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15 Harvie Road

FUNCTIONAL SERVICING REPORT

Barrie-Bryne Developments Limited

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1 Introduction

Tatham Engineering Limited has been retained by Barrie-Bryne Developments Limited to prepare a Functional Servicing Report (FSR) in support of Draft Plan of Subdivision (Draft Plan), Zoning By-law and Official Plan amendment applications for a proposed mixed-used development located at 15 Harvie Road in the City of Barrie (City).

1.1 OBJECTIVES

This report was prepared to demonstrate the servicing feasibility of the proposed development with respect to civil servicing including site grading, stormwater management (SWM), sewage collection and treatment, water supply and distribution, site grading, transportation, and utility distribution.

1.2 GUIDELINES AND BACKGROUND REPORTS

This report is prepared in consideration of the following municipal, provincial and agency guideline documents:

- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Stormwater Management Practices Planning and Design Manual* (2003);
- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Lake Simcoe Protection Plan* (LSPP) (2009);
- Lake Simcoe Region Conservation Authority (LSRCA), *Technical Guidelines for SWM Submissions* (2016);
- Lake Simcoe Region Conservation Authority (LSRCA), *Phosphorous Offsetting Policy* (2019);
- City of Barrie, *Storm Drainage and Stormwater Management Policies and Design Guidelines* (2022);
- City of Barrie, *Sanitary Sewage Collection System Policies and Design Guideline* (2017); and
- City of Barrie, *Water Transmission and Distribution Design Standard* (2021).

This report is prepared in consideration of the following City of Barrie reports and publications:

- City of Barrie, *Wastewater Collection Master Plan Update* (2019), prepared by Cole Engineering Group Ltd.;
- City of Barrie, *Wastewater Treatment Master Plan* (2019), prepared by WSP Canada Inc.;



- City of Barrie, *Water Storage and Distribution Master Plan Update* (2019), prepared by WSP Canada Inc.; and
- City of Barrie, *Water Supply Master Plan Update* (2019), prepared by WSP Canada Inc.).

This report is prepared in consideration of the following site-specific studies and reports:

- WSP Canada Inc., *Geotechnical Desktop Review* (March 2022);
- WSP Canada Inc., *Preliminary Hydrogeological Investigation* (March 2022);
- Tatham Engineering Limited, *Natural Hazards Assessment* (March 2022);
- Tatham Engineering Limited, *Preliminary Stormwater Management Report* (March 2022); and
- Tatham Engineering Limited, *Traffic Impact Study* (March 2022).



2 Site Description

2.1 SITE LOCATION

The subject property is located at 15 Harvie Road in the City of Barrie. The site is bound by Harvie Road to the north, Highway 400 to the east, Thrushwood Drive/Megan Crescent and existing residential development to the west and Bryne Drive and existing commercial developments to the south. Upstream reaches of Whiskey Creek and Lovers Creek bisect the north and south portions of the site. The site is located within the Lake Simcoe Region Conservation Authority (LSRCA) watershed. Due to the presence of Lovers Creek and Whiskey Creek, the site is located partially within the LSRCA regulated area. The site is bisected by the future Bryne Drive right-of-way (ROW).

The east half of the site is legally described as:

- PART OF LOT 7 CONCESSION 12 INNISFIL, S/T LT180101 & LT96445; CITY OF BARRIE

The west half of the site is legally described as:

- PARTS OF LOTS 5, 6 & 7 PLAN 67 AND PART OF LOT 7 CONCESSION 12 INNISFIL; S/T IN27834 & LT180101; SUBJECT TO AN EASEMENT IN GROSS OVER PART 1 PLAN 51R37280 AS IN SC1010404; CITY OF BARRIE

Refer to Figure 1: Site Location Plan, overleaf.

2.2 LAND USE

Based on the City of Barrie's current Official Plan the property is designated General Industrial, General Commercial and Environmental Protection Area.

There are three easements located within the property, a 30.5 m wide hydro servicing easement, a 26.0 m wide sanitary sewer easement and a 6.0 m/10.0 m Bell Cable easement. The eastern limit of the site is subject to a future 30.0 m Ministry of Transportation (MTO) road widening.

2.3 BRYNE DRIVE EXTENSION

The subject property is centrally bisected by a ROW which has been dedicated to the City for the future extension of Bryne Drive. The Bryne Drive extension is a City project which includes the extension of Bryne Drive north from Caplan Avenue, intersecting Harvie Road, continuing north and connecting to the existing portion of Bryne Drive south of Essa Road. The project is planned to be completed in two phases, with the south extension which bisects the subject site (Harvie Road to Caplan Avenue) expected to commence in 2022 and the north extension (Harvie Road to Essa Road) expected to commence by 2027. This report assumes the Bryne Drive



extension project will be fully constructed between Harvie Road and Caplan Avenue and available for connection prior to the proposed development construction. This report also relies on the servicing and grading design of the Bryne Drive extension as provided by the City.



Figure 1: Site Location Plan



2.4 TOPOGRAPHY

Information relating to existing topography, ground cover, and drainage patterns was obtained through a review of relevant background studies, available plans, base mapping, and topographic surveys, and was confirmed during site visits.

A detailed topographic survey was completed by J.D. Barnes Limited in July 2007. This survey has been reviewed and compared to other available contour mapping and appears to be sufficient for preliminary design. If required, additional topographic survey will be completed during the detailed design stage to reflect recent surrounding construction activity (i.e. recently completed Harvie Road construction).

The subject property is approximately 33.3 ha of undeveloped lands. There is an existing east-west drainage divide with the north half sloping (2 - 3%) towards Whiskey Creek and a smaller area from the southern half gently sloping (0.5 - 1%) towards Lover's Creek. Existing SWM facilities are located upstream of each creek; the Stolp Pond and Pond 'A' upstream of Whiskey Creek and Pond LV14 upstream of Lover's Creek. Refer to the *Preliminary Stormwater Management Report* for detailed existing site drainage characteristics.

2.5 GEOTECHNICAL

Based on the Ontario Soil Survey the existing soils on the eastern three-quarters of the site are classified as Tioga Sand Loam, Hydrologic Soil Group A and the existing soils on the western third of the site are classified as Dundonald Sand Loam, Hydrologic Soil Group A.

The *Geotechnical Desktop Review* was completed to identify the subsurface conditions and determine the engineering properties of the in-situ soils for the design and construction of the proposed development.

The report describes the existing soils as silty sand, sandy silt, sand, clayey silt, and clayey sand, generally extending to the borehole termination depths of 7.6 mbg. Topsoil was encountered with thicknesses ranging from 0.12 to 0.61 mbg.

The *Preliminary Hydrogeological Investigation* was completed to assess the presence of groundwater the impact the construction of the proposed site may have on the groundwater regime. During the monitoring season (December 2021 - January 2022) groundwater was present at depths ranging from 2.58 m to 12.14 m. The groundwater surface as provided by WSP has been utilized for the preliminary design of the SWM controls. As additional groundwater monitoring information becomes available, the design of any impacted SWM controls will be revised.



3 Proposed Development

The proposed development consists of a residential component (west of the Bryne Drive extension) and an employment component (east of the Bryne Drive extension).

3.1 RESIDENTIAL LANDS

The residential component of the site proposes 66 semi-detached units, 138 street townhouses, 34 back-to-back townhouses, and two mid-rise residential blocks (3.59 ha) with a total of 539 units. The west half of the site also includes the hydro servicing easement/corridor, a 0.93 ha park block, a 0.67 ha SWM block (Block 73) and a 0.35 ha open space block.

It should be noted that unit counts provided for the mid-rise residential blocks (539 units) are estimates only for the purposes of this analysis. The mid-rise residential blocks are subject to future Site Plan Approval requirements at which time the unit counts will be confirmed. As site plans are not currently available, this report has assumed expected unit counts, building sizes, and impervious lot coverage. Notes are included in the calculations where these assumptions are applied.

3.2 EMPLOYMENT LANDS

The employment component of the site proposes 8 employment blocks (12.69 ha) and also includes the 30.0 m MTO Highway 400 road widening, a 1.15 ha SWM block (Block 72) and two open space blocks (2.46 ha).

3.3 SITE ACCESS

The proposed development includes two accesses from Thrushwood Drive and an east-west access from the Bryne Drive extension.

The proposed Draft Plan (prepared by Weston Consulting) is provided in Appendix A.



4 Water Supply and Distribution

4.1 EXISTING WATER SYSTEM

The site is located within an area of the City serviced by the municipal water system. Specifically, the site is located within Pressure Zone 3S, supplied by the City's surface water system. The City's Surface Water Treatment Plant (SWTP) is located on the southern shore of Kempenfelt Bay at 20 Royal Parkside Drive and draws water supply from Lake Simcoe.

4.1.1 Existing Infrastructure

The following existing watermains surround the subject site:

- 200 mm dia. PVC watermain on Thrushwood Drive;
- 400 mm dia. PVC watermain on Harvie Road;
- 300 mm dia. PVC watermain on Bryne Drive extension (capped south of Harvie Road); and
- 300 mm dia. PVC watermain on existing Bryne Drive South.

The design of the Bryne Drive extension includes a 300 mm dia. watermain from Harvie Drive to the existing Bryne Drive.

4.1.2 Municipal Water Supply

The City's surface water system (supplying Pressure Zone 2S and 3S) has a firm capacity of 60 ML/day (60,000 m³/day). As per the *Water Supply Master Plan Update* the maximum combined average day demand (ADD) for Zones 2S and 3S between 2011 and 2017 was 11,998 m³/day, while the highest Maximum Day Demand (MDD) was 19,378 m³/day, resulting in significant residual capacity within the existing supply system.

Estimated ADDs and MDDs based on projected growth within Pressure Zone 2S and 3S (i.e. the areas of the City supplied via the SWTP) as per WSP are summarized in Table 1.

Therefore, under existing conditions there is sufficient water supply capacity to service additional development within Pressure Zone 2S and 3S. Future improvements are proposed to increase the SWTP firm capacity to support population growth projections beyond 2036.



Table 1: Municipal Water Supply - Projected Zone 2S and 3S Demands

| SCENARIO | AVERAGE DAY DEMAND (m ³) | MAXIMUM DAY DEMAND (m ³) | RESIDUAL (m ³) |
|----------|--------------------------------------|--------------------------------------|----------------------------|
| 2021 | 20,870 | 41,378 | 18,622 |
| 2026 | 25,030 | 48,763 | 11,237 |
| 2031 | 28,216 | 54,440 | 5,560 |
| 2036 | 31,838 | 60,168 | -168 |
| 2041 | 35,937 | 67,289 | -7,289 |

4.1.3 Municipal Water Storage

Water storage for Pressure Zone 3S is provided in the Maplevue Drive Water Tower, supplied with surplus water from Pressure Zone 2S. Under existing conditions there is a local storage deficit for Pressure Zone 3S. However, there is a surplus in storage within the Pressure Zone 2S system. As such, the storage surplus in Pressure Zone 2S is assigned to Pressure Zone 3S to offset the existing deficit, resulting in a total storage surplus of 3.05 ML for the SWTP supplied zones (all as per Table 6-3 of the *Water Storage and Distribution Master Plan Update*). Therefore, under existing conditions there is sufficient water storage within the existing municipal system to service additional development in the area.

Under future growth projections (2041) there is a storage deficit within the SWTP zones. However, the planned Salem Reservoir will increase storage for the SWTP supplied zones, resulting in a surplus of 1.20 ML under 2041 growth scenario (all as per Table 6-7 of the *Water Storage and Distribution Master Plan Update*).

4.2 PROPOSED WATER SYSTEM

4.2.1 Proposed Demands

Water demands for the proposed development have been estimated by applying relevant City standards and criteria, including the following:

- Per capita ADD = 225 L/person/day;
- Commercial ADD = 28,000 L/ha/day (assumed to be applicable for Employment lands);
- Person per unit (PPU) =
 - 1.67 for high density (mid-rise residential units)
 - 2.57 for medium density (townhouse units)



- 3.25 for low density (semi-detached units)

MDD and peak hour demand (PHD) factors of 2.5 and 3.75, respectively, have been applied in accordance with Table 3-1 of the MECP Design Guidelines for Drinking Water Systems (2008).

Refer to Appendix B for Water Demand Calculations.

Table 2: Summary of Proposed Water Demands

| SCENARIO | VOLUME (m ³) | FLOW (L/S) |
|--------------------|--------------------------|------------|
| Average Day Demand | 709.7 | 8.2 |
| Maximum Day Demand | 1,774.2 | 20.5 |
| Peak Hour Demand | 2,661.3 | 30.8 |

4.2.2 Fire Protection

Firefighting water demands have been estimated for the site using Water Supply Public Fire Protection (1999) prepared by the Fire Underwriters Survey (FUS). The estimated required fire flows for the common buildings are:

- Townhouse Block = 67 L/s;
- Semi-detached Block = 67 L/s;
- Mid-rise Residential Block (largest) = 233 L/s; and
- Employment Block (estimated building size) = 267 L/s.

Reasonable assumptions have been made with respect to building design and construction methods, recognizing the preliminary stage of the development. FUS calculations will be confirmed during detailed design stage, where required.

Refer to Appendix B for FUS Calculations. Additional design information with respect to fire flows (including results from three fire hydrant flow tests) is documented in the WaterCAD Analysis, provided in Appendix C.

4.2.3 Proposed Infrastructure

The water system will be design in accordance with City and MECP design criteria, including but not limited to the following:

- Minimum watermain size for residential areas is 150 mm dia.;
- The minimum depth of watermain and water services is 1.7 m, measured to the top of pipe;



- Single family, semi-detached and townhouse units will be service with individual 25 mm dia. water services, whereas the size of water services for multi-residential and commercial/employment buildings will be determine during detailed design when additional building details are known and water demands can be calculated for each;
- Mid-rise residential and employment buildings shall be serviced with a separate 150 mm dia. fire line;
- Maximum fire hydrant spacing of 90 m in ICI and multi-family residential areas and 150 m in single family residential areas;
- Maximum watermain velocity of 1.5 m/s under normal operating conditions (ADD and MDD flows); and
- Maximum watermain velocity of 5.0 m/s under fire flow conditions.

Utilizing the above information, a WaterCAD Analysis has been completed to demonstrate that adequate pressures and flows can be provided throughout the proposed development. The WaterCAD Analysis is provided in Appendix C.

The preliminary watermain design consists of 150, 200, 250 and 300 mm dia. watermains based on the results of the WaterCAD analysis. The proposed layout is depicted on the Watermain Distribution Plan (Drawing WAT-1), provided in Appendix E.



5 Sewage Collection and Treatment

5.1 EXISTING SANITARY SYSTEM

The site is located within an area of the City serviced by the municipal sanitary sewer system. Under existing conditions an existing 375 mm dia. trunk sewer located within an easement bisects the site conveying sewage from the existing development area upstream of Thrushwood Drive east through the site towards Harvie Road where the sewer runs under Highway 400 and ultimately to the Barrie Wastewater Treatment Facility (WWTF).

The downstream trunk sewers do not contribute to any sanitary pumping stations other than WWTF Pumping Station (PS10).

5.1.1 WWTF Capacity

As per the *Wastewater Treatment Master Plan*, the Barrie WWTF has a rated average daily flow (ADF) capacity of 76,000 m³/day, and a peak flow capacity of 156,000 m³/day. Based on historical flow data, the WWTF has received between 48,000 m³/day to 50,700 m³/day between 2014 and 2017. Based on population growth projections the ADF in 2021 is 60,019 m³/day. Therefore, under existing conditions there is an estimated residual capacity of 16,000 m³/day to service additional development in the City.

Based on the *Wastewater Treatment Master Plan*, the WWTF is expected to reach its current rated capacity of 76,000 m³/day in 2031. However, improvements are proposed to increase the capacity of the plant to support population growth projections beyond 2031.

5.1.2 Upstream External Flows

Through discussions with City staff we understand the approximate existing conditions peak sanitary flow discharging to the 375 mm dia. trunk sewer at Thrushwood Drive (immediately upstream of the subject site) is 36.87 L/s (value extracted from the City's model and provided to Tatham via email, provided in Appendix D). It is understood the City's existing sanitary sewer model does not have reliable calibration data for this catchment area, and, therefore, the City expects this existing modelled flow to be lower than actual conditions. However, the City has also provided an approximate future conditions peak flow of 57.84 L/s at the same node. This future flow has been considered in the preliminary design of the re-aligned trunk sewer, discussed below.



5.2 PROPOSED SANITARY FLOWS

5.2.1 Average Day Flow

The following City design criteria have been utilized to establish the ADF for the subject site:

- Per capita average day demand (ADD) = 225 L/person/day;
- Commercial ADD = 28,000 L/ha/day (assumed to be applicable for Employment lands); and
- Person per unit (ppu) densities of:
 - 1.67 for high density (condo units);
 - 2.34 for medium density (townhouse units); and
 - 3.13 for medium density (semi-detached units).

Utilizing this design criteria and applying the proposed land uses and unit counts, the estimated ADF for the site is 697.6 m³ (refer to calculations provided in Appendix D).

5.2.2 Peak Flow (WWTF Capacity)

Peak day flow (PDF) with respect to capacity within the WWTF has been calculated by applying peaking factors which consider the entirety of the population contributing to the WWTF. Based on the WSP reports, a peaking factor of 2.05 is recommended. This results in a total PDF of 1,432.6 m³. As mentioned above, the existing WWTF is understood to have sufficient capacity to service additional development, with an estimated existing conditions residual capacity of 16,000 m³/day. Therefore, the WWTF has sufficient capacity to service the subject development.

5.3 PROPOSED SANITARY SEWER SYSTEM

The sanitary sewer system will be design in accordance with City and MECP design criteria, including but not limited to the following:

- Minimum local sewer size is 200 mm dia. for residential areas;
- Minimum local sewer size is 250 mm dia. for employment areas;
- Minimum depth of sewer is 2.5 m, measured to the top of pipe;
- Maximum maintenance hole spacing of 110 m for 250 mm dia. and 120 m for 300 – 900 mm dia.;
- Minimum slope of 0.40%;
- Slope of first run to be minimum 1%;
- Maximum full flow velocity of 3.0 m/s; and



- Minimum velocity of 0.6 m/s.

The preliminary design of the re-aligned trunk sewer is discussed further below. The design of local sanitary sewers will be completed during the detailed design stage of the project.

As sanitary flows from Block 67 will discharge to the existing sewer in Bryne Drive which conveys flows south towards Mapleview Drive sanitary sewer, this development block is excluded from the drainage area contributing to the trunk sewer. As flows from Block 67 are expected to be relatively low (+/- 2 L/s), it is assumed the downstream sewers have sufficient capacity to convey this additional peak flow. As such, downstream assessment of these sewers is not required for the purpose of this report.

5.3.1 Preliminary Trunk Sewer Design

The existing trunk sanitary sewer will be removed and replaced to align within the road allowances of the proposed development. The existing sanitary sewer alignment enters the site between the two proposed access on Thrushwood Drive. As such, a small section of sewer on Thrushwood Drive will be required to be removed and replaced in order to reverse the pipe slope to convey the external flows through the proposed Street A ROW.

The realigned trunk sewer will run along the main development corridor (Street A) from Thrushwood Drive to Bryne Drive. The sewer will connect to proposed sanitary sewer within the Bryne Drive extension (to be designed by Hatch) and continue north on Bryne Drive for approximately 160 m, where the sewer will then jog east, routing through the northern edge of subject lands (Block 60), ultimately connecting to the existing sanitary trunk sewer located adjacent to SWM Block 72. Refer to the Sanitary Sewer Catchment Plan (Drawing SAN-1) for preliminary sewer layout.

A sanitary sewer design sheet has been prepared to confirm the re-aligned trunk sewer will have sufficient capacity to convey the upstream external flows (future conditions), as well as the flows from the subject development. The preliminary design of the trunk sewer confirms a 375 mm dia. sewer will have sufficient capacity to convey the contributing flows. In addition, the existing 450 mm dia. sewer located immediately upstream of Harvie Road (ex SANMH6 to ex SANMH5) where the re-aligned sewer will connect to has a full flow capacity of 156 L/s, whereas the total contributing flow at to this sewer is estimated to be 78.9 L/s. Therefore, it is expected the downstream infrastructure has sufficient capacity to convey the peak flows from the site. Peak flow calculations include an extraneous flow of 0.1 L/s/ha and apply Harmon peaking factors. Refer to Appendix D for additional information.



6 Stormwater Management Plan

6.1 STORMWATER MANAGEMENT REPORT SUMMARY

A *Preliminary Stormwater Management Report* has been prepared under separate cover and should be read in conjunction with this report. The following summarizes the findings of the report:

- Stormwater quantity control will be provided by proposed SWM Facility No. 1 and SWM Facility No. 2 as well as an existing SWM facility (Pond A/Stolp).
- SWM Facility No. 1, located at the southeast corner of the west half of the site will provide quantity control for approximately 3.9 ha from the western half of the site, and will discharge controlled flows into Lovers Creek.
- Existing Pond A/Stolp will provide quantity controls for the remaining 9.1 ha of the west half of the site. This existing pond was designed to peak flows from the subject site.
- SWM Facility No. 2, located in the northeast corner of the site will provide quantity control for 11.4 ha from the eastern half of the site (employment lands). Controlled flows will discharge into Whiskey Creek.
- Water quality controls are provided via a combination of SWM facilities, oil grit separator (OGS) units, membrane filter units (Jellyfish) and lot-level infiltration practices.
- Infiltration/volume control is provided by a combination of a bioretention cell located within SWM Facility No. 1 as well as lot-level infiltration features.
- Additional on-site quantity control facilities are not required within the mid-rise or employment land blocks.
- On-site infiltration controls are required for Blocks 60 through 67.
- Minor storm drainage (up to the 1:5-year design storm) will be collected and conveyed storm sewers located within the proposed ROWs. The storm sewers will outlet to a downstream SWM facility.
- Major storm drainage (greater than the 1:5-year design storm) will be conveyed through the ROWs to a downstream SWM facility.

The preliminary storm sewer layout and contributing catchments are depicted on the Storm Catchment Plan (Drawing STM-1) provided in Appendix E. Storm sewers will be designed during the detailed design stage of the project.



Pre and post-development catchment information is depicted on Drawings DP-1 and DP-2, provided in Appendix E.

6.2 PHOSPHOROUS ASSESSMENT

A preliminary phosphorous assessment has been completed for the development and is included within the *Preliminary Stormwater Management Report*. The assessment determined that under post-development conditions the total phosphorous loading is 60.25 kg/year. Applying the proposed phosphorous mitigation controls (infiltration, filtration, bioretention, detention), the phosphorous load will be reduced to 4.24 kg/year. Refer to the *Preliminary Stormwater Management Report* for additional information.

6.3 VOLUME CONTROL AND WATER BALANCE

Runoff volume control and changes in site water balance due to the proposed development will be addressed through the proposed infiltration features. Due to shallow groundwater conditions and as the site extends into a significant groundwater recharge area, it is only feasible to infiltrate runoff from the 12.5 mm storm event. A preliminary water balance assessment has been completed for the site by WSP and is provided under separate cover.



7 Floodplain Hazard

Under existing conditions the subject property is partially located within the existing floodplains of Whiskey Creek and Lovers Creek. The *Natural Hazards Assessment*, provided under separate cover, confirms the limits of the existing floodplain. In order to optimize the development blocks within the proposed development, cut/fill is proposed within Lovers Creek (Open Space Block 70) and Whiskey Creek (Open Space Block 69 and SWM Block 72). Refer to the *Natural Hazards Assessment* for additional information.



8 Roadways and Transportation

8.1 ROADWAYS

Roadways within the site will be designed in accordance with BSD-301 (18.0 m Local Road Allowance - Residential) and BSD-302 (20.0 m Local Road Allowance - Industrial), with widened ROWs located at the four-way intersection of Street A, Bryne Drive, and Street H. This intersection will also be signalized. A second access (Street B) will connect the residential area to Thrushwood Drive. The roads will be assumed by the City who will undertake routine maintenance and snowplowing activities.

Based on our review of the preliminary geotechnical investigation, the minimum pavement structure designs for the municipal ROWs is to consist of:

- | | |
|--------------------------|-------------------|
| ▪ Surface course asphalt | 50 mm HL 3/SP12.5 |
| ▪ Base course asphalt | 70 mm HL 8/SP19.0 |
| ▪ Granular base | 150 mm Granular A |
| ▪ Granular subbase | 400 mm Granular B |

8.2 TRAFFIC IMPACT STUDY

A *Traffic Impact Study* has been prepared under separate cover and should be read in conjunction with this report.



9 Grading and Landscaping

9.1 GRADING

The overall site grading design maintains existing topography and drainage divides to the extent possible while matching into existing grades at property lines or limit of development area. The Bryne Drive extension proposed grading design was provided by the City and considered in preparation of the concept grading design.

Internal road grading has been developed to ensure stormwater runoff is conveyed to proposed storm sewers designed. Proposed road grading will also provide sufficient overland flow routes contained within the road allowances.

Grading will be refined at the detailed design stage and in accordance with the City's Engineering Standards:

- Minimum road slope 0.5%
- Maximum road slope 5%
- Minimum lot grade 2%
- Maximum lot grade 5%
- Minimize the need for retaining walls
- Minimize the volume of earth to be moved and balance on-site cut/fill
- Achieve drainage and SWM objectives

Refer to Appendix E for the Preliminary Grading Plans (Drawing GP-1 and GP-2).

9.2 LANDSCAPING

A detailed landscaping design will be completed at the detailed design stage and in accordance with the City's Urban Design Guidelines. It is expected street trees will be provided throughout the municipal road allowances while landscaping designs will be prepared in support of Site Plan applications for the mid-rise residential and employment blocks.

A fencing and pedestrian circulation plan shall be prepared at the detailed design stage and in accordance with the City's Engineering Standards.

Locations of retaining walls will be confirmed during detailed design but are not expected to be required to achieve the overall grading concept for the site.



10 Erosion and Sediment Control

Erosion and sediment control measures will be implemented for all construction activities within the development site including vegetation clearing, topsoil stripping, grading, servicing, road construction and lot development. The basic principles considered to minimize erosion and sedimentation transport include:

- All erosion control measures will be designed in accordance with relevant City, LSRCA and OPSD standards;
- Silt fences to be constructed prior to commencement of any grading operations;
- Designated construction vehicle entrance(s) with stone mud mat;
- Temporary swales, silt ponds, and check dams will be constructed to control runoff during construction by reducing velocities and promoting settlement of particulates;
- Catch basins will be provided with filter screens during construction;
- Long term siltation and erosion control will be enhanced with a re-vegetation strategy for disturbed areas; and
- Confine refueling and servicing of equipment sufficiently away from existing drainage systems.

Regular inspection of control measures will be completed through a monitoring and mitigation plan, with regular repairs made as necessary. A detailed erosion and sediment control plan will be completed at detailed design stage.



11 Utilities

The following utility agencies provide services to the proposed development:

- Alectra Utilities Corporation;
- Enbridge Inc.;
- Bell Canada; and
- Rogers Communication Inc.

All utilities (electrical, gas, telecommunications) are expected to be available from Thrushwood Drive and from Harvie Road (through the Bryne Drive extension) to service the proposed development. Utility coordination will be initiated at the detailed design stage.

The existing hydro infrastructure and easement will be maintained within the proposed development (Blocks 75, 76, 77).



12 Summary

In summary, this report demonstrates the proposed development can be adequately serviced with municipal water, sanitary, stormwater and utility infrastructure. The detailed design of the required infrastructure, including coordination with utilities, will be completed as the project advances.

12.1 WATER SUPPLY AND DISTRIBUTION

The site will be serviced with municipal watermain in accordance with City standards. The existing municipal system has sufficient pressures, capacity and storage volumes to provide service to the proposed development.

12.2 SEWAGE COLLECTION AND TREATMENT

The existing 375 mm diameter sanitary trunk sewer traversing the site will be relocated within the proposed municipal road allowance where possible. Local sanitary sewers will service the site in accordance with City standards. The local sewers will outlet to the realigned sanitary trunk. Block 67 will be serviced by the existing sanitary service located within the Bryne Drive cul-de-sac. The Barrie WWTP has sufficient capacity to service the proposed development.

12.3 STORMWATER MANAGEMENT PLAN

A *Preliminary Stormwater Management Report* has been prepared to demonstrate the proposed development will not result in negative impacts with respect to stormwater. Appropriate water quantity, quality and infiltration controls are provided.

12.4 FLOODPLAIN

A *Natural Hazards Assessment* has been completed under separate cover to confirm the proposed site will be developed with consideration of the Whiskey Creek and Lovers Creek floodplains. A cut/fill exercise is proposed to optimize the developable area of the site.

12.5 ROADWAYS AND TRANSPORTATION

The proposed municipal local and industrial road allowances will be designed in accordance with the City's Engineering Standards and in accordance with the recommendations of the geotechnical consultant.

A separate *Traffic Impact Study* was completed to confirm significant external improvements are not required for the site and the internal networks are sufficient for the proposed use.



12.6 GRADING AND LANDSCAPING

The concept grading design was prepared in accordance with the City's Engineering Standards to achieve the objectives of the SWM plan and tying into existing grades.

12.7 EROSION AND SEDIMENT CONTROL

A detailed erosion and sediment control plan will be prepared and executed prior to construction in accordance with the City, LSRCA and OPSD standards.

12.8 UTILITIES

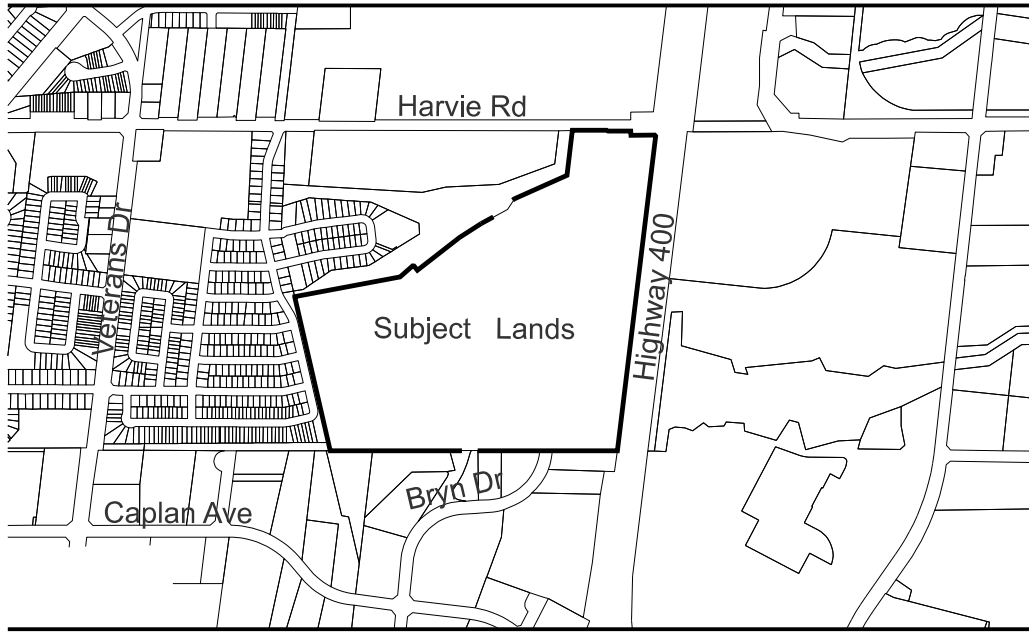
Utilities are expected to be available to service the proposed development. Utility coordination and designs will be initiated during the detailed design stage.



Appendix A: Draft Plan

DRAFT PLAN OF SUBDIVISION

PART OF LOTS 5, 6 AND 7
REGISTERED PLAN 67
AND
PART OF LOT 7
CONCESSION 12
NOW IN THE GEOGRAPHIC TOWNSHIP OF INNISFIL
CITY OF BARRIE
COUNTY OF SIMCOE



OWNER'S CERTIFICATE:
I authorize Weston Consulting Group Inc. to prepare and submit
this plan for draft approval.

Date: _____

BARRIE-BRYNE DEVELOPMENTS
3200 HIGHWAY 7
VAUGHAN, ON L4K 5Z5
647-362-3212

SURVEYOR'S CERTIFICATE:
I hereby certify that the boundaries of the lands being subdivided
and their correct relationship to the adjacent lands are accurately
and correctly shown on this plan.

Date: _____

PIER DE ROSA, OLS, OUP
JD BARNES LTD
142 COMMERCE PARK DRIVE, UNIT V
BARRIE, ONTARIO L4N 5W6
PHONE: _____

ADDITIONAL INFORMATION:
[Section 51(17) of the Planning Act, R.S.O. 1990, c. P.13],
as amended to December 12, 2021.
a), b), e), f), g), j) & l) - on plan.
c) - on key plan
d) - see statistics
h) - piped water to be installed by developer
i) - sandy silt to sand
k) - all services to be made available by developer

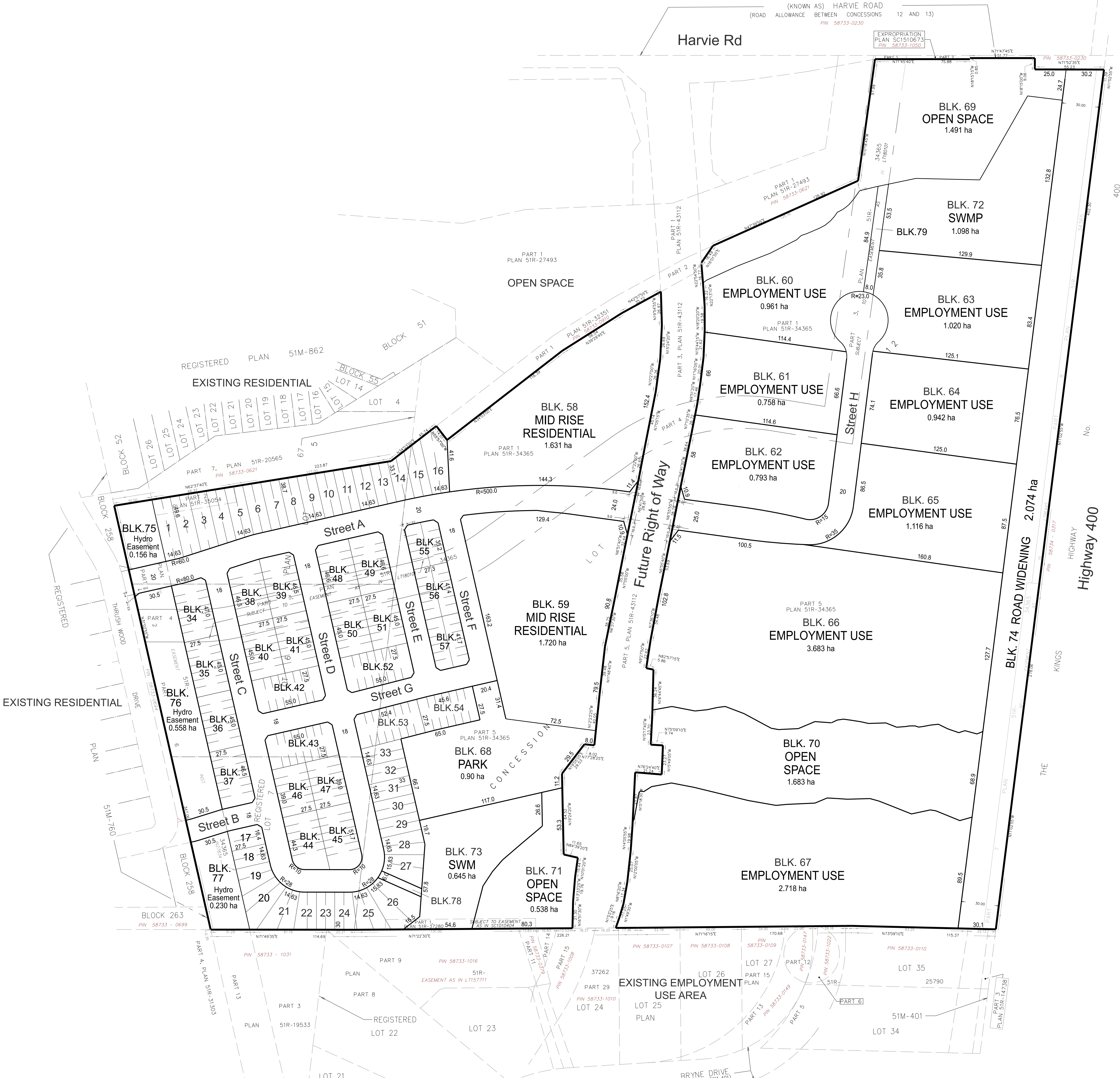
| DEVELOPMENT STATISTICS: | |
|--|-----------|
| BLOCKS | AREA(HA) |
| Semi-Detached (7.315 m) [Lots 1-33]: | 1.914 ha |
| Street Townhouses (6.0 m) [Blk 34-54]: | 2.721 ha |
| Back to Back Townhouses (6.4 m) [Blk 55-57]: | 0.322 ha |
| Mid Rise Residential [Blk 58-59]: | 3.351 ha |
| Employment Uses [Blks 60-67]: | 11.992 ha |
| Park [Block 68]: | 0.900 ha |
| Open Space [Blk 69-71]: | 3.712 ha |
| SWMP [Blk 72,73]: | 1.743 ha |
| Road Widening [Blk 74]: | 2.074 ha |
| Hydro Easement [Blk 75-77]: | 0.944 ha |
| Access Easement [Blk 78,79]: | 0.092 ha |
| Roads: | 3.496 ha |
| Total: | 33.261 ha |

SCALE 1:1500
0 75m

WESTON CONSULTING
Vaughan: 201 Millway Ave, Suite 19
Vaughan, Ontario L4K 5K8
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Toronto, Ontario M5A 2X1
T. 416.640.9917 F. 905.738.6637

| REVISIONS LIST | |
|----------------|--|
| 02 MAR 2021 | Revise Park & SWM & Open Space limits per Constraints Plan & dimensions & stats. |
| 27 JAN 2021 | Insert new survey. Update blocks, dimensions & stats. |
| 10 JAN 2021 | Revise S.W.M.P. Blk 72. Add block dimensioning & update stats. |
| 23 DEC 2021 | Revise Semi-detached frontages to 7.315 m wide |
| 21 DEC 2021 | First draft |

File Number: 9683
Drawn By: SM
Planner: RG
Scale: 1:1500
CAD: 9683/D3 Draft Plan_2022_03_02.dgn
Drawing Number: D3



Appendix B: Water Calculations

| | | | |
|---------|-------------------------|------|---------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | March 8, 2022 |
| SUBJECT | Water Demands | NAME | NM/LC |
| | | PAGE | 1 OF 1 |

Design Criteria

| | | | |
|--------------------|---|--------|---|
| High Density PPU | = | 1.67 | (condo units) |
| Medium Density PPU | = | 2.57 | (townhouse units) |
| Low Density PPU | = | 3.25 | (semi-detached units) |
| Per Capita Demand | = | 225 | L/cap/day |
| Commercial Demand | = | 28,000 | L/ha/day (assumed for Employment lands) |

Peaking Factors

| | | |
|------------------|---|------|
| Max Day Demand | = | 2.5 |
| Peak Hour Demand | = | 3.75 |

Area 1 (West of Bryne Drive)

| | | | | | |
|----------------------|---|-----|------------|---|---------------|
| Townhouse/Semi Units | = | 182 | Population | = | 1,582 persons |
| Semi-Detached Units | = | 66 | | | |
| Mid-rise Block Units | = | 539 | | | |
| Commercial Area | = | 0 | ha | | |

| | | | | | | |
|------------------------|---|-------------|-----------------------------|------------------------|---|----------|
| Average Day Demand | = | 356,033 L | = | 356.0 m ³ | = | 4.1 L/s |
| Max Day Demand (MDD) | = | 890,083 L | = | 890.1 m ³ | = | 10.3 L/s |
| Peak Hour Demand (PHD) | = | 1,335,125 L | = | 1,335.1 m ³ | = | 15.5 L/s |
| Max Fire Flow | = | 233 L/s | (refer to FUS calculations) | | | |
| MDD + Fire | = | 243.30 L/s | | | | |
| PHD + Fire | = | 248.45 L/s | | | | |

Area 2 (East of Bryne Drive)

| | | |
|-----------------|---|---------|
| Townhouse Units | = | 0 |
| Condo Units | = | 0 |
| Employment Area | = | 12.6 ha |

| | | | | | | |
|--------------------|---|-------------|-----------------------------|------------------------|---|----------|
| Average Day Demand | = | 353,640 L | = | 353.6 m ³ | = | 4.1 L/s |
| Max Day Demand | = | 884,100 L | = | 884.1 m ³ | = | 10.2 L/s |
| Peak Hour Demand | = | 1,326,150 L | = | 1,326.2 m ³ | = | 15.3 L/s |
| Max Fire Flow | = | 267 L/s | (refer to FUS calculations) | | | |
| MDD + Fire | = | 277.23 L/s | | | | |
| PHD + Fire | = | 282.35 L/s | | | | |

Site Total

| | | | | | | |
|--------------------|---|-------------|-----------------------------|------------------------|---|----------|
| Average Day Demand | = | 709,673 L | = | 709.7 m ³ | = | 8.2 L/s |
| Max Day Demand | = | 1,774,183 L | = | 1,774.2 m ³ | = | 20.5 L/s |
| Peak Hour Demand | = | 2,661,275 L | = | 2,661.3 m ³ | = | 30.8 L/s |
| Max Fire Flow | = | 267 L/s | (refer to FUS calculations) | | | |
| MDD + Fire | = | 287.53 L/s | | | | |
| PHD + Fire | = | 297.80 L/s | | | | |

| | | | |
|---------|-----------------------------------|------|--------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | Dec. 1, 2021 |
| SUBJECT | Municipal Water Supply Assessment | NAME | NM |
| | | PAGE | 1 OF |

Water Supply Analysis

Firm Capacity of Surface Water Supply (Pressure Zones 2S and 3S) = 60,000 m³/day
(as per WSP Water Supply Master Plan Update)

Average Day Demand Assessment (Surface Water System) (m³/day)

| | Pressure Zone 2S | Pressure Zone 3S | Total (2S + 3S) | Residual | |
|-------------|------------------|------------------|-----------------|----------|--|
| 2011 Actual | 9,358 | 2,640 | 11,998 | 48,002 | actual demands as per Table 2-9 of WSP Report |
| 2015 Actual | 6,730 | 1,691 | 8,421 | 51,579 | |
| 2016 Actual | 8,547 | 2,294 | 10,841 | 49,159 | |
| 2017 Actual | 7,291 | 2,349 | 9,640 | 50,360 | |
| 2021 Proj. | 9,581 | 11,289 | 20,870 | 39,130 | Projected demands as per Table 3-6 of WSP Report |
| 2026 Proj. | 11,627 | 13,403 | 25,030 | 34,970 | |
| 2031 Proj. | 12,787 | 15,429 | 28,216 | 31,784 | |
| 2036 Proj. | 14,552 | 17,286 | 31,838 | 28,162 | |
| 2041 Proj. | 16,272 | 19,665 | 35,937 | 24,063 | |

Maximum Day Demand Assessment (Surface Water System) (m³/day)

| | Pressure Zone 2S | Pressure Zone 3S | Total (2S + 3S) | Residual | |
|-------------|------------------|------------------|-----------------|---------------|--|
| 2011 Actual | 1,840 | 11,996 | 13,836 | 46,164 | Actual demands as per Table 2-9 of WSP Report |
| 2015 Actual | 4,766 | 14,612 | 19,378 | 40,622 | |
| 2016 Actual | 5,440 | 13,117 | 18,557 | 41,443 | |
| 2017 Actual | 5,485 | 12,549 | 18,034 | 41,966 | |
| 2021 Proj. | 21,057 | 20,321 | 41,378 | 18,622 | Projected demands as per Table 3-6 of WSP Report |
| 2026 Proj. | 24,638 | 24,125 | 48,763 | 11,237 | |
| 2031 Proj. | 26,668 | 27,772 | 54,440 | 5,560 | |
| 2036 Proj. | 29,053 | 31,115 | 60,168 | -168 | |
| 2041 Proj. | 31,892 | 35,397 | 67,289 | -7,289 | |

Therefore, Water Supply for Pressure Zones 2S and 3S is expected to be sufficient until 2035, based on population projections as per the WSP Report

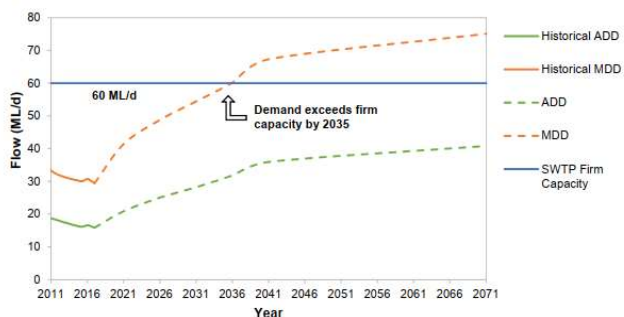


Figure 4-2 City of Barrie 2018 Surface Water Demand Projections (Southern Zones: 2S, and 3S) compared to SWTP Firm Production Capacity

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

| Step | Description | Term | Options | | Multiplier Associated with Option | Choose | Value used | Unit | Total Fire Flow (L/min) | |
|------------|---|---|---|---|-----------------------------------|--------|----------------------------------|--------------------|-------------------------|---------------------------------|
| 1 | Frame Use for Construction of Unit | Coefficient related to type of construction (C) | Framing Material | | | | | | | |
| | | | Wood Frame | 1.5 | Ordinary Construction | 1 | - | N/A | | |
| | | | | Ordinary Construction | | | | | 1 | |
| | | | | Non-combustible construction | | | | | 0.8 | |
| | | | | Fire resistive construction (< 2 hrs) | | | | | 0.7 | |
| | | | | Fire resistive construction (> 2 hrs) | | | | | 0.6 | |
| 2 | Type of Housing (if Townhouse, enter number of units per TH block) | Type of Housing | Floor Space Area | | | | | | | |
| | | | Single Family | 1 | | 0 | Units | N/A | | |
| | | | | Townhouse / Apartment- inform # of units | 1 | | | | 8 | |
| | | | | Other (Comm. Ind., etc.) | 1 | | | | | |
| | | | | 2 hour Fire Separation Between Units | 1 | Yes | | | 1 | |
| 2.1 | Number of Storeys | Number of Floors / Storeys in the unit (do not include basement) | | | | | 3 | Storeys | N/A | |
| 3 | Floor Area (exclude basements, per unit for townhouses, per single family dwelling or per building for apartments, commercial or institutional) | Ground Floor Area | | | | | 80 | Square Metres (m2) | N/A | |
| | | Total Floor Area - One Storey of Townhouse/Apartment Block | | | | | 80 | | | |
| | | Total Floor Area - All Storeys | | | | | 240 | | | |
| | | Does the building have fire-resistive design? | | No | | 240 | | | | |
| | | Are vertical openings/communications properly protected (1 hour rating)? | | No | | 240 | | | | |
| | | Total Floor Area (A) - for all storeys excluding basement - Single Family | | | | | 240 | | | |
| | | Measurement Units | Square Feet (ft²) | 0.093 | | 240 | m² | | | |
| | | | Square Metres (m²) | 1 | | | | | | |
| | | | Hectares (ha) | 10000 | | | | | | |
| 4 | Required Fire Flow without Reductions or Increases | Required Fire Flows without Reductions or Increases per FUS): (FF= 220 x C x A ^{0.5}) | | | | | | L/min | 3,000 | |
| 5 | Factors Affecting Burning | Reductions / Increases Due to Factors Affecting Burning | | | | | | | | |
| 5.1 | Combustibility of Building Contents | Occupancy content hazard reduction or surcharge | Non-combustible | -0.25 | Non-combustible | -0.25 | N/A | (750) | 2,250 | |
| | | | Limited combustible | -0.15 | | | | | | |
| | | | Combustible | 0.00 | | | | | | |
| | | | Free burning | 0.15 | | | | | | |
| | | | Rapid burning | 0.25 | | | | | | |
| 5.2 | Reduction Due to Presence of Sprinklers | Sprinkler reduction | Fully supervised system | -0.5 | None | 0.0 | N/A | - | 2,250 | |
| | | | Water supply system/hose connections | -0.4 | | | | | | |
| | | | Automatic sprinkler protection | -0.3 | | | | | | |
| | | | None | 0 | | | | | | |
| | | | 5.3 | Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units) | | | | | | Exposure distance between units |
| East Side | 0 to 3.0 m | 0.25 | | | | | | | | |
| South Side | 3.1 to 10.0 m | 0.20 | | | | | | | | |
| West Side | 0 to 3.0 m | 0.25 | | | | | | | | |
| 5.4 | Combustibility of Wood Shingle or Shake Roof Material | Surcharge for potential to spread fire | | | Non-combustible roofing material | 0 | Non-combustible roofing material | 0 | L/min | |
| | | | Low risk of fire spread | 2000 | | | | | | |
| | | | Moderate risk of fire spread | 3000 | | | | | | |
| | | | High risk of fire spread | 4000 | | | | | | |
| | | | Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied: | | | | | | | |
| 6 | Required Fire Flow, Duration and Volume | Total Required Fire Flow (above) in L/s: | | | | | | | 67 | |
| | | Required Duration of Fire Flow of | | | | | 4,000 L/min (hrs): | 1.5 | | |
| | | Required volume for Fire Flow of | | | | | 4,000 L/min (m³): | 360 | | |

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

| Step | Description | Term | Options | Multiplier Associated with Option | Choose | Value used | Unit | Total Fire Flow (L/min) | | | | | |
|---|---|--|---|-----------------------------------|----------------------------------|------------|---------------------------------|-------------------------|-------|--|--|--|--|
| 1 | Frame Use for Construction of Unit | Coefficient related to type of construction (C) | Framing Material | | | | | | | | | | |
| | | | Wood Frame | 1.5 | Ordinary Construction | 1 | - | N/A | | | | | |
| | | | Ordinary Construction | 1 | | | | | | | | | |
| | | | Non-combustible construction | 0.8 | | | | | | | | | |
| | | | Fire resistive construction (< 2 hrs) | 0.7 | | | | | | | | | |
| | | | Fire resistive construction (> 2 hrs) | 0.6 | | | | | | | | | |
| 2 | Type of Housing (if Townhouse, enter number of units per TH block) | Type of Housing | Floor Space Area | | | | | | | | | | |
| | | | Single Family | 1 | | 0 | Units | N/A | | | | | |
| | | | Townhouse / Apartment- inform # of units | 1 | | 2 | | | | | | | |
| | | | Other (Comm. Ind., etc.) | 1 | | | | | | | | | |
| | | | 2 hour Fire Separation Between Units | 1 | No | 2 | | | | | | | |
| 2.1 | Number of Storeys | Number of Floors / Storeys in the unit (do not include basement) | | | | 2 | Storeys | N/A | | | | | |
| 3 | Floor Area (exclude basements, per unit for townhouses, per single family dwelling or per building for apartments, commercial or institutional) | | Ground Floor Area | | | 100 | Square Metres (m ²) | N/A | | | | | |
| | | | Total Floor Area - One Storey of Townhouse/Apartment Block | | | 200 | | | | | | | |
| | | | Total Floor Area - All Storeys | | | 400 | | | | | | | |
| | | | Does the building have fire-resistive design? | | | No | | | | | | | |
| | | | Are vertical openings/communications properly protected (1 hour rating)? | | | Yes | | | | | | | |
| | | | Total Floor Area (A) - for all storeys excluding basement - Single Family | | | 250 | | | | | | | |
| | | | Measurement Units | Square Feet (ft ²) | 0.093 | 250 | m ² | | | | | | |
| | | | | Square Metres (m ²) | 1 | | | | | | | | |
| | | | | Hectares (ha) | 10000 | | | | | | | | |
| 4 | Required Fire Flow without Reductions or Increases | Required Fire Flows without Reductions or Increases per FUS: (FF= 220 x C x A ^{0.5}) | | | | | L/min | 3,000 | | | | | |
| 5 | Factors Affecting Burning | Reductions / Increases Due to Factors Affecting Burning | | | | | | | | | | | |
| 5.1 | Combustibility of Building Contents | Occupancy content hazard reduction or surcharge | Non-combustible | -0.25 | Non-combustible | -0.25 | N/A | (750) | 2,250 | | | | |
| | | | Limited combustible | -0.15 | | | | | | | | | |
| | | | Combustible | 0.00 | | | | | | | | | |
| | | | Free burning | 0.15 | | | | | | | | | |
| | | | Rapid burning | 0.25 | | | | | | | | | |
| 5.2 | Reduction Due to Presence of Sprinklers | Sprinkler reduction | Fully supervised system | -0.5 | None | 0.0 | N/A | - | 2,250 | | | | |
| | | | Water supply system/hose connections | -0.4 | | | | | | | | | |
| | | | Automatic sprinkler protection | -0.3 | | | | | | | | | |
| | | | None | 0 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 5.3 | Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units) | Exposure distance between units | North Side | 3.1 to 10.0 m | 0.20 | 0.75 | % | 1,688 | 3,938 | | | | |
| | | | East Side | 0 to 3.0 m | 0.25 | | | | | | | | |
| | | | South Side | 3.1 to 10.0 m | 0.20 | | | | | | | | |
| | | | West Side | 0 to 3.0 m | 0.25 | | | | | | | | |
| | | | | | | | | | | | | | |
| 5.4 | Combustibility of Wood Shingle or Shake Roof Material | Surcharge for potential to spread fire | Non-combustible roofing material | 0 | Non-combustible roofing material | 0 | L/min | 0 | 3,938 | | | | |
| | | | Low risk of fire spread | 2000 | | | | | | | | | |
| | | | Moderate risk of fire spread | 3000 | | | | | | | | | |
| | | | High risk of fire spread | 4000 | | | | | | | | | |
| | | | | | | | | | | | | | |
| Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied: | | | | | | | | | 4,000 | | | | |
| 6 | Required Fire Flow, Duration and Volume | Total Required Fire Flow (above) in L/s: | | | | | | | 67 | | | | |
| | | Required Duration of Fire Flow of 4,000 L/min (hrs): | | | | | | | 1.5 | | | | |
| | | Required volume for Fire Flow of 4,000 L/min (m ³): | | | | | | | 360 | | | | |

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

| Step | Description | Term | Options | Multiplier Associated with Option | Choose | Value used | Unit | Total Fire Flow (L/min) | | | |
|---|---|--|--|-----------------------------------|----------------------------------|------------|---------------------------------|-------------------------|--------|--|--|
| 1 | Frame Use for Construction of Unit | Coefficient related to type of construction (C) | Framing Material | | | | | | | | |
| | | | Wood Frame | 1.5 | Ordinary Construction | 1 | - | N/A | | | |
| | | | Ordinary Construction | 1 | | | | | | | |
| | | | Non-combustible construction | 0.8 | | | | | | | |
| | | | Fire resistive construction (< 2 hrs) | 0.7 | | | | | | | |
| | | | Fire resistive construction (> 2 hrs) | 0.6 | | | | | | | |
| 2 | Type of Housing (if Townhouse, enter number of units per TH block) | Type of Housing | Floor Space Area | | | | | | | | |
| | | | Single Family | 1 | | 0 | Units | N/A | | | |
| | | | Townhouse / Apartment- inform # of units | 1 | | 40 | | | | | |
| | | | Other (Comm. Ind., etc.) | 1 | | | | | | | |
| | | | 2 hour Fire Separation Between Units | 1 | Yes | 1 | | | | | |
| 2.1 | Number of Storeys | Number of Floors / Storeys in the unit (do not include basement) | | | | 6 | Storeys | N/A | | | |
| 3 | Floor Area (exclude basements, per unit for townhouses, per single family dwelling or per building for apartments, commercial or institutional) | Ground Floor Area | | | | 2580 | Square Metres (m ²) | N/A | | | |
| | | Total Floor Area - One Storey of Townhouse/Apartment Block | | | | 2580 | | | | | |
| | | Total Floor Area - All Storeys | | | | 15480 | | | | | |
| | | Does the building have fire-resistive design? | | | | No | | | | | |
| | | Are vertical openings/communications properly protected (1 hour rating)? | | | | Yes | | | | | |
| | | Total Floor Area (A) - for all storeys excluding basement - Single Family | | | | 3870 | | | | | |
| | | Measurement Units | Square Feet (ft ²) | 0.093 | | 3870 | m ² | | | | |
| | | | Square Metres (m ²) | 1 | | | | | | | |
| | | | Hectares (ha) | 10000 | | | | | | | |
| 4 | Required Fire Flow without Reductions or Increases | Required Fire Flows without Reductions or Increases per FUS: (FF= 220 x C x A ^{0.5}) | | | | | L/min | 14,000 | | | |
| 5 | Factors Affecting Burning | Reductions / Increases Due to Factors Affecting Burning | | | | | | | | | |
| 5.1 | Combustibility of Building Contents | Occupancy content hazard reduction or surcharge | Non-combustible | -0.25 | Non-combustible | -0.25 | N/A | (3,500) | 10,500 | | |
| | | | Limited combustible | -0.15 | | | | | | | |
| | | | Combustible | 0.00 | | | | | | | |
| | | | Free burning | 0.15 | | | | | | | |
| | | | Rapid burning | 0.25 | | | | | | | |
| 5.2 | Reduction Due to Presence of Sprinklers | Sprinkler reduction | Fully supervised system | -0.5 | Automatic sprinkler protection | -0.3 | N/A | (3,150) | 7,350 | | |
| | | | Water supply system/hose connections | -0.4 | | | | | | | |
| | | | Automatic sprinkler protection | -0.3 | | | | | | | |
| | | | None | 0 | | | | | | | |
| 5.3 | Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units) | Exposure distance between units | North Side | 10.1 to 20.0 m | 0.15 | 0.6 | % | 6,300 | 13,650 | | |
| | | | East Side | 10.1 to 20.0 m | 0.15 | | | | | | |
| | | | South Side | 10.1 to 20.0 m | 0.15 | | | | | | |
| | | | West Side | 10.1 to 20.0 m | 0.15 | | | | | | |
| 5.4 | Combustibility of Wood Shingle or Shake Roof Material | Surcharge for potential to spread fire | Non-combustible roofing material | 0 | Non-combustible roofing material | 0 | L/min | 0 | 13,650 | | |
| | | | Low risk of fire spread | 2000 | | | | | | | |
| | | | Moderate risk of fire spread | 3000 | | | | | | | |
| | | | High risk of fire spread | 4000 | | | | | | | |
| Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied: | | | | | | | | 14,000 | | | |
| 6 | Required Fire Flow, Duration and Volume | Total Required Fire Flow (above) in L/s: | | | | | | | 233 | | |
| | | Required Duration of Fire Flow of 14,000 L/min (hrs): | | | | | | 3 | | | |
| | | Required volume for Fire Flow of 14,000 L/min (m ³): | | | | | | 2,520 | | | |

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

| Step | Description | Term | Options | Multiplier Associated with Option | Choose | Value used | Unit | Total Fire Flow (L/min) | | | | | |
|---|---|--|---|-----------------------------------|---------------------------------------|------------|---------------------------------|-------------------------|--------|--|--|--|--|
| 1 | Frame Use for Construction of Unit | Coefficient related to type of construction (C) | Framing Material | | Fire resistive construction (< 2 hrs) | 0.7 | - | N/A | | | | | |
| | | | Wood Frame | 1.5 | | | | | | | | | |
| | | | Ordinary Construction | 1 | | | | | | | | | |
| | | | Non-combustible construction | 0.8 | | | | | | | | | |
| | | | Fire resistive construction (< 2 hrs) | 0.7 | | | | | | | | | |
| | | | Fire resistive construction (> 2 hrs) | 0.6 | | | | | | | | | |
| 2 | Type of Housing (if Townhouse, enter number of units per TH block) | Type of Housing | Floor Space Area | | | 0 | Units | N/A | | | | | |
| | | | Single Family | 1 | | | | | | | | | |
| | | | Townhouse / Apartment- inform # of units | 1 | | | | | | | | | |
| | | | Other (Comm. Ind., etc.) | 1 | | | | | | | | | |
| | | | 2 hour Fire Separation Between Units | 1 | Yes | 1 | | | | | | | |
| 2.1 | Number of Storeys | Number of Floors / Storeys in the unit (do not include basement) | | | | 1 | Storeys | N/A | | | | | |
| 3 | Floor Area (exclude basements, per unit for townhouses, per single family dwelling or per building for apartments, commercial or institutional) | | Ground Floor Area | | | 15000 | Square Metres (m ²) | N/A | | | | | |
| | | | Total Floor Area - One Storey of Townhouse/Apartment Block | | | 15000 | | | | | | | |
| | | | Total Floor Area - All Storeys | | | 15000 | | | | | | | |
| | | | Does the building have fire-resistive design? | | Yes | 15000 | | | | | | | |
| | | | Are vertical openings/communications properly protected (1 hour rating)? | | Yes | 15000 | | | | | | | |
| | | | Total Floor Area (A) - for all storeys excluding basement - Single Family | | | 15000 | | | | | | | |
| | | | Measurement Units | Square Feet (ft ²) | 0.093 | 15000 | m ² | | | | | | |
| | | | | Square Metres (m ²) | 1 | | | | | | | | |
| | | | | Hectares (ha) | 10000 | | | | | | | | |
| 4 | Required Fire Flow without Reductions or Increases | Required Fire Flows without Reductions or Increases per FUS: (FF= 220 x C x A ^{0.5}) | | | | | L/min | 19,000 | | | | | |
| 5 | Factors Affecting Burning | Reductions / Increases Due to Factors Affecting Burning | | | | | | | | | | | |
| 5.1 | Combustibility of Building Contents | Occupancy content hazard reduction or surcharge | Non-combustible | -0.25 | Non-combustible | -0.25 | N/A | (4,750) | 14,250 | | | | |
| | | | Limited combustible | -0.15 | | | | | | | | | |
| | | | Combustible | 0.00 | | | | | | | | | |
| | | | Free burning | 0.15 | | | | | | | | | |
| | | | Rapid burning | 0.25 | | | | | | | | | |
| 5.2 | Reduction Due to Presence of Sprinklers | Sprinkler reduction | Fully supervised system | -0.5 | Fully supervised system | -0.5 | N/A | (7,125) | 7,125 | | | | |
| | | | Water supply system/hose connections | -0.4 | | | | | | | | | |
| | | | Automatic sprinkler protection | -0.3 | | | | | | | | | |
| | | | None | 0 | | | | | | | | | |
| 5.3 | Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units) | Exposure distance between units | North Side | 10.1 to 20.0 m | 0.15 | 0.6 | % | 8,550 | 15,675 | | | | |
| | | | East Side | 10.1 to 20.0 m | 0.15 | | | | | | | | |
| | | | South Side | 10.1 to 20.0 m | 0.15 | | | | | | | | |
| | | | West Side | 10.1 to 20.0 m | 0.15 | | | | | | | | |
| 5.4 | Combustibility of Wood Shingle or Shake Roof Material | Surcharge for potential to spread fire | Non-combustible roofing material | 0 | Non-combustible roofing material | 0 | L/min | 0 | 15,675 | | | | |
| | | | Low risk of fire spread | 2000 | | | | | | | | | |
| | | | Moderate risk of fire spread | 3000 | | | | | | | | | |
| | | | High risk of fire spread | 4000 | | | | | | | | | |
| Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied: | | | | | | | | | 16,000 | | | | |
| 6 | Required Fire Flow, Duration and Volume | Total Required Fire Flow (above) in L/s: | | | | | | | 267 | | | | |
| | | Required Duration of Fire Flow of 16,000 L/min (hrs): | | | | | | | 3.5 | | | | |
| | | Required volume for Fire Flow of 16,000 L/min (m ³): | | | | | | | 3,360 | | | | |

Appendix C: WaterCAD Analysis

File 421487

March 23, 2022

Mark Resnick
Senior Director, Development
Barrie-Bryne Developments Limited
3200 Highway 7
Vaughan, Ontario L4K 5Z5
MResnick@smartcentres.com

Re: 15 Harvie Road Subdivision, City of Barrie
WaterCAD Analysis of Water Distribution System

Dear Mark:

Tatham completed a hydraulic analysis of the proposed Harvie Road Subdivision and employment lands development water distribution system using the WaterCAD computer modeling software. The purpose of the analysis was to demonstrate that adequate pressures and flows can be provided for domestic use and fire protection via connections to the existing watermains on Bryne Drive, Bryne Drive Extension, and Thrushwood Drive.

DESIGN CRITERIA

The water distribution analysis was completed using the design criteria listed below, based on the Design Guidelines for Drinking Water Systems (MOE, 2008) and the City of Barrie Water Transmission and Distribution Policies and Design Guidelines (August 2021).

| | |
|----------------------------------|---|
| Residential Population Density | 3.25 ppu low, 2.57 ppu medium, 1.67 ppu high |
| Average Day Demand - residential | 225 L/person/day |
| Average Day Demand - commercial | 28,000 L/ha/day |
| Maximum Day Factor | 2.5 |
| Peak Hour Factor | 3.75 |
| Minimum Fire Flow - residential | 100 L/s residential, 155 L/s townhouse, 200 L/s condo |
| Minimum Fire Flow - employment | 200 L/s institutional, 283 L/s commercial, 333 L/s industrial |
| Maximum pipe velocity | 1.5 m/s normally, 5 m/s under fire flow conditions |
| Normal operating pressures | 50 psi to 80 psi (above 80 psi requires individual PRV) |

WATER DISTRIBUTION SYSTEM

Water servicing to the development will be as shown on the attached Water Distribution Plan, Drawing WAT-1. Water infrastructure will include new 300 mm diameter watermains installed by others along Bryne Drive Extension from Bryne Drive to the existing 300 mm diameter stub at Harvie Road. The development will be serviced by the following connections to the municipal distribution system:

- One proposed connection to the 300 mm diameter stub on Bryne Drive Extension at Harvie Road;
- One proposed connection on Bryne Drive; and,
- Two proposed connections on Thrushwood Drive.

Three hydrant flow tests were completed in October 2021: one at Harvie Road near Bryne Drive Extension, one at Bryne Drive and one at Thrushwood Drive. Static pressures were measured to be 66 psi, 58 psi and 59 psi, respectively at these locations. Results of the hydrant flow tests are attached.

WATER DEMANDS

Water demands were calculated for the proposed 787 residential units and 12.6 ha of employment lands within the development. The total average day, maximum day, and peak hour demands were calculated to be 8.2 L/s, 20.5 L/s and 30.8 L/s, respectively.

Water demands were allocated to the nodes in the WaterCAD model based on discussions with the project team, and as summarized in the attached WaterCAD results sheets.

MODEL SETUP

A WaterCAD pipe network was created to simulate the development's water distribution system, based on the layout shown on Drawing WAT-1. Watermain sizes were selected initially, and then refined based on initial model results. The model results are presented for the final watermain sizes shown on WAT-1.

Based on the modelling, the employment lands are proposed to be serviced by 300 mm diameter mains connected to a 300 mm diameter watermain on Bryne Drive Extension.

The residential area is proposed to be serviced by a 250 mm watermain connected to a 300 mm watermain on Bryne Drive Extension, a 200 mm diameter watermain loop connected to the existing 200 mm diameter watermain on Thrushwood Drive, and a network of 150 mm diameter watermains on the remaining streets.

Reservoirs (R-1, R-2, and R-3) were added to the model to simulate the municipal water supply from Harvie Road, Thrushwood Drive, and Bryne Drive, respectively. For the purpose of model simulation, each reservoir was assumed to have a constant reservoir level based on the static pressures observed during hydrant flow testing at each location.



MODEL ANALYSIS

The model was used to analyze flows, pressures, and pipe velocities in the distribution system with water supplied from each of the three main connection points to the existing distribution system under the following scenarios:

- Average day demand (ADD)
- Maximum day demand (MDD)
- Peak hour demand (PHD)
- Available fire flow (AFF)
- Fire Flow plus maximum day demand

Model results were generated with water supply from one connection point at a time (either R-1, R-2, or R-3) as the hydrant tests were conducted one at a time. This is considered conservative as water would typically be supplied from all proposed connections to the municipal distribution system. Unless otherwise noted, model results are presented in this report for water supplied from the Bryne Drive connection at the south limit of the development (R-3). Summary tables and figures showing the model results are attached.

The model results predict the following within the Harvie Road development water system:

- Pressures range between 398 kPa (58 psi) and 477 kPa (69 psi) under ADD, MDD and PHD scenarios, which is within the City of Barrie's design guidelines.
- Available fire flows in the employment areas range from 250 L/s to 333 L/s, which meets the City's minimum recommended fire flow for the proposed use.
- In residential areas, available fire flows range from 112 L/s to 197 L/s adjacent to the semi-detached units and townhouses, and fire flows up to 333 L/s are available at the condominium buildings, with water supplied from the Bryne Drive connection only. This meets the City's minimum recommended fire flow requirements except on portions of Street 'C' and Street 'D' (i.e., at nodes J-12, J-13, and J-17 in areas near to Thrushwood Drive).
- When modelling with water supplied from the Thrushwood Drive connection, available fire flows are predicted to range from 148 L/s to 333 L/s adjacent to the semi-detached units and townhouses. This is considered acceptable because:
 - Fire flows meet or are only slightly below the City's minimum recommended fire flow requirements, and
 - Water would typically be supplied from more than one connection at a time.



- The maximum pipe velocity under PHD is 0.4 m/s, which is expected to occur in P-23 (proposed 300 mm diameter watermain on Bryne Drive Extension). This is less than the City's maximum recommended velocity of 1.5 m/s under normal operating conditions.
- The maximum pipe velocity under fire flow plus MDD is 3.2 m/s in P-5 (proposed 250 mm diameter watermain connecting the residential area to the Bryne Drive Extension watermain). This is less than the City's maximum recommended velocity of 5 m/s under fire flow conditions.

SUMMARY AND RECOMMENDATIONS

The WaterCAD computer model results predict that the existing watermains and proposed internal watermains will provide an adequate supply of water for domestic use and fire protection for the development.

In general, the proposed water distribution system for the development is well connected with three connection points and a 300 mm diameter trunk watermain passing through the development. This will provide good redundancy in the case of a watermain break and help to maintain water quality in the development.

The water distribution system will consist of 150 mm diameter, 200 mm diameter, 250 mm diameter and 300 mm diameter internal watermains as shown on WAT-1.

It is recommended that model demands and fire flow requirements be updated once the development plans have been finalized and prior to final design of the water distribution system.

Please do not hesitate to contact us if you have any questions.

Yours truly,

Tatham Engineering Limited



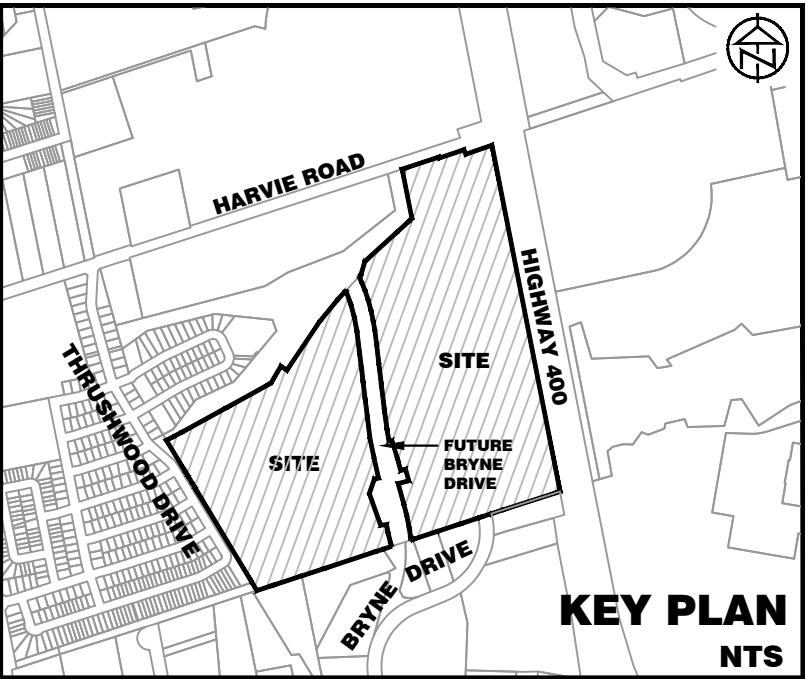
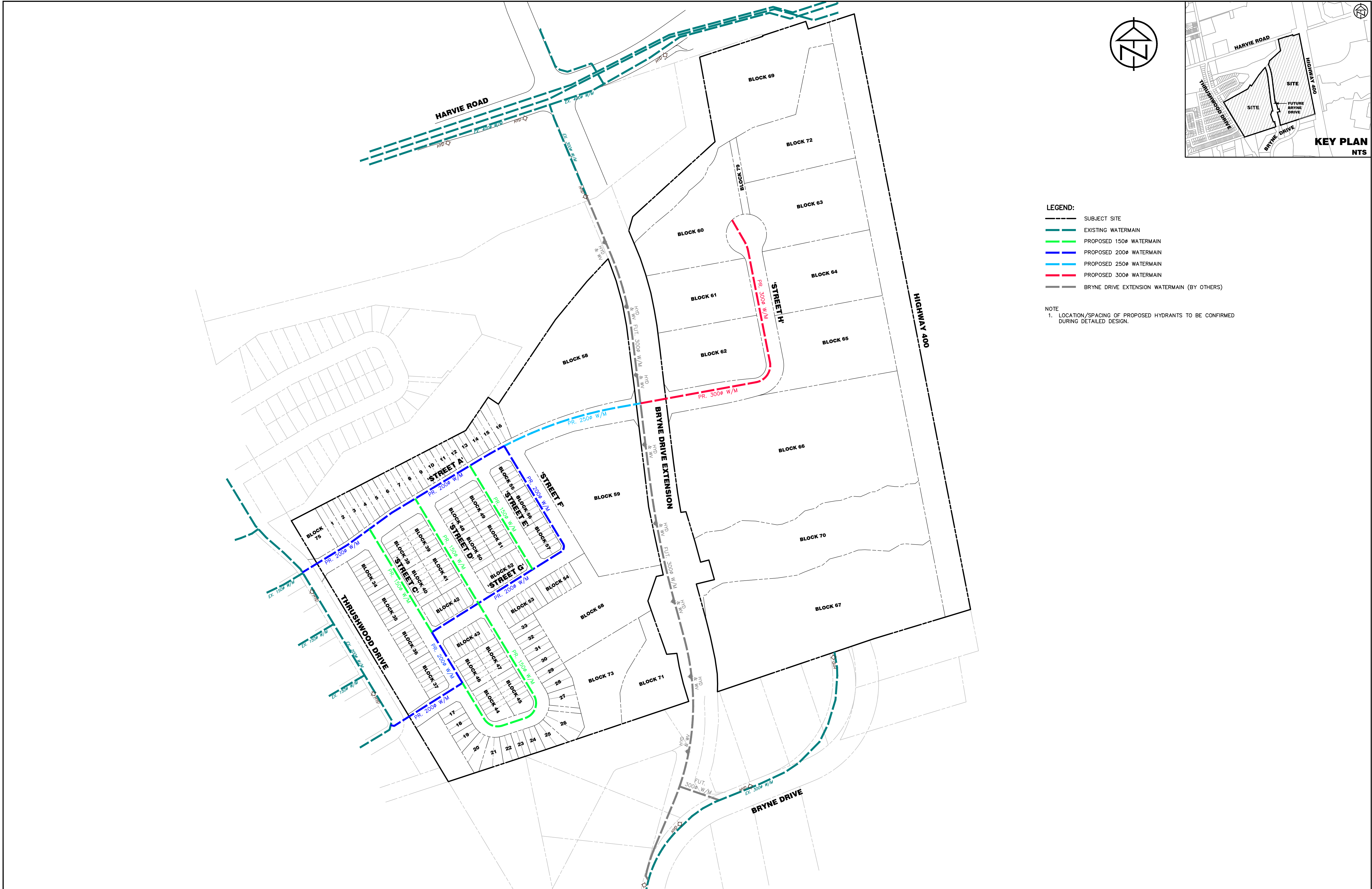
Robin Gayle Deduro, B.Eng., EIT
Engineering Intern
RGD/JRC:pt



Jason R. Covey, B.Sc.(Eng.), P.Eng.
Senior Engineer

Encl.: WAT-1, Hydrant flow tests, WaterCAD results sheets, Figures 1 to 4.






- LEGEND:
- SUBJECT SITE
 - EXISTING WATERMAIN
 - PROPOSED 150# WATERMAIN
 - PROPOSED 200# WATERMAIN
 - PROPOSED 250# WATERMAIN
 - PROPOSED 300# WATERMAIN
 - BRYNE DRIVE EXTENSION WATERMAIN (BY OTHERS)

NOTE

1. LOCATION/SPACING OF PROPOSED HYDRANTS TO BE CONFIRMED DURING DETAILED DESIGN.

| | | | | | | | | | | | | | |
|--|--|------------------|------------|-----------------------------|-------------|-----------------------|---|--|---|--|-------------------|----------------------------|---------------------------------|
| DISCLAIMER AND COPYRIGHT CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED. TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED. | DRAWING REFERENCES TOPOGRAPHIC FEATURES AND LEGAL BOUNDARIES SHOWN ON THIS PLAN FROM SURVEY (JOB NO. 07-11-125-00-A), PREPARED BY J.D. BARNES LIMITED, OLS., DATED JULY 6, 2017. PROPOSED DRAFT PLAN INFORMATION SHOWN ON THIS PLAN FROM DRAWING D3 (PROJECT NO. 9683), PREPARED BY WESTON CONSULTING PLANNING & DESIGN, DATED MARCH 2, 2022. | ELEVATION | No. | REVISION DESCRIPTION | DATE | ENGINEER STAMP | 15 HARVIE ROAD CITY OF BARRIE BARRIE - BRYNE DEVELOPMENTS LTD. | |  | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | WATER DISTRIBUTION PLAN | | DESIGN: LC | FILE: 421487 | DWG: WAT-1 |
| | | | | | | | | | | | DRAWN: LC | DATE: DECEMBER 2021 | |
| | | | | | | | | | | | CHECK: NM | SCALE: 1:2,000 | |

FLOW TEST RESULTS



DATE : OCTOBER 08, 2021 TIME : 10:00 AM

LOCATION : THRUSHWOOD DR. + CRANBERRY LN.

CITY OF BARRIE

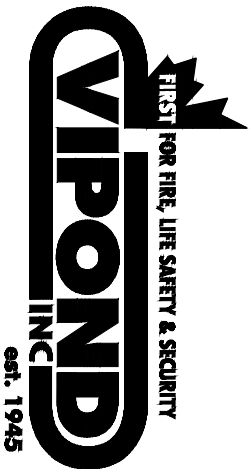
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 61 PSI

| TEST NO. | NO. OF NOZZLES | NOZZLE DIAMETER (INCHES) | DISCHARGE CO-EFFICIENT | RESIDUAL PRESSURE (PSI) | PITOT PRESSURE (PSI) | DISCHARGE (U.S.GPM) |
|----------|----------------|--------------------------|------------------------|-------------------------|----------------------|---------------------|
| 1 | 1 | 1-3/4 | 0.995 | 59 | 42 | 577 |
| 2 | 1 | 2-1/2 | 0.90 | 60 | 23 | 809 |
| 3 | 2 | 2-1/2 | 0.90 | 58 | 19 | 1470 |



THRUSHWOOD DR. + CRANBERRY LN.
CITY OF BARRIE
ONTARIO

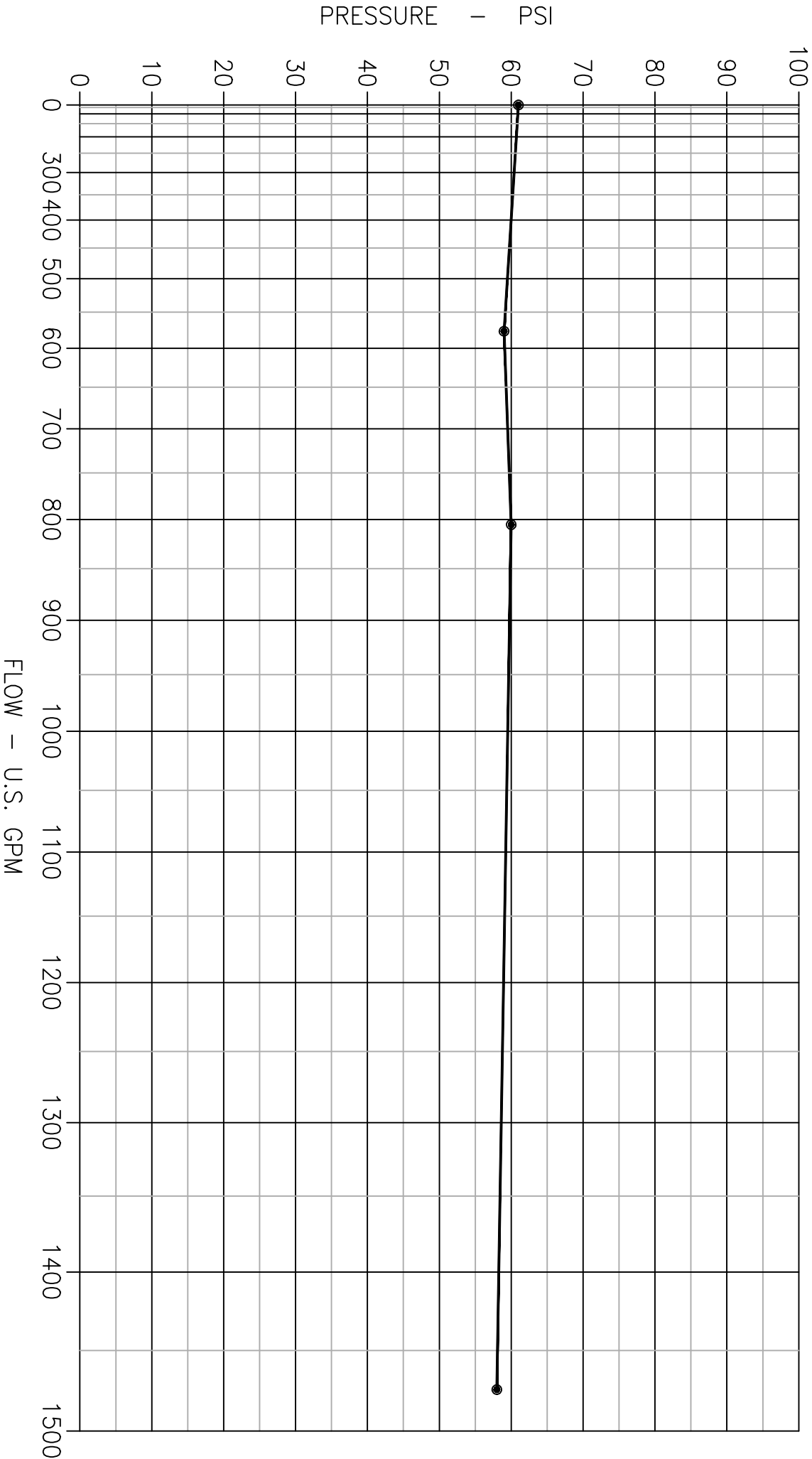
BY : LEN K./RILEY P.
OFFICE : BARRIE
TEST BY : VIPOND & PUC
DATE : OCTOBER 08, 2021

STATIC:
61 PSI

RESIDUAL:

FLOW:

TEST#1 59 PSI @ 577 GPM
TEST#2 60 PSI @ 809 GPM
TEST#3 58 PSI @ 1470 GPM



FLOW TEST RESULTS



DATE : OCTOBER 08, 2021 TIME : 11:00 AM

LOCATION : HARVIE RD

CITY OF BARRIE

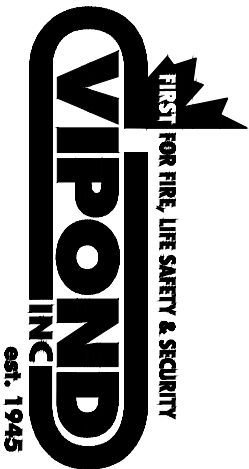
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 68 PSI

| TEST NO. | NO. OF NOZZLES | NOZZLE DIAMETER (INCHES) | DISCHARGE CO-EFFICIENT | RESIDUAL PRESSURE (PSI) | PITOT PRESSURE (PSI) | DISCHARGE (U.S.GPM) |
|----------|----------------|--------------------------|------------------------|-------------------------|----------------------|---------------------|
| 1 | 1 | 1-3/4 | 0.995 | 66 | 50 | 630 |
| 2 | 1 | 2-1/2 | 0.90 | 66 | 20 | 754 |
| 3 | 2 | 2-1/2 | 0.90 | 66 | 19 | 1470 |



HARVIE RD
CITY OF BARRIE
ONTARIO

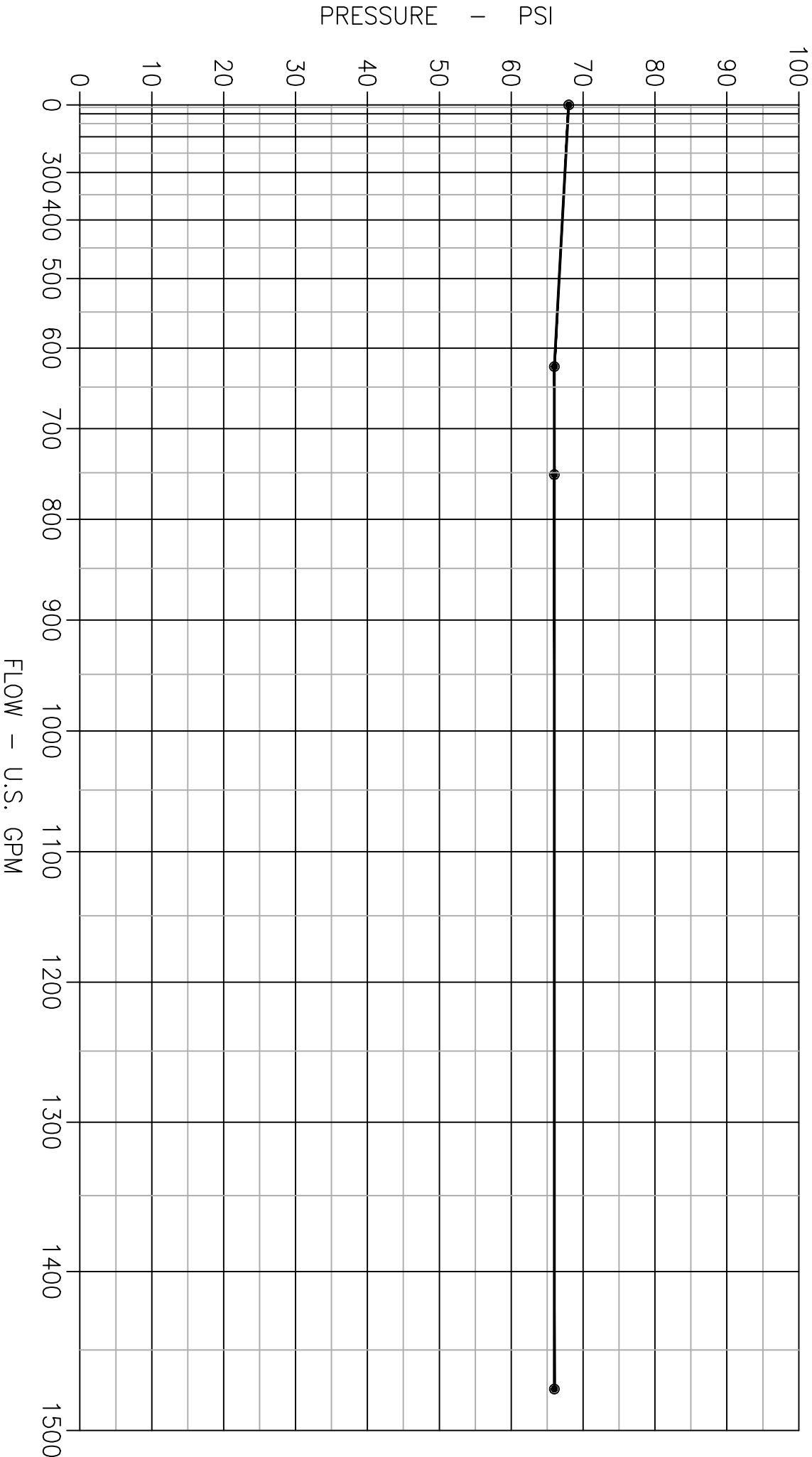
BY : LEN K./RILEY P.
OFFICE : BARRIE
TEST BY : VIPOND & PUC
DATE : OCTOBER 08, 2021

STATIC:
68 PSI

RESIDUAL:

FLOW:

TEST#1 66 PSI @ 630 GPM
TEST#2 66 PSI @ 754 GPM
TEST#3 66 PSI @ 1470 GPM



FLOW TEST RESULTS



DATE : OCTOBER 08, 2021

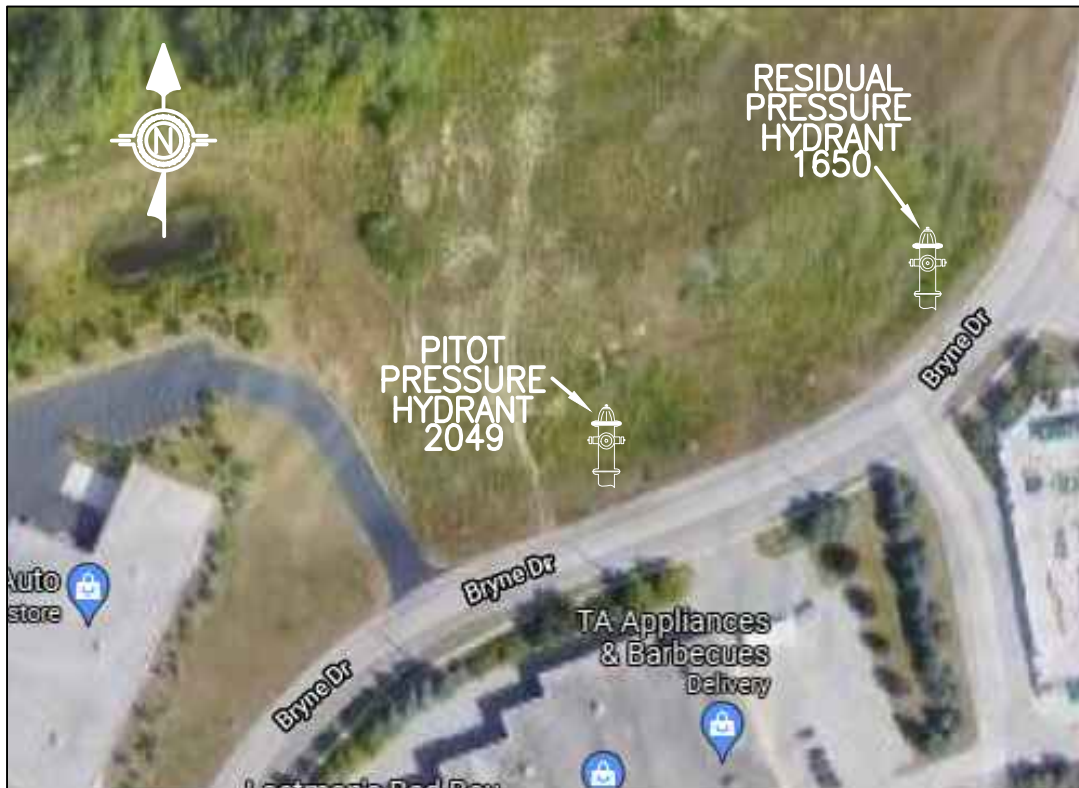
TIME : 12:00 PM

LOCATION : BRYNE DR.

CITY OF BARRIE

ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 60 PSI

| TEST NO. | NO. OF NOZZLES | NOZZLE DIAMETER (INCHES) | DISCHARGE CO-EFFICIENT | RESIDUAL PRESSURE (PSI) | PITOT PRESSURE (PSI) | DISCHARGE (U.S.GPM) |
|----------|----------------|--------------------------|------------------------|-------------------------|----------------------|---------------------|
| 1 | 1 | 1-3/4 | 0.995 | 58 | 48 | 617 |
| 2 | 1 | 2-1/2 | 0.9 | 58 | 23 | 809 |
| 3 | 2 | 2-1/2 | 0.9 | 56 | 20 | 1508 |



BRYNE DR.
CITY OF BARRIE
ONTARIO

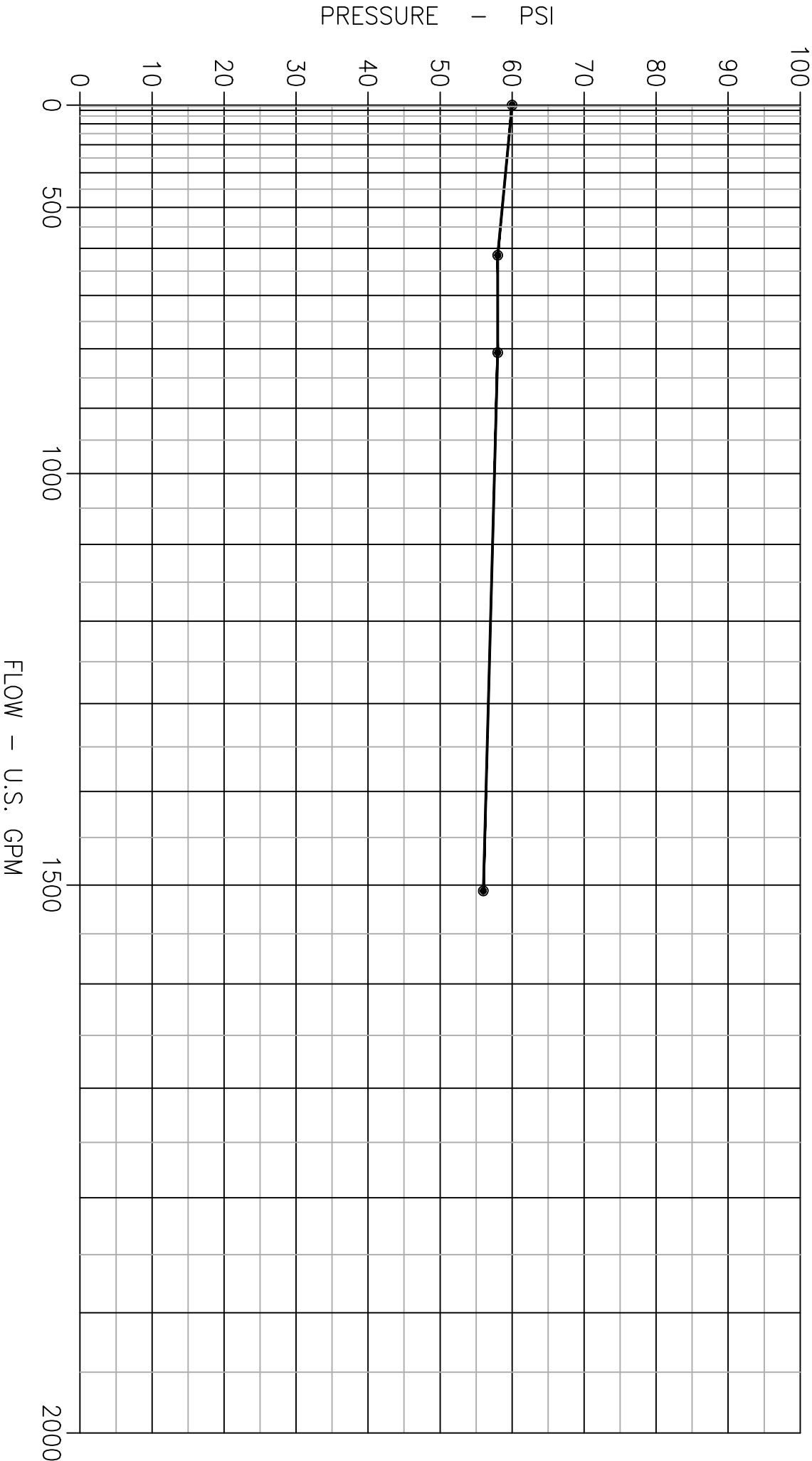
BY : LEN K./RILEY P.
OFFICE : BARRIE
TEST BY : VIPOND & PUC
DATE : OCTOBER 08, 2021

STATIC:
60 PSI

RESIDUAL:

FLOW:

TEST#1 58 PSI @ 617 GPM
TEST#2 58 PSI @ 809 GPM
TEST#3 56 PSI @ 1508 GPM



| | | | |
|---------|-------------------------|---------|------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | 2022-03-11 |
| SUBJECT | WaterCAD Demands | NAME | RGD |
| | | CHECKED | JRC |

WATER DISTRIBUTION SYSTEM DESIGN CRITERIA

From City of Barrie Water Transmission and Distribution Design Standard, August 2021:

Residential ppu:

| | | |
|------|-----|---|
| 3.25 | ppu | Low Density (single detached, duplexes, semi-detached dwellings) |
| 2.57 | ppu | Medium Density (triplexes, fourplexes, block townhouses, street townhouses) |
| 1.67 | ppu | High Density (apartment dwellings) |

Average Water Consumption Rate:

| | | |
|--------|-----------|---|
| 225 | L/cap/day | Residential |
| 28,000 | L/ha/day | Commercial/Institutional (Employment Lands) |

Maximum Velocities:

| | | |
|-----|-----|---|
| 1.5 | m/s | Under normal operating conditions (ADD and MDD) |
| 5.0 | m/s | Under fire flow conditions |

From the 2008 MOE Design Guidelines for Drinking Water Systems:

Operating pressures:

| | | |
|-----|-----|---|
| 275 | kPa | Minimum operating pressure |
| 700 | kPa | Maximum operating pressure |
| 350 | kPa | Preferred minimum operating pressure |
| 485 | kPa | Preferred maximum operating pressure |
| 550 | kPa | Pressure above this require individual PRVs |
| 140 | kPa | Minimum pressure under MDD+FF |

Peaking factors:

| | |
|------|--|
| 2.50 | MDF for systems serving between 1,001-2,000 people |
| 3.75 | MDF for systems serving between 1,001-2,000 people |

WATERCAD DESIGN DEMANDS

See appended page for detailed water demands and distribution in the WaterCAD model.

FRICTION FACTORS

- Proposed watermains to service the development are 150 mm dia., 200 mm dia., or 300 mm dia.
- Hazen-Williams friction coefficients, C, used in model from City of Barrie standards:

| | |
|-------------|---------|
| 150 mm dia. | C = 100 |
| 200 mm dia. | C = 110 |
| 300 mm dia. | C = 120 |

| | | | |
|---------|-------------------------|---------|------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | 2022-03-11 |
| SUBJECT | WaterCAD Demands | NAME | RGD |
| | | CHECKED | JRC |

WATER SUPPLY

- The development will be connected to the existing Barrie water distribution system at three locations:
 - The intersection of Harvie Road and the future Bryne Drive Extension (north connection)
 - Thrushwood Drive and the intersection of Thrushwood Drive and Cranberry Lane (east connections)
 - Bryne Drive and the intersection of Bryne Drive and Barrie View Drive (south connections)
- A reservoir was modelled at each connection point to simulate a water supply for the development.

Reservoir water level is based on hydrant tests completed by Vipond Inc. on October 8, 2021.

The static pressures measured during the hydrant tests are as follows:

- Harvie Road Test: 68 psi • Hydrant elevation: 296.0 m
- Thrushwood Drive Test: 61 psi • Hydrant elevation: 304.0 m
- Bryne Drive Test: 60 psi • Hydrant elevation: 304.0 m
- Reservoir water level elevation was taken as the lower hydraulic grade line of the three tests.
- HGL = Elevation of hydrant + pressure head of hydrant
 - HGL Harvie Road Test = 296.0 m + 68 psi * 0.703 = 343.8 m
 - HGL Thrushwood Drive Test = 304.0 m + 61 psi * 0.703 = 346.9 m
 - HGL Bryne Drive Test = 304.0 m + 60 psi * 0.703 = 346.2 m
- Assumptions:
 - Elevation of hydrant is equivalent to the elevation of the road surface at the hydrant location.
 - Reservoir water level is constant

SYSTEM PRESSURES AND FLOWS

- The proposed piping network, consisting of 150 mm, 200 mm, 250 mm and 300 mm diameter watermain, and the existing 400 mm diameter watermain on Harvie Road, 300 mm diameter watermain on Bryne Drive and existing 200 mm diameter watermain on Thrushwood Drive, are able to provide pressures within Barrie's Water Design Guidelines throughout the development under all demand scenarios.
- Pressures range from 399 kPa (58 psi) at junction J-13 to 477 kPa (69 psi) at junction J-5 at grade level under ADD, MDD and PHD scenarios.
- System pressures of at least 138 kPa (20 psi) at grade level are able to be maintained at all locations of the development during the maximum day plus fire flow scenario.
- The minimum available fire flow is 112 L/s occurring at junction J-17 when the water supply is fed from the Bryne Drive connection.
- In the event of a fire in the residential areas, water is expected to be supplied from the Thrushwood Drive Drive connection or multiple connections at once.
- In a case where fire flows are supplied from the Thrushwood Drive connection, the minimum available fire flow is 148 L/s occurring at junction J-17.
- The maximum pipe velocity under PHD is 0.4 m/s experienced at pipe P-23.
- The maximum pipe velocity under the simulated fire scenario is 3.2 m/s, experienced at pipe P-5.

| | | | |
|---------|-------------------------|---------|------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | 2022-03-11 |
| SUBJECT | WaterCAD Demands | NAME | RGD |
| | | CHECKED | JRC |

Design Criteria

| | | |
|--------------------|------|---------------------|
| High Density ppu | 1.67 | For mid-rise condos |
| Medium Density ppu | 2.57 | For townhouses |
| Low Density ppu | 3.25 | For semi-detached |

| | |
|------------------------|-----------------|
| Average Day Res Demand | 225 L/cap/day |
| Average Day ICI Demand | 28,000 L/ha/day |

Demands Calculation and Summary

Peaking Factors

Water Demands

| Demands Calculation and Summary | | | | | | Water Demands | | | | | |
|--|--|----------------------|--------------|-------|---------------------|---------------|-----------|--------------|-----------|------------------|---------------|
| | | | | | | 1 | | 2.5 | | 3.75 | |
| Development | Description | WaterCAD Junction ID | No. of Units | Pop. | Comm. Lot Area (ha) | ADD (m³/day) | ADD (L/s) | MDD (m³/day) | MDD (L/s) | Peak HR (m³/day) | Peak HR (L/s) |
| Area 1 (West of Bryne Drive) | Semi-Detached Residential | J-6 | 12 | 39 | - | 9 | 0.10 | 22 | 0.25 | 33 | 0.38 |
| | | J-7 | 12 | 39 | - | 9 | 0.10 | 22 | 0.25 | 33 | 0.38 |
| | | J-8 | 10 | 33 | - | 7 | 0.08 | 18 | 0.21 | 27 | 0.32 |
| | | J-9 | 10 | 33 | - | 7 | 0.08 | 18 | 0.21 | 27 | 0.32 |
| | | J-12 | 10 | 33 | - | 7 | 0.08 | 18 | 0.21 | 27 | 0.32 |
| | | J-17 | 12 | 39 | - | 9 | 0.10 | 22 | 0.25 | 33 | 0.38 |
| | Townhouse and Back-to-Back Townhouse Residential | J-7 | 21 | 54 | - | 12 | 0.14 | 30 | 0.35 | 46 | 0.53 |
| | | J-8 | 21 | 54 | - | 12 | 0.14 | 30 | 0.35 | 46 | 0.53 |
| | | J-9 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 |
| | | J-13 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 |
| | | J-14 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 |
| | | J-15 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 |
| | | J-16 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 |
| | | J-12 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 |
| | J-17 | 20 | 51 | - | 12 | 0.13 | 29 | 0.33 | 43 | 0.50 | |
| | Mid-Rise Condos Residential | J-6 | 167 | 279 | - | 63 | 0.73 | 157 | 1.82 | 235 | 2.72 |
| | | J-2 | 124 | 207 | - | 47 | 0.54 | 116 | 1.35 | 175 | 2.02 |
| | | J-18 | 248 | 414 | - | 93 | 1.08 | 233 | 2.70 | 349 | 4.04 |
| Area 2 (East of Bryne Drive, incl. area south of Lovers Creek) | Commercial | J-4 | - | - | 5.6 | 156 | 1.81 | 390 | 4.51 | 585 | 6.77 |
| | | J-5 | - | - | 4.3 | 121 | 1.40 | 303 | 3.50 | 454 | 5.25 |
| | | J-24 | - | - | 2.7 | 77 | 0.89 | 192 | 2.22 | 287 | 3.33 |
| Total | | | 787 | 1,582 | 12.6 | 710 | 8.2 | 1,774 | 20.5 | 2,661 | 30.8 |

| | | | |
|---------|-------------------------|---------|------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | 2022-03-11 |
| SUBJECT | WaterCAD Results | NAME | RGD |
| | | CHECKED | JRC |

AFF under MDD - Harvie Road connection

| Node ID | Elev. (m) | AFF (L/s) | HGL (m) | Pressure | |
|---------|-----------|-----------|---------|----------|-----|
| | | | | psi | kPa |
| J-1 | 293.0 | 333 | 342.4 | 70 | 483 |
| J-2 | 298.3 | 333 | 342.3 | 36 | 247 |
| J-3 | 301.5 | 298 | 342.3 | 24 | 164 |
| J-4 | 299.7 | 276 | 342.3 | 20 | 138 |
| J-5 | 296.1 | 251 | 342.2 | 20 | 138 |
| J-18 | 302.7 | 263 | 342.3 | 22 | 153 |
| J-19 | 303.5 | 199 | 342.3 | 21 | 144 |
| J-21 | 304.1 | 194 | 342.3 | 20 | 138 |
| J-22 | 302.5 | 176 | 342.3 | 20 | 138 |
| J-24 | 302.0 | 170 | 342.3 | 20 | 138 |
| J-6 | 299.9 | 194 | 342.2 | 26 | 176 |
| J-7 | 300.3 | 176 | 342.2 | 24 | 163 |
| J-8 | 301.3 | 162 | 342.2 | 21 | 146 |
| J-9 | 302.2 | 150 | 342.2 | 20 | 138 |
| J-10 | 302.5 | 138 | 342.2 | 20 | 138 |
| J-11 | 303.8 | 132 | 342.2 | 20 | 138 |
| J-12 | 303.4 | 141 | 342.2 | 20 | 138 |
| J-13 | 303.7 | 145 | 342.2 | 20 | 138 |
| J-14 | 303.1 | 155 | 342.2 | 20 | 138 |
| J-15 | 302.7 | 164 | 342.2 | 20 | 138 |
| J-16 | 302.6 | 165 | 342.2 | 20 | 138 |
| J-17 | 302.8 | 107 | 342.2 | 20 | 138 |

AFF under MDD - Thrushwood Drive connection

| Node ID | Elev. (m) | AFF (L/s) | HGL (m) | Pressure | |
|---------|-----------|-----------|---------|----------|-----|
| | | | | psi | kPa |
| J-1 | 293.0 | 150 | 345.1 | 27 | 188 |
| J-2 | 298.3 | 150 | 345.1 | 25 | 174 |
| J-3 | 301.5 | 150 | 345.1 | 24 | 164 |
| J-4 | 299.7 | 150 | 345.1 | 23 | 157 |
| J-5 | 296.1 | 150 | 345.1 | 23 | 162 |
| J-18 | 302.7 | 144 | 345.1 | 22 | 153 |
| J-19 | 303.5 | 130 | 345.1 | 21 | 144 |
| J-21 | 304.1 | 129 | 345.1 | 20 | 138 |
| J-22 | 302.5 | 125 | 345.1 | 20 | 138 |
| J-24 | 302.0 | 123 | 345.1 | 20 | 138 |
| J-6 | 299.9 | 189 | 345.2 | 26 | 180 |
| J-7 | 300.3 | 208 | 345.2 | 25 | 169 |
| J-8 | 301.3 | 239 | 345.3 | 21 | 145 |
| J-9 | 302.2 | 260 | 345.3 | 20 | 138 |
| J-10 | 302.5 | 265 | 345.4 | 20 | 138 |
| J-11 | 303.8 | 333 | 345.5 | 58 | 402 |
| J-12 | 303.4 | 330 | 345.4 | 20 | 138 |
| J-13 | 303.7 | 276 | 345.3 | 20 | 138 |
| J-14 | 303.1 | 250 | 345.3 | 20 | 138 |
| J-15 | 302.7 | 216 | 345.3 | 20 | 138 |
| J-16 | 302.6 | 199 | 345.2 | 20 | 138 |
| J-17 | 302.8 | 148 | 345.3 | 20 | 138 |

AFF under MDD - Bryne Drive connection

| Node ID | Elev. (m) | AFF (L/s) | HGL (m) | Pressure | |
|---------|-----------|-----------|---------|----------|-----|
| | | | | psi | kPa |
| J-1 | 293.0 | 257 | 344.7 | 20 | 138 |
| J-2 | 298.3 | 283 | 344.7 | 20 | 138 |
| J-3 | 301.5 | 292 | 344.7 | 23 | 161 |
| J-4 | 299.7 | 272 | 344.7 | 20 | 138 |
| J-5 | 296.1 | 250 | 344.7 | 20 | 138 |
| J-18 | 302.7 | 333 | 344.7 | 23 | 157 |
| J-19 | 303.5 | 333 | 344.8 | 58 | 403 |
| J-21 | 304.1 | 333 | 344.8 | 53 | 368 |
| J-22 | 302.5 | 333 | 344.8 | 31 | 211 |
| J-24 | 302.0 | 333 | 344.8 | 22 | 150 |
| J-6 | 299.9 | 197 | 344.7 | 26 | 176 |
| J-7 | 300.3 | 180 | 344.6 | 24 | 163 |
| J-8 | 301.3 | 166 | 344.6 | 21 | 145 |
| J-9 | 302.2 | 154 | 344.6 | 20 | 138 |
| J-10 | 302.5 | 142 | 344.6 | 20 | 138 |
| J-11 | 303.8 | 136 | 344.6 | 20 | 138 |
| J-12 | 303.4 | 145 | 344.6 | 20 | 138 |
| J-13 | 303.7 | 150 | 344.6 | 20 | 138 |
| J-14 | 303.1 | 159 | 344.6 | 20 | 138 |
| J-15 | 302.7 | 168 | 344.6 | 20 | 138 |
| J-16 | 302.6 | 169 | 344.6 | 20 | 138 |
| J-17 | 302.8 | 112 | 344.6 | 20 | 138 |

| | | | |
|---------|-------------------------|---------|------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | 2022-03-11 |
| SUBJECT | WaterCAD Results | NAME | RGD |
| | | CHECKED | JRC |

Average Day Demand - Bryne Drive connection

| Node ID | Elev. (m) | Demand (L/s) | HGL (m) | Pressure | |
|---------------|-----------|--------------|---------|----------|-----|
| | | | | psi | kPa |
| J-1 | 293.0 | 0.00 | 344.8 | 74 | 507 |
| J-2 | 298.3 | 0.54 | 344.8 | 66 | 455 |
| J-3 | 301.5 | 0.00 | 344.8 | 61 | 424 |
| J-4 | 299.7 | 1.81 | 344.8 | 64 | 441 |
| J-5 | 296.1 | 1.40 | 344.8 | 69 | 477 |
| J-18 | 302.7 | 1.08 | 344.8 | 60 | 412 |
| J-19 | 303.5 | 0.00 | 344.8 | 59 | 404 |
| J-21 | 304.1 | 0.00 | 344.8 | 58 | 398 |
| J-22 | 302.5 | 0.00 | 344.8 | 60 | 414 |
| J-24 | 302.0 | 0.89 | 344.8 | 61 | 419 |
| J-6 | 299.9 | 0.83 | 344.8 | 64 | 439 |
| J-7 | 300.3 | 0.24 | 344.8 | 63 | 435 |
| J-8 | 301.3 | 0.22 | 344.8 | 62 | 426 |
| J-9 | 302.2 | 0.21 | 344.8 | 60 | 417 |
| J-10 | 302.5 | 0.00 | 344.8 | 60 | 413 |
| J-11 | 303.8 | 0.00 | 344.8 | 58 | 401 |
| J-12 | 303.4 | 0.21 | 344.8 | 59 | 405 |
| J-13 | 303.7 | 0.13 | 344.8 | 58 | 402 |
| J-14 | 303.1 | 0.13 | 344.8 | 59 | 408 |
| J-15 | 302.7 | 0.13 | 344.8 | 60 | 412 |
| J-16 | 302.6 | 0.13 | 344.8 | 60 | 413 |
| J-17 | 302.8 | 0.23 | 344.8 | 60 | 411 |
| Total Demands | | 8.2 | | | |

Maximum Day Demand - Bryne Drive connection

| Node ID | Elev. (m) | Demand (L/s) | HGL (m) | Pressure | |
|---------------|-----------|--------------|---------|----------|-----|
| | | | | psi | kPa |
| J-1 | 293.0 | 0.00 | 344.7 | 73 | 506 |
| J-2 | 298.3 | 1.35 | 344.7 | 66 | 454 |
| J-3 | 301.5 | 0.00 | 344.7 | 61 | 422 |
| J-4 | 299.7 | 4.51 | 344.7 | 64 | 440 |
| J-5 | 296.1 | 3.50 | 344.7 | 69 | 475 |
| J-18 | 302.7 | 2.70 | 344.7 | 60 | 411 |
| J-19 | 303.5 | 0.00 | 344.8 | 59 | 404 |
| J-21 | 304.1 | 0.00 | 344.8 | 58 | 398 |
| J-22 | 302.5 | 0.00 | 344.8 | 60 | 414 |
| J-24 | 302.0 | 2.22 | 344.8 | 61 | 419 |
| J-6 | 299.9 | 2.07 | 344.7 | 64 | 438 |
| J-7 | 300.3 | 0.60 | 344.6 | 63 | 434 |
| J-8 | 301.3 | 0.56 | 344.6 | 62 | 425 |
| J-9 | 302.2 | 0.54 | 344.6 | 60 | 415 |
| J-10 | 302.5 | 0.00 | 344.6 | 60 | 412 |
| J-11 | 303.8 | 0.00 | 344.6 | 58 | 400 |
| J-12 | 303.4 | 0.54 | 344.6 | 59 | 404 |
| J-13 | 303.7 | 0.33 | 344.6 | 58 | 401 |
| J-14 | 303.1 | 0.33 | 344.6 | 59 | 406 |
| J-15 | 302.7 | 0.33 | 344.6 | 60 | 411 |
| J-16 | 302.6 | 0.33 | 344.6 | 60 | 411 |
| J-17 | 302.8 | 0.58 | 344.6 | 59 | 409 |
| Total Demands | | 20.5 | | | |

Peak Hour Demand - Bryne Drive connection

| Node ID | Elev. (m) | Demand (L/s) | HGL (m) | Pressure | |
|---------------|-----------|--------------|---------|----------|-----|
| | | | | psi | kPa |
| J-1 | 293.0 | 0.00 | 344.5 | 73 | 504 |
| J-2 | 298.3 | 2.02 | 344.5 | 66 | 452 |
| J-3 | 301.5 | 0.00 | 344.5 | 61 | 421 |
| J-4 | 299.7 | 6.77 | 344.5 | 64 | 439 |
| J-5 | 296.1 | 5.25 | 344.5 | 69 | 474 |
| J-18 | 302.7 | 4.04 | 344.6 | 59 | 410 |
| J-19 | 303.5 | 0.00 | 344.8 | 59 | 404 |
| J-21 | 304.1 | 0.00 | 344.8 | 58 | 398 |
| J-22 | 302.5 | 0.00 | 344.8 | 60 | 414 |
| J-24 | 302.0 | 3.33 | 344.8 | 61 | 419 |
| J-6 | 299.9 | 3.10 | 344.5 | 63 | 436 |
| J-7 | 300.3 | 0.91 | 344.5 | 63 | 432 |
| J-8 | 301.3 | 0.85 | 344.5 | 61 | 423 |
| J-9 | 302.2 | 0.82 | 344.5 | 60 | 414 |
| J-10 | 302.5 | 0.00 | 344.5 | 59 | 410 |
| J-11 | 303.8 | 0.00 | 344.5 | 58 | 398 |
| J-12 | 303.4 | 0.82 | 344.5 | 58 | 402 |
| J-13 | 303.7 | 0.50 | 344.5 | 58 | 399 |
| J-14 | 303.1 | 0.50 | 344.5 | 59 | 405 |
| J-15 | 302.7 | 0.50 | 344.5 | 59 | 409 |
| J-16 | 302.6 | 0.50 | 344.5 | 59 | 410 |
| J-17 | 302.8 | 0.88 | 344.5 | 59 | 408 |
| Total Demands | | 30.8 | | | |

| | | | |
|---------|-------------------------|---------|------------|
| PROJECT | Harvie Road Subdivision | FILE | 421487 |
| | | DATE | 2022-03-11 |
| SUBJECT | WaterCAD Results | NAME | RGD |
| | | CHECKED | JRC |

Pipe Characteristics and Conditions under PHD and MDD + Fire - Bryne Drive Connection

| Pipe Characteristics | | | | Pipe Conditions under PHD and MDD + Fire | | | |
|----------------------|-----------|------------|-------------|--|-------------------|------------------------------|---------------------|
| | | | | PHD | | MDD + Fire at J-13 (150 L/s) | |
| ID | Dia. (mm) | Length (m) | Roughness * | Velocity (m/s) | Friction Loss (m) | Velocity (m/s) | Friction Loss (m/m) |
| P-1 | 300 | 0 | 120 | 0.0 | 0.0 | 0.0 | 0.0 |
| P-2 | 300 | 0.03 | 120 | 0.0 | 0.0 | 0.02 | 0.0 |
| P-3 | 300 | 0.17 | 120 | 0.2 | 0.02 | 0.1 | 0.01 |
| P-4 | 300 | 0.07 | 120 | 0.1 | 0.01 | 0.1 | 0.0 |
| P-22 | 300 | 0.33 | 120 | 0.3 | 0.1 | 2.3 | 2.0 |
| P-23 | 300 | 0.39 | 120 | 0.4 | 0.2 | 2.4 | 6.7 |
| P-25 | 300 | 0.05 | 120 | 0.1 | 0.0 | 0.03 | 0.0 |
| P-26 | 300 | 0.05 | 120 | 0.1 | 0.0 | 0.03 | 0.0 |
| P-29 | 300 | 0.05 | 120 | 0.1 | 0.0 | 0.03 | 0.0 |
| P-5 | 250 | 0.19 | 110 | 0.2 | 0.0 | 3.2 | 8.1 |
| P-6 | 200 | 0.12 | 110 | 0.1 | 0.01 | 3.0 | 2.7 |
| P-8 | 200 | 0.04 | 110 | 0.04 | 0.0 | 1.8 | 1.6 |
| P-9 | 200 | 0.01 | 110 | 0.01 | 0.0 | 1.0 | 0.6 |
| P-11 | 200 | 0.01 | 110 | 0.01 | 0.0 | 1.0 | 0.6 |
| P-12 | 200 | 0.03 | 110 | 0.03 | 0.0 | 1.4 | 0.9 |
| P-13 | 200 | 0.04 | 110 | 0.04 | 0.0 | 2.6 | 3.2 |
| P-14 | 200 | 0.06 | 110 | 0.1 | 0.0 | 2.5 | 2.8 |
| P-15 | 200 | 0.06 | 110 | 0.1 | 0.0 | 1.9 | 1.2 |
| P-16 | 200 | 0.08 | 110 | 0.1 | 0.01 | 1.9 | 3.3 |
| P-17 | 150 | 0.01 | 100 | 0.01 | 0.0 | 1.5 | 3.4 |
| P-18 | 150 | 0.01 | 100 | 0.01 | 0.0 | 1.1 | 1.8 |
| P-19 | 150 | 0.03 | 100 | 0.03 | 0.0 | 1.0 | 1.7 |
| P-20 | 150 | 0.02 | 100 | 0.02 | 0.0 | 0.8 | 0.8 |
| P-21 | 150 | 0.03 | 100 | 0.03 | 0.0 | 0.8 | 1.5 |

Figure 1: WaterCAD Results - AFF under MDD

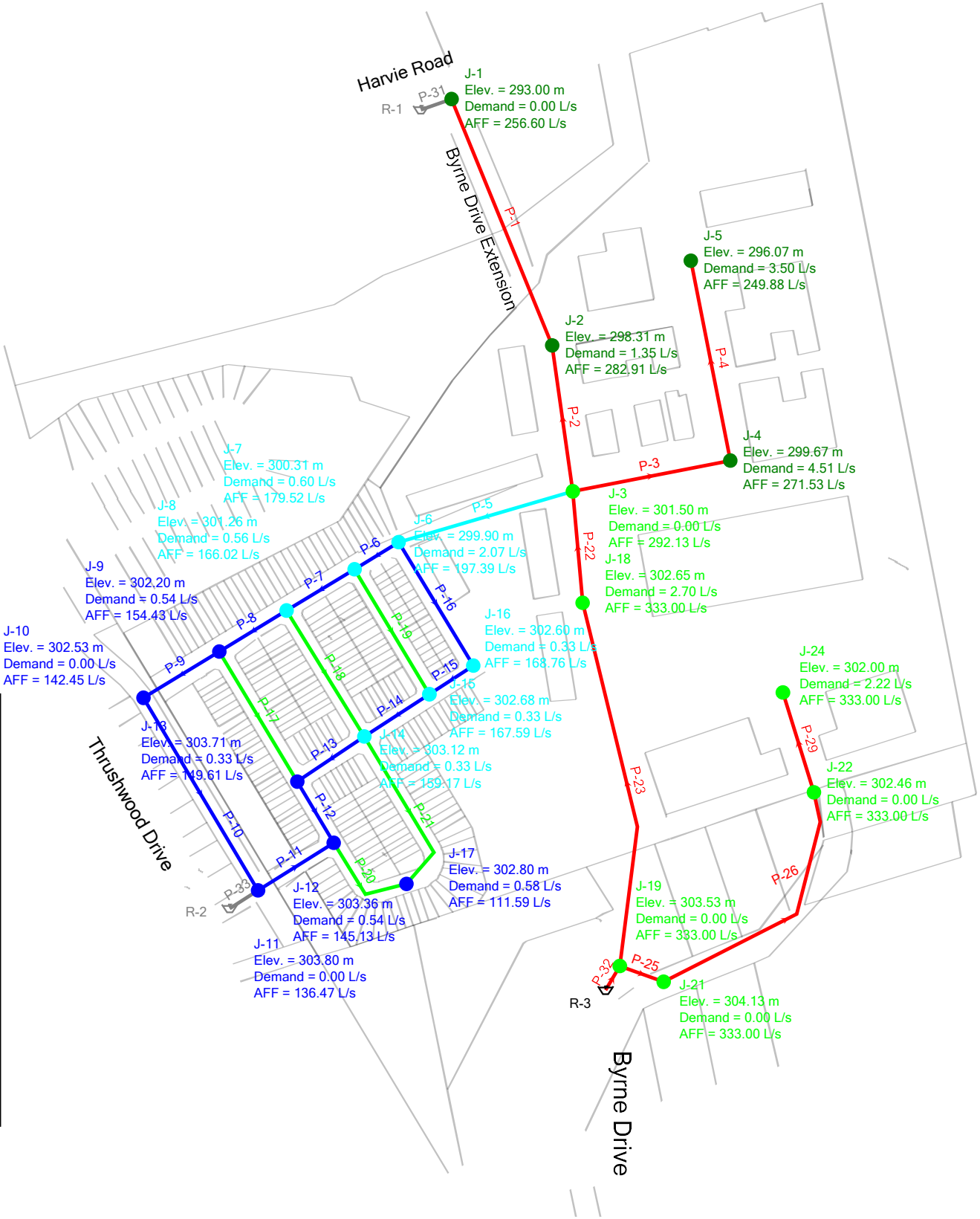
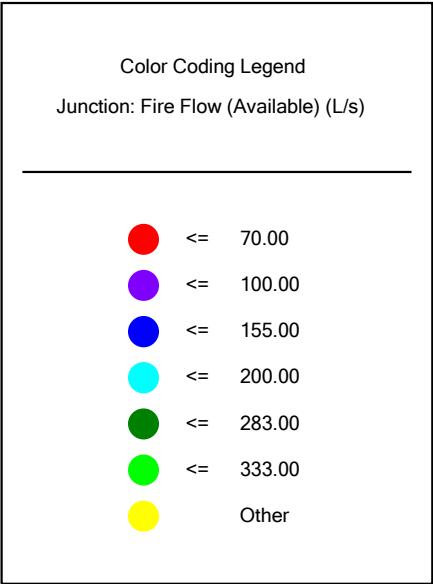


Figure 2: WaterCAD Results - ADD Pressures

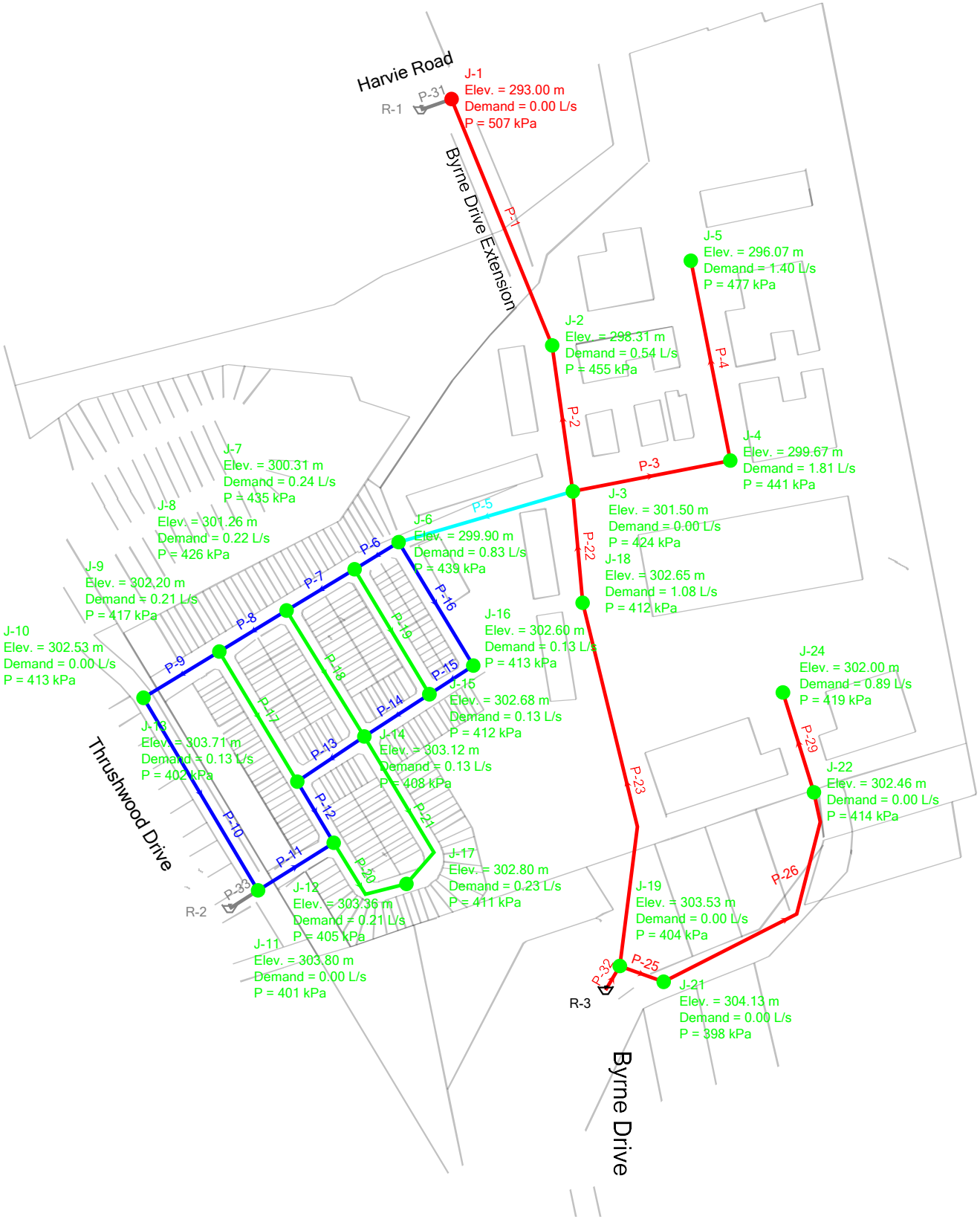
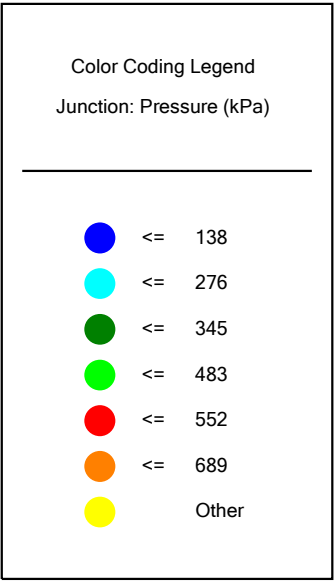


Figure 3: WaterCAD Results - MDD Pressures

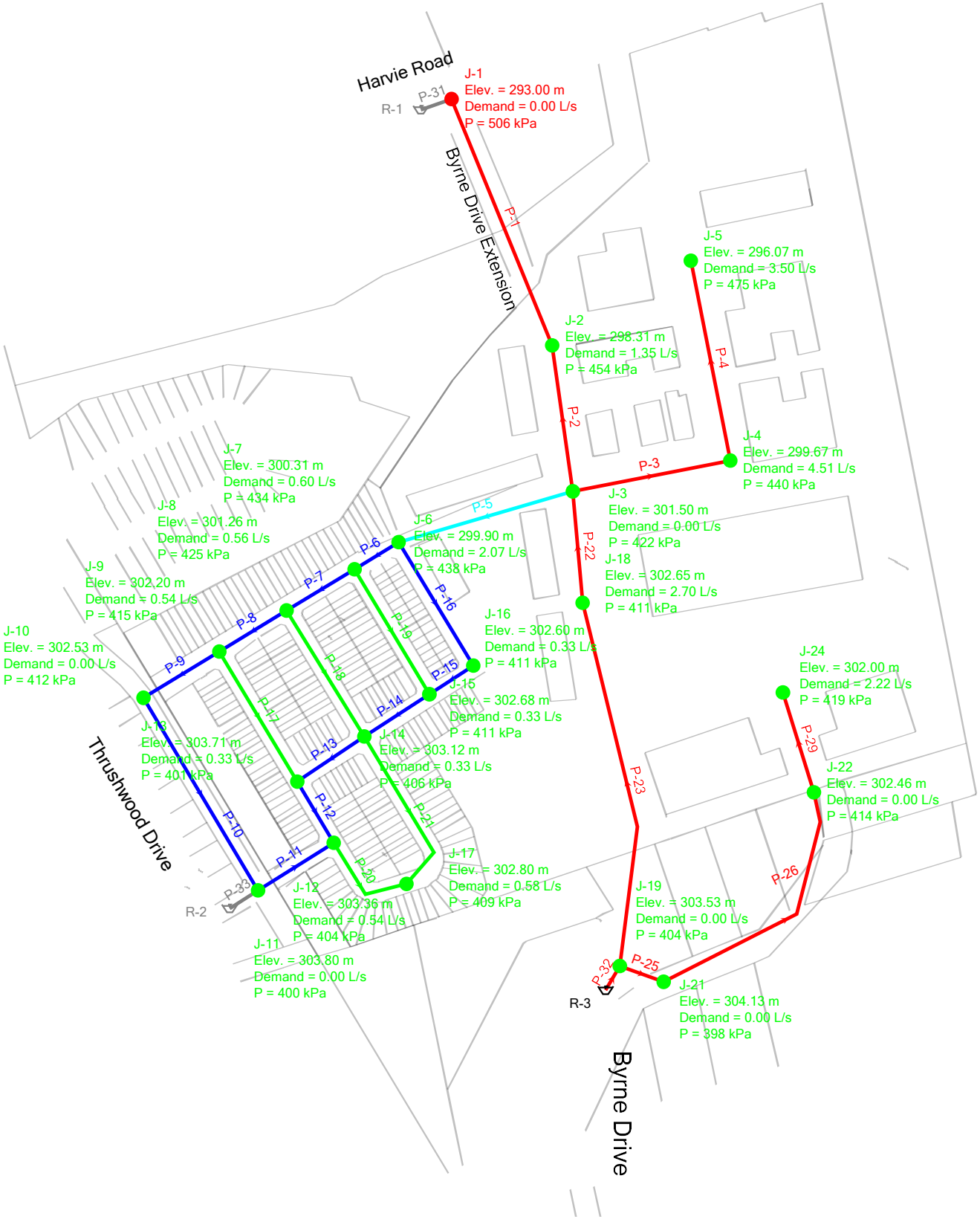
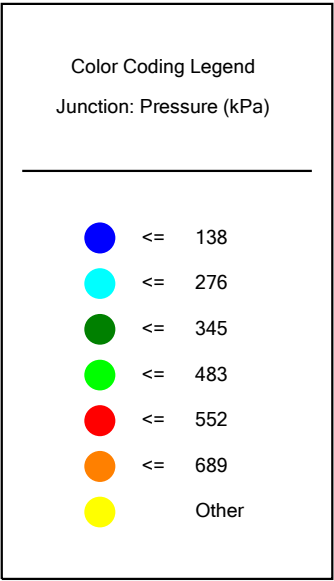
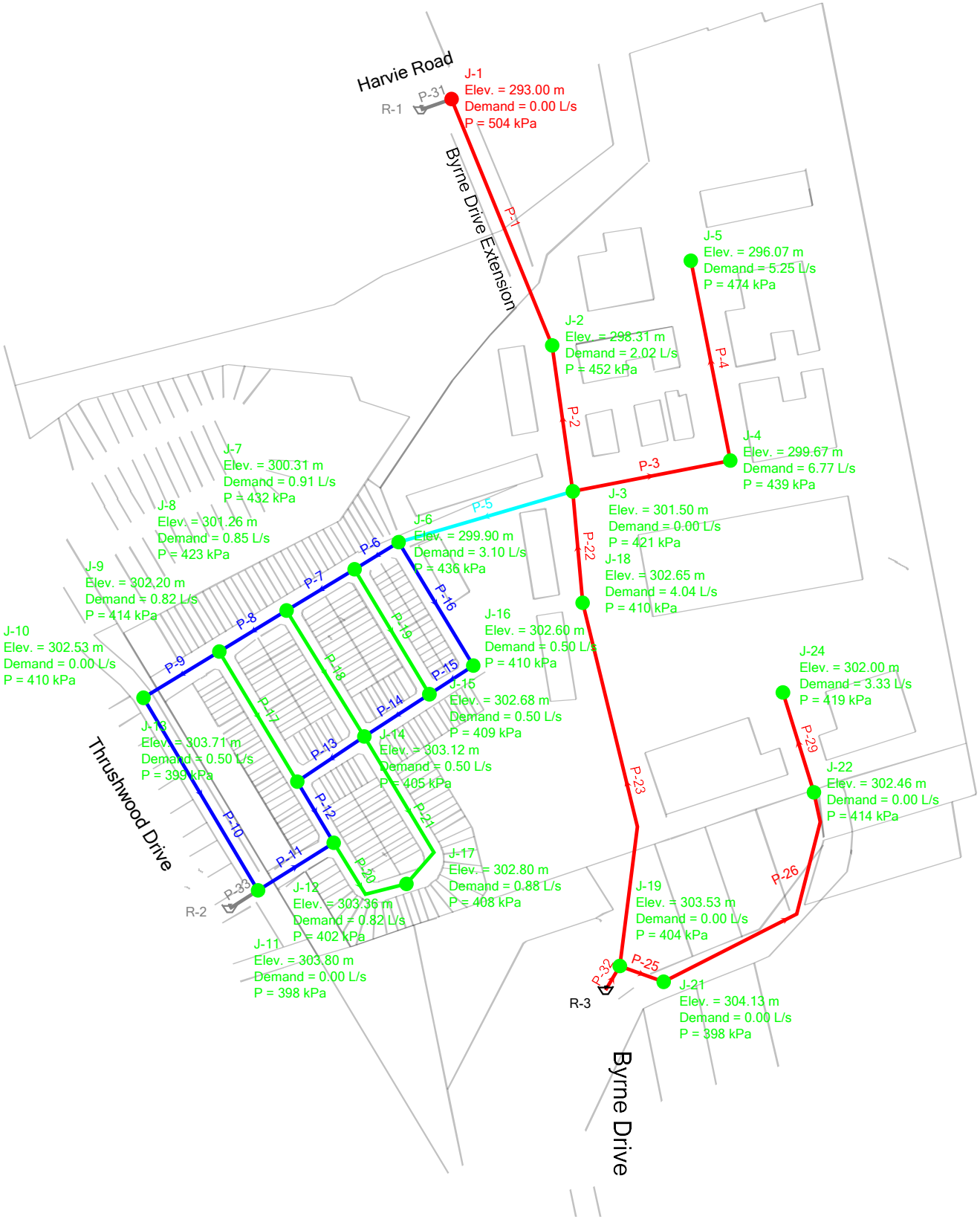
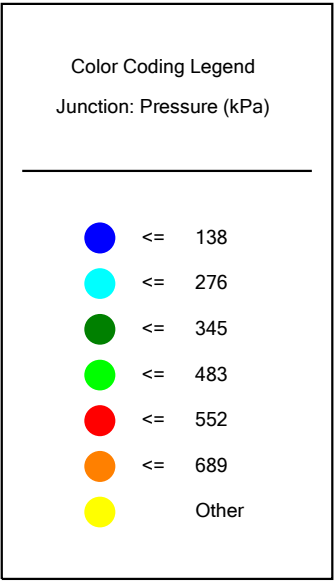


Figure 4: WaterCAD Results - PHD Pressures



Appendix D: Sanitary Calculations

| | | | |
|---------|----------------------------|------|---------------|
| PROJECT | 15 Harvie Road Subdivision | FILE | 421487 |
| | | DATE | March 9, 2022 |
| SUBJECT | Sanitary Flow Calculations | NAME | NM |
| | | PAGE | 1 OF 3 |

Design Criteria (as per City Standards)

Demands

| | | | |
|------------------------|---|-----|------------------------|
| Per Capita Flow | = | 225 | L/cap/day |
| Commercial | = | 28 | m ³ /ha/day |
| General Industrial | = | 35 | m ³ /ha/day |
| Heavy Industrial | = | 55 | m ³ /ha/day |
| Unknown/Mix Industrial | = | 50 | m ³ /ha/day |
| Extraneous (infil.) | = | 0.1 | L/s/ha |

Peak Factors

| | | |
|-------------|---|--------|
| Commercial | = | 2 |
| Industrial | = | 2 |
| Residential | = | Harmon |

Population Densities (ppu)

| | | |
|--------------------|---|------|
| High Density PPU | = | 1.67 |
| Medium Density PPU | = | 2.34 |
| Low Density PPU | = | 3.13 |

Note 1) ADF = Average Day Flow, PDF = Peak Day Flow

Note 2) Employment Area (land use of east half of proposed development) assumed to be equivalent to Commercial Demand

Site Information

| | | | | | |
|-----------------------------------|---|-------|---|---|-------|
| High Density Units (Condo units) | = | 539 | Total Population | = | 1,533 |
| Medium Density Units (Townhouses) | = | 182 | | | |
| Low Density Units (Semis) | = | 66 | | | |
| Employment Area | = | 12.6 | ha | | |
| Employment Area ROW | = | 0.76 | ha (utilized for Extraneous flows only) | | |
| Residential Site Area | = | 10.95 | ha (utilized for Extraneous flows only) | | |

Average Day Design Flow

| | | | | | | | | | |
|-------------------|---|---------|---|---|-------|----------------|---|------|-----|
| ADF (Residential) | = | 344,833 | L | = | 344.8 | m ³ | = | 3.99 | L/s |
| ADF (Employment) | = | 352,800 | L | = | 352.8 | m ³ | = | 4.08 | L/s |
| Total ADF | = | 697,633 | L | = | 697.6 | m ³ | = | 8.07 | L/s |

Adjusted PDF for WWTF Population

Peak Flow Peaking Factor as per *Wastewater Treatment Master Plan (2019)* prepared by WSP = 2.05

Therefore, total peak flow received at Barrie WWTF = 1,430.1 m³ (excl. extraneous)

Therefore, total peak flow received at Barrie WWTF = 1,432.6 m³ (incl. extraneous)

| | | | |
|---------|----------------------------|------|---------------|
| PROJECT | 15 Harvie Road Subdivision | FILE | 421487 |
| | | DATE | March 9, 2022 |
| SUBJECT | Sanitary Flow Calculations | NAME | NM |
| | | PAGE | 2 OF 3 |

Upstream Contributing Peak Flow

Existing Conditions

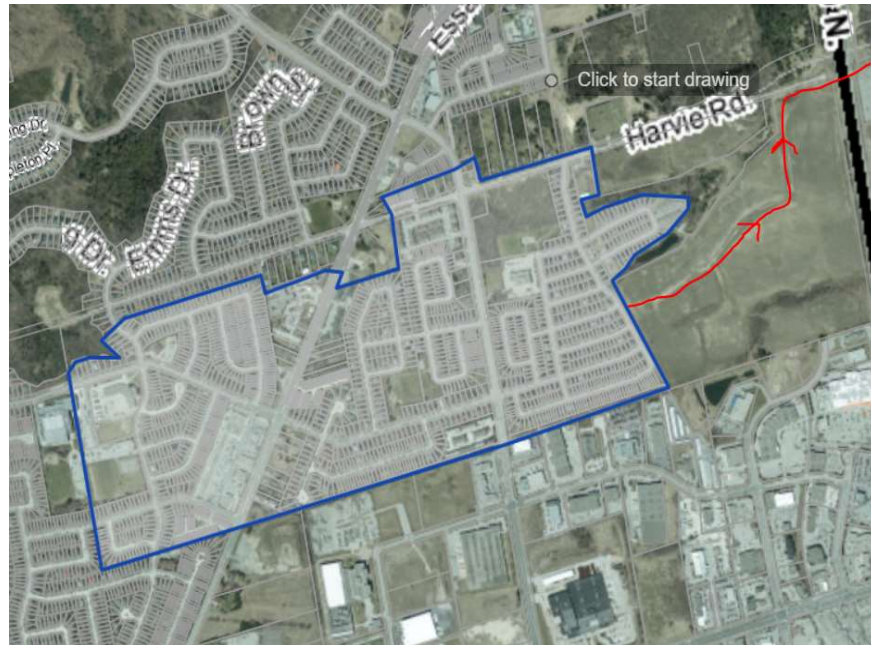
| | | | |
|---|---|---------------|--------------------|
| Ex. Peak Flow as provided by City (approximate) | = | 36.9 L/s | (incl. extraneous) |
| Approximate upstream drainage area | = | 115 ha | |
| Approximate Extraneous Flow | = | 11.5 L/s | |
| Approximate Residential/commercial Peak Flow | = | 25.4 L/s | |
| Estimated Harmon Peaking Factor | = | 3.45 | |
| Equivalent Population | = | 2,824 persons | |

Future Conditions

| | | | |
|--|---|---------------|----------------------------------|
| Fut. Peak Flow as provided by City (approximate) | = | 57.8 L/s | (incl. extraneous) |
| Approximate upstream drainage area | = | 115 ha | (assumed equivalent to existing) |
| Approximate Extraneous Flow | = | 11.5 L/s | |
| Approximate Residential/commercial Peak Flow | = | 46.3 L/s | |
| Estimated Harmon Peaking Factor | = | 3.2 | |
| Equivalent Population | = | 5,561 persons | |

Approximate upstream area

Equivalent persons and area
utilized in Sanitary Sewer
Design sheets



| | | | |
|---------|----------------------------|------|---------------|
| PROJECT | 15 Harvie Road Subdivision | FILE | 421487 |
| | | DATE | March 9, 2022 |
| SUBJECT | Sanitary Flow Calculations | NAME | NM |
| | | PAGE | 3 OF 3 |

Equivalent Population Calculations for Trunk Sewer Design Sheet

Catchment 101

| | | | |
|-------------------------------|---|-----|---------|
| Total Area | = | 2.6 | ha |
| Townhouses | = | 55 | units |
| Back to Back Townhouse | = | 0 | units |
| Semi-Detached | = | 28 | units |
| Total Equivalent Population = | = | 216 | persons |

Catchment 102

| | | | |
|-------------------------------|---|-----|---------|
| Total Area | = | 0.4 | ha |
| Townhouses | = | 0 | units |
| Back to Back Townhouse | = | 0 | units |
| Semi-Detached | = | 10 | units |
| Total Equivalent Population = | = | 31 | persons |

Catchment 103

| | | | |
|-------------------------------|---|-----|---------|
| Total Area | = | 2.2 | ha |
| Townhouses | = | 56 | units |
| Back to Back Townhouse | = | 0 | units |
| Semi-Detached | = | 21 | units |
| Total Equivalent Population = | = | 197 | persons |

Catchment 104

| | | | |
|-------------------------------|---|-----|---------|
| Total Area | = | 0.9 | ha |
| Townhouses | = | 14 | units |
| Back to Back Townhouse | = | 17 | units |
| Semi-Detached | = | 7 | units |
| Total Equivalent Population = | = | 94 | persons |

Catchment 105

| | | | |
|-------------------------------|---|-----|---------|
| Total Area | = | 1.0 | ha |
| Townhouses | = | 23 | units |
| Back to Back Townhouse | = | 17 | units |
| Semi-Detached | = | 0 | units |
| Total Equivalent Population = | = | 94 | persons |

Catchment 106

| | | | |
|-------------------------------|---|-----|---------|
| Total Area | = | 3.7 | ha |
| Condo/apartment units | = | 539 | units |
| Total Equivalent Population = | = | 900 | persons |

TATHAM

ENGINEERING

FLOW CRITERIA

Average Daily Flow Rate (L/cap/day)

225

Extraneous Flow (L/s/ha)

0.1

Peaking Factor

Harmon

Population Density (ppu):

Low3.13

Medium2.57

High1.67

Project Number:

421487

Project Name:

15 Harvie Road Subdivision

Municipality:

City of Barrie

Designed By:

LB

Date:

Mar-22

Checked By:

NM

Date:

Revision:

| STREET NAME | AREA LABEL | UPSTREAM MAINTENANCE HOLE | DOWNSTREAM MAINTENANCE HOLE | NUMBER OF UNITS | POPULATION | ACCUMULATED POPULATION | PEAKING FACTOR | AREA | ACCUMULATED AREA | AVERAGE FLOW | | | PEAK FLOW | | | SEWER | | | | | | |
|------------------------|------------|------------------------------|--------------------------------|--------------------|------------|---------------------------|-------------------|-------|---------------------|--------------|--------------|-------|-------------|--------------|-------|----------------|---------------|-------|-----------------------|--------------------|----------------------|----------------------|
| | | | | | | | | | | FLOW | INFILTRATION | TOTAL | RESIDENTIAL | INFILTRATION | TOTAL | LENGTH OF PIPE | PIPE DIAMETER | GRADE | FULL FLOW CAPACITY | FULL FLOW VELOCITY | ACTUAL FLOW VELOCITY | PERCENT FLOWING FULL |
| | | MH No. | MH No. | no. | cap. | cap. | | ha | ha | l/s | l/s | l/s | l/s | l/s | l/s | m | mm | % | l/s | m/s | m/s | % |
| | | | | | | | | | | | | | | | | | | | | | | |
| TRUNK SEWER | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| Thrushwood - External¹ | EXT | - | EX SAN MH14 | - | 5561 | 5561 | 3.20 | 115 | 115.00 | 14.48 | 11.50 | 25.98 | 46.37 | 11.50 | 57.87 | 46.4 | 375 | 0.4% | 110.88 | 1.00 | 0.97 | 67.5% |
| Proposed Development¹ | 101 | EX SAN MH14 | SAN MH9 | - | 216 | 5777 | 3.19 | 2.63 | 117.63 | 15.04 | 11.76 | 26.81 | 47.94 | 11.76 | 59.70 | 81.4 | 375 | 0.4% | 110.88 | 1.00 | 0.98 | 53.8% |
| Proposed Development¹ | 102 | SAN MH9 | SAN MH10 | - | 31 | 5808 | 3.18 | 0.44 | 118.07 | 15.13 | 11.81 | 26.93 | 48.16 | 11.81 | 59.97 | 72.9 | 375 | 0.4% | 110.88 | 1.00 | 0.98 | 54.1% |
| Proposed Development¹ | 103 | SAN MH10 | SAN MH14 | - | 197 | 6005 | 3.17 | 2.22 | 120.29 | 15.64 | 12.03 | 27.67 | 49.58 | 12.03 | 61.61 | 72.9 | 375 | 0.4% | 110.88 | 1.00 | 0.99 | 55.6% |
| Proposed Development¹ | 104 | SAN MH14 | SAN MH17 | - | 94 | 6099 | 3.16 | 0.95 | 121.24 | 15.88 | 12.12 | 28.01 | 50.25 | 12.12 | 62.38 | 45.0 | 375 | 0.4% | 110.88 | 1.00 | 0.99 | 56.3% |
| Proposed Development¹ | 105 | SAN MH17 | SAN MH21 | - | 94 | 6193 | 3.16 | 1.02 | 122.26 | 16.13 | 12.23 | 28.35 | 50.93 | 12.23 | 63.15 | 82.0 | 375 | 0.4% | 110.88 | 1.00 | 0.99 | 57.0% |
| Proposed Development¹ | 106 | SAN MH21 | SAN MH22 | 539 | 900 | 7093 | 3.10 | 3.67 | 125.93 | 18.47 | 12.59 | 31.06 | 57.28 | 12.59 | 69.87 | 86.0 | 375 | 0.4% | 110.88 | 1.00 | 1.00 | 63.0% |
| Bryne Drive Extension | 107 | SAN MH22 | FUT SAN MH5 | - | - | 7093 | 3.10 | 1.70 | 125.93 | 18.47 | 12.59 | 31.06 | 57.28 | 12.59 | 69.87 | 67.5 | 375 | 1.7% | 228.59 | 2.07 | 1.73 | 30.6% |
| Bryne Drive Extension | 108 | FUT SAN MH5 | FUT SAN MH6 | - | - | 7093 | 3.10 | 0.33 | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 94.9 | 375 | 2.0% | 247.94 | 2.24 | 1.83 | 28.2% |
| Bryne Drive Extension | - | FUT SAN MH6 | FUT SAN MH1A | - | - | 7093 | 3.10 | - | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 26.7 | 375 | 2.0% | 247.94 | 2.24 | 1.83 | 28.2% |
| Proposed Development¹ | - | FUT SAN MH1A | FUT SAN MH2A | - | - | 7093 | 3.10 | - | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 12.6 | 375 | 2.0% | 247.94 | 2.24 | 1.83 | 28.2% |
| Proposed Development¹ | - | FUT SAN MH2A | FUT SAN MH3A | - | - | 7093 | 3.10 | - | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 48.0 | 375 | 2.0% | 247.94 | 2.24 | 1.83 | 28.2% |
| Proposed Development¹ | - | FUT SAN MH3A | FUT SAN MH4A | - | - | 7093 | 3.10 | - | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 49.9 | 375 | 2.0% | 247.94 | 2.24 | 1.83 | 28.2% |
| Proposed Development¹ | - | FUT SAN MH4A | FUT SAN MH5A | - | - | 7093 | 3.10 | - | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 24.7 | 375 | 2.5% | 277.20 | 2.51 | 1.99 | 25.2% |
| Proposed Development¹ | - | FUT SAN MH5A | FUT SAN MH6A | - | - | 7093 | 3.10 | - | 126.26 | 18.47 | 12.63 | 31.10 | 57.28 | 12.63 | 69.91 | 26.5 | 375 | 3.0% | 303.66 | 2.75 | 2.13 | 23.0% |
| Proposed Development¹ | 109 | FUT SAN MH6A | FUT SAN MH7A | - | 1160 | 8253 | 3.04 | 10.08 | 136.34 | 21.49 | 13.63 | 35.13 | 65.27 | 13.63 | 78.91 | 13.4 | 375 | 3.0% | 303.66 | 2.75 | 2.20 | 26.0% |
| Proposed Development¹ | - | FUT SAN MH7A | EX SAN MH6 | - | - | 8253 | 3.04 | - | 136.34 | 21.49 | 13.63 | 35.13 | 65.27 | 13.63 | 78.91 | 10.4 | 375 | 3.0% | 303.66 | 2.75 | 2.20 | 26.0% |
| Proposed Development¹ | | EX SAN MH6 | EX SAN MH5 | - | - | 8253 | 3.04 | - | 136.34 | 21.49 | 13.63 | 35.13 | 65.27 | 13.63 | 78.91 | 70.0 | 450 | 0.3% | 156.15 | 0.98 | 0.94 | 50.5% |
| | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |

Note 1) ¹ = Equivalent or total population as per appended calculation sheets

Note 2) Refer to Drawing SAN-1 for catchment delineation and preliminary sewer layout

Nick Millington

From: Nick Millington
Sent: March 9, 2022 1:03 PM
To: Nick Millington
Subject: FW: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

From: Tom Reeve <Tom.Reeve@barrie.ca>
Sent: December 17, 2021 10:10 AM
To: Nick Millington <nmillington@tathameng.com>
Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

36.87 l/s

Tom Reeve
Senior Project Manager – Water/Wastewater Planning
The City of Barrie
705-739-4220 x4465

Please consider the environment before printing this email.

From: Nick Millington <nmillington@tathameng.com>
Sent: Friday, December 17, 2021 10:04 AM
To: Tom Reeve <Tom.Reeve@barrie.ca>
Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Will do Tom. Last question – Can you tell me the existing flows at the Thrushwood node?

From: Tom Reeve <Tom.Reeve@barrie.ca>
Sent: December 17, 2021 9:15 AM
To: Nick Millington <nmillington@tathameng.com>
Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Hi Nick,

It isn't in the appendix, I pulled it straight from the model. Please add a discussion of uncertainty with calibration I included in my first email and discuss the design with regards to sensitivity (i.e. how far could it be wrong before it changes the design).

Thanks,

Tom Reeve
Senior Project Manager – Water/Wastewater Planning
The City of Barrie
705-739-4220 x4465

Please consider the environment before printing this email.

From: Nick Millington <nmillington@tathameng.com>
Sent: Friday, December 17, 2021 9:05 AM

To: Tom Reeve <Tom.Reeve@barrie.ca>

Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Tom - is this number (57.84 L/s) provided in any appendices of the Wastewater Collection Master Plan update report, or have you pulled directly from the model? Just want to be able to reference it appropriately

Nick

From: Tom Reeve <Tom.Reeve@barrie.ca>

Sent: December 16, 2021 4:00 PM

To: Nick Millington <nmillington@tathameng.com>

Cc: Lisa Cowan <lcowan@tathameng.com>; Alvaro Almuina <Alvaro.Almuina@barrie.ca>; Aaron Toth <Aaron.Toth@barrie.ca>

Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

This information assumed flows being added from the property you are looking at. Coming out at Thrushwood the flows in the model are 57.84 in the future condition.

Tom Reeve

Senior Project Manager – Water/Wastewater Planning

The City of Barrie

705-739-4220 x4465

Please consider the environment before printing this email.

From: Nick Millington <nmillington@tathameng.com>

Sent: Thursday, December 16, 2021 1:45 PM

To: Tom Reeve <Tom.Reeve@barrie.ca>

Cc: Lisa Cowan <lcowan@tathameng.com>; Alvaro Almuina <Alvaro.Almuina@barrie.ca>; Aaron Toth <Aaron.Toth@barrie.ca>

Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Thanks Tom,

Is the future flow of 74.86 l/s you reference below intended to include the subject site, or is this just upstream of Thrushwood?

Nick

Nick Millington, P.Eng.

Senior Engineer, Group Leader

Tatham Engineering Limited

41 King Street, Unit 4 | Barrie | Ontario | L4N 6B5

T 705-733-9037 x2056 | **C** 705-984-5688 | nmillington@tathameng.com | tathameng.com



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From: Tom Reeve <Tom.Reeve@barrie.ca>
Sent: December 16, 2021 11:08 AM
To: Nick Millington <nmillington@tathameng.com>
Cc: Lisa Cowan <lcowan@tathameng.com>; Alvaro Almuina <Alvaro.Almuina@barrie.ca>; Aaron Toth <Aaron.Toth@barrie.ca>
Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Hi Nick,

Sorry for the delay.

1. The master plan model isn't great for this area of the City because of the lack of calibration data in the upper catchments (like this one). We are hoping to update the model in 2022 but right now, we suspect the numbers we have are a bit too low. That said, I will provide you with the flows below for consideration in your design. I would suggest that as long as the pipe isn't losing capacity compared to existing, we are probably safe.

Existing: 40.52 l/s

Future: 74.86 l/s

2. The existing sewer has capacity and we don't have any projects identified in the master plan for this area.

If you have any questions or wish to discuss further, please don't hesitate to contact me.

Thanks,

Tom Reeve
Senior Project Manager – Water/Wastewater Planning
The City of Barrie
705-739-4220 x4465

Please consider the environment before printing this email.

From: Nick Millington <nmillington@tathameng.com>
Sent: Tuesday, December 14, 2021 12:51 PM
To: Tom Reeve <Tom.Reeve@barrie.ca>
Cc: Lisa Cowan <lcowan@tathameng.com>; Alvaro Almuina <Alvaro.Almuina@barrie.ca>; Aaron Toth <Aaron.Toth@barrie.ca>
Subject: RE: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Hi Tom,

Just wanted to follow up on this one.

Thanks,
Nick

Nick Millington, P.Eng.
Senior Engineer, Group Leader

Tatham Engineering Limited
41 King Street, Unit 4 | Barrie | Ontario | L4N 6B5
T 705-733-9037 x2056 | C 705-984-5688 | nmillington@tathameng.com | tathameng.com



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From: Nick Millington

Sent: December 8, 2021 9:14 PM

To: Tom Reeve <Tom.Reeve@barrie.ca>

Cc: Lisa Cowan <lcowan@tathameng.com>; Alvaro Almuina <Alvaro.Almuina@barrie.ca>; Aaron Toth <Aaron.Toth@barrie.ca>

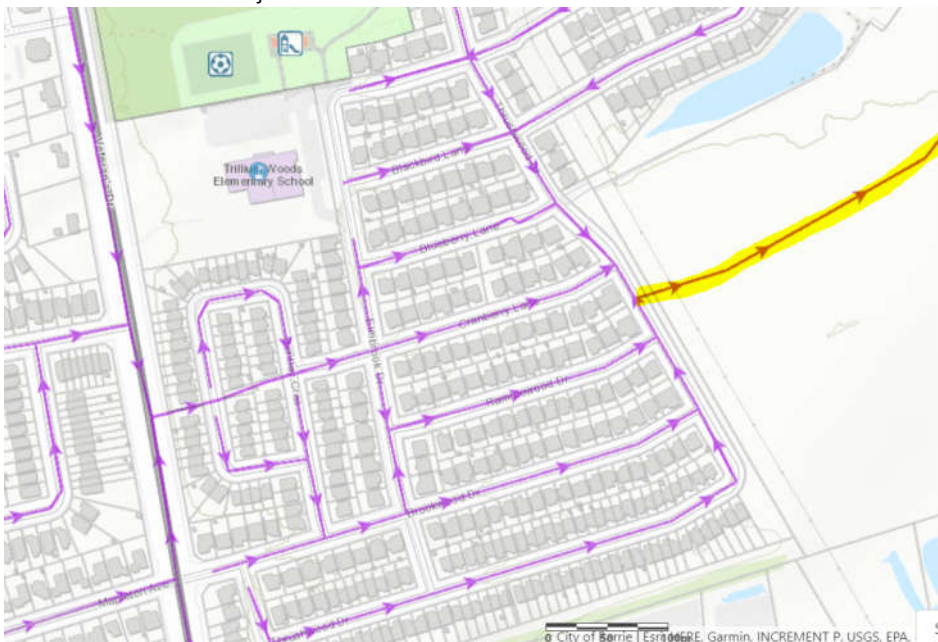
Subject: FW: EN1277 RE: 421487 - Smartcentres Harvie Road Subdivision - Trunk Sanitary Sewer

Hi Tom,

Hope all is well. In support of our work on the Smartcentres subdivision (located east of Thrushwood, south of Harvie) and further to Alvaro's email below, are you able to provide the following information related to the existing sanitary trunk sewer which bisects our site (between Thrushwood and hwy 400):

- 1) Sanitary catchment plans or peak flows for area contributing to the trunk sewer
- 2) Summary of any recommendations for improvements for this trunk sewer as per Master Infrastructure Plans

Screenshot of subject area here:



Thanks, and feel free to give me a call if you would like to discuss.

Nick Millington, P.Eng.

Senior Engineer, Group Leader

Tatham Engineering Limited

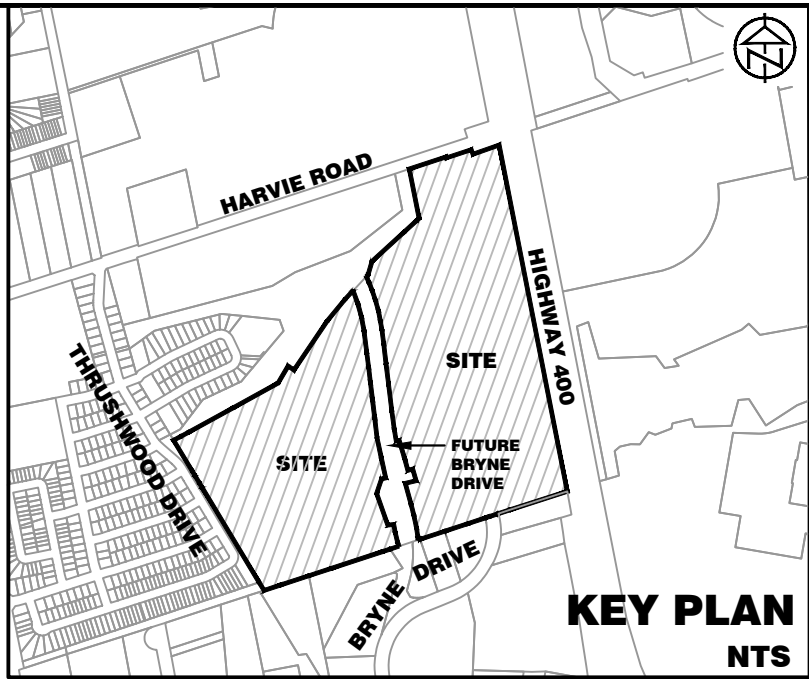
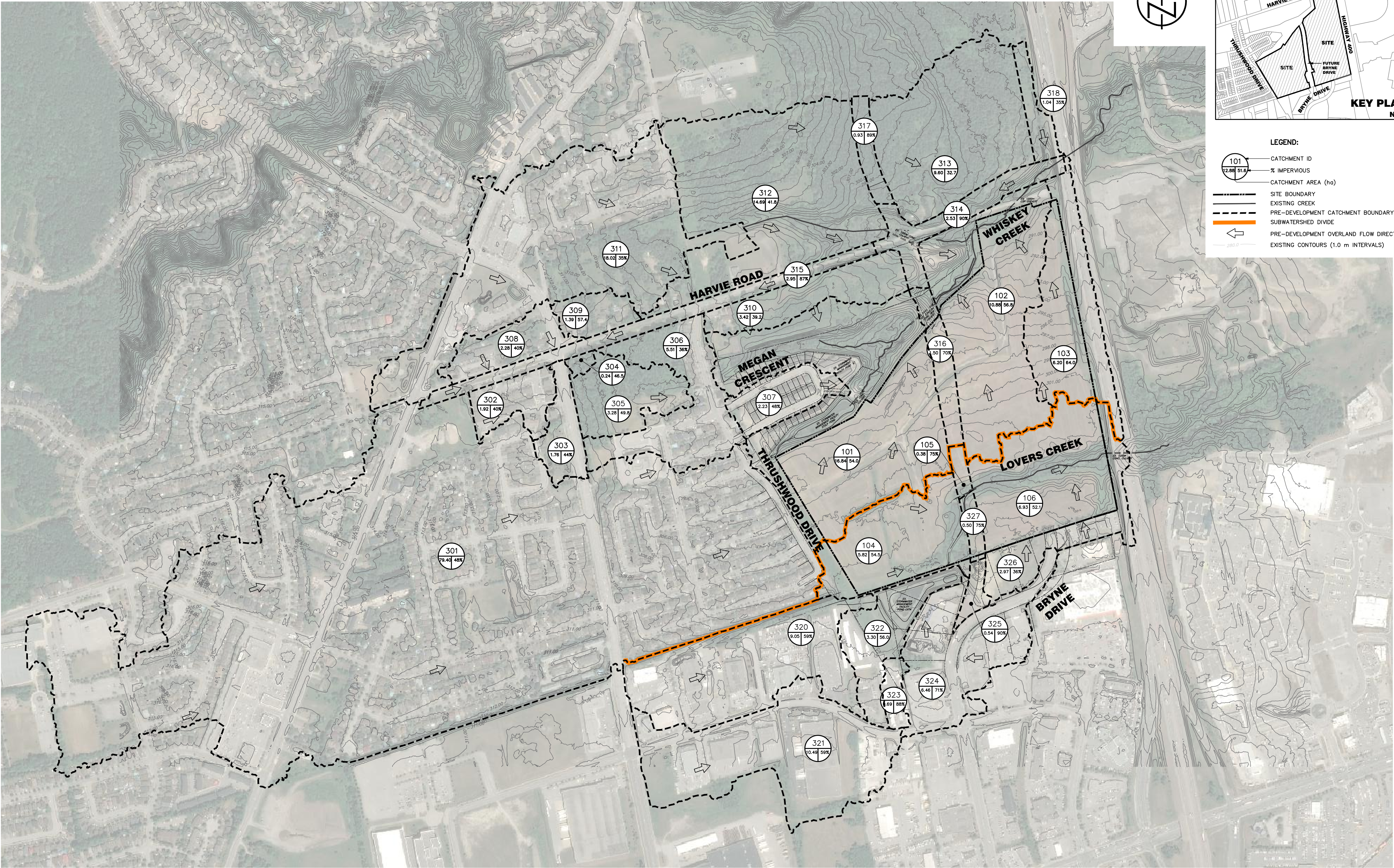
41 King Street, Unit 4 | Barrie | Ontario | L4N 6B5

T 705-733-9037 x2056 | C 705-984-5688 | nmillington@tathameng.com | tathameng.com



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Appendix E: Drawings



- LEGEND:
- 101 CATCHMENT ID
 - 12.88 51.6 % IMPERVIOUS
 - CATCHMENT AREA (ha)
 - SITE BOUNDARY
 - EXISTING CREEK
 - PRE-DEVELOPMENT CATCHMENT BOUNDARY
 - SUBWATERSHED DIVIDE
 - PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
 - EXISTING CONTOURS (1.0 m INTERVALS)

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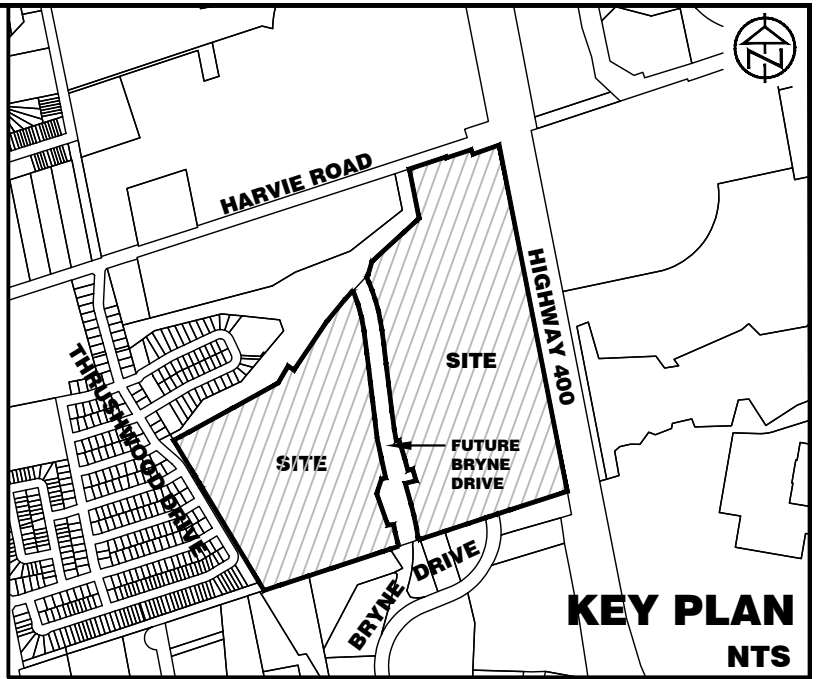
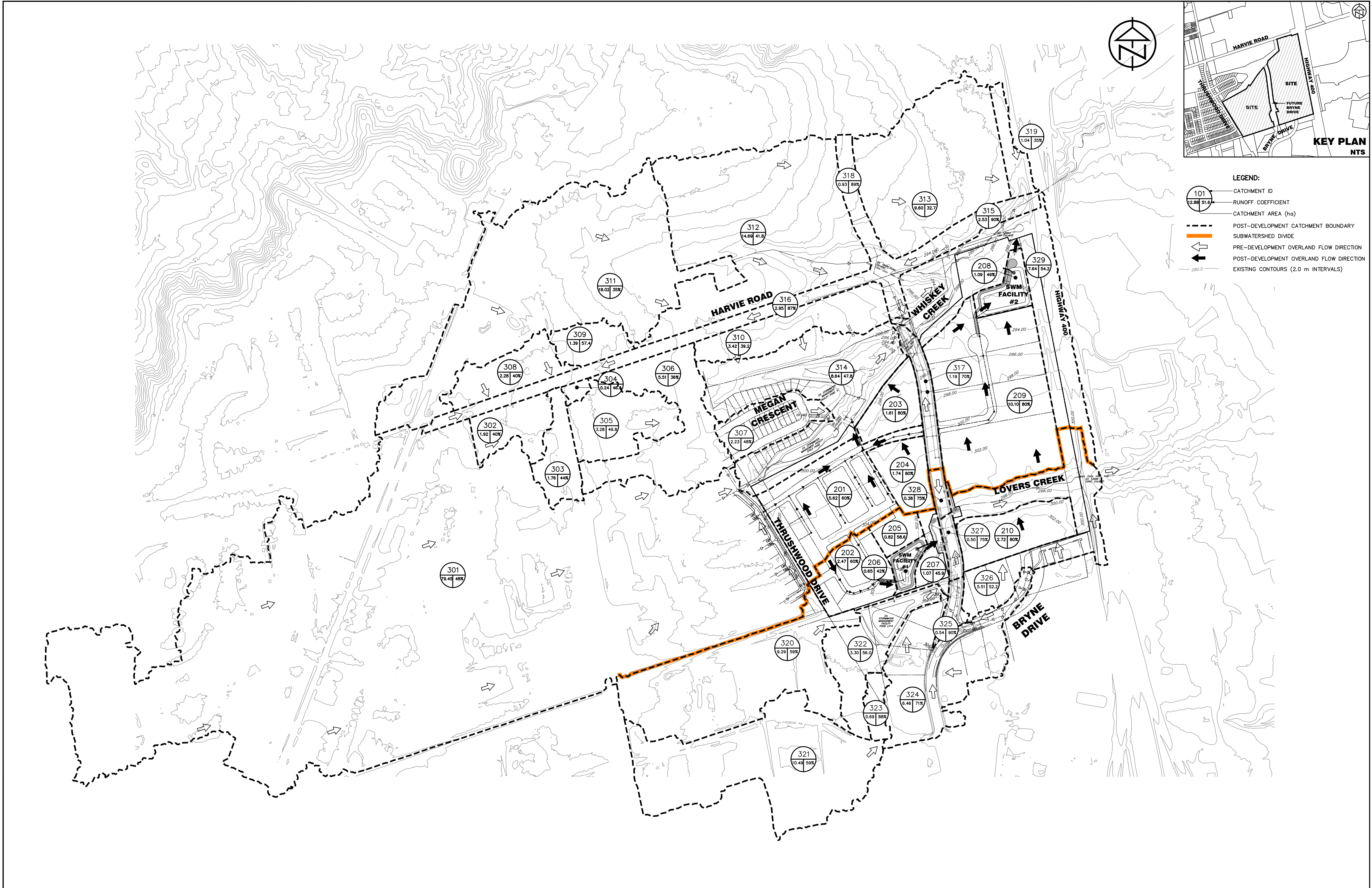
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CHECK: DRT

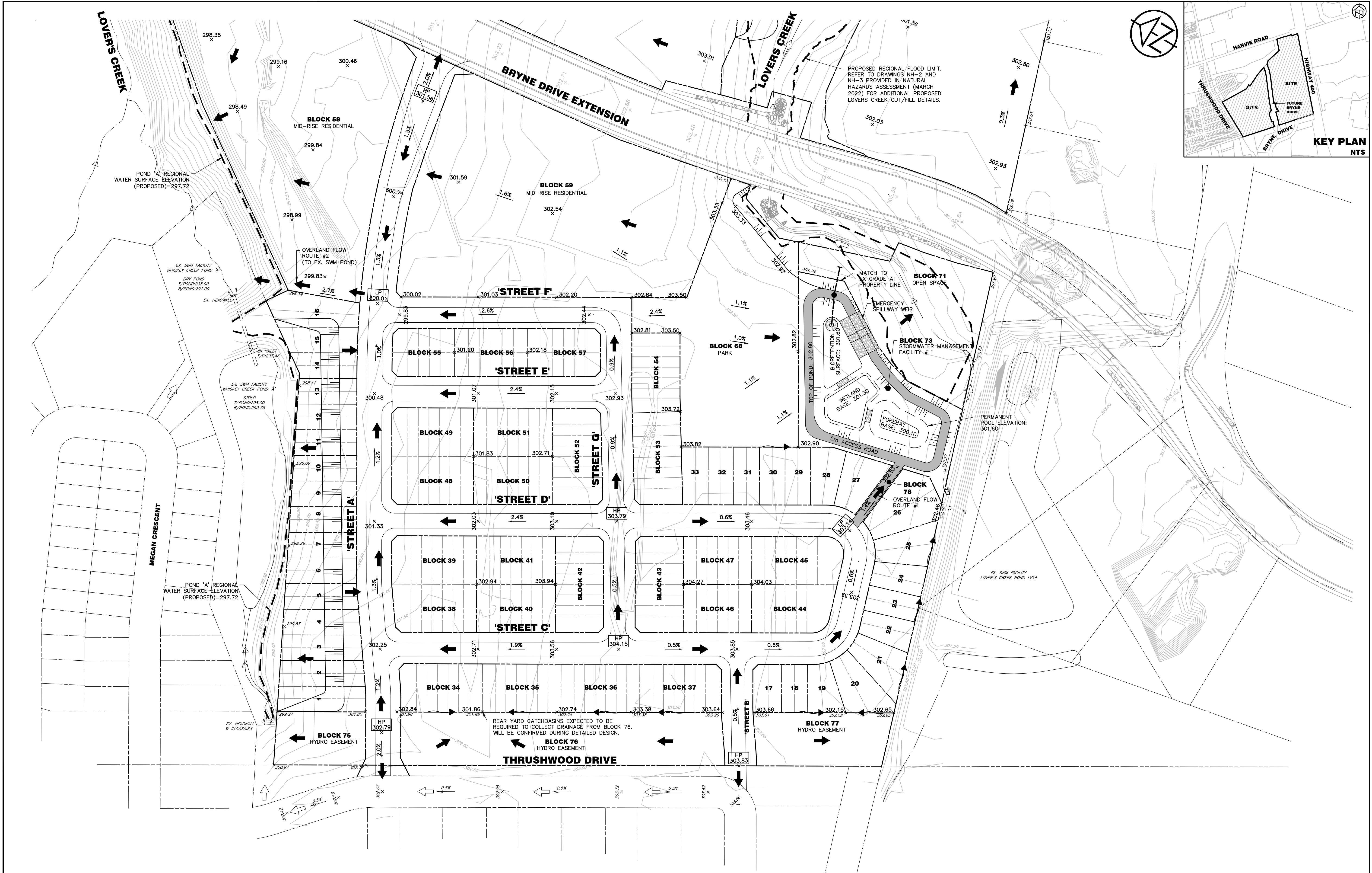
FILE: 421487
DATE: NOVEMBER 2021
SCALE: 1:2,000

DWG:
DP-1



- LEGEND:**
- 101 CATCHMENT ID
 - 12.88 51.6 RUNOFF COEFFICIENT
 - CATCHMENT AREA (ha)
 - POST-DEVELOPMENT CATCHMENT BOUNDARY
 - SUBWATERSHED DIVIDE
 - PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
 - POST-DEVELOPMENT OVERLAND FLOW DIRECTION
 - EXISTING CONTOURS (2.0 m INTERVALS)

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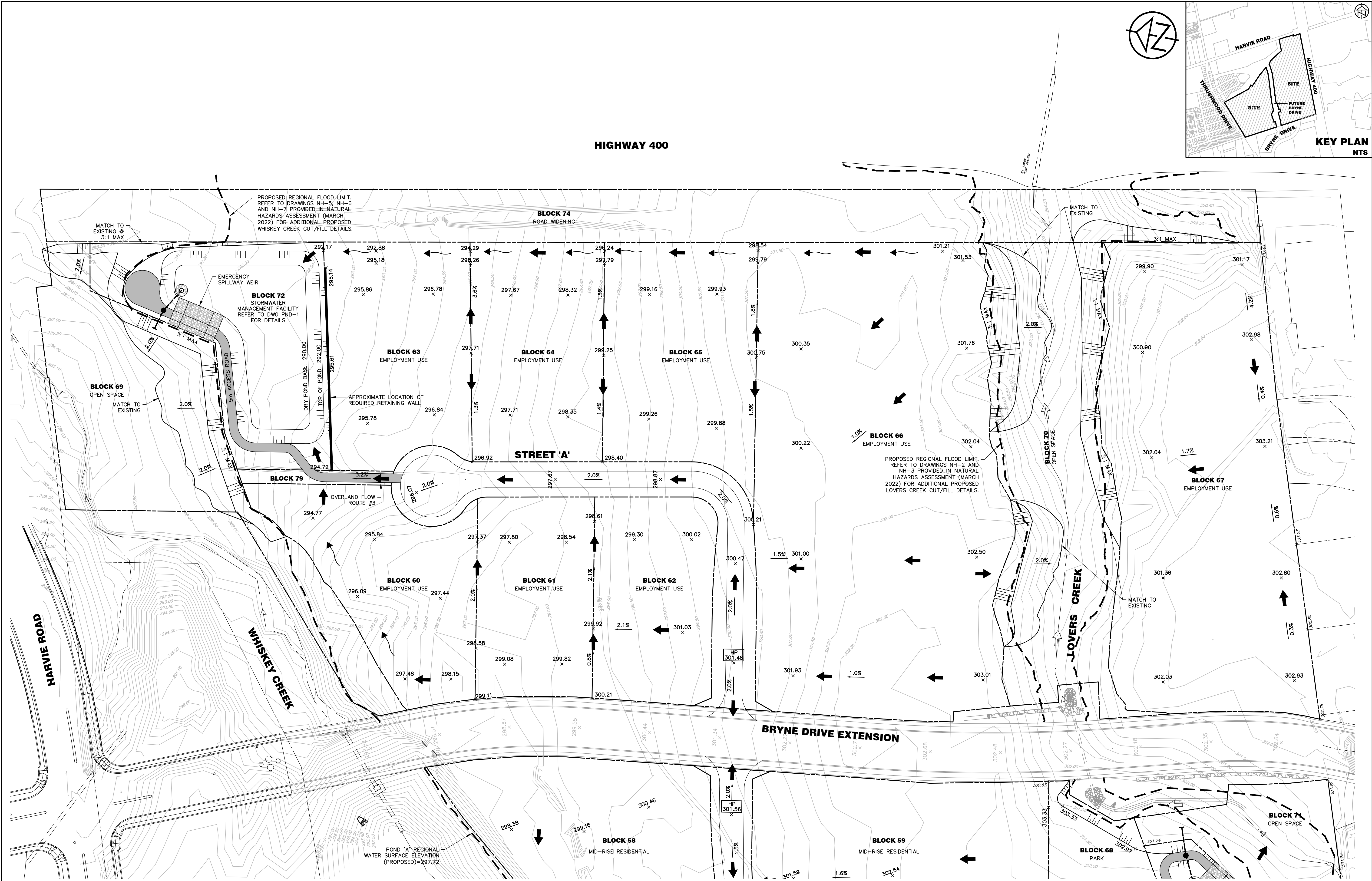
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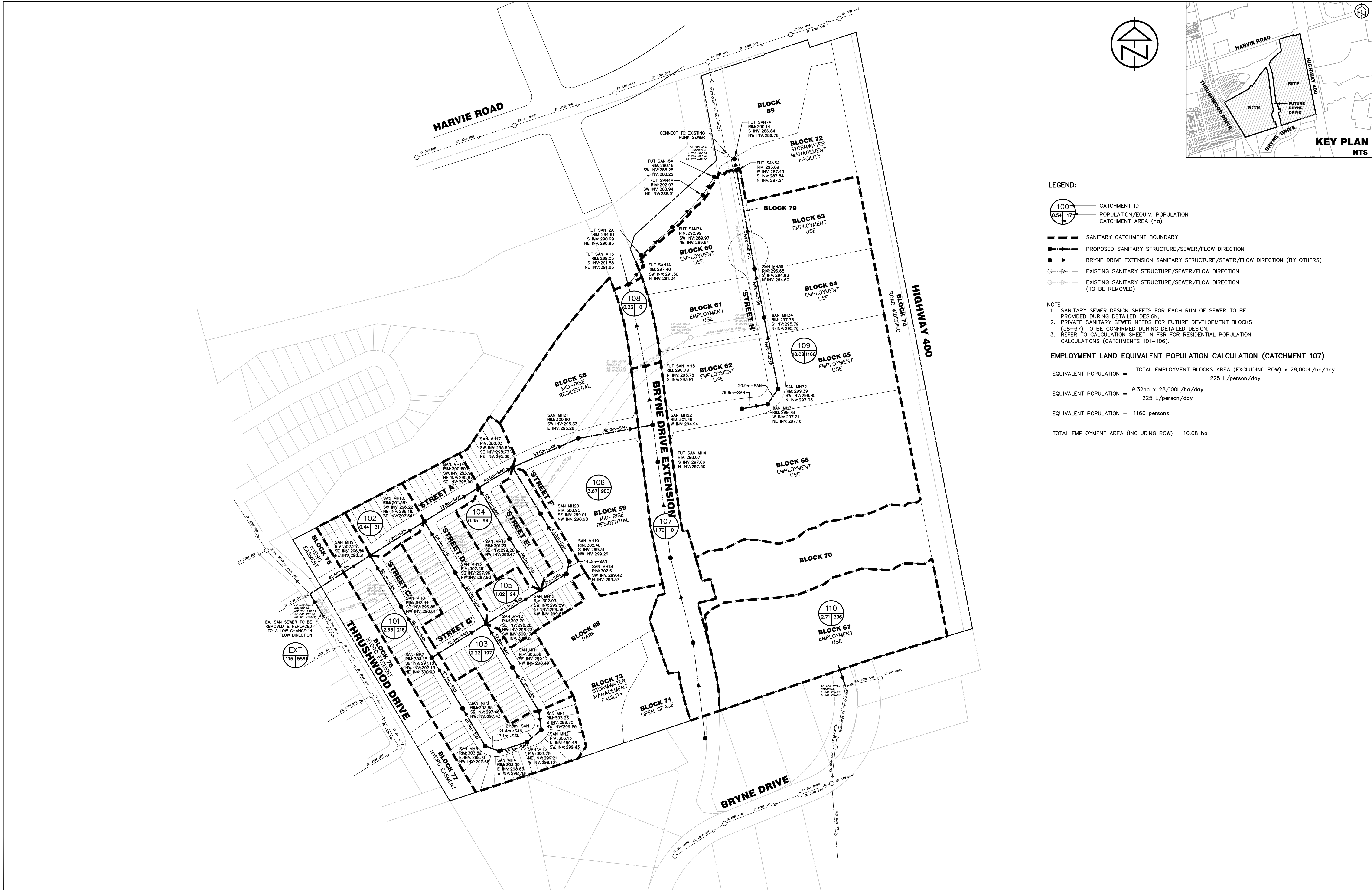
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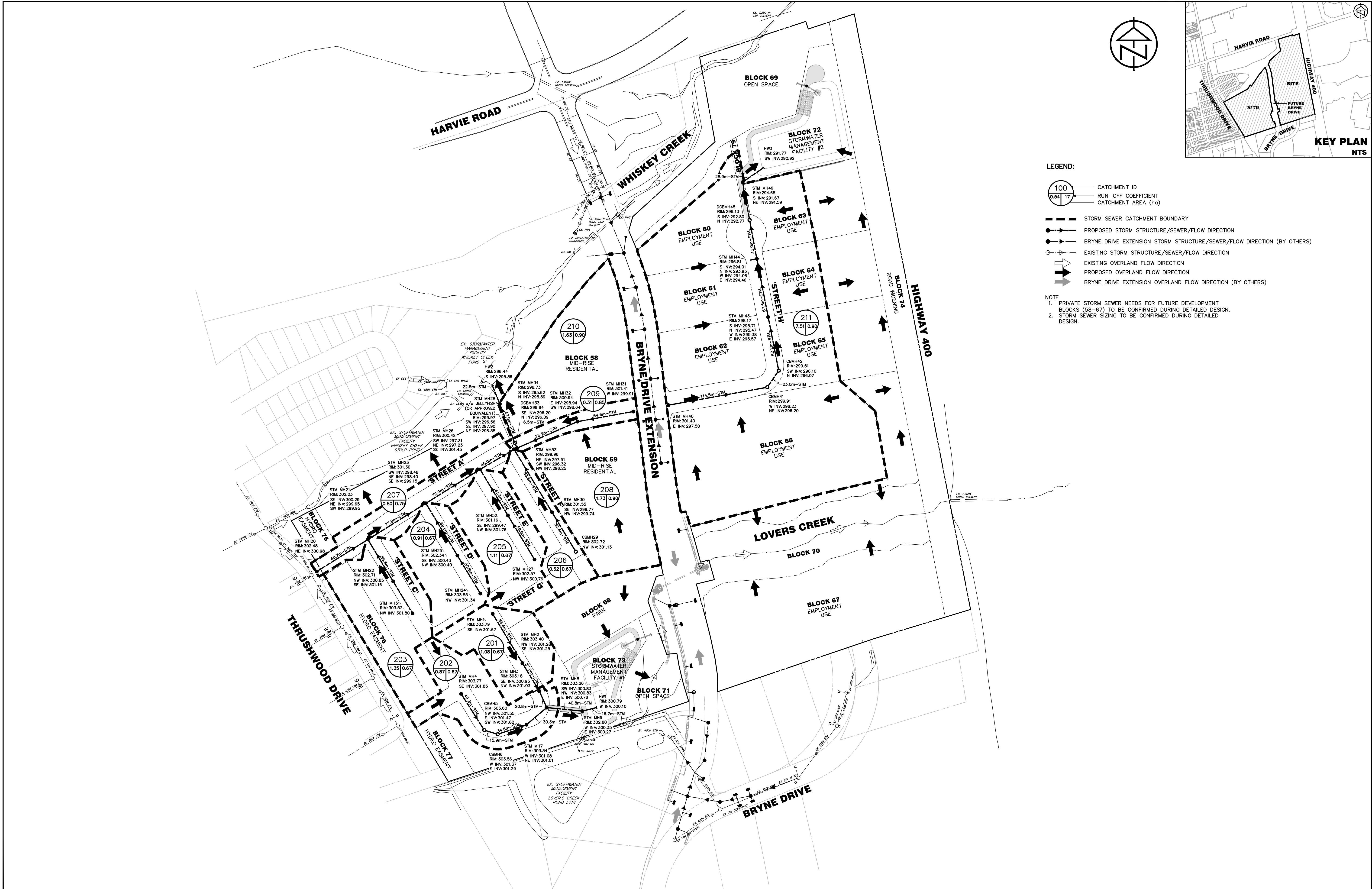
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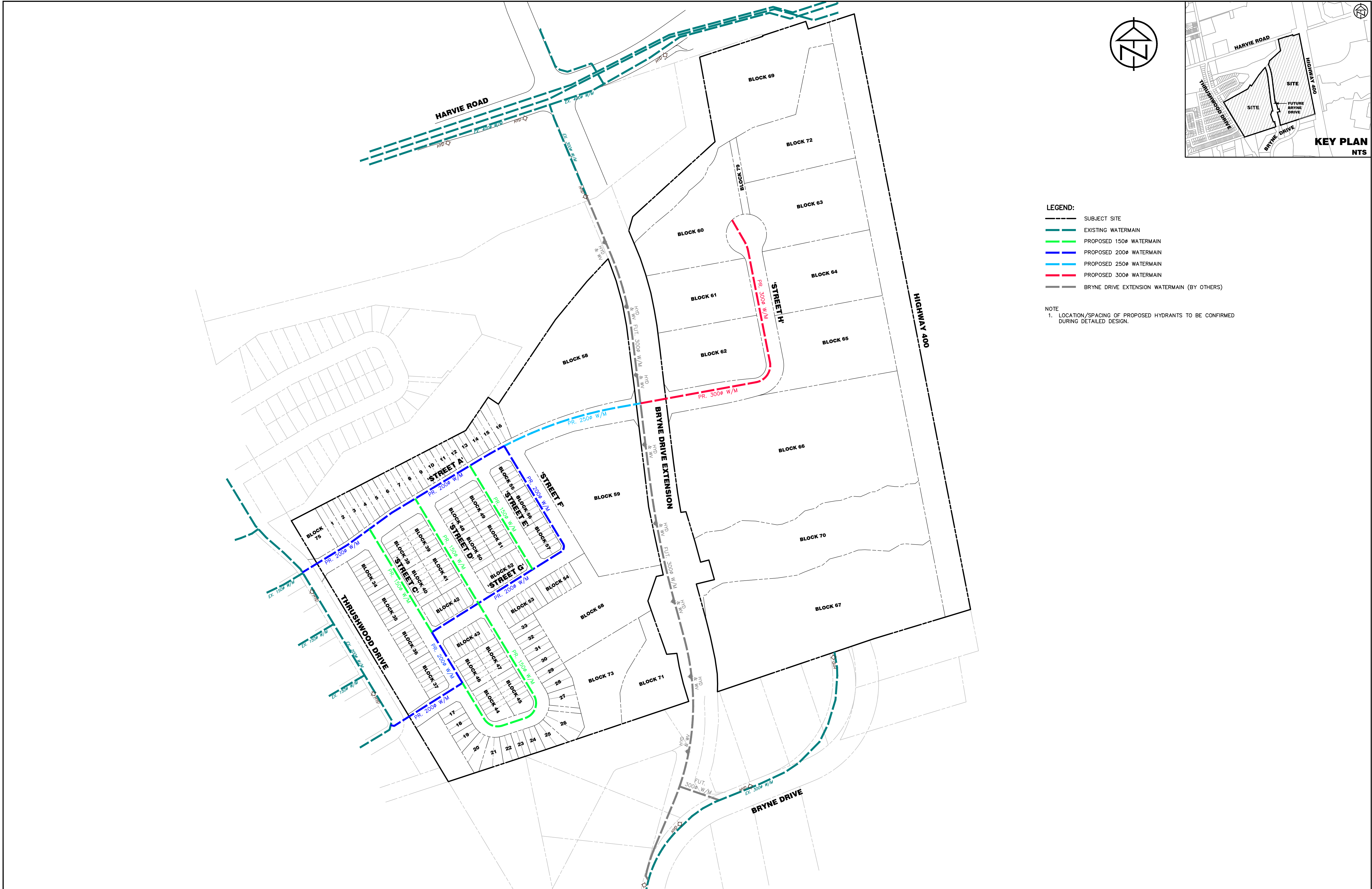
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| DRAWN: LC | DATE: NOVEMBER 2021 | GP-2 |
| CHECK: NM | SCALE: 1:1,000 | |



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- LEGEND:
- SUBJECT SITE
 - EXISTING WATERMAIN
 - PROPOSED 150# WATERMAIN
 - PROPOSED 200# WATERMAIN
 - PROPOSED 250# WATERMAIN
 - PROPOSED 300# WATERMAIN
 - BRYNE DRIVE EXTENSION WATERMAIN (BY OTHERS)

NOTE

1. LOCATION/SPACING OF PROPOSED HYDRANTS TO BE CONFIRMED DURING DETAILED DESIGN.

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|--|--|---|-----|----------------------|----------|----------------|---|---------------------|------------------|--|
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| | | | 1 | 1ST SUBMISSION | 03/24/22 | | | | | |
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| <div>WATER DISTRIBUTION PLAN</div> | | | | | | | DESIGN: LC | FILE: 421487 | DWG: | |
| | | | | | | | DRAWN: LC | DATE: DECEMBER 2021 | <div>WAT-1</div> | |
| | | | | | | | CHECK: NM | SCALE: 1:2,000 | | |