PRELIMINARY SERVICING & STORMWATER MANAGEMENT REPORT

McBain Subdivision
Crysler, ON

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0	2022/12/12	Draft Plan Application	

This report is respectfully submitted to G&E Reno Construction in response to the request for civil engineering services to support the design of a proposed residential development in Crysler, Ontario.

Prepared By:
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1 Introduction

1.1 Background

This report is submitted on behalf of G&E Reno Construction in support of an application for Draft Plan of subdivision and encompasses the proposed approach for stormwater management and conceptual servicing for the proposed development.

1.2 General Location, Description & Phasing

The proposed subdivision is generally located in the northeast corner of the village of Crysler within the Township of North Stormont. The site's legal description is Part of Lot 12, Part of the North Half of Lot 13 and Part of the Road Allowance Between Lots 12 and 13, Concession 10, Geographic Township of Finch, now in the Township of North Stormont, County of Stormont, Ontario.

A total of 152 residential lots are proposed, of which 115 will be single detached dwellings, 19 will be semi-detached dwellings (38 units), 18 will be townhomes (69 units) and approximately 50 will be medium density units (Block 154 & 155), for a total of 272 residential units. Blocks will also be provided as follows:

- Block 153 for greenspace along Stan Street,
- Block 154 & 155 for medium density residential (i.e. apartment buildings or condos),
- Block 156 & 159 to create future lots with neighbouring (Blanchard) subdivision,
- Block 157 for sanitary pumping station,
- Block 158 for access to the stormwater management facility,
- Block 160 for the stormwater management facilty,
- Block 161, 162, 163, 164 and 165 to consist of 0.3m reserves

Refer to the Draft Plan prepared by Annis, O'Sullivan, Vollebekk Ltd. (AOV) as part of this application.

Phasing is proposed to be done for this development, as can be shown on FIG.6 – Conceptual Phasing Plan found in Appendix "I". Note that the exact phasing extents and sequence is subject to change as the project advances.

1.3 Land Use, Zoning & Official Plan

The property is undeveloped, and its south portion is zoned R1 – *Residential First Density* and R4 –*Residential Fourth Density* in the Township of North Stormont Comprehensive Zoning By-Law No. 08-2014(2021 Consolidation). Rezoning will be required to accommodate the proposed development shown on theDraft Plan prepared by AOV. The north portion of the site is zoned AG – *Agricultural* and will need to berezoned to allow for future development.

With regards to the Official Plan designation, the south portion of the property is located within Crysler's Urban Settlement Area while the north half of the property is part of the Agricultural Designation. An expansion of the Urban Settlement Area will be required to allow for future development in the north portion of the property. As noted in further sections of this report, the north portion of the property is serviceable with municipal services (watermains, sanitary sewer and storm sewers) hence would be a good candidate for inclusion within Crysler's Urban Settlement Area.

The site is surrounded by vacant agricultural land to the north and east, residential land to the west and the South Nation River to the south.

Refer to the Planning Rationale prepared by Fotenn for additional information related to planning.

2 Servicing

EVB has completed the current report to satisfy requirements of the Township and in support of a Draft Plan application. Full municipal services (sanitary sewer, watermain and storm sewer) will be provided as part of the proposed development as well as asphalt roadways, street lighting and utilities.

2.1 Sanitary Sewage

The following sections provide a review of conceptual design sewage flows for the proposed subdivision and provide information for the update to the Township's *Wastewater Servicing Master Plan* currently being undertaken by R.V. Anderson Associates Ltd. and expected to be complete in 2023.

The following sections are also meant to serve as an update to the technical memorandum prepared by EVB Engineering dated April 12th, 2022, which is included in Appendix "A" for reference without appendices to avoid confusion and duplication with updated information found in the current report.

A gravity sewage collection system is proposed, which will discharge into a new sanitary pumping station located in the southeast corner of the property. A new forcemain will extend from the sanitary pumping station to the existing lagoons which are located northeast of G&E Reno's property.

The proposed parcel was sized to accommodate a sanitary pumping station, metering chamber and access driveway as can be seen in Appendix "A".

2.1.1 Summary of Previous Discussions with Township

As discussed in previous emails and meetings with the Township, it was determined that the existing sanitary on County Road 12 / Bridge Street is too shallow to accommodate new development within the property owned by G&E Reno Construction or would have required impractical amounts of fill. A new sanitary pumping station is therefore required for the proposed development.

It was also determined that the existing Flagstone Meadows (catchment area A-10 in FIG.1 – *Conceptual Sanitary Catchment Areas* which may be found in Appendix "I") could be easily redirected into the new pumping station to reduce flows at Crysler's existing sanitary pumping station, located on the south side of the South Nation River. As a result, capacity would be freed for future development on the south side of the South Nation River.

Likewise, it was determined that catchment area A-1 consisting of potential future development can easily drain into the sanitary sewer system proposed for G&E Reno's new subdivision.

Areas south and west of Flagstone Meadows cannot easily drain into the sanitary sewer system proposed for G&E Reno's new subdivision, since extensive redirection of existing sanitary sewers would be required.

Furthermore, at a meeting with Township representatives on September 9th, 2022, and subsequent emails, the option of redirecting the existing sanitary pumping station into the proposed pumping station was also discussed. The main benefit of this option would be shorter forcemains from the existing pumping station which in turn would increase the capacity of the existing pumping station to some extent (head losses along the forcemain would be less). The existing forcemain could be redirected into MH220 located at the southwest corner of the proposed subdivision, increasing peak flows by 46 L/s (capacity of existing sanitary pumping station according to the 2013 *Wastewater Servicing Master Plan*). Township staff could not comment at the time and noted that R.V. Anderson will be evaluating options as part of their update of the Township's *Wastewater Servicing Master Plan*. New gravity sewers on Helene Street would need to be upsized to accommodate this additional flow.

2.1.2 Peak Flow Calculations

Peak flows were calculated based on the assumptions below and is consistent with the Ministry of the Environment, Conservation and Parks (MECP) *Design Guidelines for Sewage Works* (2008):

- 3.00 persons per dwelling which compares to North Stormont's density of 2.53 persons per dwelling according to Statistics Canada (6,873 population in 2,717 dwellings as per the 2016 Census),
- Average daily flow of 450 L/cap/day,
- Peaking factor as calculated from Harmon formula (minimum of 2, maximum of 4),
- Infiltration & inflow allowance of 0.19 L/s/ha,
- Actual unit count for Flagstone Meadows (A-10),
- For future developments A-1 and A-4, development was assumed to consist of 45% single family, 45% semi-detached, 10% townhomes by area
- The proposed development consists of 60.8% single family, 13.1% semi-detached, 17.9% townhomes and 8.3% apartments by area

For future development areas, the following densities were used, which were measured from the existing Flagstone Meadows subdivision as shown in Appendix "A":

- 16.1 residential units per hectare for single family dwellings
- 22.2 residential units per hectare for semi-detached dwellings
- 34.3 residential units per hectare for townhomes

Conceptual sanitary flows are summarized in Table 2-1 –Table 2-1 – Sanitary Peak Flow Summary below, while the detailed calculations may be found in Appendix "B". The right-most column shows each parcel's contribution to the total flow, which could be used for cost sharing discussions.

Table 2-1 – Sanitary Peak Flow Summary

Catchment Area	Total Area (ha)	# of Units	Population	Peak Flow (L/s)**	% of Total Peak Flow**
G&E Subdivision (A-2, 3, 5 to 9, 11 to 14)	14.05	272*	816	19.67	24.37
Future G&E Subdivision (A-4)	26.72	552	1,657	39.59	49.05
Future Subdivision (A-1)	6.38	132	396	9.45	11.71
Flagstone Meadows (A-10)	6.60	90	270	6.88	8.52
Blanchard Property (A-15)	4.30	69	207	5.13	6.35
Total	**58.04**	**1,115**	**3,345**	**80.72**	**100%**

* Assuming 50 apartment units are done in catchment area A-11 (to be determined)
** Assuming peaking factor of 4 for all properties for comparison purposes

2.1.3 Gravity Collection System

The conceptual design of the gravity sanitary sewer system is consistent with the MECP *Design Guidelines for Sewage Works* (2008) and was based on the following assumptions and design criteria:

- Manning coefficient of 0.013,
- Minimum 200mm pipe diameter,
- Minimum full flow velocity of 0.6 m/s,
- Maximum velocity of 3.0 m/s,
- Minimum pipe cover of 2.8m to ensure gravity drainage of basements

The detailed sanitary sewer design sheet may be found in Appendix “B”. Catchment areas are illustrated on FIG.1 – *Conceptual Sanitary Catchment Areas* while the conceptual sanitary sewer network is shown on FIG.2 – *Conceptual Sanitary Sewer Servicing*, both found in Appendix “I”.

As can be seen, the proposed top of grate elevation of most proposed maintenance holes closely reflect existing ground elevations throughout the property, with a few structures requiring marginal amounts of grade raise (< 0.5m).

2.1.4 Sanitary Pumping Station Depth

As can be seen in FIG.2 – *Conceptual Sanitary Sewer Servicing* found in Appendix “I”, the proposed sanitary pumping station is expected to have the following elevations, for a total depth of approximately 7.5m:

- Top of structure = 65.50m
- Invert elevation = 61.00m
- Bottom of wet well = 58.00m (to be confirmed during detailed design)

2.1.5 Sanitary Pumping Station Wet Well

Since the future expansion of a pumping station wet well is a major and expensive undertaking, we recommend that the sanitary pumping station wet well be sized to accommodate the ultimate peak flow of approximately 80 L/s, and that the wet-well structure and associated appurtenances (hatches, openings, in-station piping, etc.) be sized to accommodate the pumps at ultimate development. This would have minimal impact to the overall cost of constructing the pumping station but would give the most flexibility for efficient expansion as development occurs.

2.1.6 Sewage Handling Pumps

At ultimate development, pumps will need to accommodate an ultimate peak flow of 80 L/s at a total head of approximately 15.76 m per the conceptual pump design sheet found in Appendix “C”, which corresponds to a Xylem N3171 MT 3~ pump with 25 horsepower (hp) motor and 234mm impeller. Pump size is to be confirmed during detailed design.

We recommend the pumps be sized for a peak flow corresponding to their expected life span of typically 15-20 years to avoid grossly oversized pumps in the early stages of development. If development of all areas is expected to be completed within that timeframe, oversized pumps could be installed and operated at a slower speed with the use of Variable Frequency Drives (VFD’s). Pump speed would be increased as development occurs and as flows increase.

If development is expected to take longer than 15-20 years, we recommend that smaller pumps be installed for the first portion of development, to then be replaced with larger pumps as flows increase.

2.1.7 New Forcemain

Per the conceptual pump design sheet found in Appendix “C”, a new 350mmØ forcemain is proposed between the new sanitary pumping station and the existing lagoons. This forcemain size results in reasonable head losses at ultimate development and achieves a minimum flow velocity of 0.6 m/s at flows greater than 50 L/s.

The proposed forcemain length assumes the forcemain extends along the east property line of the G&E Reno property as shown in FIG.1 and FIG.2 (Appendix “I”), and discharges into the existing lagoons. Length and minor losses will have to be revised during detailed design to reflect the final alignment.

2.1.8 Existing Forcemain

The approximate location of the existing forcemain extending from Crysler’s existing sanitary pumping station to the lagoons is shown on FIG.1 and FIG.2 (Appendix “I”). The existing forcemain conflicts with the northern portion of the proposed future development and will need to be relocated to allow for the most efficient use of the property. This work could also include the upsizing of the existing forcemain, and/or the twinning of the pipe to accommodate future growth.

The capacity review of the existing forcemain and determination of possible improvements will be reviewed as part of the update to the Wastewater Servicing Master Plan undertaken by others.

2.2 Water Supply

A water distribution system concurrent with Township and MECP *Design Guidelines for Drinking-Water Systems* (2008) is proposed for the development and will consist of a pipe network designed to provide potable and firefighting water to the residents of the subdivision.

2.2.1 Water Model & Hydraulic Boundary Conditions

The proposed watermains were modeled using WaterCAD CONNECT to reflect the proposed road and lot configuration. The water levels in the Crysler water tower were obtained from the drawings prepared by Landmark (May 1994):

- High-water level = 382.6’ = 116.6m
- Near empty level (base of bowl) = 354.5’ = 108.05m
- Ground elevation = 217.03’ = 66.15m

The water model was developed using a reservoir and a pump given a curve replicating the minimum flow available at a Class AA (blue) hydrant based on the NFPA 291, per the classification of the existing hydrants near the connection point as noted by the Township.

Two different pump curves were used. For the average day demand, maximum day demand, peak hour demand and maximum day + fire flow demand scenarios, the water tower was conservatively assumed to be near empty. The tower was then assumed to be full for the minimum hour demand to review the impacts of high pressures in the system.

The pump curve for the ‘tower near empty’ scenarios was input as follows:

- Shutoff: 70 psi = 49m head @ 0 L/s
- Design: 63 psi @ 500 usgpm = 44.3m head @ 31.5 L/s interpolated using $N^{1.85}$ graph paper
- Max: 20 psi = 14m head @ 94.6 L/s, matching Class AA (blue hydrant) minimum rated capacity per NFPA 291

While the pump curve for the ‘tower full’ scenario was input as follows:

- Shutoff: 70 psi = 49m head @ 0 L/s
- Design: 63 psi @ 500 usgpm = 44.3m head @ 31.5 L/s $N^{1.85}$ graph paper

- Max: 20 psi = 14m head @ 94.6 L/s, matching Class AA (blue hydrant) minimum rated capacity per NFPA 291

See Appendix "D" for the marked-up water tower drawing and for the theoretical supply curves prepared using $N^{1.85}$ graph paper for both scenarios.

2.2.2 Design Criteria

Watermains were sized to achieve the following pressures as per the requirements of the MECP for water systems:

- Pressure range of 50 to 70 psi (350 to 480 kPa) for average day demands,
- Pressure range of 50 to 70 psi (350 to 480 kPa) for maximum day demands,
- Minimum pressure of 40 psi (275 kPa) for peak hourly demands,
- Maximum pressure of 100 psi (700 kPa) for minimum hourly demands,
- Minimum pressure of 20 psi under maximum day + fire flow demand conditions,

While the following design criteria were used:

- Hazen-Williams C factor of 100 for 150mmø watermains,
- Hazen-Williams C factor of 110 for 200mmø and 250mmø watermains,
- Number of residential units as per sanitary sewer calculations,
- 3.0 persons per unit as per sanitary sewer calculations,
- Average day demand of 450 L/cap/day as per sanitary sewer calculations,
- Minimum hour peaking factor of 0.40 per MECP Table 3-1 (pop. 500 - 1,000),
- Maximum day peaking factor of 2.75 per MECP Table 3-1 (pop. 500 - 1,000),
- Peak hourly peaking factor of 4.13 per MECP Table 3-1 (pop. 500 - 1,000),
- Minimum hour peaking factor of 0.45 per MECP Table 3-1 (pop. 2,001 - 3,000),
- Maximum day peaking factor of 2.25 per MECP Table 3-1 (pop. 2,001 - 3,000),
- Peak hourly peaking factor of 3.38 per MECP Table 3-1 (pop. 2,001 - 3,000),

Note that peaking factors for a population of 500 to 1,000 were conservatively used for the south half of G&E Subdivision and Blanchard property since the design population is marginally above 1,000.

2.2.3 Water Demands – Domestic Flows

The theoretical water demands for the entire development were calculated based on the above design criteria and are shown in Table 2-2 – Domestic Water Demands below. Domestic water demands were then distributed throughout the model based on expected population densities at those junctions.

Two scenarios were considered, the first being full development of the G&E Subdivision as shown on the Draft Plan (south portion of G&E's property) and full development of the Blanchard property. The second scenario consists of full development of G&E's entire property and of the Blanchard property to represent conditions at ultimate development. Additional information may be found in Appendix "D".

Table 2-2 – Domestic Water Demands

	Scenario #1: Full Development in South Portion of G&E Property + Blanchard Property	Scenario #2: Ultimate Development of G&E Property + Blanchard Property
	# of Residential Units / Demand (L/s)	# of Residential Units / Demand (L/s)
Average Day	341 units / 5.33 L/s	893 units / 13.95 L/s
Minimum Hour	341 units / 2.13 L/s	893 units / 6.28 L/s
Maximum Day	341 units / 14.65 L/s	893 units / 31.39 L/s
Peak Hourly	341 units / 22.01 L/s	893 units / 47.16 L/s

2.2.4 Water Demand – Firefighting Flows

Fire Underwriters Survey (FUS) short method resulting in firefighting flow of 4,000 L/min (66.7 L/s) for groupings of detached one-family and small two-family dwelling not exceeding two stories in height with exposure distances between 3 to 10 m.

Firefighting water demands for the higher density residential will have to be determined using the FUS or Ontario Building Code (OBC) method when construction details for those developments are available. We expect the required firefighting flows to be greater than noted above.

2.2.5 WaterCAD Model Results

The detailed junction reports from WaterCAD may be found in Appendix “E” for all demands considered (average day, maximum day, peak hourly, minimum hourly) and for the maximum day plus fire flow report, for development within the south half of the property and for ultimate development. Results are also summarized in Table 2-3 and Table 2-4 below, alongside with MECP criteria.

As can be seen, the proposed water supply system meets MECP requirements for all demands considered and provides adequate flow for firefighting purposes.

Table 2-3 – WaterCAD Model Results – G&E South Portion + Blanchard

Return Period (years)	Total Demand (L/s)	MECP Design Criteria			Model Results		Meets MECP
		Min. Pressure (kPa/psi)	Max. Pressure (kPa/psi)	Minimum Fire Flow (L/s)	Pressure (min. or max. psi)	Max. Pressure (psi) or Fire Flow (L/s)	
Average Day	5.33	350 / 50	480 / 70		57.3 psi	60.5 psi	True
Min. Hourly	2.13		700 / 100			72.7 psi	True
Maximum Day	14.65	350 / 50	480 / 70		56.7 psi	59.7 psi	True
Peak Hourly	22.01	275 / 40			55.8 psi	58.6 psi	True
Max. Day + Fire Flow	14.65 + fire flow	140 / 20		66.7	20 psi	71.54 L/s (J-14)	True

Table 2-4 – WaterCAD Model Results – G&E Ultimate Development + Blanchard

Return Period (years)	Total Demand (L/s)	MECP Criteria			Model Results		Meets MECP
		Min. Pressure (kPa/psi)	Max. Pressure (kPa/psi)	Minimum Fire Flow (L/s)	Min. Pressure (psi)	Max. Pressure (psi) / Fire Flow (L/s)	
Average Day	13.95	350 / 50	480 / 70		53.2 psi	59.9 psi	True
Min. Hourly	6.28		700 / 100			72.4 psi	True
Maximum Day	31.39	350 / 50	480 / 70		49.9 psi	56.7 psi	True
Peak Hourly	47.16	275 / 40			44.3 psi	51.4 psi	True
Max. Day + Fire Flow	31.39 + fire flow	140 / 20		66.7	20 psi	50.28 L/s (J-19)	**False**

It is interesting to note that available fire flows decrease by approximately 20 L/s at ultimate development. This is caused by the higher ground elevations (hence lower pressures) at the north end of the subdivision, and by limitations in the existing water distribution system which are discussed in the following section. Water demands and related calculations will need to be revised when additional information is known for the development in the north half of the property. At that time, we also recommend that hydrant flow testing be done to confirm assumptions made in the present watermain sizing.

200mmø watermains are proposed throughout the subdivision, except for Jean Street and the first section of Helene Street which was modeled as 250mmø. A schematic of the WaterCAD model is shown in Figure 1 and Figure 2 below with 150mmø watermains (existing) in **red,** 200mmø watermains in **orange**, and 250mmø watermains in **green**. Inactive watermains for the first scenario are shown in **gray**.

As can be seen, the first scenario was conservatively modeled assuming a single connection is made to the Township's water distribution system, and a loop is then introduced only at ultimate development. Furthermore, extension of the existing watermain along County Road 12 was conservatively not considered at ultimate development.

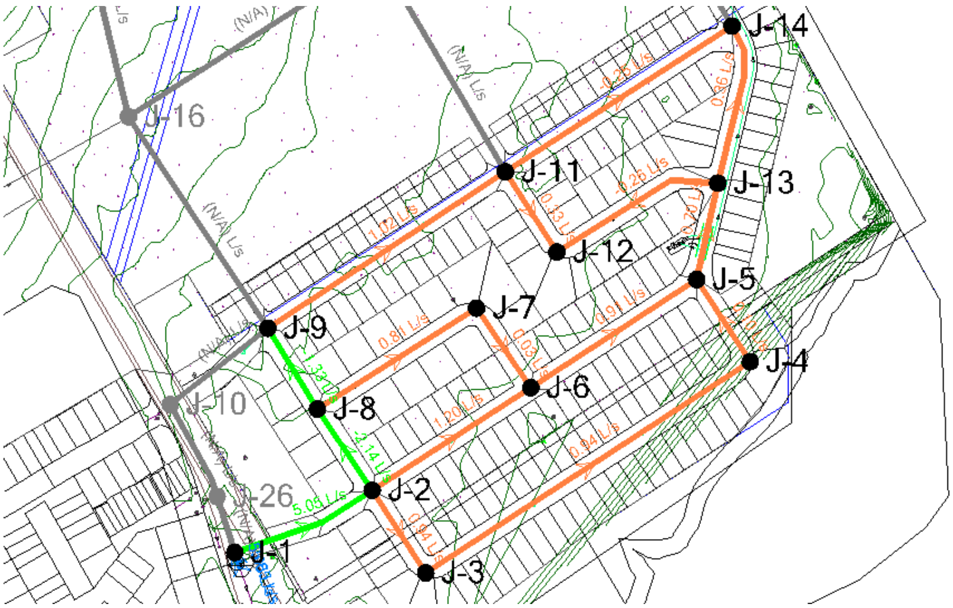


Figure 1: WaterCAD Model Schematic – G&E South Portion + Blanchard

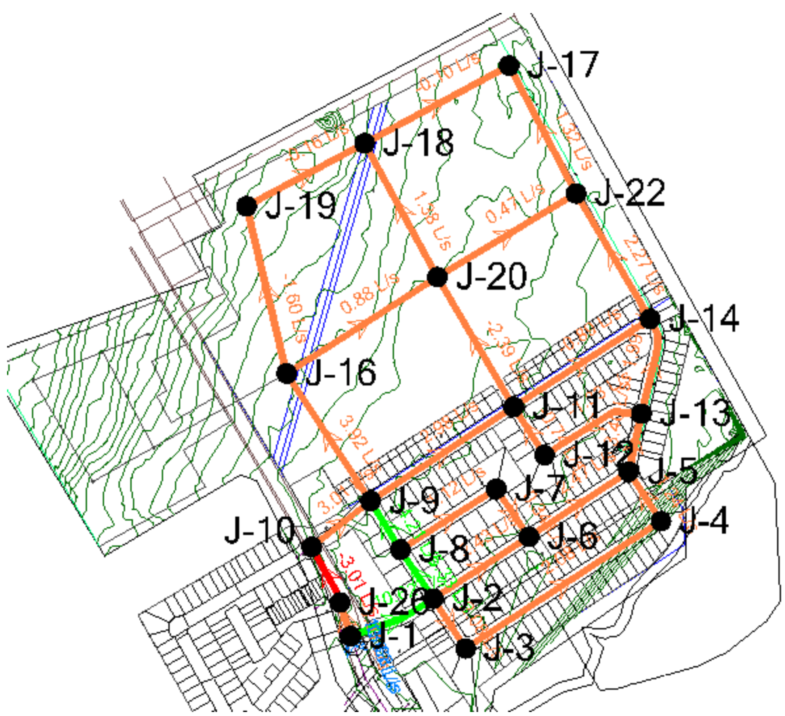


Figure 2: WaterCAD Model Schematic – G&E Ultimate Development + Blanchard

2.2.6 Limitations of Existing Water Distribution System

From as-built drawings provided by the Township, Crysler's water distribution system was designed and constructed in the mid 1990's hence was based on section 2.1.1.4 of MOE Design Guidelines (July 1984) wherein a minimum fire flow of 30 L/s is to be provided at any one node along the system, and with a total system flow and duration varying based on design population as further described in Appendix N of the same guidelines.

Since then, there has been a shift in how fire flows are evaluated. More specifically, the 2008 MECP *Design Guidelines for Drinking-Water Systems* no longer provide a minimum fire flow to be provided at any one node along the system, and instead recommends that the designer considers local fire flow rates when sizing pipes.

This can be done with either the Fire Underwriters Survey (FUS) or the Ontario Building Code (OBC) method, with the FUS method recommending a minimum flow of 4,000 L/min (66.7 L/s) for groupings of detached one-family and small two-family dwelling not exceeding two stories in height with exposure distances between 3 to 10 m, and with even greater values for higher density developments.

Comparatively, the OBC method requires a minimum firefighting flow of 1,800 L/min (30 L/s) for one-storey buildings with building area not exceeding 600 m^2, and that the minimum firefighting flow be calculated for all other buildings based on the volume of the building, exposure distances, and type of construction. The floor area is not expected to exceed 600 m^2 for single and semi-detached dwellings however it is likely that two-storey buildings will be done in at least some areas, resulting in greater required firefighting flows.

As such, required fire flows have become much more conservative when compared to historical design values. This can cause issues when expanding older water distribution systems as older systems are sometimes not able to meet new fire flow requirements, especially as the market appears to be trending towards higher density developments.

It should also be noted that the design population of 2,679 persons at ultimate development is significant, especially when compared to Crysler's 2011 population of 639 persons as noted in the 2013 *Wastewater Servicing Master Plan* prepared by R.V. Anderson Associates Ltd. Further review of the existing water distribution system will therefore be required. We understand that the need for upgrades to the water distribution system such as a new storage tank, booster pumping station, upsizing of existing watermains, wells, disinfection, etc. is currently being undertaken by R.V. Anderson Associates Ltd. as part of their update to the Township's *Wastewater Servicing Master Plan* which is expected to be complete in 2023.

2.3 Asphalt Roadways

A 20.0 m urban local street corridor is proposed for all roadways as shown in Appendix "E". The need for sidewalks is to be discussed and established with the Township of North Stormont.

As discussed in previous emails and meetings with the Township, concrete curbs are proposed to direct runoff into catchbasins, to protect the edge of asphalt and to guide the snow plow. Barrier or mountable curb could be done at the discretion of the Township.

The pavement structure proposed is as per the recommendations of the geotechnical investigation prepared by Kollaard Associates and as summarized below:

- 40mm Superpave 12.5 (or HL-3),
- 50mm Superpave 19.0 (or HL-8)
- 150mm Granular "A",
- 300mm Granular "B" Type II,

- Non-woven geotextile as required by the Township

2.4 Utilities & Street Lighting

Underground utility corridors are proposed to be located inside the road right-of-way to accommodate street lighting, Hydro One, communications and natural gas.

2.5 Lot Grading

The site grading will be developed as part of the detailed design drawings and will be based on a minimum slope of 0.5% for swales, and minimum and maximum slopes for hard surfaces & grass surfaces of 1% and 4%, respectively. 3H:1V terracing will be done where slopes exceed 4%.

Lots will be graded as split drainage (high point near the middle of the house) where possible to facilitate construction of houses. Back-to-front drainage may be required on some lots to match existing elevations.

Lot grading will include rear and side yard swales as well as rear-yard catch basins for surface drainage, which will be directed to the storm sewer system.

3 Stormwater Servicing

3.1 Summary of Previous Discussions with Township

As discussed in previous emails and meetings with the Township, a conventional storm sewer system and end-of-pipe stormwater management facility are proposed as opposed to a shallow twin storm sewer system as was used in previous developments in the Township of North Stormont.

Storm runoff is significant due to the large size of the development of 45 hectares (110 acres); more specifically, peak runoff exceeds 2,600 L/s for the 5-year storm and 4,400 L/s for the 100-year storm. Conveying the 5-year storm would require either a 1,350mm storm sewer (conventional system) or twin 1,050mm storm sewers, the latter of which would be impractical, will cause conflicts with other utilities and would be prohibitively expensive to construct, especially when considering the need for upsized catchbasins at every driveway. A conventional storm sewer system is also expected to require less maintenance as the pipe length is essentially half that of a twin system, and as there is a much smaller number of catchbasins (70-90m spacing in a conventional system versus 15-20m spacing for twin shallow systems.

With regards to the stormwater management facility, a wet pond is proposed to be done since a dry pond can only achieve a total suspended solids (TSS) removal rate of 60% as per the MECP *Stormwater Management Planning and Design Manual* (2003), much less than the required TSS removal rate of 80%. Supplementary treatment such as an oil & grit interceptor would be required with a dry pond which is not recommended for sites larger than 2 ha as per the *Stormwater Management Planning and Design Manual* (2003). Mosquitoes are not expected to be a concern as they require shallow and/or stagnant pools of water for breeding as per EPA publication 833-F-05-003. The proposed wet pond will have a permanent pool depth of 1.4 m and the large catchment area will ensure turnover of water.

Potential for Low Impact Development (LID) was reviewed; LID will be difficult due to the high percentage of impervious areas. Furthermore, the presence of clayey (low permeability) soils are not ideal for infiltration trenches, pits or basins especially when considering the need to infiltrate the runoff from a large impervious area into a small footprint.

3.2 Existing & Proposed Drainage Patterns

Based on a topographic survey completed by EVB Engineering, the existing site drains entirely towards the southeast and into the South Nation River. The pre-development catchment area is illustrated on FIG.3 – *Pre-Development Storm Catchment Areas* found in Appendix "I", along with the location of the 100-year flood plain based on a topographic survey completed by EVB Engineering in September 2022.

Conceptual post-development stormwater catchment areas were developed based on expected grading and storm sewer flow direction within the subdivision and are shown on FIG.4 – *Conceptual Storm Catchment* Areas and FIG.5 – *Conceptual Storm Sewer Servicing* found in Appendix "I".

All catchment areas will be directed to a proposed stormwater management facility to be constructed in the southeast corner of the property which will then discharge into the South Nation River.

3.3 Design Criteria

The rational method and the following design criteria were used in sizing the stormwater management facility and storm sewers.

3.3.1 Rainfall Intensity

The rainfall intensity was derived from the MTO's IDF Curve Lookup Tool for the site and may be found in Appendix "F", which uses data from nearby Environment Canada weather stations.

3.3.2 Runoff Coefficients

The following runoff coefficients were used as per the MECP *Design Guidelines for Sewage Works* (2008). Runoff coefficients were taken at the middle of the range given in the MECP design guidelines due to the relatively low road profile slopes:

- 0.20 for undeveloped areas
- 0.45 for single family dwellings
- 0.52 for semi-detached dwellings
- 0.60 for townhouses
- 0.75 for medium density residential

Refer to Appendix "F" for weighted C factor calculations. Note that the runoff coefficients were increased by +25% for the 100-year storm event for sizing the stormwater management facility.

3.3.3 Time of Concentration

The time of concentration (Tc) represents the longest time that will take for a water droplet to run off the watershed to its discharge point, and at which time peak flow will occur. The pre-development time of concentration was calculated to be 88.67 minutes using the Airport formula with an average slope of 0.88% and flow length of 840 m. Refer to Appendix "F" for detailed pre-development time of concentration calculations and for FIG.3 – *Pre-Development Storm Catchment* Areas found in Appendix "I" for the flow path.

The post-development time of concentration was taken as 20 minutes for single, semi-detached and townhouses, while it was taken as 15 minutes for medium density residential.

3.3.4 Stormwater Management

As per pre-consultation with South Nation Conservation (SNC), the design criteria for the proposed development were determined to be as follows:

- Post- to pre-development for 5-year and 100-year storm events
- 80% total suspended solids (TSS) removal

3.4 Stormwater Management – Quantity

Stormwater storage will need to be done on site such that the post-development peak runoff does not exceed the allowable pre-development values for storm events with return periods of 5 and 100 years. The proposed footprint of the stormwater management (SWM) facilities is shown on FIG.4 – *Conceptual Storm Catchment* Areas and FIG.5 – *Conceptual Storm Sewer Servicing* found in Appendix "I".

The outlet of the stormwater management facility will feature ditch inlets and a storm sewer draining into the South Nation River. Orifices will be used to control both storm events to acceptable levels. The design of the outlet structures will be done as part of detailed design.

Provided storage calculations were based on the water levels in the SWM facility and on the elevation vs. storage volume information obtained from AutoCAD Civil 3D.

Table 3-1 below summarizes the pre- and post-development scenarios for the entire subdivision, for both the 5- and 100-year storms. Detailed calculations pertaining to weighted runoff coefficient, required storage, provided storage (stage-storage calculations), and resulting outlet flow calculations may be found in Appendix "F".

Table 3-1 - Stormwater Peak Runoff for Pre and Post Development Flows

Return Period (years)	Pre-Development			Post-Development				Total Required Storage* (m^3)	Total Provided Storage* (m^3)
	Area (ha)	C Factor	Flow (L/s)	Area (ha)	C Factor	Uncont. Flow (L/s)	Controlled Flow* (L/s)		
5	46.48	0.20	521.20	46.48	0.49	3,656.4	512.60	4,208.62	4,243.55
100	46.48	0.20	871.29	46.48	0.49	6,051.3	861.00	9,661.99	9,731.67

Storage for the 5-year storm will be achieved at an elevation of 62.67 m (0.67 m above the permanent pool) while storage for the 100-year storm will be achieved at an elevation of 63.36 m (1.36 m above the permanent pool) and above the 100-year flood plain elevation of the South Nation River of 62.00 m.

As can be seen, the controlled flows are less than the allowable pre-development peak flows, and the required storage volumes are met for both the 5-year and 100-year design storms. The proposed stormwater management facilities will therefore meet the stipulated quantitative criterion.

3.5 Stormwater Management – Quality

As previously mentioned, 80% total suspended solids (TSS) removal is required for the development. The proposed stormwater management facilities will be designed as a wet pond per the MECP *Stormwater Management Planning and Design Manual* (2003) to provide the necessary quality treatment.

Sizing of the north SWM facility was based on an imperviousness of 51.2% as calculated by converting the runoff coefficient to an equivalent imperviousness percentage. By extrapolating from Table 3.2 of the MECP design manual, the north SWM facility will require 178.99 m^3/ha to achieve 80% TSS removal. Of this amount, 40 m^3/ha is to be extended detention while the remainder (138.99 m^3/ha) is to be permanent storage.

The required and provided qualitative volumes are summarized in Table 3-2 below for both stormwater management facilities.

Table 3-2 – Qualitative Stormwater Management Volumes

	Area (ha)	Required Volume (m^3/ha)	Total Required Volume (m^3)	Provided Volume (m3)	Water Elevation (m)
Extended Detention	44.98*	40	1,799.08	1,821.66	62.33
Permanent Storage		138.99	6,251.58	6,393.10	62.00

* Excludes the area of the pond itself which will not contribute TSS.

The water elevations in the above table were based on the stage-storage characteristics of the pond as shown in Appendix "G". The permanent storage represents a water depth of 1.4 m from the bottom of the pond, within the desired range for wet ponds of 1 m to 2 m. Water depths and volumes will be further refined during detailed design.

Other requirements of the MECP Design Manual were also verified to confirm that the footprint shown on FIG.4 – *Conceptual Storm Catchment Areas* and FIG.5 – *Conceptual Storm Sewer Servicing* found in Appendix “I” is adequate and to ensure that the SWM facility will provide the necessary TSS removal. Refer to Appendix “G” for these calculations and verifications.

3.6 Minor & Major Drainage Systems

The proposed minor drainage system consists of storm sewers sized to accommodate the peak flow of the 5-year design storm event without surcharging. Design peak flows were calculated using the Rational method and the design criteria described above, while a Manning roughness coefficient of 0.013 was used in sizing storm sewers.

The storm sewer design sheet may be found in Appendix “H” and is in accordance with the standards outlined by the MECP to achieve a minimum full flow velocity of 0.6 m/s, and includes flows based on ultimate development conditions. A hydraulic grade line (HGL) calculation was also done to ensure the storm sewer can still convey the 5-year storm when the outlet pipe into the stormwater management facility is partially submerged resulting from the 5-year water elevation in the stormwater management facility. As can be seen in Appendix “H”, three storm sewer sections are marginally surcharged (0.01 m to 0.04 m above the obvert) hence the storm sewer will adequately convey the 5-year storm even with a partially submerged outlet.

The major system will consist of pressurized flow in storm sewers for which a HGL calculation was done with an almost fully submerged outlet pipe resulting from the 100-year water elevation in the stormwater management facility. As can be seen in Appendix “H”, the storm sewer can convey the 100-year storm with flooding at a few structures, however it appears as though flooding at MH900 and MH910 is caused by oversimplification of the future development area.

HGL calculations will be updated during detailed design of the subdivision. Where necessary, overland flow in roadways could be done, which is expected to work well for this development as the proposed topography generally slopes towards the southeast corner of the property where the pond is located.

3.7 Erosion & Sediment Control Measures

Straw bale flow check dams as per OPSD 219.180 will be installed in ditches and swales at the start of construction and will be maintained during the project. Sediment control measures will be removed only once adequate grass cover has been achieved. It is expected anticipated that these measures will provide adequate protection to minimize erosion and sediment transport during construction.

The contractor will be required to monitor the sediment control measures weekly and following any significant storm consisting of 13 mm of precipitation or greater. The contractor will also be responsible to repair the sediment control measures as required to ensure their proper operation.

The erosion & sediment control plan will be done during detailed design.

4 Approvals & Permits

4.1 Conservation Authority

This report and design drawings will also be circulated to the South Nation Conservation (SNC) as part of the Draft Plan application pertaining to stormwater management.

4.2 Environmental Compliance Approval

An Environmental Compliance Approval (ECA) from the Ministry of the Environment, Conservation and Parks (MECP) will be required for this development since sanitary and storm sewers will be done, and since the SWM facility services multiple properties.

4.3 Other Permits

Building permits will be applied for and obtained at a later time and on a “lot by lot” basis.

5 Conclusion

5.1 Conclusions & Recommendations

It is concluded that the conceptual design of the proposed development meets all servicing constraints and associated design criteria, hence adequately supports the Draft Plan application.

5.2 Schedule

G&E Reno Construction intends to proceed with the detailed design and construction of this proposed development as soon as possible.

APPENDIX A

EVB Design Sewage Flow Technical Memo (April 12th, 2022)
Conceptual Site Plan of Sanitary Pumping Station Block
Approximation of Densities

TECHNICAL MEMORANDUM

PROJECT: New Crysler Subdivisions
Date: April 12, 2022
To: Mary McCuaig, A.M.C.T, Township of North Stormont
From: Francois Lafleur, P. Eng.

RE: Design Sewage Flows – New Crysler Subdivisions & Sanitary Pumping Station

1. INTRODUCTION

The following Technical Memorandum provides a review of conceptual design sewage flows for the proposed Crysler subdivisions to support an expansion of the village's Urban Settlement Area and to provide information for the update to the Township's Wastewater Servicing Master Plan currently being undertaken by others.

2. SUMMARY OF PREVIOUS DISCUSSIONS

As per previous email discussions and meetings, it was determined that the existing sanitary on County Road 12 / Bridge Street was too shallow to accommodate new development within the property owned by G&E Reno Construction (area A-2 on FIG.1 in Appendix "A") or would have required impractical amounts of fill.

It was also determined that Flagstone Meadows (area A-1 on the attached FIG.1) could be easily redirected into the new pumping station to reduce flows at Crysler's existing sanitary pumping station, located on the south side of the South Nation River. As a result, capacity would be freed for future development on the south side of the South Nation River.

Likewise, area A-4 consisting of potential future development can easily drain into the sanitary sewer system proposed for G&E Reno's new subdivision.

Areas south and west of A-1 cannot easily drain into the sanitary sewer system proposed for G&E Reno's new subdivision, since extensive redirection (reconstruction) of existing sanitary sewers would be required.

Previously prepared Drawing SK.1 – *Conceptual Sanitary Servicing* may be found in Appendix "A" for reference; note that the lot layout has not yet been finalized.

3. SANITARY CATCHMENT AREAS

Sanitary catchment areas are shown on attached FIG.1 – *Sanitary Catchment Areas* and were developed from approximate property lines as shown on the SDG Counties' GIS mapping. Contours were based on a topographic survey of areas A-2, A-3 and A-4 by EVB Engineering.

As can be seen, the existing topography generally slopes towards the southeast corner of area A-2, where a sanitary pumping station is proposed to be constructed to minimize the depth of the wet well.

4. FLOW CALCULATIONS

Peak flows were calculated based on the assumptions below, per the requirements of the Ministry of the Environment, Conservation and Parks (MECP) *Design Guidelines for Sewage Works (2008)*:

- 16.1 units per hectare for single family dwellings,
- 22.2 units per hectare for semi-detached dwellings,
- 34.3 units per hectare for townhomes,
- 3 persons per unit,
- Average day flow of 450 L/person/day,
- Peaking factor of 4 based on the Harmon formula,
- Infiltration & inflow allowance of 0.19 L/s/ha,
- Actual unit count for Flagstone Meadows (A-1),
- For future developments A-2, A-3 and A-4, development was assumed to consist of 45% single family, 45% semi-detached, 10% townhomes by area

Existing densities were measured from the existing Flagstone Meadows subdivision as shown in Appendix “B”.

Conceptual sanitary flows are summarized in Table 1 below, while the detailed calculations may be found in Appendix “C”.

Table 1: Flow Summary

Catchment Area	**Total Area (ha)**	**# of Units**	**Population**	**Peak Flow (L/s)**	**% of Total Peak Flow**
A-1: Existing Flagstone Meadows	6.10	90	270	6.78	8.70%
A-2: G&E Reno Subdivision	42.83	885	2656	56.37	72.29%
A-3: Blanchard Subdivision	3.64	75	226	5.39	6.92%
A-4: Future Subdivision	6.36	131	394	9.42	12.09%
Total	**58.93**	**1182**		**77.97**	**100%**

5. CONCLUSION & RECOMMENDATIONS

5.1 Sanitary Pumping Station Wet Well

Since the future expansion of a pumping station wet well is a major and expensive undertaking, we recommend that the sanitary pumping station wet well be sized to accommodate the ultimate peak flow of approximately 80 L/s, and that the wet-well structure and associated appurtenances (hatches, openings, in-station piping, etc.) be sized to accommodate the pumps at ultimate development. This would have minimal impact to the overall cost of constructing the pumping station but would give the most flexibility for efficient expansion as development occurs.

5.2 Sewage Handling Pumps

At ultimate development, pumps will need to accommodate an ultimate peak flow of 80 L/s at a total head of approximately 33 m per the conceptual pump design sheet found in Appendix “D”, which corresponds to a Xylem N3202 HT 3~ pump with 60 horsepower (hp) motor and 310mm impeller. Pump size is to be confirmed during detailed design.

We recommend the pumps be sized for a peak flow corresponding to their expected life span of typically 15-20 years to avoid grossly oversized pumps in the early stages of development. If development of all areas is expected to be completed within that timeframe, oversized pumps could be installed and operated at a slower speed with the use of Variable Frequency Drives (VFD’s). Pump speed would be increased as development occurs and as flows increase. The above pump could be slowed to approximately 30 L/s at 30 Hertz (Hz).

If development is expected to take longer than 15-20 years, we would recommend that smaller pumps be installed for the first portion of development, to then be replaced with larger pumps as flows increase.

5.3 New Forcemain

Per the conceptual pump design sheet found in Appendix “D”, a new 250mmØ forcemain is proposed, which results in reasonable head losses at ultimate development and allows for a minimum flow rate of approximately 30 L/s to maintain a minimum velocity of 0.6 m/s as per the MECP *Design Guidelines for Sewage Works (2008)*.

The proposed forcemain length assumes the forcemain extends along the east property line of the G&E Reno property as shown in FIG.1 (Appendix A), and discharges into the existing lagoon. Length and minor losses will have to be revised during detailed design to reflect the final alignment.

5.4 Existing Forcemain

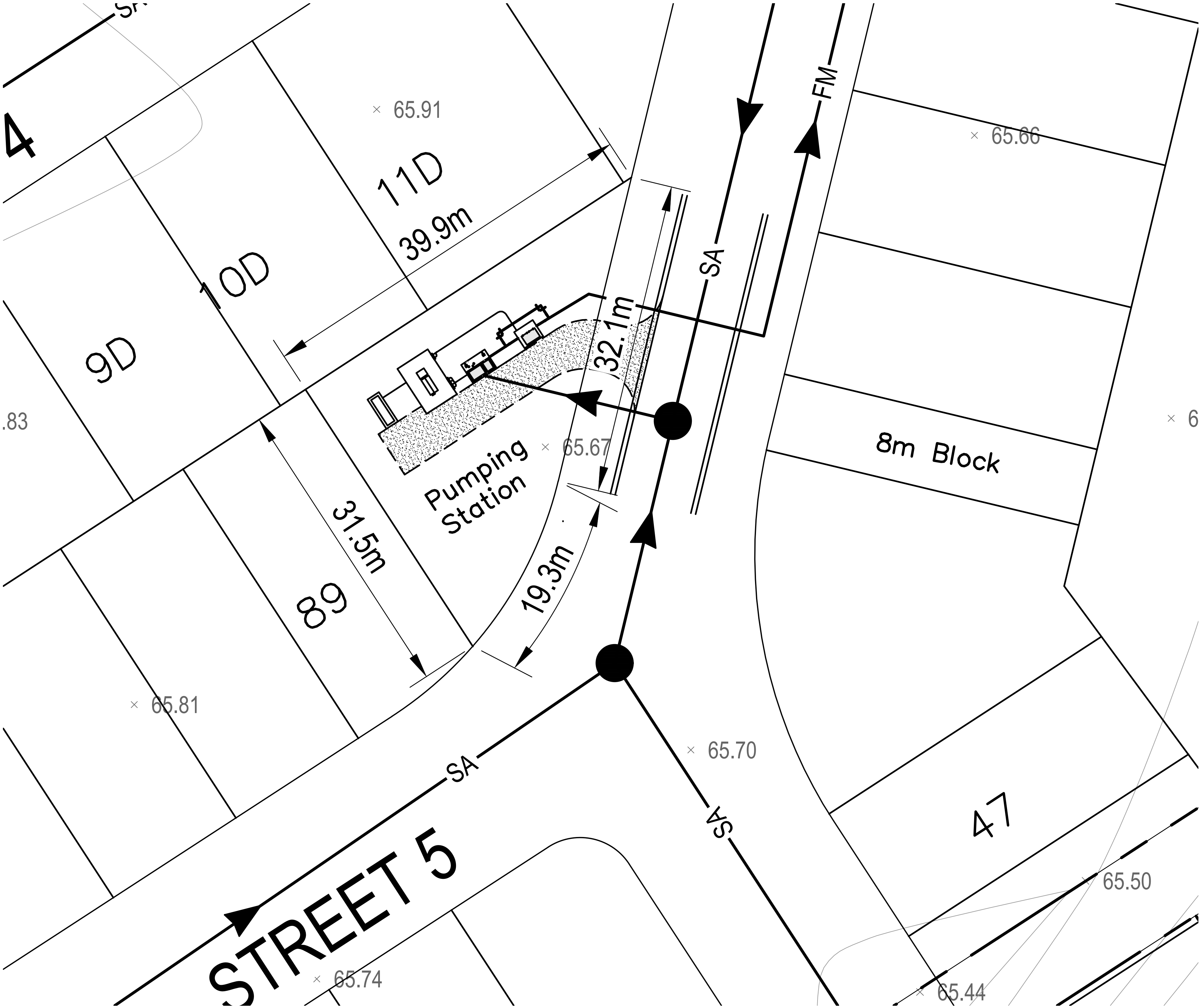
The existing forcemain will need to be relocated to allow for the most efficient use of the property. This work could also include the upsizing of the existing forcemain, and/or the twinning of the pipe to accommodate future growth.

The capacity review of the existing forcemain and determination of possible improvements will be reviewed as part of the update to the Wastewater Servicing Master Plan undertaken by others.

5.5 Gravity Sanitary Sewers

Since the upsizing of gravity sewers is a major and expensive undertaking, we recommend that new gravity sanitary sewers be sized to accommodate the peak flow at ultimate development.

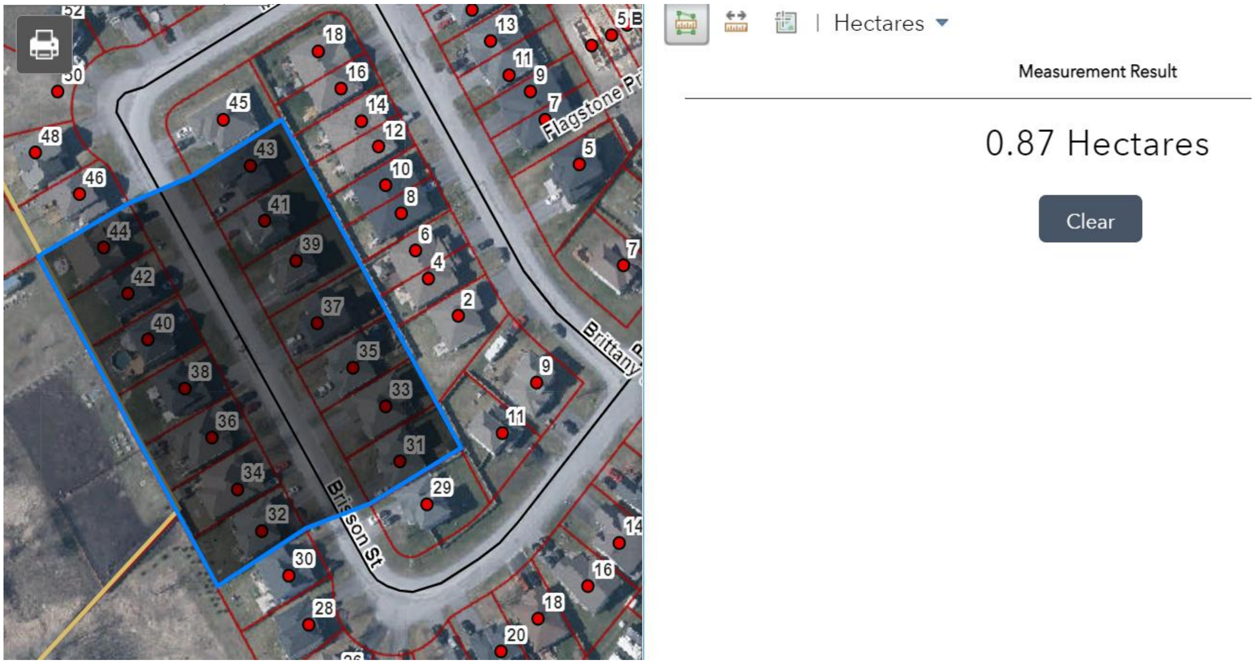
As shown in Appendix “C”, a 375 mm Ø sanitary sewer at 0.30% slope would be required for the section of sanitary sewer directly upstream of the new sanitary pumping station, decreasing in diameter towards the north and west.



4
65.91
11D
39.9m
10D
9D
.83
65.66
FM
SA
32.1m
Pumping
Station
65.67
8m Block
31.5m
89
19.3m
65.81
65.70
SA
SA
47
65.50
STREET 5
65.74
65.44
6

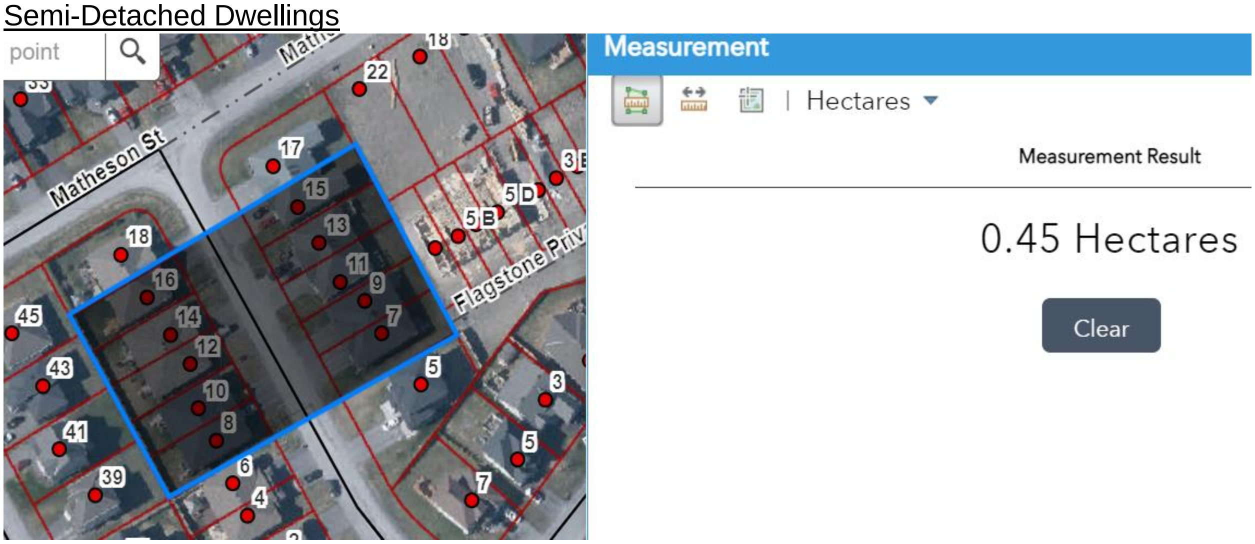
Approximation of Densities (as measured from SDG's GIS maps)

Single (Detached) Dwellings



14 units / 0.87 hectares = 16.1 units per hectare

Semi-Detached Dwellings



10 units / 0.45 hectares = 22.2 units per hectare

Townhomes

12 units / 0.35 hectares = 34.3 units per hectare

APPENDIX B

Sanitary Sewer Design Sheet – Summary
Sanitary Sewer Design Sheet (Ultimate Development)

Sanitary Sewer Design Sheet - Summary (Ultimate Development)

Owner: G&E Reno Construction

Service Location and Contributing Areas						Inlet Flow										
Location	Manhole		Contributing Areas			Individual Population			Cumulative		q	Peaking	Peak Q	I*A	Q	% of Flow
	From	To	No.	Ha	Σ Areas	# Units	Pop.	P(1000)	Σ P(1000)	Σ AREA (ha)	l/cap/d)	Factor (M)	(l/s)	(l/s)	(l/s)	
New G&E Subdivision			**A-2, 3, 5 to 9, 11 to 14**													
Singles	60.5%			8.50		115	345	0.345								
Semi's	13.1%			1.85		38	114	0.114								
Towns	18.0%			2.53		69	207	0.207								
Apartments	8.3%			1.17		50	150	0.150								
Sub-Total				**14.05**		**272**	**816**	**0.816**	**0.816**	**14.05**	450	4.00	17.00	2.67	19.67	24.37%
Future G&E Subdivision			**A-4**													
Singles	45%			12.02		193	580	0.580								
Semi's	45%			12.02		267	802	0.802								
Towns	10%			2.67		92	275	0.275								
Sub-Total				**26.72**		**552**	**1657**	**1.657**	**1.657**	**26.72**	450	4.00	34.51	5.08	39.59	49.05%
Future Subdivision			**A-1**													
Singles	45%			2.87		46	139	0.139								
Semi's	45%			2.87		64	191	0.191								
Towns	10%			0.64		22	66	0.066								
Sub-Total				**6.38**		**132**	**396**	**0.396**	**0.396**	**6.38**	450	4.00	8.24	1.21	9.45	11.71%
Flagstone Meadows			**A-10**													
Singles						60	180	0.180								
Semi's						18	54	0.054								
Towns						12	36	0.036								
Sub-Total				**6.60**		**90**	**270**	**0.270**	**0.270**	**6.60**	450	4.00	5.63	1.25	6.88	8.52%
Blanchard Subdivision			**A-15**													
Singles						69	207	0.207								
Semi's							0	0.000								
Towns							0	0.000								
Sub-Total				**4.30**		**69**	**207**	**0.207**	**0.207**	**4.30**	450	4.00	4.31	0.82	5.13	6.35%
Total To SPS				**58.04**		**1115**			**3.345**	**58.04**	**450**	**4.00**	**69.69**	**11.03**	**80.72**	

Design Parameters

Coefficients		Flows		
Mannings n =	0.0130	Average Daily Per Capita Flow (q):	450 l/cap/d	new
Persons Per Lot	3.00	Peak Extrenuous Flow (I):	0.19 l/s/ha	

	Singles	Semi's	Towns	
Densities:	16.1	22.2	34.3	units/ha

Designed By: François Lafleur, P.Eng	**Project:** McBain Lands Subdivision		
Reviewed By: Josh Eamon, P.Eng	**Location:** Crysler, Ontario		
Dwg. Reference: FIG.1 & FIG.2	**Project Number:** 21043	**Date:** 07-Nov-22	**Sheet Number:** 1/1

Sanitary Sewer Design Sheet (Ultimate Development)

Owner: G&E Reno Construction

Service Location and Contributing Areas						Inlet Flow										Outlet Pipe Data								
						Individual			Cumulative															
Location	Manhole		Contributing Areas			Population			Σ	Σ	q	Peaking	Peak Q	I*A	Q	SIZE	Slope	Qcap	Q/Qcap	Velocity	Length	Δ Elev	Pipe Inverts	
	From	To	No.	Ha	Σ Areas	# Units	Pop.	P(1000)	P(1000)	AREA (ha)	l/cap/d)	Factor (M)	(l/s)	(l/s)	(l/s)	(mm)	(%)	(l/s)		(m/s)	(m)	(m)	U/S	D/S
Future Subdivisio	MH470	MH440							0.000	0.00	450	4.00	0.00	0.00	0.00	200	0.50%	23.19	0.00	0.74	109.9	0.549	68.48	67.94
Future Subdivisio	MH450	MH440							0.000	0.00	450	4.00	0.00	0.00	0.00	200	0.50%	23.19	0.00	0.74	71.6	0.358	68.29	67.94
Future Subdivisio	MH440	MH430							0.000	0.00	450	4.00	0.00	0.00	0.00	200	0.50%	23.19	0.00	0.74	158.7	0.794	67.79	66.99
Future Subdivisio	MH470	MH460							0.000	0.00	450	4.00	0.00	0.00	0.00	200	0.50%	23.19	0.00	0.74	172.6	0.863	68.39	67.53
Future Subdivisio	MH460	MH430							0.000	0.00	450	4.00	0.00	0.00	0.00	200	0.50%	23.19	0.00	0.74	101.9	0.509	67.38	66.87
Future Subdivisio	MH430	MH420	A-1	6.38	A-1	132	396	0.396	0.396	6.38	450	4.00	8.25	1.21	9.46	200	0.50%	23.19	0.41	0.74	109.5	0.548	66.84	66.29
Future Subdivisio	MH420	MH410			A-1				0.396	0.00	450	4.00	8.25	0.00	8.25	200	0.50%	23.19	0.36	0.74	50.6	0.253	66.23	65.98
Future Subdivisio	MH410	MH400			A-1				0.396	0.00	450	4.00	8.25	0.00	8.25	200	0.50%	23.19	0.36	0.74	326.7	1.634	65.92	64.29
Future Subdivisio	MH400	MH310			A-1				0.396	6.38	450	4.00	8.25	1.21	9.46	200	0.50%	23.19	0.41	0.74	258.0	1.290	64.14	62.85
Stan Street	MH340	MH330	A-2	1.92	A-2	28	84	0.084	0.084	1.92	450	4.00	1.75	0.37	2.12	200	0.40%	20.74	0.10	0.66	84.0	0.336	64.04	63.70
Stan Street	MH330	MH320			A-2				0.084	1.92	450	4.00	1.75	0.37	2.12	200	0.40%	20.74	0.10	0.66	84.0	0.336	63.67	63.34
Stan Street	MH320	MH310			A-2				0.084	1.92	450	4.00	1.75	0.37	2.12	200	0.40%	20.74	0.10	0.66	84.9	0.340	63.31	62.97
Nicole Street	MH310	MH300	A-3	1.85	A-1 TO A-3	38	114	0.114	0.594	10.15	450	3.93	12.17	1.93	14.10	250	0.40%	37.61	0.37	0.77	86.0	0.344	62.82	62.47
Nicole Street	MH300	MH290			A-1 TO A-3				0.594	10.15	450	3.93	12.17	1.93	14.10	250	0.40%	37.61	0.37	0.77	120.0	0.480	62.32	61.84
Nicole Street	MH290	MH240			A-1 TO A-3				0.594	10.15	450	3.93	12.17	1.93	14.10	250	0.40%	37.61	0.37	0.77	40.6	0.162	61.78	61.62
Future G&E	MH510	MH500	A-4	26.72	A-4	552	1657	1.657	1.657	26.72	450	3.65	31.48	5.08	36.55	250	0.50%	42.05	0.87	0.86	435.7	2.178	66.77	64.59
Future G&E	MH500	MH270			A-4				1.657	26.72	450	3.65	31.48	5.08	36.55	250	0.50%	42.05	0.87	0.86	442.1	2.210	64.44	62.23
Stan Street	MH310	MH280	A-5	1.78	A-5	25	75	0.075	0.075	1.78	450	4.00	1.56	0.34	1.90	200	0.40%	20.74	0.09	0.66	119.3	0.477	63.34	62.86
Stan Street	MH280	MH270			A-5				0.075	1.78	450	4.00	1.56	0.34	1.90	200	0.40%	20.74	0.09	0.66	119.3	0.477	62.83	62.35
Helene Street	MH270	MH260	A-6	1.12	A-4 TO A-6	14	42	0.042	1.774	29.61	450	3.63	33.50	5.63	39.12	300	0.40%	61.16	0.64	0.87	24.1	0.096	62.20	62.10
Helene Street	MH260	MH250			A-4 TO A-6				1.774	29.61	450	3.63	33.50	5.63	39.12	300	0.40%	61.16	0.64	0.87	24.5	0.098	62.04	61.95
Helene Street	MH250	MH240			A-4 TO A-6				1.774	29.61	450	3.63	33.50	5.63	39.12	300	0.40%	61.16	0.64	0.87	96.4	0.386	61.89	61.50
Helene Street	MH240	MH100	A-7	0.56	A-1 TO A-7	5	15	0.015	2.383	40.32	450	3.53	43.75	7.66	51.41	300	0.40%	61.16	0.84	0.87	60.3	0.241	61.47	61.23
Stan Street	MH350	MH340	A-8	0.33	A-8	1	3	0.003	0.003	0.33	450	4.00	0.06	0.06	0.13	200	0.40%	20.74	0.01	0.66	29.2	0.117	63.99	63.87
Jean Street	MH340	MH230	A-9	0.80	A-8 TO A-9	19	57	0.057	0.060	1.13	450	4.00	1.25	0.21	1.46	200	0.40%	20.74	0.07	0.66	86.0	0.344	63.72	63.38

Sanitary Sewer Design Sheet (Ultimate Development)

Owner: G&E Reno Construction

Service Location and Contributing Areas						Inlet Flow										Outlet Pipe Data								
						Individual			Cumulative															
Location	Manhole		Contributing Areas			Population			Σ	Σ	q	Peaking	Peak Q	I*A	Q	SIZE	Slope	Qcap	Q/Qcap	Velocity	Length	Δ Elev	Pipe Inverts	
	From	To	No.	Ha	Σ Areas	# Units	Pop.	P(1000)	P(1000)	AREA (ha)	l/cap/d)	Factor (M)	(l/s)	(l/s)	(l/s)	(mm)	(%)	(l/s)		(m/s)	(m)	(m)	U/S	D/S
Jean Street	MH230	MH210			A-8 TO A-9				0.060	1.13	450	4.00	1.25	0.21	1.46	200	0.40%	20.74	0.07	0.66	86.0	0.344	63.35	63.00
Flagstone Meadov	EXMH8	MH220	A-10	6.60	A-10	90	270	0.270	0.270	6.60	450	4.00	5.63	1.25	6.88	200	0.85%	30.24	0.23	0.96	82.4	0.700	63.82	63.12
Apartments	MH220	MH210	A-11	1.17	A-10 TO A-11	50	150	0.150	0.420	7.77	450	4.00	8.75	1.48	10.23	200	0.40%	20.74	0.49	0.66	51.5	0.206	63.09	62.88
Helene Street	MH210	MH200	A-12	1.45	A-7 TO A-12	20	60	0.060	0.540	10.35	450	3.96	11.13	1.97	13.09	250	0.40%	37.61	0.35	0.77	83.3	0.333	62.85	62.52
Helene Street	MH200	MH170							0.540	10.35	450	3.96	11.13	1.97	13.09	250	0.40%	37.61	0.35	0.77	83.3	0.333	62.49	62.16
Larocque Street	MH230	MH190	A-13	1.73	A-13	50	150	0.150	0.150	1.73	450	4.00	3.13	0.33	3.45	200	0.40%	20.74	0.17	0.66	83.3	0.333	63.47	63.13
Larocque Street	MH190	MH180			A-13				0.150	1.73	450	4.00	3.13	0.33	3.45	200	0.40%	20.74	0.17	0.66	83.3	0.333	63.10	62.77
Larocque Street	MH180	MH170			A-13				0.150	1.73	450	4.00	3.13	0.33	3.45	200	0.40%	20.74	0.17	0.66	86.0	0.344	62.62	62.28
Helene Street	MH170	MH160	A-14	1.35	A-7 TO A-14	20	60	0.060	0.750	13.43	450	3.88	15.14	2.55	17.70	250	0.40%	37.61	0.47	0.77	88.0	0.352	62.13	61.77
Helene Street	MH160	MH110							0.750	13.43	450	3.88	15.14	2.55	17.70	250	0.40%	37.61	0.47	0.77	88.1	0.352	61.74	61.39
Blanchard	MH210	MH150	A-15	4.30	A-15	71	213	0.213	0.213	4.30	450	4.00	4.44	0.82	5.25	200	0.40%	20.74	0.25	0.66	87.0	0.348	63.83	63.48
	MH150	MH140			A-15				0.213	4.30	450	4.00	4.44	0.82	5.25	200	0.40%	20.74	0.25	0.66	114.0	0.456	63.33	62.87
	MH140	MH130			A-15				0.213	4.30	450	4.00	4.44	0.82	5.25	200	0.40%	20.74	0.25	0.66	114.0	0.456	62.84	62.39
	MH130	MH120			A-15				0.213	4.30	450	4.00	4.44	0.82	5.25	200	0.40%	20.74	0.25	0.66	114.7	0.459	62.36	61.90
	MH120	MH110			A-15				0.213	4.30	450	4.00	4.44	0.82	5.25	200	0.40%	20.74	0.25	0.66	89.1	0.356	61.75	61.39
Helene Street	MH110	MH100			A-7 TO A-15				0.963	17.72	450	3.81	19.11	3.37	22.48	250	0.40%	37.61	0.60	0.77	25.6	0.102	61.33	61.23
	MH100	SPS			ALL				3.346	58.04	450	3.40	59.28	11.03	70.30	375	0.40%	110.89	0.63	1.00	19.9	0.080	61.08	61.00

Design Parameters

Coefficients
Mannings n = 0.0130
Persons Per Lot 3.00

Flows
Average Daily Per Capita Flow (q): 450 l/cap/d new
Peak Extrenuous Flow (I): 0.19 l/s/ha

	Singles	Semi's	Towns	
Densities:	16.1	22.2	34.3	units/ha

Designed By: François Lafleur, P.Eng

Reviewed By: Josh Eamon, P.Eng

Dwg. Reference: FIG.1 & FIG.2

Project: McBain Subdivision

Location: Crysler, Ontario

Project Number: 21043

Date: 07-Nov-22

Sheet Number: 1/1

APPENDIX C

Pump Design Sheet
System Head Curve
Pump Technical Specifications

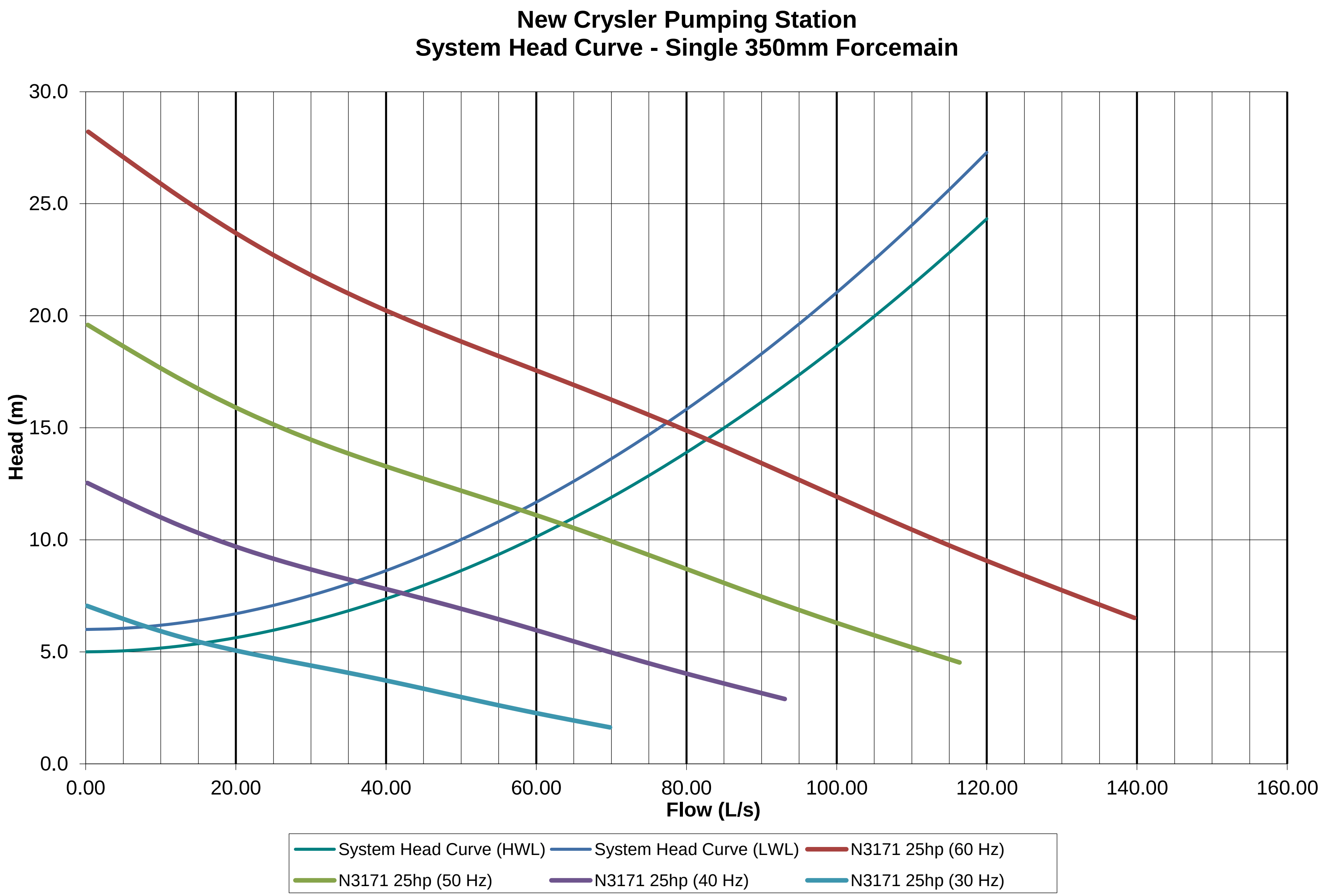
Pump Design Sheet

Project Name: Crysler New Pumping Station
Project No: 21043
Client: G&E Reno Construction

Designed By: FL
Reviewed By: JE
Date: November 28, 2022

	Discharge Piping	
	200 mm	**350 mm**
Flow (L/s)	80.00	80.00
Forcemain Pipe Type	SS Sch 10S	PVC SDR26
Forcemain Pipe Size (mm)	200	350
Actual Inside Pipe Diameter (mm)	211.60	326.56
Roughness Coefficient (C)	120	110
Pipe Length (m)	15	1500
Velocity (m/s)	2.275	0.955
Friction Head Loss (m/100m)	2.6996	0.3831
Total Minor Head Loss Coeff. (K) From Table	13.5	1.2
Total Minor Head Loss (m)	3.55	0.06
Total Friction Head Loss (m)	**3.95**	**5.80**

Total Dynamic Head Summary	
Total System Friction Head (m)	**9.76**
Static Head Losses	
Low Water Level in Wetwell	58.00
High Water Level in Wetwell	59.00
FM Elevation at Lagoon	64.00
Total Static Head - Liquid High Level (m)	5.00
Total Static Head - Liquid Low Level (m)	6.00
Total Dynamic Head - High Level (m)	**14.76**
Total Dynamic Head - Low Level (m)	**15.76**



2022-12-12

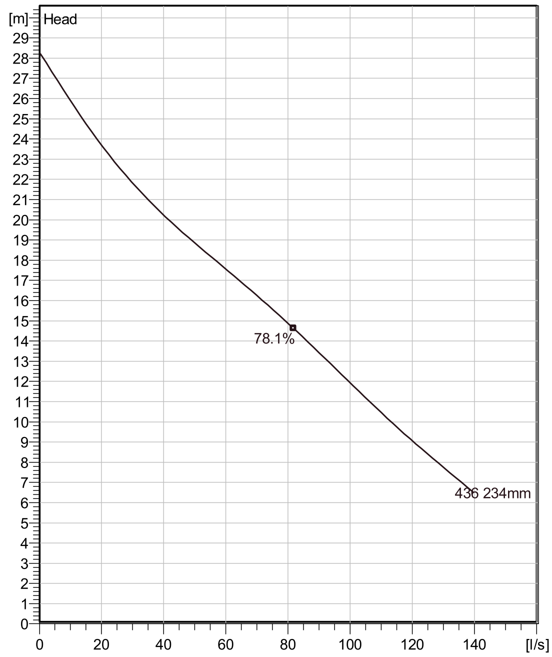
EVB Engineering

NP 3171 MT 3~ 436

Patented self cleaning semi-open channel impeller, ideal for pumping in most waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.43 lb/ft³,1.6888E-5 ft²/s



Curve: ISO 9906

Configuration

Motor number
N3171.181 25-14-4AA-W
25hp

Installation type
P - Semi permanent, Wet

Impeller diameter
234 mm

Discharge diameter
150 mm

Configuration

Pump information

Impeller diameter
234 mm

Discharge diameter
150 mm

Inlet diameter
200 mm

Maximum operating speed
1755 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Grey cast iron

Project		**Created by**	Francois Lafleur		
Block	0	**Created on**	12/12/2022	**Last update**	12/12/2022

NP 3171 MT 3~ 436

Technical specification

Motor - General

Motor number N3171.181 25-14-4AA-W 25hp	**Phases** 3~	**Rated speed** 1755 rpm	**Rated power** 25 hp
Approval No	**Number of poles** 4	**Rated current** 61 A	**Stator variant** 7
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** H	**Type of Duty** S1
Version code 181			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 88.0 %	**Total moment of inertia** 0.131 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.83	**Motor efficiency - 3/4 Load** 89.5 %	**Starting current, direct starting** 360 A	
Power factor - 1/2 Load 0.74	**Motor efficiency - 1/2 Load** 90.0 %	**Starting current, star-delta** 120 A	

Project		**Created by**	Francois Lafleur		
Block	0	**Created on**	12/12/2022	**Last update**	12/12/2022

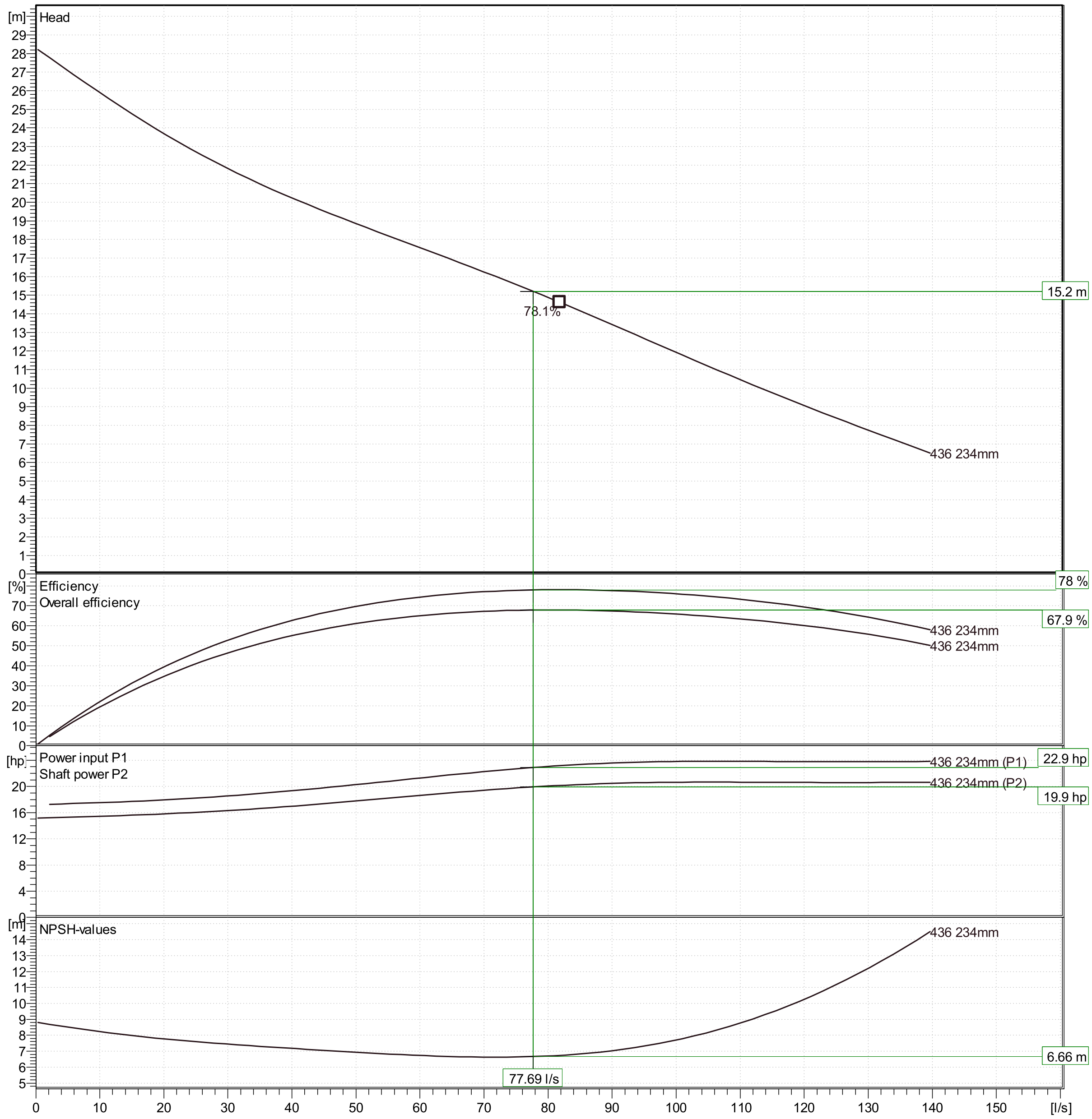
NP 3171 MT 3~ 436

Performance curve

Duty point

Flow	Head
77.7 l/s	15.2 m

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.43 lb/ft³,1.6888E-5 ft²/s



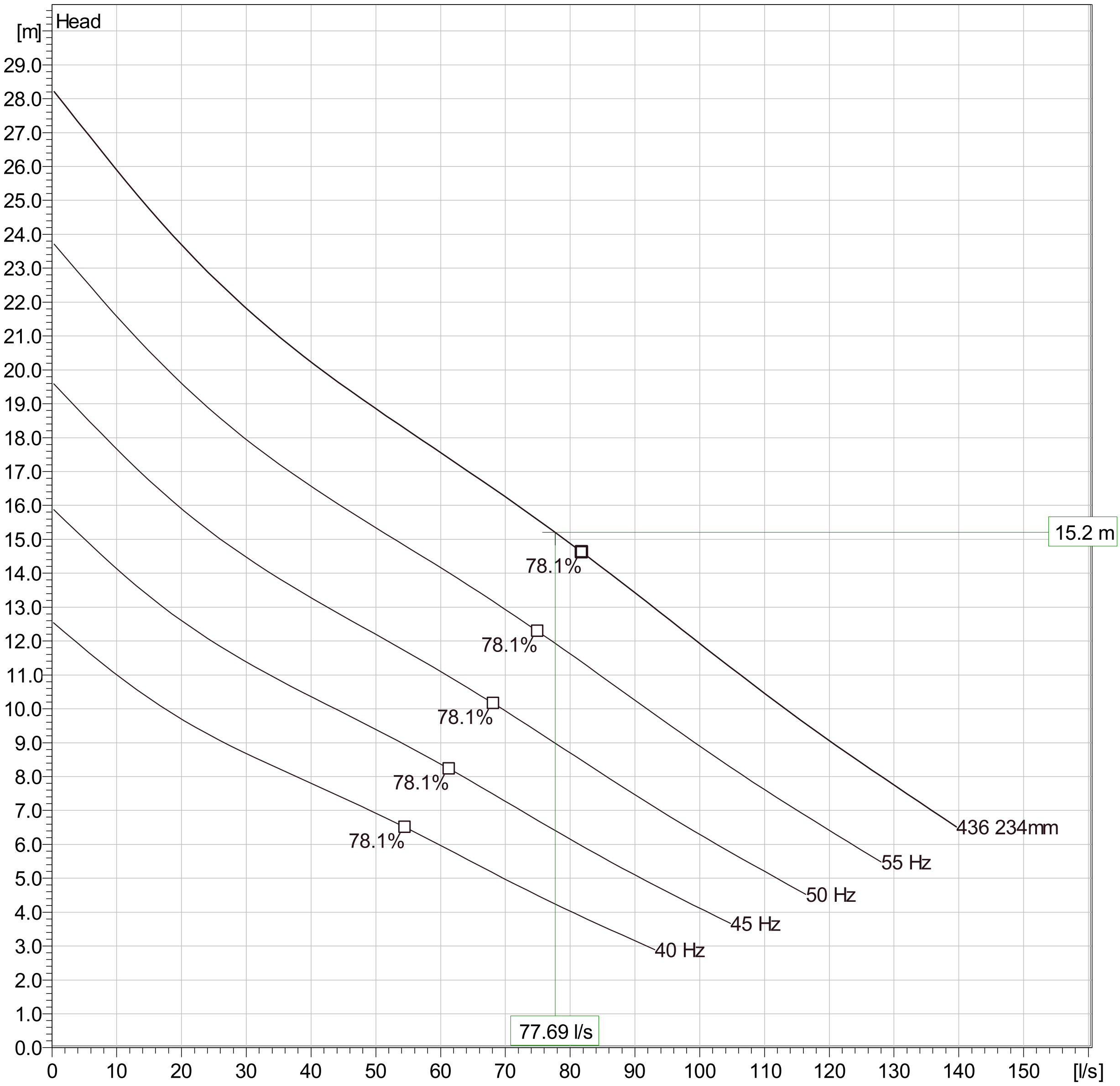
Curve: ISO 9906

	Francois Lafleur		
0	**Created on** 12/12/2022	**Last update**	12/12/2022

NP 3171 MT 3~ 436

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.43lb/ft³; 1.6888E-5ft²/s



Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/US MG	m
1	77.7	15.2	19.9	77.7	15.2	19.9	78 %	231	6.66

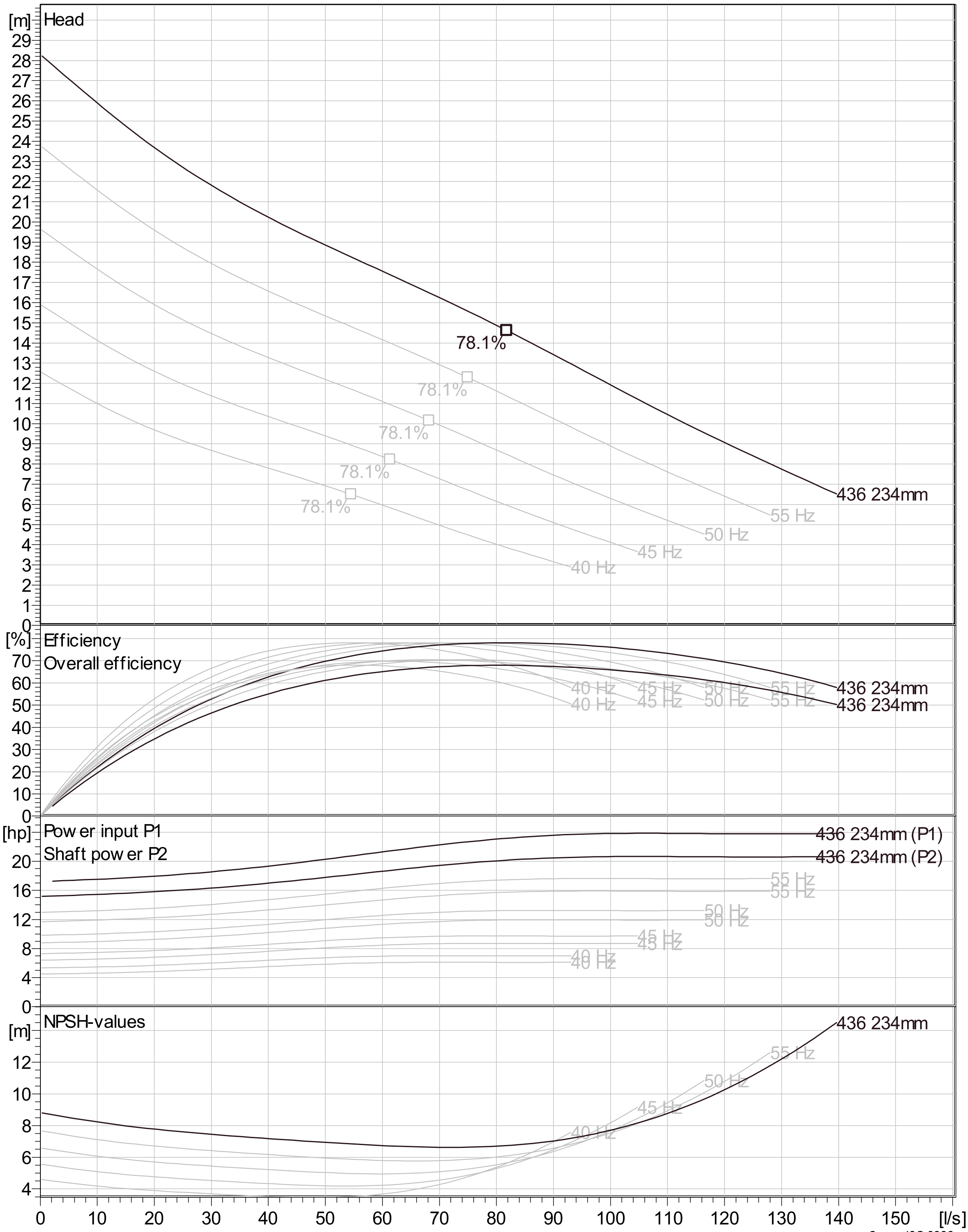
Project		**Created by**	Francois Lafleur		
Block		**Created on**	12/12/2022	**Last update**	12/12/2022

NP 3171 MT 3~ 436

VFD Curve

FLYGT
a xylem brand

Curves according to: Water, pure ,39.2 °F,62.43 lb/ft³,1.6888E-5 ft²/s



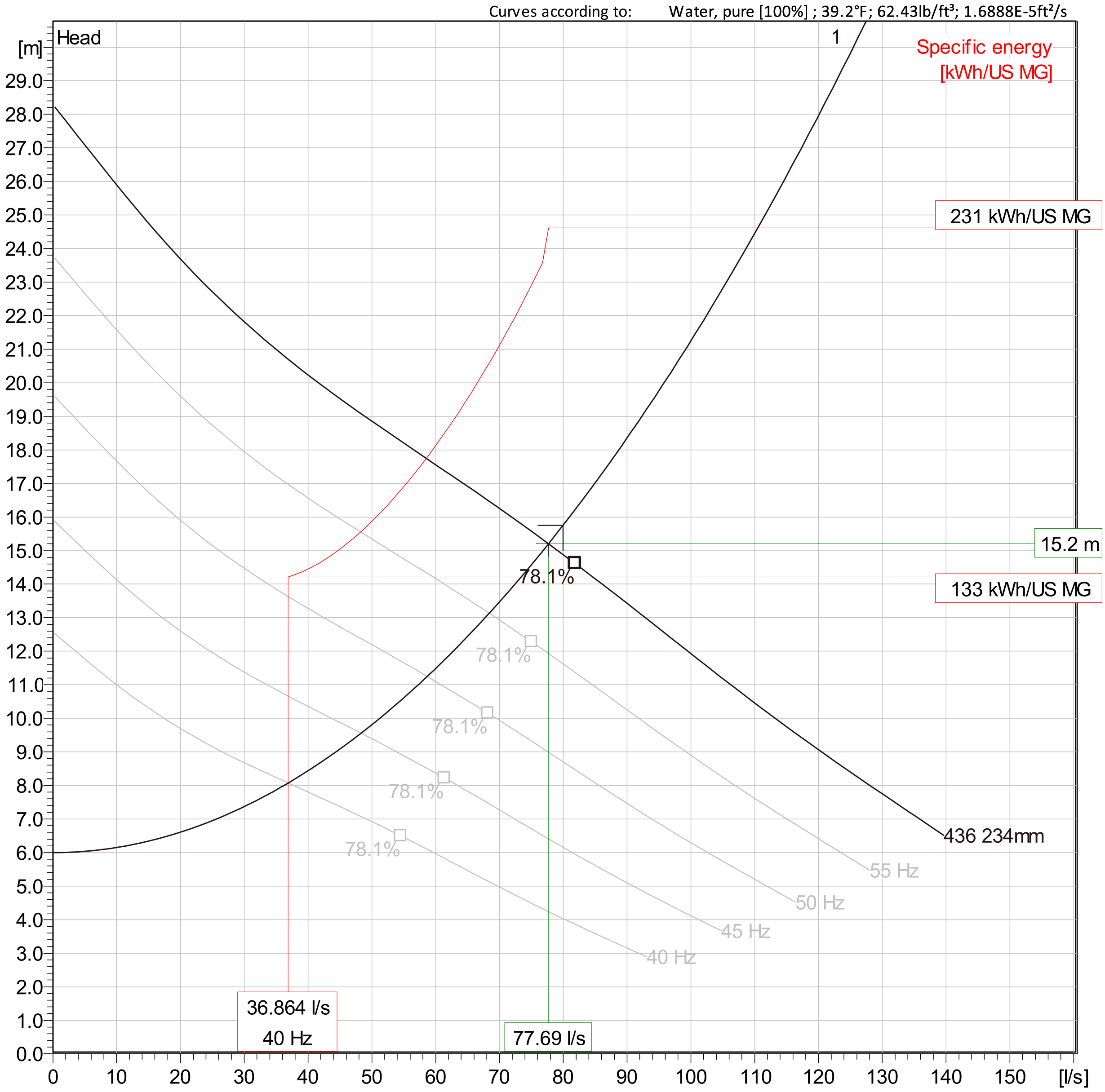
Curve: ISO 9906

Project		**Created by**	Francois Lafleur
Block	0	**Created on**	12/12/2022 **Last update** 12/12/2022

NP 3171 MT 3~ 436

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.43lb/ft³; 1.6888E-5ft²/s



Operating Characteristics

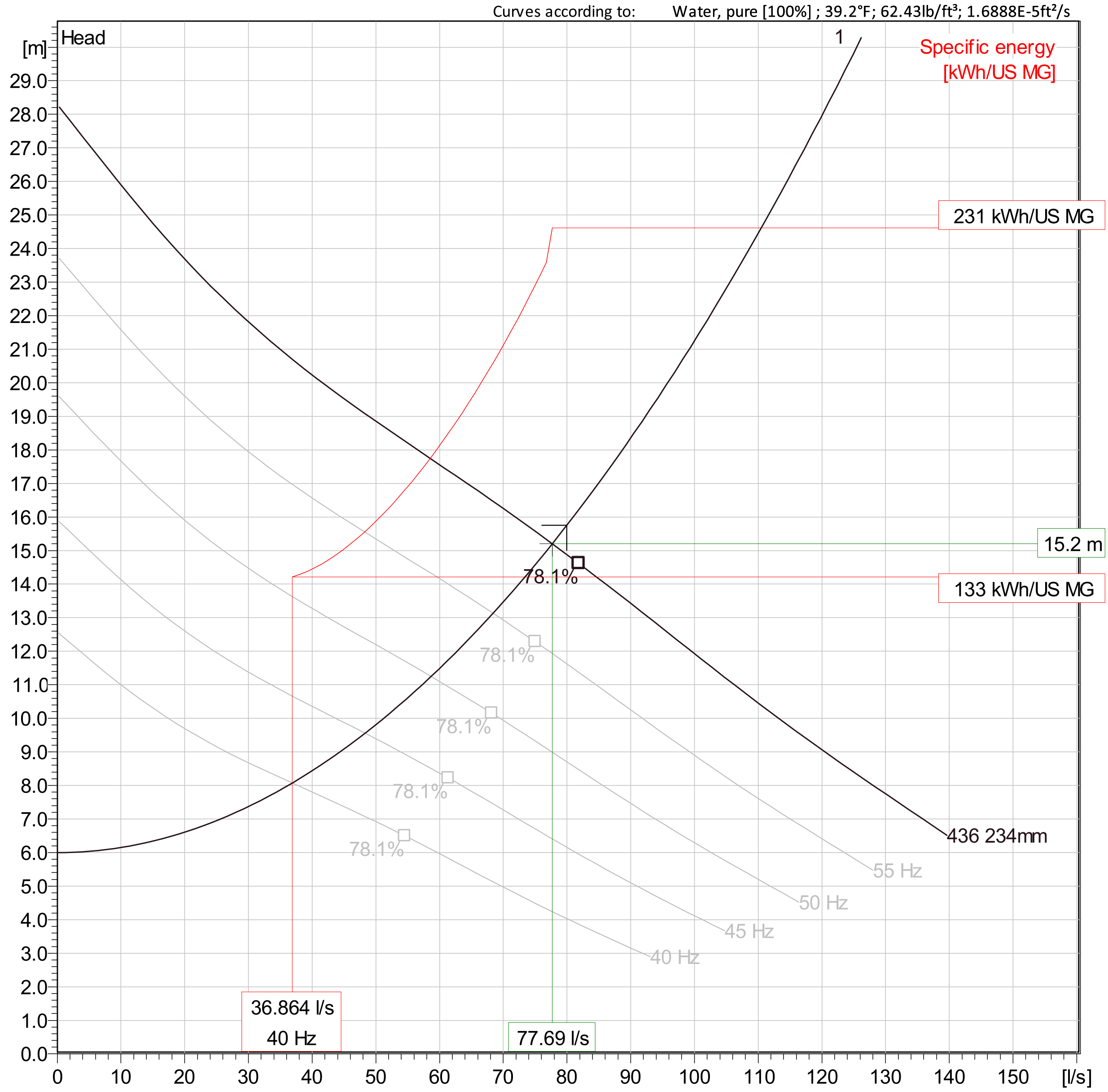
Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/US MG	m
1	60 Hz	77.7	15.2	19.9	77.7	15.2	19.9	78 %	231	6.66
1	55 Hz	68.4	13.1	15.2	68.4	13.1	15.2	77.7 %	193	5.77
1	50 Hz	58.7	11.2	11.3	58.7	11.2	11.3	77.1 %	167	4.95
1	45 Hz	48.3	9.56	8.01	48.3	9.56	8.01	75.8 %	146	4.21

Project		**Created by**	Francois Lafleur		
Block	0	**Created on**	12/12/2022	**Last update**	12/12/2022

NP 3171 MT 3~ 436

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.43lb/ft³; 1.6888E-5ft²/s



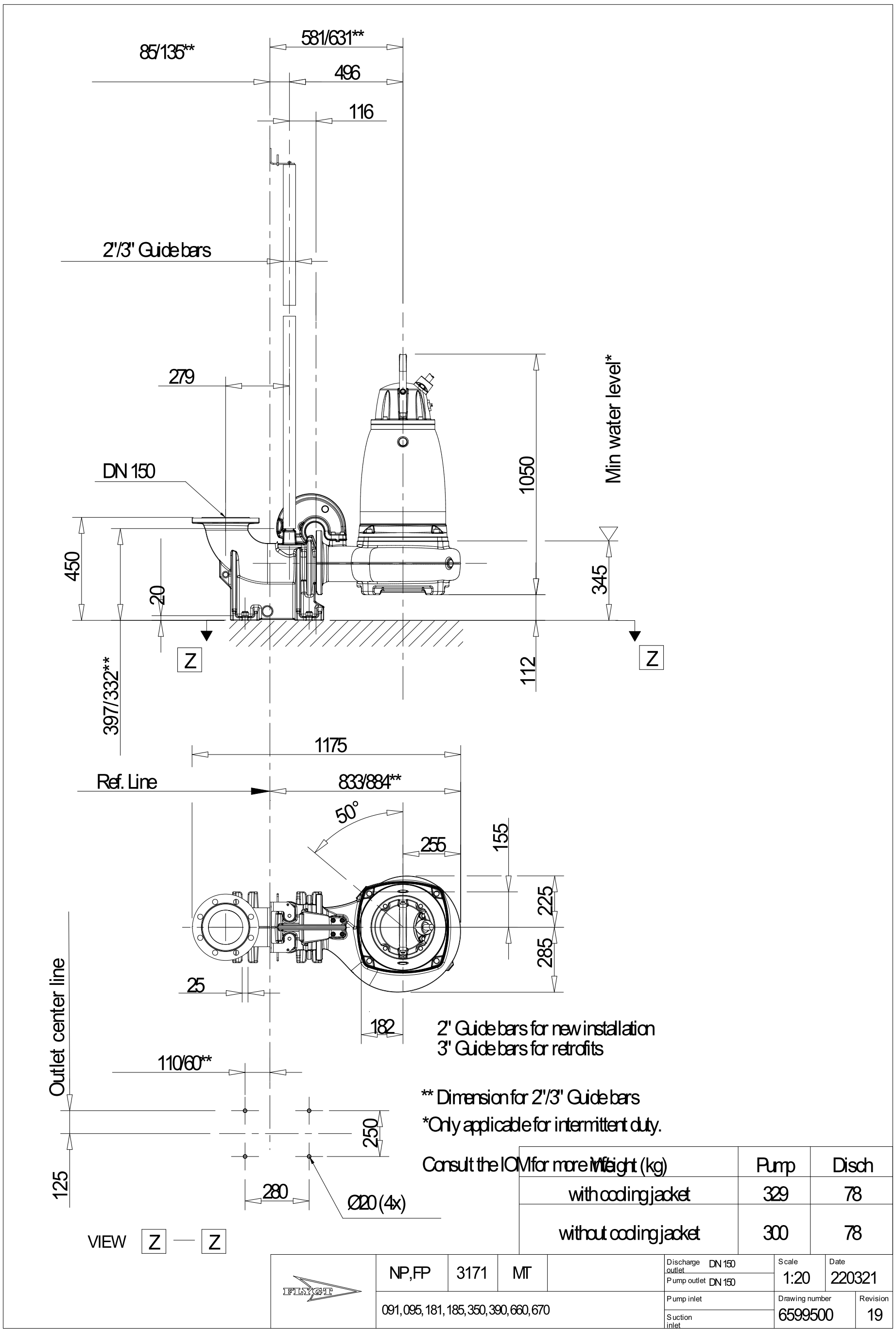
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/US MG	m
1	40 Hz	36.9	8.07	5.4	36.9	8.07	5.4	72.5 %	133	3.57

Project		**Created by**	Francois Lafleur		
Block	0	**Created on**	12/12/2022	**Last update**	12/12/2022

NP 3171 MT 3~ 436

Dimensional drawing



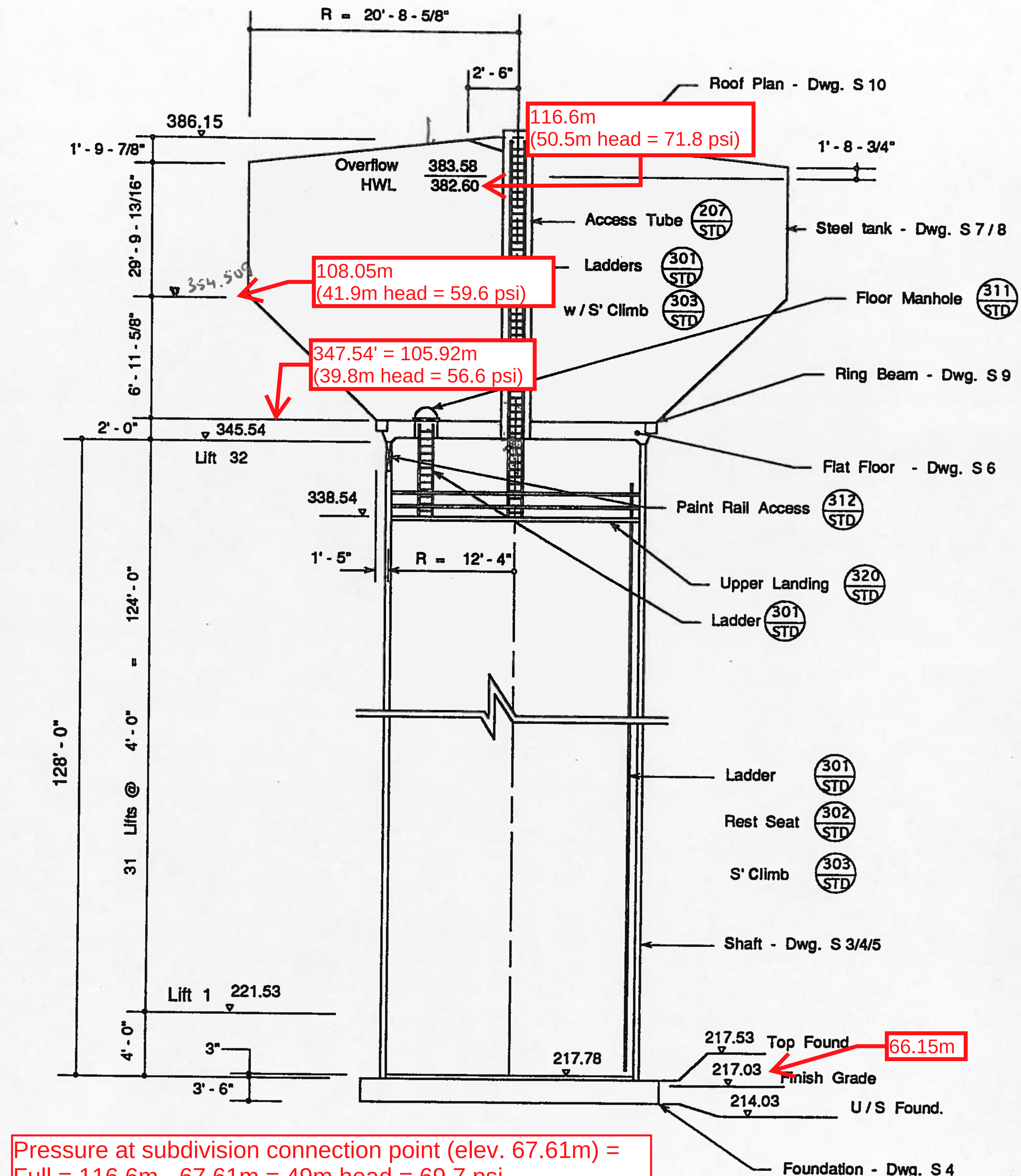
Weight (kg)	Pump	Disch
with cooling jacket	329	78
without cooling jacket	300	78

NP,FP	3171	MT	Discharge outlet DN 150 Pump outlet DN 150	Scale 1:20	Date 220321
091, 095, 181, 185, 350, 390, 660, 670			Pump inlet Suction inlet	Drawing number 6599500	Revision 19

Project		**Created by**	Francois Lafleur
Block	0	**Created on**	12/12/2022 **Last update** 12/12/2022

APPENDIX D

Water Tower Calculations
Theoretical Supply Curves
Water Demand Calculations
WaterCAD Junction Reports (G&E South Half + Blanchard)
WaterCAD Max. Day + Fire Flow (G&E South + Blanchard)
WaterCAD Junction Reports (Ult. Development + Blanchard)
WaterCAD Max. Day + Fire Flow (Ult. Development + Blanchard)
WaterCAD Sample Pipe Report



Pressure at subdivision connection point (elev. 67.61m) =
Full = 116.6m - 67.61m = 49m head = 69.7 psi
Near empty = 108.05m - 67.61m = 40.44m head = 57.5 psi

Rev.	Date	CRYSLER - # 402	SECTION		
		LANDMARK / CAZALY	Date 05 / 94	Dwn. [signature] / Chk.	S 2 - B3

MAIN SIZE: ______ Theoretical Supply Curves

STATIC PRESSURE: 57.5 psi - Tower near empty   70 psi = Tower Full

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	Blue hydrant (low end)		1,500 (94.6 L/s)	20 psi
#2				
#3				
#4				

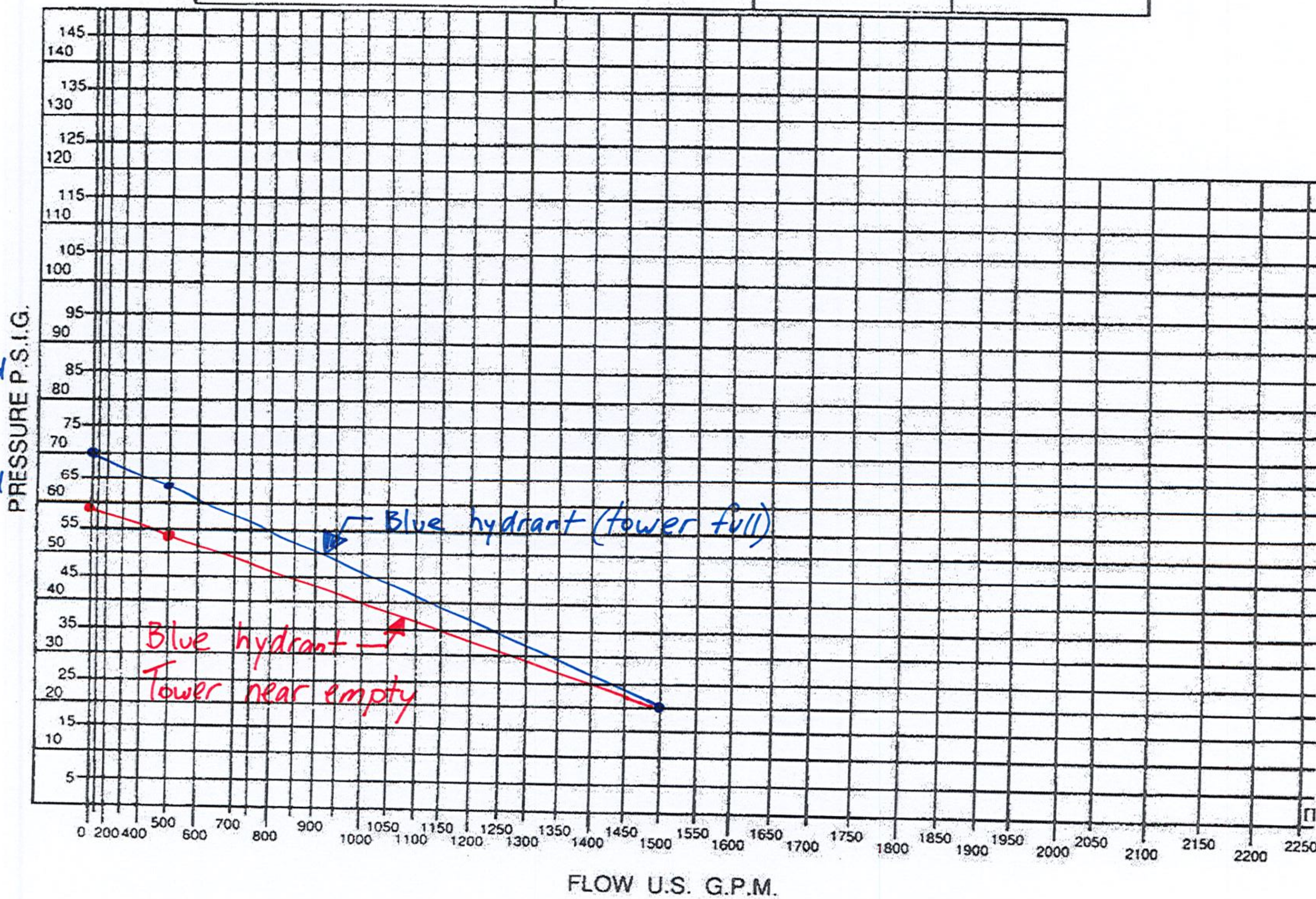
Duty points for model:

Tower full

Shutoff = 70 psi
= 49m head
@ 0 L/s

Design: 63 psi
= 44.3m head
@ 500 gpm
= 31.5 L/s

Max: 20 psi
= 14m head
@ 94.6 L/s



Tower near empty:

Shutoff = 57.5 psi
= 40.4m
@ 0 L/s

Design = 54 psi
= 38m head
@ 500 gpm
= 31.5 L/s

Max: 20 psi
= 14m head
@ 94.6 L/s

Water Demand Calculations
South Half Only & Blanchard

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng
Reviewed By: Josh Eamon, P.Eng.
Date: 2022/11/7

Average water demand per residual unit

residents per unit	3	
Avg. day flow (ADF)	450	L/cap/day
ADF per unit	1,350	L/day
ADF per unit	0.015625	L/s

Peaking factors (Table 3-1)
Population 500 - 1,000

Min. Hour	0.40
Max. Day	2.75
Peak Hour	4.13

Water Demand per Junction

Junction #	Units	Average Day Flow (L/s)	Minimum Hour (L/s)	Maximum Day (L/s)	Peak Hour (L/s)
J-2	50	0.78	0.31	2.15	3.23
J-4	71	1.11	0.44	3.05	4.58
J-5	20	0.31	0.13	0.86	1.29
J-6	20	0.31	0.13	0.86	1.29
J-7	50	0.78	0.31	2.15	3.23
J-9	20	0.31	0.13	0.86	1.29
J-11	28	0.44	0.18	1.20	1.81
J-12	38	0.59	0.24	1.63	2.45
J-13	5	0.08	0.03	0.21	0.32
J-14	39	0.61	0.24	1.68	2.52
Total	**341**	**5.33**	**2.13**	**14.65**	**22.01**

Population 1023

(272 units in G&E South Half + 69 units in Blanchard)

Water Demand Calculations
Ultimate Development

Project Name: McBain Subdivision	**Designed By:** François Lafleur, P.Eng
Project No: 21043	**Reviewed By:** Josh Eamon, P.Eng.
Client: G&E Reno Construction	**Date:** 2022/11/7

Average water demand per residual unit

residents per unit	3	
Avg. day flow (ADF)	450	L/cap/day
ADF per unit	1,350	L/day
ADF per unit	0.015625	L/say

Peaking factors (Table 3-1)
Population 2,001 - 3,000

Min. Hour	0.45
Max. Day	2.25
Peak Hour	3.38

Water Demand per Junction

Junction #	Units	Average Day Flow (L/s)	Minimum Hour (L/s)	Maximum Day (L/s)	Peak Hour (L/s)
J-2	50	0.78	0.35	1.76	2.64
J-4	71	1.11	0.50	2.50	3.75
J-5	20	0.31	0.14	0.70	1.06
J-6	20	0.31	0.14	0.70	1.06
J-7	50	0.78	0.35	1.76	2.64
J-9	20	0.31	0.14	0.70	1.06
J-11	28	0.44	0.20	0.98	1.48
J-12	38	0.59	0.27	1.34	2.01
J-13	5	0.08	0.04	0.18	0.26
J-14	39	0.61	0.27	1.37	2.06
J-16	92	1.44	0.65	3.23	4.86
J-17	92	1.44	0.65	3.23	4.86
J-18	92	1.44	0.65	3.23	4.86
J-19	92	1.44	0.65	3.23	4.86
J-20	92	1.44	0.65	3.23	4.86
J-22	92	1.44	0.65	3.23	4.86
Total	**893**	**13.95**	**6.28**	**31.39**	**47.16**

Population 2,679

(824 units in G&E + 69 units in Blanchard)

McBain Subdivision
Project #21043

Average Day, Tower Near Empty
(GE South Half + Blanchard)

November 7, 2022

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	107.96	57.3	Min =	57.3	psi
31	J-2	66.34	<None>	0.78	107.95	59.1	Max. =	60.5	psi
32	J-3	66.33	<None>	0	107.95	59.1			
33	J-4	65.35	<None>	1.11	107.94	60.5			
34	J-5	65.70	<None>	0.31	107.94	60.0			
35	J-6	66.00	<None>	0.31	107.94	59.5			
36	J-7	66.22	<None>	0.78	107.94	59.2			
37	J-8	66.47	<None>	0	107.95	58.9			
38	J-9	67.04	<None>	0.31	107.95	58.1			
39	J-10	67.92	<None>	(N/A)	(N/A)	(N/A)			
40	J-11	66.35	<None>	0.44	107.94	59.0			
41	J-12	66.00	<None>	0.59	107.94	59.5			
42	J-13	65.72	<None>	0.08	107.94	59.9			
43	J-14	65.70	<None>	0.61	107.94	60.0			
69	J-16	68.25	<None>	(N/A)	(N/A)	(N/A)			
71	J-17	67.50	<None>	(N/A)	(N/A)	(N/A)			
73	J-18	69.00	<None>	(N/A)	(N/A)	(N/A)			
75	J-19	70.00	<None>	(N/A)	(N/A)	(N/A)			
78	J-20	67.50	<None>	(N/A)	(N/A)	(N/A)			
84	J-22	67.00	<None>	(N/A)	(N/A)	(N/A)			
120	J-26	67.50	<None>	(N/A)	(N/A)	(N/A)			

McBain Subdivision
Project #21043

Min. Hour, Tower Full
(GE South Half + Blanchard)

November 7, 2022

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	116.58	69.5	Min =	69.5	psi
31	J-2	66.34	<None>	0.31	116.57	71.3	Max. =	72.7	psi
32	J-3	66.33	<None>	0	116.57	71.3			
33	J-4	65.35	<None>	0.44	116.57	72.7			
34	J-5	65.70	<None>	0.12	116.57	72.2			
35	J-6	66.00	<None>	0.12	116.57	71.8			
36	J-7	66.22	<None>	0.31	116.57	71.5			
37	J-8	66.47	<None>	0	116.57	71.1			
38	J-9	67.04	<None>	0.12	116.57	70.3			
39	J-10	67.92	<None>	(N/A)	(N/A)	(N/A)			
40	J-11	66.35	<None>	0.18	116.57	71.3			
41	J-12	66.00	<None>	0.24	116.57	71.8			
42	J-13	65.72	<None>	0.03	116.57	72.2			
43	J-14	65.70	<None>	0.24	116.57	72.2			
69	J-16	68.25	<None>	(N/A)	(N/A)	(N/A)			
71	J-17	67.50	<None>	(N/A)	(N/A)	(N/A)			
73	J-18	69.00	<None>	(N/A)	(N/A)	(N/A)			
75	J-19	70.00	<None>	(N/A)	(N/A)	(N/A)			
78	J-20	67.50	<None>	(N/A)	(N/A)	(N/A)			
84	J-22	67.00	<None>	(N/A)	(N/A)	(N/A)			
120	J-26	67.50	<None>	(N/A)	(N/A)	(N/A)			

McBain Subdivision
Project #21043

Maximum Day, Tower Near Empty
(GE South Half + Blanchard)

November 7, 2022

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	107.56	56.7	Min =	56.7	psi
31	J-2	66.34	<None>	2.15	107.48	58.4	Max. =	59.7	psi
32	J-3	66.33	<None>	0	107.47	58.4			
33	J-4	65.35	<None>	3.05	107.44	59.7			
34	J-5	65.70	<None>	0.85	107.44	59.3			
35	J-6	66.00	<None>	0.85	107.46	58.8			
36	J-7	66.22	<None>	2.15	107.46	58.5			
37	J-8	66.47	<None>	0	107.47	58.2			
38	J-9	67.04	<None>	0.85	107.46	57.4			
39	J-10	67.92	<None>	(N/A)	(N/A)	(N/A)			
40	J-11	66.35	<None>	1.21	107.44	58.3			
41	J-12	66.00	<None>	1.62	107.44	58.8			
42	J-13	65.72	<None>	0.22	107.44	59.2			
43	J-14	65.70	<None>	1.68	107.44	59.2			
69	J-16	68.25	<None>	(N/A)	(N/A)	(N/A)			
71	J-17	67.50	<None>	(N/A)	(N/A)	(N/A)			
73	J-18	69.00	<None>	(N/A)	(N/A)	(N/A)			
75	J-19	70.00	<None>	(N/A)	(N/A)	(N/A)			
78	J-20	67.50	<None>	(N/A)	(N/A)	(N/A)			
84	J-22	67.00	<None>	(N/A)	(N/A)	(N/A)			
120	J-26	67.50	<None>	(N/A)	(N/A)	(N/A)			

Peak Hour, Tower Near Empty
(GE South Half + Blanchard)

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	106.92	55.8	Min =	55.8	psi
31	J-2	66.34	<None>	3.22	106.74	57.4	Max. =	58.6	psi
32	J-3	66.33	<None>	0	106.73	57.3			
33	J-4	65.35	<None>	4.58	106.67	58.6			
34	J-5	65.70	<None>	1.28	106.67	58.1			
35	J-6	66.00	<None>	1.28	106.70	57.8			
36	J-7	66.22	<None>	3.22	106.70	57.5			
37	J-8	66.47	<None>	0	106.72	57.1			
38	J-9	67.04	<None>	1.28	106.71	56.3			
39	J-10	67.92	<None>	(N/A)	(N/A)	(N/A)			
40	J-11	66.35	<None>	1.82	106.66	57.2			
41	J-12	66.00	<None>	2.44	106.66	57.7			
42	J-13	65.72	<None>	0.33	106.66	58.1			
43	J-14	65.70	<None>	2.52	106.66	58.1			
69	J-16	68.25	<None>	(N/A)	(N/A)	(N/A)			
71	J-17	67.50	<None>	(N/A)	(N/A)	(N/A)			
73	J-18	69.00	<None>	(N/A)	(N/A)	(N/A)			
75	J-19	70.00	<None>	(N/A)	(N/A)	(N/A)			
78	J-20	67.50	<None>	(N/A)	(N/A)	(N/A)			
84	J-22	67.00	<None>	(N/A)	(N/A)	(N/A)			
120	J-26	67.50	<None>	(N/A)	(N/A)	(N/A)			

Maximum Day + Fire Flow, Tower Near Empty
(GE South Half + Blanchard)

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow?	Fire Flow Needed (L/s)	Fire Flow (Avail.) (L/s)	Flow (Total Needed) (L/s)	Flow (Total Avail.) (L/s)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Min. Pressure (Zone)
J-1	<None>	4	TRUE	38	79.8	38	79.8	20	20	20	20.7	J-9
J-2	<None>	5	TRUE	38	76.66	40.15	78.81	20	21	20	20	J-9
J-3	<None>	4	TRUE	38	74.86	38	74.86	20	20	20	21.5	J-9
J-4	<None>	10	TRUE	38	74.41	41.05	77.46	20	20	20	21.1	J-11
J-5	<None>	5	TRUE	38	75.13	38.85	75.99	20	20.1	20	20	J-11
J-6	<None>	4	TRUE	38	76.04	38.85	76.89	20	20	20	20.1	J-9
J-7	<None>	12	TRUE	38	74.78	40.15	76.93	20	20	20	21.1	J-9
J-8	<None>	21	TRUE	38	75.56	38	75.56	20	20.8	20	20	J-9
J-9	<None>	4	TRUE	38	74.51	38.85	75.37	20	20	20	21.5	J-11
J-10	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-11	<None>	4	TRUE	38	72.49	39.21	73.7	20	20	20	20.9	J-12
J-12	<None>	4	TRUE	38	72.05	39.62	73.67	20	20	20	21	J-11
J-13	<None>	21	TRUE	38	73.69	38.22	73.91	20	20.2	20	20	J-11
J-14	<None>	12	TRUE	38	71.54	39.68	73.22	20	20	20	21.6	J-11
J-16	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-17	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-18	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-19	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-20	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-22	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)
J-26	<None>	(N/A)	(N/A)	38	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)

Min. Available Fire Flow = 71.54 L/s

[grey shading] = north half / future development (not evaluated as part of this scenario)

McBain Subdivision
Project #21043

Average Day, Tower Near Empty
(Ultimate Development + Blanchard)

November 7, 2022

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	107.60	56.8	Min =	53.2	psi
31	J-2	66.34	<None>	0.78	107.56	58.5	Max. =	59.9	psi
32	J-3	66.33	<None>	0	107.55	58.5			
33	J-4	65.35	<None>	1.11	107.53	59.9			
34	J-5	65.70	<None>	0.31	107.53	59.4			
35	J-6	66.00	<None>	0.31	107.54	59.0			
36	J-7	66.22	<None>	0.78	107.54	58.7			
37	J-8	66.47	<None>	0	107.55	58.3			
38	J-9	67.04	<None>	0.31	107.54	57.5			
39	J-10	67.92	<None>	0	107.55	56.3			
40	J-11	66.35	<None>	0.44	107.52	58.4			
41	J-12	66.00	<None>	0.59	107.52	58.9			
42	J-13	65.72	<None>	0.08	107.52	59.3			
43	J-14	65.70	<None>	0.61	107.52	59.4			
69	J-16	68.25	<None>	1.44	107.51	55.7			
71	J-17	67.50	<None>	1.44	107.50	56.8			
73	J-18	69.00	<None>	1.44	107.50	54.6			
75	J-19	70.00	<None>	1.44	107.50	53.2			
78	J-20	67.50	<None>	1.44	107.50	56.8			
84	J-22	67.00	<None>	1.44	107.50	57.5			
120	J-26	67.50	<None>	0	107.60	56.9			

Min. Hour, Tower Full
(Ultimate Development + Blanchard)

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	116.36	69.2	Min =	65.8	psi
31	J-2	66.34	<None>	0.35	116.35	71.0	Max. =	72.4	psi
32	J-3	66.33	<None>	0	116.35	71.0			
33	J-4	65.35	<None>	0.5	116.35	72.4			
34	J-5	65.70	<None>	0.14	116.35	71.9			
35	J-6	66.00	<None>	0.14	116.35	71.5			
36	J-7	66.22	<None>	0.35	116.35	71.2			
37	J-8	66.47	<None>	0	116.35	70.8			
38	J-9	67.04	<None>	0.14	116.35	70.0			
39	J-10	67.92	<None>	0	116.35	68.7			
40	J-11	66.35	<None>	0.2	116.34	71.0			
41	J-12	66.00	<None>	0.27	116.34	71.5			
42	J-13	65.72	<None>	0.04	116.34	71.9			
43	J-14	65.70	<None>	0.27	116.34	71.9			
69	J-16	68.25	<None>	0.65	116.34	68.3			
71	J-17	67.50	<None>	0.65	116.34	69.3			
73	J-18	69.00	<None>	0.65	116.34	67.2			
75	J-19	70.00	<None>	0.65	116.34	65.8			
78	J-20	67.50	<None>	0.65	116.34	69.3			
84	J-22	67.00	<None>	0.65	116.34	70.0			
120	J-26	67.50	<None>	0	116.36	69.4			

McBain Subdivision
Project #21043

Maximum Day, Tower Near Empty
(Ultimate Development + Blanchard)

November 7, 2022

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
30	J-1	67.61	<None>	0	105.62	54.0
31	J-2	66.34	<None>	1.76	105.41	55.5
32	J-3	66.33	<None>	0	105.39	55.4
33	J-4	65.35	<None>	2.5	105.31	56.7
34	J-5	65.70	<None>	0.7	105.30	56.2
35	J-6	66.00	<None>	0.7	105.36	55.9
36	J-7	66.22	<None>	1.76	105.36	55.6
37	J-8	66.47	<None>	0	105.38	55.2
38	J-9	67.04	<None>	0.7	105.35	54.4
39	J-10	67.92	<None>	0	105.40	53.2
40	J-11	66.35	<None>	0.99	105.24	55.2
41	J-12	66.00	<None>	1.33	105.24	55.7
42	J-13	65.72	<None>	0.18	105.26	56.1
43	J-14	65.70	<None>	1.37	105.23	56.1
69	J-16	68.25	<None>	3.24	105.19	52.4
71	J-17	67.50	<None>	3.24	105.16	53.5
73	J-18	69.00	<None>	3.24	105.16	51.3
75	J-19	70.00	<None>	3.24	105.16	49.9
78	J-20	67.50	<None>	3.24	105.18	53.5
84	J-22	67.00	<None>	3.24	105.18	54.2
120	J-26	67.50	<None>	0	105.60	54.1

Min =	49.9	psi
Max. =	56.7	psi

McBain Subdivision
Project #21043

Peak Hour, Tower Near Empty
(Ultimate Development + Blanchard)

November 7, 2022

ID	Label	Elev. (m)	Zone	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)			
30	J-1	67.61	<None>	0	102.21	49.1	Min =	44.3	psi
31	J-2	66.34	<None>	2.64	101.77	50.3	Max. =	51.4	psi
32	J-3	66.33	<None>	0	101.72	50.2			
33	J-4	65.35	<None>	3.75	101.55	51.4			
34	J-5	65.70	<None>	1.05	101.54	50.9			
35	J-6	66.00	<None>	1.05	101.66	50.6			
36	J-7	66.22	<None>	2.64	101.66	50.3			
37	J-8	66.47	<None>	0	101.69	50.0			
38	J-9	67.04	<None>	1.05	101.64	49.1			
39	J-10	67.92	<None>	0	101.74	48.0			
40	J-11	66.35	<None>	1.49	101.40	49.8			
41	J-12	66.00	<None>	1.99	101.41	50.3			
42	J-13	65.72	<None>	0.27	101.44	50.7			
43	J-14	65.70	<None>	2.06	101.38	50.6			
69	J-16	68.25	<None>	4.87	101.30	46.9			
71	J-17	67.50	<None>	4.87	101.22	47.9			
73	J-18	69.00	<None>	4.87	101.22	45.7			
75	J-19	70.00	<None>	4.87	101.22	44.3			
78	J-20	67.50	<None>	4.87	101.27	47.9			
84	J-22	67.00	<None>	4.87	101.26	48.6			
120	J-26	67.50	<None>	0	102.16	49.2			

Maximum Day + Fire Flow, Tower Near Empty
(GE South Half + Blanchard)

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow?	Fire Flow Needed (L/s)	Fire Flow (Avail.) (L/s)	Flow (Total Needed) (L/s)	Flow (Total Avail.) (L/s)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Min. Pressure (Zone)
J-1	<None>	6	TRUE	38	58.2	38	58.17	20	24.1	20	20	J-19
J-2	<None>	6	TRUE	38	56	39.75	57.75	20	25.5	20	20	J-19
J-3	<None>	6	TRUE	38	55.6	38	55.6	20	24.3	20	20	J-19
J-4	<None>	6	TRUE	38	54.91	40.5	57.4	20	25.3	20	20	J-19
J-5	<None>	6	TRUE	38	54.68	38.7	55.38	20	25.7	20	20	J-19
J-6	<None>	6	TRUE	38	55.36	38.7	56.06	20	25.3	20	20	J-19
J-7	<None>	6	TRUE	38	55.45	39.75	57.21	20	24.5	20	20	J-19
J-8	<None>	6	TRUE	38	55.55	38	55.55	20	25.2	20	20	J-19
J-9	<None>	6	TRUE	38	55.17	38.7	55.87	20	24.4	20	20	J-19
J-10	<None>	6	TRUE	38	55.65	38	55.65	20	22.1	20	20	J-19
J-11	<None>	6	TRUE	38	53.82	38.99	54.81	20	24.9	20	20	J-19
J-12	<None>	6	TRUE	38	53.94	39.33	55.27	20	24.7	20	20	J-19
J-13	<None>	6	TRUE	38	54.09	38.18	54.27	20	25.7	20	20	J-19
J-14	<None>	6	TRUE	38	53.72	39.37	55.09	20	25.3	20	20	J-19
J-16	<None>	6	TRUE	38	52.59	41.24	55.83	20	22.3	20	20	J-19
J-17	<None>	6	TRUE	38	52.41	41.24	55.65	20	21.5	20	20	J-19
J-18	<None>	6	TRUE	38	51.78	41.24	55.02	20	20.8	20	20	J-19
J-19	<None>	3	TRUE	38	50.28	41.24	53.52	20	20	20	22.8	J-18
J-20	<None>	6	TRUE	38	52.8	41.24	56.04	20	23.2	20	20	J-19
J-22	<None>	6	TRUE	38	52.96	41.24	56.2	20	23.2	20	20	J-19
J-26	<None>	6	TRUE	38	57.49	38	57.49	20	23.4	20	20	J-19

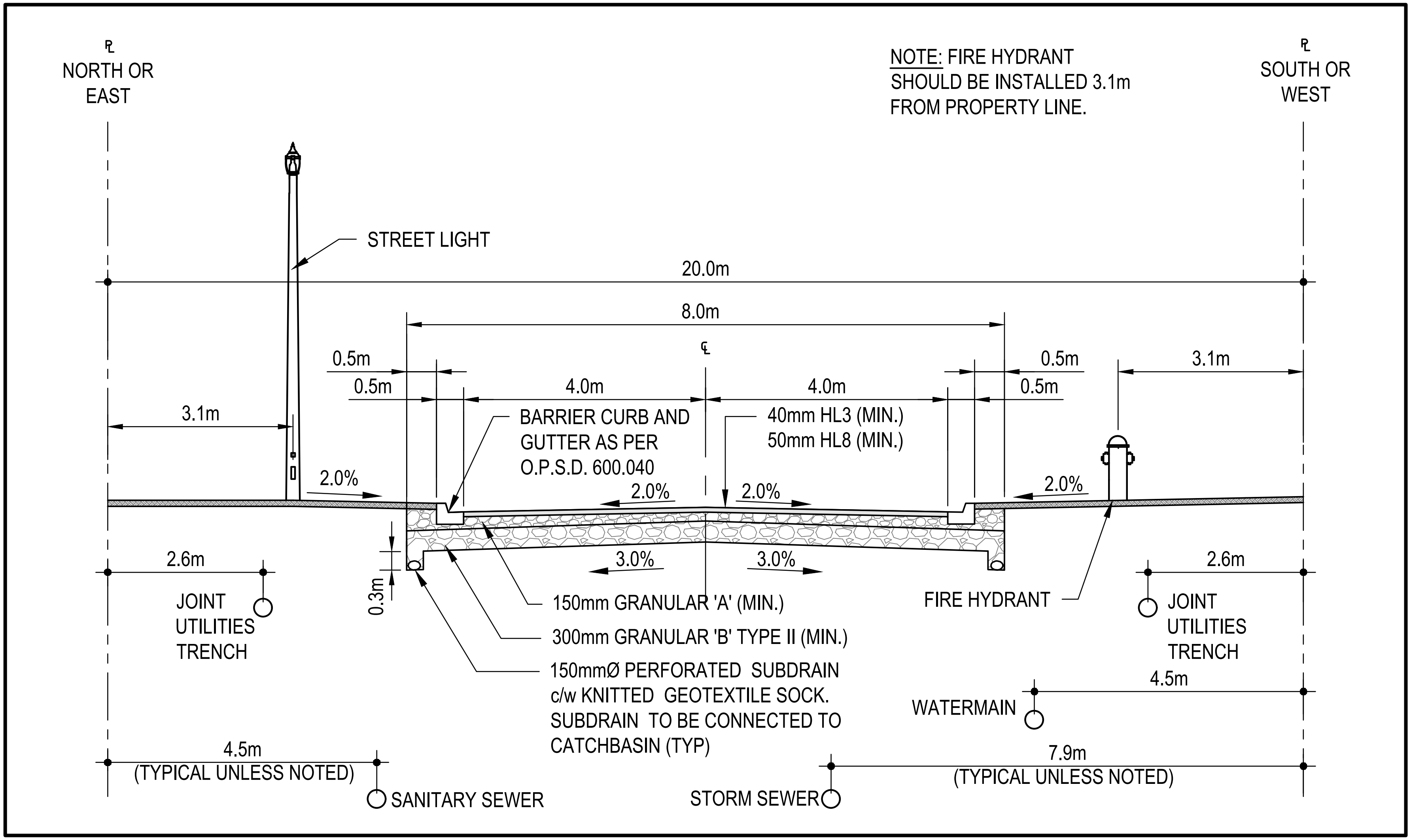
Min. Available Fire Flow = 50.28 L/s

(shaded) = north half / future development

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/m)
44	P-1	109	J-10	J-9	200	PVC	110	10.35	0.33	0.001
45	P-2	84	J-9	J-8	250	PVC	110	-14.34	0.29	0.001
46	P-3	87	J-8	J-2	250	PVC	110	-18.28	0.37	0.001
47	P-4	87	J-2	J-3	200	PVC	110	7.33	0.23	0
48	P-5	342	J-3	J-4	200	PVC	110	7.33	0.23	0
49	P-6	87	J-4	J-5	200	PVC	110	3.75	0.12	0
50	P-7	87	J-5	J-13	200	PVC	110	11.37	0.36	0.001
51	P-8	144	J-13	J-14	200	PVC	110	6.68	0.21	0
52	P-9	238	J-14	J-11	200	PVC	110	-3.07	0.1	0
53	P-10	84	J-11	J-12	200	PVC	110	-2.43	0.08	0
54	P-11	161	J-12	J-13	200	PVC	110	-4.42	0.14	0
56	P-12	134	J-1	J-2	250	PVC	110	36.66	0.75	0.003
57	P-13	167	J-2	J-6	200	PVC	110	8.41	0.27	0.001
58	P-14	175	J-6	J-5	200	PVC	110	8.67	0.28	0.001
59	P-15	167	J-8	J-7	200	PVC	110	3.95	0.13	0
60	P-16	85	J-7	J-6	200	PVC	110	1.31	0.04	0
61	P-17	251	J-9	J-11	200	PVC	110	10.25	0.33	0.001
65	P-19	8	R-1	PMP-1	300	PVC	130	47.02	0.67	0.002
66	P-20	8	PMP-1	J-1	300	PVC	130	47.02	0.67	0.002
70	P-21	224	J-9	J-16	200	PVC	110	13.39	0.43	0.002
74	P-23	241	J-17	J-18	200	PVC	110	-0.42	0.01	0
76	P-24	196	J-18	J-19	200	PVC	110	-0.61	0.02	0
77	P-25	252	J-19	J-16	200	PVC	110	-5.47	0.17	0
79	P-26	263	J-16	J-20	200	PVC	110	3.05	0.1	0
83	P-29	223	J-20	J-18	200	PVC	110	4.68	0.15	0
85	P-22(1)	214	J-14	J-22	200	PVC	110	7.69	0.24	0.001
86	P-22(2)	212	J-22	J-17	200	PVC	110	4.45	0.14	0
87	P-30	221	J-20	J-11	200	PVC	110	-8.12	0.26	0.001
88	P-31	238	J-20	J-22	200.0	PVC	110	1.62	0.05	0
121	P-18(1)	92	J-10	J-26	150	PVC	100	-10.35	0.59	0.005
122	P-18(2)	52	J-26	J-1	200	PVC	110	-10.35	0.33	0.001

APPENDIX E

Proposed Roadway Cross-Section



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C4.1

TYPICAL 20.0m URBAN CROSS-SECTION DETAIL

SCALE: 1:100

APPENDIX F

IDF Curve Lookup – MTO
Weighted C Factor Calculations
Pre- & Post-Development Runoff Calculations
5-Year Storage & Orifice Calculations
100-Year Storage & Orifice Calculations
Stage vs Storage Calculations

Ontario IDF CURVE LOOKUP

Active coordinate

45° 13' 15" N, 75° 9' 15" W (45.220833,-75.154167)

Retrieved: Mon, 11 Apr 2022 20:32:45 GMT

Location summary

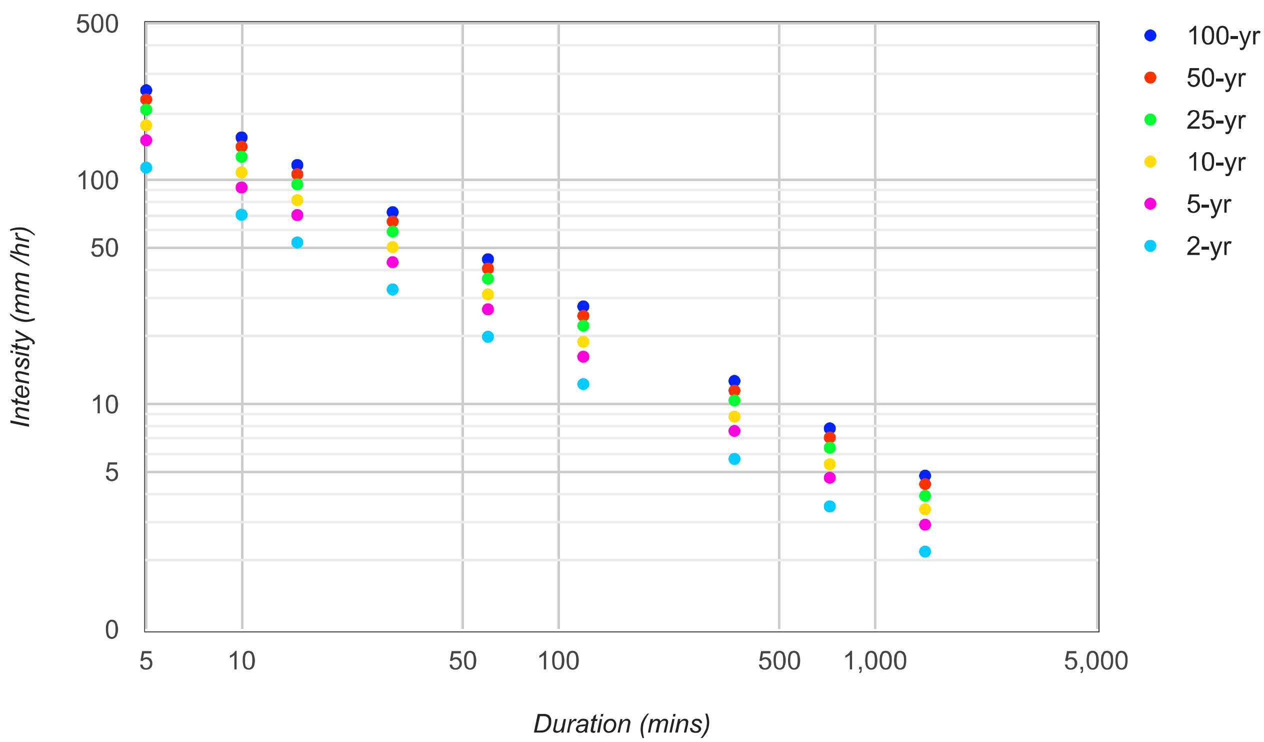
These are the locations in the selection.

IDF Curve: 45° 13' 15" N, 75° 9' 15" W (45.220833,-75.154167)

Results

An IDF curve was found.

Coordinate: 45.220833, -75.154167
IDF curve year: 2010



Coefficient summary

IDF Curve: 45° 13' 15" N, 75° 9' 15" W (45.220833,-75.154167)

Retrieved: Mon, 11 Apr 2022 20:32:45 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	20.0	26.5	30.9	36.3	40.3	44.3
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	113.6	70.0	52.7	32.5	20.0	12.3	5.7	3.5	2.2
5-yr	150.5	92.7	69.8	43.0	26.5	16.3	7.6	4.7	2.9
10-yr	175.5	108.1	81.4	50.2	30.9	19.0	8.8	5.4	3.4
25-yr	206.2	127.0	95.7	58.9	36.3	22.4	10.4	6.4	3.9
50-yr	228.9	141.0	106.2	65.4	40.3	24.8	11.5	7.1	4.4
100-yr	251.6	155.0	116.7	71.9	44.3	27.3	12.7	7.8	4.8

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	9.5	11.7	13.2	16.2	20.0	24.6	34.3	42.3	52.1
5-yr	12.5	15.5	17.5	21.5	26.5	32.6	45.4	56.0	69.0
10-yr	14.6	18.0	20.4	25.1	30.9	38.1	53.0	65.3	80.4
25-yr	17.2	21.2	23.9	29.5	36.3	44.7	62.2	76.7	94.5
50-yr	19.1	23.5	26.6	32.7	40.3	49.6	69.1	85.1	104.9
100-yr	21.0	25.8	29.2	36.0	44.3	54.6	76.0	93.6	115.3

Terms of Use

Weighted C Factor Calculations

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng
Reviewed By: Josh Eamon, P.Eng.
Date: 2022/11/10

A-101 (Pre)

SurfaceType	Coefficient	Area (ha)
Asphalt/Concrete	0.90	0
Roof	0.95	0
Gravel	0.50	0
Precast Paving	0.75	0
Grassed & Undeveloped	0.20	46.477
Σ Areas		46.477
Weighted 'C' Factor		0.20

A-201

SurfaceType	Coefficient	Area (ha)
Singles	0.45	1.92
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.92
Weighted 'C' Factor		0.45

A-202

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0
Semi's	0.52	1.85
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.85
Weighted 'C' Factor		0.52

A-203 (Future G&E)

SurfaceType	Coefficient	Area (ha)
Singles	0.45	11.98
Semi's	0.52	11.98
Townhomes	0.60	2.66
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		26.62
Weighted 'C' Factor		0.50

A-204

SurfaceType	Coefficient	Area (ha)
Singles	0.45	1.78
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.78
Weighted 'C' Factor		0.45

A-205

SurfaceType	Coefficient	Area (ha)
Singles	0.45	1.21
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.21
Weighted 'C' Factor		0.45

A-206

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0.56
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		0.56
Weighted 'C' Factor		0.45

A-207

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0.33
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		0.33
Weighted 'C' Factor		0.45

A-208

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0
Semi's	0.52	0
Townhomes	0.60	0.8
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		0.8
Weighted 'C' Factor		0.60

A-209

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	1.17
Grassed & Undeveloped	0.20	0
Σ Areas		1.17
Weighted 'C' Factor		0.75

A-210

SurfaceType	Coefficient	Area (ha)
Singles	0.45	1.45
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.45
Weighted 'C' Factor		0.45

A-211

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0
Semi's	0.52	0
Townhomes	0.60	1.73
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.73
Weighted 'C' Factor		0.60

A-212

SurfaceType	Coefficient	Area (ha)
Singles	0.45	1.35
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		1.35
Weighted 'C' Factor		0.45

A-213

SurfaceType	Coefficient	Area (ha)
Singles	0.45	2.552
Semi's	0.52	0.735
Townhomes	0.60	0.920
Apartments	0.75	0
Grassed & Undeveloped	0.20	0
Σ Areas		4.207
Weighted 'C' Factor		0.50

A-214

SurfaceType	Coefficient	Area (ha)
Singles	0.45	0
Semi's	0.52	0
Townhomes	0.60	0
Apartments	0.75	0
Grassed & Undeveloped	0.20	1.50
Σ Areas		1.50
Weighted 'C' Factor		0.20

Pre-Development & Post-Development Runoff Calculations

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng
Reviewed By: Josh Eamon, P.Eng
Date: 2022/11/10

Pre-Development Peak Run-off Rates (Allowable)

Contributing Area		Runoff Data						
No.	Ha	C	AC	Tc (min.)	I (mm/hr)		Q (L/s)	
					5 Year	100 Year	5 Year	100 Year
A-101 (Pre)	46.477	0.20	9.30	88.67	20.17	33.72	521.20	871.29
Total	**46.477**	**0.20**	**9.30**					

Tc is calculated per the Airport method, with a C = 0.2, average slope of 0.88% across existing site, and L = 840m.

Uncontrolled Post-Development Peak Run-off Rates

Contributing Area		Runoff Data						
No.	Ha	C	AC	Tc (min.)	I (mm/hr)		Q (L/s)	
					5 Year	100 Year	5 Year	100 Year
A-201	1.920	0.45	0.86	20.00	57.12	95.48	137.19	229.33
A-202	1.850	0.52	0.96	20.00	57.12	95.48	152.75	255.35
A-203 (Future G&E)	26.620	0.50	13.22	20.00	57.12	95.48	2098.58	3508.19
A-204	1.780	0.45	0.80	20.00	57.12	95.48	127.18	212.61
A-205	1.210	0.45	0.54	20.00	57.12	95.48	86.46	144.53
A-206	0.560	0.45	0.25	20.00	57.12	95.48	40.01	66.89
A-207	0.330	0.45	0.15	20.00	57.12	95.48	23.58	39.42
A-208	0.800	0.60	0.48	20.00	57.12	95.48	76.21	127.41
A-209	1.170	0.75	0.88	15.00	69.84	116.75	170.36	284.80
A-210	1.450	0.45	0.65	20.00	57.12	95.48	103.60	173.20
A-211	1.730	0.60	1.04	20.00	57.12	95.48	164.81	275.52
A-212	1.350	0.45	0.61	20.00	57.12	95.48	96.46	161.25
A-213	4.207	0.50	2.08	20.00	57.12	95.48	330.68	552.79
A-214	1.500	0.20	0.30	20.00	57.12	95.48	47.63	79.63
Total	**46.477**	**0.49**	**22.83**				**3655.52**	**6110.92**

Controlled Post-Development Peak Run-off Rates

Contributing Area		Runoff Data						
No.	Ha	C	AC	Tc (min.)	I (mm/hr)		Q (L/s)	
					5 Year	100 Year	5 Year	100 Year
A-201 to A-214	46.477	0.49	--	--	--	--	**512.60**	**861.00**
Total	46.477						**512.60**	**861.00**

5 Year Required Storage Calculations

Full Build-Out Scenario

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng.
Reviewed By: Josh Eamon, P.Eng
Date: 2022/11/10

Rational Method Storage Computation
Storage Rate Method

Contributing Area (Contolled)		
No.	**Ha**	**C**
A-201	1.920	0.45
A-202	1.850	0.52
-203 (Future G&E	26.620	0.50
A-204	1.780	0.45
A-205	1.210	0.45
A-206	0.560	0.45
A-207	0.330	0.45
A-208	0.800	0.60
A-209	1.170	0.75
A-210	1.450	0.45
A-211	1.730	0.60
A-212	1.350	0.45
A-213	4.207	0.50
A-214	1.500	0.20
Σ Areas		**46.477**
Weighted 'C' Factor		**0.49**

	Storage Event	Q (L/s)
Total Allow. Q	5 Year	521.20
Total Actual Q	5 Year	512.60

Time (Min.)	I (mm/hr)	Peak Flow (L/s)	Actual Release Rate (L/s)	Required Storage Rate (L/s)	Required Storage Volume (m^3)
40	35.18	2232.68	512.60	1720.08	4128.19
45	32.40	2056.22	512.60	1543.62	4167.78
50	30.10	1910.23	512.60	1397.63	4192.89
55	28.16	1787.11	512.60	1274.51	4205.90
60	26.50	1681.66	512.60	1169.06	4208.62
65	25.06	1590.16	512.60	1077.55	4202.46
70	23.79	1509.88	512.60	997.28	4188.57
75	22.67	1438.79	512.60	926.19	4167.86
80	21.67	1375.33	512.60	862.73	4141.09
85	20.77	1318.26	512.60	805.66	4108.88
90	19.96	1266.63	512.60	754.03	4071.77

5 Year Required Storage Calculations

Full Build-Out Scenario

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng.
Reviewed By: Josh Eamon, P.Eng
Date: 2022/11/10

Orifice Flow Calculations

Water Elevation (m)	Orifice Diameter (mm)	Head (m)	Flow (L/s)	Provided Storage (m3)
62.67	465.00	1.17	512.60	4243.55

Orifice C/L elev.=	61.50	m
Cd =	0.63	
g =	9.81	m/s2

100 Year Required Storage Calculations

Full Build-Out Scenario

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng.
Reviewed By: Josh Eamon, P.Eng
Date: 2022/11/10

Rational Method Storage Computation
Storage Rate Method

Contributing Area (Contolled)		
No.	**Ha**	**C**
A-201	1.920	0.45
A-202	1.850	0.52
-203 (Future G&E	26.620	0.50
A-204	1.780	0.45
A-205	1.210	0.45
A-206	0.560	0.45
A-207	0.330	0.45
A-208	0.800	0.60
A-209	1.170	0.75
A-210	1.450	0.45
A-211	1.730	0.60
A-212	1.350	0.45
A-213	4.207	0.50
A-214	1.500	0.20
Σ Areas		**46.477**
Weighted 'C' Factor		**0.61**

C +25% for 100 Yr Storm

	Storm Event	Q (L/s)
Total Allow. Q	100 Year	871.29
Total Actual Q	100 Year	861.00

Time (Min.)	I (mm/hr)	Peak Flow (L/s)	Actual Release Rate (L/s)	Required Storage Rate (L/s)	Required Storage Volume (m^3)
60	44.30	3514.03	861.00	2653.04	9550.93
65	41.89	3322.82	861.00	2461.82	9601.12
70	39.77	3155.08	861.00	2294.08	9635.13
75	37.90	3006.53	861.00	2145.53	9654.90
80	36.23	2873.91	861.00	2012.92	9661.99
85	34.73	2754.67	861.00	1893.67	9657.73
90	33.37	2646.78	861.00	1785.78	9643.23
95	32.13	2548.62	861.00	1687.62	9619.43
100	31.00	2458.86	861.00	1597.86	9587.16
105	29.96	2376.42	861.00	1515.42	9547.12
110	29.00	2300.38	861.00	1439.38	9499.94

100 Year Required Storage Calculations

Full Build-Out Scenario

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng.
Reviewed By: Josh Eamon, P.Eng
Date: 2022/11/10

Orifice Flow Calculations (5 YR Structure)

Water Elevation (m)	Orifice Diameter (mm)	Head (m)	Flow (L/s)	Provided Storage (m3)
63.36	465.00	1.86	646.31	9731.67

Orifice C/L elev.=	61.50	m
Cd =	0.63	
g =	9.81	m/s2

Orifice Flow Calculations (100 YR Structure)

Water Elevation (m)	Orifice Diameter (mm)	Head (m)	Flow (L/s)	Provided Storage (m3)
63.36	268.00	1.86	214.69	9731.67

Orifice C/L elev.=	61.50	m
Cd =	0.63	
g =	9.81	m/s2

Provided Storage Calculations

Full Build-Out Scenario

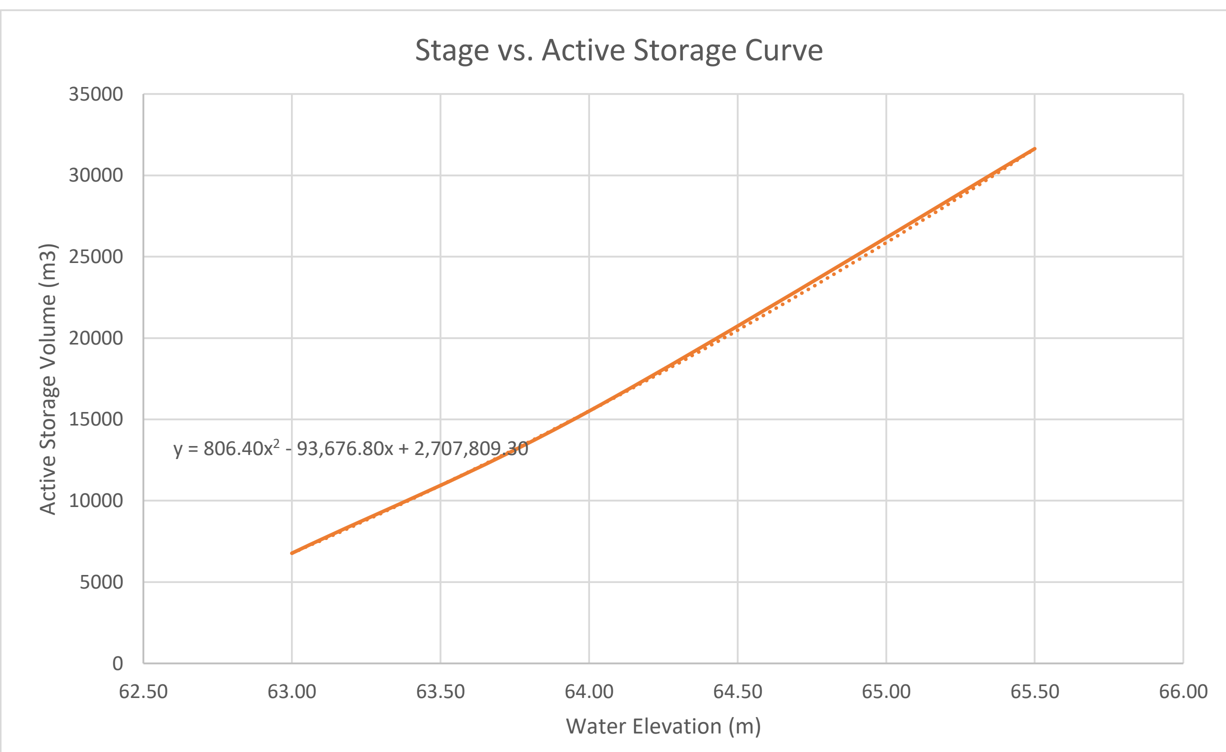
Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng.
Reviewed By: Josh Eamon, P.Eng.
Date: 2022/11/10

Pond Storage - Stage Vs. Storage

Stage (m)	Incremental Depth (m)	Surface Area (m^2) (From CAD)	Incremental Storage (m^3)	Cumulative Storage (m^3)	Active Storage (m^3)
60.60	0.00	3382	0	0.00	0.00
62.00	1.40	5751	6393.10	6393.10	0.00
63.00	1.00	7794	6772.50	13165.60	6772.50
64.00	1.00	9678	8736.00	21901.60	15508.50
65.50	1.50	11826	16128.00	38029.60	31636.50

			Provided	Required
Permanent Water Level:	**62.00**	Permanent Storage (m^3):	**6393.10**	**6251.58**
Ext. Detention Water Level:	**62.33**	Extended Detention Storage (m^3):	**1821.66**	**1799.08**
5 Year Water Elevation:	**62.67**	5 Year Provided Storage (m^3):	**4243.55**	**4208.62**
100 Year Water Elevation:	**63.36**	100 Year Provided Storage (m^3):	**9731.67**	**9661.99**



APPENDIX G

Impervious Area & Water Quality Calculations
SWM Facility Qualitative Sizing
SWM Facility Qualitative Criteria

Impervious Area & Water Quality Calculations

Full Build-Out Scenario

Project Name: McBain Subdivision	**Designed By:** François Lafleur, P.Eng.
Project No: 21043	**Reviewed By:** Josh Eamon, P.Eng.
Client: G&E Reno Construction	**Date:** 2022/11/10

Relationship Between Watershed Imperviousness and the Storm Runoff Coefficient	
Impervious %	**C Factor**
16	0.2
98	0.9

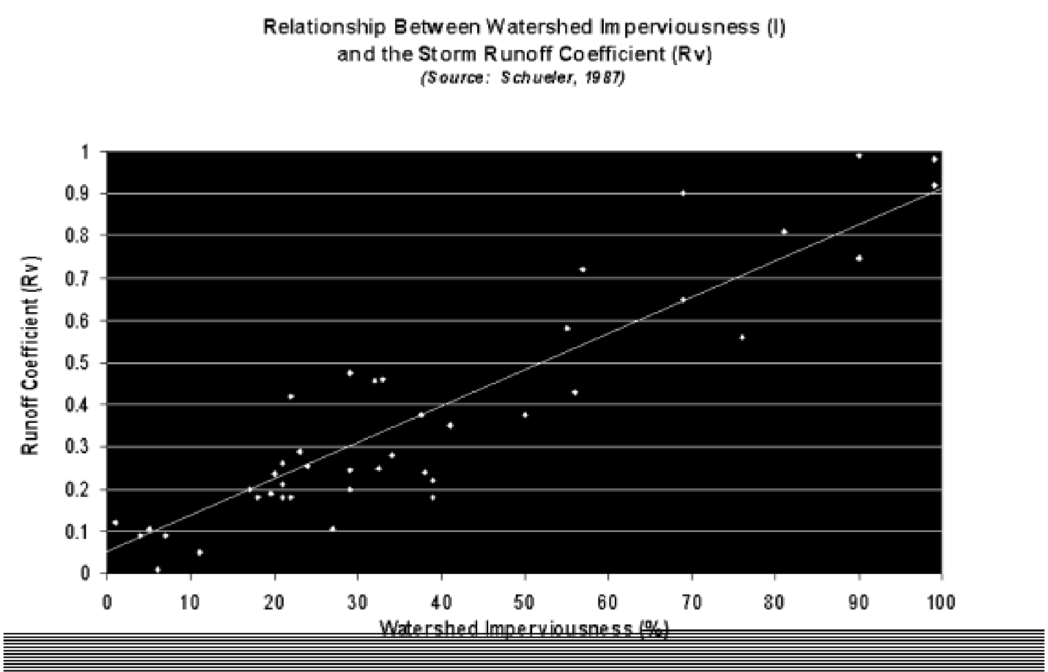
Contributing Area Equivalent Imperviousness %	
Weighted 'C' Factor	**Imperviousness %**
0.50	51.2

Contributing Area (Contolled)		
No.	**Ha**	**C**
A-201 to 213	44.98	0.50
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
Σ Areas		**44.98**
Weighted 'C' Factor		**0.50**

Protection Level (%)	**SWM Type**	**Storage Volume (m^3/ha) for Impervious Level**			
		35%	**55%**	**75%**	**85%**
80	Wet Pond	140	190	225	250

Req'd Storage (m^3/ha) for Impervious Level of 52.1%:	178.99	m^3/ha
Required Extended Detention Volume (40m^3/ha):	1,799.08	m^3
Required Permanent Pool Volume (Remainder):	6,251.58	m^3

138.99



SWM Facility Qualitative Sizing

Full Build-Out Scenario

Project Name: McBain Subdivision
Project No: 21043
Client: G&E Reno Construction

Designed By: François Lafleur, P.Eng.
Reviewed By: Josh Eamon, P.Eng.
Date: 2022/11/10

$$t = \frac{2A_p}{CA_o(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

Equation 4.10: Drawdown Time

where t	=	drawdown time in seconds		
A_p	=	surface area of the pond (m^2)	=	5557 m2 (ext. det)
C	=	discharge coefficient (typically 0.63)	=	0.63
A_o	=	cross-sectional area of the orifice (m^2)	=	0.0254 m2
g	=	gravitational acceleration constant (9.81 m/s^2)	=	9.81 m/s2
h_1	=	starting water elevation above the orifice (m)	=	0.33 m
h_2	=	ending water elevation above the orifice (m)	=	0 m

Orifice dia.= 0.18 m, meets minimum orifice diameter ✓

t = 89909 s
t = 24.97 hr

Max. Q for quality storm = CAo(2gh)^0.5
= 0.040793 m3/s

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Equation 4.5: Forebay Settling Length

Dist	=	forebay length (m)	
r	=	length-to-width ratio of forebay	= 6.72
Q_p	=	peak flow rate from the pond during design quality storm	= 0.04079
V_s	=	settling velocity (dependent on desired particle size to settle). It is recommended that a value of 0.0003 m/s be used in most cases.	= 0.0003

Dist = 30.24 m, < ~39 m provided ✓

$$Width = \frac{Dist}{8}$$

Equation 4.7: Minimum Forebay Deep Zone Bottom Width

Width = 3.78 m, < 5.8m (average) provided ✓

SWM Facility Qualitative Criteria

Full Build-Out Scenario

Project Name: McBain Subdivision	**Designed By:** François Lafleur, P.Eng.
Project No: 21043	**Reviewed By:** Josh Eamon, P.Eng.
Client: G&E Reno Construction	**Date:** 2022/11/10

Per MECP Table 4.6 - Wet Pond

Design Element	**Minimum Criteria**	**Provided**	**Meets?**
Drainage Area	5 ha, 10 ha preferable	44.977 ha	✓
Treatment Volume (per Table 3.2)	1,799.08 m3 extended storage 6,251.58 m3 permanent pool	1,821.66 m3 6,393.10 m3	✓ ✓
Extended Storage Detention	24 hrs	24.97 hr	✓
Forebay, min. depth Forebay, max. area	1.0 m minimum, >1.5m preferred 20% of permanent pool	2.0 m 13.3%	✓ ✓
Length-to-width ratio	Overall, minimum = 3:1 Forebay, minimum = 2:1	178/20m = 8.9 39/5.8m = 6.72	✓ ✓
Permanent pool depth	Maximum 3 m, mean 1 m to 2 m	1.4m	✓
Active storage depth	Maximum 1m for <10 yr storms	0.66m for 5yr 1.35m for 100yr	✓ ✓
Side slopes	5:1 for 3m above & below perm. pool, max 3:1 elsewhere	3:1 everywhere	x[1]
Inlet	Minimum 450mm Slope > 1%	1,350mm 0.30%	✓ x[2]
Outlet	Minimum 450mm Slope > 1% Min. 75mm orifice	TBD TBD 180mm (qualitative)	 ✓
Maintenance Access	Provided to City approval Provision of drawdown pipe	5m flat area around SWM facility TBD	✓
Buffer	Min. 7.5m from max water level Min. 3.0m from high water level	>20m to houses	✓

Notes:

1: Side slopes are currently 3H:1V to maximize the area of the SWM facility block. To be reviewed during detailed design based on final grading plan.

2: Inlet slope was kept flatter to minimize flow velocities & potential for erosion at the forebay.

APPENDIX H

Storm Sewer Design Sheet – 5 Year Storm
Storm Sewer HGL Calculation – 5 Year Storm
Storm Sewer Design Sheet – 100 Year Storm
Storm Sewer HGL Calculation – 100 Year Storm

Storm Sewer Design Sheet - 5 Year Storm

Client: G&E Reno Construction

Service Location and Contributing Areas						Runoff Data						Outlet Pipe Data								
Location	Manhole		Contributing Area			C	AC	Σ	Tc	I	Q	Size	Slope	Qcap	Q/Qcap	Velocity	Length	Δ Elev	Pipe Inverts	
	From	To	No.	Ha	Σ Areas			AC	(min.)	(mm/hr)	(L/s)	(mm)	(%)	(l/s)		(m/s)	(m)	(m)	U/S	D/S
Stan Street	MH840	MH830	A-201	1.920	A-201	0.45	0.864	0.864	20.0	57.1	138.17	450	0.30%	156.2	0.88	0.98	84.00	0.252	64.77	64.52
Stan Street	MH830	MH820			A-201			0.864	21.4	54.4	131.68	450	0.25%	142.6	0.92	0.90	84.00	0.210	64.49	64.28
Stan Street	MH820	MH810			A-201			0.864	23.0	51.8	125.36	450	0.25%	142.6	0.88	0.90	84.90	0.212	64.25	64.04
Nicole Street	MH810	MH800	A-202	1.850	A-201 to 202	0.52	0.962	1.826	24.6	49.5	252.92	600	0.20%	274.6	0.92	0.97	86.00	0.172	63.89	63.72
Nicole Street	MH800	MH790			A-201 to 202			1.826	26.0	47.5	242.81	600	0.20%	274.6	0.88	0.97	120.00	0.240	63.57	63.33
Nicole Street	MH790	MH740			A-201 to 202			1.826	28.1	45.0	230.23	600	0.20%	274.6	0.84	0.97	40.60	0.081	63.27	63.19
Future G&E	MH910	MH900	A-203	26.620	A-203	0.50	13.217	13.217	20.0	57.1	2113.68	1200	0.35%	2306.5	0.92	2.04	435.69	1.525	65.96	64.43
Future G&E	MH900	MH770			A-203			13.217	23.6	50.9	1884.95	1200	0.30%	2135.4	0.88	1.89	442.10	1.326	64.28	62.95
Stan Street	MH810	MH780	A-204	1.780	A-204	0.45	0.801	0.801	20.0	57.1	128.10	525	0.15%	166.6	0.77	0.77	119.30	0.179	63.96	63.78
Stan Street	MH780	MH770			A-204			0.801	22.6	52.5	117.67	525	0.10%	136.0	0.87	0.63	119.30	0.119	63.75	63.63
Helene Street	MH770	MH760	A-205	1.210	A-203 to 205	0.45	0.545	14.562	27.5	45.8	1865.85	1350	0.15%	2067.2	0.90	1.44	24.10	0.036	62.80	62.77
Helene Street	MH760	MH750			A-203 to 205			14.562	27.7	45.4	1852.76	1350	0.15%	2067.2	0.90	1.44	24.50	0.037	62.71	62.67
Helene Street	MH750	MH740			A-203 to 205			14.562	28.0	45.1	1839.67	1350	0.15%	2067.2	0.89	1.44	96.40	0.145	62.61	62.47
Helene Street	MH740	MH600	A-206	0.560	A-201 to 206	0.45	0.252	16.640	29.1	43.9	2045.75	1350	0.20%	2387.0	0.86	1.67	57.00	0.114	62.44	62.32
Stan Street	MH850	MH840	A-207	0.330	A-207	0.45	0.149	0.149	20.0	57.1	23.75	250	0.30%	32.6	0.73	0.66	29.20	0.088	64.63	64.54
Jean Street	MH840	MH730	A-208	0.800	A-207 to 208	0.60	0.480	0.629	20.7	55.7	98.01	450	0.20%	127.5	0.77	0.80	86.00	0.172	64.34	64.17
Jean Street	MH730	MH710			A-207 to 208			0.629	22.5	52.6	92.51	450	0.20%	127.5	0.73	0.80	86.00	0.172	64.14	63.97
Helene Street	MH720	MH710	A-209	1.170	A-209	0.75	0.878	0.878	15.0	69.8	171.59	525	0.20%	192.3	0.89	0.89	51.50	0.103	63.99	63.89
Helene Street	MH710	MH700	A-210	1.450	A-207 to 210	0.45	0.653	2.159	24.3	49.8	301.18	750	0.20%	497.9	0.60	1.13	83.30	0.167	63.67	63.50
Helene Street	MH700	MH670			A-207 to 210			2.159	25.5	48.1	290.95	750	0.20%	497.9	0.58	1.13	83.30	0.167	63.47	63.30
Larocque Street	MH730	MH690	A-211	1.730	A-211	0.60	1.038	1.038	20.0	57.1	166.00	525	0.20%	192.3	0.86	0.89	83.30	0.167	64.18	64.02
Larocque Street	MH690	MH680			A-211			1.038	21.6	54.2	157.50	525	0.20%	192.3	0.82	0.89	83.30	0.167	63.99	63.82
Larocque Street	MH680	MH670			A-211			1.038	23.1	51.6	149.98	525	0.20%	192.3	0.78	0.89	86.00	0.172	63.67	63.50
Helene Street	MH670	MH660	A-212	1.350	A-207 to 212	0.45	0.608	3.804	26.8	46.6	496.15	750	0.25%	556.6	0.89	1.26	88.00	0.220	63.27	63.05
Helene Street	MH660	MH610			A-207 to 212			3.804	27.9	45.2	481.61	750	0.25%	556.6	0.87	1.26	88.10	0.220	63.02	62.80

Storm Sewer Design Sheet - 5 Year Storm

Client: G&E Reno Construction

Service Location and Contributing Areas						Runoff Data						Outlet Pipe Data								
Location	Manhole		Contributing Area			C	AC	Σ AC	Tc (min.)	I (mm/hr)	Q (L/s)	Size (mm)	Slope (%)	Qcap (l/s)	Q/Qcap	Velocity (m/s)	Length (m)	Δ Elev (m)	Pipe Inverts	
	From	To	No.	Ha	Σ Areas														U/S	D/S
Blanchard	MH710	MH650	A-213	4.207	A-213	0.50	2.083	2.083	20.0	57.1	333.06	600	0.35%	363.3	0.92	1.28	87.00	0.305	63.87	63.56
Blanchard	MH650	MH640			A-213			2.083	21.1	55.0	320.52	750	0.10%	352.0	0.91	0.80	114.00	0.114	63.41	63.30
Blanchard	MH640	MH630			A-213			2.083	23.5	51.0	297.44	750	0.10%	352.0	0.84	0.80	114.00	0.114	63.27	63.16
Blanchard	MH630	MH620			A-213			2.083	25.9	47.7	278.02	750	0.10%	352.0	0.79	0.80	114.70	0.115	63.13	63.01
Blanchard	MH620	MH610			A-213			2.083	28.3	44.8	261.32	750	0.10%	352.0	0.74	0.80	89.10	0.089	62.86	62.77
Helene Street	MH610	MH600			A-207 to 213			5.887	30.2	42.9	706.44	1050	0.10%	863.5	0.82	1.00	29.00	0.029	62.50	62.47
Block 158	MH600	POND			ALL			22.527	30.6	42.4	2673.46	1350	0.30%	2923.4	0.91	2.04	57.70	0.173	62.17	62.00

Design Parameters

Coefficients

Mannings n = 0.0130

Red text = upstream structure (tc = 15 mins or 20 mins)

Designed By: François Lafleur, P.Eng.

Reviewed By: Josh Eamon, P.Eng

Dwg. Reference: FIG.4 & FIG.5

Project: McBain Subdivision

Location: Crysler, Ontario

Project Number: 21043

Date: 10-Nov-22

Sheet Number: 1/1

Storm Sewer HGL Calculation - 5 Year Storm

Client: G&E Reno Construction

Pipe Location and Elevation					Pipe Properties				Pipe Flow Data								Water Level (W.L.)				
Location	Manhole ID		Inverts (m)		Size	Length	Slope	Qcap	Q	Q/Qcap	Computational Columns				Manhole	Headloss	D/S W.L.	U/S W.L.	U/S T/G	U/S Obvert	W.L. Below
	From	To	U/S	D/S	(m)	(m)	(%)	(m^3/s)	(m^3/s)		A	R	V	f	Losses (K)	(m)	(m)	(m)	(m)	(m)	Obvert (m)
Stan Street	MH840	MH830	64.77	64.52	0.45	84.0	0.30%	0.156	0.13817	0.88	0.1590	0.1125	0.87	0.027	0.5	0.217	64.94	65.16	67.04	65.22	0.07
Stan Street	MH830	MH820	64.49	64.28	0.45	84.0	0.25%	0.143	0.13168	0.92	0.1590	0.1125	0.83	0.027	0.5	0.197	64.70	64.90	66.67	64.94	0.04
Stan Street	MH820	MH810	64.25	64.04	0.45	84.9	0.25%	0.143	0.12536	0.88	0.1590	0.1125	0.79	0.027	0.5	0.180	64.49	64.67	66.50	64.70	0.03
Nicole Street	MH810	MH800	63.89	63.72	0.6	86.0	0.20%	0.275	0.25292	0.92	0.2827	0.1500	0.89	0.025	0.5	0.166	64.17	64.33	66.32	64.49	0.16
Nicole Street	MH800	MH790	63.57	63.33	0.6	120.0	0.20%	0.275	0.24281	0.88	0.2827	0.1500	0.86	0.025	0.5	0.206	63.87	64.07	66.03	64.17	0.09
Nicole Street	MH790	MH740	63.27	63.19	0.6	40.6	0.20%	0.275	0.23023	0.84	0.2827	0.1500	0.81	0.025	0.5	0.074	63.79	63.86	65.83	63.87	0.01
Future G&E	MH910	MH900	65.96	64.43	1.2	435.7	0.35%	2.307	2.11368	0.92	1.1310	0.3000	1.87	0.020	0.5	1.370	65.48	66.85	70.00	67.16	0.31
Future G&E	MH900	MH770	64.28	62.95	1.2	442.1	0.30%	2.135	1.88495	0.88	1.1310	0.3000	1.67	0.020	0.5	1.104	64.15	65.26	67.50	65.48	0.22
Stan Street	MH810	MH780	63.96	63.78	0.525	119.3	0.15%	0.167	0.12810	0.77	0.2165	0.1313	0.59	0.026	0.5	0.115	64.27	64.39	66.34	64.48	0.09
Stan Street	MH780	MH770	63.75	63.63	0.525	119.3	0.10%	0.136	0.11767	0.87	0.2165	0.1313	0.54	0.026	0.5	0.097	64.15	64.25	65.86	64.27	0.02
Helene Street	MH770	MH760	62.80	62.77	1.35	24.1	0.15%	2.067	1.86585	0.90	1.4314	0.3375	1.30	0.019	0.5	0.073	64.06	64.13	65.70	64.15	0.02
Helene Street	MH760	MH750	62.71	62.67	1.35	24.5	0.15%	2.067	1.85276	0.90	1.4314	0.3375	1.29	0.019	0.5	0.072	63.96	64.03	65.74	64.06	0.02
Helene Street	MH750	MH740	62.61	62.47	1.35	96.4	0.15%	2.067	1.83967	0.89	1.4314	0.3375	1.29	0.019	0.5	0.157	63.79	63.94	65.79	63.96	0.02
Helene Street	MH740	MH600	62.44	62.32	1.35	57.0	0.20%	2.387	2.04575	0.86	1.4314	0.3375	1.43	0.019	0.5	0.136	63.52	63.66	65.72	63.79	0.13
Stan Street	MH850	MH840	64.63	64.54	0.25	29.2	0.30%	0.033	0.02375	0.73	0.0491	0.0625	0.48	0.033	0.5	0.053	64.79	64.84	66.99	64.88	0.04
Jean Street	MH840	MH730	64.34	64.17	0.45	86.0	0.20%	0.128	0.09801	0.77	0.1590	0.1125	0.62	0.027	0.5	0.111	64.59	64.70	66.72	64.79	0.09
Jean Street	MH730	MH710	64.14	63.97	0.45	86.0	0.20%	0.128	0.09251	0.73	0.1590	0.1125	0.58	0.027	0.5	0.099	64.42	64.51	66.40	64.59	0.07
Helene Street	MH720	MH710	63.99	63.89	0.525	51.5	0.20%	0.192	0.17159	0.89	0.2165	0.1313	0.79	0.026	0.5	0.098	64.42	64.51	66.30	64.52	0.01
Helene Street	MH710	MH700	63.67	63.50	0.75	83.3	0.20%	0.498	0.30118	0.60	0.4418	0.1875	0.68	0.023	0.5	0.073	64.22	64.29	66.34	64.42	0.12
Helene Street	MH700	MH670	63.47	63.30	0.75	83.3	0.20%	0.498	0.29095	0.58	0.4418	0.1875	0.66	0.023	0.5	0.068	64.02	64.09	66.10	64.22	0.13
Larocque Street	MH730	MH690	64.18	64.02	0.525	83.3	0.20%	0.192	0.16600	0.86	0.2165	0.1313	0.77	0.026	0.5	0.139	64.51	64.65	66.47	64.71	0.06
Larocque Street	MH690	MH680	63.99	63.82	0.525	83.3	0.20%	0.192	0.15750	0.82	0.2165	0.1313	0.73	0.026	0.5	0.125	64.19	64.32	66.30	64.51	0.19
Larocque Street	MH680	MH670	63.67	63.50	0.525	86.0	0.20%	0.192	0.14998	0.78	0.2165	0.1313	0.69	0.026	0.5	0.117	64.02	64.14	66.22	64.19	0.06
Helene Street	MH670	MH660	63.27	63.05	0.75	88.0	0.25%	0.557	0.49615	0.89	0.4418	0.1875	1.12	0.023	0.5	0.207	63.81	64.02	66.00	64.02	0.00

Storm Sewer HGL Calculation - 5 Year Storm

Client: G&E Reno Construction

Pipe Location and Elevation					Pipe Properties				Pipe Flow Data								Water Level (W.L.)				
Location	Manhole ID		Inverts (m)		Size	Length	Slope	Qcap	Q	Q/Qcap	Computational Columns				Manhole	Headloss	D/S W.L.	U/S W.L.	U/S T/G	U/S Obvert	W.L. Below
	From	To	U/S	D/S	(m)	(m)	(%)	(m^3/s)	(m^3/s)		A	R	V	f	Losses (K)	(m)	(m)	(m)	(m)	(m)	Obvert (m)
Helene Street	MH660	MH610	63.02	62.80	0.75	88.1	0.25%	0.557	0.48161	0.87	0.4418	0.1875	1.09	0.023	0.5	0.195	63.62	63.81	66.00	63.77	-0.04
Blanchard	MH710	MH650	63.87	63.56	0.6	87.0	0.35%	0.363	0.33306	0.92	0.2827	0.1500	1.18	0.025	0.5	0.291	64.16	64.46	66.83	64.47	0.01
Blanchard	MH650	MH640	63.41	63.30	0.75	114.0	0.10%	0.352	0.32052	0.91	0.4418	0.1875	0.73	0.023	0.5	0.108	64.02	64.13	66.33	64.16	0.04
Blanchard	MH640	MH630	63.27	63.16	0.75	114.0	0.10%	0.352	0.29744	0.84	0.4418	0.1875	0.67	0.023	0.5	0.093	63.88	63.97	65.84	64.02	0.05
Blanchard	MH630	MH620	63.13	63.01	0.75	114.7	0.10%	0.352	0.27802	0.79	0.4418	0.1875	0.63	0.023	0.5	0.082	63.62	63.70	65.50	63.88	0.18
Blanchard	MH620	MH610	62.86	62.77	0.75	89.1	0.10%	0.352	0.26132	0.74	0.4418	0.1875	0.59	0.023	0.5	0.058	63.56	63.62	65.35	63.61	-0.01
Helene Street	MH610	MH600	62.50	62.47	1.05	29.0	0.10%	0.864	0.70644	0.82	0.8659	0.2625	0.82	0.021	0.5	0.036	63.52	63.56	65.70	63.55	-0.01
Block 158	MH600	POND	62.17	62.00	1.35	57.7	0.30%	2.923	2.67346	0.91	1.4314	0.3375	1.87	0.019	0.5	0.234	62.67	62.90	65.67	63.52	0.62

Design Parameters

Coefficients

Mannings n = 0.0130

Head Loss by Darcy-Weisback:

A = Area (m2)

R = Hydraulic Radius

V = Velocity (m/s)

f = Friction Factor

Site Conditions

5 Year HWL in pond: 62.67 m

D/S W.L. is based on lesser of: W.L. from pipe directly downstream, OR obvert of pipe directly downstream (to conservatively assume pipe is flowing full)

Designed By: Francois Lafleur, P.Eng.	**Project:** McBain Subdivision
Reviewed By: Josh Eamon, P.Eng.	**Location:** Crysler, Ontario
Dwg. Reference: FIG.4 & FIG.5	**Project Number:** 21043 — **Date:** 12-Nov-22 — **Sheet Number:** 1/1

Storm Sewer Design Sheet - 100 Year Storm

Client: G&E Reno Construction

Service Location and Contributing Areas						Runoff Data						Outlet Pipe Data								
Location	Manhole		Contributing Area			C	AC	Σ	Tc	I	Q	Size	Slope	Qcap	Q/Qcap	Velocity	Length	Δ Elev	Pipe Inverts	
	From	To	No.	Ha	Σ Areas			AC	(min.)	(mm/hr)	(L/s)	(mm)	(%)	(l/s)		(m/s)	(m)	(m)	U/S	D/S
Stan Street	MH840	MH830	A-201	1.920	A-201	0.45	0.864	0.864	20.0	95.5	230.98	450	0.30%	156.2	1.48	0.98	84.00	0.252	64.77	64.52
Stan Street	MH830	MH820			A-201			0.864	21.4	91.0	220.13	450	0.25%	142.6	1.54	0.90	84.00	0.210	64.49	64.28
Stan Street	MH820	MH810			A-201			0.864	23.0	86.6	209.56	450	0.25%	142.6	1.47	0.90	84.90	0.212	64.25	64.04
Nicole Street	MH810	MH800	A-202	1.850	A-201 to 202	0.52	0.962	1.826	24.6	82.7	422.81	600	0.20%	274.6	1.54	0.97	86.00	0.172	63.89	63.72
Nicole Street	MH800	MH790			A-201 to 202			1.826	26.0	79.4	405.91	600	0.20%	274.6	1.48	0.97	120.00	0.240	63.57	63.33
Nicole Street	MH790	MH740			A-201 to 202			1.826	28.1	75.3	384.88	600	0.20%	274.6	1.40	0.97	40.60	0.081	63.27	63.19
Future G&E	MH910	MH900	A-203	26.620	A-203	0.50	13.217	13.217	20.0	95.5	3533.43	1200	0.35%	2306.5	1.53	2.04	435.69	1.525	65.96	64.43
Future G&E	MH900	MH770			A-203			13.217	23.6	85.1	3151.07	1200	0.30%	2135.4	1.48	1.89	442.10	1.326	64.28	62.95
Stan Street	MH810	MH780	A-204	1.780	A-204	0.45	0.801	0.801	20.0	95.5	214.14	525	0.15%	166.6	1.29	0.77	119.30	0.179	63.96	63.78
Stan Street	MH780	MH770			A-204			0.801	22.6	87.7	196.70	525	0.10%	136.0	1.45	0.63	119.30	0.119	63.75	63.63
Helene Street	MH770	MH760	A-205	1.210	A-203 to 205	0.45	0.545	14.562	27.5	76.5	3119.14	1350	0.15%	2067.2	1.51	1.44	24.10	0.036	62.80	62.77
Helene Street	MH760	MH750			A-203 to 205			14.562	27.7	76.0	3097.25	1350	0.15%	2067.2	1.50	1.44	24.50	0.037	62.71	62.67
Helene Street	MH750	MH740			A-203 to 205			14.562	28.0	75.4	3075.37	1350	0.15%	2067.2	1.49	1.44	96.40	0.145	62.61	62.47
Helene Street	MH740	MH600	A-206	0.560	A-201 to 206	0.45	0.252	16.640	29.1	73.4	3419.88	1350	0.20%	2387.0	1.43	1.67	57.00	0.114	62.44	62.32
Stan Street	MH850	MH840	A-207	0.330	A-207	0.45	0.149	0.149	20.0	95.5	39.70	250	0.30%	32.6	1.22	0.66	29.20	0.088	64.63	64.54
Jean Street	MH840	MH730	A-208	0.800	A-207 to 208	0.60	0.480	0.629	20.7	93.1	163.85	450	0.20%	127.5	1.29	0.80	86.00	0.172	64.34	64.17
Jean Street	MH730	MH710			A-207 to 208			0.629	22.5	87.9	154.64	450	0.20%	127.5	1.21	0.80	86.00	0.172	64.14	63.97
Helene Street	MH720	MH710	A-209	1.170	A-209	0.75	0.878	0.878	15.0	116.7	286.85	525	0.20%	192.3	1.49	0.89	51.50	0.103	63.99	63.89
Helene Street	MH710	MH700	A-210	1.450	A-207 to 210	0.45	0.653	2.159	24.3	83.3	503.49	750	0.20%	497.9	1.01	1.13	83.30	0.167	63.67	63.50
Helene Street	MH700	MH670			A-207 to 210			2.159	25.5	80.5	486.39	750	0.20%	497.9	0.98	1.13	83.30	0.167	63.47	63.30
Larocque Street	MH730	MH690	A-211	1.730	A-211	0.60	1.038	1.038	20.0	95.5	277.50	525	0.20%	192.3	1.44	0.89	83.30	0.167	64.18	64.02
Larocque Street	MH690	MH680			A-211			1.038	21.6	90.6	263.29	525	0.20%	192.3	1.37	0.89	83.30	0.167	63.99	63.82
Larocque Street	MH680	MH670			A-211			1.038	23.1	86.3	250.72	525	0.20%	192.3	1.30	0.89	86.00	0.172	63.67	63.50
Helene Street	MH670	MH660	A-212	1.350	A-207 to 212	0.45	0.608	3.804	26.8	77.9	829.41	750	0.25%	556.6	1.49	1.26	88.00	0.220	63.27	63.05
Helene Street	MH660	MH610			A-207 to 212			3.804	27.9	75.6	805.10	750	0.25%	556.6	1.45	1.26	88.10	0.220	63.02	62.80

Storm Sewer Design Sheet - 100 Year Storm

Client: G&E Reno Construction

Service Location and Contributing Areas						Runoff Data							Outlet Pipe Data									
Location	Manhole		Contributing Area			C	AC	Σ AC	Tc (min.)	I (mm/hr)	Q (L/s)	Size (mm)	Slope (%)	Qcap (l/s)	Q/Qcap	Velocity (m/s)	Length (m)	Δ Elev (m)	Pipe Inverts	
	From	To	No.	Ha	Σ Areas														U/S	D/S
Blanchard	MH710	MH650	A-213	4.207	A-213	0.50	2.083	2.083	20.0	95.5	556.77	600	0.35%	363.3	1.53	1.28	87.00	0.305	63.87	63.56
Blanchard	MH650	MH640			A-213			2.083	21.1	91.9	535.81	750	0.10%	352.0	1.52	0.80	114.00	0.114	63.41	63.30
Blanchard	MH640	MH630			A-213			2.083	23.5	85.3	497.22	750	0.10%	352.0	1.41	0.80	114.00	0.114	63.27	63.16
Blanchard	MH630	MH620			A-213			2.083	25.9	79.7	464.76	750	0.10%	352.0	1.32	0.80	114.70	0.115	63.13	63.01
Blanchard	MH620	MH610			A-213			2.083	28.3	74.9	436.86	750	0.10%	352.0	1.24	0.80	89.10	0.089	62.86	62.77
Helene Street	MH610	MH600			A-207 to 213			5.887	30.2	71.6	1180.96	1050	0.10%	863.5	1.37	1.00	29.00	0.029	62.50	62.47
Block 158	MH600	POND			ALL			22.527	30.6	70.9	4469.22	1350	0.30%	2923.4	1.53	2.04	57.70	0.173	62.17	62.00

Design Parameters

Coefficients

Mannings n = 0.0130

Red text = upstream structure (tc = 15 mins or 20 mins)

Designed By: François Lafleur, P.Eng.

Reviewed By: Josh Eamon, P.Eng

Dwg. Reference: FIG.4 & FIG.5

Project: McBain Subdivision

Location: Crysler, Ontario

Project Number: 21043

Date: 10-Nov-22

Sheet Number: 1/1

Storm Sewer HGL Calculation - 100 Year Storm

Client: G&E Reno Construction

Pipe Location and Elevation					Pipe Properties				Pipe Flow Data								Water Level (W.L.)			
Location	Manhole ID		Inverts (m)		Size (m)	Length (m)	Slope (%)	Qcap (m^3/s)	Q (m^3/s)	Q/Qcap	Computational Columns				Manhole Losses (K)	Headloss (m)	D/S W.L. (m)	U/S W.L. (m)	U/S T/G (m)	W.L. Below T/G (m)
	From	To	U/S	D/S							A	R	V	f						
Stan Street	MH840	MH830	64.77	64.52	0.45	84.0	0.30%	0.156	0.23098	1.48	0.1590	0.1125	1.45	0.027	0.5	0.605	66.69	67.30	67.04	-0.26
Stan Street	MH830	MH820	64.49	64.28	0.45	84.0	0.25%	0.143	0.22013	1.54	0.1590	0.1125	1.38	0.027	0.5	0.550	66.14	66.69	66.67	-0.02
Stan Street	MH820	MH810	64.25	64.04	0.45	84.9	0.25%	0.143	0.20956	1.47	0.1590	0.1125	1.32	0.027	0.5	0.503	65.64	66.14	66.50	0.36
Nicole Street	MH810	MH800	63.89	63.72	0.6	86.0	0.20%	0.275	0.42281	1.54	0.2827	0.1500	1.50	0.025	0.5	0.465	65.18	65.64	66.32	0.68
Nicole Street	MH800	MH790	63.57	63.33	0.6	120.0	0.20%	0.275	0.40591	1.48	0.2827	0.1500	1.44	0.025	0.5	0.577	64.60	65.18	66.03	0.85
Nicole Street	MH790	MH740	63.27	63.19	0.6	40.6	0.20%	0.275	0.38488	1.40	0.2827	0.1500	1.36	0.025	0.5	0.207	64.39	64.60	65.83	1.23
Future G&E	MH910	MH900	65.96	64.43	1.2	435.7	0.35%	2.307	3.53343	1.53	1.1310	0.3000	3.12	0.020	0.5	3.827	68.32	72.15	70.00	-2.15
Future G&E	MH900	MH770	64.28	62.95	1.2	442.1	0.30%	2.135	3.15107	1.48	1.1310	0.3000	2.79	0.020	0.5	3.086	65.24	68.32	67.50	-0.82
Stan Street	MH810	MH780	63.96	63.78	0.525	119.3	0.15%	0.167	0.21414	1.29	0.2165	0.1313	0.99	0.026	0.5	0.321	65.51	65.83	66.34	0.51
Stan Street	MH780	MH770	63.75	63.63	0.525	119.3	0.10%	0.136	0.19670	1.45	0.2165	0.1313	0.91	0.026	0.5	0.271	65.24	65.51	65.86	0.35
Helene Street	MH770	MH760	62.80	62.77	1.35	24.1	0.15%	2.067	3.11914	1.51	1.4314	0.3375	2.18	0.019	0.5	0.203	65.03	65.24	65.70	0.46
Helene Street	MH760	MH750	62.71	62.67	1.35	24.5	0.15%	2.067	3.09725	1.50	1.4314	0.3375	2.16	0.019	0.5	0.202	64.83	65.03	65.74	0.71
Helene Street	MH750	MH740	62.61	62.47	1.35	96.4	0.15%	2.067	3.07537	1.49	1.4314	0.3375	2.15	0.019	0.5	0.438	64.39	64.83	65.79	0.96
Helene Street	MH740	MH600	62.44	62.32	1.35	57.0	0.20%	2.387	3.41988	1.43	1.4314	0.3375	2.39	0.019	0.5	0.379	64.01	64.39	65.72	1.33
Stan Street	MH850	MH840	64.63	64.54	0.25	29.2	0.30%	0.033	0.03970	1.22	0.0491	0.0625	0.81	0.033	0.5	0.147	66.38	66.53	66.99	0.46
Jean Street	MH840	MH730	64.34	64.17	0.45	86.0	0.20%	0.128	0.16385	1.29	0.1590	0.1125	1.03	0.027	0.5	0.311	66.07	66.38	66.72	0.34
Jean Street	MH730	MH710	64.14	63.97	0.45	86.0	0.20%	0.128	0.15464	1.21	0.1590	0.1125	0.97	0.027	0.5	0.277	65.79	66.07	66.40	0.33
Helene Street	MH720	MH710	63.99	63.89	0.525	51.5	0.20%	0.192	0.28685	1.49	0.2165	0.1313	1.33	0.026	0.5	0.274	65.79	66.07	66.30	0.23
Helene Street	MH710	MH700	63.67	63.50	0.75	83.3	0.20%	0.498	0.50349	1.01	0.4418	0.1875	1.14	0.023	0.5	0.203	65.59	65.79	66.34	0.55
Helene Street	MH700	MH670	63.47	63.30	0.75	83.3	0.20%	0.498	0.48639	0.98	0.4418	0.1875	1.10	0.023	0.5	0.190	65.40	65.59	66.10	0.51
Larocque Street	MH730	MH690	64.18	64.02	0.525	83.3	0.20%	0.192	0.27750	1.44	0.2165	0.1313	1.28	0.026	0.5	0.389	66.08	66.47	66.47	0.00
Larocque Street	MH690	MH680	63.99	63.82	0.525	83.3	0.20%	0.192	0.26329	1.37	0.2165	0.1313	1.22	0.026	0.5	0.350	65.73	66.08	66.30	0.22
Larocque Street	MH680	MH670	63.67	63.50	0.525	86.0	0.20%	0.192	0.25072	1.30	0.2165	0.1313	1.16	0.026	0.5	0.326	65.40	65.73	66.22	0.49
Helene Street	MH670	MH660	63.27	63.05	0.75	88.0	0.25%	0.557	0.82941	1.49	0.4418	0.1875	1.88	0.023	0.5	0.578	64.82	65.40	66.00	0.60

Storm Sewer HGL Calculation - 100 Year Storm

Client: G&E Reno Construction

Pipe Location and Elevation					Pipe Properties				Pipe Flow Data								Water Level (W.L.)			
Location	Manhole ID		Inverts (m)		Size	Length	Slope	Qcap	Q	Q/Qcap	Computational Columns				Manhole	Headloss	D/S W.L.	U/S W.L.	U/S T/G	W.L. Below
	From	To	U/S	D/S	(m)	(m)	(%)	(m^3/s)	(m^3/s)		A	R	V	f	Losses (K)	(m)	(m)	(m)	(m)	T/G (m)
Helene Street	MH660	MH610	63.02	62.80	0.75	88.1	0.25%	0.557	0.80510	1.45	0.4418	0.1875	1.82	0.023	0.5	0.545	64.28	64.82	66.00	1.18
Blanchard	MH710	MH650	63.87	63.56	0.6	87.0	0.35%	0.363	0.55677	1.53	0.2827	0.1500	1.97	0.025	0.5	0.814	65.07	65.88	66.83	0.95
Blanchard	MH650	MH640	63.41	63.30	0.75	114.0	0.10%	0.352	0.53581	1.52	0.4418	0.1875	1.21	0.023	0.5	0.302	64.76	65.07	66.33	1.26
Blanchard	MH640	MH630	63.27	63.16	0.75	114.0	0.10%	0.352	0.49722	1.41	0.4418	0.1875	1.13	0.023	0.5	0.260	64.50	64.76	65.84	1.08
Blanchard	MH630	MH620	63.13	63.01	0.75	114.7	0.10%	0.352	0.46476	1.32	0.4418	0.1875	1.05	0.023	0.5	0.228	64.28	64.50	65.50	1.00
Blanchard	MH620	MH610	62.86	62.77	0.75	89.1	0.10%	0.352	0.43686	1.24	0.4418	0.1875	0.99	0.023	0.5	0.162	64.11	64.28	65.35	1.07
Helene Street	MH610	MH600	62.50	62.47	1.05	29.0	0.10%	0.864	1.18096	1.37	0.8659	0.2625	1.36	0.021	0.5	0.102	64.01	64.11	65.70	1.59
Block 158	MH600	POND	62.17	62.00	1.35	57.7	0.30%	2.923	4.46922	1.53	1.4314	0.3375	3.12	0.019	0.5	0.653	63.36	64.01	65.67	1.66

Design Parameters

Coefficients

Mannings n = 0.0130

Head Loss by Darcy-Weisback:
A = Area (m2)
R = Hydraulic Radius
V = Velocity (m/s)
f = Friction Factor

Site Conditions

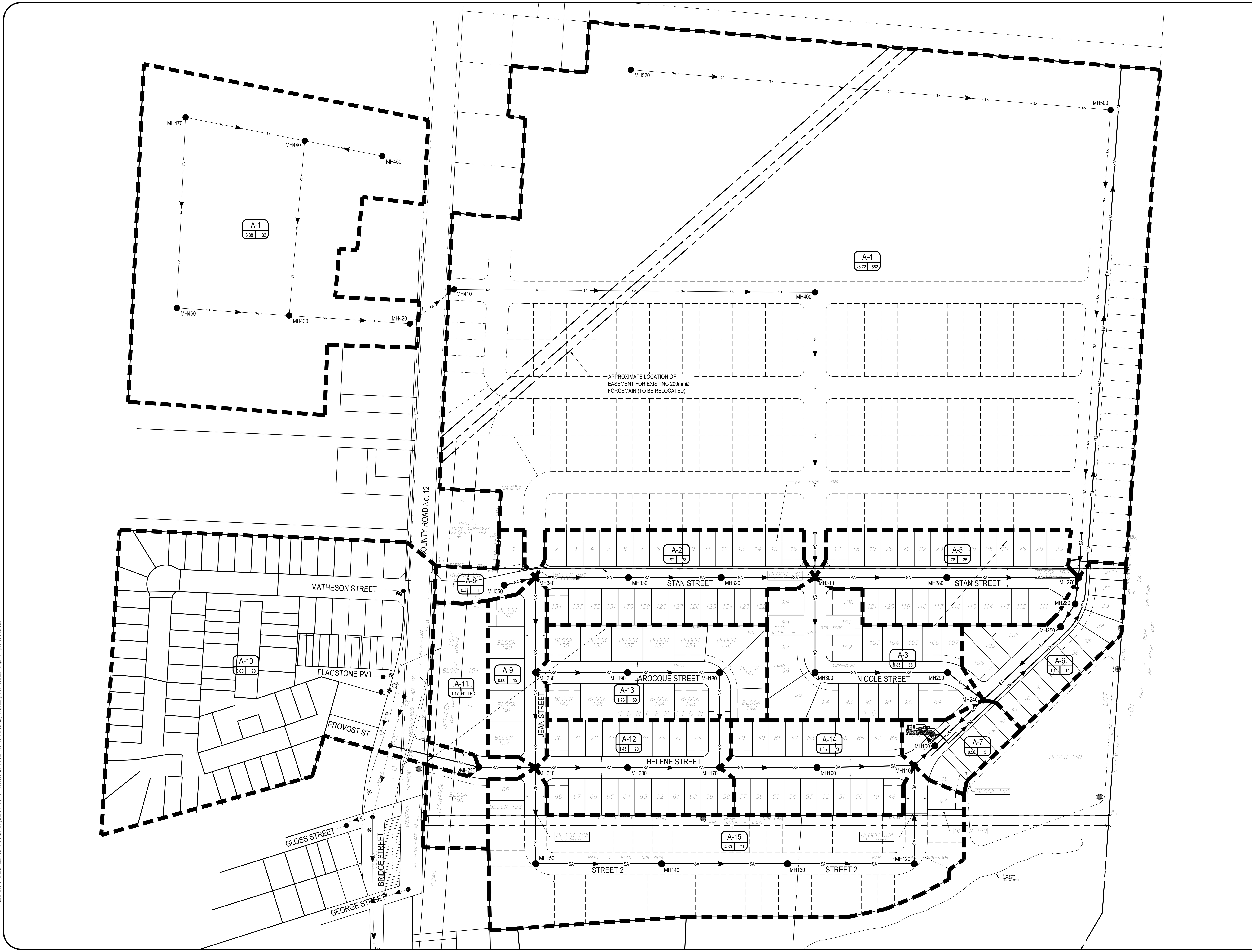
100 Year HWL in pond: 63.36 m

D/S W.L. is based on lesser of: W.L. from pipe directly downstream, OR obvert of pipe directly downstream (to conservatively assume pipe is flowing full)

Designed By: Francois Lafleur, P.Eng.	**Project:** McBain Subdivision
Reviewed By: Josh Eamon, P.Eng.	**Location:** Crysler, Ontario
Dwg. Reference: FIG.4 & FIG.5	**Project Number:** 21043
Date: 12-Nov-22	**Sheet Number:** 1/1

APPENDIX I

FIG.1 – Conceptual Sanitary Catchment Areas
FIG.2 – Conceptual Sanitary Sewer Servicing
FIG.3 – Pre-Development Storm Catchment Areas
FIG.4 – Conceptual Storm Catchment Areas
FIG.5 – Conceptual Storm Catchment Areas
FIG.6 – Conceptual Phasing Plan



LEGEND:

SANITARY DRAINAGE BUBBLE

A-3	
42.83	885

- A-3 — AREA LABEL
- 885 — # OF RESIDENTIAL UNITS
- 42.83 — AREA IN HECTARES
- ▬ ▬ ▬ SANITARY DRAINAGE LIMIT

DATE	No.	REVISION
2022/11/07	1	ISSUED FOR DRAFT PLAN APPLICATION

EVB ENGINEERING
800 SECOND STREET WEST
CORNWALL, ONTARIO CANADA, K6J 1H6
TEL: 613-935-3775 | FAX: 613-935-6450
WEBSITE: EVBengineering.com

CLIENT:
G&E Reno Construction

PROJECT:
McBAIN LAND SUBDIVISION

TITLE:
CONCEPTUAL SANITARY CATCHMENT AREAS

SCALE: 1:1,500	JOB NO: 21043
DESIGNED BY: F.L.	DATE: 2022/11/07
DRAWN BY: K.B.W./M.K.	DRAWING NO.
CHECKED BY: F.L.	FIG.1

LEGEND:

- NEW PROPERTY LINE
- EXISTING PROPERTY LINE
- NEW LOT LINE
- NEW SANITARY SEWER
- FUTURE SANITARY SEWER
- NEW FORCEMAIN
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- NEW SANITARY MANHOLE
- FUTURE SANITARY MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING STORM MANHOLE
- EXISTING POLYETHYLENE CATCH BASIN
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING TEST PIT

DATE	No.	REVISION
2022/11/07	1	ISSUED FOR DRAFT PLAN APPLICATION

EVB ENGINEERING
800 SECOND STREET WEST
CORNWALL, ONTARIO CANADA, K6J 1H6
TEL: 613-935-3775 | FAX: 613-935-6450
WEBSITE: EVBengineering.com

CLIENT: G&E Reno Construction

PROJECT: McBAIN LAND SUBDIVISION

TITLE: CONCEPTUAL SANITARY SEWER SERVICING

SCALE: 1:1,500	JOB NO: 21043
DESIGNED BY: F.L.	DATE: 2022/11/07
DRAWN BY: K.B.W./M.K.	DRAWING NO.
CHECKED BY: F.L.	FIG.2

LEGEND:

STORM DRAINAGE BUBBLE
A-3 — AREA LABEL
0.45 — RUNOFF COEFFICIENT
42.83 — AREA IN HECTARES
— STORM DRAINAGE LIMIT

DATE	No.	REVISION
2022/11/10	1	ISSUED FOR DRAFT PLAN APPLICATION

EVB ENGINEERING
800 SECOND STREET WEST
CORNWALL, ONTARIO CANADA, K6J 1H6
TEL: 613-935-3775 | FAX: 613-935-6450
WEBSITE: EVBengineering.com

CLIENT:
G&E Reno Construction

PROJECT:

McBAIN LAND SUBDIVISION

TITLE:

PRE-DEVELOPMENT STORM CATCHMENT AREAS

SCALE: 1:2,000	JOB NO: 21043
DESIGNED BY: F.L.	DATE: 2022/11/08
DRAWN BY: K.B.W./M.K.	DRAWING NO.
CHECKED BY: F.L.	FIG.3

LEGEND:

STORM DRAINAGE BUBBLE

- A-3 — AREA LABEL
- 0.45 — RUNOFF COEFFICIENT
- 42.83 — AREA IN HECTARES
- STORM DRAINAGE LIMIT

DATE	No.	REVISION
2022/11/10	1	ISSUED FOR DRAFT PLAN APPLICATION

EVB ENGINEERING
800 SECOND STREET WEST
CORNWALL, ONTARIO CANADA, K6J 1H6
TEL: 613-935-3775 | FAX: 613-935-6450
WEBSITE: EVBengineering.com

CLIENT: G&E Reno Construction

PROJECT:

McBAIN LAND SUBDIVISION

TITLE:

CONCEPTUAL STORM CATCHMENT AREAS

SCALE: 1:1,500	JOB NO: 21043
DESIGNED BY: F.L.	DATE: 2022/11/08
DRAWN BY: K.B.W./M.K.	DRAWING NO.
CHECKED BY: F.L.	FIG.4

LEGEND:

- NEW PROPERTY LINE
- EXISTING PROPERTY LINE
- NEW LOT LINE
- EXISTING SANITARY SEWER
- NEW STORM SEWER
- EXISTING STORM SEWER
- FUTURE STORM SEWER
- NEW TOP OF SLOPE
- NEW BOTTOM OF SLOPE
- NEW STORM MANHOLE
- FUTURE STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING STORM MANHOLE
- EXISTING POLYETHYLENE CATCH BASIN
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING TEST PIT

DATE	No.	REVISION
2022/09/22	1	ISSUED FOR DRAFT PLAN APPLICATION

EVB ENGINEERING
800 SECOND STREET WEST
CORNWALL, ONTARIO CANADA, K6J 1H6
TEL: 613-935-3775 | FAX: 613-935-6450
WEBSITE: EVBengineering.com

CLIENT: G&E Reno Construction

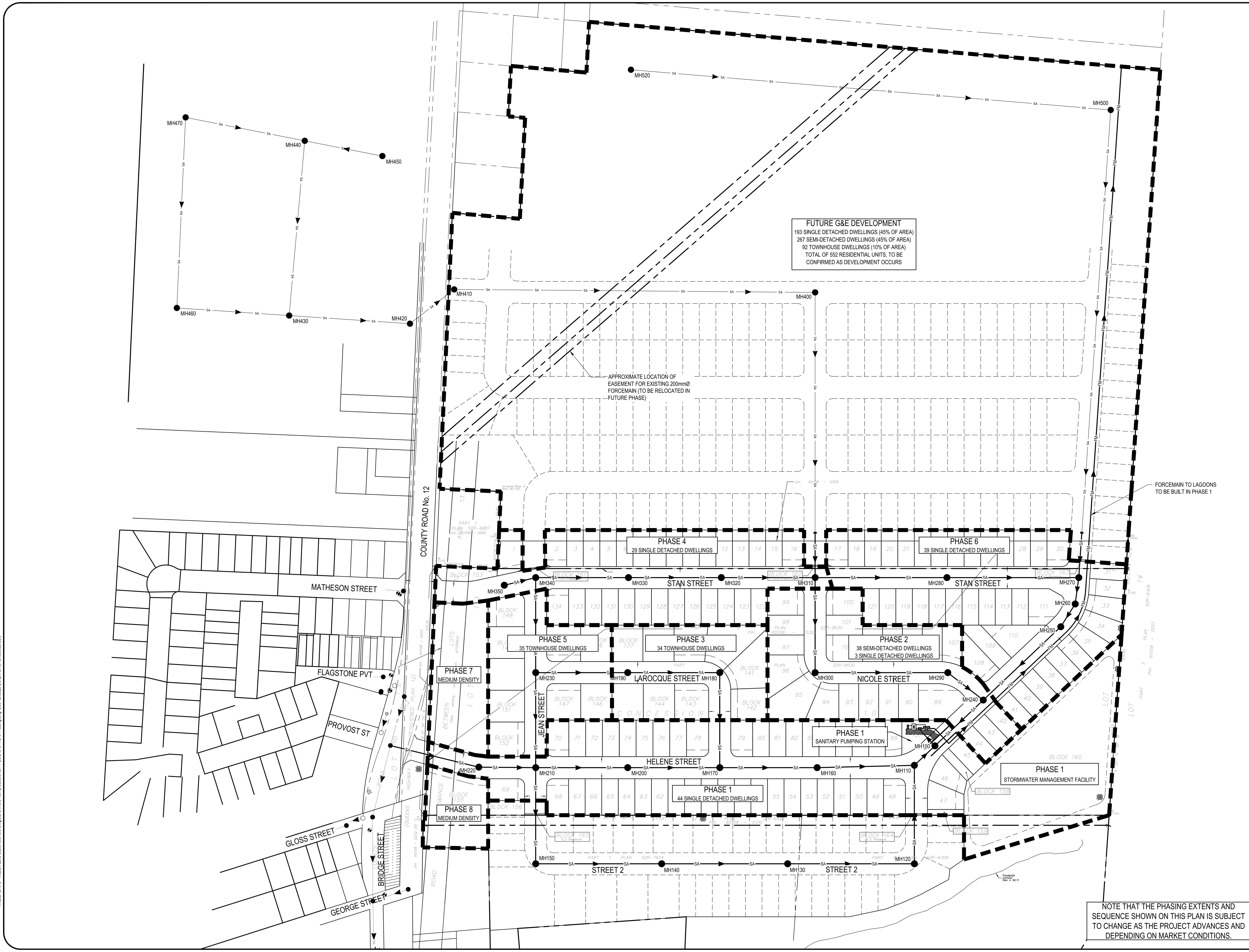
PROJECT:

McBAIN LAND SUBDIVISION

TITLE:

CONCEPTUAL STORM SEWER SERVICING

SCALE: 1:1,500	JOB NO: 21043
DESIGNED BY: F.L.	DATE: 2022/01/26
DRAWN BY: K.B.W./M.K.	DRAWING NO.
CHECKED BY: F.L.	FIG.5



DATE	No.	REVISION
2022/11/14	1	ISSUED FOR DRAFT PLAN APPLICATION

EVB ENGINEERING
800 SECOND STREET WEST
CORNWALL, ONTARIO CANADA, K6J 1H6
TEL: 613-935-3775 | FAX: 613-935-6450
WEBSITE: EVBengineering.com

CLIENT:
G&E Reno Construction

PROJECT:
McBAIN LAND SUBDIVISION

TITLE:
CONCEPTUAL PHASING PLAN

SCALE:	JOB NO:
1:1,500	21043
DESIGNED BY: F.L.	DATE: 2022/11/07
DRAWN BY: K.B.W./M.K.	DRAWING NO.
CHECKED BY: F.L.	FIG.6