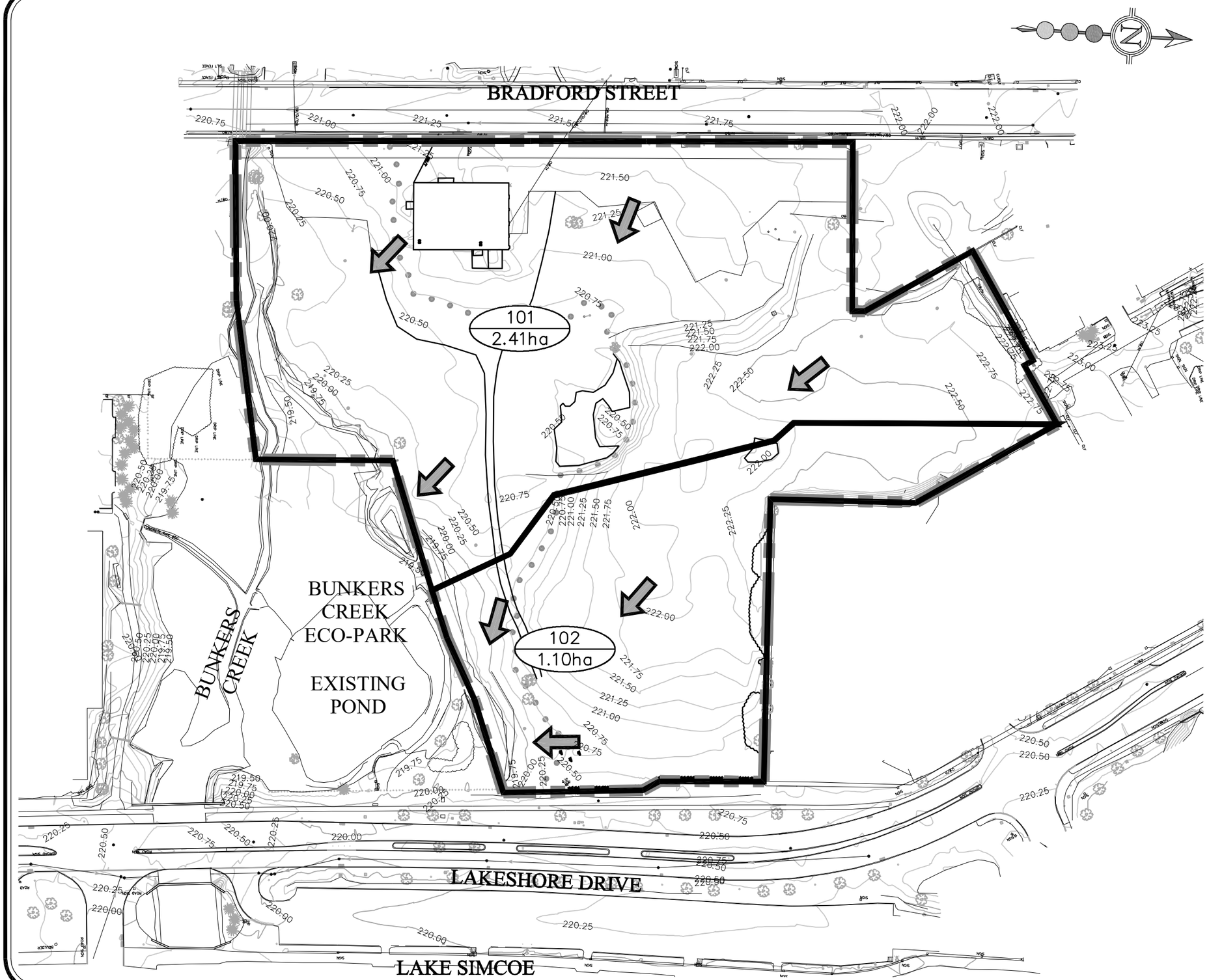


for

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Paige Turchet, P.Eng
pturchet@scsconsultinggroup.com

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LEGEND:

- PROPERTY BOUNDARY
- 270.25 — EXISTING CONTOUR AND ELEVATION
- OVERLAND FLOW DIRECTION
- 101 / 2.41ha — CATCHMENT ID; DRAINAGE AREA (HECTARES)
- EXISTNG REGULATORY FLOODLINE (POST LAKESHORE DRIVE RECONSTRUCTION)

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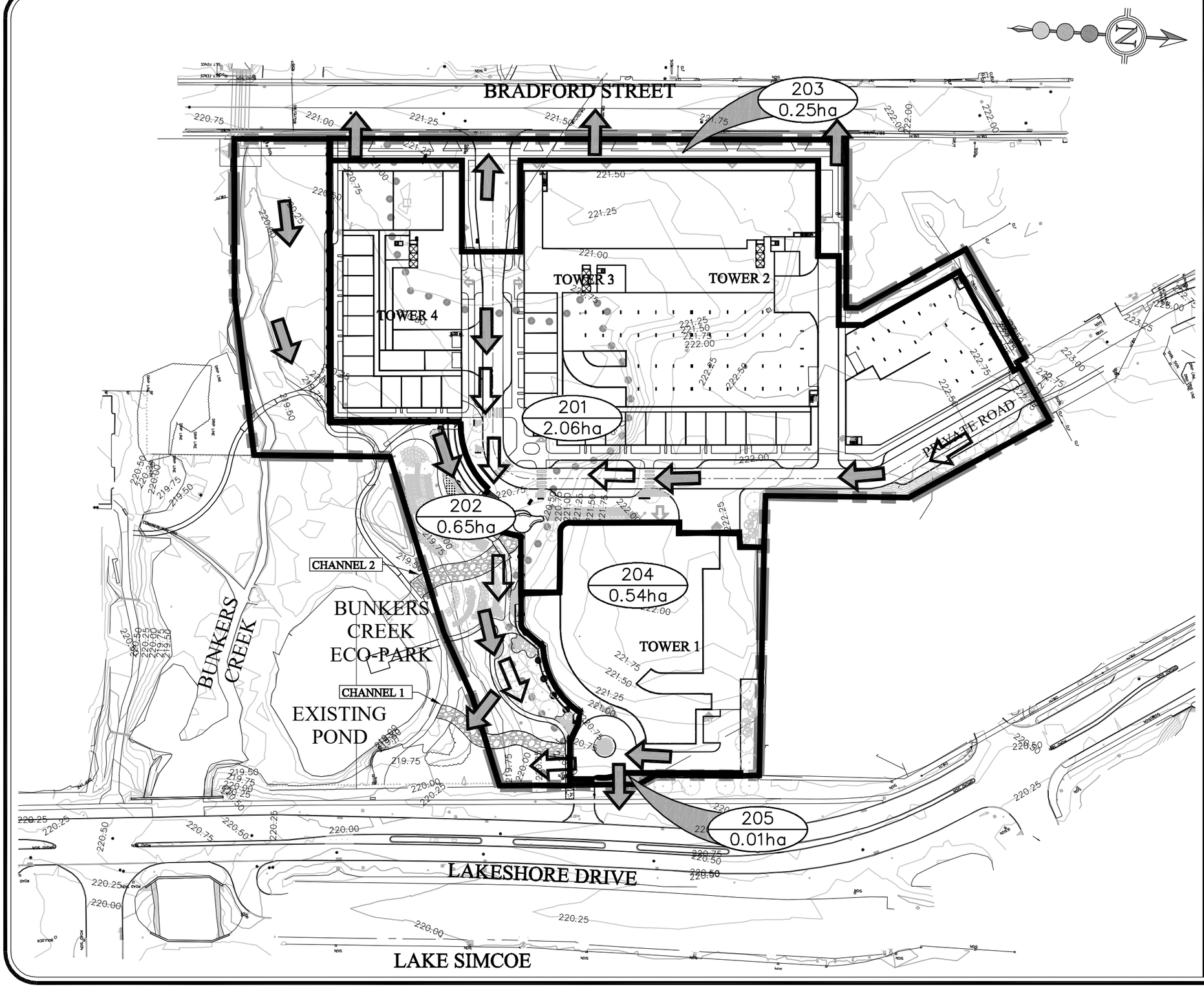
BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET
AND 20 CHECKLEY STREET- BARRIE

EXISTING STORM DRAINAGE PLAN

DESIGNED BY: C.M..	CHECKED BY: P.A.T
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 2.1

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LEGEND:

- PROPERTY BOUNDARY
- PROPOSED STORM DRAINAGE BOUNDARY
- 270.25 — EXISTING CONTOUR AND ELEVATION
- 201 / 2.06ha — CATCHMENT ID; DRAINAGE AREA (HECTARES)
- MAJOR SYSTEM - OVERLAND FLOW
- MINOR SYSTEM - STORM SEWER
- EXISTNG REGULATORY FLOODLINE (POST LAKESHORE DRIVE RECONSTRUCTION)
- PROPOSED REGULATORY FLOODLINE

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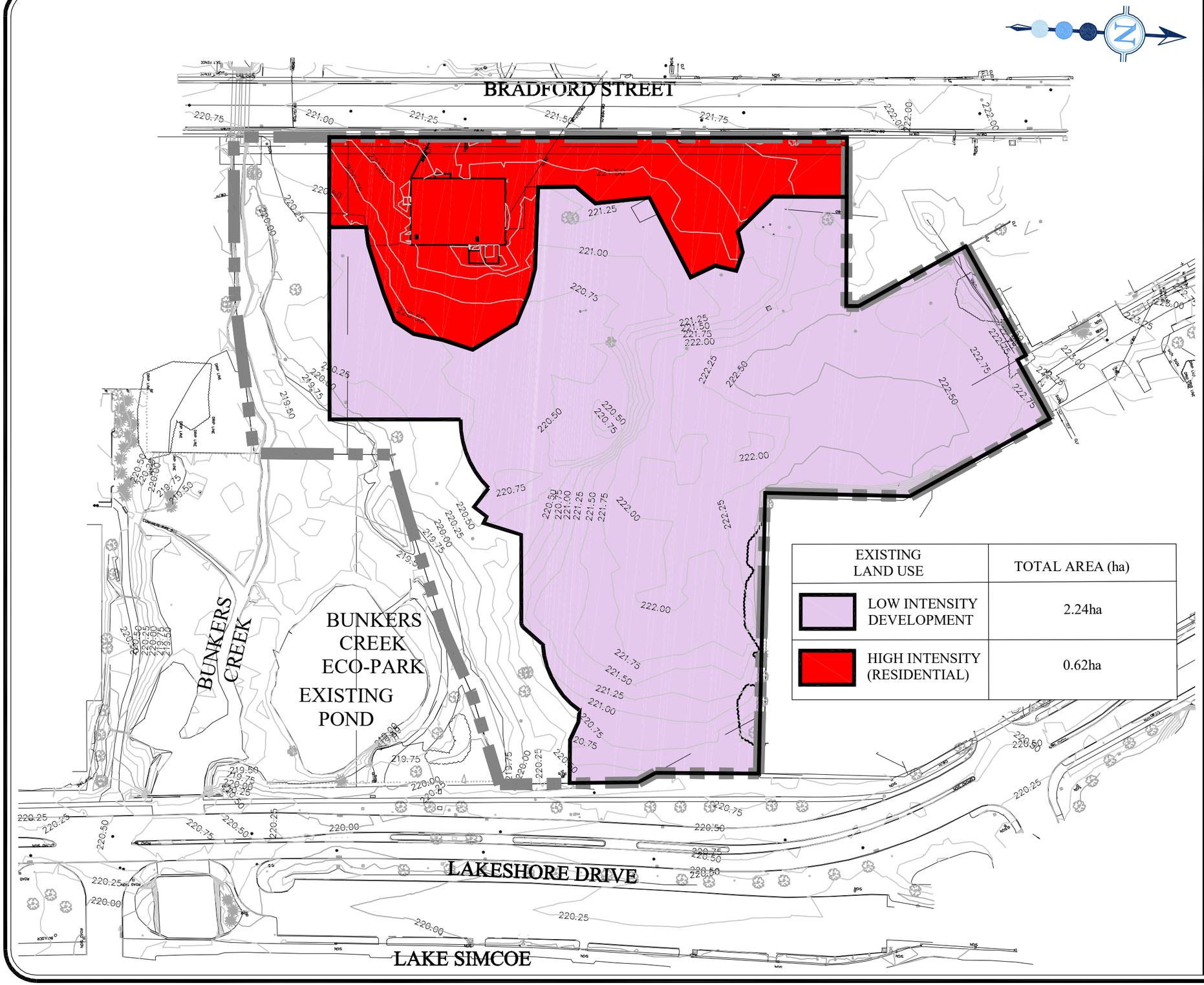
BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET AND 20 CHECKLEY STREET- BARRIE

PROPOSED STORM DRAINAGE FIGURE

DESIGNED BY: C.M.	CHECKED BY: P.A.T..
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 2.2

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LEGEND:

PROPERTY BOUNDARY

270.25 EXISTING CONTOUR AND ELEVATION

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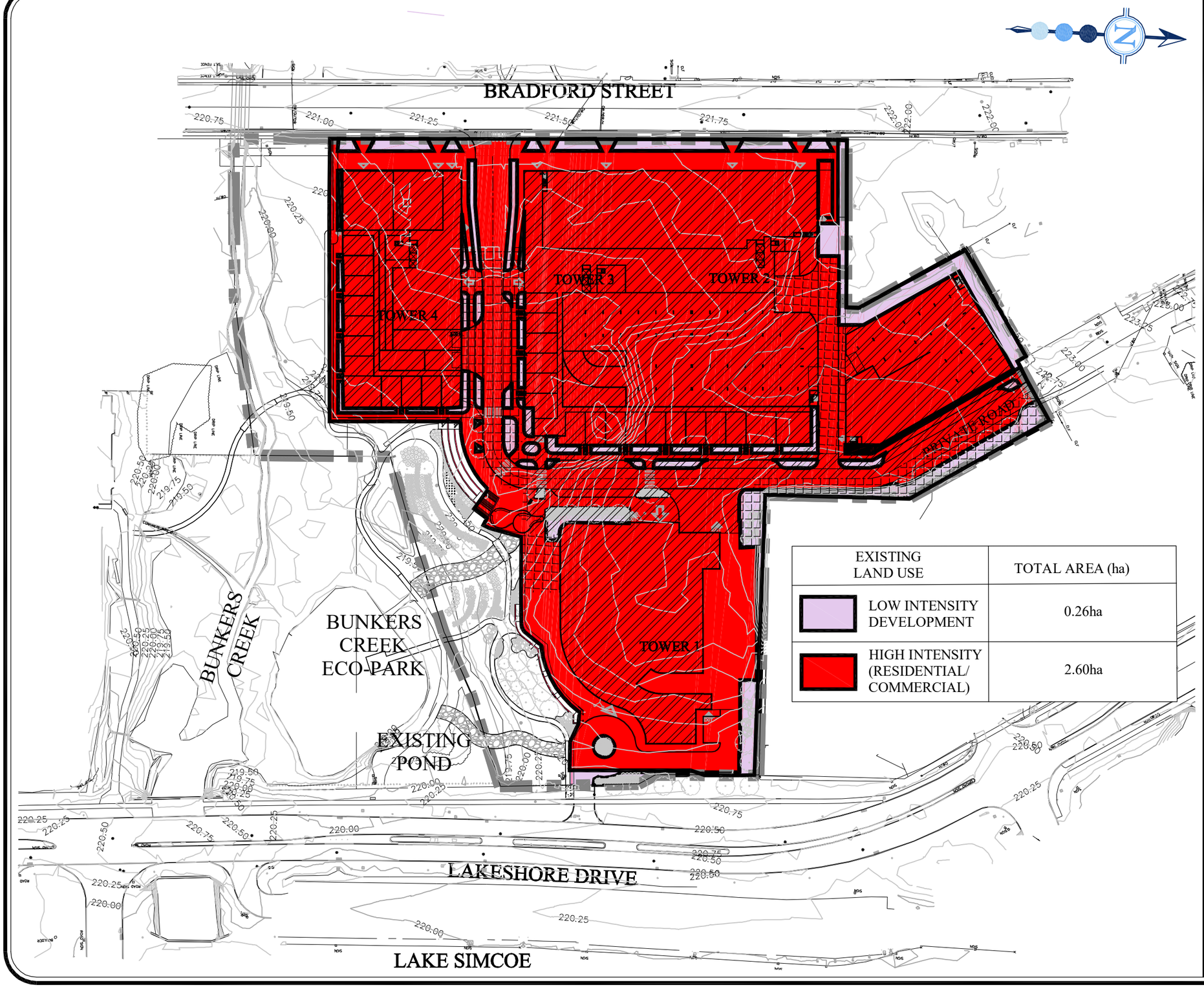
BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET AND 20 CHECKLEY STREET- BARRIE

EXISTING PHOSPHOROUS BUDGET

DESIGNED BY: C.M.	CHECKED BY: P.A.T.
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 2.3

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EXISTING LAND USE	TOTAL AREA (ha)
LOW INTENSITY DEVELOPMENT	0.26ha
HIGH INTENSITY (RESIDENTIAL/ COMMERCIAL)	2.60ha

LEGEND:

PROPERTY BOUNDARY

AREA TO FILTRATION TRENCHES AND JELLYFISH

AREA TO JELLYFISH

270.25 EXISTING CONTOUR AND ELEVATION

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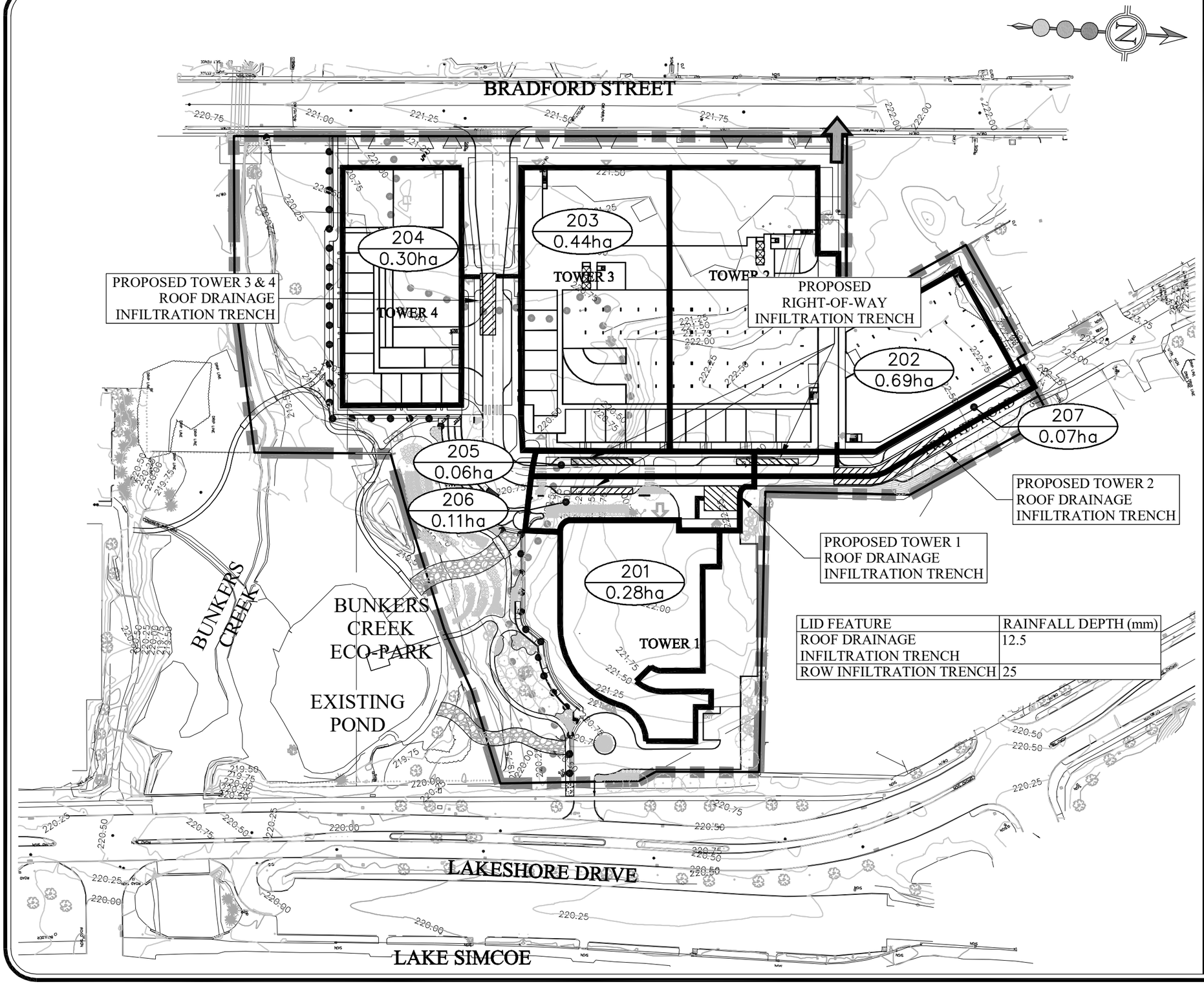
BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET AND 20 CHECKLEY STREET- BARRIE

PROPOSED PHOSPHOROUS BUDGET

DESIGNED BY: C.M.	CHECKED BY: P.A.T.
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 2.4

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LID FEATURE	RAINFALL DEPTH (mm)
ROOF DRAINAGE INFILTRATION TRENCH	12.5
ROW INFILTRATION TRENCH	25

LEGEND:

- PROPERTY BOUNDARY
- PROPOSED LID FEATURE DRAINAGE BOUNDARY
- 270.25 — EXISTING CONTOUR AND ELEVATION
- 201 / 2.60ha — CATCHMENT ID; DRAINAGE AREA (HECTARES)
- PROPOSED INFILTRATION TRENCH
- EXISTNG REGULATORY FLOODLINE (POST LAKESHORE DRIVE RECONSTRUCTION)
- PROPOSED REGULATORY FLOODLINE

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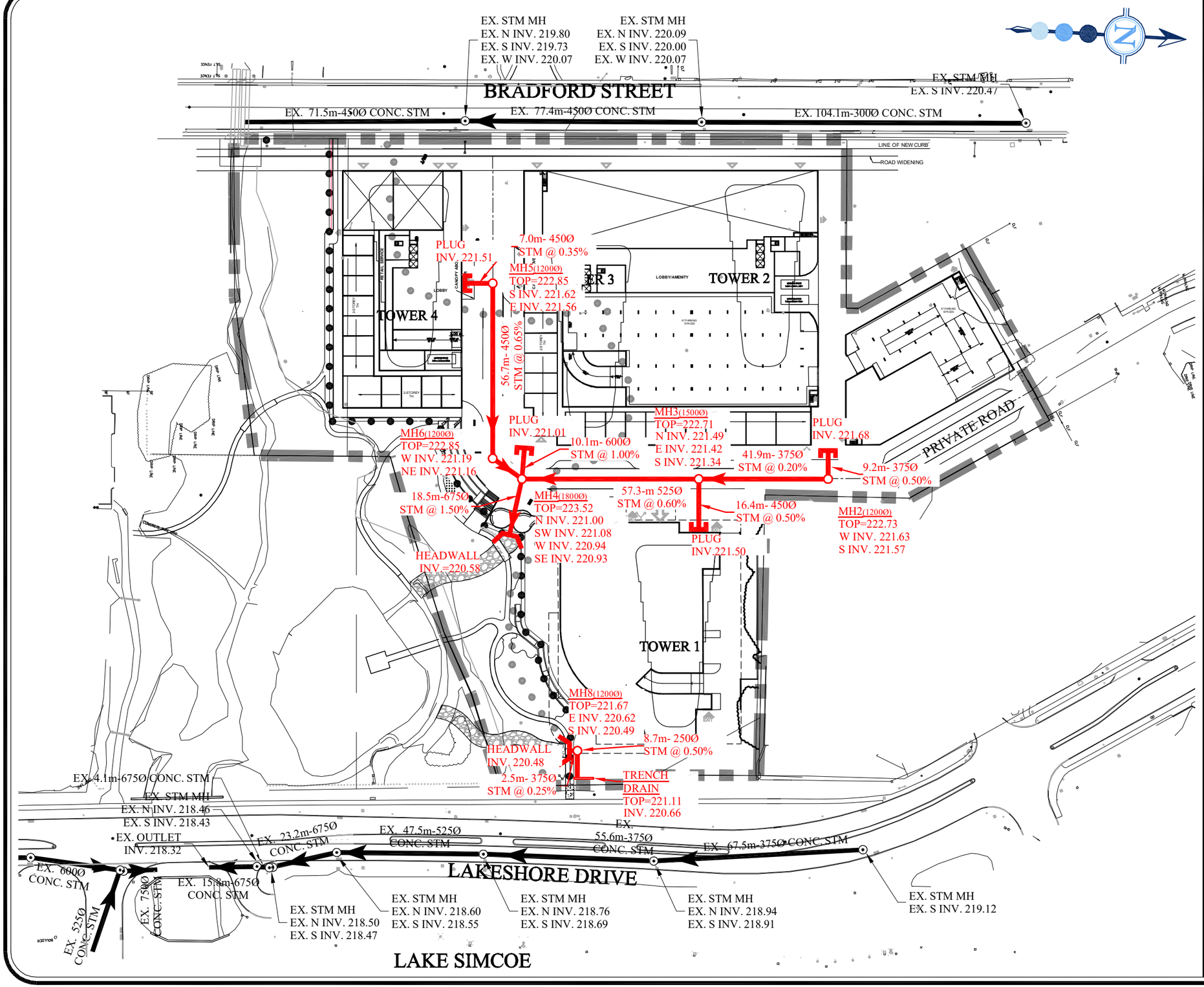
BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET
AND 20 CHECKLEY STREET- BARRIE

PROPOSED LOW IMPACT DEVELOPMENT FIGURE

DESIGNED BY: C.M.	CHECKED BY: P.A.T..
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 2.5

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LEGEND:

- PROPERTY BOUNDARY
- PROPOSED STORM SEWER AND MANHOLE
- EXISTING STORM SEWER AND MANHOLE
- EXISTNG REGULATORY FLOODLINE (POST LAKESHORE DRIVE RECONSTRUCTION)
- PROPOSED REGULATORY FLOODLINE

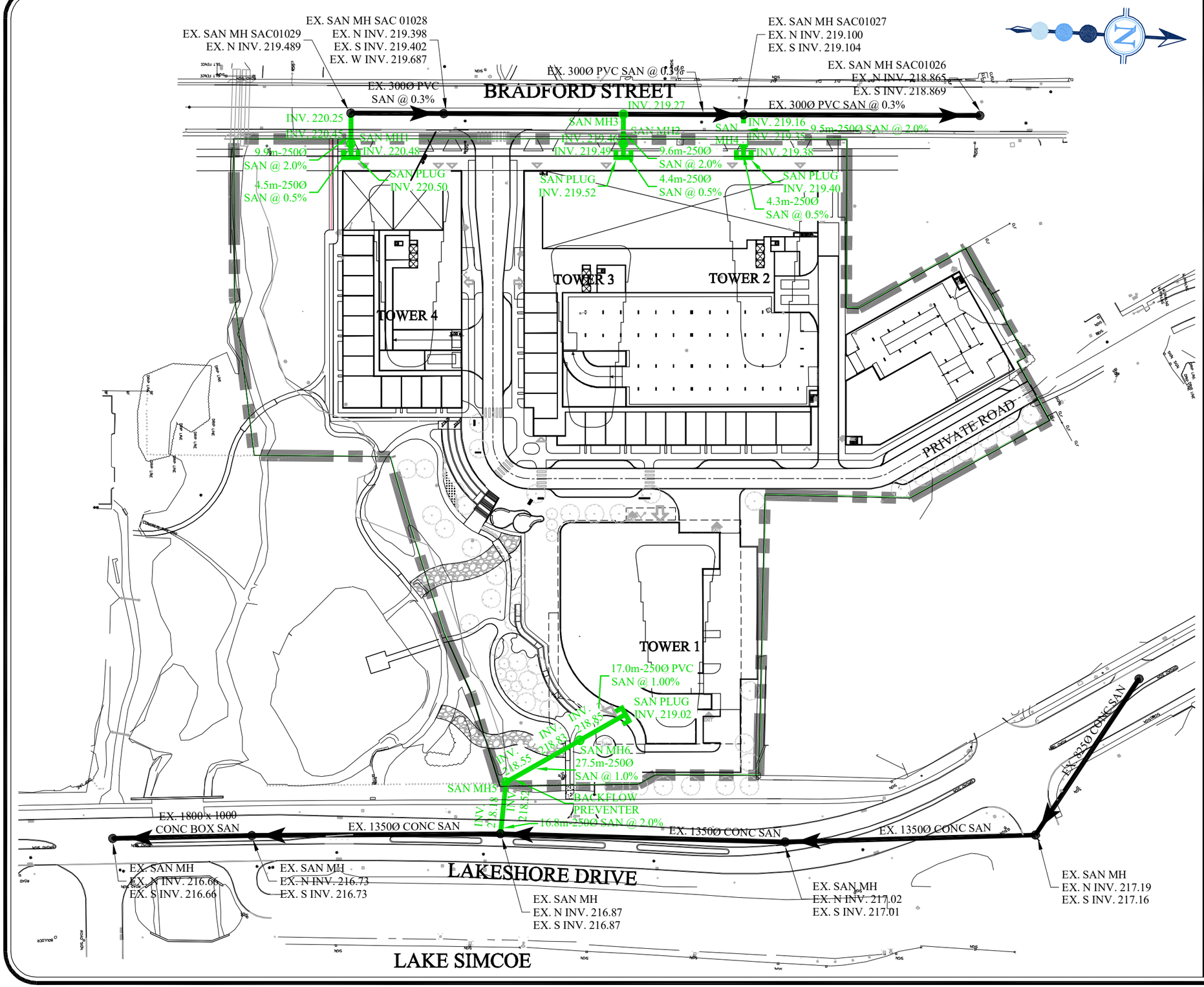
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BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET
AND 20 CHECKLEY STREET- BARRIE

PRELIMINARY STORM SERVICING PLAN

DESIGNED BY: V.A.S.	CHECKED BY: P.G.
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 3.1



LEGEND:

- PROPERTY BOUNDARY
- PROPOSED SANITARY SEWER AND MANHOLE
- EXISTING SANITARY SEWER AND MANHOLE

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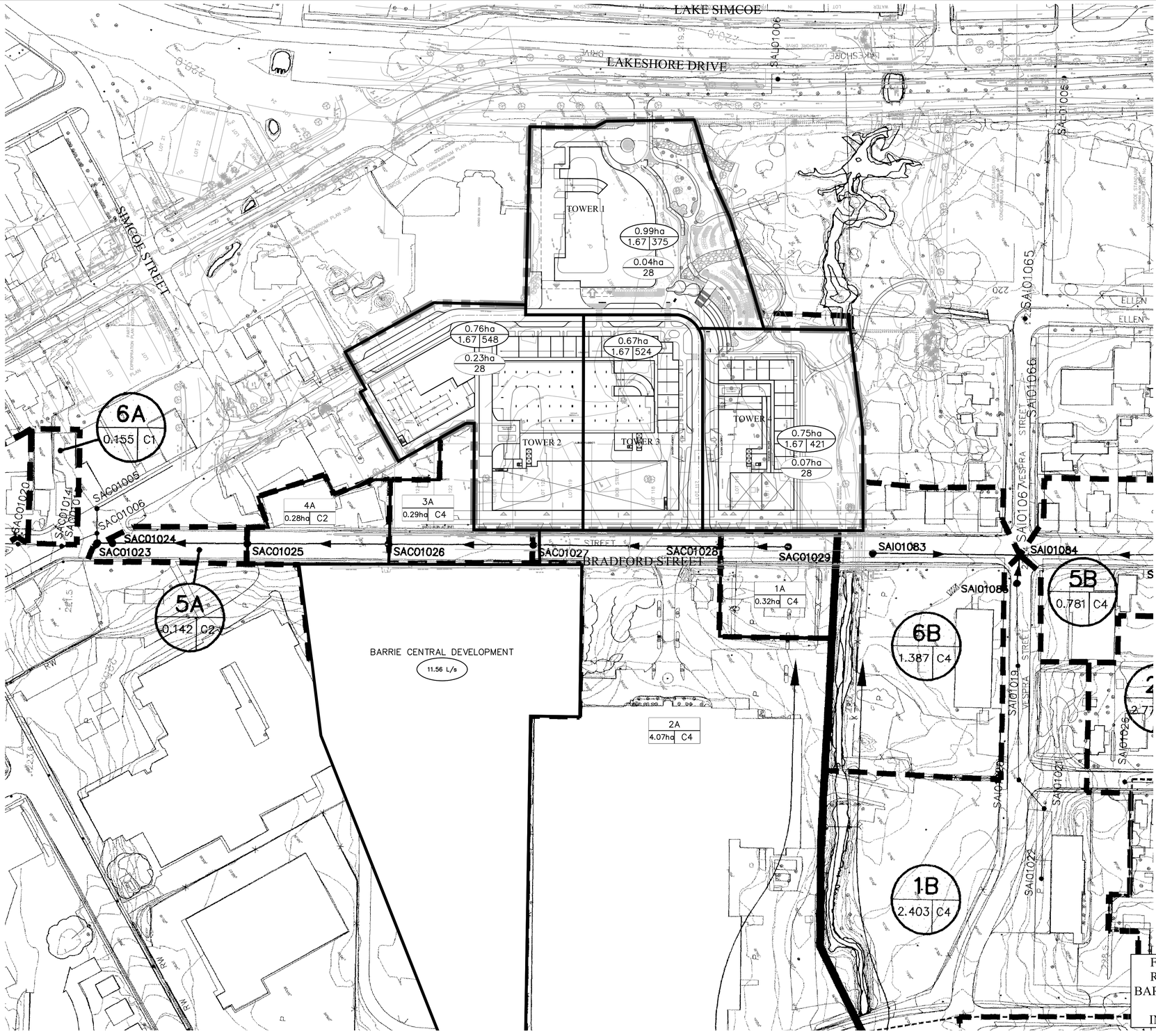
BARRIE LAKESHORE DEVELOPMENTS

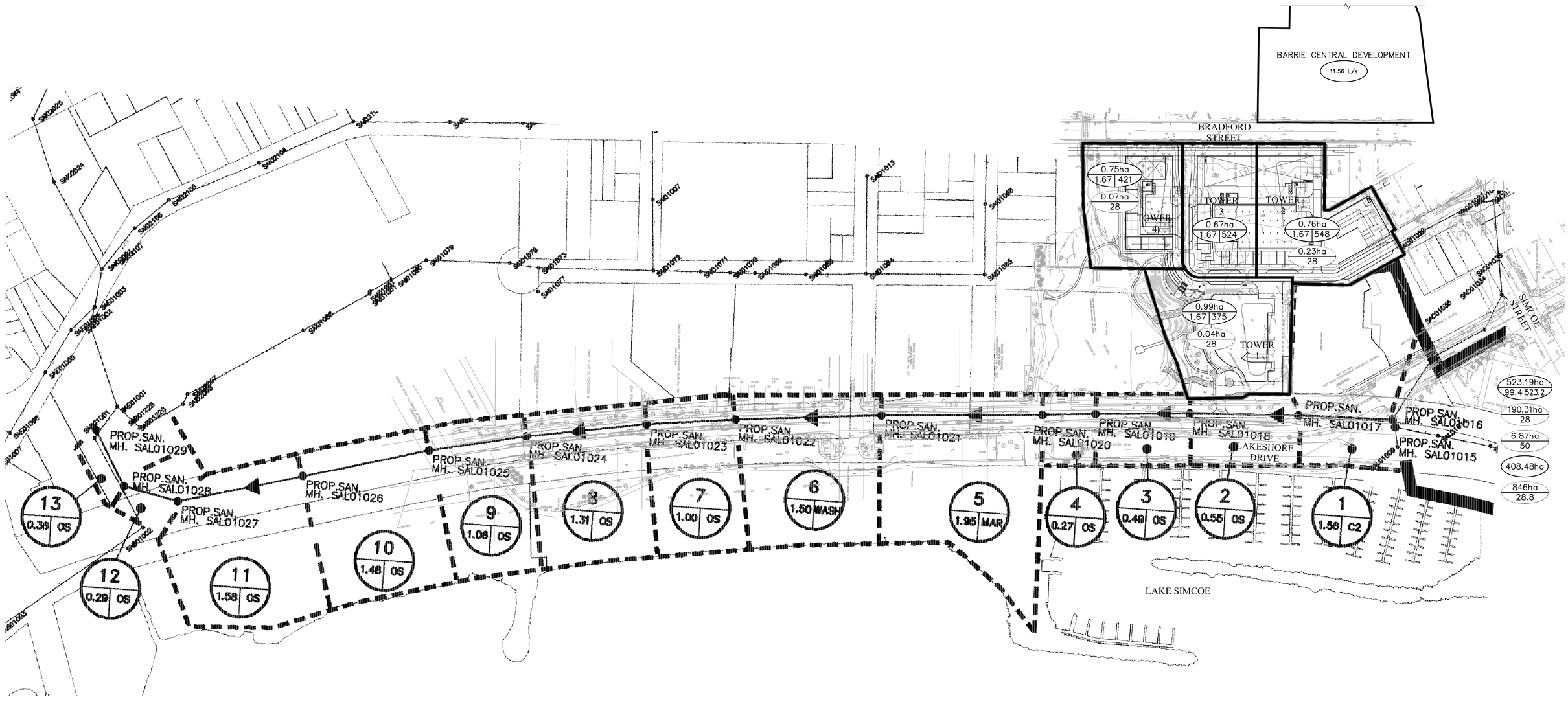
51, 53, 55 & 75 BRADFORD STREET
AND 20 CHECKLEY STREET- BARRIE

PRELIMINARY SANITARY SERVICING PLAN

DESIGNED BY:	V.A.S.	CHECKED BY:	P.G.
SCALE:	1:1250	DATE:	AUGUST 2020
PROJECT No:	2196	FIGURE No:	4.1

File: P:\2196 51-75 Bradford Street\Drawings\FSP\Fig\Report Figures\2196P-SANI-SERV-4.1.dwg - Revised by <GWONG> : Fri, Aug 07 2020 - 2:11pm


LAKE SIMCOE
LAKESHORE DRIVE
SIMCOE STREET
BRADFORD STREET
TOWER 1
TOWER 2
TOWER 3
TOWER 4
0.99ha 1.67 375
0.04ha 28
0.76ha 1.67 548
0.23ha 28
0.67ha 1.67 524
0.75ha 1.67 421
0.07ha 28
6A 0.155 C1
5A 0.142 C2
4A 0.28ha C2
3A 0.29ha C4
1A 0.32ha C4
2A 4.07ha C4
5B 0.781 C4
6B 1.387 C4
1B 2.403 C4
BARRIE CENTRAL DEVELOPMENT
11.56 L/s
SAC01026
SAC01014
SAC01006
SAC01005
SAC01024
SAC01023
SAC01025
SAC01026
SAC01027
SAC01028
SAC01029
SAI01083
SAI01084
SAI01085
SAI01065
SAI01066
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SAI01120
SAI01121
SAI01122
SAI01123
SAI01124
SAI01125



FOR ORGINAL DRAINAGE BOUNDARIES, REFER TO DRAWING 2007-33 BY CITY OF BARRIE ENGINEER DEPARTMENT. DRAINAGE BOUNDARIES MODIFIED BASED ON INTRODUCTION OF NEW DEVELOPMENT

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

BARRIE LAKESHORE DEVELOPMENTS

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

LEGEND:

- PROPERTY BOUNDARY
- SANITARY DRAINAGE BOUNDARY
- EXTERNAL SANITARY DRAINAGE BOUNDARY
- 0.72ha / 1.67 | 464 — RESIDENTIAL SANITARY DRAINAGE AREA (HECTARES); NUMBER OF UNITS; POPULATION PER UNIT
- 0.09ha / 28 — ICI SANITARY DRAINAGE AREA (HECTARES); FLOW RATE (m³/ha/day)
- 2A / 4.07ha | C4 — MODIFIED AREA NUMBER; ZONING; MODIFIED SANITARY DRAINAGE AREA (HECTARES)
- PROP.SAN. MH. SAL01025 — EXISTING CITY MANHOLE NUMBERS
- 2A / 5.526 | C4 — EXISTING AREA NUMBER; ZONING; EXISTING SANITARY DRAINAGE AREA (HECTARES)

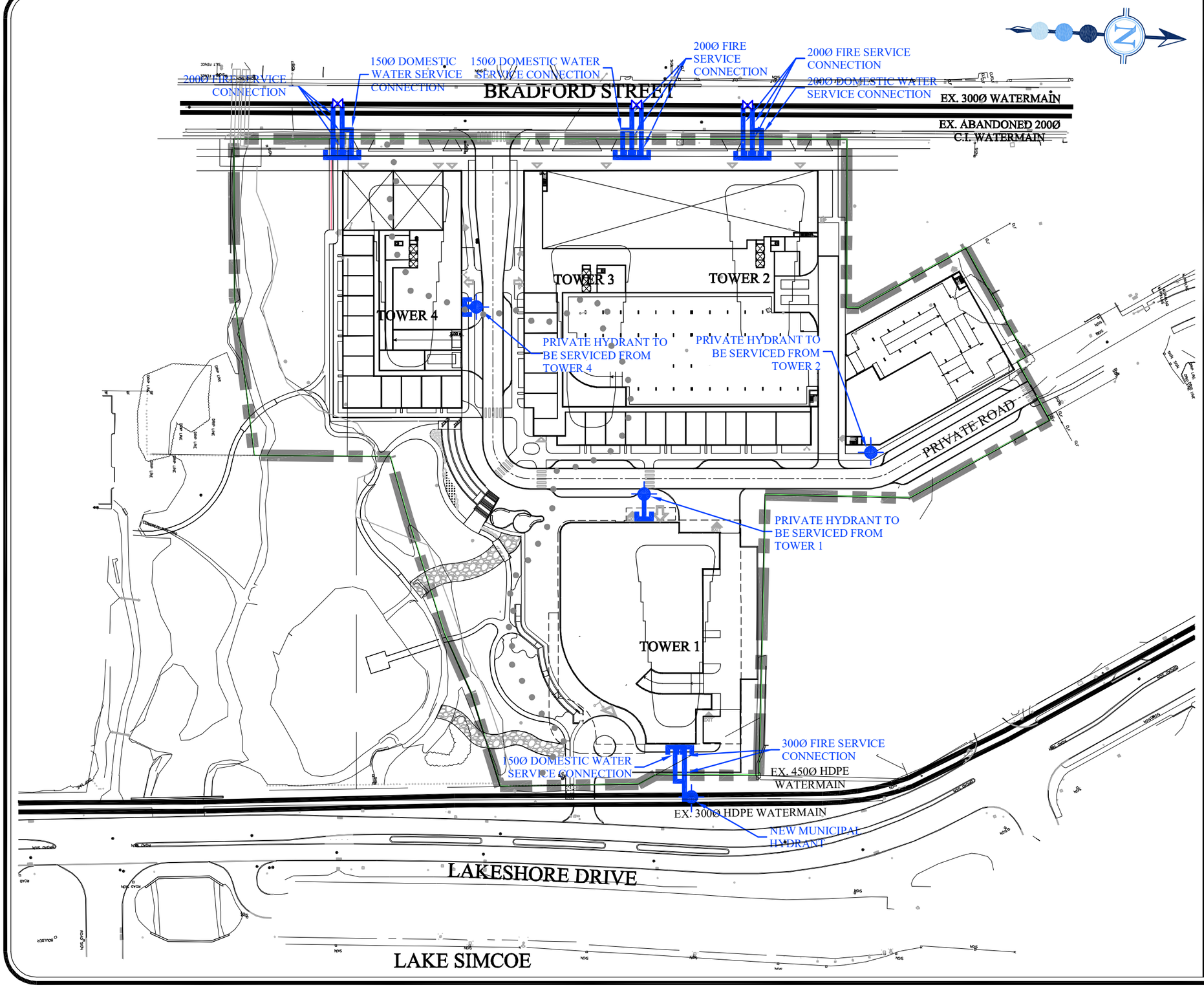
51, 53, 55 & 75 BRADFORD STREET AND 20 CHECKLEY STREET- BARRIE

DESIGNED BY: V.A.S. | CHECKED BY: P.G.
SCALE: 1:1500 | DATE: AUGUST 2020

PROPOSED LAKESHORE DRIVE SANITARY DRAINAGE PLAN

PROJECT No: 2196 | FIGURE No: 4.3

File: P:\2196 51-75 Bradford Street\Drawings\FSP\Fig\Report Figures\2196P-SANI-EXTR-4.3.dwg - Revised by <MMCCLYMONT> : Tue, Aug 11 2020 - 10:22am



LEGEND:

- PROPERTY BOUNDARY
- PROPOSED WATERMAIN
- EXISTING WATERMAIN
- PROPOSED HYDRANT

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

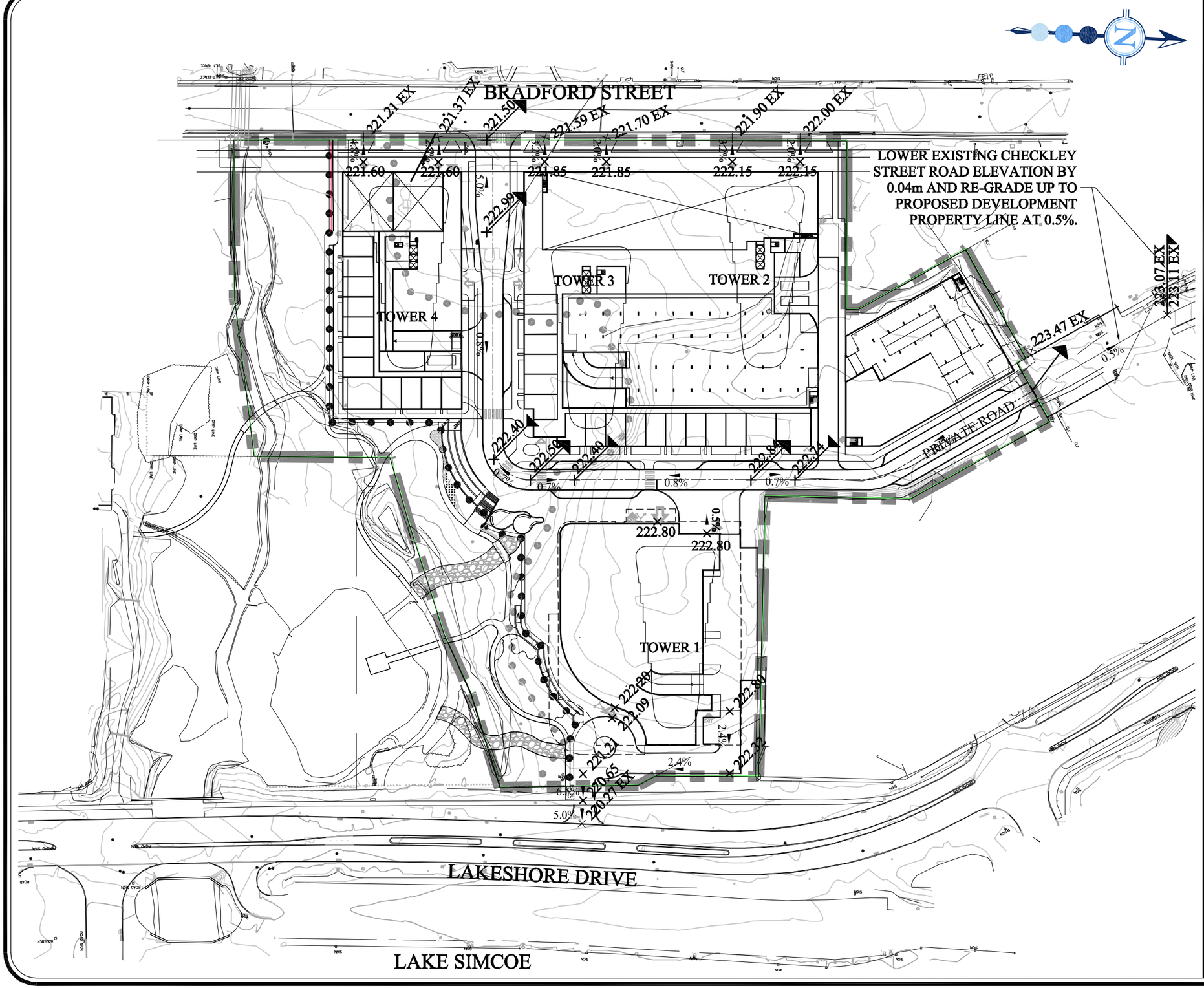
BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET AND 20 CHECKLEY STREET- BARRIE

PRELIMINARY WATER DISTRIBUTION PLAN

DESIGNED BY: V.A.S.	CHECKED BY: P.G.
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 5.1

File: P:\2196 51-75 Bradford Street\Drawings\FSP\Fig\Report Figures\2196P-WTRM-5.1.dwg – Revised by <GWONG> : Fri, Aug 07 2020 – 2:01pm



LEGEND:

- PROPERTY BOUNDARY
- 270.25 — EXISTING CONTOUR AND ELEVATION
- × 223.91 — PROPOSED ELEVATION
- × 224.35EX — EXISTING ELEVATION
- 3.5% — PROPOSED ROAD GRADE
- EXISTNG REGULATORY FLOODLINE (POST LAKESHORE DRIVE RECONSTRUCTION)
- PROPOSED REGULATORY FLOODLINE

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

BARRIE LAKESHORE DEVELOPMENTS

51, 53, 55 & 75 BRADFORD STREET
AND 20 CHECKLEY STREET- BARRIE

PRELIMINARY GRADING PLAN

DESIGNED BY: V.A.S.	CHECKED BY: P.G.
SCALE: 1:1250	DATE: AUGUST 2020
PROJECT No: 2196	FIGURE No: 6.1

APPENDIX A

SITE PLAN



TURNER FLEISCHER

Turner Fleischer Architects Inc.

67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

The issue of this record drawing is a representation by Turner Fleischer Architects Inc. that the construction, enlargement or alteration of the building may be undertaken in accordance with the applicable building code. The information contained in the drawings provided by Turner Fleischer Architects Inc. is for use in representation that the contractor owns or is conformity with a design that has been reviewed by Turner Fleischer Architects Inc. Turner Fleischer Architects Inc. is not responsible for any errors or omissions and shall not be held responsible for the accuracy of the information provided by Lurlow Companies Limited. The reasons to be taken on the basis of the drawings and specifications prepared by Turner Fleischer Architects Inc. for the Site Plan submitted by the contractor to Turner Fleischer Architects Inc. Turner Fleischer Architects Inc. shall not be held responsible for the accuracy or completeness of the information provided by the contractor

#	DATE	DESCRIPTION	BY

PROJECT

BARRIE WATERFRONT

51, 53, 55 &75 BRADFORD STREET AND 20 CHECKLEY STREET, BARRIE, ON

DRAWING

ROOF PLAN (WITH CONTEXT)

PROJECT NO.	19.105SD
PROJECT DATE	2019-09-09
DRAWN BY	Author
CHECKED BY	RMM
SCALE	1 : 500

DRAWING NO.

RZ006

2020-07-16 7:40:26 PM

APPENDIX B

RECORD DRAWINGS AND BACKGROUND INFORMATION

McCarthy, Christine

From: Nadine Rush <Nadine.Rush@barrie.ca>
Sent: July-24-20 4:06 PM
To: Szeghalmi, Victor
Subject: FW: Barrie Waterfront - Follow up to July 6th conference call

Hi Victor,

Please see responses in red below.

If you require more information or clarification please contact me.

Regards,

Nadine Rush, C.E.T.
Senior Development Services Technologist
Development Services

The City of Barrie
Central Ontario's Premier Waterfront Community

Mailing Address:
P.O. Box 400, Barrie ON, L4M 4T5
Tel: 705-739-4220 ext. 5231

From: Szeghalmi, Victor <vszeghalmi@scsconsultinggroup.com>
Sent: Tuesday, July 14, 2020 11:14 AM
To: Nadine Rush <Nadine.Rush@barrie.ca>
Cc: Celeste Kitsemetry <Celeste.Kitsemetry@barrie.ca>; William Woodfine <WWoodfine@smartcentres.com>; Tabby Nassiri <MNassiri@smartcentres.com>; Wong, Galvin <gwong@scsconsultinggroup.com>
Subject: RE: Barrie Waterfront - Follow up to July 6th conference call

My apologies Nadine, I missed the corresponding attachments included herein.

Victor Szeghalmi, A Sc. T.
SCS Consulting Group Ltd.
30 Centurian Drive, Suite 100
Markham, ON, L3R 8B8
(T) 905.475.1900 Ext. 2272
(F) 905.475.8335
vszeghalmi@scsconsultinggroup.com
www.scsconsultinggroup.com

From: Szeghalmi, Victor
Sent: Tuesday, July 14, 2020 11:11 AM
To: Nadine Rush <Nadine.Rush@barrie.ca>
Cc: Celeste Kitsemetry <Celeste.Kitsemetry@barrie.ca>; William Woodfine <WWoodfine@smartcentres.com>; Tabby Nassiri <MNassiri@smartcentres.com>; Wong, Galvin <gwong@scsconsultinggroup.com>
Subject: Barrie Waterfront - Follow up to July 6th conference call

Good morning Nadine,

Thank you and the City of Barrie team for taking the time to discuss the first submission comments with us. I would like to follow up on the details specifically for our sanitary design to ensure that we are providing all of the information the City requires for our OPA/ZBA resubmission and first SPA submission. For your convenience the original comments with respect to sanitary have been provided below with our responses/questions italicized per our discussion with Nathanial and yourself on July 6. An email with respect to water servicing will be provided in a separate email.

1. The calculations do not use the City of Barrie sanitary design sheet.
   We will transfer all of our sanitary design sheet information to the City's template, utilizing the "Development Detail Basis – Residential" template specifically. Please also use the Land Use sanitary spreadsheet to add equivalent commercial population, add it to the development detail basis – residential, and append it to your calculations as discussed during the meeting.

2. The sanitary calculations do not calculate d/D nor evaluate the capacity of the pipe with respect to City of Barrie d/D criteria.
   The above mentioned design sheet will include d/D evaluation of the existing sanitary sewers. Yes, the City needs this information in order to further discussion on the servicing needs of your site.

3. The sanitary calculations do not recommend upgrades on Bradford Street (pipe size increase or twinning) although the flows calculated are greater than 0.5 d/D.
   Further discussion with Corporate Asset Management recommended by Nathanial to address request for concession on exceeding the City's 0.5 d/D allowance through an "Exemption". We would welcome and appreciate and opportunity to further discuss this item at your earliest convenience. The sanitary analysis will need to be completed first identifying if there is a failure to meet the 0.5 d/D criteria. Only following identification will the City begin to discuss alternatives with you or your client ways to mitigate risk to its infrastructure. Options available would be to twin the sanitary pipe, expand the pipe size through reconstruction, or provide financial compensation towards a future upgrade. An 'Exemption' would be coordinated through Development Services. As I understand it, the 'exemption' that was discussed is an exemption to avoid construction of the pipe at the time of building but usually this has dollars attached to it for a future upgrade. Nadine can further discuss typical practice of past applicants as this is usually coordinated through Development Services and my understanding could be wrong. ***(This can be discussed at a later date if required).*** *For information purposes, the Bradford Street 300mm sanitary sewer pipe is a local benefit sewer. When local sewers are in need of upgrade the costs remain with the developer and are not DC eligible. Nadine will have more information on this if you are interested. As discussed during the meeting, this protects existing tax base from having to upgrade sewers on behalf of new development to the City.*

4. Please review the flows used for the HIP development as they do not match the FSR on file.
   We will update the HIP flows with the latest report found on the City's website. Ok.

5. The consultant must assess if it is desirable to connect directly or partially to the Lakeshore Trunk sewer or the Checkley sewer with a greater number of units than currently proposed.
   To avoid additional infrastructure, disturbance within the City's Lake Shore/Checkley r.o.w.'s, the requirements for private easements and ECA's and to allow for (possible) severance flexibility, the development proposes to continue with our current sanitary service connection configuration. Based on our call, City staff did not seem to be opposed to this approach. Kindly confirm. The consultant must confirm that the development does not negatively impact existing residents/landowners. The connection for the sanitary sewers may have to be altered so as to not affect existing landowners.

6. A hydraulic grade line analysis was not performed on Bradford Street or at Lakeshore Drive. Details were provided in a call between Smart Centres and City of Barrie on Dec. 12, 2019.

We understand from our July 6th phone call that a static design sheet HGL analysis is acceptable and that an update to the City's PCSWMM model is not required. Per Nathanael's instruction from December 2019, we understand the Lakeshore Drive trunk analysis shall include a surcharging scenario with elevation of 218.24 at the waste water treatment plant. To aid us in the analysis could the City please confirm/provide the following?

- *the starting HGL elevation mentioned above for the Lakeshore analysis should be at MH SAL01029 on the attached drawing 2007-033-004? The starting HGL at MH SAL01029 should be 218.97. The 218.24m is the height at the WwTF. The backwater effect at MH SAL01029 is 218.97.*
- *extent of analysis (end at our connection point or MH SAL01015 on the attached drawing 2007-033-004)? The connection point at MH SAL01029.*
- *attached sanitary drainage plans are the latest record drawings which the analysis should be based on? Please arrange for the latest Plan Profile drawings with our Engineering Records Department. Nadine can assist you on obtaining the contact information**..(Please see the attached link for the Records Request Form)*** https://www.barrie.ca/City%20Hall/Planning-and-Development/Engineering-Resources/Pages/Engineering-Records.aspx
- *provide us with the plan and profile drawings for Lakeshore, south of Victoria Street (City staff have provided plan and profiles north of Victoria, thank you)? Please arrange for the latest Plan Profile drawings with our Engineering Records Department. Nadine can assist you on this.*

Nathanial mentioned that HGL on Bradford Street may not be a concern. Could City Staff please confirm if we are required to complete and HGL analysis for Bradford Street? If required, to aid us in the analysis, could the city please confirm/provide the following?

- *Starting HGL elevation?*
- *Starting HGL location (SAC01001 on attached drawing 2003-002-003)?*

The HGL is a concern for existing property owners who have lateral connections downstream due to the flows from the proposed development and the backwater effects from the plant.
Starting HGL elevation would be 219.00 at SAC01006 on drawing 2003-002-003.

For both Lakeshore Drive and Bradford Street, the analysis should be performed both with the WwTF backwater and with no backwater (freeflow condition) so that the consultant and the City understand the risks involved.

In addition to the above, the following was also discussed:

- *A backwater valve will be installed on the Lakeshore sanitary connection, Yes*
- *Best effort will be made to ensure that the invert of the Lakeshore sanitary connection is at or above the obvert of the Lakeshore trunk sewer. The invert needs to be above the obvert of the pipe.*
- *The service connection will connect to an existing manhole on Lakeshore (no blind connection) Nathanael mentioned that City record drawing 2007-033-012 indicates this information.*
  Not certain what "indicates this information means, this will have to be clarified. 2007-033-012 has plan/ profile of Lakeshore Drive Sewer at SAL 01029
- *The Lakeshore trunk sewer is built on piles and beams. The Lakeshore plan and profile drawings (series 2014-001-XX) we've received do not indicate this information, are there any other record drawings which may provide further details on this? (Drawings S1-S9, of the 2007-033 drawing package show foundation details, coordinate with Engineering Records S1 to S9 are records 2007-033-023 to 2007-033-031).*
- *As the sewer is below the water table, please ensure the sewage works are wrapped to avoid Inflow and Infiltration.*

Please feel free to contact me on my mobile phone at 416-460-3694 should you have any questions or would like to discuss any of the above. We look forward to your response.

Regards,
Victor

Victor Szeghalmi, A Sc. T.

SCS Consulting Group Ltd.
30 Centurian Drive, Suite 100
Markham, ON, L3R 8B8
(T) 905.475.1900 Ext. 2272
(F) 905.475.8335
vszeghalmi@scsconsultinggroup.com
www.scsconsultinggroup.com



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The MECP design criteria is a conservative approach used by smaller municipalities. The Master Plan completed in 2013 utilized MECP fire flow durations. Table 4-9 outlines the fire flow criteria and level of service used for this Master Plan by land use type.

Table 4-9 Fire Flow Criteria – Final Criteria and Comparison

Land Use Types	**Final Barrie Master Plan (2018)**		***Previous Barrie Master Plan (2013 Water Storage and Distribution Master Plan)***		***Water Storage and Distribution MP Update (2018)***		**MOECC Design Criteria**	
	Fire Flow (L/s)	Duration (Hr)	Fire Flow (L/s)[1]	Duration (Hr)[2]	Fire Flow (L/s)	Duration (Hr)	Fire Flow (L/s)	Duration (Hr)
Low Density Residential	**70**	**2**	50	3/6	70	N/A	378	6
Medium Density Residential	**155**	**3**	100/ 117	3/6	195	N/A	378	6
High Density Residential	**200**	**4**	100/ 117	3/6	200	N/A	378	6
Industrial	**333**	**5**	333	3/6	333	N/A	378	6
Institutional	**200**	**4**	167	3/6	200	N/A	378	6
City Centre	**240**	**4**	N/A	3/6	N/A	N/A	378	6
Commercial	**283**	**4**	283	3/6	283	N/A	378	6

1 The previous Master Plan used FUS calculated values for existing infrastructure and City of Barrie Design Criteria for new infrastructure (Appendix B).
2 The durations for the 2013 master plan were by pressure zone, all zones except 3N were 6 hours.

4.2.2 Water Storage

Water storage requirements for systems that provide regular servicing and fire flow projection are to be sized in accordance with MECP criteria. The calculation based on the *Design Guidelines for Drinking-Water Systems (2008)* is as follows:

APPENDIX C

TOPOGRAPHIC SURVEY

METRIC: DISTANCES AND ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

TOPOGRAPHIC PLAN OF SURVEY OF

ALL OF LOT 90
WEST SIDE OF HIGH STREET
PART OF LOT 65
EAST SIDE OF HIGH STREET
PART OF HIGH STREET
REGISTERED PLAN 115
ALL OF LOTS 115 TO 120, BOTH INCLUSIVE
PART OF LOT 121
ALL OF BOB STREET
ROBERT ROSS UNREGISTERED PLAN
PART OF ELLEN STREET
(CLOSED BY BY-LAW No. 2005-115, INST. No. SC450705)
REGISTERED PLAN 22
EAST PART OF LOT 24 AND
EAST PART OF BROKEN LOT 25
CONCESSION 5
(GEOGRAPHIC TOWNSHIP OF VESPRA)
CITY OF BARRIE
COUNTY OF SIMCOE
SCALE 1:300

5 2.5 0 5 10 15 20 METRES

SCHAEFFER DZALDOV BENNETT LTD.

© COPYRIGHT

SIMCOE STANDARD CONDOMINIUM PLAN No. 259
CONDO BLOCK 59259

NOTES

□	DENOTES	PLANTED MONUMENT
■	-	FOUND MONUMENT
SSIB	-	SHORT STANDARD IRON BAR
IB	-	IRON BAR
SIB	-	STANDARD IRON BAR
CP	-	CONCRETE PIN
P	-	PLAN 51R-37947
M	-	MEASURED
CDN	-	CDN LAND SURVEYORS INC.
1403	-	W.D. SMITH, O.L.S.
1546	-	RUDY MAK, O.L.S.
CLF	-	CHAIN LINK FENCE
IF	-	IRON FENCE
GR	-	GUARD RAIL

BEARINGS ARE GRID, DERIVED FROM UTM ZONE 17, NAD83 (ORIGINAL).

TOPOGRAPHIC NOTES

BB	☒	DENOTES BELL BOX
CB	■	DENOTES CATCH BASIN
MH	⊛	DENOTES MANHOLE
GM	⊕	DENOTES GAS METER
UP	●	DENOTES UTILITY POLE
WP	●	DENOTES WOOD POST
MP	●	DENOTES METAL POST
M		DENOTES METAL
L		DENOTES LIGHT
H		DENOTES HYDRO
T		DENOTES TELEPHONE
OW		DENOTES OVERHEAD WIRES
GS		DENOTES GARAGE SILL
DS		DENOTES DOOR SILL
D/T 0.10		DENOTES DECIDUOUS TREE 0.10m dia.
C/T 0.10		DENOTES CONIFEROUS TREE 0.10m dia.
CSP (500)		DENOTES CORRUGATED STEEL PIPE (500mm DIA.)
GUY	—○	DENOTES GUY WIRE/POLE
INV	◁	DENOTES CULVERT INVERT

BENCHMARK

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO CITY OF BARRIE MONUMENT No. 031208B0022 HAVING A PUBLISHED ELEVATION OF 222.437 METRES

CONTOUR INTERVAL 0.50m

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON 21ST DAY OF MAY, 2019.

DATE: JUNE 5, 2019.

ORHIR N. DZALDOV
ONTARIO LAND SURVEYOR

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2071175

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29(3).

SCHAEFFER DZALDOV BENNETT LTD.
ONTARIO LAND SURVEYORS
64 JARDIN DRIVE CONCORD, ONTARIO L4K 3P3 TEL.(416)987-0101

CALC. SL | DRAWN SAMI/LW | CHECKED | SCALE 1:300 | JOB NO. 19-047-00

APPENDIX D

STORMWATER MANAGEMENT CALCULATIONS

OVERLAND FLOW CALCULATIONS
TOTAL FLOW TO CHANNEL 1

Channel 1	**100 Year Return Period Factor =**		1.25
	Runoff Coefficient	Area (ha)	Weighted Runoff Coefficient (100 Year)
Catchment 204	0.86	0.54	1.00
TOTAL		0.54	1.00

Channel 1	**Return Period**
Area (ha)=	0.54
Runoff Coeff. =	1.00
T_c (min)=	10.00
a =	**1426.408**
b =	**5.273**
c =	**0.759**
Intensity (mm/hr) =	180.15
Runoff (m^3/s) =	**0.270**

*Increase per City of Barrie Standards

*Area and Runoff coefficient per **Drawing 2.2**

*IDF parameters per City of Barrie

100 Year Flow (Channel 1)

Q_{100yr} (m^3/s) = 0.270

Channel 1 - (1.65 m Bottom Width)

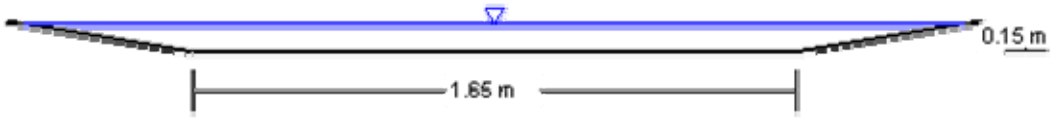
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

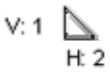
Input Data

Roughness Coefficient	0.025	
Channel Slope	0.7	%
Normal Depth	0.15	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	1.65	m
Discharge	0.270	m³/s

Cross Section Image



Therefore, there is sufficient capacity in the channel to convey the 100 year flow.



Channel 1 - (1.65 m Bottom Width)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.7	%
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	1.65	m
Discharge	0.270	m^3/s

Results

Normal Depth	0.15	m
Flow Area	0.32	m^2
Wetted Perimeter	2.62	m
Top Width	2.57	m
Critical Depth	0.13	m
Critical Slope	0.01316	m/m
Velocity	0.83	m/s
Velocity Head	0.04	m
Specific Energy	0.19	m
Froude Number	0.75	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.15	m
Critical Depth	0.13	m
Channel Slope	0.00700	m/m
Critical Slope	0.01316	m/m

OVERLAND FLOW CALCULATIONS
TOTAL FLOW TO CHANNEL 2

Channel 2	**100 Year Return Period Factor =**		1.25
	Runoff Coefficient	Area (ha)	Weighted Runoff Coefficient (100 Year)
Catchment 201	0.90	2.06	1.00
TOTAL		2.06	2.64

Channel 2	**Return Period**
Area (ha)=	2.06
Runoff Coeff. =	1.00
T_c (min)=	10.00
a =	**1426.408**
b =	**5.273**
c =	**0.759**
Intensity (mm/hr) =	180.15
Runoff (m^3/s) =	**1.031**

*Increase per City of Barrie Standards

*Area and Runoff coefficient per **Drawing 2.2**

*IDF parameters per City of Barrie

100 Year Flow (Channel 2)

Q_{100yr} (m^3/s) = 1.031

Channel 2 - (3 m Bottom Width)

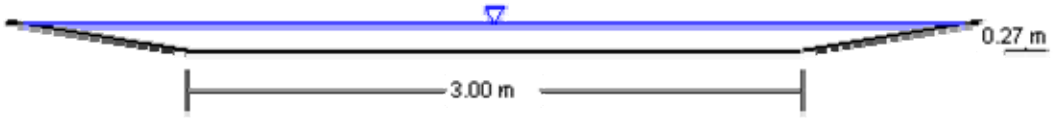
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

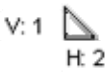
Input Data

Roughness Coefficient	0.025	
Channel Slope	0.5	%
Normal Depth	0.27	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	3.00	m
Discharge	1.031	m³/s

Cross Section Image



Therefore, there is sufficient capacity in the channel to convey the 100 year flow.



Channel 2 - (3 m Bottom Width)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.5	%
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	3.00	m
Discharge	1.031	m^3/s

Results

Normal Depth	0.27	m
Flow Area	1.01	m^2
Wetted Perimeter	4.69	m
Top Width	4.60	m
Critical Depth	0.21	m
Critical Slope	0.01107	m/m
Velocity	1.02	m/s
Velocity Head	0.05	m
Specific Energy	0.32	m
Froude Number	0.69	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.27	m
Critical Depth	0.21	m
Channel Slope	0.00500	m/m
Critical Slope	0.01107	m/m

Preliminary LID Sizing

Water Balance Calculations:

LID Catchment	Area (ha)	Rainfall Depth (mm)	Rainfall Volume (m^3)	Runoff Volume from Impervious Area (m^3)
	(1)	(2)	(3) = (2)x(1)x10 m3/ha-mm	(2)x(1)x10 m3/ha-mm
201	0.28	12.5	35.0	35.0
202	0.69	12.5	86.3	86.3
203	0.44	12.5	55.0	55.0
204	0.30	12.5	37.5	37.5

*Catchments per **Figure 2.5**

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Monday, August 10, 2020
Project Name	51, 53, 55, and 75 Bradford St.
Project Number	2196
Location	Barrie

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF8-9-2 is recommended to meet the water quality objective by treating a flow of 50.5 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 569 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF8-9-2	9	2	2.4	50.5	569

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

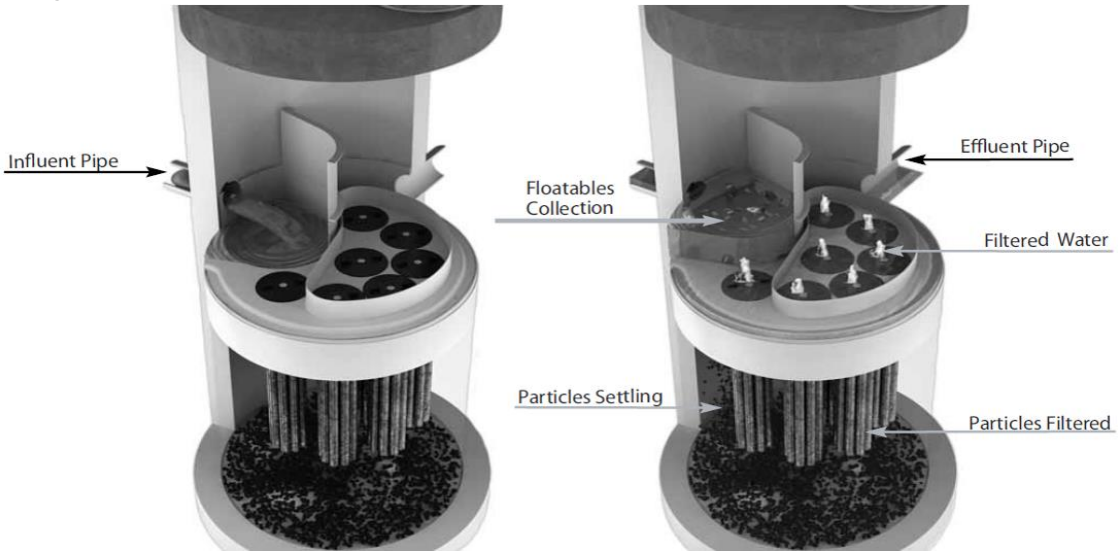
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 59%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Monday, August 10, 2020
Project Name:	51, 53, 55, and 75 Bradford St.
Project Number:	2196
Location:	Barrie

Designer Information

Company:	SCS Consulting Group Ltd.
Contact:	Paige Turchet
Phone #:	

Notes

Rainfall

Name:	BARRIE WPCC
State:	ON
ID:	557
Record:	1968 to 2003
Co-ords:	44°23'N, 79°41'W

Drainage Area

Total Area:	2.12 ha
Imperviousness:	85%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 36 years of BARRIE WPCC rainfall data:	**45.7 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 5239 m³, with a suspended sediment concentration of 60 mg/L.	**314 kg**

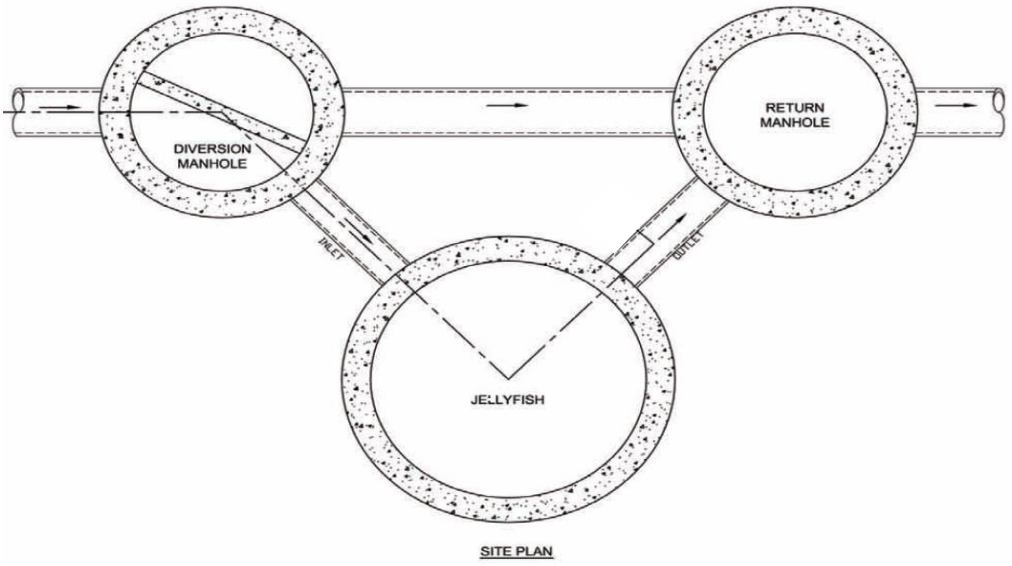
Recommendation

The Jellyfish Filter model JF8-9-2 is recommended to meet the water quality objective by treating a flow of 50.5 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 569 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	**9**	**2**	**2.4**	**9252**	**1.42**	**1469**	**50.5**	**569**
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	62º	150	200
1.8	59º	200	250
2.4	**52º**	**250**	**300**
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

APPENDIX E

PHOSPHOROUS BUDGET CALCULATIONS

SCS consulting group ltd

Ontario

MINISTRY OF THE ENVIRONMENT

Database Version: **V 2.0 Release Update**
Update Date: **30-Mar-12**

Project DEVELOPMENT Summary

DEVELOPMENT: 2196 - Bradford Barrie with Jellyfish
Subwatershed: Barrie Creeks

Total Pre-Development Area (ha):	**2.8600**	Total Pre-Development Phosphorus Load (kg/yr):	**1.11**

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
High Intensity - Residential	0.62	1.32	0.82
Low Intensity Development	2.24	0.13	0.29

DEVELOPMENT: 2196 - Bradford Barrie with Jellyfish
Subwatershed: Barrie Creeks

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Residential	0.17	1.32	Hydrodynamic devices	**60%**	0.09
			Jellyfish Filter, ETV vertified for 60% removal		
NOTE: BMP efficiency has been adjusted from the reference provided value by 60% (from 0% to 60%)					
High Intensity - Residential	0.6	1.32	NONE	0%	0.79
High Intensity - Residential	1.76	1.32	Treatment Train Approach	92%	0.19
			Filtration trench plus Jellyfish treatment train		
High Intensity - Residential	0.01	1.32	Other	92%	0.00
			Filtration Trech plus Jelyfish treatmet		
Low Intensity Development	0.12	0.13	Hydrodynamic devices	**60%**	0.01
			Jellyfish treatment		
NOTE: BMP efficiency has been adjusted from the reference provided value by 60% (from 0% to 60%)					
Low Intensity Development	0.09	0.13	NONE	0%	0.01
Low Intensity Development	0.05	0.13	Treatment Train Approach	92%	0.00
			Filtration trench plus Jellyfish treatment		

Post-Development Area Altered:	**2.80**
Total Pre-Development Area:	**2.86**
Unaffected Area:	**0**

	P Load (kg/yr)
Pre-Development:	**1.11**
Post-Development:	**3.39**
Change (Pre - Post):	**-2.28**
205% Net Increase in Load	
Post-Development (with BMPs):	**1.09**
Change (Pre - Post):	**0.02**
2% Net Reduction in Load	

DEVELOPMENT: 2196 - Bradford Barrie with Jellyfish
Subwatershed: Barrie Creeks

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	**P Load (kg/yr)**
Pre-Development:	**1.11**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**1.09**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**0.02**
Conclusion:	**2% Reduction in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

APPENDIX F

SANITARY FLOW CALCULATIONS

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Bradford Street - Existing Conditions prior to Barrie Central
FILE NO 2196
CONTRACT / PROJECT 51-75 Bradford Street

M = 5/P^0.2 Babbit

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.
$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)
$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC) Com	POP. (ACC) Res	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Bradford Street	SAC01029	SAC01028	C	1	0.83	248.9	208	208					0.541	0.83	0.083	0.624	29	300	0.30%	52.965	0.076	Ok	0.749	0.242	Check
Bradford Street	SAC01028	SAC01027	C	1	5.53	248.9	1375	1583					4.122	6.36	0.636	4.758	98	300	0.30%	52.965	0.202	Ok	0.749	0.444	Check
Bradford Street	SAC01027	SAC01026	C	1	1.32	248.9	328	1911					4.976	7.68	0.768	5.744	77	300	0.30%	52.965	0.222	Ok	0.749	0.470	Check
Bradford Street	SAC01026	SAC01025	C	1	0.53	248.9	131	2042					5.318	8.21	0.821	6.139	75	300	0.30%	52.965	0.229	Ok	0.749	0.480	Check
Bradford Street	SAC01025	SAC01024	C	1	0.14	248.9	35	2077					5.410	8.35	0.835	6.245	68	300	0.30%	52.965	0.231	Ok	0.749	0.481	Check
Bradford Street	SAC01024	SAC01023	C	1	0.00	248.9	0	2077					5.410	8.35	0.835	6.245	11	300	0.30%	52.965	0.231	Ok	0.749	0.481	Check
Bradford Street	SAC1023	SAC1006	C	1	0.00	248.9	0	2077					5.410	8.35	0.835	6.245	5	300	0.30%	52.965	0.231	Ok	0.749	0.481	Check

DATE: 29/07/2020 CALCULATED BY: M.M. CHECKED BY: P.G.

Notes:
(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Density PPU for commercial use is equivalent to flow rate of 28 cu.m/ha day, including commercial peaking factor of 2.0 per Barrie Sanitary Guidelines Sections 3.3.2

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Bradford Street - Existing Conditions with Barrie Central
FILE NO 2196
CONTRACT / PROJECT 51-75 Bradford Street

M = 5/P^0.2 Babbit

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.
$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)
$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC) Com	POP. (ACC) Res	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Bradford Street	SAC01029	SAC01028	C	1	0.83	248.9	208	208					0.541	0.83	0.083	0.624	29	300	0.30%	52.965	0.076	Ok	0.749	0.242	Check
Bradford Street	SAC01028	SAC01027	C	1	5.53	248.9	1375	1583					4.122	6.36	0.636	4.758	98	300	0.30%	52.965	0.202	Ok	0.749	0.444	Check
Bradford Street	SAC01027	SAC01026	C	1	0.49	248.9	123	1706					4.442	6.85	0.685	5.127	77	300	0.30%	52.965	0.210	Ok	0.749	0.454	Check
Barrie Central - Inst	BARRIE CENTRAL	SAC01026	C	1	1.00	111.1	111		111																
Barrie Central - Res	BARRIE CENTRAL	SAC01026	R	341	1.76	1.67	1002		1113		3.770	3.770	10.927	2.76	0.635	11.562	100	200	1.00%	32.798	0.409	Ok	1.044	0.938	Ok
Bradford Street	SAC01026	SAC01025	C	1	0.28	248.9	70	1775	1113		3.770	3.770	15.550	9.89	1.448	16.998	75	300	0.30%	52.965	0.389	Ok	0.749	0.651	Ok
Bradford Street	SAC01025	SAC01024	C	1	0.14	248.9	35	1811	1113		3.770	3.770	15.642	10.04	1.462	17.104	68	300	0.30%	52.965	0.390	Ok	0.749	0.652	Ok
Bradford Street	SAC01024	SAC01023	C	1	0.00	248.9	0	1811	1113		3.770	3.770	15.642	10.04	1.462	17.104	11	300	0.30%	52.965	0.390	Ok	0.749	0.652	Ok
Bradford Street	SAC1023	SAC1006	C	1	0.00	248.9	0	1811	1113		3.770	3.770	15.642	10.04	1.462	17.104	5	300	0.30%	52.965	0.390	Ok	0.749	0.652	Ok

DATE: 29/07/2020 CALCULATED BY: M.M. CHECKED BY: P.G.

Notes:
(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Density PPU for commercial use is equivalent to flow rate of 28 cu.m/ha day, including commercial peaking factor of 2.0 per Barrie Sanitary Guidelines Sections 3.3.2
(6) [ ] = Flow calculation per Barrie Central Development FSR (June 2019)

Hydraulic Grade Line Analysis
51-75 Bradford Street
EXISTING SANITARY HGL (PRIOR TO BARRIE CENTRAL)
City of Barrie

EL. FROM STREETLINE TO BASEMENT (m)= 1.80
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 219.00

Project: 51-75 Bradford Street
Project No. 2196
Date: 30-Jul-20
Designed By: V.A.S./J.Y.L.
Reviewed By: P.G.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Bradford Street\[Sanitary HGL analysis existing conditions-Bradford St-no Barrie Central-28jul2020.xlsm]Design

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING's 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
BRADFORD STREET	SAC01029	SAC01028	219.489	219.402	0.6	300	29.0	0.013	0.071	0.178	0.30	52.9	0.01	96.667	0.031	0.009	0.000	0.000	0.00	0.00	0.00	219.789	0.000	219.702	221.16	219.36	-0.43	Surcharge
BRADFORD STREET	SAC01028	SAC01027	219.398	219.104	4.8	300	98.0	0.013	0.071	0.178	0.30	52.9	0.09	326.667	0.031	0.067	0.000	0.002	0.00	0.00	0.00	219.698	0.000	219.404	221.38	219.58	-0.12	Surcharge
BRADFORD STREET	SAC01027	SAC01026	219.101	218.869	5.7	300	77.4	0.013	0.071	0.178	0.30	52.9	0.11	258.000	0.031	0.081	0.000	0.003	0.00	0.00	0.00	219.401	0.000	219.169	221.82	220.02	0.62	OK
BRADFORD STREET	SAC01026	SAC01025	218.865	218.640	6.1	300	75.0	0.013	0.071	0.178	0.30	52.9	0.12	250.000	0.031	0.087	0.000	0.003	0.00	0.00	0.00	219.165	0.000	219.004	222.05	220.25	1.09	OK
BRADFORD STREET	SAC01025	SAC01024	218.636	218.433	6.2	300	67.6	0.013	0.071	0.178	0.30	52.9	0.12	225.333	0.031	0.088	0.000	0.003	0.00	0.00	0.00	219.004	0.068	219.001	222.33	220.53	1.53	OK
BRADFORD STREET	SAC01024	SAC01023	218.429	218.395	6.2	300	11.2	0.013	0.071	0.178	0.30	52.9	0.12	37.333	0.031	0.088	0.000	0.000	0.00	0.00	0.00	219.001	0.272	219.000	222.13	220.33	1.33	OK
BRADFORD STREET	SAC01023	SAC1006	218.326	218.311	6.2	300	5.0	0.013	0.071	0.178	0.30	52.9	0.12	16.667	0.031	0.088	0.000	0.000	0.00	0.00	0.00	219.000	0.374	219.000	222.27	220.47	1.47	OK

Hydraulic Grade Line Analysis
51-75 Bradford Street
EXISTING SANITARY HGL
City of Barrie

EL. FROM STREETLINE TO BASEMENT (m)= 1.90
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 219.00

Project: 51-75 Bradford Street
Project No. 2196
Date: 30-Jul-20
Designed By: V.A.S./J.Y.L.
Reviewed By: P.G.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Bradford Street\[Sanitary HGL analysis existing conditions-Bradford St-Barrie Centrnl-28jul2020.xlsm]Design

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING's 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
BRADFORD STREET	SAC01029	SAC01028	219.489	219.402	0.6	300	29.0	0.013	0.071	0.178	0.30	52.9	0.01	96.667	0.031	0.009	0.000	0.000	0.00	0.00	0.00	219.789	0.000	219.702	221.16	219.26	-0.53	Surcharge
BRADFORD STREET	SAC01028	SAC01027	219.398	219.104	4.8	300	98.0	0.013	0.071	0.178	0.30	52.9	0.09	326.667	0.031	0.067	0.000	0.002	0.00	0.00	0.00	219.698	0.000	219.404	221.38	219.48	-0.22	Surcharge
BRADFORD STREET	SAC01027	SAC01026	219.101	218.869	5.1	300	77.4	0.013	0.071	0.178	0.30	52.9	0.10	258.000	0.031	0.073	0.000	0.002	0.00	0.00	0.00	219.401	0.000	219.169	221.82	219.92	0.52	OK
BARRIE CENTRAL	BARRIE CENTRAL	SAC01026	219.950	218.950	11.6	200	100.0	0.013	0.031	0.136	1.00	32.8	0.35	500.000	0.036	0.368	0.007	0.124	0.00	0.00	0.13	220.150	0.000	219.165	222.78	220.88	0.73	OK
BRADFORD STREET	SAC01026	SAC01025	218.865	218.640	17.0	300	75.0	0.013	0.071	0.178	0.30	52.9	0.32	250.000	0.031	0.240	0.003	0.023	0.00	0.00	0.02	219.165	0.000	219.029	222.05	220.15	0.99	OK
BRADFORD STREET	SAC01025	SAC01024	218.636	218.433	17.1	300	67.6	0.013	0.071	0.178	0.30	52.9	0.32	225.333	0.031	0.242	0.003	0.021	0.00	0.00	0.02	219.029	0.093	219.007	222.33	220.43	1.40	OK
BRADFORD STREET	SAC01024	SAC01023	218.429	218.395	17.1	300	11.2	0.013	0.071	0.178	0.30	52.9	0.32	37.333	0.031	0.242	0.003	0.004	0.00	0.00	0.01	219.007	0.279	219.002	222.13	220.23	1.22	OK
BRADFORD STREET	SAC01023	SAC1006	218.326	218.311	17.1	300	5.0	0.013	0.071	0.178	0.30	52.9	0.32	16.667	0.031	0.242	0.003	0.002	0.00	0.00	0.00	219.002	0.376	219.000	222.27	220.37	1.37	OK

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Bradford Street - Proposed Conditions
FILE NO 2196
CONTRACT / PROJECT 51-75 Bradford Street

Numbers in blue or text in red are equations

M = 5/P^0.2 Babbit (Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.

$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)

$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC) ICI	POP. (ACC) Res	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Tower 4 - Comm	SANMH1	SAC01029	C	1	0.07	248.9	17	17					0.045	0.07	0.007	0.052	10	250	2.00%						
Tower 4 - Res	SANMH1	SAC01029	R	561	0.75	1.67	703		703		3.893	3.893	7.129	0.75	0.075	7.204	10	250	2.00%						
Bradford Street	SAC01029	SAC01028	C	1	0.32	248.9	80	97	703		3.893	3.893	7.381	1.14	0.114	7.495	29	300	0.30%	52.965	0.254	Ok	0.749	0.527	Check
Bradford Street	SAC01028	SANMH3	C	1	4.07	248.9	1013	1110	703		3.893	3.893	10.019	5.21	0.521	10.540	58	300	0.30%	52.965	0.302	Ok	0.749	0.575	Check
Tower 3 - Res	SANMH2	SANMH3	R	782	0.67	1.67	875		875		3.837	3.837	8.743	0.67	0.067	8.810	10	250	2.00%						
Bradford Street	SANMH3	SAC01027			0.00			1110	1578		3.663	3.663	17.947	5.88	0.588	18.535	39	300	0.30%	52.965	0.408	Ok	0.749	0.677	Ok
Tower 2 - Comm	SANMH4	SAC01027	C	1	0.23	248.9	57	57					0.149	0.23	0.023	0.172	10	250	2.00%						
Tower 2 - Res	SANMH4	SAC01027	R	721	0.76	1.67	915		915		3.824	3.824	9.115	0.76	0.076	9.191	10	250	2.00%						
Bradford Street	SAC01027	SAC01026	C	1	0.29	248.9	72	1239	2493		3.509	3.509	26.014	7.16	0.716	26.730	77	300	0.30%	52.965	0.502	Check	0.749	0.745	Ok
Barrie Central - Inst	BARRIE CENTRAL	SAC01026	C	1	1.00	111.1	111		111																
Barrie Central - Res	BARRIE CENTRAL	SAC01026	R	341	1.76	1.7	1002		1113		3.770	3.770	10.927	2.76	0.635	11.562	100	200	1.00%	32.798	0.409	Ok	1.044	0.938	Ok
Bradford Street	SAC01026	SAC01025	C	1	0.28	248.9	70	1309	3606		3.373	3.373	35.090	10.20	1.379	36.469	75	300	0.30%	52.965	0.609	Check	0.749	0.801	Ok
Bradford Street	SAC01025	SAC01024	C	1	0.14	248.9	35	1344	3606		3.373	3.373	35.182	10.34	1.393	36.575	68	300	0.30%	52.965	0.610	Check	0.749	0.801	Ok
Bradford Street	SAC01024	SAC01023	C	1	0.00	248.9	0	1344	3606		3.373	3.373	35.182	10.34	1.393	36.575	11	300	0.30%	52.965	0.610	Check	0.749	0.801	Ok
Bradford Street	SAC1023	SAC1006	C	1	0.00	248.9	0	1344	3606		3.373	3.373	35.182	10.34	1.393	36.575	5	300	0.30%	52.965	0.610	Check	0.749	0.801	Ok

DATE: 29/07/2020 CALCULATED BY: M.M. CHECKED BY: P.G.

Notes:

(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Density PPU for commercial use is equivalent to flow rate of 28 cu.m/ha day, including commercial peaking factor of 2.0 per Barrie Sanitary Guidelines Sections 3.3.2
(6) [ ] = Flow calculation per Barrie Central Development FSR (June 2019)

Hydraulic Grade Line Analysis
51-75 Bradford Street
PROPOSED SANITARY HGL
City of Barrie

EL. FROM STREETLINE TO BASEMENT (m)= 1.90
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 219.00

Project: 51-75 Bradford Street
Project No. 2196
Date: 30-Jul-20
Designed By: V.A.S./J.Y.L.
Reviewed By: P.G.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Bradford Street\[Sanitary HGL analysis-Bradford St-28jul2020.xlsm]Design

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING's 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$v^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
TOWER 4	SANMH1	SAC01029	220.448	220.250	7.3	250	9.9	0.013	0.049	0.157	2.00	84.1	0.09	39.600	0.033	0.148	0.001	0.001	0.00	0.00	0.00	220.698	0.000	220.500	221.34	219.44	-1.26	Surcharge
BRADFORD STREET	SAC01029	SAC01028	219.489	219.402	7.5	300	29.0	0.013	0.071	0.178	0.30	52.9	0.14	96.667	0.031	0.106	0.001	0.002	0.00	0.00	0.00	219.789	0.000	219.702	221.16	219.26	-0.53	Surcharge
BRADFORD STREET	SAC01028	SANMH3	219.397	219.222	10.5	300	58.2	0.013	0.071	0.178	0.30	52.9	0.20	194.000	0.031	0.149	0.001	0.007	0.00	0.00	0.01	219.697	0.000	219.522	221.38	219.48	-0.22	Surcharge
TOWER 3	SANMH2	SANMH3	219.462	219.270	8.8	250	9.6	0.013	0.049	0.157	2.00	84.1	0.10	38.400	0.033	0.179	0.002	0.002	0.00	0.00	0.00	219.712	0.000	219.521	221.71	219.81	0.10	Surcharge
BRADFORD STREET	SANMH3	SAC01027	219.221	219.104	18.5	300	39.0	0.013	0.071	0.178	0.30	52.9	0.35	130.000	0.031	0.262	0.004	0.014	0.00	0.00	0.01	219.521	0.000	219.404	221.64	219.74	0.22	Surcharge
TOWER 2	SANMH4	SAC01027	219.350	219.160	9.4	250	9.5	0.013	0.049	0.157	2.00	84.1	0.11	38.000	0.033	0.191	0.002	0.002	0.00	0.00	0.00	219.600	0.000	219.410	221.99	220.09	0.49	Surcharge
BRADFORD STREET	SAC01027	SAC01026	219.101	218.869	26.7	300	77.4	0.013	0.071	0.178	0.30	52.9	0.50	258.000	0.031	0.378	0.007	0.059	0.00	0.00	0.06	219.401	0.000	219.239	221.82	219.92	0.52	OK
BARRIE CENTRAL	RRIE CENTR	SAC01026	219.950	218.950	11.6	200	100.0	0.013	0.031	0.136	1.00	32.8	0.35	500.000	0.036	0.368	0.007	0.124	0.00	0.00	0.13	220.150	0.000	219.239	222.78	220.88	0.73	OK
BRADFORD STREET	SAC01026	SAC01025	218.865	218.640	36.5	300	75.0	0.013	0.071	0.178	0.30	52.9	0.69	250.000	0.031	0.516	0.014	0.107	0.00	0.00	0.11	219.239	0.074	219.131	222.05	220.15	0.92	OK
BRADFORD STREET	SAC01025	SAC01024	218.636	218.433	36.6	300	67.6	0.013	0.071	0.178	0.30	52.9	0.69	225.333	0.031	0.517	0.014	0.097	0.00	0.00	0.10	219.131	0.196	219.034	222.33	220.43	1.30	OK
BRADFORD STREET	SAC01024	SAC01023	218.429	218.395	36.6	300	11.2	0.013	0.071	0.178	0.30	52.9	0.69	37.333	0.031	0.517	0.014	0.016	0.01	0.00	0.03	219.034	0.305	219.008	222.13	220.23	1.20	OK
BRADFORD STREET	SAC01023	SAC1006	218.326	218.311	36.6	300	5.0	0.013	0.071	0.178	0.30	52.9	0.69	16.667	0.031	0.517	0.014	0.007	0.00	0.00	0.01	219.008	0.382	219.000	222.27	220.37	1.36	OK

EXTERNAL DRAINAGE AREAS SUMMARY

51-75 Bradford Street, Barrie
Job Number: 2196
Date: August 2020
Designer Initials: M.L.M.

North Sanitary Drainage Area

Total Drainage Area: 846 ha

Total Flow at SAN.MH3227 (including infiltration & inflow):	0.719 m^3/s
Portion of Flow from Lakeshore Drainage Area:	0.352 m^3/s
Portion of Flow from North Drainage Area:	0.367 m^3/s
Infiltration & inflow @ 0.1 L/s/ha:	0.085 m^3/s
Total flow (excluding infiltration & inflow):	0.282 m^3/s
Resulting flow rate:	**28.8 m^3/ha/day**

Lakeshore Sanitary Drainage Area

Residential Land Uses

Zoning	Area (ha)	Density Type	Density (units/ha)	Density (P.P.U.)	Population
R1	6.64	Low Density	25	3.13	519.6
R2	172.79	Low Density	25	3.13	13520.8
R3	51.74	Low Density	25	3.13	4048.7
R4	2.24	Low Density	25	3.13	175.3
RA1	6.04	High Density	300	1.67	3026.0
RA2	1.35	High Density	300	1.67	676.4
RH	0.60	Low Density	25	3.13	47.0
RM2	37.90	Med Density	53	2.34	4700.4
Total	**279.30**				**26714.0**

Commercial/Institutional Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
C1	12.19	28	2
C2	7.01	28	2
C3	1.56	28	2
C4	8.07	28	2
I	44.96	28	2
Total	**73.79**		

Industrial Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
M1	5.50	50	3
Total	**5.50**		

Other Land Uses Not Contributing Sanitary Flow

Zoning	Area (ha)	Land Type
A	5.58	Agriculture
EP	12.80	Environmental Protection
OS	36.92	Open Space
	127.57	Rights-of-way
Total	**182.87**	

EXTERNAL DRAINAGE AREAS SUMMARY

51-75 Bradford Street, Barrie
Job Number: 2196
Date: August 2020
Designer Initials: M.L.M.

Mary Street Sanitary Drainage Area

Residential Land Uses

Zoning	Area (ha)	Density Type	Density (units/ha)	Density (P.P.U.)	Population
R3	2.85	Low Density	25	3.13	223.0
RM2	3.03	Med Density	53	2.34	375.8
Total	**5.88**				**598.8**

Commercial/Institutional Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
C1	3.86	28	2
C2	4.82	28	2
I	7.50	28	2
Total	**16.18**		

Other Land Uses Not Contributing Sanitary Flow

Zoning	Area (ha)	Land Type
OS	2.86	Open Space
	7.50	Rights-of-way
Total	**10.36**	

Area 3 (Toronto Street) & Area 4

Commercial/Institutional Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
C1	0.15	28	2
C2	1.67	28	2
Total	**1.82**		

Other Land Uses Not Contributing Sanitary Flow

Zoning	Area (ha)	Land Type
OS	0.01	Open Space
	0.43	Rights-of-way
Total	**0.44**	

High Street Sanitary Drainage Area

Commercial/Institutional Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
C2	1.32	28	2
Total	**1.32**		

EXTERNAL DRAINAGE AREAS SUMMARY

51-75 Bradford Street, Barrie
Job Number: 2196
Date: August 2020
Designer Initials: M.L.M.

Cundles Trunk Sanitary Drainage Area

Residential Land Uses

Zoning	Area (ha)	Density Type	Density (units/ha)	Density (P.P.U.)	Population
R2	112.65	Low Density	25	3.13	8814.9
R3	32.34	Low Density	25	3.13	2530.6
R4	1.12	Low Density	25	3.13	87.6
RA1	6.07	High Density	300	1.67	3041.1
RA2	3.81	High Density	300	1.67	1908.8
RH	0.50	Low Density	25	3.13	39.1
RM1	39.89	Low Density	25	3.13	3121.4
RM2	39.82	Med Density	53	2.34	4938.5
RM2TH	1.81	Med Density	53	2.34	224.5
Total	**238.01**				**24706.5**

Commercial/Institutional Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
C1	0.68	28	2
C2	6.52	28	2
C3	23.9	28	2
C4	32.24	28	2
C5	0.45	28	2
I	36.65	28	2
Total	**100.44**		

Industrial Land Uses

Zoning	Area (ha)	Flow Rate (m^3/ha/day)	Peaking Factor
M1	0.64	50	3
M2	0.73	50	3
Total	**1.37**		

Other Land Uses Not Contributing Sanitary Flow

Zoning	Area (ha)	Land Type
A	2.21	Agriculture
EP	5.86	Environmental Protection
OS	83.30	Open Space
	123.44	Rights-of-way
Total	**214.81**	

EXTERNAL DRAINAGE AREAS SUMMARY

51-75 Bradford Street, Barrie
Job Number: 2196
Date: August 2020
Designer Initials: M.L.M.

Total External Areas

	Area (ha)	*Flow Rate*
North Sanitary Drainage Area	846	28.8 m^3/ha/day

Residential Land Uses

	Area (ha)	*Population*
Lakeshore Sanitary Drainage Area	279.30	26714.0
Mary Street Sanitary Drainage Area	5.88	598.8
Area 3 (Toronto Street) & Area 4		
High Street Sanitary Drainage Area		
Cundles Trunk Sanitary Drainage Area	238.01	24706.5
Total	**523.19**	**52019.3**

Commercial/Institutional Land Uses

	Area (ha)
Lakeshore Sanitary Drainage Area	73.79
Mary Street Sanitary Drainage Area	16.18
Area 3 (Toronto Street) & Area 4	1.82
High Street Sanitary Drainage Area	1.32
Cundles Trunk Sanitary Drainage Area	100.44
Total	**193.55**

Industrial Land Uses

	Area (ha)
Lakeshore Sanitary Drainage Area	5.50
Mary Street Sanitary Drainage Area	
Area 3 (Toronto Street) & Area 4	
High Street Sanitary Drainage Area	
Cundles Trunk Sanitary Drainage Area	1.37
Total	**6.87**

Other Land Uses Not Contributing Sanitary Flow

	Area (ha)
Lakeshore Sanitary Drainage Area	182.87
Mary Street Sanitary Drainage Area	10.36
Area 3 (Toronto Street) & Area 4	0.44
High Street Sanitary Drainage Area	
Cundles Trunk Sanitary Drainage Area	214.81
Total	**408.48**

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Lakeshore Drive - Existing Conditions
FILE NO 2196
CONTRACT / PROJECT 51-75 Bradford Street

Numbers in blue or text in red are equations

M = 5/P^0.2 Babbit (Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.

$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)

$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC) ICI	POP. (ACC) Res	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
External Drainage Areas	Residential	SAL01016	R	1	523.19	99.4	52019		52019		2.249	2.249	304.613	523.19	52.319	356.932									
	Commercial	SAL01016	C	1	193.55	248.8889	48172	48172					125.449	193.55	19.355	144.804									
	Industrial	SAL01016	Ind	1	6.87	666.6667	4580	4580					11.927	6.87	0.687	12.614									
	Other	SAL01016			408.48		0						0.000	408.48	40.848	40.848									
	North Drainage Area	SAL01016		1	846.00	128.18	108442	108442					282.400	846.00	84.600	367.000									
Lakeshore Dr	SAL01016	SAL01017	C	1	1.56	248.8889	388	161582	52019		2.249	2.249	725.400	1979.65	197.965	923.365	80	1350	0.18%	2232.795	0.448	Ok	1.560	1.393	Ok
Lakeshore Dr	SAL01017	SAL01018	OS		0.55		0	161582	52019		2.249	2.249	725.400	1980.20	198.020	923.420	92	1350	0.15%	2067.167	0.468	Ok	1.444	1.316	Ok
Lakeshore Dr	SAL01018	SAL01019	OS		0.49		0	161582	52019		2.249	2.249	725.400	1980.69	198.069	923.469	80	1350	0.18%	2232.795	0.448	Ok	1.560	1.393	Ok
Lakeshore Dr	SAL01019	SAL01020	OS		0.27		0	161582	52019		2.249	2.249	725.400	1980.96	198.096	923.496	45	1514	0.15%	2805.836	0.329	Ok	1.559	1.559	Ok
Lakeshore Dr	SAL01020	SAL01021	OS		1.95		0	161582	52019		2.249	2.249	725.400	1982.91	198.291	923.691	137	1350	0.18%	2232.795	0.448	Ok	1.560	1.393	Ok
Lakeshore Dr	SAL01021	SAL01022	OS		1.50		0	161582	52019		2.249	2.249	725.400	1984.41	198.441	923.841	124	1350	0.17%	2200.667	0.451	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01022	SAL01023	OS		1.00		0	161582	52019		2.249	2.249	725.400	1985.41	198.541	923.941	76	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01023	SAL01024	OS		1.31		0	161582	52019		2.249	2.249	725.400	1986.72	198.672	924.072	102	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01024	SAL01025	OS		1.06		0	161582	52019		2.249	2.249	725.400	1987.78	198.778	924.178	82	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01025	Culvert Start	OS		1.48		0	161582	52019		2.249	2.249	725.400	1989.26	198.926	924.326	65	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	Culvert Start	Culvert End			0.00		0	161582	52019		2.249	2.249	725.400	1989.26	198.926	924.326	10	1354	0.17%	2218.338	0.417	Ok	1.541	1.541	Ok
Lakeshore Dr	Culvert End	SAL01026			0.00		0	161582	52019		2.249	2.249	725.400	1989.26	198.926	924.326	35	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01026	SAL01027	OS		1.58		0	161582	52019		2.249	2.249	725.400	1990.84	199.084	924.484	108	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01027	SAL01028	OS		0.29		0	161582	52019		2.249	2.249	725.400	1991.13	199.113	924.513	41	1350	0.17%	2200.667	0.452	Ok	1.537	1.378	Ok
Lakeshore Dr	SAL01028	SAL01029	OS		0.36		0	161582	52019		2.249	2.249	725.400	1991.49	199.149	924.549	46	1350	0.24%	2601.571	0.411	Ok	1.818	1.557	Ok

DATE: 11/08/2020 CALCULATED BY: M.M. CHECKED BY: C.C.

Notes:

(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Density PPU for commercial use is equivalent to flow rate of 28 cu.m/ha day, including commercial peaking factor of 2.0 per Barrie Sanitary Guidelines Sections 3.3.2
(6) Density PPU for industrial use is equivalent to flow rate of 50 cu.m/ha day, including industrial peaking factor of 3.0 per Barrie Sanitary Guidelines Sections 3.3.3
(7) Refer to External Drainage Areas Summary Sheet for area breakdowns
(8) = Equivalent diameter to 1800x1000 box culvert
(9) = Equivalent diameter to 1800x800 box culvert

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Lakeshore Drive - Existing Conditions with Barrie Central
FILE NO 2196
CONTRACT / PROJECT 51-75 Bradford Street

Numbers in blue or text in red are equations

M = 5/P^0.2 Babbit (Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.

$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)

$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC) ICI	POP. (ACC) Res	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
External Drainage Areas	Residential	SAL01016	R	1	523.19	99.4	52019		52019		2.249	2.249	304.613	523.19	52.319	356.932									
	Commercial	SAL01016	C	1	192.48	248.8889	47906	47906					124.754	192.48	19.248	144.002									
	Industrial	SAL01016	Ind	1	6.87	666.6667	4580	4580					11.927	6.87	0.687	12.614									
	Other	SAL01016			408.48		0						0.000	408.48	40.848	40.848									
	North Drainage Area	SAL01016		1	846.00	128.18	108442	108442					282.400	846.00	84.600	367.000									
Barrie Central - Inst	BARRIE CENTRAL	SAL01016	C	1	1.00	111.1	111		111																
Barrie Central - Res	BARRIE CENTRAL	SAL01016	R	341	1.76	1.7	1002		1113		3.770	3.770	10.927	2.76	0.635	11.562									
Lakeshore Dr	SAL01016	SAL01017	C	1	1.56	248.8889	388	161316	53132		2.240	2.240	730.049	1981.34	198.493	928.541	80	1350	0.18%	2232.795	0.449	Ok	1.560	1.395	Ok
Lakeshore Dr	SAL01017	SAL01018	OS		0.55		0	161316	53132		2.240	2.240	730.049	1981.89	198.548	928.596	92	1350	0.15%	2067.167	0.469	Ok	1.444	1.319	Ok
Lakeshore Dr	SAL01018	SAL01019	OS		0.49		0	161316	53132		2.240	2.240	730.049	1982.38	198.597	928.645	80	1350	0.18%	2232.795	0.449	Ok	1.560	1.395	Ok
Lakeshore Dr	SAL01019	SAL01020	OS		0.27		0	161316	53132		2.240	2.240	730.049	1982.65	198.624	928.672	45	1514	0.15%	2805.836	0.331	Ok	1.559	1.559	Ok
Lakeshore Dr	SAL01020	SAL01021	OS		1.95		0	161316	53132		2.240	2.240	730.049	1984.60	198.819	928.867	137	1350	0.18%	2232.795	0.449	Ok	1.560	1.395	Ok
Lakeshore Dr	SAL01021	SAL01022	OS		1.50		0	161316	53132		2.240	2.240	730.049	1986.10	198.969	929.017	124	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01022	SAL01023	OS		1.00		0	161316	53132		2.240	2.240	730.049	1987.10	199.069	929.117	76	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01023	SAL01024	OS		1.31		0	161316	53132		2.240	2.240	730.049	1988.41	199.200	929.248	102	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01024	SAL01025	OS		1.06		0	161316	53132		2.240	2.240	730.049	1989.47	199.306	929.354	82	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01025	Culvert Start	OS		1.48		0	161316	53132		2.240	2.240	730.049	1990.95	199.454	929.502	65	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	Culvert Start	Culvert End			0.00		0	161316	53132		2.240	2.240	730.049	1990.95	199.454	929.502	10	1354	0.17%	2218.338	0.419	Ok	1.541	1.541	Ok
Lakeshore Dr	Culvert End	SAL01026			0.00		0	161316	53132		2.240	2.240	730.049	1990.95	199.454	929.502	35	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01026	SAL01027	OS		1.58		0	161316	53132		2.240	2.240	730.049	1992.53	199.612	929.660	108	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01027	SAL01028	OS		0.29		0	161316	53132		2.240	2.240	730.049	1992.82	199.641	929.689	41	1350	0.17%	2200.667	0.453	Ok	1.537	1.380	Ok
Lakeshore Dr	SAL01028	SAL01029	OS		0.36		0	161316	53132		2.240	2.240	730.049	1993.18	199.677	929.725	46	1350	0.24%	2601.571	0.413	Ok	1.818	1.559	Ok

DATE: 11/08/2020 CALCULATED BY: M.M. CHECKED BY: C.C.

Notes:

(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Density PPU for commercial use is equivalent to flow rate of 28 cu.m/ha day, including commercial peaking factor of 2.0 per Barrie Sanitary Guidelines Sections 3.3.2
(6) Density PPU for industrial use is equivalent to flow rate of 50 cu.m/ha day, including industrial peaking factor of 3.0 per Barrie Sanitary Guidelines Sections 3.3.3
(7) Refer to External Drainage Areas Summary Sheet for area breakdowns
(8) = Flow calculation per Barrie Central Development FSR (June 2019)
(9) = Equivalent diameter to 1800x1000 box culvert
(10) = Equivalent diameter to 1800x800 box culvert

Hydraulic Grade Line Analysis
51-75 Bradford Street
EXISTING SANITARY HGL (prior to BARRIE CENTRAL)
City of Barrie

EL. FROM STREETLINE TO BASEMENT (m)= 0.00
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 218.97

= Equivalent diameter to 1800x1000 box culvert
= Equivalent diameter to 1800x800 box culvert

Project: 51-75 Bradford Street
Project No. 2196
Date: 11-Aug-20
Designed By: M.L.M.
Reviewed By: C.C.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Lakeshore Drive\[Sanitary HGL analysis existing conditions-Lakeshore Dr-28jul2020.xlsm]Design

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING'S 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
LAKESHORE DR	SAL01016	SAL01017	217.160	217.020	923.4	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.41	59.185	0.019	0.645	0.021	0.024	0.00	0.00	0.02	219.335	0.825	219.310	220.00	220.00	0.66	OK
LAKESHORE DR	SAL01017	SAL01018	217.008	216.870	923.4	1350	91.8	0.013	1.431	0.485	0.15	2066.1	0.45	68.000	0.019	0.645	0.021	0.027	0.00	0.00	0.03	219.310	0.953	219.282	220.49	220.49	1.18	OK
LAKESHORE DR	SAL01018	SAL01019	216.870	216.730	923.5	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.41	59.185	0.019	0.645	0.021	0.024	0.00	0.00	0.02	219.282	1.062	219.257	220.22	220.22	0.94	OK
LAKESHORE DR	SAL01019	SAL01020	216.728	216.660	923.5	1513.8795	45.4	0.013	1.800	0.523	0.15	2804.4	0.33	29.989	0.018	0.513	0.013	0.007	0.00	0.00	0.01	219.257	1.015	219.249	220.50	220.50	1.24	OK
LAKESHORE DR	SAL01020	SAL01021	216.660	216.420	923.7	1350	137.1	0.013	1.431	0.485	0.18	2231.7	0.41	101.556	0.019	0.645	0.021	0.041	0.00	0.00	0.04	219.249	1.239	219.207	220.58	220.58	1.33	OK
LAKESHORE DR	SAL01021	SAL01022	216.421	216.210	923.8	1350	124.0	0.013	1.431	0.485	0.17	2199.6	0.42	91.852	0.019	0.645	0.021	0.037	0.00	0.00	0.04	219.207	1.436	219.168	220.80	220.80	1.59	OK
LAKESHORE DR	SAL01022	SAL01023	216.208	216.080	923.9	1350	75.6	0.013	1.431	0.485	0.17	2199.6	0.42	55.963	0.019	0.645	0.021	0.023	0.00	0.00	0.02	219.168	1.610	219.145	221.01	221.01	1.84	OK
LAKESHORE DR	SAL01023	SAL01024	216.084	215.910	924.1	1350	102.3	0.013	1.431	0.485	0.17	2199.6	0.42	75.741	0.019	0.646	0.021	0.031	0.00	0.00	0.03	219.145	1.711	219.113	220.45	220.45	1.31	OK
LAKESHORE DR	SAL01024	SAL01025	215.910	215.770	924.2	1350	82.4	0.013	1.431	0.485	0.17	2199.6	0.42	61.037	0.019	0.646	0.021	0.025	0.00	0.00	0.03	219.113	1.853	219.087	220.66	220.66	1.55	OK
LAKESHORE DR	SAL01025	Culvert Start	215.772	215.661	924.3	1350	65.3	0.013	1.431	0.485	0.17	2199.6	0.42	48.333	0.019	0.646	0.021	0.020	0.00	0.00	0.02	219.087	1.965	219.067	220.68	220.68	1.59	OK
LAKESHORE DR	Culvert Start	Culvert End	215.656	215.639	924.3	1354.055	9.9	0.013	1.440	0.486	0.17	2217.2	0.42	7.311	0.019	0.642	0.021	0.003	0.00	0.00	0.00	219.067	2.057	219.063	220.78	220.78	1.71	OK
LAKESHORE DR	Culvert End	SAL01026	215.639	215.580	924.3	1350	34.8	0.013	1.431	0.485	0.17	2199.6	0.42	25.778	0.019	0.646	0.021	0.010	0.00	0.00	0.01	219.063	2.073	219.051	220.83	220.83	1.77	OK
LAKESHORE DR	SAL01026	SAL01027	215.584	215.400	924.5	1350	108.4	0.013	1.431	0.485	0.17	2199.6	0.42	80.259	0.019	0.646	0.021	0.033	0.01	0.00	0.04	219.051	2.117	219.008	221.01	221.01	1.96	OK
LAKESHORE DR	SAL01027	SAL01028	215.400	215.330	924.5	1350	41.3	0.013	1.431	0.485	0.17	2199.6	0.42	30.615	0.019	0.646	0.021	0.012	0.01	0.00	0.02	219.008	2.258	218.985	221.46	221.46	2.45	OK
LAKESHORE DR	SAL01028	SAL01029	215.320	215.210	924.5	1350	46.3	0.013	1.431	0.485	0.24	2600.3	0.36	34.296	0.019	0.646	0.021	0.014	0.00	0.00	0.01	218.985	2.315	218.970	219.80	219.80	0.82	OK

Hydraulic Grade Line Analysis
51-75 Bradford Street
EXISTING SANITARY HGL (prior to BARRIE CENTRAL)
City of Barrie

Project: 51-75 Bradford Street
Project No. 2196
Date: 11-Aug-20
Designed By: M.L.M.
Reviewed By: C.C.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Lakeshore Drive\[Sanitary HGL analysis existing conditions-Lakeshore Dr-w basements-28jul2020.xlsm]Design

EL. FROM STREETLINE TO BASEMENT (m)= 1.90
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 218.97

= Equivalent diameter to 1800x1000 box culvert
= Equivalent diameter to 1800x800 box culvert

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING's 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
LAKESHORE DR	SAL01016	SAL01017	217.160	217.020	923.4	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.41	59.185	0.019	0.645	0.021	0.024	0.00	0.00	0.02	219.335	0.825	219.310	220.00	218.10	-1.24	Surcharge
LAKESHORE DR	SAL01017	SAL01018	217.008	216.870	923.4	1350	91.8	0.013	1.431	0.485	0.15	2066.1	0.45	68.000	0.019	0.645	0.021	0.027	0.00	0.00	0.03	219.310	0.953	219.282	220.49	218.59	-0.72	Surcharge
LAKESHORE DR	SAL01018	SAL01019	216.870	216.730	923.5	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.41	59.185	0.019	0.645	0.021	0.024	0.00	0.00	0.02	219.282	1.062	219.257	220.22	218.32	-0.96	Surcharge
LAKESHORE DR	SAL01019	SAL01020	216.728	216.660	923.5	1513.8795	45.4	0.013	1.800	0.523	0.15	2804.4	0.33	29.989	0.018	0.513	0.013	0.007	0.00	0.00	0.01	219.257	1.015	219.249	220.50	218.60	-0.66	Surcharge
LAKESHORE DR	SAL01020	SAL01021	216.660	216.420	923.7	1350	137.1	0.013	1.431	0.485	0.18	2231.7	0.41	101.556	0.019	0.645	0.021	0.041	0.00	0.00	0.04	219.249	1.239	219.207	220.58	218.68	-0.57	Surcharge
LAKESHORE DR	SAL01021	SAL01022	216.421	216.210	923.8	1350	124.0	0.013	1.431	0.485	0.17	2199.6	0.42	91.852	0.019	0.645	0.021	0.037	0.00	0.00	0.04	219.207	1.436	219.168	220.80	218.90	-0.31	Surcharge
LAKESHORE DR	SAL01022	SAL01023	216.208	216.080	923.9	1350	75.6	0.013	1.431	0.485	0.17	2199.6	0.42	55.963	0.019	0.645	0.021	0.023	0.00	0.00	0.02	219.168	1.610	219.145	221.01	219.11	-0.06	Surcharge
LAKESHORE DR	SAL01023	SAL01024	216.084	215.910	924.1	1350	102.3	0.013	1.431	0.485	0.17	2199.6	0.42	75.741	0.019	0.646	0.021	0.031	0.00	0.00	0.03	219.145	1.711	219.113	220.45	218.55	-0.59	Surcharge
LAKESHORE DR	SAL01024	SAL01025	215.910	215.770	924.2	1350	82.4	0.013	1.431	0.485	0.17	2199.6	0.42	61.037	0.019	0.646	0.021	0.025	0.00	0.00	0.03	219.113	1.853	219.087	220.66	218.76	-0.35	Surcharge
LAKESHORE DR	SAL01025	Culvert Start	215.772	215.661	924.3	1350	65.3	0.013	1.431	0.485	0.17	2199.6	0.42	48.333	0.019	0.646	0.021	0.020	0.00	0.00	0.02	219.087	1.965	219.067	220.68	218.78	-0.31	Surcharge
LAKESHORE DR	Culvert Start	Culvert End	215.656	215.639	924.3	1354.055	9.9	0.013	1.440	0.486	0.17	2217.2	0.42	7.311	0.019	0.642	0.021	0.003	0.00	0.00	0.00	219.067	2.057	219.063	220.78	218.88	-0.19	Surcharge
LAKESHORE DR	Culvert End	SAL01026	215.639	215.580	924.3	1350	34.8	0.013	1.431	0.485	0.17	2199.6	0.42	25.778	0.019	0.646	0.021	0.010	0.00	0.00	0.01	219.063	2.073	219.051	220.83	218.93	-0.13	Surcharge
LAKESHORE DR	SAL01026	SAL01027	215.584	215.400	924.5	1350	108.4	0.013	1.431	0.485	0.17	2199.6	0.42	80.259	0.019	0.646	0.021	0.033	0.01	0.00	0.04	219.051	2.117	219.008	221.01	219.11	0.06	Surcharge
LAKESHORE DR	SAL01027	SAL01028	215.400	215.330	924.5	1350	41.3	0.013	1.431	0.485	0.17	2199.6	0.42	30.615	0.019	0.646	0.021	0.012	0.01	0.00	0.02	219.008	2.258	218.985	221.46	219.56	0.55	OK
LAKESHORE DR	SAL01028	SAL01029	215.320	215.210	924.5	1350	46.3	0.013	1.431	0.485	0.24	2600.3	0.36	34.296	0.019	0.646	0.021	0.014	0.00	0.00	0.01	218.985	2.315	218.970	219.80	217.90	-1.08	Surcharge

Hydraulic Grade Line Analysis
51-75 Bradford Street
EXISTING SANITARY HGL (incl BARRIE CENTRAL)
City of Barrie

Project: 51-75 Bradford Street
Project No. 2196
Date: 11-Aug-20
Designed By: M.L.M.
Reviewed By: C.C.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Lakeshore Drive\[Sanitary HGL analysis existing conditions-w Barrie Central-Lakeshore Dr-28jul2020 - Copy.xlsm]Design

EL. FROM STREETLINE TO BASEMENT (m)= 0.00
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 218.97

= Equivalent diameter to 1800x1000 box culvert
= Equivalent diameter to 1800x800 box culvert

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING's 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
LAKESHORE DR	SAL01016	SAL01017	217.160	217.020	928.5	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.649	0.021	0.024	0.00	0.00	0.03	219.339	0.830	219.314	220.00	220.00	0.66	OK
LAKESHORE DR	SAL01017	SAL01018	217.008	216.870	928.6	1350	91.8	0.013	1.431	0.485	0.15	2066.1	0.45	68.000	0.019	0.649	0.021	0.028	0.00	0.00	0.03	219.314	0.956	219.285	220.49	220.49	1.18	OK
LAKESHORE DR	SAL01018	SAL01019	216.870	216.730	928.6	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.649	0.021	0.024	0.00	0.00	0.03	219.285	1.065	219.260	220.22	220.22	0.93	OK
LAKESHORE DR	SAL01019	SAL01020	216.728	216.660	928.7	1513.87951	45.4	0.013	1.800	0.523	0.15	2804.4	0.33	29.989	0.018	0.516	0.014	0.007	0.00	0.00	0.01	219.260	1.018	219.252	220.50	220.50	1.24	OK
LAKESHORE DR	SAL01020	SAL01021	216.660	216.420	928.9	1350	137.1	0.013	1.431	0.485	0.18	2231.7	0.42	101.556	0.019	0.649	0.021	0.042	0.00	0.00	0.04	219.252	1.242	219.209	220.58	220.58	1.33	OK
LAKESHORE DR	SAL01021	SAL01022	216.421	216.210	929.0	1350	124.0	0.013	1.431	0.485	0.17	2199.6	0.42	91.852	0.019	0.649	0.021	0.038	0.00	0.00	0.04	219.209	1.438	219.171	220.80	220.80	1.59	OK
LAKESHORE DR	SAL01022	SAL01023	216.208	216.080	929.1	1350	75.6	0.013	1.431	0.485	0.17	2199.6	0.42	55.963	0.019	0.649	0.021	0.023	0.00	0.00	0.02	219.171	1.612	219.147	221.01	221.01	1.84	OK
LAKESHORE DR	SAL01023	SAL01024	216.084	215.910	929.2	1350	102.3	0.013	1.431	0.485	0.17	2199.6	0.42	75.741	0.019	0.649	0.021	0.031	0.00	0.00	0.03	219.147	1.713	219.115	220.45	220.45	1.30	OK
LAKESHORE DR	SAL01024	SAL01025	215.910	215.770	929.4	1350	82.4	0.013	1.431	0.485	0.17	2199.6	0.42	61.037	0.019	0.649	0.021	0.025	0.00	0.00	0.03	219.115	1.855	219.089	220.66	220.66	1.55	OK
LAKESHORE DR	SAL01025	Culvert Start	215.772	215.661	929.5	1350	65.3	0.013	1.431	0.485	0.17	2199.6	0.42	48.333	0.019	0.649	0.021	0.020	0.00	0.00	0.02	219.089	1.967	219.068	220.68	220.68	1.59	OK
LAKESHORE DR	Culvert Start	Culvert End	215.656	215.639	929.5	1354.055	9.9	0.013	1.440	0.486	0.17	2217.2	0.42	7.311	0.019	0.645	0.021	0.003	0.00	0.00	0.00	219.068	2.058	219.064	220.78	220.78	1.71	OK
LAKESHORE DR	Culvert End	SAL01026	215.639	215.580	929.5	1350	34.8	0.013	1.431	0.485	0.17	2199.6	0.42	25.778	0.019	0.649	0.021	0.011	0.00	0.00	0.01	219.064	2.075	219.052	220.83	220.83	1.77	OK
LAKESHORE DR	SAL01026	SAL01027	215.584	215.400	929.7	1350	108.4	0.013	1.431	0.485	0.17	2199.6	0.42	80.259	0.019	0.649	0.021	0.033	0.01	0.00	0.04	219.052	2.118	219.008	221.01	221.01	1.96	OK
LAKESHORE DR	SAL01027	SAL01028	215.400	215.330	929.7	1350	41.3	0.013	1.431	0.485	0.17	2199.6	0.42	30.615	0.019	0.650	0.022	0.013	0.01	0.00	0.02	219.008	2.258	218.985	221.46	221.46	2.45	OK
LAKESHORE DR	SAL01028	SAL01029	215.320	215.210	929.7	1350	46.3	0.013	1.431	0.485	0.24	2600.3	0.36	34.296	0.019	0.650	0.022	0.014	0.00	0.00	0.02	218.985	2.315	218.970	219.80	219.80	0.81	OK

Hydraulic Grade Line Analysis
51-75 Bradford Street
EXISTING SANITARY HGL (incl BARRIE CENTRAL)
City of Barrie

Project: 51-75 Bradford Street
Project No. 2196
Date: 11-Aug-20
Designed By: M.L.M.
Reviewed By: C.C.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Lakeshore Drive\[Sanitary HGL analysis existing conditions-w Barrie Central-Lakeshore Dr-w basements-28jul2020.xlsm]Design

EL. FROM STREETLINE TO BASEMENT (m)= 1.90
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 218.97

= Equivalent diameter to 1800x1000 box culvert
= Equivalent diameter to 1800x800 box culvert

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING'S 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
LAKESHORE DR	SAL01016	SAL01017	217.160	217.020	928.5	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.649	0.021	0.024	0.00	0.00	0.03	219.339	0.830	219.314	220.00	218.10	-1.24	Surcharge
LAKESHORE DR	SAL01017	SAL01018	217.008	216.870	928.6	1350	91.8	0.013	1.431	0.485	0.15	2066.1	0.45	68.000	0.019	0.649	0.021	0.028	0.00	0.00	0.03	219.314	0.956	219.285	220.49	218.59	-0.72	Surcharge
LAKESHORE DR	SAL01018	SAL01019	216.870	216.730	928.6	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.649	0.021	0.024	0.00	0.00	0.03	219.285	1.065	219.260	220.22	218.32	-0.97	Surcharge
LAKESHORE DR	SAL01019	SAL01020	216.728	216.660	928.7	1513.8795	45.4	0.013	1.800	0.523	0.15	2804.4	0.33	29.989	0.018	0.516	0.014	0.007	0.00	0.00	0.01	219.260	1.018	219.252	220.50	218.60	-0.66	Surcharge
LAKESHORE DR	SAL01020	SAL01021	216.660	216.420	928.9	1350	137.1	0.013	1.431	0.485	0.18	2231.7	0.42	101.556	0.019	0.649	0.021	0.042	0.00	0.00	0.04	219.252	1.242	219.209	220.58	218.68	-0.57	Surcharge
LAKESHORE DR	SAL01021	SAL01022	216.421	216.210	929.0	1350	124.0	0.013	1.431	0.485	0.17	2199.6	0.42	91.852	0.019	0.649	0.021	0.038	0.00	0.00	0.04	219.209	1.438	219.171	220.80	218.90	-0.31	Surcharge
LAKESHORE DR	SAL01022	SAL01023	216.208	216.080	929.1	1350	75.6	0.013	1.431	0.485	0.17	2199.6	0.42	55.963	0.019	0.649	0.021	0.023	0.00	0.00	0.02	219.171	1.612	219.147	221.01	219.11	-0.06	Surcharge
LAKESHORE DR	SAL01023	SAL01024	216.084	215.910	929.2	1350	102.3	0.013	1.431	0.485	0.17	2199.6	0.42	75.741	0.019	0.649	0.021	0.031	0.00	0.00	0.03	219.147	1.713	219.115	220.45	218.55	-0.60	Surcharge
LAKESHORE DR	SAL01024	SAL01025	215.910	215.770	929.4	1350	82.4	0.013	1.431	0.485	0.17	2199.6	0.42	61.037	0.019	0.649	0.021	0.025	0.00	0.00	0.03	219.115	1.855	219.089	220.66	218.76	-0.35	Surcharge
LAKESHORE DR	SAL01025	Culvert Start	215.772	215.661	929.5	1350	65.3	0.013	1.431	0.485	0.17	2199.6	0.42	48.333	0.019	0.649	0.021	0.020	0.00	0.00	0.02	219.089	1.967	219.068	220.68	218.78	-0.31	Surcharge
LAKESHORE DR	Culvert Start	Culvert End	215.656	215.639	929.5	1354.055	9.9	0.013	1.440	0.486	0.17	2217.2	0.42	7.311	0.019	0.645	0.021	0.003	0.00	0.00	0.00	219.068	2.058	219.064	220.78	218.88	-0.19	Surcharge
LAKESHORE DR	Culvert End	SAL01026	215.639	215.580	929.5	1350	34.8	0.013	1.431	0.485	0.17	2199.6	0.42	25.778	0.019	0.649	0.021	0.011	0.00	0.00	0.01	219.064	2.075	219.052	220.83	218.93	-0.13	Surcharge
LAKESHORE DR	SAL01026	SAL01027	215.584	215.400	929.7	1350	108.4	0.013	1.431	0.485	0.17	2199.6	0.42	80.259	0.019	0.649	0.021	0.033	0.01	0.00	0.04	219.052	2.118	219.008	221.01	219.11	0.06	Surcharge
LAKESHORE DR	SAL01027	SAL01028	215.400	215.330	929.7	1350	41.3	0.013	1.431	0.485	0.17	2199.6	0.42	30.615	0.019	0.650	0.022	0.013	0.01	0.00	0.02	219.008	2.258	218.985	221.46	219.56	0.55	OK
LAKESHORE DR	SAL01028	SAL01029	215.320	215.210	929.7	1350	46.3	0.013	1.431	0.485	0.24	2600.3	0.36	34.296	0.019	0.650	0.022	0.014	0.00	0.00	0.02	218.985	2.315	218.970	219.80	217.90	-1.09	Surcharge

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Lakeshore Drive - Proposed Conditions
FILE NO 2196
CONTRACT / PROJECT 51-75 Bradford Street

Numbers in blue or text in red are equations

M = 5/P^0.2 Babbit (Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.

$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)

$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC) ICI	POP. (ACC) Res	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
External Drainage Areas	Residential	SAL01016	R	1	523.19	99.4	52019		52019		2.249	2.249	304.613	523.19	52.319	356.932									
	Commercial	SAL01016	C	1	190.31	248.8889	47365	47365					123.346	190.31	19.031	142.376									
	Industrial	SAL01016	Ind	1	6.87	666.6667	4580	4580					11.927	6.87	0.687	12.614									
	Other	SAL01016			408.48		0						0.000	408.48	40.848	40.848									
	North Drainage Area	SAL01016		1	846.00	128.18	108442	108442					282.400	846.00	84.600	367.000									
Barrie Central - Inst	BARRIE CENTRAL	SAL01016	C	1	1.00	111.1	111		111																
Barrie Central - Res	BARRIE CENTRAL	SAL01016	R	341	1.76	1.7	1002		1113		3.770	3.770	10.927	2.76	0.635	11.562									
Towers 2, 3, 4 - Comm	Towers 2, 3, 4	SAL01016	C	1	0.30	248.8889	75	75					0.194	0.30	0.030	0.224									
Towers 2, 3, 4 - Res	Towers 2, 3, 4	SAL01016	R	1	2.18	1143.7	2493		2493		3.509	3.509	22.787	2.18	0.218	23.005									
Lakeshore Dr	SAL01016	SAL01017	C	1	1.56	248.8889	388	160849	55626		2.222	2.222	740.729	1981.65	198.523	939.252	80	1350	0.18%	2232.795	0.452	Ok	1.560	1.400	Ok
Lakeshore Dr	SAL01017	SAL01018	OS		0.55		0	160849	55626		2.222	2.222	740.729	1982.20	198.578	939.307	92	1350	0.15%	2067.167	0.472	Ok	1.444	1.323	Ok
Tower 1 - Res	MH5a	SAL01018	R	379	0.99	1.67	626		626		3.922	3.922	6.396	0.99	0.099	6.495	17	250	2.00%						
Tower 1 - Com	MH5a	SAL01018	C	1	0.04	248.8889	10	10					0.026	0.04	0.004	0.030	17	250	2.00%						
Lakeshore Dr	SAL01018	SAL01019	OS		0.49		0	160859	56252		2.217	2.217	743.727	1983.72	198.730	942.457	80	1350	0.18%	2232.795	0.453	Ok	1.560	1.402	Ok
Lakeshore Dr	SAL01019	SAL01020	OS		0.27		0	160859	56252		2.217	2.217	743.727	1983.99	198.757	942.484	45	1514	0.15%	2805.836	0.336	Ok	1.559	1.559	Ok
Lakeshore Dr	SAL01020	SAL01021	OS		1.95		0	160859	56252		2.217	2.217	743.727	1985.94	198.952	942.679	137	1350	0.18%	2232.795	0.453	Ok	1.560	1.402	Ok
Lakeshore Dr	SAL01021	SAL01022	OS		1.50		0	160859	56252		2.217	2.217	743.727	1987.44	199.102	942.829	124	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01022	SAL01023	OS		1.00		0	160859	56252		2.217	2.217	743.727	1988.44	199.202	942.929	76	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01023	SAL01024	OS		1.31		0	160859	56252		2.217	2.217	743.727	1989.75	199.333	943.060	102	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01024	SAL01025	OS		1.06		0	160859	56252		2.217	2.217	743.727	1990.81	199.439	943.166	82	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01025	Culvert Start	OS		1.48		0	160859	56252		2.217	2.217	743.727	1992.29	199.587	943.314	65	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	Culvert Start	Culvert End			0.00		0	160859	56252		2.217	2.217	743.727	1992.29	199.587	943.314	10	1354	0.17%	2218.338	0.425	Ok	1.541	1.541	Ok
Lakeshore Dr	Culvert End	SAL01026			0.00		0	160859	56252		2.217	2.217	743.727	1992.29	199.587	943.314	35	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01026	SAL01027	OS		1.58		0	160859	56252		2.217	2.217	743.727	1993.87	199.745	943.472	108	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01027	SAL01028	OS		0.29		0	160859	56252		2.217	2.217	743.727	1994.16	199.774	943.501	41	1350	0.17%	2200.667	0.457	Ok	1.537	1.387	Ok
Lakeshore Dr	SAL01028	SAL01029	OS		0.36		0	160859	56252		2.217	2.217	743.727	1994.52	199.810	943.537	46	1350	0.24%	2601.571	0.416	Ok	1.818	1.566	Ok

DATE: 11/08/2020 CALCULATED BY: M.M. CHECKED BY: C.C.

Notes:

(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity
(5) Density PPU for commercial use is equivalent to flow rate of 28 cu.m/ha day, including commercial peaking factor of 2.0 per Barrie Sanitary Guidelines Sections 3.3.2
(6) Density PPU for industrial use is equivalent to flow rate of 50 cu.m/ha day, including industrial peaking factor of 3.0 per Barrie Sanitary Guidelines Sections 3.3.3
(7) Refer to External Drainage Areas Summary Sheet for area breakdowns
(8) = Flow calculation per Barrie Central Development FSR (June 2019)
(9) = Equivalent diameter to 1800x1000 box culvert
(10) = Equivalent diameter to 1800x800 box culvert

Hydraulic Grade Line Analysis
51-75 Bradford Street
PROPOSED SANITARY HGL
City of Barrie

Project: 51-75 Bradford Street
Project No. 2196
Date: 11-Aug-20
Designed By: M.L.M.
Reviewed By: C.C.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Lakeshore Drive\[Sanitary HGL analysis-Lakeshore Dr-28jul2020.xlsm]Design

EL. FROM STREETLINE TO BASEMENT (m)= 0.00
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 218.97

= Equivalent diameter to 1800x1000 box culvert
= Equivalent diameter to 1800x800 box culvert

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING'S 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
LAKESHORE DR	SAL01016	SAL01017	217.160	217.020	939.3	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.656	0.022	0.025	0.00	0.00	0.03	219.350	0.840	219.324	220.00	220.00	0.65	OK
LAKESHORE DR	SAL01017	SAL01018	217.008	216.870	939.3	1350	91.8	0.013	1.431	0.485	0.15	2066.1	0.45	68.000	0.019	0.656	0.022	0.028	0.00	0.00	0.03	219.324	0.967	219.295	220.49	220.49	1.17	OK
TOWER 1	MH5a	SAL01018	218.516	218.180	6.5	250	16.8	0.013	0.049	0.157	2.00	84.1	0.08	67.200	0.033	0.133	0.001	0.002	0.00	0.00	0.00	219.297	0.531	219.295	220.00	220.00	0.70	OK
LAKESHORE DR	SAL01018	SAL01019	216.870	216.730	942.5	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.658	0.022	0.025	0.00	0.00	0.03	219.295	1.075	219.269	220.22	220.22	0.93	OK
LAKESHORE DR	SAL01019	SAL01020	216.728	216.660	942.5	1513.8795	45.4	0.013	1.800	0.523	0.15	2804.4	0.34	29.989	0.018	0.524	0.014	0.008	0.00	0.00	0.01	219.269	1.027	219.260	220.50	220.50	1.23	OK
LAKESHORE DR	SAL01020	SAL01021	216.660	216.420	942.7	1350	137.1	0.013	1.431	0.485	0.18	2231.7	0.42	101.556	0.019	0.659	0.022	0.043	0.00	0.00	0.04	219.260	1.250	219.216	220.58	220.58	1.32	OK
LAKESHORE DR	SAL01021	SAL01022	216.421	216.210	942.8	1350	124.0	0.013	1.431	0.485	0.17	2199.6	0.43	91.852	0.019	0.659	0.022	0.039	0.00	0.00	0.04	219.216	1.446	219.177	220.80	220.80	1.58	OK
LAKESHORE DR	SAL01022	SAL01023	216.208	216.080	942.9	1350	75.6	0.013	1.431	0.485	0.17	2199.6	0.43	55.963	0.019	0.659	0.022	0.024	0.00	0.00	0.02	219.177	1.618	219.152	221.01	221.01	1.83	OK
LAKESHORE DR	SAL01023	SAL01024	216.084	215.910	943.1	1350	102.3	0.013	1.431	0.485	0.17	2199.6	0.43	75.741	0.019	0.659	0.022	0.032	0.00	0.00	0.03	219.152	1.718	219.119	220.45	220.45	1.30	OK
LAKESHORE DR	SAL01024	SAL01025	215.910	215.770	943.2	1350	82.4	0.013	1.431	0.485	0.17	2199.6	0.43	61.037	0.019	0.659	0.022	0.026	0.00	0.00	0.03	219.119	1.859	219.092	220.66	220.66	1.54	OK
LAKESHORE DR	SAL01025	Culvert Start	215.772	215.661	943.3	1350	65.3	0.013	1.431	0.485	0.17	2199.6	0.43	48.333	0.019	0.659	0.022	0.020	0.00	0.00	0.02	219.092	1.970	219.071	220.68	220.68	1.59	OK
LAKESHORE DR	Culvert Start	Culvert End	215.656	215.639	943.3	1354.055	9.9	0.013	1.440	0.486	0.17	2217.2	0.43	7.311	0.019	0.655	0.022	0.003	0.00	0.00	0.00	219.071	2.061	219.066	220.78	220.78	1.71	OK
LAKESHORE DR	Culvert End	SAL01026	215.639	215.580	943.3	1350	34.8	0.013	1.431	0.485	0.17	2199.6	0.43	25.778	0.019	0.659	0.022	0.011	0.00	0.00	0.01	219.066	2.077	219.054	220.83	220.83	1.76	OK
LAKESHORE DR	SAL01026	SAL01027	215.584	215.400	943.5	1350	108.4	0.013	1.431	0.485	0.17	2199.6	0.43	80.259	0.019	0.659	0.022	0.034	0.01	0.00	0.04	219.054	2.120	219.010	221.01	221.01	1.96	OK
LAKESHORE DR	SAL01027	SAL01028	215.400	215.330	943.5	1350	41.3	0.013	1.431	0.485	0.17	2199.6	0.43	30.615	0.019	0.659	0.022	0.013	0.01	0.00	0.02	219.010	2.259	218.986	221.46	221.46	2.45	OK
LAKESHORE DR	SAL01028	SAL01029	215.320	215.210	943.5	1350	46.3	0.013	1.431	0.485	0.24	2600.3	0.36	34.296	0.019	0.659	0.022	0.014	0.00	0.00	0.02	218.986	2.316	218.970	219.80	219.80	0.81	OK

Hydraulic Grade Line Analysis
51-75 Bradford Street
PROPOSED SANITARY HGL
City of Barrie

Project: 51-75 Bradford Street
Project No. 2196
Date: 11-Aug-20
Designed By: M.L.M.
Reviewed By: C.C.

P:\2196 51-75 Bradford Street\Design\Pipe Design\Sanitary\Lakeshore Drive\[Sanitary HGL analysis-Lakeshore Dr-w basements-28jul2020.xlsm]Design

EL. FROM STREETLINE TO BASEMENT (m)= 1.90
ALLOWABLE DISTANCE FROM BASEMENT TO HGL (m)= 0.50
STARTING DOWNSTREAM HGL (if above obvert) (m) = 218.97

= Equivalent diameter to 1800x1000 box culvert
= Equivalent diameter to 1800x800 box culvert

LOCATION			INVERTS		FLOW	PIPE DATA								PIPE LOSS CALCULATIONS					MH LOSS CALCULATIONS		TOTAL LOSS	HYDRAULIC GRADE LINE			HGL VS. BASEMENT SEPARATION			
STREET	FROM (U/S)	TO (D/S)	U/S (m)	D/S (m)	TOTAL PIPE FLOW (Qdes) (L/s)	PIPE DIAMETER (mm)	LENGTH (m)	MANNING's 'n'	PIPE AREA (m2)	HYD. RAD$^{2/3}$	SLOPE (%)	Qcap. (L/s)	Qdes/Qcap (%)	L/D	f	Vf	$V^2/2g$	TOTAL PIPE LOSS (m)	MH LOSS (m)	PIPE BEND LOSS (m)	TOTAL LOSS (m)	HGL (U/S) (m)	HGL SURCHARGE ABOVE U/S OBV. (m)	HGL (D/S) (m)	MH TOP (U/S) (m)	BASEMENT ELEV. (U/S) (m)	HGL TO BASEMENT (U/S) (m)	CHECK
LAKESHORE DR	SAL01016	SAL01017	217.160	217.020	939.3	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.656	0.022	0.025	0.00	0.00	0.03	219.350	0.840	219.324	220.00	218.10	-1.25	Surcharge
LAKESHORE DR	SAL01017	SAL01018	217.008	216.870	939.3	1350	91.8	0.013	1.431	0.485	0.15	2066.1	0.45	68.000	0.019	0.656	0.022	0.028	0.00	0.00	0.03	219.324	0.967	219.295	220.49	218.59	-0.73	Surcharge
TOWER 1	MH5a	SAL01018	218.516	218.180	6.5	250	16.8	0.013	0.049	0.157	2.00	84.1	0.08	67.200	0.033	0.133	0.001	0.002	0.00	0.00	0.00	219.297	0.531	219.295	220.00	218.10	-1.20	Surcharge
LAKESHORE DR	SAL01018	SAL01019	216.870	216.730	942.5	1350	79.9	0.013	1.431	0.485	0.18	2231.7	0.42	59.185	0.019	0.658	0.022	0.025	0.00	0.00	0.03	219.295	1.075	219.269	220.22	218.32	-0.97	Surcharge
LAKESHORE DR	SAL01019	SAL01020	216.728	216.660	942.5	1513.8795	45.4	0.013	1.800	0.523	0.15	2804.4	0.34	29.989	0.018	0.524	0.014	0.008	0.00	0.00	0.01	219.269	1.027	219.260	220.50	218.60	-0.67	Surcharge
LAKESHORE DR	SAL01020	SAL01021	216.660	216.420	942.7	1350	137.1	0.013	1.431	0.485	0.18	2231.7	0.42	101.556	0.019	0.659	0.022	0.043	0.00	0.00	0.04	219.260	1.250	219.216	220.58	218.68	-0.58	Surcharge
LAKESHORE DR	SAL01021	SAL01022	216.421	216.210	942.8	1350	124.0	0.013	1.431	0.485	0.17	2199.6	0.43	91.852	0.019	0.659	0.022	0.039	0.00	0.00	0.04	219.216	1.446	219.177	220.80	218.90	-0.32	Surcharge
LAKESHORE DR	SAL01022	SAL01023	216.208	216.080	942.9	1350	75.6	0.013	1.431	0.485	0.17	2199.6	0.43	55.963	0.019	0.659	0.022	0.024	0.00	0.00	0.02	219.177	1.618	219.152	221.01	219.11	-0.07	Surcharge
LAKESHORE DR	SAL01023	SAL01024	216.084	215.910	943.1	1350	102.3	0.013	1.431	0.485	0.17	2199.6	0.43	75.741	0.019	0.659	0.022	0.032	0.00	0.00	0.03	219.152	1.718	219.119	220.45	218.55	-0.60	Surcharge
LAKESHORE DR	SAL01024	SAL01025	215.910	215.770	943.2	1350	82.4	0.013	1.431	0.485	0.17	2199.6	0.43	61.037	0.019	0.659	0.022	0.026	0.00	0.00	0.03	219.119	1.859	219.092	220.66	218.76	-0.36	Surcharge
LAKESHORE DR	SAL01025	Culvert Start	215.772	215.661	943.3	1350	65.3	0.013	1.431	0.485	0.17	2199.6	0.43	48.333	0.019	0.659	0.022	0.020	0.00	0.00	0.02	219.092	1.970	219.071	220.68	218.78	-0.31	Surcharge
LAKESHORE DR	Culvert Start	Culvert End	215.656	215.639	943.3	1354.055	9.9	0.013	1.440	0.486	0.17	2217.2	0.43	7.311	0.019	0.655	0.022	0.003	0.00	0.00	0.00	219.071	2.061	219.066	220.78	218.88	-0.19	Surcharge
LAKESHORE DR	Culvert End	SAL01026	215.639	215.580	943.3	1350	34.8	0.013	1.431	0.485	0.17	2199.6	0.43	25.778	0.019	0.659	0.022	0.011	0.00	0.00	0.01	219.066	2.077	219.054	220.83	218.93	-0.14	Surcharge
LAKESHORE DR	SAL01026	SAL01027	215.584	215.400	943.5	1350	108.4	0.013	1.431	0.485	0.17	2199.6	0.43	80.259	0.019	0.659	0.022	0.034	0.01	0.00	0.04	219.054	2.120	219.010	221.01	219.11	0.06	Surcharge
LAKESHORE DR	SAL01027	SAL01028	215.400	215.330	943.5	1350	41.3	0.013	1.431	0.485	0.17	2199.6	0.43	30.615	0.019	0.659	0.022	0.013	0.01	0.00	0.02	219.010	2.259	218.986	221.46	219.56	0.55	OK
LAKESHORE DR	SAL01028	SAL01029	215.320	215.210	943.5	1350	46.3	0.013	1.431	0.485	0.24	2600.3	0.36	34.296	0.019	0.659	0.022	0.014	0.00	0.00	0.02	218.986	2.316	218.970	219.80	217.90	-1.09	Surcharge

APPENDIX G

WATER MODELLING ANALYSIS



Municipal Engineering Solutions

December 17, 2019 Project No. 17002-70

Sent via email
Mr. Victor Szeghalmi
SCS Consulting Group Ltd.
30 Centurian Drive, Suite 100
Markham, ON,
L3R 8B8

Subject: Bradford Street Development Watermain Analysis
City of Barrie

Dear Mr. Szeghalmi,

We are pleased to submit our report entitled "Bradford Street Development Watermain Analysis" outlining the results of our water distribution analysis for a high-rise residential development in the City of Barrie.

This development was incorporated into an Infowater sub-model of the development site and modeled utilizing the design information provided to Municipal Engineering Solutions. The findings of our analysis are summarized in the following report.

We trust you find this report satisfactory. Should you have any questions or require further clarification, please call.

Yours truly,

Municipal Engineering Solutions

Per: John C. Bourrie, P.Eng.

/LMC

File Location: D:\Projects\2019\19-030 Bradford St Barrie SCS 17002-70\3.0 Report\Final Report\17002-70_Bradford St Watermain Analysis_20191217.docx

55 Gilbank Drive, Aurora, Ontario L4G 6H9

Tel: 905.726.1016 Cell: 416.434.0186 Fax: 905.726.1225

BRADFORD STREET DEVELOPMENT

WATERMAIN ANALYSIS

PREPARED BY:

MUNICIPAL ENGINEERING SOLUTIONS

FOR:

SCS CONSULTING GROUP LTD.
December 2019

Project Number: 17002-70

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APPENDICES

Appendix A Demands
Appendix B Model Results

Section 1 – INTRODUCTION

Municipal Engineering Solutions ("MES") was retained by SCS Consulting Group Ltd. to conduct a hydraulic water analysis for the proposed Bradford Street Development located in the City of Barrie. As part of this hydraulic assessment MES was requested to undertake the following:

1. Calculate/verify water demands for the proposed development using City of Barrie, provincial and industry design standards;
2. Add the subject watermains/development/boundary information to a development water model;
3. Run the model to size the subject mains to achieve service criteria during Minimum Hour, Peak Hour and fire flow during Maximum Day demand; and
4. Prepare a Report summarizing the modeling results for agency review and design purposes.

1.1 Development Background

The Bradford Street Development site is located between Bradford Street and Lakeshore Drive south of Simcoe Street in the City of Barrie. The residential development consists of four high-rise towers that are a combination of 1,900 residential apartments, 3,371 m^2 of commercial area and 152 hotel rooms. The demands for the site are shown in **Appendix A**. The proposed development is shown below on **Figure 1**.

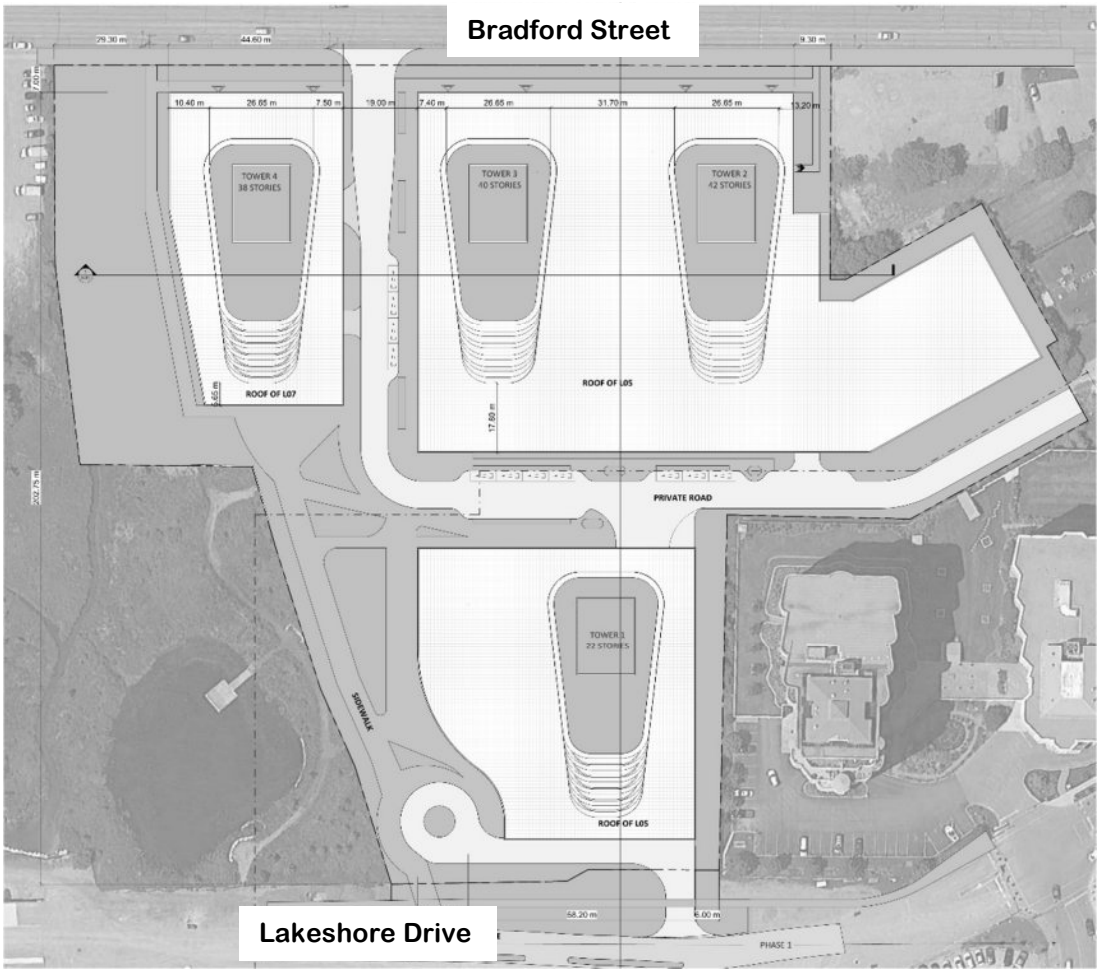


Figure 1 - Proposed Bradford Street Development

Section 2 – WATERMAIN DESIGN CRITERIA

The design criteria utilized to estimate the water demands for the hydraulic water model follows general industry standards and is calculated using the design criteria and guidelines outlined in the City of Barrie Water Transmission & Distribution Policies Design Guidelines, the Ministry of the Environment Conservation and Parks (MECP) Watermain Design Criteria, and the Fire Underwriters Survey.

The following sections summarize the specific design criteria used to carry out the hydraulic watermain assessment for this development.

2.1 Equivalent Population Densities & Water Design Factors

To calculate the equivalent population and water design factors for this development MES used City of Barrie standard population densities as noted in the *"Water Transmission & Distribution Policies Design Guidelines Dec 2017"* and *"Sanitary Sewage Collection System Policies and Design Guidelines Oct 2017"*. **Table 1** summarizes the population densities and **Table 2** summarizes the average daily demand and peaking factors used for this analysis.

Table 1 – Equivalent Population Density

Type of Development	Population
Single Family	3.13 ppu
Townhouse	2.34 ppu
Apartment	1.67 ppu
Light Commercial	142 persons/ha

Source: Sanitary Sewage Collection System Policies & Design Guidelines Oct 2017

Table 2 - Water Design Factors

Type of Development	Average Daily Demand (L per capita)	Minimum Hour Peaking Factor	Maximum Daily Peaking Factor	Peak Hour Peaking Factor
Residential & ICI	225	0.5	2.0	3.0

Source: Water Transmission & Distribution Policies & Design Guidelines Dec 2017, Sanitary Sewage Collection System Policies & Design Guidelines Oct 2017 and MECP

Section 3 –FLOW DEMANDS

Utilizing the equivalent population data from Table 1 and the corresponding Average Day and Maximum Day data from Table 2 the water demands for this development were calculated.

3.1 Equivalent Population Flow Demands

The calculated demands for the development are summarized in **Table 3**. For additional details on the development water demands and assigned demand nodes used in the water model see **Appendix A**.

Table 3 – Water Demand for Bradford Street Development

	Average Day Demand (L/S)	Minimum Hour Demand (L/S)	Maximum Day Demand (L/S)	Peak Hour Demand (L/S)
Bradford Street Development	9.37	4.69	18.74	28.11

3.2 Fire Flow Demands

The fire demands for this development are based on the City of Barrie Engineering Design Standards & Criteria, December 2017. The City's 'Preferred' fire flows are shown in **Table 4**.

Table 4 – City Criteria Fire Flow Requirements

Type of Development	Fire Flow (L/S)
Single Family Homes	76
Townhomes	None
Institutional/Convenience Commercial	114
Industrial/ Commercial	152
Downtown Commercial	189

Source: City of Barrie Engineering Design Standards & Criteria, December 2017

It should be noted that the site will comprise mainly of apartments and the City's criteria does not have values for apartments. The most recent City of Barrie "*Water Storage and Distribution Master Plan Oct 2013*" reviewed the City's fire flows. The report did breakdown the types of land use differently and increased the flows for ICI developments and included an apartment fire flow of 117 L/s. However, based on the proximity of this development to the Downtown area, the Downtown Commercial flow (189 L/s) was assumed for this report for all buildings.

3.3 External Demands

The hydrant test results would have considered external demands.

Section 4 – OTHER SYSTEM REQUIREMENTS

4.1 System Pressure Requirements

In addition to meeting the various flow requirements, the system must also satisfy minimum and maximum pressure requirements as outlined by the City of Barrie. The City's pressure requirements are outlined in the Design Criteria and stipulate the following:

1. The minimum system pressure shall not be less than 140 kPa (20 psi) at any point in the water system under fire flow conditions.
2. The minimum pressure shall be 350 kPa (50 psi).
3. The maximum pressure shall be 550 kPa (80 psi). Pressure reducing valves may need to be installed on individual services.

4.2 Watermain Sizing

The City of Barrie also stipulates that all watermains are adequately sized to maintain demand flows at the required pressures without causing excessive energy loss or result in water quality decay. The watermain system must therefore be designed to accommodate the Maximum day plus fire demand.

For distribution systems providing fire protection the minimum pipe size shall be 150 mm diameter in accordance with Ministry of the Environment Conservation and Parks (MECP) and NFPA requirements.

To provide appropriate fire protection, reliable supply and pressures the water distribution system should be looped wherever possible to improve supply security and water quality and also have two connections to the existing system where possible.

4.3 Watermain C-Factor

In designing and modeling of the pipes the Coefficient of Roughness (C-Factor) factors are not mentioned in the design criteria. The C-Factor were based on those stated in the MECP criteria. The Coefficient of Roughness assigned to each pipe size in summarized in **Table 5** below.

Table 5 - Hazen-Williams Coefficient of Roughness (C-Factors)

Size of Pipe (Diameter in mm)	Coefficient of Roughness (C)
150 mm	100
200 mm to 250 mm	110
Greater Than 300 mm	120

Source: MECP

Section 5 – ANALYSIS & MODELING RESULTS

To conduct the hydraulic water analysis for the proposed development the water demands were estimated by MES using the design criteria previously discussed and incorporated the demands into an InfoWater model provided by the City. The following sections discusses the model setup and results.

5.1 Model Setup

The Bradford Street Development is located within the City of Barrie water system in the 1 Zone that has top water elevation of 281.2 m. Elevations within the development range from 220 m to 2248 m and should be adequately serviced by this zone.

The development was modeled under existing conditions to confirm that the development could be serviced from the existing watermains on Bradford Street and Lakeshore Drive. Three hydrant tests were performed on the surrounding streets. Boundary conditions were based on the hydrant test on Bradford Street north of Simcoe Street as it had the best results and hydrants located close to the watermain. The hydrants for the other two tests have long hydrant leads reducing the accuracy of the watermain capabilities. All three test results are included in **Appendix B.**

Fire flows were based on the flow noted in **Table 4**. Nodes were created to add the flow demands and service elevation information from the development to the Infowater hydraulic water model and the development analysis was carried out. Friction factor for the pipes were assigned according to **Table 5**.

5.2 Watermain Sizing and System Pressures

The analysis was conducted under existing and future servicing conditions for Minimum Hour, Peak Hour, Maximum Day and Maximum day plus Fire demands to size the watermains and meet the pressure requirements. The pipe size and layout are shown in **Appendix B**.

The Bradford Street Development is located between Bradford Street and Lakeshore Drive. Three of the proposed apartment buildings, fronting on Bradford Street will be supplied from the existing Bradford Street 300 mm watermain via two connections to each building (building code requirement for high rises exceeding 84 m in height) – one fire only connection and one combined fire and domestic supply. The residential/hotel building will be supplied from a single combined fire and domestic supply from the existing 300 mm watermain on Lakeshore Drive.

The pressures will be above the Ontario Building Code (OBC) pressure of 80 psi (550 kPa) in all demand scenarios. Pressure reduction will be necessary to maintain pressures below this limit.

Modeled service pressures are summarized in **Table 6**. Fire flow demand can be met under maximum day conditions under existing conditions based on the assumptions outlined in this report. Detailed pipe and node tables for the various scenarios modelled are attached to this report in **Appendix B**.

Table 6- Modeled Service Pressures

Scenario	Minimum Hour	Maximum Day	Peak Hour	Max. Day + Fire
Existing Conditions	85.2 to 90.9 psi (587 to 627 kPa)	84.8 to 90.4 psi (585 to 624 kPa)	84.3 to 89.8 psi (581 to 619 kPa)	194 to 241 L/s @ 20 psi (140 kPa)

Section 6 – CONCLUSIONS/RECOMMENDATIONS

The proposed supply watermains for the Bradford Street Development can achieve hydraulic requirements as prescribed by the City of Barrie watermain design criteria as summarized below.

- The service pressures are expected to range from 84.3 to 90.9 psi (581 to 627 kPa) under existing conditions.
- Pressure reducing valves will be required to meet the OBC requirements. Pressures are above 550 kPa (80 psi) in all demand scenarios modeled.
- The available fire flow within the site meets or exceeds the fire flow demands as noted in Table 4 at the minimum pressure of 20 psi (140 kPa) based on the proposed watermain configuration.
- It should be noted that the theoretical available fire flow to this site, based on the modeling and assumptions in this report, are only slightly greater than the fire flow required (i.e. 189L/s required vs. 194 L/s available). As such, it is possible that the actual available fire flow for this development, at the time of construction, may be lower than indicated within this report and that the final building design will need to be designed to suit the available flow and pressure at the time of construction.
- Should it be determined, based on the final site, building design and discussions with the City, that greater fire flows than those noted in Table 4 are required or fire flows must be calculated using the Fire Underwriters survey formula, the fire flows must be reviewed and updated where necessary.
- Once the building designs have been completed all fire flow requirements, including all theoretical modeled fire flows and pressures noted within this report, must be confirmed prior to construction.
- Required fire flows for all proposed buildings must be confirmed with the appropriate designer (architect or mechanical designer) as well as the City to determine the appropriate level of fire protection required.
- The hydrant test used for the boundary conditions provides a snapshot of the system performance and does not capture the system variations as accurately as boundary information from a calibrated model or system monitoring. The City of Barrie must confirm that the results presented in this report are in keeping with the pressures and flows currently measured in this area.
- Confirmation and/or changes to the criteria should also be provided to and reviewed with MES prior to the construction of the watermain system. Final design parameters are to be provided to MES prior to construction for further review to confirm that the actual (final) site conditions and building design(s) reflect those modeled by MES within this report.
- This report, including all modeling assumptions used, is to be submitted to and reviewed by the water operating authority (municipality) to confirm that the modeling parameters used are acceptable to the operating authority and/or confirm if modified domestic or fire flow requirements are required or should be implemented for this particular development.

Appendix A

Demands

Barrie Design Criteria

Water Transmission & Distribution Policies Design Guidelines Dec 2017 (unless otherwise stated)

Equivalent Population by Unit

(Sanitary Sewage Collection System Policies and Design Guidelines Oct 2017 for population and Average Day Demand)

Type of Development	Equivalent Population Density *(Person/Unit)*
Single Family or Semi-Detached	3.13
Townhouse	2.34
Apartment	1.67

Equivalent Population by Area

Type of Development	Equivalent Population Density *(Person/Hectare)*	Average Day Demands *(m3/ha/day)*
Single Family, Duplex, Semis	78.25	
Triplex and 4-plex	81.9	
Townhouse	110	
Apartments (>6 stories)	500	
Light Commercial Areas	124	28.00
Community Services	124	28.00
Light Industrial Areas	155	35.00
Hospitals (persons/bed)		

Water Design Factors

Average Daily Demand (m3/capita)	0.225	
Minimum Hourly Demand P.F.	0.5	MECP (3001-10000 Persons)
Maximum Daily Demand P.F.	2	MECP
Maximum Hourly Demand P.F.		
Residential	*3*	MECP
I/C/I	*3*	MECP

Cofficient of Roughness

Size of Pipe (mm Dia.)	Coefficient of Roughness (C)
150	130
200-250	130
300-600	130
Over 600	130

Minimum Pipe Size

Type of Development	Size of Pipe (mm Dia.)
Designed for Fire Protection	150
Domestic supply only	75

Working Pressures

Parameter	Pressure
Normal Condition	
Minimum Pressure	345kPa (50 psi)
Maximum (Building Code)	550 kPa (80 psi)
Maximum	620 kPa (90 psi)
Fire Flow Conditions	
Minimum Pressure	140 kPa (20 psi)

Water Demand
Bradford Street, Innisfil, ON
December 17, 2019

Municipal Engineering Solutions

Node	Note	Elevation	Type of Development		Equivalent Population		Demands				Fire Flow Demands
			Apartments	Commercial	Total Population	Total Population	ADD	MHD	MDD	PHD	
		(m)	*(units)*	*(ha)*	*(Residential)*	*(ICI)*	*(L/s)*	*(L/s)*	*(L/s)*	*(L/s)*	*(L/s)*
J-100		221.19			0	0	0.00	0.00	0.00	0.00	
J-101		221.63			0	0	0.00	0.00	0.00	0.00	
J-102		221.85			0	0	0.00	0.00	0.00	0.00	
J-103		224.00			0	0	0.00	0.00	0.00	0.00	
J-104		224.10			0	0	0.00	0.00	0.00	0.00	
J-105		221.50			0	0	0.00	0.00	0.00	0.00	
J-106		220.67			0	0	0.00	0.00	0.00	0.00	
J-109		222.00			0	0	0.00	0.00	0.00	0.00	
J-110	T4 Fire	222.00			0	0	0.00	0.00	0.00	0.00	189
J-111	T4 Dom	222.00	464	*0.1*	775	12	2.05	1.03	4.10	6.15	
J-112		222.00			0	0	0.00	0.00	0.00	0.00	
J-113	T2 Fire	222.00			0	0	0.00	0.00	0.00	0.00	189
J-114	T2 Dom	222.00	569	*0.12*	950	15	2.51	1.26	5.03	7.54	
J-115		222.00			0	0	0.00	0.00	0.00	0.00	
J-116	T3 Fire	222.00			0	0	0.00	0.00	0.00	0.00	189
J-117	T3 Dom	222.00	535	*0.12*	893	15	2.37	1.18	4.73	7.10	
J-118		220.00			0	0	0.00	0.00	0.00	0.00	
J-119	T1 Fire	220.00			0	0	0.00	0.00	0.00	0.00	189
J-120	T1 Dom	220.00	484	*1.05*	808	130	2.44	1.22	4.89	7.33	
J-121		221.19			0	0	0.00	0.00	0.00	0.00	
J-122	T4 Fire	222.00			0	0	0.00	0.00	0.00	0.00	189
J-123		221.65			0	0	0.00	0.00	0.00	0.00	
J-124	T2 Fire	222.00			0	0	0.00	0.00	0.00	0.00	189
J-125		221.82			0	0	0.00	0.00	0.00	0.00	
J-126	T3 Fire	222.00			0	0	0.00	0.00	0.00	0.00	189
J-127		221.69			0	0	0.00	0.00	0.00	0.00	
J-128		221.35			0	0	0.00	0.00	0.00	0.00	
J-129		222.12			0	0	0.00	0.00	0.00	0.00	
J-130		221.13			0	0	0.00	0.00	0.00	0.00	
J-132		222.55			0	0	0.00	0.00	0.00	0.00	
J-133		221.36			0	0	0.00	0.00	0.00	0.00	
J-134		222.49			0	0	0.00	0.00	0.00	0.00	
Total			**2052**	**1.39**	**3427**	**172**	**9.37**	**4.69**	**18.74**	**28.11**	

Location Maps: Checkley Street



Fire Flow Test Report: Checkley Street

Owner:	City of Barrie
Project Number:	Smart Centres
Test Number:	3

Date:	Tuesday, October 29, 2019
Time:	13:59:00 AM

	Location	Address	Hydrant Number
Q1	Flow Hydrant	Simcoe Street / Checkley Street	H3830
Q2	Flow Hydrant		
R2	Residual Hydrant		
R1	Residual Hydrant	Bradford Street / High Street	H3514

Material	HDPE		
Age	Years		
Nominal Diameter	Inches	8	
Internal Diameter	Inches	8	
Area	Sq. Feet	0.342	
Hydraulic Perimeter	Feet		
Number of Tests	1		

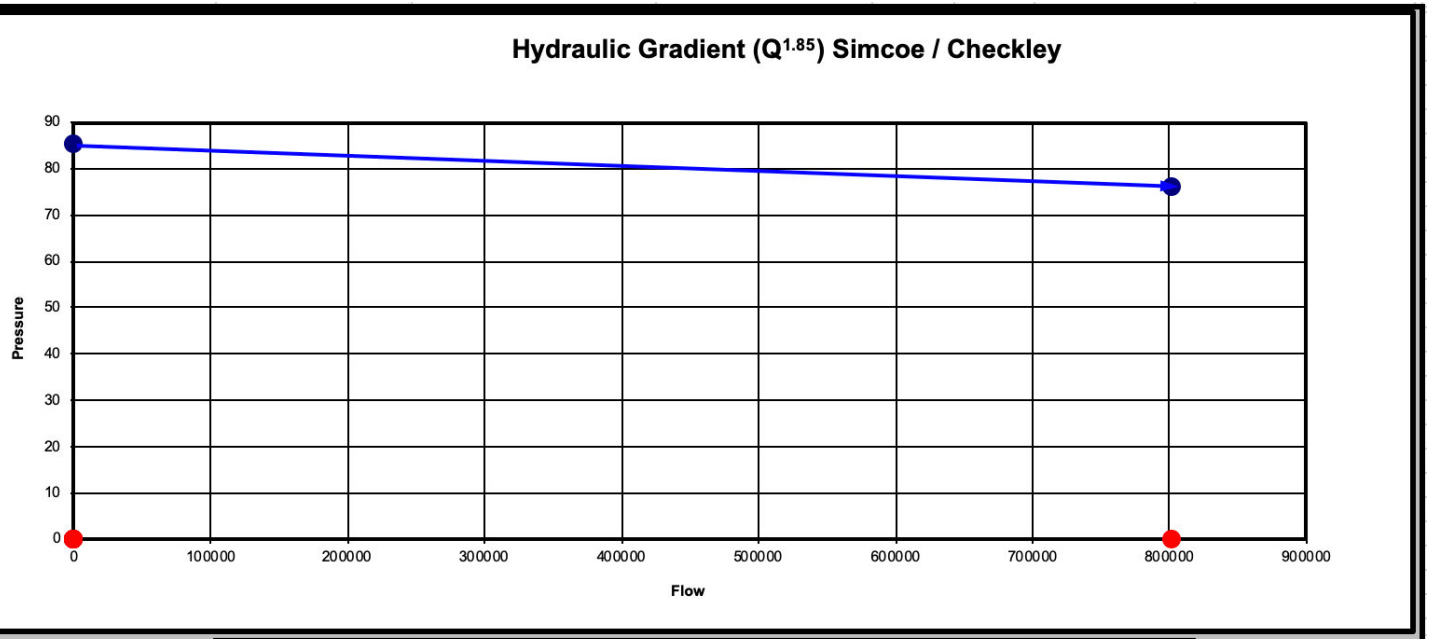
Static Pressure	**R1**	**R2**	PSI
	85		

						Flow		**Residual Pressure**	
Test	Configuration	Pitot 1	Pitot 2	Pitot 3	Pitot 4	Nozzle Coefficient	USGPM	R1	R2
A	1 X 2.5"	HoseMonster							
B	2 X 2.5"	HoseMonster				0.9	1554	76.0	
C							0		
D							0		
E							0		
F							0		
G							0		
H							0		
I							0		

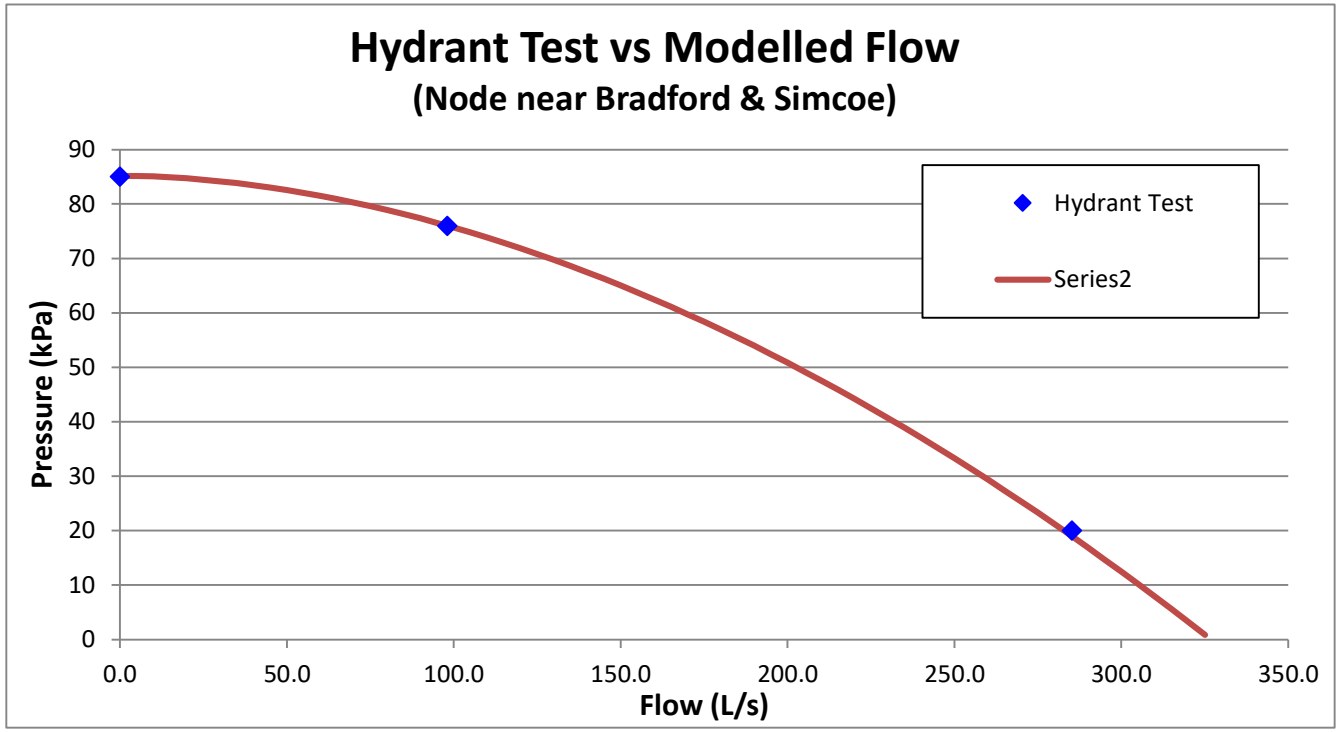
Test	**Flow Characteristics**				**Projected Flow @ 20 PSI**		**NFPA Rating**	
	Velocity (fps)	USGPM	MGD	cu. ft per min	R1	R2	**R1**	**R2**
A								
B	10.123	1554	2.2	3.462	4520		CLASS AA - BLUE	
C					0			
D					0			
E					0			
F					0			
G					0			
H					0			
I					0			

Notes	

Fire Flow Test Report and Hydraulic Graph: Checkley Street

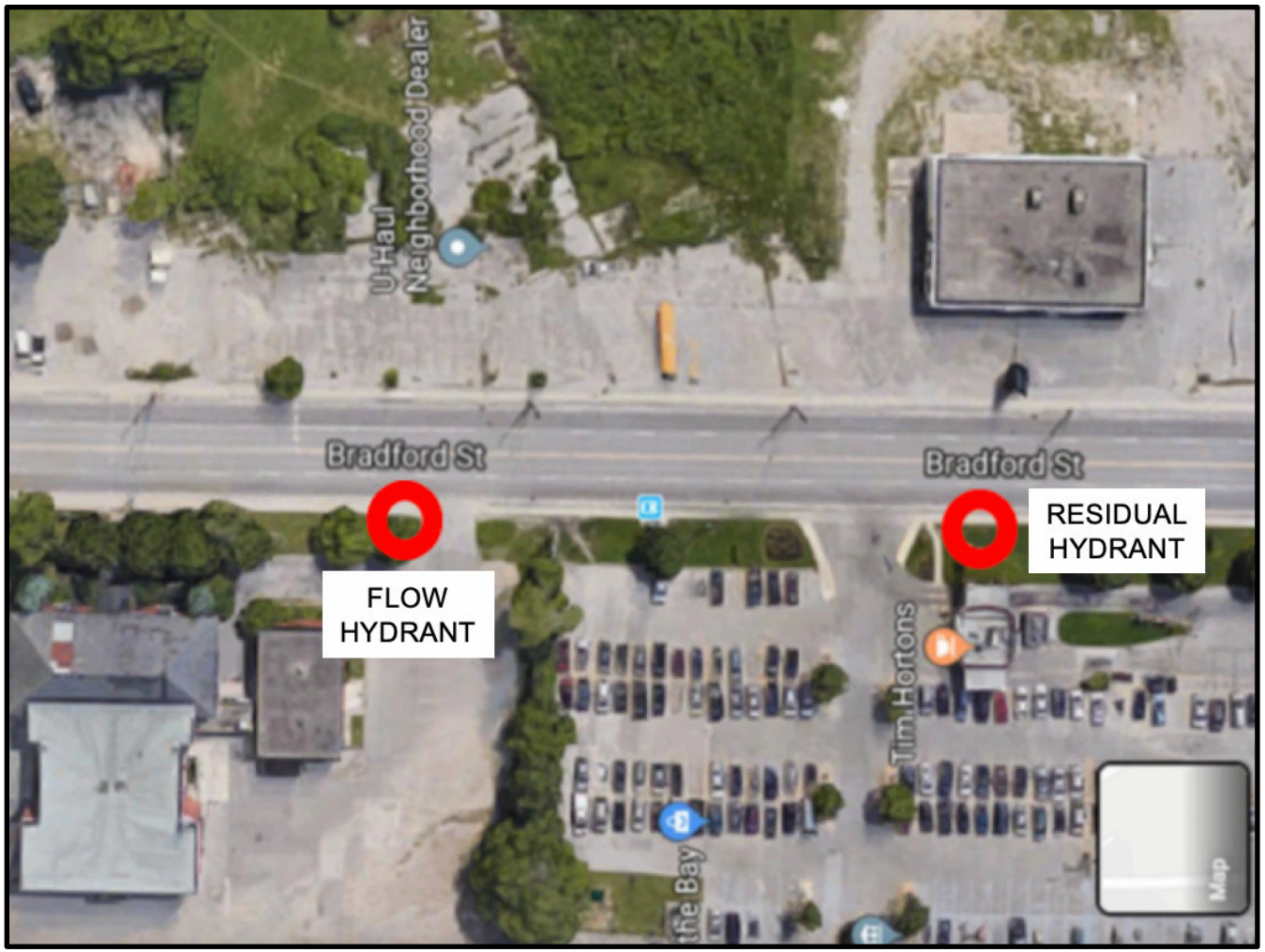


Test	Flow (USGPM)	Flow ($Q^{1.85}$)	R1	R1
Static	0	0	85	0
A	0	0	0	0
B	1554	802018.4826	76	0
C	0	0	0	0
D	0	0	0	0
E	0	0	0	0
F	0	0	0	0
G	0	0	0	0
H	0	0	0	0



	Static Pressure	Residual Pressure	Test Flow	Theoretical Flow at 20 psi (140 kPa)
	(psi)	(psi)	(L/s)	(L/s)
Hydrant Test	85.0	76.0	98.0	285.2
Model	85.2	75.7	100.0	280.0

Location Maps: Bradford Street



Fire Flow Test Report: Bradford Street

Owner:	City of Barrie
Project Number:	Smart Centres
Test Number:	1

Date:	Tuesday, October 29, 2019
Time:	11:09:00 AM

Location		Address	Hydrant Number
Q1	Flow Hydrant	Bradford Street Prince Wales School	H3271
Q2	Flow Hydrant		
R2	Residual Hydrant		
R1	Residual Hydrant	Bradford Street Tim Hortons	H3272

Material	PVC	
Age	Years	
Nominal Diameter	Inches	12
Internal Diameter	Inches	12
Area	Sq. Feet	0.785
Hydraulic Perimeter	Feet	
Number of Tests	1	

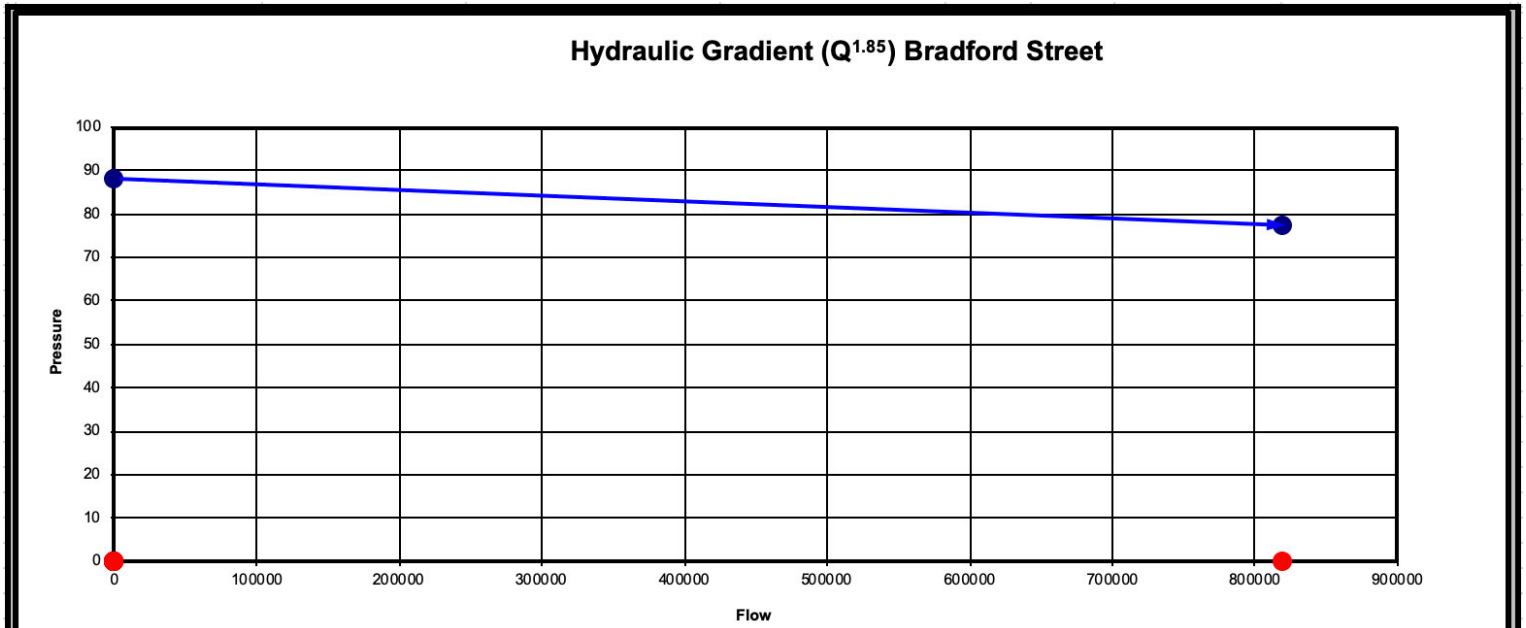
Static Pressure	R1	R2	PSI
	88		

Test	Configuration	Pitot 1	Pitot 2	Pitot 3	Pitot 4	Flow		Residual Pressure	
						Nozzle Coefficient	USGPM	R1	R2
A	1 X 2.5"	HoseMonster							
B	2 X 2.5"	HoseMonster				0.9	1572	77.0	
C							0		
D							0		
E							0		
F							0		
G							0		
H							0		
I							0		

Test	Flow Characteristics				Projected Flow @ 20 PSI		NFPA Rating	
	Velocity (fps)	USGPM	MGD	cu. ft per min	R1	R2	R1	R2
A								
B	4.461	1572	2.3	3.502	4204		CLASS AA - BLUE	
C					0			
D					0			
E					0			
F					0			
G					0			
H					0			
I					0			

Notes	

Fire Flow Hydraulic Gradient Line Graph: Bradford Street



Test	Flow (USGPM)	Flow ($Q^{1.85}$)	R1	R1
Static	0	0	88	0
A	0	0	0	0
B	1572	819289.1475	77	0
C	0	0	0	0
D	0	0	0	0
E	0	0	0	0
F	0	0	0	0
G	0	0	0	0
H	0	0	0	0

Location Maps: Lakeshore Drive



Fire Flow Test Report: Lakeshore Drive

Owner:	City of Barrie
Project Number:	Smart Centres
Test Number:	2
Date:	Tuesday, October 29, 2019
Time:	13:38:00 AM

	Location	Address	Hydrant Number
Q1	Flow Hydrant	Lakeshore Drive / Toronto Street	H3120
Q2	Flow Hydrant		
R2	Residual Hydrant		
R1	Residual Hydrant	Lakeshore Drive / Toronto Street	H3119

Material	HDPE	
Age	Years	
Nominal Diameter	Inches	6
Internal Diameter	Inches	6
Area	Sq. Feet	0.196
Hydraulic Perimeter	Feet	
Number of Tests	1	

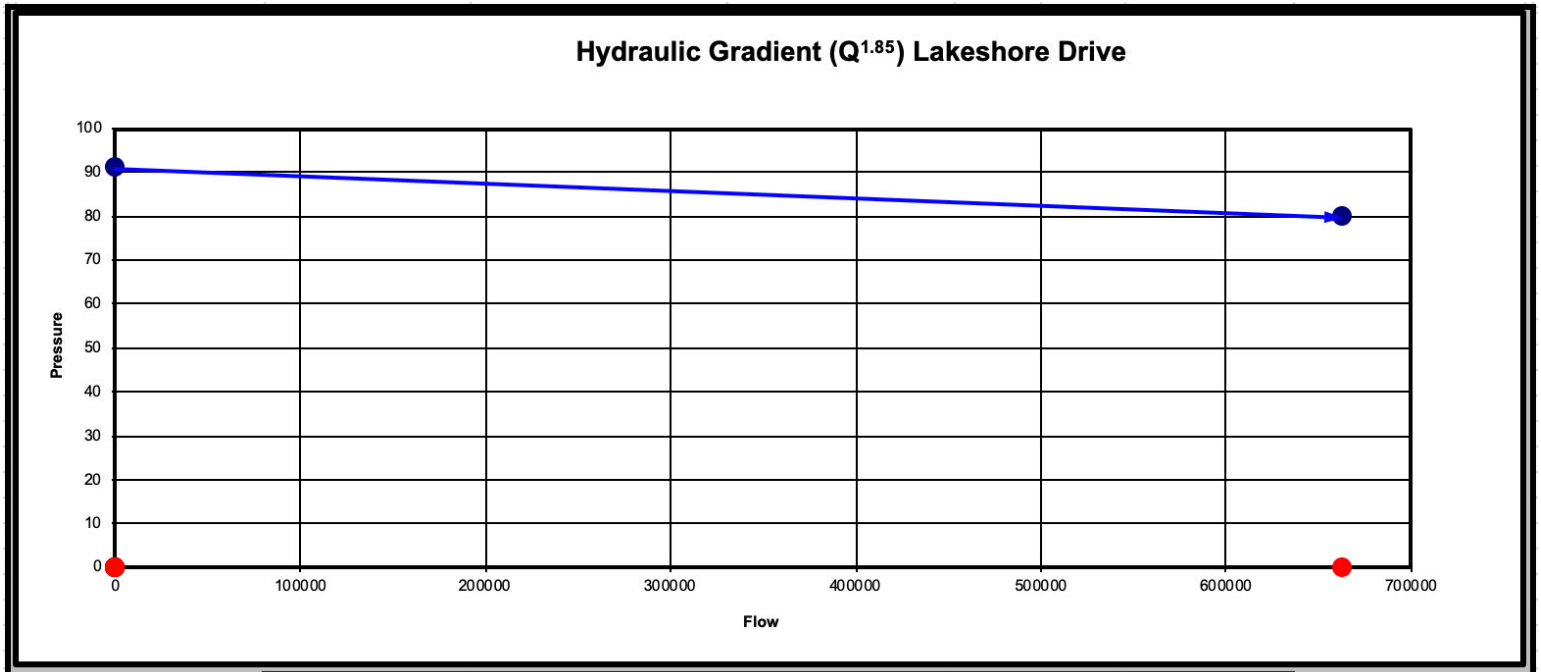
Static Pressure	R1	R2	PSI
	91		

Test	Configuration	Pitot 1	Pitot 2	Pitot 3	Pitot 4	Flow		Residual Pressure	
						Nozzle Coefficient	USGPM	R1	R2
A	1 X 2.5"	HoseMonster							
B	2 X 2.5"	HoseMonster				0.9	1402	80.0	
C							0		
D							0		
E							0		
F							0		
G							0		
H							0		
I							0		

Test	Flow Characteristics				Projected Flow @ 20 PSI		NFPA Rating	
	Velocity (fps)	USGPM	MGD	cu. ft per min	R1	R2	R1	R2
A								
B	15.908	1402	2.0	3.123	3838		CLASS AA - BLUE	
C					0			
D					0			
E					0			
F					0			
G					0			
H					0			
I					0			

Notes	

Fire Flow Hydraulic Gradient Line Graph: Lakeshore Drive



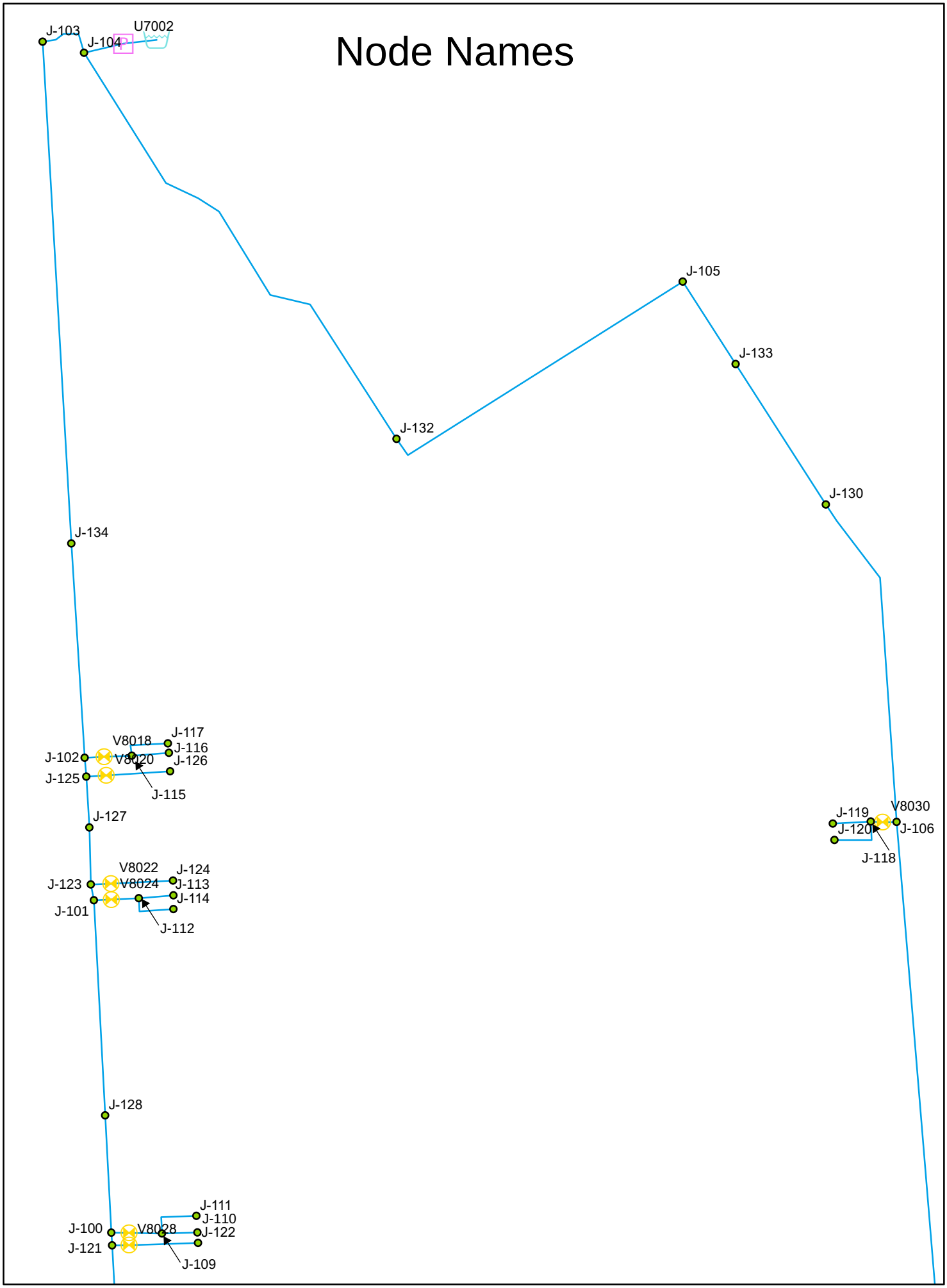
Test	Flow (USGPM)	Flow ($Q^{1.85}$)	R1	R1
Static	0	0	91	0
A	0	0	0	0
B	1402	662954.6563	80	0
C	0	0	0	0
D	0	0	0	0
E	0	0	0	0
F	0	0	0	0
G	0	0	0	0
H	0	0	0	0

Static & Residual Pressure Graph: Lakeshore Drive

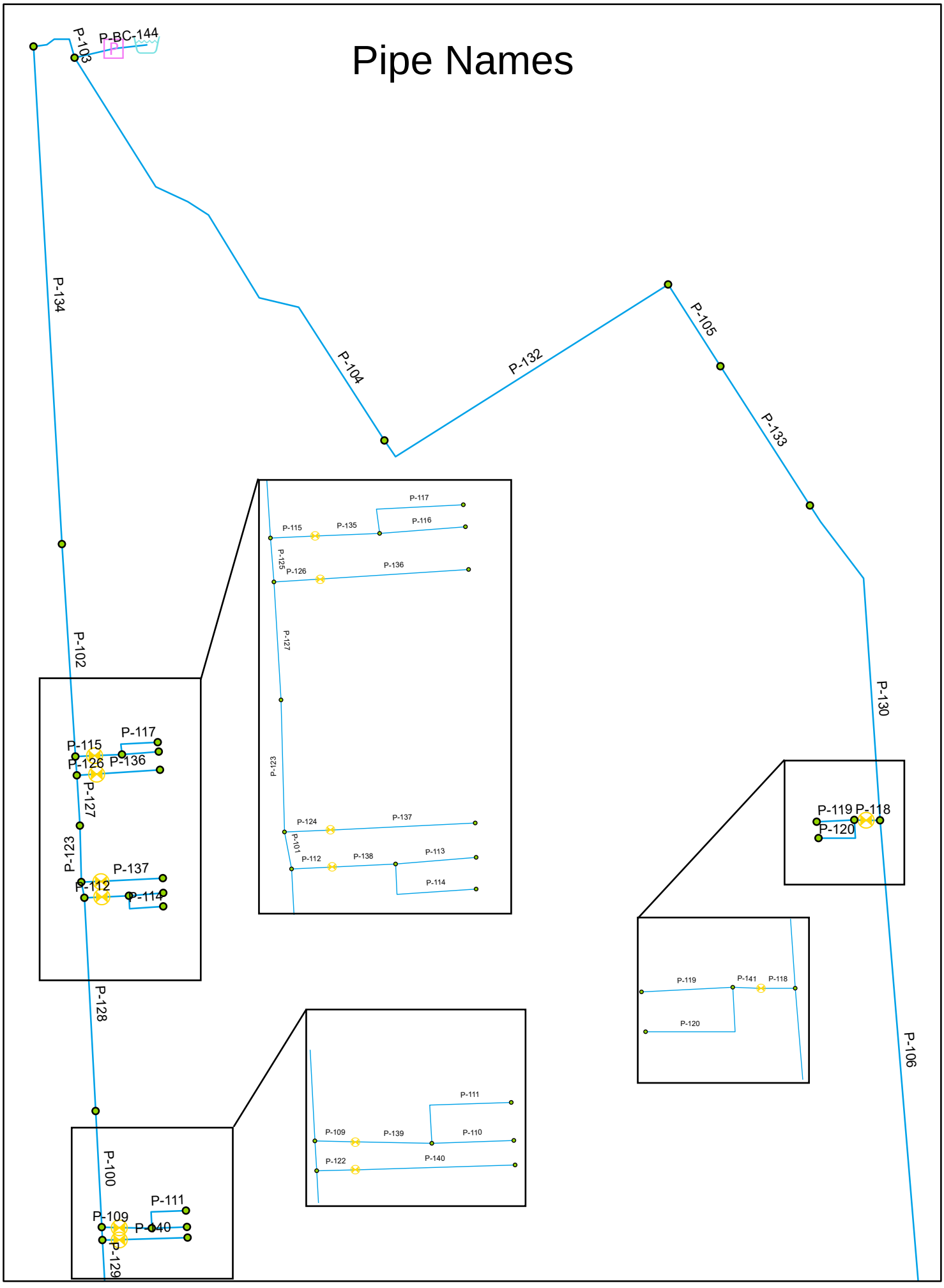
Appendix B

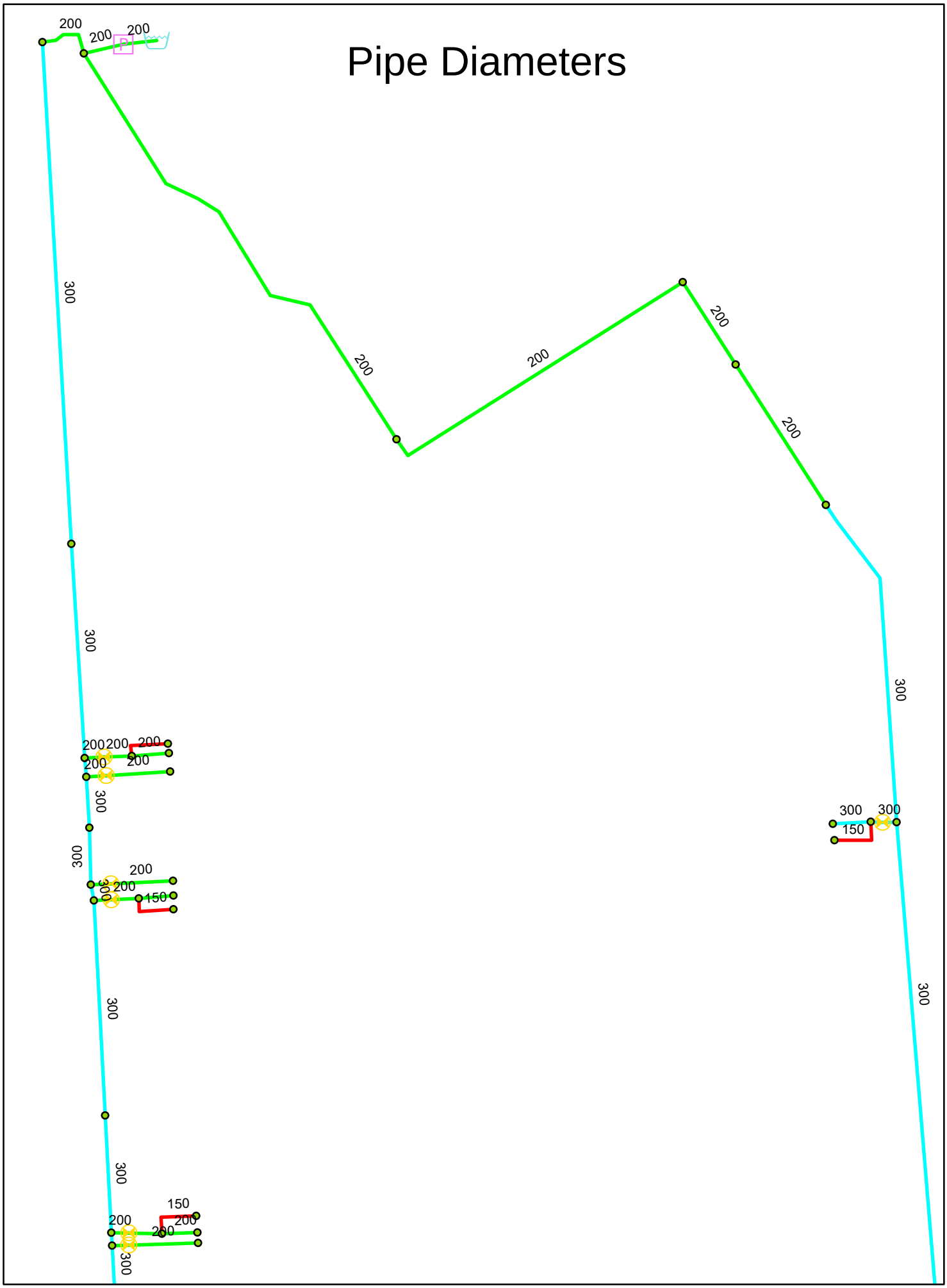
Model Results

Node Names


J-103
U7002
J-104
J-105
J-133
J-132
J-130
J-134
V8018
J-117
J-116
J-102
V8020
J-126
J-125
J-115
J-127
J-119
V8030
J-120
J-106
J-118
V8022
J-124
J-123
V8024
J-113
J-114
J-101
J-112
J-128
J-111
J-110
J-100
V8028
J-122
J-121
J-109

Pipe Names


P-103
P-BC-144
P-134
P-104
P-132
P-105
P-133
P-130
P-106
P-102
P-115
P-117
P-126
P-136
P-127
P-123
P-137
P-112
P-114
P-128
P-100
P-111
P-109
P-140
P-129
P-125
P-135
P-116
P-101
P-124
P-138
P-113
P-139
P-110
P-122
P-119
P-118
P-120
P-141


Pipe Diameters
200
200
200
300
200
200
200
300
200
200
200
200
200
300
300
300
200
200
150
300
300
300
300
150
200
200
200
300

Existing Conditions
Bradford St, Barrie ON
December 17, 2019

Municipal Engineering Solutions

Minimum Hour

Node Table

ID	Demand	Elevation	Head	Pressure
	(L/s)	*(m)*	*(m)*	*(psi)*
J-100	0.00	221.19	284.00	89.29
J-101	0.00	221.63	284.00	88.66
J-102	0.00	221.85	284.00	88.35
J-103	0.00	224.00	284.00	85.30
J-104	0.00	224.10	284.00	85.16
J-105	0.00	221.50	284.00	88.85
J-106	0.00	220.67	284.00	90.02
J-109	0.00	222.00	283.74	87.78
J-110	0.00	222.00	283.74	87.78
J-111	1.03	222.00	283.74	87.77
J-112	0.00	222.00	283.68	87.68
J-113	0.00	222.00	283.68	87.68
J-114	1.26	222.00	283.68	87.68
J-115	0.00	222.00	283.70	87.72
J-116	0.00	222.00	283.70	87.72
J-117	1.18	222.00	283.70	87.72
J-118	0.00	220.00	283.94	90.90
J-119	0.00	220.00	283.94	90.90
J-120	1.22	220.00	283.94	90.90
J-121	0.00	221.19	284.00	89.29
J-122	0.00	222.00	284.00	88.13
J-123	0.00	221.65	284.00	88.63
J-124	0.00	222.00	284.00	88.13
J-125	0.00	221.82	284.00	88.39
J-126	0.00	222.00	284.00	88.13
J-127	0.00	221.69	284.00	88.58
J-128	0.00	221.35	284.00	89.07
J-129	0.00	222.12	284.00	87.96
J-130	0.00	221.13	284.00	89.37
J-132	0.00	222.55	284.00	87.36
J-133	0.00	221.36	284.00	89.04
J-134	0.00	222.49	284.00	87.44
MIN		**220.00**		**85.16**
MAX		**224.10**		**90.90**

Pipe Table

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	*(mm)*	*(C)*	*(L/s)*	*(m/s)*
P-100	J-100	J-128	32.73	300	120	-1.10	0.02
P-101	J-101	J-123	4.52	300	120	-2.36	0.03
P-102	J-102	J-134	59.86	300	120	-3.54	0.05
P-103	J-104	J-103	16.06	200	110	3.54	0.11
P-104	J-104	J-132	143.12	200	110	1.19	0.04
P-105	J-105	J-133	27.30	200	110	1.19	0.04
P-109	J-100	V8026	4.90	200	110	1.03	0.03
P-110	J-109	J-110	9.91	200	110	0.00	0.00
P-111	J-109	J-111	14.47	150	100	1.03	0.06
P-112	J-101	V8024	4.90	200	110	1.26	0.04
P-113	J-112	J-113	9.72	200	110	0.00	0.00
P-114	J-112	J-114	13.20	150	100	1.26	0.07
P-115	J-102	V8018	5.38	200	110	1.18	0.04
P-116	J-115	J-116	10.35	200	110	0.00	0.00
P-117	J-115	J-117	13.40	150	100	1.18	0.07
P-118	J-106	V8030	3.96	300	120	1.22	0.02
P-119	J-118	J-119	10.60	300	120	0.00	0.00
P-120	J-118	J-120	15.53	150	100	1.22	0.07
P-121	J-121	J-100	3.60	300	120	-0.07	0.00
P-122	J-121	V8028	4.68	200	110	0.00	0.00
P-123	J-123	J-127	15.88	300	120	-2.36	0.03
P-124	J-123	V8022	5.53	200	110	0.00	0.00
P-125	J-125	J-102	5.31	300	120	-2.36	0.03
P-126	J-125	V8020	5.59	200	110	0.00	0.00
P-127	J-127	J-125	14.21	300	120	-2.36	0.03
P-128	J-128	J-101	60.07	300	120	-1.10	0.02
P-130	J-130	J-106	93.70	300	120	1.19	0.02
P-132	J-132	J-105	96.22	200	110	1.19	0.04
P-133	J-133	J-130	46.58	200	110	1.19	0.04
P-134	J-134	J-103	140.22	300	120	-3.54	0.05
P-135	V8018	J-115	7.78	200	110	1.18	0.04
P-136	V8020	J-126	17.87	200	110	0.00	0.00
P-137	V8022	J-124	17.43	200	110	0.00	0.00
P-138	V8024	J-112	7.64	200	110	1.26	0.04
P-139	V8026	J-109	9.23	200	110	1.03	0.03
P-140	V8028	J-122	19.30	200	110	0.00	0.00
P-141	V8030	J-118	3.28	300	120	1.22	0.02

Valve Table

ID	Diameter (mm)	Elevation (m)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (L/s)	Velocity (m/s)	Headloss (m)
V8018	200	222.00	88.13	87.72	1.18	0.04	0.29
V8020	200	222.00	88.13	88.13	0.00	0.00	0.00
V8022	200	222.00	88.13	88.13	0.00	0.00	0.00
V8024	200	222.00	88.13	87.69	1.26	0.04	0.32
V8026	200	222.00	88.13	87.78	1.03	0.03	0.25
V8028	200	222.00	88.13	88.13	0.00	0.00	0.00
V8030	300	220.00	90.98	90.90	1.22	0.02	0.06

Maximum Day

Node Table

ID	Demand	Elevation	Head	Pressure
	(L/s)	*(m)*	*(m)*	*(psi)*
J-100	0.00	221.19	283.65	88.80
J-101	0.00	221.63	283.65	88.17
J-102	0.00	221.85	283.66	87.87
J-103	0.00	224.00	283.70	84.87
J-104	0.00	224.10	283.72	84.76
J-105	0.00	221.50	283.67	88.38
J-106	0.00	220.67	283.65	89.53
J-109	0.00	222.00	282.24	85.64
J-110	0.00	222.00	282.24	85.64
J-111	4.10	222.00	282.23	85.63
J-112	0.00	222.00	282.08	85.41
J-113	0.00	222.00	282.08	85.41
J-114	5.03	222.00	282.07	85.39
J-115	0.00	222.00	282.10	85.43
J-116	0.00	222.00	282.10	85.43
J-117	4.73	222.00	282.08	85.41
J-118	0.00	220.00	283.59	90.40
J-119	0.00	220.00	283.59	90.40
J-120	4.89	220.00	283.57	90.38
J-121	0.00	221.19	283.65	88.80
J-122	0.00	222.00	283.65	87.64
J-123	0.00	221.65	283.65	88.14
J-124	0.00	222.00	283.65	87.65
J-125	0.00	221.82	283.66	87.90
J-126	0.00	222.00	283.66	87.65
J-127	0.00	221.69	283.66	88.10
J-128	0.00	221.35	283.65	88.58
J-129	0.00	222.12	283.65	87.47
J-130	0.00	221.13	283.65	88.88
J-132	0.00	222.55	283.69	86.93
J-133	0.00	221.36	283.67	88.57
J-134	0.00	222.49	283.67	86.97
MIN		**220.00**		**84.76**
MAX		**224.10**		**90.40**

Pipe Table

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	*(mm)*	*(C)*	*(L/s)*	*(m/s)*
P-100	J-100	J-128	32.73	300	120	-4.27	0.06
P-101	J-101	J-123	4.52	300	120	-9.30	0.13
P-102	J-102	J-134	59.86	300	120	-14.03	0.20
P-103	J-104	J-103	16.06	200	110	14.03	0.45
P-104	J-104	J-132	143.12	200	110	4.72	0.15
P-105	J-105	J-133	27.30	200	110	4.72	0.15
P-109	J-100	V8026	4.90	200	110	4.10	0.13
P-110	J-109	J-110	9.91	200	110	0.00	0.00
P-111	J-109	J-111	14.47	150	100	4.10	0.23
P-112	J-101	V8024	4.90	200	110	5.03	0.16
P-113	J-112	J-113	9.72	200	110	0.00	0.00
P-114	J-112	J-114	13.20	150	100	5.03	0.28
P-115	J-102	V8018	5.38	200	110	4.73	0.15
P-116	J-115	J-116	10.35	200	110	0.00	0.00
P-117	J-115	J-117	13.40	150	100	4.73	0.27
P-118	J-106	V8030	3.96	300	120	4.89	0.07
P-119	J-118	J-119	10.60	300	120	0.00	0.00
P-120	J-118	J-120	15.53	150	100	4.89	0.28
P-121	J-121	J-100	3.60	300	120	-0.17	0.00
P-122	J-121	V8028	4.68	200	110	0.00	0.00
P-123	J-123	J-127	15.88	300	120	-9.30	0.13
P-124	J-123	V8022	5.53	200	110	0.00	0.00
P-125	J-125	J-102	5.31	300	120	-9.30	0.13
P-126	J-125	V8020	5.59	200	110	0.00	0.00
P-127	J-127	J-125	14.21	300	120	-9.30	0.13
P-128	J-128	J-101	60.07	300	120	-4.27	0.06
P-130	J-130	J-106	93.70	300	120	4.72	0.07
P-132	J-132	J-105	96.22	200	110	4.72	0.15
P-133	J-133	J-130	46.58	200	110	4.72	0.15
P-134	J-134	J-103	140.22	300	120	-14.03	0.20
P-135	V8018	J-115	7.78	200	110	4.73	0.15
P-136	V8020	J-126	17.87	200	110	0.00	0.00
P-137	V8022	J-124	17.43	200	110	0.00	0.00
P-138	V8024	J-112	7.64	200	110	5.03	0.16
P-139	V8026	J-109	9.23	200	110	4.10	0.13
P-140	V8028	J-122	19.30	200	110	0.00	0.00
P-141	V8030	J-118	3.28	300	120	4.89	0.07

Valve Table

ID	Diameter (mm)	Elevation (m)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (L/s)	Velocity (m/s)	Headloss (m)
V8018	200	222.00	87.65	85.43	4.73	0.15	1.56
V8020	200	222.00	87.65	87.65	0.00	0.00	0.00
V8022	200	222.00	87.65	87.65	0.00	0.00	0.00
V8024	200	222.00	87.65	85.41	5.03	0.16	1.57
V8026	200	222.00	87.64	85.64	4.10	0.13	1.41
V8028	200	222.00	87.64	87.64	0.00	0.00	0.00
V8030	300	220.00	90.49	90.40	4.89	0.07	0.06

Peak Hour

Node Table

ID	Demand	Elevation	Head	Pressure
	(L/s)	*(m)*	*(m)*	*(psi)*
J-100	0.00	221.19	283.22	88.18
J-101	0.00	221.63	283.22	87.56
J-102	0.00	221.85	283.23	87.26
J-103	0.00	224.00	283.32	84.32
J-104	0.00	224.10	283.37	84.26
J-105	0.00	221.50	283.26	87.80
J-106	0.00	220.67	283.22	88.92
J-109	0.00	222.00	281.60	84.73
J-110	0.00	222.00	281.60	84.73
J-111	6.15	222.00	281.58	84.69
J-112	0.00	222.00	281.54	84.65
J-113	0.00	222.00	281.54	84.65
J-114	7.54	222.00	281.51	84.60
J-115	0.00	222.00	281.57	84.69
J-116	0.00	222.00	281.57	84.69
J-117	7.10	222.00	281.54	84.64
J-118	0.00	220.00	283.15	89.78
J-119	0.00	220.00	283.15	89.78
J-120	7.33	220.00	283.12	89.73
J-121	0.00	221.19	283.22	88.18
J-122	0.00	222.00	283.22	87.03
J-123	0.00	221.65	283.22	87.53
J-124	0.00	222.00	283.22	87.04
J-125	0.00	221.82	283.23	87.30
J-126	0.00	222.00	283.23	87.04
J-127	0.00	221.69	283.23	87.49
J-128	0.00	221.35	283.22	87.96
J-129	0.00	222.12	283.22	86.85
J-130	0.00	221.13	283.22	88.27
J-132	0.00	222.55	283.31	86.38
J-133	0.00	221.36	283.25	87.97
J-134	0.00	222.49	283.26	86.38
MIN		**220.00**		**84.26**
MAX		**224.10**		**89.78**

Pipe Table

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	*(mm)*	*(C)*	*(L/s)*	*(m/s)*
P-100	J-100	J-128	32.73	300	120	-6.62	0.09
P-101	J-101	J-123	4.52	300	120	-14.16	0.20
P-102	J-102	J-134	59.86	300	120	-21.26	0.30
P-103	J-104	J-103	16.06	200	110	21.26	0.68
P-104	J-104	J-132	143.12	200	110	7.16	0.23
P-105	J-105	J-133	27.30	200	110	7.16	0.23
P-109	J-100	V8026	4.90	200	110	6.15	0.20
P-110	J-109	J-110	9.91	200	110	0.00	0.00
P-111	J-109	J-111	14.47	150	100	6.15	0.35
P-112	J-101	V8024	4.90	200	110	7.54	0.24
P-113	J-112	J-113	9.72	200	110	0.00	0.00
P-114	J-112	J-114	13.20	150	100	7.54	0.43
P-115	J-102	V8018	5.38	200	110	7.10	0.23
P-116	J-115	J-116	10.35	200	110	0.00	0.00
P-117	J-115	J-117	13.40	150	100	7.10	0.40
P-118	J-106	V8030	3.96	300	120	7.33	0.10
P-119	J-118	J-119	10.60	300	120	0.00	0.00
P-120	J-118	J-120	15.53	150	100	7.33	0.41
P-121	J-121	J-100	3.60	300	120	-0.47	0.01
P-122	J-121	V8028	4.68	200	110	0.00	0.00
P-123	J-123	J-127	15.88	300	120	-14.16	0.20
P-124	J-123	V8022	5.53	200	110	0.00	0.00
P-125	J-125	J-102	5.31	300	120	-14.16	0.20
P-126	J-125	V8020	5.59	200	110	0.00	0.00
P-127	J-127	J-125	14.21	300	120	-14.16	0.20
P-128	J-128	J-101	60.07	300	120	-6.62	0.09
P-130	J-130	J-106	93.70	300	120	7.16	0.10
P-132	J-132	J-105	96.22	200	110	7.16	0.23
P-133	J-133	J-130	46.58	200	110	7.16	0.23
P-134	J-134	J-103	140.22	300	120	-21.26	0.30
P-135	V8018	J-115	7.78	200	110	7.10	0.23
P-136	V8020	J-126	17.87	200	110	0.00	0.00
P-137	V8022	J-124	17.43	200	110	0.00	0.00
P-138	V8024	J-112	7.64	200	110	7.54	0.24
P-139	V8026	J-109	9.23	200	110	6.15	0.20
P-140	V8028	J-122	19.30	200	110	0.00	0.00
P-141	V8030	J-118	3.28	300	120	7.33	0.10

Valve Table

ID	Diameter (mm)	Elevation (m)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (L/s)	Velocity (m/s)	Headloss (m)
V8018	200	222.00	87.04	84.69	7.10	0.23	1.65
V8020	200	222.00	87.04	87.04	0.00	0.00	0.00
V8022	200	222.00	87.04	87.04	0.00	0.00	0.00
V8024	200	222.00	87.03	84.65	7.54	0.24	1.67
V8026	200	222.00	87.03	84.73	6.15	0.20	1.61
V8028	200	222.00	87.03	87.03	0.00	0.00	0.00
V8030	300	220.00	89.87	89.78	7.33	0.10	0.06

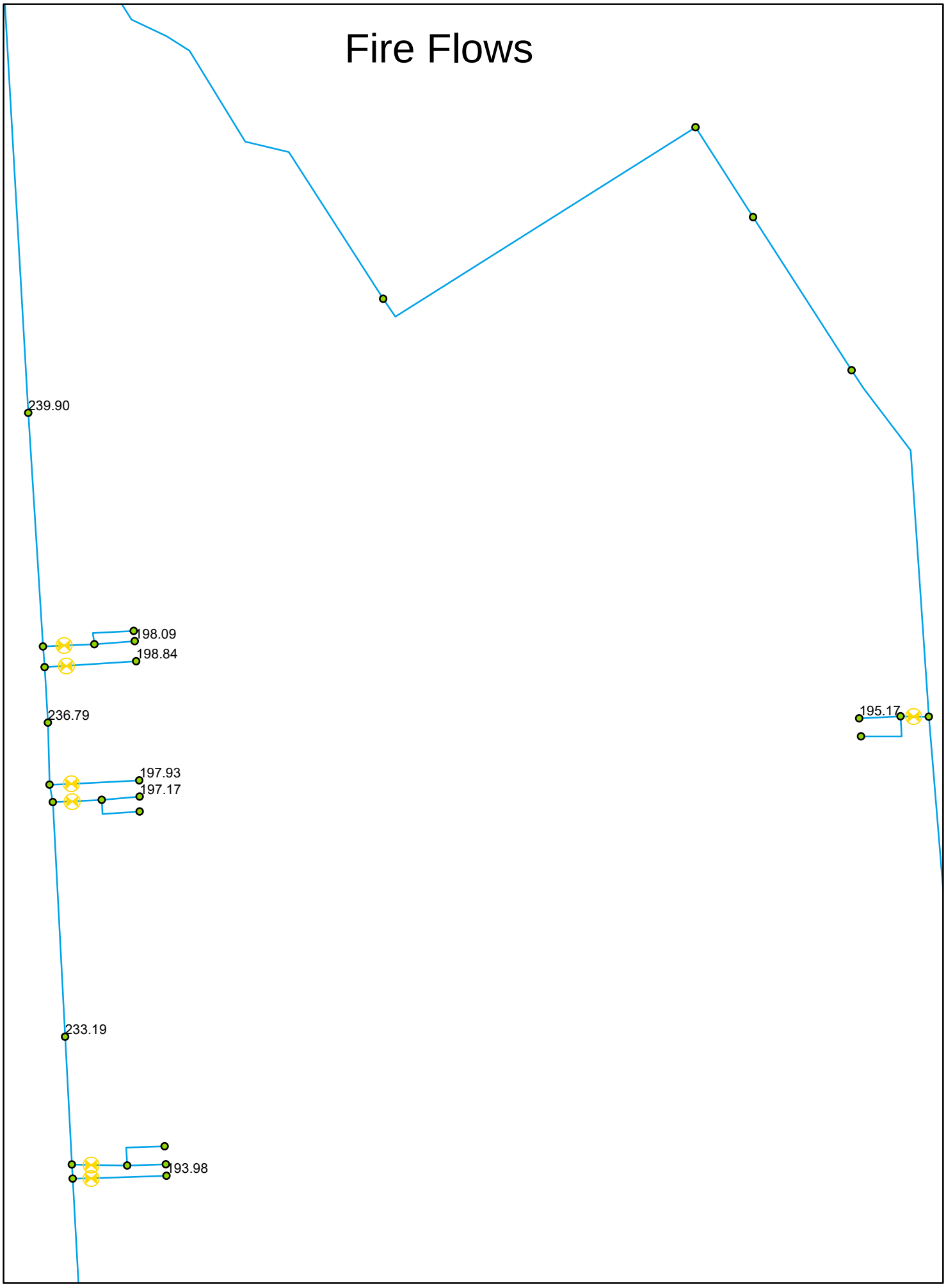
Existing Conditions
Bradford St, Barrie ON
December 17, 2019

Municipal Engineering Solutions

Fire Flow Table			
ID	Total Demand	Available Flow	Fire Flow Met?
	(L/s)	*(L/s)*	
J-110	189.00	193.24	TRUE
J-113	189.00	197.17	TRUE
J-116	189.00	198.09	TRUE
J-119	189.00	195.17	TRUE
J-122	189.00	193.98	TRUE
J-124	189.00	197.93	TRUE
J-126	189.00	198.84	TRUE
J-127	189.00	236.79	TRUE
J-128	189.00	233.19	TRUE
J-134	189.00	239.90	TRUE

MIN	**193.24**
MAX	**239.90**

Fire Flows



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