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SITE SERVICING AND STORMWATER MANAGEMENT REPORT

FOR

METRO CANADA INC.
3831 CAMBRIAN ROAD – PHASE 1

CITY OF OTTAWA

PROJECT NO.: 19-1135
CITY APPLICATION NO.: D07-12-XX-XXXX

AUGUST 2020 – REV 1

SITE SERVICING AND STORMWATER MANAGEMENT REPORT
FOR
3831 CAMBRIAN ROAD – PHASE 1

METRO CANADA

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CITY OF OTTAWA
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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained by Metro Canada Inc. to prepare a Site Servicing and Stormwater Management report in support of the application for a Site Plan Control (SPC) at 3831 Cambrian Road.

The subject property is located within the City of Ottawa urban boundary, in Barrhaven ward. As illustrated in ***Figure 1***, the subject property is located south of the intersection of Cambrian Road and Future Greenbank Road. Comprised of a single parcel the subject property measures approximately ***2.2 ha*** and is zoned General Mixed Use (GM).

Figure 1: Site Location

The proposed SPC would allow for the development of a commercial building fronting onto an internal drive aisle. The proposed phase 1 development would include approximately ***4953 m²*** of ground level retail and above ground parking, with access from Cambrian Drive and Future Greenbank Road. A copy of the Site Plan is included in ***Drawings/Figures***.

The objective of this report is to provide sufficient detail to demonstrate that the proposed development is supported by existing municipal services.

1.1 Existing Conditions

The existing site a vacant lot used for staging of the adjacent subdivision construction consisting of aggregate piles and sandy the elevations range between 94.27 m and 93.00 m with a minimal grade change of approximate 0.45% from the Northeast to the Southwest corner of the property.

The existing soil conditions on the site consist of silty clay with gravel fill with practical refusal occurring between 5.25 m and 13 m in depth per the ***Geotechnical Report***. Due to the existence of underlying silty clay, there are grade raise restrictions applicable to the proposed development. There is on-going surcharge under the proposed metro location and grade raise restrictions of 1.0 m to 1.5 m for the rest of the site. Refer to ***Geotechnical Report*** for grade raise restriction details.

Sewer and watermain mapping collected from the City of Ottawa indicate that the following services exist across the property frontages within the adjacent municipal right-of-ways:

Cambrian Road

- 406 mm diameter PVC watermain;
- 525 mm diameter concrete storm sewer tributary to the Todd Pond;
- 375 mm diameter PVC storm sewer tributary to Todd Pond; and
- 500 mm diameter concrete sanitary sewer tributary to the South Nepean Trunk.

Future Greenbank Road

- 2550 mm diameter concrete storm sewer tributary to Clarke Pond; and
- 375 mm diameter PVC sanitary sewer tributary to the South Nepean Collector.

1.2 Required Permits / Approvals

The proposed development is subject to the site plan control approval process. The City of Ottawa must approve the engineering design drawings and reports prior to the issuance of site plan control.

The proposed development is a single parcel of land that is not industrial and would outlet to a storm sewer. As a result, the stormwater management system is exempt from sections 53(1) and (3) of the Ontario Water Resources Act under Ontario Regulation 525/98, and does not require Environmental Compliance Approval from the Ministry of Environment.

1.3 Pre-consultation

Pre-consultation correspondence, along with the servicing guidelines checklist, is located in ***Appendix A***.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following studies were utilized in the preparation of this report:

- **Ottawa Sewer Design Guidelines**,
  City of Ottawa, *SDG002,* October 2012.
  (City Standards)
  - **Technical Bulletin ISTB-2018-01**
    City of Ottawa, March 21, 2018.
    (*ISTB-2018-01*)
  - **Technical Bulletin ISTB-2018-03**
    City of Ottawa, March 21, 2018.
    (*ISTB-2018-03*)
- **Ottawa Design Guidelines – Water Distribution**
  City of Ottawa, July 2010.
  (Water Supply Guidelines)
  - **Technical Bulletin ISD-2010-2**
    City of Ottawa, December 15, 2010.
    (*ISD-2010-2*)
  - **Technical Bulletin ISDTB-2014-02**
    City of Ottawa, May 27, 2014.
    (*ISDTB-2014-02*)
  - **Technical Bulletin ISDTB-2018-02**
    City of Ottawa, March 21, 2018.
    (*ISDTB-2018-02*)
- **Design Guidelines for Sewage Works,**
  Ministry of the Environment, 2008.
  (MOE* Design Guidelines*)
- **Stormwater Planning and Design Manual,**
  Ministry of the Environment, March 2003.
  (SWMP Design Manual)
- **Ontario Building Code Compendium**
  Ministry of Municipal Affairs and Housing Building Development Branch, January 1, 2010 Update.
  (OBC)

- **Barrhaven South Master Servicing Study Addendum**
  Stantec, October 12, 2017.
  (BSMSS)

- **Design Brief for the Clarke Stormwater Management Pond for the Half Moon Bay West Subdivision**
  J.F. Sabourin and Associates & DSEL
  Revised, October 19, 2017
  (Clarke Pond Design Brief)

- **Half Moon Bay West Subdivision Phase 2A/2B**
  DSEL, November 6, 2019.
  (HMBW Phase 2 Design Brief)

- **City of Ottawa Infrastructure Master Plan**
  City of Ottawa, November 2013.
  (City of Ottawa IMP)

- **Stormwater Management Report for Phase 2 of the Half Moon Bay West Subdivision**
  J.F. Sabourin and Associates
  Updated, October 2019
  (Phase 2 SWM Report)

- **Geotechnical Investigation Report**
  PG2037-1 Revision 1, Paterson Group
  July 29, 2020
  (Geotechnical Report)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property lies within the City of Ottawa BARR pressure zone, as shown by the Pressure Zone map in ***Appendix B***. A local 406 mm diameter watermain exists within the Cambrian Road right-of-way.

3.2 Water Supply Servicing Design

It is proposed to service the development through a 200 mm internal looped watermain with two connections to the existing 406 mm diameter watermain within Cambrian Road.

Based on As-built drawings, there is one fire hydrant fronting the property along Cambrian Road.

Table 1, below, summarizes the ***Water Supply Guidelines*** employed in the preparation of the preliminary water demand estimate.

Table 1
Water Supply Design Criteria

Design Parameter	Value
Commercial Retail	2.5 L/m^2/d
Commercial Maximum Daily Demand	1.5 x avg. day
Commercial Maximum Hour Demand	1.8 x max. day
Minimum Watermain Size	150 mm diameter
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350 kPa and 480 kPa
During normal operating conditions pressure must not drop below	275 kPa
During normal operating conditions pressure must not exceed	552 kPa
During fire flow operating pressure must not drop below	140 kPa

Daily average based on Appendix 4-A from **Water Supply Guidelines*
*** Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.*
-Table updated to reflect ISD-2010-2

Table 2, below, summarizes the estimated water supply demand and boundary conditions for the proposed development based on the ***Water Supply Guidelines***.

Table 2
Water Demands
Proposed Conditions

Design Parameter	Anticipated Demand[1] Phase 1 (L/min)	Anticipated Demand[1] Ultimate (L/min)
Average Daily Demand	8.6	11.9
Max Day + Fire Flow	12.9 + 6,000= 6,012.9	17.8+ 15,000= 15,017.8
Peak Hour	23.2	32.1
1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.		

The City of Ottawa was contacted to obtain boundary conditions associated with the estimated water demands as indicated in ***Table 2***. Boundary conditions were not received at the time of publication. Correspondence with the City has been included in ***Appendix A***. It is anticipated that a maximum pressure available at site to be approximately ***597.7 kPa*** and the minimum required pressure based on the maximum day demand in the ultimate condition plus the fire flow requirement for Metro and Retail A, which have the highest fire flow demand is ***175.9 kPa***.

Fire flow requirements are to be determined in accordance with City of Ottawa ***Water Supply Guidelines*** and the Ontario Building Code.

Fire flow requirements were estimated per City of Ottawa Technical Bulletin ***ISTB-2018-02***. The following parameters were assumed for Phase 1:

- Type of construction – Non-Combustible Construction;
- Occupancy type – Limited Combustible; and
- Sprinkler Protection – Fully-Supervised Sprinkled System.

The above assumptions result in an estimated fire flow of approximately ***6,000 L/min*** for Phase 1, noting that actual building materials selected will affect the estimated flow. A certified fire protection system specialist will need to be employed to design the building fire suppression system and confirm the actual fire flow demand.

Two private hydrants are proposed in order to accommodate the anticipated fire flow demand for the proposed development.

Table 3, below, summarizes the maximum available fire flow from the proposed hydrants as per ***Table 18.5.4.3*** of the ***ISTB-2018-02.***

Table 3
Total Available Fire Flow from Proposed Hydrants

Number of Hydrants	Distance from Metro & Retail 1 (m)	Available Fire Flow per Table 18.5.4.3 of ISTB-2018-02 (L/min)
2	< 76	5,678 x 2
0	76 < and < 152	3,785 x 0
Total		**11,356**

The available fire flow from the hydrants is ***11,356 L/min*** as per *Table 18.5.4.3* of the ***ISTB-2018-02.***

3.3 Watermain Modelling

EPANet was utilized to determine the availability of pressures throughout the system during average day, max day plus fire flow, and peak hour demands. This static model determines pressures based on the available head obtained from the anticipated maximum and minimum pressures at the connection points. The model will be updated with boundary conditions provided by the City of Ottawa once received.

The model utilizes the Hazen-Williams equation to determine pressure drop, while the pipe properties have been selected in accordance with ***Water Supply Guidelines***. The model was prepared to assess the available pressure at each building, as well as, the pressures the watermain provides to fire hydrants during fire flow conditions.

The anticipated fire flow for the ultimate development was modeled through the proposed private hydrants. Please refer to ***Appendix B*** for a model sketch showing the node locations, fire demands assigned to each hydrant and the resulting pressures. ***Table 4*** indicates the resulting pressures at each node during the average day, peak hour and maximum day plus fire flow scenarios. ***Appendix B*** contains output reports and model schematics for each scenario.

Table 4
Model Simulation Output Summary

Location	Average Day (kPa)	Max Day + Fire Flow (kPa)	Peak Hour (kPa)
Metro2	596.25	146.76	596.25
2	597.43	147.93	597.43
RetA	597.72	143.81	597.72
Hyd1	597.82	142.25	597.82
RetC	598.41	165.00	598.41
RetB	595.96	166.67	595.96
Hyd2	599.69	159.22	599.69

As demonstrated in ***Table 4***, the anticipated pressures during the peak hour and max day + fire flow scenarios simulations are within the allowable pressure range described in ***Table 1*** from the ***Water Supply Guidelines***. Pressures during average day demand are

above the recommended pressures outlined in ***Table 1***. A pressure check should be conducted at the time of construction to determine if pressure control is required.

3.4 Water Supply Conclusion

It is proposed to service the development through a looped internal watermain network via a 200 mm diameter watermains with two connections to the existing 406 mm watermain within Cambrian Road.

Estimated water demand under proposed conditions was submitted to the City of Ottawa for establishing boundary conditions. Boundary conditions have not yet been received at the time of this submission.

It is estimated that the maximum available pressure at the site will be approximately ***597.7 kPa***, and the minimum required pressure at the connection points is ***175.9 kPa***.

It is proposed that the development will be serviced by the two proposed internal hydrants. Based on ***Table 18.5.4.3*** of **ISTB-2018-02,** the fire flow demands of the proposed buildings can be supplied through both of the proposed hydrants.

An EPANET model was prepared for the average day, maximum day plus fire flow and peak hour scenarios using the estimated maximum and the estimated minimum required pressure. The EPANET water distribution model confirmed adequate pressure exists within fire hydrants during fire flow, and within the system for the Average Day, Max Day + Fire Flow and Peak Hour scenarios. Pressure during all scenarios to be confirmed once boundary conditions are received from the City of Ottawa.

The proposed water supply design conforms to all relevant City Guidelines and Policies.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

The subject site lies within the South Nepean Trunk Sewer catchment area, as shown by the City sewer mapping included in ***Appendix C***. An existing 500 mm diameter sanitary sewer within Cambrian Road is available to service the proposed development.

4.2 Wastewater Design

It is proposed that the development will be serviced via the existing 500 mm sanitary sewer within Cambrian Road via a 250 mm internal sanitary sewer.

Table 5, below***,*** summarizes the ***City Standards*** employed in the design of the proposed wastewater sewer system.

Table 5
Wastewater Design Criteria

Design Parameter	Value
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0 Harmon's Corrector Factor 0.8
Commercial Floor Space	5 L/m^2/d
Infiltration and Inflow Allowance	0.05 L/s/ha (Dry Weather) 0.28 L/s/ha (Wet Weather) 0.33 L/s/ha (Total)
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sewer Size (Non-Residential)	250 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012.	

Table 6, below, demonstrates the estimated peak flow from the proposed development. See ***Appendix C*** for associated calculations.

Table 6
Summary of Estimated Peak Wastewater Flow

Design Parameter	Total Flow (L/s)
Estimated Average Dry Weather Flow	**0.90**
Estimated Peak Dry Weather Flow	**1.48**
Estimated Peak Wet Weather Flow	**2.10**

The estimated sanitary flow based on the ***Site Plan,*** included in ***Drawings/Figures,*** results in a peak wet weather flow of ***2.10 L/s***.

A sanitary sewer analysis was completed as part of the Barrhaven South Master Servicing Study (***BSMSS***) which included the existing sewers within Cambrian Road and those downstream. The subject property was contemplated as commercial lands in the study. Based on the ***BSMSS*** Sanitary Sewer Design Sheet, the controlling section of sewer is within Cambrian Road between MH13A and MH15A with an available capacity of ***51.5 L/s***, which is sufficient to accommodate the sanitary flow from the proposed development. Extracted sanitary figures and design sheets from ***BSMSS*** and detailed calculations for the proposed site are included in ***Appendix C***.

4.3 Wastewater Servicing Conclusions

The site is tributary to the South Nepean Trunk It is proposed to discharge wastewater to the existing 500 mm diameter sanitary sewer within Cambrian Road via a 250mm internal sanitary sewer.

Based on the above sanitary analysis, sufficient capacity is available to accommodate the anticipated ***2.10 L/s*** peak wet weather flow from the contemplated/proposed development.

The proposed wastewater design conforms to all relevant ***City Standards***.

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Services

Stormwater runoff from the subject property is tributary to the City of Ottawa sewer system located within the Jock River sub-watershed. As such, approvals for proposed development within this area are under the approval authority of the City of Ottawa.

Flows that influence the watershed in which the subject property is located are further reviewed by the principal authority. The subject property is located within the Jock River watershed, and is therefore subject to review by the Rideau Valley Conservation Authority (RVCA). Consultation with the RVCA is located in ***Appendix A***.

It was assumed that the existing development contained no stormwater management controls for flow attenuation. The estimated pre-development peak flows for the 2, 5, and 100-year events are summarized in ***Table 7,*** below:

Table 7
Summary of Existing Peak Storm Flow Rates

City of Ottawa Design Storm	Estimated Peak Flow Rate (L/s)
2-year	183.9
5-year	249.5
100-year	534.4

5.2 Post-development Stormwater Management Target

Stormwater management requirements for the proposed development were reviewed with the City of Ottawa and summarized in pre-consultation notes in ***Appendix A***, where the proposed development is required to:

- Meet an allowable release rate based on a Rational Method Coefficient of 0.64, employing the City of Ottawa IDF parameters for a 5-year storm with a time of concentration equal to or less than 21.5 minutes and greater than or equal to 10 minutes;
- Attenuate all storms up to and including the City of Ottawa 100-year design event on site; and
- Quality controls are to be provided to achieve 80% Total Suspended Solids (TSS) removal as per the recommendation of the Rideau Valley Conservation Authority (RVCA).

Based on the above the allowable release rate for the proposed development is ***263.4 L/s***.

5.3 Proposed Stormwater Management System

The subject site was contemplated in the ***HMBW Phase 2 Design Brief***, as well as, the ***HMBW Phase 2 SWM Report,*** to drain to the minor system within future Greenbank Road, eventually draining to the Clarke Pond and ultimately to the Jock River.

It is proposed that the stormwater outlet from the development will be to the existing 2550 mm diameter storm sewer within future Greenbank Road via a 750 mm connection to the existing sewer.

The ***Clarke Pond Design Brief*** contemplates the area in which the subject property falls within to be a 5-year capture area with onsite 100-year control.

Per the ***HMBW Phase 2 Design Brief,*** there is a Hydraulic Grade Line (HGL) elevation in the 100-year storm event of approximately ***93.09 m*** at the future *MH904* within future Greenbank Road storm sewer, located upstream of the proposed storm connection. Refer to *Plan & Profile of future Greenbank Road*, prepared by DSEL, revision 8, dated February 25, 2020 in ***Appendix D***.

To meet the stormwater quantity control objectives the proposed development will employ rooftop and surface storage. To adhere to the allocated release rate, inlet control devices (ICDs) are proposed at catch basins and manholes to control flow. The 100-year HGL elevation was taken into account in the design of available storage. The downstream condition was set at ***93.09 m*** to size the ICDs. Refer to drawing ***SSP-1*** for ICD locations.

Table 8, below, estimates post-development flow rates to the storm sewer within Greenbank Road.

Table 8
Stormwater Flow Rate Summary

Control Area	5-Year Release Rate	5-Year Required Storage	100-Year Release Rate	100-Year Required Storage	100-Year Available Storage
	(L/s)	(m^3)	(L/s)	(m^3)	(m^3)
U1	3.1	0.0	6.6	0.0	0.0
U2	14.8	0.0	28.3	0.0	0.0
U3	17.7	0.0	37.8	0.0	0.0
METRO	24.2	55.5	31.9	126.8	317.5
RET A	7.5	10.7	10.0	25.3	73.6
A109	9.6	0.0	14.7	3.5	4.3
A110B	5.9	0.1	11.8	1.7	46.9
A110A	12.1	5.8	13.0	21.9	54.7
A104A	21.8	32.1	25.1	81.7	106.2
A104B	8.4	25.2	9.3	60.8	88.3
A108	8.3	26.1	9.1	62.8	106.1
A103A	18.4	5.5	19.5	19.9	89.2
A103B	7.9	7.6	8.3	21.6	76.9
A106 &, A107	31.8	48.2	37.7	138.0	138.3
Total	**191.2**	**216.9**	**263.1**	**563.9**	**1102.0**

It is anticipated that approximately ***563.9 m³*** of surface storage will be required on site to attenuate flow to the established release rate of ***263.4 L/s***; storage calculations are contained within ***Appendix D***. Sufficient surface storage is provided to satisfy the 100-year required storage.

"Enhanced" Quality control is provided by the Clarke Pond per the ***Clarke Pond Design Brief.*** Excerpts and figures extracted from the ***Clarke Pond Design Brief*** are included in ***Appendix D***.

5.4 Stormwater Servicing Conclusions

The subject site was contemplated in the ***HMBW Phase 2 Design Brief*** and ***HMBW Phase 2 SWM Report***. An allowalbe release rate of ***263.4 L/s*** is to be achieved with attenuation up to the 100-year storm event.

Controls are provided at each catch basin to restrict the total flow from the site to the allowable release rate. To attenuate flow to the allowable release rate, ***563.9 m³*** of surface storage is required.

Quality control is provided by the Clarke Pond at an enhanced protection level per the ***Clarke Pond Design Brief.***

The proposed stormwater design conforms to all relevant ***City Standards*** and Policies for approval.

6.0 UTILITIES

Gas and Hydro services currently exist within the Cambrian Road right-of-way. Utility servicing will be coordinated with the individual utility companies prior to site development.

The proposed development will be coordinated and approved by the utility company having jurisdiction.

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. During construction the extent of erosion losses is exaggerated due to the removal of vegetation and the top layer of soil becoming agitated.

Prior to topsoil stripping, earthworks or underground construction, erosion and sediment controls will be implemented and will be maintained throughout construction.

Silt fence will be installed around the perimeter of the site and will be cleaned and maintained throughout construction. Silt fence will remain in place until the working areas have been stabilized and re-vegetated.

Catch basins will have SILTSACKs or an approved equivalent installed under the grate during construction to protect from silt entering the storm sewer system.

A mud mat will be installed at the construction access in order to prevent mud tracking onto adjacent roads.

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents:

- Limit extent of exposed soils at any given time;
- Re-vegetate exposed areas as soon as possible;
- Minimize the area to be cleared and grubbed;
- Protect exposed slopes with plastic or synthetic mulches;
- Install silt fence to prevent sediment from entering existing ditches;
- No refueling or cleaning of equipment near existing watercourses;
- Provide sediment traps and basins during dewatering;
- Install filter cloth between catch basins and frames;
- Plan construction at proper time to avoid flooding; and
- Establish material stockpiles away from watercourses, so that barriers and filters may be installed.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

- Verification that water is not flowing under silt barriers; and
- Clean and change filter cloth at catch basins.

8.0 CONCLUSION AND RECOMMENDATIONS

David Schaeffer Engineering Ltd. (DSEL) has been retained by Metro Canada Inc. to prepare a Site Servicing and Stormwater Management report in support of the application for a Site Plan Control (SPC) at 3831 Cambrian Road. The preceding report outlines the following:

- The watermain boundary conditions have been requested from the City of Ottawa, however they were unavailable at the time of this publication. It is anticipated that there will be an estimated maximum available pressure of ***597.7 kPa*** and that the minimum required pressure to meet maximum day and fire flow demands is ***175.9 kPa***;
- The FUS method for estimating fire flow indicated ***6,000 L/min*** is required for Phase 1 of the contemplated development;
- The contemplated development is anticipated to have a peak wet weather flow of ***2.10 L/s***; Based the ***BSMSS*** the existing municipal sewer infrastructure has sufficient capacity to support the development;
- Storm water quantity controls are proposed per the subdivision design, a maximum release rate of ***263.4 L/s*** is required and provided through the use of ICD's. Flow attenuation to be provided up to the 100-year storm event;
- It is proposed to attenuate flow through rooftop and surface storage. It is anticipated that ***563.9 m^3*** of onsite surface storage will be required to attenuate flow to the established release rate above;
- Quality control is provided by the Clarke Pond at an enhanced protection level per the ***Clarke Pond Design Brief.***

Prepared by,
David Schaeffer Engineering Ltd.

Per: Genavieve Greenberg

Per: Steven L. Merrick, P.Eng

Per: Brandon N. Chow

APPENDIX A

Pre-Consultation

Genavieve Greenberg

From: Jaime Posen <posen@fotenn.com>
Sent: Friday, June 5, 2020 5:23 PM
To: Wayne Williams; Antony Cannell
Cc: Bria Aird; Fel Petti; Christopher Gordon
Subject: FW: Metro pre-consult - 3831 Cambrian Rd
Attachments: Pre-con Study and Plan Identification List.pdf; 3831 Cambrian Design Brief.pdf

Hello team,

Please see below and attached for the meeting minutes from the pre-application consultation meeting with the City of Ottawa for 3831 Cambrian Road.

After scanning the comments, I didn't see anything dramatically different than what was shared with us in the meeting, but please let me know if anything stands out as being problematic.

Mélanie also advised that Frank McKinney had shared a link with Chris Gordon to download some material related to the EAs for the surrounding roads.

Hope that's helpful, have a great weekend.

Jaime Posen, MCIP RPP
Senior Planner
T 613.730.5709 ext. 236

From: Gervais, Melanie <Melanie.Gervais@ottawa.ca>
Sent: June 4, 2020 3:48 PM
To: Jaime Posen <posen@fotenn.com>
Subject: Metro pre-consult - 3831 Cambrian Rd

Hi Jaime,

Please find below a recap of our pre-consultation meeting. Please note that during the COVID-19 pandemic the department is accepting electronic applications. Please send pdfs of your submission material (including a scanned copy of the application form) to planningcirculations@ottawa.ca (and cc myself). They will create the file number and upload the files to the proper location. Following the receipt of the electronic submission I will send you an email with your new file number and the new process for submitting payment.

Planning:

You will need to submit a New - Complex Site Plan application with a fee of $35,487.53 + engineering review fees + $1,015 (Conservation Authority fee).

The property is zoned GM[2340]-h which stands for General Mixed Use Zone Exception 2340 with a holding, the zoning provisions for Mixed Use Zone can be found here and all the provisions for parking lots can be found here. Please note that the holding zone can be lifted given that the Clarke Pond is operational.

The site is also with the Community Core in the Barrhaven South CDP. The CDP speaks to a Community Core Concept Plan and Design Framework which was completed by FoTenn and previously sent to you. Please ensure that the Planning Rationale indicated how the design elements identified in the plan have been met (Built Form, Architecture, and Land Use / Landscape and the Environment / Pedestrians and Cyclists / Vehicles and Parking…).

Proper landscaping will be required on site. This includes the addition of trees along the street edge, within landscape buffers and landscaped islands... Please note that all Landscape Plans need to be stamped by a Landscape Architect.

The Planning Rationale will have to explain the proposal, review the applicable Official Plan and CDP policies, review the applicable Zoning By-law provisions and review the Accessibility Design Standards.

The adjacent property to the south is the Dowitcher Park.

Please see the attached list identifying the submission requirements. Although the list identifies numbers of paper copies these are **not** required at this time.

Design:

More information is necessary to provide design comments and will be detailed in the Design Brief. Some of these will include:

- More details of the surrounding context and how it connects and supports it. (Using page 20 in the Community Design Plan as a guide for the extent of context requested);
- Additional details regarding the landscaping approach (Interim and future);
- How pedestrians will be directed across and through the site;
- How direct adjacency to the park will be considered and any negative impacts from the loading and access road will be mitigated;
- How the buildings will related to the streetscape with active entrances/facades etc. especially when the interim road is removed;

We recommend the site plan illustrate a future design that shows what will replace the interim road. The final design layout should illustrate the mediating solutions to achieve the ten-year plan (especially regarding building placement) when the interim access road that will separate the buildings from the future road is removed;

Please see the Design Brief Terms of Reference provided.

Forestry:

Soil volume is fundamental to the success of newly planted trees. Please ensure newly planted trees have an adequate soil volume for their size at maturity. The following is a table of recommended minimum soil volumes:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)

Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

Plant for survival to maturity - choose the right species that for the site and one that will contribute to the design and function of the built site, ensure that salt tolerant species are selected for high salt areas.

Transportation:

- Follow Traffic Impact Assessment Guidelines
    - Please begin the TIA report (Steps 1-3 must be submitted and approved prior to application or it will be deemed incomplete).
        - https://ottawa.ca/en/transportation-impact-assessment-guidelines
- Noise Impact Studies required for the following:
    - Stationary (any exposed mechanical equipment and loading zone) due to the proximity to neighboring noise sensitive land uses.
- Temporary access road on Greenbank will be permitted.
- Ensure that the Cambrian and Greenbank EAs are followed for right of way requirements and the intersection control at Cambrian and Greenbank temporary road.
- All maintenance of the temporary road will be at the applicant's expense.
- On site plan:
    - Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
    - Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions).
    - Show all curb radii measurements; ensure that all curb radii are reduced as much as possible
    - Show lane/aisle widths.
    - Ensure pedestrian connections are provided on the site.
    - Grey out any area that will not be impacted by this application.
- AODA legislation (link) is in effect for all organizations, please ensure that the design conforms to these standards, see attached checklist for guidance.

For any transportation questions, please contact Mike Giampa (Mike.Giampa@ottawa.ca).

Transportation Planning (Frank McKinney):

- Although we are not opposed to a complete throw away of the temporary access road, it would be best if we could find a way to prevent this as much as possible.
- Metro will be required to restore the boulevard.
- The timing of realigned Greenbank from Jockvale to Cambrian Rd is 2031 while south of Cambrian Rd is still to be determined through the next TMP.

- Once realigned Greenbank is constructed up to Cambrian Rd, how will the temporary access tie up to the intersection?
- Please hide parking as much as possible

We are having problems locating the microstation files for the Cambrian Road Widening. Frank McKinney will send all information on to Chris Gordon as soon as it is available.

Please note that an email was sent to Patrick Sammon in ISD concerning the design for realigned Greenbank but he is unfortunately away from the office. We will provide you with more information on this as soon as possible and hopefully be able to provide you with more information on how the tie-in to the future intersection should be.

<u>Engineering</u>:

Water

Water District Plan No: 362-012
Existing public services:

- Cambrian Road – 406 mm PVC

- Service areas with a basic demand greater than 50 m^3/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.
- District Metering Area Chambers are required for services 150mm or greater in diameter.
- A water meter sizing questionnaire [water card] will have to be completed prior to receiving a water permit (water card will be provided post approval)

Boundary conditions:
Civil consultant must request boundary conditions from the City's assigned Project Manager prior to first submission.

- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:
  - Location of service(s)
  - Type of development and the amount of fire flow required (as per FUS, 1999).
  - Average daily demand: ___ l/s.
  - Maximum daily demand: ___l/s.
  - Maximum hourly daily demand: ___ l/s.
- Fire protection (Fire demand, Hydrant Locations)
- A water meter sizing questionnaire [water card] will have to be completed prior to receiving a water permit (water card will be provided post approval)

Sanitary Sewer

Existing public services:

- Cambrian Road – 500 mm Conc.

- A monitoring manhole is required on private property.
- The sanitary sewer design has assumed a flow of 0.00058 m^3/s/ha area. The sewer design should demonstrate that the proposed development is within that design criteria or that additional demand can be accommodated.

Storm Sewer

Existing public services:

- Future Greenbank Road – 2550 mm Conc. Currently this storm sewer has been constructed to just south of Cambrian.
  - The outlet to the Clark Pond and the stormwater network north of Cambrian Road have been constructed by Mattamy as part of the Half Moon Bay West development. The stormwater

network ends just south of Cambrian Road and there are no immediate plans to extend the sewer south of Cambrian Road prior to the construction of the Future Greenbank Road.
    - The Zoning Hold can be lifted now that the Clarke Pond is operational.
- Cambrian Road – 375 mm PVC (South) – not designed for drainage from subject site
- Cambrian Road – 525 mm Conc (North) – not designed for drainage from subject site

Stormwater Management

Quality Control:
- Rideau Valley Conservation Authority to confirm quality control requirements.

Quantity Control:
- Master Servicing Study:
    - Barrhaven South Creek Subwatershed Study (Jock River Reach 1)
    - Barrhaven South Master Servicing Study Oct 2017
    - Half Moon Bay West Subdivision
- Allowable Run-off Coefficient: C = 0.64
- Time of concentration (Tc): Tc = pre-development; maximum Tc = 21.5 min
- Allowable flowrate: Control the 100-year storm events to the 5-year storm event

Ministry of Environment, Conservation and Parks (MECP)

All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

a. Consultant determines if an approval for sewage works under Section 53 of OWRA is required. Consultant determines what type of application is required and the City's project manager confirms. (If the consultant is not clear if an ECA is required, they will work with the City to determine what is required. If unclear or there is a difference of opinion the City Project Manager will coordinate requirements with MECP).
b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
c. Pre-consultation is not required if applying for standard or additional works (Schedule A of the Agreement) under Transfer Review.
d. Pre-consultation with local District office of MECP is recommended for direct submission.
e. Consultant completes an MECP request form for a pre-consultation. Sends request to moeccottawasewage@ontario.ca
f. ECA applications are required to be submitted online through the MECP portal. A business account required to submit ECA application. For more information visit https://www.ontario.ca/page/environmental-compliance-approval

NOTE: Site Plan Approval is required before any MECP application is signed

General Service Design Comments

- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.
- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.
- Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstration minimum separation distances. A watermain crossing table may be provided.

Other

Are there are Capital Works Projects scheduled that will impact the application? ☐ **Yes** ☒ **No**

References

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.

CREO (Corporate Real Estate Office)

Please provide a sketch showing area and dimensions of the portion of future Greenbank Road that want to lease for their access road. CREO will then undertake a circulation to all City departments and utility companies to determine if there are any objections to entering into a license with Metro.

CREO will need to seek Legal advice as to whether a license is appropriate in this case or whether it should be a lease given that it appears that you will be occupying City land for many years.

If you or the Metro consultant should provide some background and anticipated works to be completed on the property.

Once CREO receive the sketch and information, a request for an appraisal will be done.

RVCA

The RVCA would be looking for water quality protection of 80% TSS removal on-site as part of Site Plan.

****

Please refer to the links to "Guide to preparing studies and plans" and fees for general information. Additional information is available related to building permits, development charges, and the Accessibility Design Standards. Be aware that other fees and permits may be required, outside of the

development review process. You may obtain background drawings by contacting informationcentre@ottawa.ca (613-580-2424 ext. 44455).

All required plans are to be submitted utilizing a reasonable and appropriate metric scale as per City of Ottawa Servicing and Grading Plan Requirements: title blocks are to be placed on the right of the sheets and not along the bottom. Engineering plans may be combined, but the Site Plans must be provided separately. Plans shall include the survey monument used to confirm datum. Information shall be provided to enable a non-surveyor to locate the survey monument presented by the consultant.

All required plans & reports are to be provided in *.pdf format (at application submission and for any, and all, re-submissions).

These pre-consultation comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change.

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

Regards,

Mélanie Gervais *MCIP, RPP*
Planner / Urbaniste
Development Review /
Examen des demandes d'aménagement
Planning, Infrastructure and Economic Development Department /
Services de la planification, de l'infrastructure et du développement économique
City of / Ville d'Ottawa
110, avenue Laurier Avenue West / Ouest,
4th Floor / 4ième étage
Ottawa, ON K1P 1J1
Tel. : 613-580-2424 ext. 24025
Fax / Télécopieur : 613-580-2576
E-mail / Courriel : Melanie.Gervais@ottawa.ca
Mail Code: 01-14

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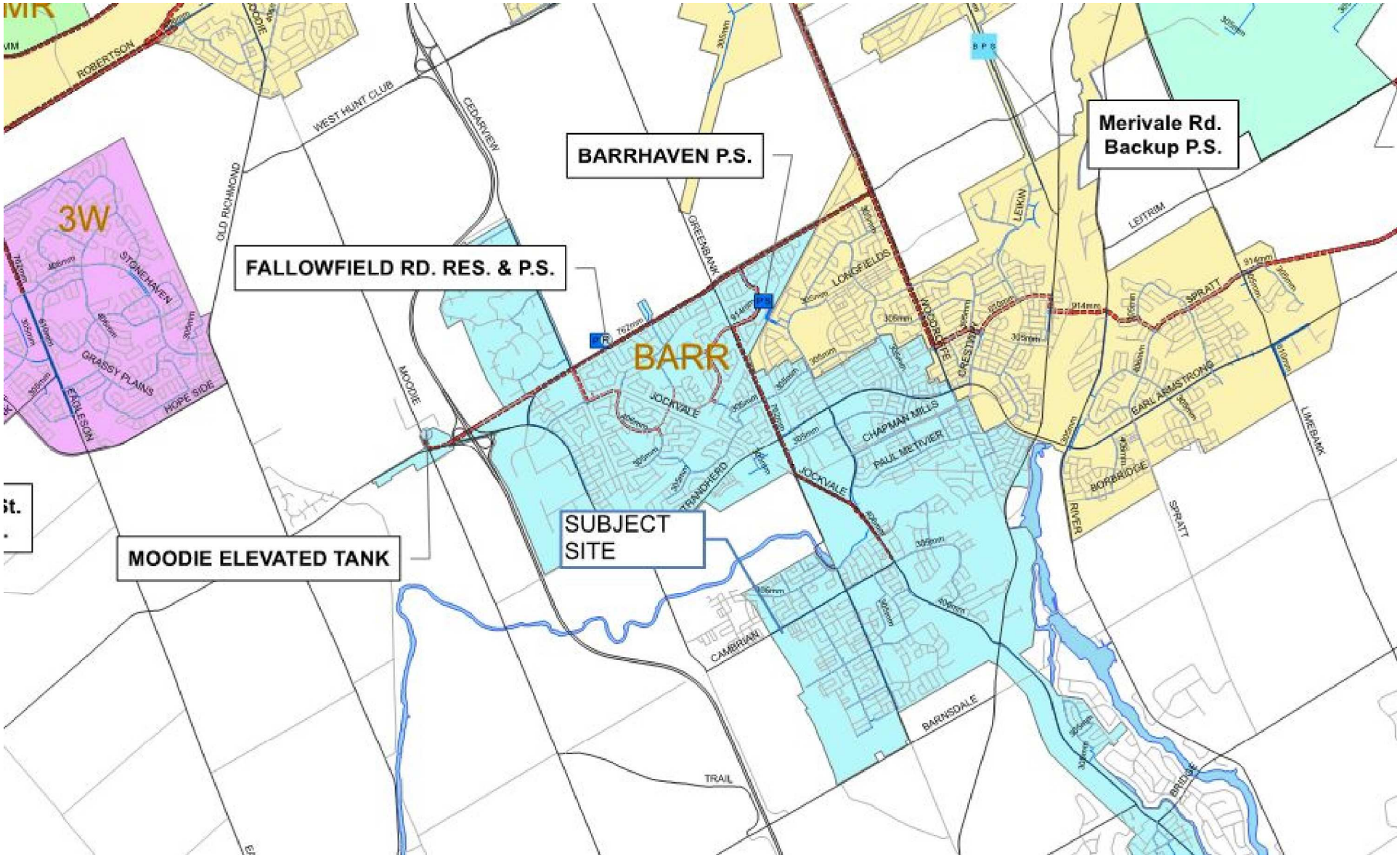
APPENDIX B

Water Supply

Pressure Zone Map



Metro Canada Inc.
3831 Cambrian Road
Proposed Site Phase 1 Conditions

Water Demand Design Flows per Unit Count
City of Ottawa - Water Distribution Guidelines, July 2010

Institutional / Commercial / Industrial Demand

			Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**	**Units**	**m^3/d**	**L/min**	**m^3/d**	**L/min**	**m^3/d**	**L/min**
Metro	2.5 $L/m^2/d$	4,024	10.06	7.0	15.1	10.5	27.2	18.9
Retail A	2.5 $L/m^2/d$	929	2.32	1.6	3.5	2.4	6.3	4.4
	Total I/CI Demand		12.4	8.6	18.6	12.9	33.4	23.2
	Total Demand		**12.4**	**8.6**	**18.6**	**12.9**	**33.4**	**23.2**

Metro Canada Inc.
3831 Cambrian Road
Proposed Site Ultimate Conditions

Water Demand Design Flows per Unit Count
City of Ottawa - Water Distribution Guidelines, July 2010

Institutional / Commercial / Industrial Demand

			Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**	**Units**	**m^3/d**	**L/min**	**m^3/d**	**L/min**	**m^3/d**	**L/min**
Metro	2.5 $L/m^2/d$	4,024	10.06	7.0	15.1	10.5	27.2	18.9
Retail A	2.5 $L/m^2/d$	929	2.32	1.6	3.5	2.4	6.3	4.4
2-Storey Retail	2.5 $L/m^2/d$	1,060	2.65	1.8	4.0	2.8	7.2	5.0
Retail B	2.5 $L/m^2/d$	830	2.08	1.4	3.1	2.2	5.6	3.9
	Total I/CI Demand		17.1	11.9	25.7	17.8	46.2	32.1
	Total Demand		**17.1**	**11.9**	**25.7**	**17.8**	**46.2**	**32.1**

Metro Canada Inc.
3831 Cambrian Road
Proposed Site Conditions
Metro Retail A (Phase 1)

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required

1. Base Requirement

$$F = 220C\sqrt{A}$$ L/min *Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area*

Type of Construction: Non-Combustible Construction

C	0.8		*Type of Construction Coefficient per FUS Part II, Section 1*
A	4,953	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	12386.4	L/min	
	12000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%
Fire Flow	**10200.0 L/min**

3. Reduction for Sprinkler Protection

Sprinklered - Supervised	-50%
Reduction	**-5100 L/min**

4. Increase for Separation Distance

	Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC	
N	Non-Combustible	30.1m-45m	15	2	30	5%	
S	Non-Combustible	>45m	0	0	0	0%	
E	Non-Combustible	>45m	0	1	0	0%	
W	Non-Combustible	>45m	0	1	0	0%	
		% Increase				**5%**	*value not to exceed 75%*

Increase	**510.0 L/min**

Lw = Length of the Exposed Wall
Ha = number of storeys of the adjacent structure. Max 5 stories
LH = Length-height factor of exposed wall. Value rounded up.
EC = Exposure Charge

Total Fire Flow

Fire Flow	5610.0	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	6000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Notes:
-Type of construction, Occupancy Type and Sprinkler Protection information provided by _____.
-Calculations based on Fire Underwriters Survey - Part II

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required

1. Base Requirement

$F = 220C\sqrt{A}$ L/min *Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area*

Type of Construction: Non-Combustible Construction

C	0.8		*Type of Construction Coefficient per FUS Part II, Section 1*
A	830	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	5070.5	L/min	
	5000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%	
Fire Flow	**4250.0**	**L/min**

3. Reduction for Sprinkler Protection

Non-Sprinklered	0%	
Reduction	**0**	**L/min**

4. Increase for Separation Distance

	Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC	
N	Non-Combustible	>45m	0	0	0	0%	
S	Non-Combustible	>45m	0	0	0	0%	
E	Non-Combustible	>45m	0	0	0	0%	
W	Non-Combustible	30.1m-45m	30	1	30	5%	
		% Increase				**5%**	*value not to exceed 75%*

Increase	**212.5**	**L/min**

Lw = Length of the Exposed Wall
Ha = number of storeys of the adjacent structure. Max 5 stories
LH = Length-height factor of exposed wall. Value rounded up.
EC = Exposure Charge

Total Fire Flow

Fire Flow	4462.5	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	4000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Notes:
-Type of construction, Occupancy Type and Sprinkler Protection information provided by _____.
-Calculations based on Fire Underwriters Survey - Part II

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required

1. Base Requirement

$F = 220C\sqrt{A}$ L/min *Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area*

Type of Construction: Non-Combustible Construction

C	0.8		*Type of Construction Coefficient per FUS Part II, Section 1*
A	1,060	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	5730.1	L/min	
	6000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%	
Fire Flow	**5100.0**	**L/min**

3. Reduction for Sprinkler Protection

Non-Sprinklered	0%	
Reduction	**0**	**L/min**

4. Increase for Separation Distance

	Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC	
N	Non-Combustible	>45m	0	0	0	0%	
S	Non-Combustible	>45m	0	0	0	0%	
E	Non-Combustible	>45m	0	0	0	0%	
W	Non-Combustible	30.1m-45m	40	1	40	5%	
		% Increase				**5%**	*value not to exceed 75%*

Increase	**255.0**	**L/min**

Lw = Length of the Exposed Wall
Ha = number of storeys of the adjacent structure. Max 5 stories
LH = Length-height factor of exposed wall. Value rounded up.
EC = Exposure Charge

Total Fire Flow

Fire Flow	5355.0	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section 4*
	5000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Notes:
-Type of construction, Occupancy Type and Sprinkler Protection information provided by _____.
-Calculations based on Fire Underwriters Survey - Part II

through pressure control at the PSs. The key characteristics of each pump station in the system are provided in *Table 5.3*.

Table 5.3: Existing Water Pump Station Characteristics

Pump Station	Pressure Zone	Zone Type	Nominal Discharge HGL (m)	Total Capacity (MLD)[1]	Firm Capacity (MLD)[2]
Carlington 2W	2W	Open	131	68.0	34.0
Barrhaven Reservoir	BARR	Open	155	7.5	0.0
Ottawa South	3C	Closed	151	39.7	26.2
Billings Bridge	2C	Open	134	177.5	127.0
Britannia 2W	2W	Open	134	302.0	208.0
Glen Cairn	3W	Open	160	87.5	49.5
Forest Ridge	2E	Open	134	91.5	47.0
Lemieux	1W	Open	115	456.0	308.0
Fleet	1W	Open	115	279.0	189.0
Britannia 1W	1W	Open	115	328.0	213.0
Carlington ME	ME	Closed	154	13.5	5.5
Campeau	3W	Open	160	100.0	58.0
Hurdman	1E	Open	115	286.0	204.0
Barrhaven	BARR	Open	155	104.5	57.0
Orléans	2E	Open	134	93.4	64.5
Leitrim	4C	Closed	165	33.3	19.0
Montreal	MONT	Closed	148	39.4	21.9
Brittany	MONT	Closed	148	8.1	2.6
Morgan's Grant	MG	Closed	145	17.7	12.3

Source: Pressure Zone Operation Manuals
HGL = Hydraulic Grade Line (a number that reflects both the elevation of the pump station, and the station discharge pressure)
MLD = Million Litres per Day
BARR = Barrhaven
MONT = Montreal
ME = Meadowlands
MG = Morgan's Grant

1. The nominal capacity of the station with all pumps in operation.
2. Total capacity of the station less the capacity of the largest pump. Typically, pump stations are designed to provide a firm capacity that is at least equal to the expected water system demand at the planning horizon.

5.2.1.3 Water Storage Facilities

Water storage facilities are strategically located throughout the distribution system to augment supply during high water demand periods and fire flow conditions, and to increase the reliability of water supply during system outages. During average water demand conditions, pumps are operated to allow frequent turnover of water within each facility to keep the water fresh. The key characteristics of each of the storage facilities are provided in *Table 5.4*.

EPANET Model Inputs

```
[TITLE]


[JUNCTIONS]
;ID                     Elev            Demand          Pattern
 Metro                  94.22           7                                      ;
 2                      94.10           0                                      ;
 RetA                   94.07           1.6                                    ;
 hyd1                   94.06           0                                      ;
 RetC                   94.00           1.8                                    ;
 RETB                   94.25           1.4                                    ;
 hyd2                   93.87           0                                      ;

[RESERVOIRS]
;ID                     Head            Pattern
 7                      155                                    ;
 1                      155                                    ;

[TANKS]
;ID                     Elevation       InitLevel       MinLevel        MaxLevel
Diameter        MinVol          VolCurve

[PIPES]
;ID                     Node1                   Node2                   Length
Diameter        Roughness       MinorLoss       Status
 1                      RETB                    2                       136.5
200             110             1.4             Open    ;
 2                      2                       Metro                   101.65
200             110             3.4             Open    ;
 3                      2                       RetA                    28.5
200             110             0.6             Open    ;
 4                      RetA                    hyd1                    7.9
200             110             0.6             Open    ;
 5                      hyd1                    hyd2                    75.1
200             110             1.6             Open    ;
 9                      RetC                    1                       40
200             110             2               Open    ;
 10                     RETB                    7                       40
200             110             2.0             Open    ;
 6                      hyd2                    RetC                    27.3
200             110             0.8             Open    ;

[PUMPS]
;ID                     Node1                   Node2                   Parameters

[VALVES]
;ID                     Node1                   Node2                   Diameter
Type    Setting         MinorLoss

[TAGS]
```

EPANET Model Inputs

```
[DEMANDS]
;Junction                Demand          Pattern                  Category

[STATUS]
;ID                      Status/Setting

[PATTERNS]
;ID                      Multipliers

[CURVES]
;ID                      X-Value         Y-Value

[CONTROLS]

[RULES]

[ENERGY]
 Global Efficiency      75
 Global Price           0
 Demand Charge          0

[EMITTERS]
;Junction                Coefficient

[QUALITY]
;Node                    InitQual

[SOURCES]
;Node                    Type            Quality         Pattern

[REACTIONS]
;Type           Pipe/Tank               Coefficient


[REACTIONS]
 Order Bulk             1
 Order Tank             1
 Order Wall             1
 Global Bulk            0
 Global Wall            0
 Limiting Potential     0
 Roughness Correlation  0

[MIXING]
;Tank                    Model

[TIMES]
 Duration               0
 Hydraulic Timestep     1:00
```

EPANET Model Inputs

```
 Quality Timestep       0:05
 Pattern Timestep       1:00
 Pattern Start          0:00
 Report Timestep        1:00
 Report Start           0:00
 Start ClockTime        12 am
 Statistic              None

[REPORT]
 Status                 No
 Summary                No
 Page                   0

[OPTIONS]
 Units                  LPM
 Headloss               H-W
 Specific Gravity       1
 Viscosity              1
 Trials                 40
 Accuracy               0.001
 CHECKFREQ              2
 MAXCHECK               10
 DAMPLIMIT              0
 Unbalanced             Continue 10
 Pattern                1
 Demand Multiplier      1
 Emitter Exponent       0.5
 Quality                None mg/L
 Diffusivity            1
 Tolerance              0.01

[COORDINATES]
;Node                   X-Coord                Y-Coord
 Metro                  2805.56                8311.11
 2                      1616.67                5644.44
 RetA                   2661.11                5655.56
 hyd1                   3061.11                5644.44
 RetC                   4127.78                2511.11
 RETB                   1483.33                2544.44
 hyd2                   4127.78                3966.67
 7                      1494.44                1211.11
 1                      4105.56                1266.67

[VERTICES]
;Link                   X-Coord                Y-Coord
 1                      1483.33                5533.33
 2                      1627.78                8277.78
 2                      1716.67                8366.67
 2                      2816.67                8377.78
 5                      4105.56                5644.44
```

EPANET Model Inputs

```
 5                     4161.11                 5544.44

[LABELS]
;X-Coord           Y-Coord          Label & Anchor Node

[BACKDROP]
 DIMENSIONS            0.00                    0.00                    10000.00
        10000.00
 UNITS                 None
 FILE                  Z:\Projects\19-1135_Metro - Greenbank
Rd\B_Design\B1_Analysis\B1-5_Water\EPANet\Background\2020-07-28_Greenbank-Metro_spa_
base-fig-11x17.bmp
 OFFSET                0.00                    0.00

[END]
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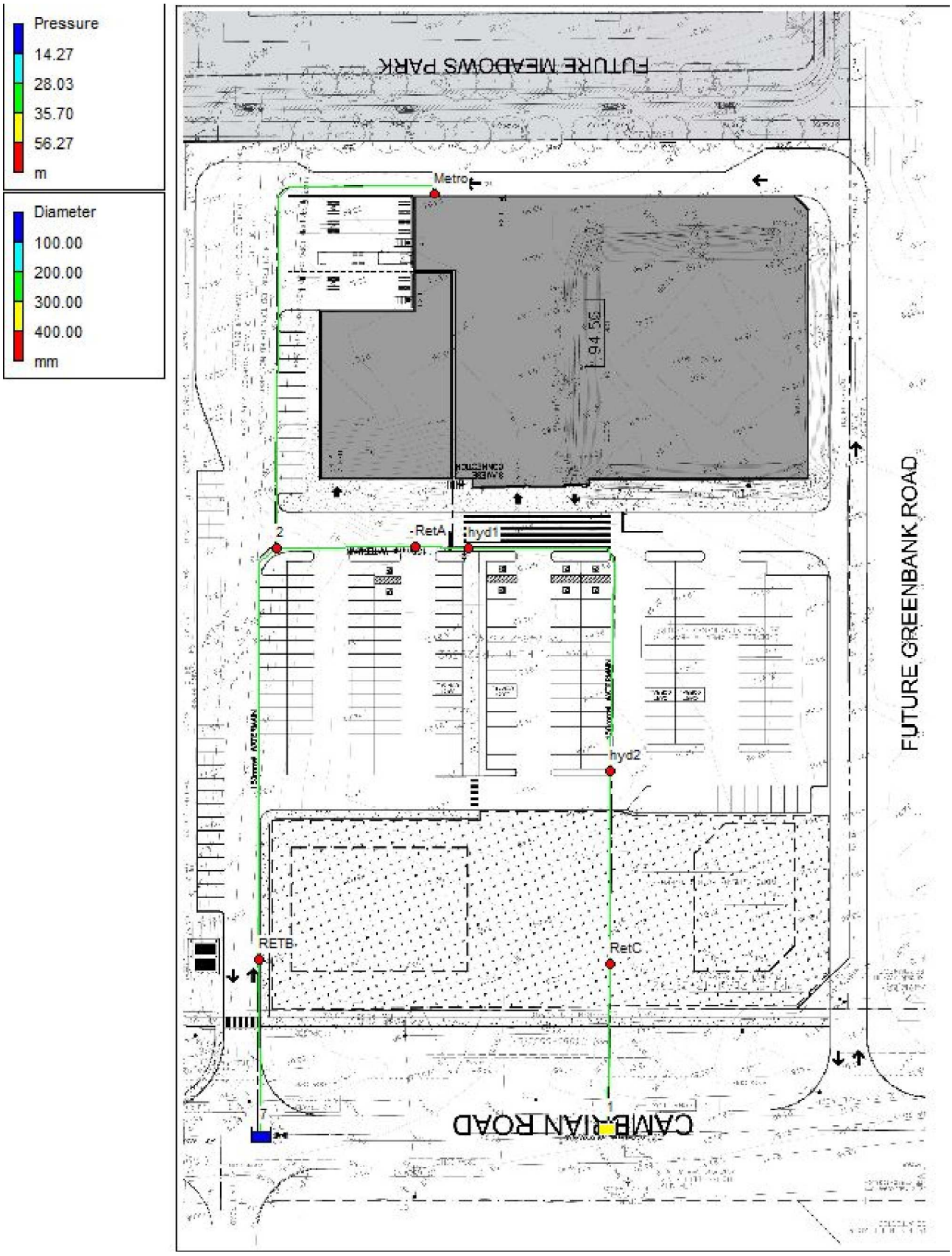
Average Day Figure



```
******************************************************************************
*                            E P A N E T                                     *
*                     Hydraulic and Water Quality                            *
*                     Analysis for Pipe Networks                             *
*                          Version 2.0                                       *
******************************************************************************

Input File: 1135_Peak-Hour.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	200
3	2	RetA	28.5	200
4	RetA	hyd1	7.9	200
5	hyd1	hyd2	75.1	200
9	RetC	1	40	200
10	RETB	7	40	200
6	hyd2	RetC	27.3	200

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	18.90	155.00	60.78	0.00	
2	0.00	155.00	60.90	0.00	
RetA	4.40	155.00	60.93	0.00	
hyd1	0.00	155.00	60.94	0.00	
RetC	5.00	155.00	61.00	0.00	
RETB	3.90	155.00	60.75	0.00	
hyd2	0.00	155.00	61.13	0.00	
7	-15.59	155.00	0.00	0.00	Reservoir
1	-16.61	155.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	11.69	0.01	0.00	Open
2	18.90	0.01	0.00	Open
3	-7.21	0.00	0.00	Open
4	-11.61	0.01	0.00	Open

```
******************************************************************
*                          E P A N E T                           *
*                  Hydraulic and Water Quality                   *
*                  Analysis for Pipe Networks                    *
*                        Version 2.0                             *
******************************************************************
```

Input File: 1135_Avg-Day.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	150
3	2	RetA	34.1	200
4	RetA	hyd1	2.3	200
5	hyd1	RetC	102.4	200
9	RetC	1	40	200
10	RETB	7	40	200
6	1	exhyd	3.5	400

Node Results:

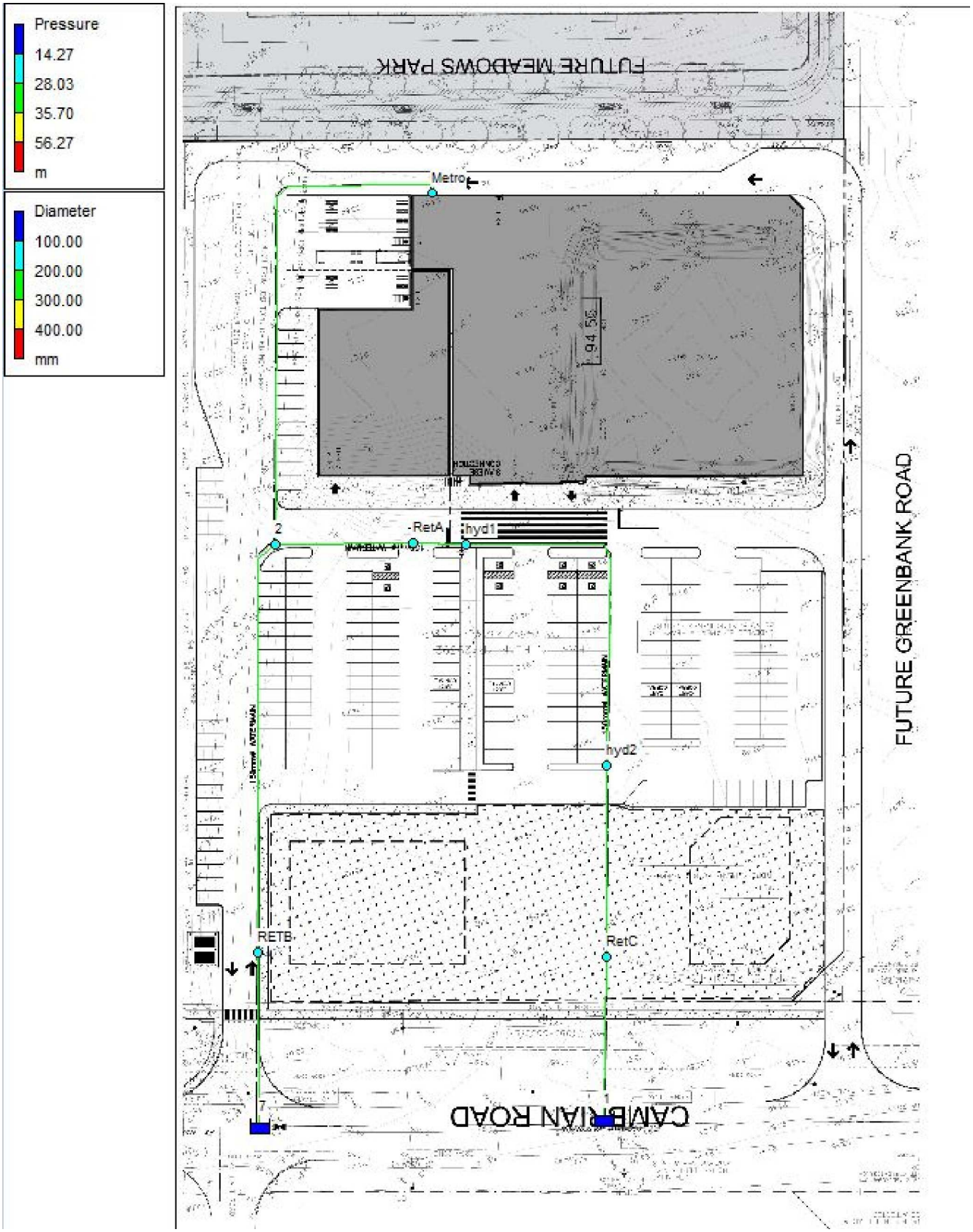
Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	7.00	155.00	60.78	0.00	
2	0.00	155.00	60.90	0.00	
RetA	1.60	155.00	60.93	0.00	
hyd1	0.00	155.00	60.94	0.00	
RetC	1.80	155.00	61.00	0.00	
RETB	1.40	155.00	60.75	0.00	
exhyd	0.00	155.00	61.40	0.00	
7	-5.68	155.00	0.00	0.00	Reservoir
1	-6.13	155.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	4.28	0.00	0.00	Open
2	7.00	0.01	0.00	Open
3	-2.72	0.00	0.00	Open
4	-4.32	0.00	0.00	Open

5	-4.32	0.00	0.00	Open
9	-6.12	0.00	0.00	Open
10	-5.68	0.00	0.00	Open
6	0.00	0.00	0.00	Open

Maximum Day + Fire Flow Figure



```
******************************************************************
*                          E P A N E T                           *
*                  Hydraulic and Water Quality                   *
*                  Analysis for Pipe Networks                    *
*                        Version 2.0                             *
******************************************************************

Input File: 1135_Max-Day+FF.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	200
3	2	RetA	28.5	200
4	RetA	hyd1	7.9	200
5	hyd1	hyd2	75.1	200
9	RetC	1	40	200
10	RETB	7	40	200
6	hyd2	RetC	27.3	200

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	10.50	109.18	14.96	0.00	
2	0.00	109.18	15.08	0.00	
RetA	2.40	108.73	14.66	0.00	
hyd1	5678.00	108.56	14.50	0.00	
RetC	2.80	110.82	16.82	0.00	
RETB	3.10	111.24	16.99	0.00	
hyd2	322.00	110.10	16.23	0.00	
7	-2664.36	112.00	0.00	0.00	Reservoir
1	-3354.44	112.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	2661.26	1.41	15.04	Open
2	10.50	0.01	0.00	Open
3	2650.76	1.41	16.02	Open
4	2648.36	1.41	21.51	Open

5	-3029.64	1.61	20.61	Open
9	-3354.44	1.78	29.56	Open
10	-2664.36	1.41	19.12	Open
6	-3351.64	1.78	26.18	Open

```
******************************************************************************
*                            E P A N E T                                     *
*                     Hydraulic and Water Quality                            *
*                     Analysis for Pipe Networks                             *
*                          Version 2.0                                       *
******************************************************************************

Input File: 1135_Peak-Hour.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	200
3	2	RetA	28.5	200
4	RetA	hyd1	7.9	200
5	hyd1	hyd2	75.1	200
9	RetC	1	40	200
10	RETB	7	40	200
6	hyd2	RetC	27.3	200

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	18.90	155.00	60.78	0.00	
2	0.00	155.00	60.90	0.00	
RetA	4.40	155.00	60.93	0.00	
hyd1	0.00	155.00	60.94	0.00	
RetC	5.00	155.00	61.00	0.00	
RETB	3.90	155.00	60.75	0.00	
hyd2	0.00	155.00	61.13	0.00	
7	-15.59	155.00	0.00	0.00	Reservoir
1	-16.61	155.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	11.69	0.01	0.00	Open
2	18.90	0.01	0.00	Open
3	-7.21	0.00	0.00	Open
4	-11.61	0.01	0.00	Open

```
*********************************************************************
*                            E P A N E T                            *
*                     Hydraulic and Water Quality                   *
*                     Analysis for Pipe Networks                    *
*                           Version 2.0                             *
*********************************************************************

Input File: 1135_Max-Day+FF.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	150
3	2	RetA	34.1	200
4	RetA	hyd1	2.3	200
5	hyd1	RetC	102.4	200
9	RetC	1	40	200
10	RETB	7	40	200
6	1	exhyd	3.5	400

Node Results:

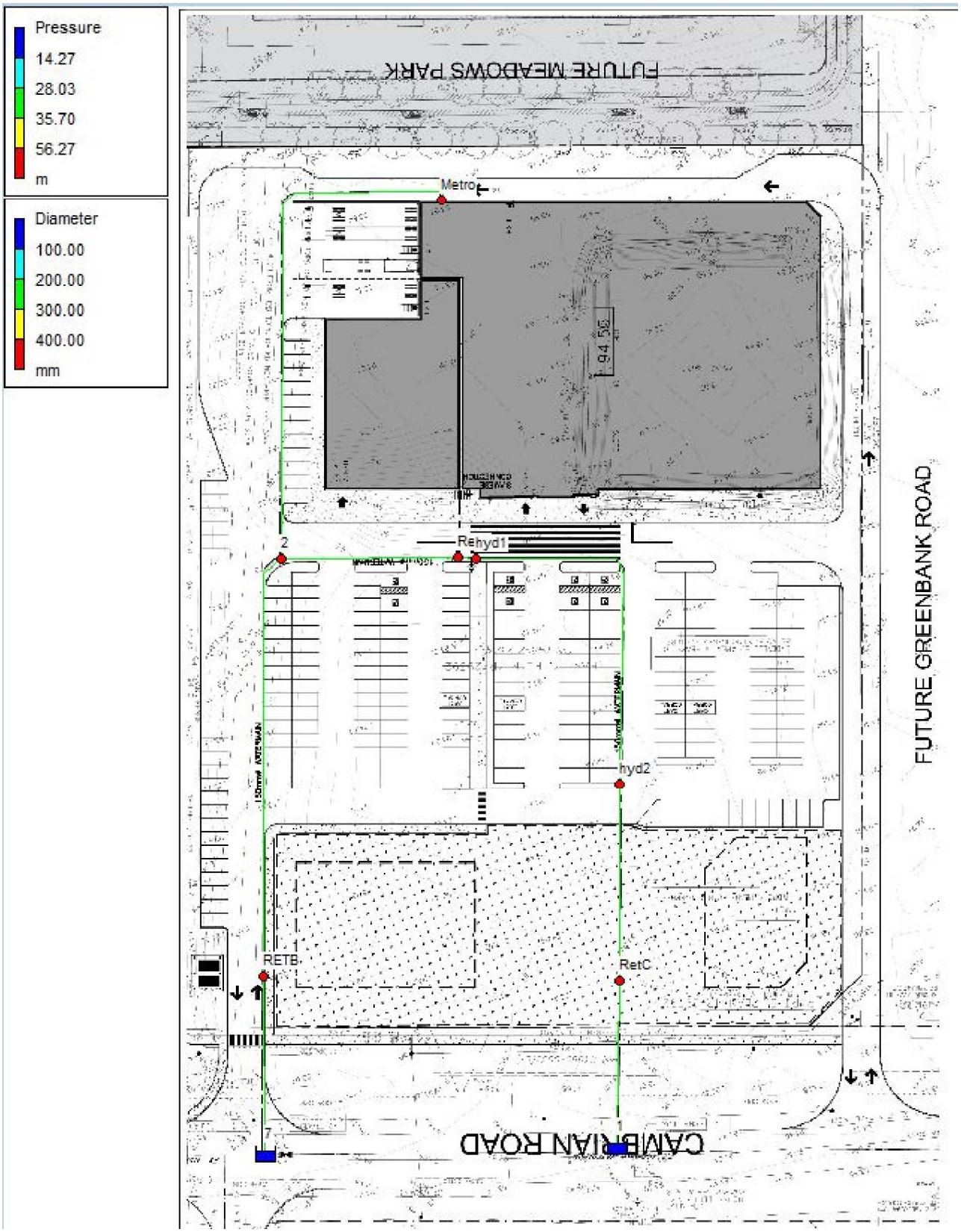
Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	10.50	109.38	15.16	0.00	
2	0.00	109.38	15.28	0.00	
RetA	2.40	108.88	14.81	0.00	
hyd1	5678.00	108.80	14.74	0.00	
RetC	2.80	110.96	16.96	0.00	
RETB	2.20	111.29	17.04	0.00	
exhyd	1322.00	112.00	18.40	0.00	
7	-2561.91	112.00	0.00	0.00	Reservoir
1	-4455.99	112.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	2559.71	1.36	13.99	Open
2	10.50	0.01	0.00	Open
3	2549.21	1.35	14.57	Open
4	2546.81	1.35	37.17	Open

5	-3131.19	1.66	21.12	Open
9	-3133.99	1.66	25.99	Open
10	-2561.91	1.36	17.75	Open
6	1322.00	0.18	1.01	Open

Peak Hour Figure



```
******************************************************************
*                          E P A N E T                           *
*                   Hydraulic and Water Quality                  *
*                   Analysis for Pipe Networks                   *
*                         Version 2.0                            *
******************************************************************
```

Input File: 1135_Peak-Hour.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	200
3	2	RetA	28.5	200
4	RetA	hyd1	7.9	200
5	hyd1	hyd2	75.1	200
9	RetC	1	40	200
10	RETB	7	40	200
6	hyd2	RetC	27.3	200

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	18.90	155.00	60.78	0.00	
2	0.00	155.00	60.90	0.00	
RetA	4.40	155.00	60.93	0.00	
hyd1	0.00	155.00	60.94	0.00	
RetC	5.00	155.00	61.00	0.00	
RETB	3.90	155.00	60.75	0.00	
hyd2	0.00	155.00	61.13	0.00	
7	-15.59	155.00	0.00	0.00	Reservoir
1	-16.61	155.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	11.69	0.01	0.00	Open
2	18.90	0.01	0.00	Open
3	-7.21	0.00	0.00	Open
4	-11.61	0.01	0.00	Open

5	-11.61	0.01	0.00	Open
9	-16.61	0.01	0.00	Open
10	-15.59	0.01	0.00	Open
6	-11.61	0.01	0.00	Open

```
******************************************************************
*                          E P A N E T                           *
*                   Hydraulic and Water Quality                  *
*                   Analysis for Pipe Networks                   *
*                         Version 2.0                            *
******************************************************************

Input File: 1135_Peak-Hour.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RETB	2	136.5	200
2	2	Metro	101.65	150
3	2	RetA	34.1	200
4	RetA	hyd1	2.3	200
5	hyd1	RetC	102.4	200
9	RetC	1	40	200
10	RETB	7	40	200
6	1	exhyd	3.5	400

Node Results:

Node ID	Demand LPM	Head m	Pressure m	Quality	
Metro	18.90	155.00	60.78	0.00	
2	0.00	155.00	60.90	0.00	
RetA	4.40	155.00	60.93	0.00	
hyd1	0.00	155.00	60.94	0.00	
RetC	5.00	155.00	61.00	0.00	
RETB	3.90	155.00	60.75	0.00	
exhyd	0.00	155.00	61.40	0.00	
7	-15.50	155.00	0.00	0.00	Reservoir
1	-16.70	155.00	0.00	0.00	Reservoir

Link Results:

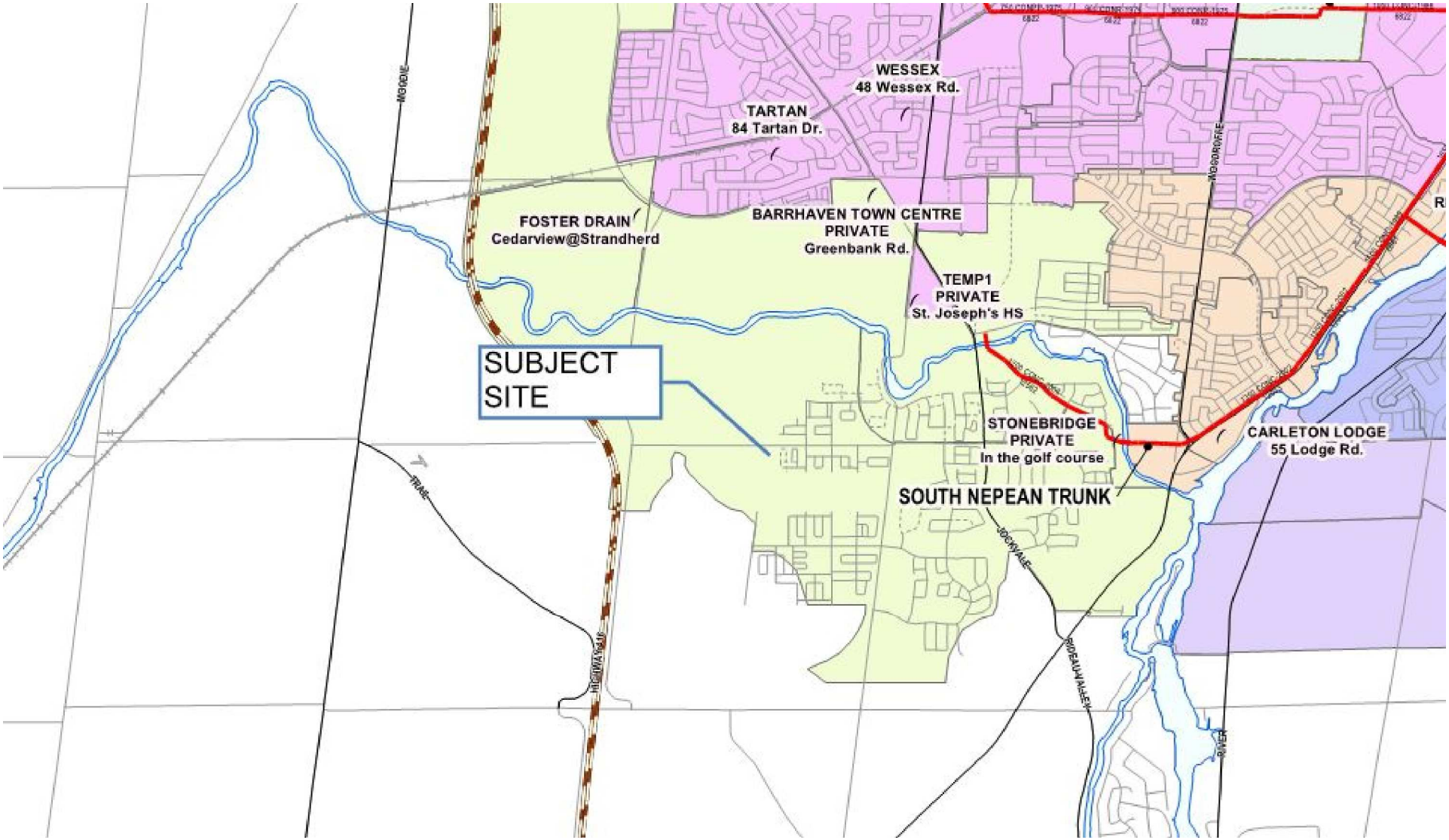
Link ID	Flow LPM	Velocity m/s	Unit Headloss m/km	Status
1	11.60	0.01	0.00	Open
2	18.90	0.02	0.01	Open
3	-7.30	0.00	0.00	Open
4	-11.70	0.01	0.00	Open

5	-11.70	0.01	0.00	Open
9	-16.70	0.01	0.00	Open
10	-15.50	0.01	0.00	Open
6	0.00	0.00	0.00	Open

APPENDIX C

Wastewater Collection

Sanitary Trunk Sewer and Collection Area Map



Metro Canada Inc.
3831 Cambrian Road
Proposed Site Conditions

Wastewater Design Flows per Unit Count
City of Ottawa Sewer Design Guidelines, 2004

Site Area 2.200 **ha**

Extraneous Flow Allowances

Infiltration / Inflow (Dry)	**0.11**	**L/s**
Infiltration / Inflow (Wet)	**0.62**	**L/s**
Infiltration / Inflow (Total)	**0.73**	**L/s**

Institutional / Commercial / Industrial Contributions

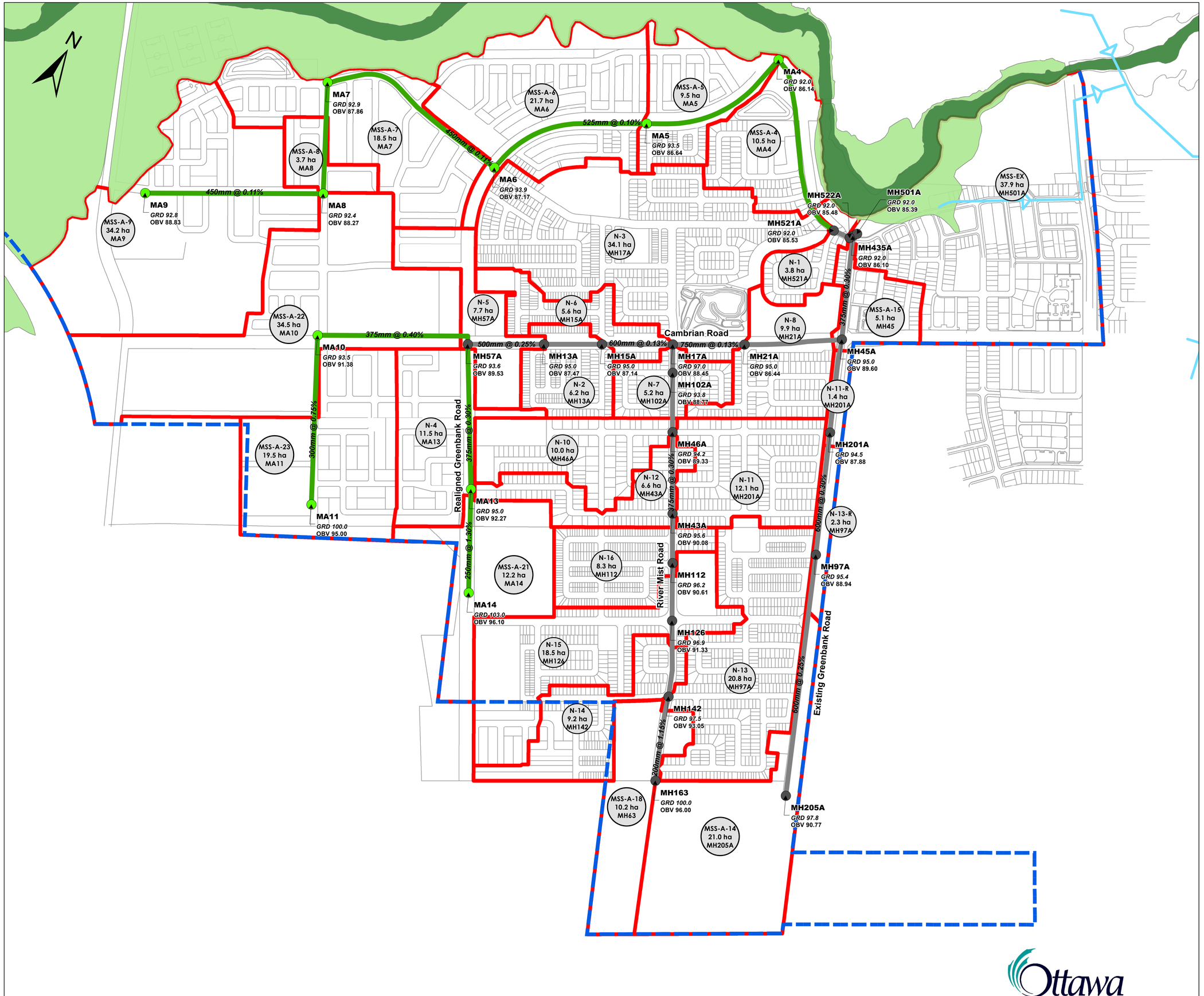
Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Metro	5 $L/m^2/d$	4,024	0.47
Retail A	5 $L/m^2/d$	929	0.11
Retail B	5 $L/m^2/d$	830	0.10
Retail C	5 $L/m^2/d$	1,060	0.12

Average I/C/I Flow	**0.79**
Peak Institutional / Commercial Flow	1.19
Peak I/C/I Flow	**1.37**

** assuming a 12 hour commercial operation*

*** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B*

Total Estimated Average Dry Weather Flow Rate	**0.90 L/s**
Total Estimated Peak Dry Weather Flow Rate	**1.48 L/s**
Total Estimated Peak Wet Weather Flow Rate	**2.10 L/s**



W:\active\1634_00999_Barrhaven_SUC_MSS_Update\planning\drawing\Sanitary\163400999-SAN-DRAWING4.mxd

Stantec

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

Legend

- BARRHAVEN SOUTH COMMUNITY BOUNDARY
- EXISTING NODES
- FUTURE NODES
- EXISTING SEWER
- FUTURE SEWER
- EXISTING SEWER (FROM 2007 MSS)
- RIVER
- 100 YEAR FLOOD PLAIN
- SANITARY DRAINAGE CATCHMENTS
- Area Name / Area (ha) / Manhole — SANITARY CATCHMENT INFORMATION

Node Name
Ground Elevation
Top Obvert Elevation

Notes

1 ISSUED FOR MSS ADDENDUM	LP	AP	14.11.28
Revision	By	Appd.	YY.MM.DD

File Name: 163400999-SAN-DRAWING4.MXD	LP	AP	LP	14.11.28
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

CITY OF OTTAWA

BARRHAVEN SOUTH MASTER SERVICING STUDY ADDENDUM

Ottawa, ON

Title

SANITARY SERVICING PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
163400999	1:5,000 (0 75 150 300 Meters)	A-4	4 of 9	1

Area:

BARRHAVEN SOUTH
MASTER SERVICING STUDY

DATE: 2017/09/29
REVISION: 2
DESIGNED BY: LP
CHECKED BY: /

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 163400999

Colour code: HMB values
Hard coded values — Most US MH
Caculated value — Estimated value
updated value — Value from subdivision design — MH receiving flow from 2 or more sewers

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 L/p/day	MINIMUM VELOCITY	0.60 m/s	As per CDP (units/ha)	
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	50,000 L/ha/day	MAXIMUM VELOCITY	3.00 m/s	LOW DENSITY RESIDENTIAL	26
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 L/ha/day	MANNINGS n	0.013	SEMI-DETACHED	52
PEAKING FACTOR (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B	TOWN HOUSES	82
PERSONS / SINGLE UNIT	3.4	INSTITUTIONAL	50,000 L/ha/day	MINIMUM COVER	2.50 m	APARTMENTS	120
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 L/s/ha			COMMUNITY CORE	60
PERSONS / APARTMENT	1.8					AVERAGE PERSONS/ha	107

LOCATION				RESIDENTIAL AREA AND POPULATION										COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE						
AREA ID NUMBER	Source	FROM M.H.	TO M.H.	DEV AREA	DEV POP	ADD'N RES AREA	ADD'N POP	TOTAL AREA	TOTAL POP	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
				(ha)		(ha)		(ha)		(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)		(%)	(L/s)	(%)	(m/s)	(m/s)
MSS-A-23		MA11	MA10	0.00	0	14.2	1,523	14.2	1,523	14.20	1,523	3.67	22.6	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	2.5	2.5	2	19.5	19.5	5.5	30.1	482.1	300	PVC	0.75	87.6	34%	1.20	1.08
MSS-A-22		**MA10**	MH57A	0.00	0	12.8	1,371	12.8	1,371	27.00	2,894	3.46	40.6	0.0	0.0	0.0	0.0	0.0	0.0	7.2	10.0	14.5	17.0	8.7	34.5	54.0	15.1	64.4	449.7	375	PVC	0.40	115.1	56%	1.01	1.04
Realigned Greenbank Road																																			
MSS-A-21		MA14	MA13	0.0	0	4.8	513	4.8	513	4.8	513	3.97	8.3	0.0	0.0	0.0	0.0	0.0	0.0	7.5	7.5	0.0	0.0	6.5	12.3	12.3	3.4	18.2	295.0	250	PVC	1.30	71.4	25%	1.40	1.12
N-4		**MA13**	MH57A	0.0	0	11.0	1,176	11.0	1,176	15.8	1,689	3.64	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.5	0.5	6.5	11.5	23.8	6.7	38.1	413.1	375	PVC	0.30	100.3	38%	0.88	0.81
Cambrian Road																																			
N-5		**MH57A**	MH13A	0.0	0	4.3	458	4.3	458	47.1	5,041	3.24	66.2	3.4	3.4	0.0	0.0	0.0	0.0	0.0	17.5	0.0	17.5	18.1	7.7	85.5	23.9	108.2	216.5	500	CPP	0.25	188.2	57%	0.96	0.99
N-2		**MH13A**	MH15A	6.2	631	0.0	3	6.2	634	53.3	5,675	3.19	73.3	0.0	3.4	0.0	0.0	0.0	0.0	0.0	17.5	0.0	17.5	18.1	6.2	91.7	25.7	117.1	165.2	500	CPP	0.20	168.6	69%	0.86	0.93
N-6		**MH15A**	MH17A	5.6	868	0.0	2	5.6	870	58.9	6,545	3.13	83.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	17.5	0.0	17.5	18.1	5.6	97.3	27.2	128.3	202.0	600	CPP	0.13	230.7	56%	0.79	0.81
River Mist Road																																			
MSS-A-18	Stantec	MH163	162	6.5	543	0.0	0	6.5	543	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	0.9	0.9	2.4	10.2	10.2	2.9	14.0	36.3	200	PVC	1.15	35.8	39%	1.12	1.04
	Stantec	162	161	0.0	0	0.0	0	0.0	0	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.9	2.4	0.0	10.2	2.9	14.0	87.2	250	PVC	1.15	67.3	21%	1.32	1.00
	Stantec	161	EX151	0.0	0	0.0	0	0.0	0	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.9	2.4	0.0	10.2	2.9	14.0	75.6	250	PVC	1.15	67.3	21%	1.32	1.00
	Stantec	EX151	MH142	0.0	0	0.0	0	0.0	0	6.5	543	3.96	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.9	2.4	0.0	10.2	2.9	14.0	44.4	300	PVC	1.40	119.0	12%	1.63	1.08
N-14	Stantec	**MH142**	EX139	8.2	825	1.0	102	9.2	927	15.7	1,470	3.69	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.9	2.4	9.2	19.4	5.4	29.8	74.8	300	PVC	0.40	63.5	47%	0.87	0.85
	Stantec	EX139	EX136	0.0	0	0.0	0	0.0	0	15.7	1,470	3.69	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.9	2.4	0.0	19.4	5.4	29.8	64.7	300	PVC	0.40	63.5	47%	0.87	0.85
	Stantec	EX136	MH126	0.0	0	0.0	0	0.0	0	15.7	1,470	3.69	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.9	2.4	0.0	19.4	5.4	29.8	78.9	300	PVC	0.41	64.2	46%	0.88	0.86
N-15	Stantec	**MH126**	EX123	16.5	954	0.0	0	16.5	954	32.2	2,424	3.52	34.6	0.0	0.0	0.0	0.0	0.0	0.0	2.1	4.9	0.0	0.9	4.3	18.6	38.0	10.6	49.5	71.3	375	PVC	0.45	122.0	41%	1.07	1.01
	Stantec	EX123	MH112	0.0	0	0.0	0	0.0	0	32.2	2,424	3.52	34.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	38.0	10.6	49.5	90.3	375	PVC	0.42	118.6	42%	1.04	0.99
N-16	Stantec	**MH112**	EX102	8.3	689	0.0	0	8.3	689	40.5	3,113	3.43	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	8.3	46.3	13.0	60.6	68.0	375	PVC	0.31	101.5	60%	0.89	0.93
	Stantec	EX102	EX101	0.0	0	0.0	0	0.0	0	40.5	3,113	3.43	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	46.3	13.0	60.6	34.0	375	PVC	0.29	98.0	62%	0.86	0.91
	IBI	EX101	MH43A	0.0	0	0.0	0	0.0	0	40.5	3,113	3.43	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	46.3	13.0	60.6	38.0	375	PVC	0.30	100.3	60%	0.88	0.92
N-12	IBI	**MH43A**	MH44A	6.6	352	0.0	0	6.6	352	47.1	3,465	3.39	47.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	6.6	52.9	14.8	66.7	81.0	375	PVC	0.30	100.3	67%	0.88	0.95
	IBI	MH44A	MH45A	0.0	0	0.0	0	0.0	0	47.1	3,465	3.39	47.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	52.9	14.8	66.7	64.0	375	PVC	0.30	100.3	67%	0.88	0.95
	IBI	MH45A	MH46A	0.0	0	0.0	0	0.0	0	47.1	3,465	3.39	47.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.9	4.3	0.0	52.9	14.8	66.7	85.0	375	PVC	0.30	100.3	67%	0.88	0.95
N-10	IBI	**MH46A**	MH47A	8.4	562	0.0	0	8.4	562	55.5	4,027	3.33	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	1.6	2.5	4.3	10.0	62.9	17.6	76.2	41.0	375	PVC	0.30	100.3	76%	0.88	0.98
	DSEL	MH47A	MH101A	0.0	0	0.0	0	0.0	0	55.5	4,027	3.33	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	2.5	4.3	0.0	62.9	17.6	76.2	64.0	375	PVC	0.30	100.3	76%	0.88	0.98
	DSEL	MH101A	MH102A	0.0	0	0.0	0	0.0	0	55.5	4,027	3.33	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	2.5	4.3	0.0	62.9	17.6	76.2	64.0	375	PVC	0.30	100.3	76%	0.88	0.98
N-7	DSEL	**MH102A**	MH17A	4.0	291	1.2	129	5.2	420	60.7	4,447	3.29	59.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	2.5	4.3	5.2	68.1	19.1	82.7	81.0	375	PVC	0.30	100.3	82%	0.88	0.99
Cambrian Road																																			
N-3		**MH17A**	MH21A	26.0	1,956	0.0	0	26.0	1,956	145.6	12,948	2.84	149.0	0.0	3.4	0.0	0.0	0.0	0.0	3.0	25.4	5.1	25.1	25.0	34.1	199.5	55.9	229.9	204.3	750	CPP	0.13	419.5	55%	0.92	0.94
N-8		**MH21A**	MH45	7.0	408	0.0	0	7.0	408	152.6	13,356	2.83	153.1	0.0	3.4	0.0	0.0	0.0	0.0	0.0	25.4	2.9	28.0	25.0	9.9	209.4	58.6	236.7	277.8	750	CPP	0.13	419.5	56%	0.92	0.95
Greenbank Road																																			
MSS-A-14	IBI	MH205A	MH98A	0.0	0	21.0	2,246	21.0	2,246	21.0	2,246	3.55	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	21.0	5.9	38.2	126.0	600	CPP	0.25	321.2	12%	1.10	0.73
	IBI	MH98A	MH99A	0.0	0	0.0	0	0.0	0	21.0	2,246	3.55	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	5.9	38.2	125.0	600	CPP	0.25	321.2	12%	1.10	0.73
	IBI	MH99A	MH100A	0.0	0	0.0	0	0.0	0	21.0	2,246	3.55	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	5.9	38.2	108.0	600	CPP	0.25	321.2	12%	1.10	0.73
	IBI	MH100A	MH204A	0.0	0	0.0	0	0.0	0	21.0	2,246	3.55	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	5.9	38.2	105.0	600	CPP	0.25	321.2	12%	1.10	0.73
	IBI	MH204A	MH206A	0.0	0	0.0	0	0.0	0	21.0	2,246	3.55	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	5.9	38.2	103.0	600	CPP	0.25	321.2	12%	1.10	0.73
	IBI	MH206A	MH97A	0.0	0	0.0	0	0.0	0	21.0	2,246	3.55	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	5.9	38.2	125.0	600	CPP	0.25	321.2	12%	1.10	0.73
N-13, N-13-R	IBI	**MH97A**	MH96A	19.9	1,625	0.1	6	20.0	1,631	41.0	3,877	3.35	52.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	20.8	41.8	11.7	64.3	98.0	600	CPP	0.30	350.4	18%	1.20	0.89
	IBI	MH96A	MH95A	0.0	0	0.0	0	0.0	0	41.0	3,877	3.35	52.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	41.8	11.7	64.3	129.0	600	CPP	0.30	350.4	18%	1.20	0.89
	IBI	MH95A	MH201A	0.0	0	0.0	0	0.0	0	41.0	3,877	3.35	52.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	41.8	11.7	64.3	123.0	600	CPP	0.30	350.4	18%	1.20	0.89
N-11, N-11-R	IBI	**MH201A**	MH201B	12.1	787	0.0	0	12.1	787	53.1	4,664	3.27	61.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	12.1	53.9	15.1	76.9	124.0	600	CPP	0.30	350.4	22%	1.20	0.94
	IBI	MH201B	MH200A	0.0	0	0.0	0	0.0	0	53.1	4,664	3.27	61.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	53.9	15.1	76.9	68.0	600	CPP	0.30	350.4	22%	1.20	0.94
	IBI	MH200A	MH200C	0.0	0	0.0	0	0.0	0	53.1	4,664	3.27	61.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	53.9	15.1	76.9	48.0	600	CPP	0.50	452.6	17%	1.55	1.12
	IBI	MH200C	MH45	0.0	0	0.0	0	0.0	0	53.1	4,664	3.27	61.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	53.9	15.1	76.9	26.0	600	CPP	0.12	221.9	35%	0.76	0.68
MSS-A-15		**MH45**	MH435A	0.0	0	5.1	548	5.1	548	210.8	18,568	2.68	201.6	0.0	3.4	0.0	0.0	0.0	0.0	0.0	25.4	0.0	28.8	25.0	5.1	268.4	75.2	301.8	296.6	900	CPP	0.10	597.0	51%	0.91	0.91
North																																			
MSS-A-9		MA9	MA8	0.0	0	22.2	2,378	22.2	2,378	22.2	2,378	3.53	34.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	9.5	9.5	2.2	34.2	34.2	9.6	45.8	507.5	450	CPP	0.11	98.4	47%	0.60	0.59
MSS-A-8		**MA8**	MA7	0.0	0	2.9	308	2.9	308	25.1	2,686	3.48	37.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.8	10.3	2.2	3.7	37.9	10.6	50.7	317.1	450	CPP	0.11	98.4	52%	0.60	0.61
MSS-A-7		**MA7**	MA6	0.0	0	18.5	1,979	18.5	1,979	43.6	4,665	3.27	61.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	18.5	56.4	15.8	79.8	573.1	450	CPP	0.11	98.4	81%	0.60	0.67
MSS-A-6		**MA6**	MA5	0.0	0	21.7	2,320	21.7	2,320	65.3	6,985	3.11	88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	21.7	78.1	21.9	112.1	473.9	600	CPP	0.10	201.5	56%	0.69	0.71
MSS-A-5		**MA5**	M27A	0.0	0	9.5	1,020	9.5	1,020	74.8	8,005	3.05	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	9.5	87.6	24.5	125.6	220.0	600	CPP	0.10	201.5	62%	0.69	0.73
MSS-A-4		**M27A**	MH5200A	0.0	0	8.1	863	8.1	863	82.9	8,868	3.01	108.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	8.1	95.7	26.8	137.1	501.5	600	CPP	0.15	248.2	55%	0.85	0.87
		MH5200A	MH520A	0.0	0	0.0	0	0.0	0	82.9	8,868	3.01	108.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	0.0	95.7	26.8	137.1	46.0	600	CPP	0.08	181.0	76%	0.62	0.69
		MH520A	MH521A	0.0	0	0.0	0	0.0	0	82.9	8,868	3.01	108.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	0.0	95.7	26.8	137.1	44.4	600	CPP	0.10	201.5	68%	0.69	0.75
N-1		**MH521A**	MH522A	3.3	177	0.5	54	3.8	231	86.7	9,099	3.00	110.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	3.8	99.5	27.9	140.7	50.1	600	CPP	0.09	192.7	73%	0.66	0.73
		MH522A	MH435A	0.0	0	0.0	0	0.0	0	86.7	9,099	3.00	110.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	10.3	2.2	0.0	99.5	27.9	140.7	10.8	600	CPP	0.21	292.0	48%	1.00	0.99
		MH435A	MH501A	0.0	0	0.0	0	0.0	0	297.5	27,667	2.51	281.3	0.0	3.4	0.0	0.0	0.0	0.0	0.0	27.9	0.0	39.1	27.2	0.0	367.9	103.0	411.5	13.3	900	CPP	0.11	623.2	66%	0.95	1.02

Area: B
MAS

DATE: 2017/09/29
REVISION: 1
DESIGNED: LP
CHECKED: /

BARRHAVEN SOUTH
MASTER SERVICING STUDY

SANITARY SEWER DESIGN SHEET

PIPE DESIGN

FILE NUMBER: 163400999

Colour code:
Hard coded values
Caculated value
Value from subdivision design
Most US MH
Estimated value
MH receiving flow from 2 or more sewers

LOCATION				CALCULATED VALUES					UPSTREAM				DOWNSTREAM				
AREA ID NUMBER	Source	FROM M.H.	TO M.H.	ACTUAL PIPE SIZE (mm)	AREA (m^2)	HYDR. RADIUS	SURCHARGE VELOCITY (m/s)	DEPTH OF FLOW (m)	GROUND ELEVATION (m)	OBVERT ELEVATION (m)	INVERT ELEVATION (m)	U/S COVER (m)	GROUND ELEVATION (m)	OBVERT ELEVATION (m)	INVERT ELEVATION (m)	D/S COVER (m)	
MSS-A-23		MA11	MA10	305	0.073	0.076			100.00	95.000	94.695	5.00	93.50	91.384	91.079	2.12	
MSS-A-22		MA10	MH57A	381	0.114	0.095			93.50	91.324	90.943	2.18	93.60	89.525	89.144	4.07	
															^ must be above 88.01		
Realigned Greenbank Road																	
MSS-A-21		MA14	MA13	254	0.051	0.064			103.00	96.100	95.846	6.90	95.00	92.265	92.011	2.74	
N-4		MA13	MH57A	381	0.114	0.095			95.00	89.800	89.419	5.20	93.60	88.561	88.180	5.04	
															^ must be above plug @ 88.151		
Cambrian Road																	
N-5		MH57A	MH13A	500	0.196	0.125			93.60	88.010	87.510	5.59	95.00	87.469	86.969	7.53	
N-2		MH13A	MH15A	500	0.196	0.125			95.00	87.469	86.969	7.53	95.00	87.139	86.639	7.86	
N-6		MH15A	MH17A	610	0.292	0.152			95.00	87.139	86.529	7.86	97.00	86.876	86.266	10.12	
River Mist Road																	
MSS-A-18	Stantec	MH163	162	203	0.032	0.050	0.333	0.058	100.00	96.000	95.797	4.00	99.55	95.580	95.380	3.97	
	Stantec	162	161	254	0.051	0.064	0.284	0.053	99.55	95.580	95.330	3.97	98.55	94.580	94.327	3.97	
	Stantec	161	EX151	254	0.051	0.064	0.285	0.053	98.55	94.540	94.292	4.00	97.88	93.670	93.423	4.21	
	Stantec	EX151	MH142	305	0.073	0.076	0.201	0.036	97.88	93.670	93.373	4.21	97.48	93.050	92.752	4.42	
N-14	Stantec	MH142	EX139	305	0.073	0.076	0.351	0.120	97.48	93.030	92.732	4.44	96.84	92.730	92.433	4.11	
	Stantec	EX139	EX136	305	0.073	0.076	0.366	0.126	96.84	92.710	92.411	4.13	96.66	92.450	92.152	4.21	
	Stantec	EX136	MH126	305	0.073	0.076	0.383	0.129	96.66	91.650	91.350	5.01	96.85	91.320	91.024	5.53	
N-15	Stantec	MH126	EX123	381	0.114	0.095	0.415	0.147	96.85	91.330	90.959	5.52	96.41	91.010	90.639	5.39	
	Stantec	EX123	MH112	381	0.114	0.095	0.441	0.161	96.41	90.990	90.616	5.42	96.22	90.610	90.236	5.61	
N-16	Stantec	MH112	EX102	381	0.114	0.095	0.497	0.213	96.22	90.590	90.213	5.63	95.71	90.380	90.003	5.33	
	Stantec	EX102	EX101	381	0.114	0.095	0.562	0.246	95.71	90.360	89.984	5.35	95.69	90.260	89.884	5.43	
	IBI	EX101	MH43A	381	0.114	0.095			95.69	90.265	89.884	5.43	95.60	90.090	89.709	5.51	
N-12	IBI	MH43A	MH44A	381	0.114	0.095			95.60	90.070	89.689	5.53	95.50	89.826	89.445	5.67	
	IBI	MH44A	MH45A	381	0.114	0.095			95.50	89.806	89.425	5.69	95.00	89.604	89.223	5.40	
	IBI	MH45A	MH46A	381	0.114	0.095			95.00	89.594	89.213	5.41	94.20	89.339	88.958	4.86	
N-10	IBI	MH46A	MH47A	381	0.114	0.095			94.20	89.319	88.938	4.88	94.20	89.181	88.800	5.02	
	DSEL	MH47A	MH101A	381	0.114	0.095			94.20	89.181	88.800	5.02	94.20	88.989	88.608	5.21	
	DSEL	MH101A	MH102A	381	0.114	0.095			94.20	88.969	88.588	5.23	93.80	88.777	88.396	5.02	
N-7	DSEL	MH102A	MH17A	381	0.114	0.095			93.80	88.693	88.312	5.11	93.40	88.451	88.070	4.95	
Cambrian Road																	
N-3		MH17A	MH21A	762	0.456	0.190			97.00	86.876	86.114	10.12	95.00	86.773	86.011	8.23	
N-8		MH21A	MH45	762	0.456	0.190			95.00	86.773	86.011	8.23	94.50	86.412	85.650	8.09	
Greenbank Road																	
MSS-A-14	IBI	MH205A	MH98A	610	0.292	0.152			97.80	90.780	90.170	7.02	97.40	90.465	89.855	6.94	
	IBI	MH98A	MH99A	610	0.292	0.152			97.40	90.443	89.833	6.96	96.90	90.130	89.520	6.77	
	IBI	MH99A	MH100A	610	0.292	0.152			96.90	90.105	89.495	6.80	96.60	89.835	89.225	6.77	
	IBI	MH100A	MH204A	610	0.292	0.152			96.60	89.803	89.193	6.80	96.20	89.540	88.930	6.66	
	IBI	MH204A	MH206A	610	0.292	0.152			96.20	89.517	88.907	6.68	95.80	89.260	88.650	6.54	
	IBI	MH206A	MH97A	610	0.292	0.152			95.80	89.260	88.650	6.54	95.40	88.948	88.338	6.45	
N-13, N-13-R	IBI	MH97A	MH96A	610	0.292	0.152			95.40	88.938	88.328	6.46	95.20	88.643	88.033	6.56	
	IBI	MH96A	MH95A	610	0.292	0.152			95.20	88.643	88.033	6.56	95.00	88.256	87.646	6.74	
	IBI	MH95A	MH201A	610	0.292	0.152			95.00	88.256	87.646	6.74	94.50	87.887	87.277	6.61	
N-11, N-11-R	IBI	MH201A	MH201B	610	0.292	0.152			94.50	87.887	87.277	6.61	94.70	87.514	86.904	7.19	
	IBI	MH201B	MH200A	610	0.292	0.152			94.70	87.510	86.900	7.19	94.40	87.307	86.697	7.09	
	IBI	MH200A	MH200C	610	0.292	0.152			94.40	87.241	86.631	7.16	94.80	87.001	86.391	7.80	
	IBI	MH200C	MH45	610	0.292	0.152			94.80	87.001	86.391	7.80	94.50	86.405	85.795	8.10	
MSS-A-15		MH45	MH435A	914	0.656	0.228			94.50	86.405	85.491	8.10	92.60	86.108	85.194	6.49	
North																	
MSS-A-9		MA9	MA8	457	0.164	0.114			92.75	89.550	89.093	3.20	92.35	88.992	88.535	3.36	
MSS-A-8		MA8	MA7	457	0.164	0.114			92.35	88.932	88.475	3.42	92.90	88.583	88.126	4.32	
MSS-A-7		MA7	MA6	457	0.164	0.114			92.90	88.523	88.066	4.38	93.90	87.893	87.436	6.01	
MSS-A-6		MA6	MA5	610	0.292	0.152			93.90	87.833	87.223	6.07	93.50	87.359	86.749	6.14	
MSS-A-5		MA5	M27A	610	0.292	0.152			93.50	87.299	86.689	6.20	93.00	87.079	86.469	5.92	
MSS-A-4		M27A	MH5200A	610	0.292	0.152			93.00	87.019	86.409	5.98	93.00	86.267	85.657	6.73	
		MH5200A	MH520A	610	0.292	0.152			93.00	86.231	85.621	6.77	93.80	86.194	85.584	7.61	
		MH520A	MH521A	610	0.292	0.152			93.70	86.155	85.545	7.55	93.80	86.111	85.501	7.69	
N-1		MH521A	MH522A	610	0.292	0.152			93.80	86.078	85.468	7.72	92.60	86.033	85.423	6.57	
		MH522A	MH435A	610	0.292	0.152			92.60	86.005	85.395	6.60	92.60	85.982	85.372	6.62	
		MH435A	MH501A	914	0.656	0.228			92.60	85.982	85.068	6.62	92.60	85.967	85.053	6.63	

APPENDIX D

Stormwater Management

Estimated Peak Stormwater Flow Rate
City of Ottawa Sewer Design Guidelines, 2012

Existing Drainage Charateristics From Internal Site

Area	2.21	ha
C	0.39	Rational Method runoff coefficient
L	152	m
Up Elev	94.71	m
Dn Elev	93.62	m
Slope	0.7	%
Tc	31.9	min

1) Time of Concentration per Federal Aviation Administration

$$t_c = \frac{1.8(1.1-C)L^{0.5}}{S^{0.333}}$$

tc, in minutes
C, rational method coefficient, (-)
L, length in ft
S, average watershed slope in %

Estimated Peak Flow

	2-year	**5-year**	**100-year**	
i	76.8	104.2	178.6	mm/hr
Q	183.9	249.5	534.4	L/s

Note:
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Stormwater - Proposed Development
City of Ottawa Sewer Design Guidelines, 2012

Target Flow Rate

Area	2.21	ha
C	0.64	Rational Method runoff coefficient
t_c	21.5	min

5-year

i	67.1	mm/hr
Q	263.4	L/s

Estimated Post Development Peak Flow from Unattenuated Areas

Area ID U1
Total Area 0.053 ha
C 0.20 Rational Method runoff coefficient

	5-year					100-year				
t_c (min)	i (mm/hr)	Q_{actual} (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual} (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10.0	104.2	3.1	3.1	0.0	0.0	178.6	6.6	6.6	0.0	0.0

Note:
C value for the 100-year storm is increased by 25%, to a maximum of 1.0 per Ottawa Sewer Design Guidelines (5.4.5.2.1)

Area ID U2
Total Area 0.057 ha
C 0.90 Rational Method runoff coefficient

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	14.8	14.8	0.0	0.0	178.6	28.3	28.3	0.0	0.0

5-Year Qattenuated **14.85 L/s** **100-year $Q_{attenuated}$** **28.27 L/s**
5-Year Max. Storage Required **0.0 m^3** **100-year Max. Storage Required** **0.0 m^3**

Area ID U3
Total Area 0.122 ha
C 0.50 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	17.7	17.7	0.0	0.0	178.6	37.8	37.8	0.0	0.0

5-Year Qattenuated **17.65 L/s** **100-year $Q_{attenuated}$** **37.82 L/s**
5-Year Max. Storage Required **0.0 m^3** **100-year Max. Storage Required** **0.0 m^3**

Estimated Post Development Peak Flow from Attenuated Area

Building ID	METRO	
Roof Area	0.401	ha
Avail Storage Area	0.381	
C	0.90	Rational Method runoff coefficient
t_c	10	min, tc at outlet without restriction

Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

Estimated Number of Roof Drains

Building Length	69	
Building Width	55.6	
Number of Drains	21	
m^2 / Drain	181.4	max 232.25m^2/notch as recommended by Zurn for Ottawa

Roof Top Rating Curve per Zurn Model Z-105-5

d	A	V_{acc}	V_{avail}	Q_{notch}	Q_{roof}	$V_{drawdown}$
(m)	(m^2)	(m^3)	(m^3)	(L/s)	(L/s)	(hr)
0.000	0	0.0	0.0	0.00	0.00	0.00
0.025	238.1	2.0	2.0	0.38	7.98	0.07
0.050	952.4	13.9	15.9	0.77	16.17	0.31
0.075	2142.8	37.7	53.6	1.14	23.94	0.75
0.100	3809.5	73.4	127.0	1.52	31.92	1.38
0.125	3809.5	95.2	222.2	1.90	39.90	2.05
0.150	3809.5	95.2	317.5	2.28	47.88	2.60

* Assumes one notch opening per drain, assumes maximum slope of 10cm

	5-year					100-year				
t_c	i	Q_{actual}	$Q_{release}$	Q_{stored}	V_{stored}	i	Q_{actual}	$Q_{release}$	Q_{stored}	V_{stored}
(min)	(mm/hr)	(L/s)	(L/s)	(L/s)	(m^3)	(mm/hr)	(L/s)	(L/s)	(L/s)	(m^3)
10	104.2	104.5	24.2	80.3	48.2	178.6	198.9	31.9	167.0	100.2
15	83.6	83.8	24.2	59.6	53.7	142.9	159.2	31.9	127.3	114.5
20	70.3	70.4	24.2	46.3	55.5	120.0	133.6	31.9	101.7	122.1
25	60.9	61.0	24.2	36.9	55.3	103.8	115.7	31.9	83.8	125.7
30	53.9	54.1	24.2	29.9	53.8	91.9	102.3	31.9	70.4	126.8
35	48.5	48.6	24.2	24.5	51.4	82.6	92.0	31.9	60.1	126.2
40	44.2	44.3	24.2	20.1	48.3	75.1	83.7	31.9	51.8	124.3
45	40.6	40.7	24.2	16.6	44.8	69.1	76.9	31.9	45.0	121.5
50	37.7	37.7	24.2	13.6	40.8	64.0	71.2	31.9	39.3	118.0
55	35.1	35.2	24.2	11.1	36.5	59.6	66.4	31.9	34.5	113.9
60	32.9	33.0	24.2	8.9	31.9	55.9	62.3	31.9	30.4	109.3
65	31.0	31.1	24.2	7.0	27.2	52.6	58.6	31.9	26.7	104.3
70	29.4	29.4	24.2	5.3	22.2	49.8	55.5	31.9	23.6	99.0
75	27.9	28.0	24.2	3.8	17.1	47.3	52.6	31.9	20.7	93.3
80	26.6	26.6	24.2	2.5	11.9	45.0	50.1	31.9	18.2	87.4
85	25.4	25.4	24.2	1.3	6.5	43.0	47.8	31.9	15.9	81.3
90	24.3	24.3	24.2	0.2	1.1	41.1	45.8	31.9	13.9	75.0
95	23.3	23.4	23.4	0.0	0.0	39.4	43.9	31.9	12.0	68.6
100	22.4	22.5	22.5	0.0	0.0	37.9	42.2	31.9	10.3	61.9
105	21.6	21.6	21.6	0.0	0.0	36.5	40.7	31.9	8.8	55.2
110	20.8	20.9	20.9	0.0	0.0	35.2	39.2	31.9	7.3	48.3

5-year Q_{roof}	**24.15 L/s**	**100-year Q_{roof}**	**31.90 L/s**
5-year Max. Storage Required	**55.5 m^3**	**100-year Max. Storage Required**	**126.8 m^3**
5-year Storage Depth	**0.076 m**	**100-year Storage Depth**	**0.100 m**
5-year Estimated Drawdown Time	**0.76 hr**	**00-year Estimated Drawdown Time**	**1.38 hr**

Building ID	RET A	
Roof Area	0.093 ha	
Avail Storage Area	0.088	
C	0.90	Rational Method runoff coefficient
t_c	10	min, tc at outlet without restriction

Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations

Estimated Number of Roof Drains

Building Length	33	
Building Width	26	
Number of Drains	7	
m^2 / Drain	126.2	max 232.25m^2/notch as recommended by Zurn for Ottawa

Roof Top Rating Curve per Zurn Model Z-105-5

d	A	V_{acc}	V_{avail}	Q_{notch}	Q_{roof}	$V_{drawdown}$
(m)	(m^2)	(m^3)	(m^3)	(L/s)	(L/s)	(hr)
0.000	0	0.0	0.0	0.00	0.00	0.00
0.025	55.2	0.5	0.5	0.38	2.66	0.05
0.050	220.9	3.2	3.7	0.77	5.39	0.21
0.075	497.0	8.7	12.4	1.14	7.98	0.52
0.100	883.5	17.0	29.5	1.52	10.64	0.96
0.125	883.5	22.1	51.5	1.90	13.30	1.42
0.150	883.5	22.1	73.6	2.28	15.96	1.81

* Assumes one notch opening per drain, assumes maximum slope of 10cm

	5-year					100-year				
t_c	i	Q_{actual}	$Q_{release}$	Q_{stored}	V_{stored}	i	Q_{actual}	$Q_{release}$	Q_{stored}	V_{stored}
(min)	(mm/hr)	(L/s)	(L/s)	(L/s)	(m^3)	(mm/hr)	(L/s)	(L/s)	(L/s)	(m^3)
10	104.2	24.2	7.5	16.7	10.0	178.6	46.1	10.0	36.1	21.7
15	83.6	19.4	7.5	11.9	10.7	142.9	36.9	10.0	26.9	24.2
20	70.3	16.3	7.5	8.8	10.6	120.0	31.0	10.0	21.0	25.2
25	60.9	14.2	7.5	6.7	10.0	103.8	26.8	10.0	16.8	25.3
30	53.9	12.5	7.5	5.1	9.1	91.9	23.7	10.0	13.7	24.7
35	48.5	11.3	7.5	3.8	8.0	82.6	21.3	10.0	11.3	23.8
40	44.2	10.3	7.5	2.8	6.7	75.1	19.4	10.0	9.4	22.6
45	40.6	9.4	7.5	2.0	5.3	69.1	17.8	10.0	7.9	21.2
50	37.7	8.8	7.5	1.3	3.8	64.0	16.5	10.0	6.5	19.6
55	35.1	8.2	7.5	0.7	2.3	59.6	15.4	10.0	5.4	17.9
60	32.9	7.7	7.5	0.2	0.6	55.9	14.4	10.0	4.5	16.0
65	31.0	7.2	7.2	0.0	0.0	52.6	13.6	10.0	3.6	14.1
70	29.4	6.8	6.8	0.0	0.0	49.8	12.9	10.0	2.9	12.1
75	27.9	6.5	6.5	0.0	0.0	47.3	12.2	10.0	2.2	10.0
80	26.6	6.2	6.2	0.0	0.0	45.0	11.6	10.0	1.6	7.9
85	25.4	5.9	5.9	0.0	0.0	43.0	11.1	10.0	1.1	5.7
90	24.3	5.6	5.6	0.0	0.0	41.1	10.6	10.0	0.6	3.4
95	23.3	5.4	5.4	0.0	0.0	39.4	10.2	10.0	0.2	1.1
100	22.4	5.2	5.2	0.0	0.0	37.9	9.8	9.8	0.0	0.0
105	21.6	5.0	5.0	0.0	0.0	36.5	9.4	9.4	0.0	0.0
110	20.8	4.8	4.8	0.0	0.0	35.2	9.1	9.1	0.0	0.0

5-year Q_{roof}	**7.48 L/s**	**100-year Q_{roof}**	**9.99 L/s**
5-year Max. Storage Required	**10.7 m^3**	**100-year Max. Storage Required**	**25.3 m^3**
5-year Storage Depth	**0.070 m**	**100-year Storage Depth**	**0.094 m**
5-year Estimated Drawdown Time	**0.46 hr**	**00-year Estimated Drawdown Time**	**0.85 hr**

Area ID A109
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	91.29						0.0	0.0	0.00
TG	93.55	0.4	93.09	0.46	0.46	0.2	0.2	13.0	0.00
0.10m ponding	93.65	43.8	93.09	0.56	0.10	1.6	1.8	14.4	0.03
Max Ponding	93.69	84.8	93.09	0.60	0.04	2.5	4.3	14.9	0.08

* V=Incremental storage volume
**V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **STM109** **Dia** 95
Total Area 0.083 ha
C 0.40 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	9.6	9.6	0.0	0.0	178.6	20.6	14.7	5.9	3.5
20	70.3	6.5	6.5	0.0	0.0	120.0	13.8	13.8	0.0	0.0
30	53.9	5.0	5.0	0.0	0.0	91.9	10.6	13.8	0.0	0.0
40	44.2	4.1	4.1	0.0	0.0	75.1	8.7	13.8	0.0	0.0
50	37.7	3.5	3.5	0.0	0.0	64.0	7.4	13.8	0.0	0.0
60	32.9	3.0	3.0	0.0	0.0	55.9	6.4	13.8	0.0	0.0
70	29.4	2.7	2.7	0.0	0.0	49.8	5.7	13.8	0.0	0.0
80	26.6	2.4	2.4	0.0	0.0	45.0	5.2	13.8	0.0	0.0
90	24.3	2.2	2.2	0.0	0.0	41.1	4.7	13.8	0.0	0.0
100	22.4	2.1	2.1	0.0	0.0	37.9	4.4	13.8	0.0	0.0
110	20.8	1.9	1.9	0.0	0.0	35.2	4.1	13.8	0.0	0.0
120	19.5	1.8	1.8	0.0	0.0	32.9	3.8	13.8	0.0	0.0
130	18.3	1.7	1.7	0.0	0.0	30.9	3.6	13.8	0.0	0.0
140	17.3	1.6	1.6	0.0	0.0	29.2	3.4	13.8	0.0	0.0
150	16.4	1.5	1.5	0.0	0.0	27.6	3.2	13.8	0.0	0.0
160	15.6	1.4	1.4	0.0	0.0	26.2	3.0	13.8	0.0	0.0
170	14.8	1.4	1.4	0.0	0.0	25.0	2.9	13.8	0.0	0.0
180	14.2	1.3	1.3	0.0	0.0	23.9	2.8	13.8	0.0	0.0
190	13.6	1.3	1.3	0.0	0.0	22.9	2.6	13.8	0.0	0.0
200	13.0	1.2	1.2	0.0	0.0	22.0	2.5	13.8	0.0	0.0
210	12.6	1.2	1.2	0.0	0.0	21.1	2.4	13.8	0.0	0.0
220	12.1	1.1	1.1	0.0	0.0	20.4	2.3	13.8	0.0	0.0
230	11.7	1.1	1.1	0.0	0.0	19.7	2.3	13.8	0.0	0.0
240	11.3	1.0	1.0	0.0	0.0	19.0	2.2	13.8	0.0	0.0
250	10.9	1.0	1.0	0.0	0.0	18.4	2.1	13.8	0.0	0.0
260	10.6	1.0	1.0	0.0	0.0	17.8	2.1	13.8	0.0	0.0

5-Year Qattenuated **9.60 L/s**
5-Year Max. Storage Required **0.0 m^3**
Est. 5-Year Storage Elevation **91.36 m**

100-year $Q_{attenuated}$ **14.73 L/s**
100-year Max. Storage Required **3.5 m^3**
Est. 100-year Storage Elevation **93.68 m**

Area ID A110B
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.05						0.0	0.0	0.00
TG	93.55	0.36	93.09	0.46	0.46	0.2	0.2	11.7	0.00
Max Ponding	93.85	454	93.09	0.76	0.30	46.7	46.9	15.0	0.87

* V=Incremental storage volume
**V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB110B** **Dia** 90
Total Area 0.060 ha
C 0.80 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
40	44.2	5.9	5.9	0.0	0.1	75.1	12.5	11.8	0.7	1.7
50	37.7	5.0	5.0	0.0	0.0	64.0	10.7	10.7	0.0	0.0
60	32.9	4.4	4.4	0.0	0.0	55.9	9.3	10.7	0.0	0.0
70	29.4	3.9	3.9	0.0	0.0	49.8	8.3	10.7	0.0	0.0
80	26.6	3.5	3.5	0.0	0.0	45.0	7.5	10.7	0.0	0.0
90	24.3	3.2	3.2	0.0	0.0	41.1	6.9	10.7	0.0	0.0
100	22.4	3.0	3.0	0.0	0.0	37.9	6.3	10.7	0.0	0.0
110	20.8	2.8	2.8	0.0	0.0	35.2	5.9	10.7	0.0	0.0
120	19.5	2.6	2.6	0.0	0.0	32.9	5.5	10.7	0.0	0.0
130	18.3	2.4	2.4	0.0	0.0	30.9	5.1	10.7	0.0	0.0
140	17.3	2.3	2.3	0.0	0.0	29.2	4.9	10.7	0.0	0.0
150	16.4	2.2	2.2	0.0	0.0	27.6	4.6	10.7	0.0	0.0
160	15.6	2.1	2.1	0.0	0.0	26.2	4.4	10.7	0.0	0.0
170	14.8	2.0	2.0	0.0	0.0	25.0	4.2	10.7	0.0	0.0
180	14.2	1.9	1.9	0.0	0.0	23.9	4.0	10.7	0.0	0.0
190	13.6	1.8	1.8	0.0	0.0	22.9	3.8	10.7	0.0	0.0
200	13.0	1.7	1.7	0.0	0.0	22.0	3.7	10.7	0.0	0.0
210	12.6	1.7	1.7	0.0	0.0	21.1	3.5	10.7	0.0	0.0
220	12.1	1.6	1.6	0.0	0.0	20.4	3.4	10.7	0.0	0.0
230	11.7	1.6	1.6	0.0	0.0	19.7	3.3	10.7	0.0	0.0
240	11.3	1.5	1.5	0.0	0.0	19.0	3.2	10.7	0.0	0.0
250	10.9	1.5	1.5	0.0	0.0	18.4	3.1	10.7	0.0	0.0
260	10.6	1.4	1.4	0.0	0.0	17.8	3.0	10.7	0.0	0.0
270	10.3	1.4	1.4	0.0	0.0	17.3	2.9	10.7	0.0	0.0
280	10.0	1.3	1.3	0.0	0.0	16.8	2.8	10.7	0.0	0.0
290	9.7	1.3	1.3	0.0	0.0	16.3	2.7	10.7	0.0	0.0

5-Year Qattenuated **5.86 L/s** **100-year $Q_{attenuated}$** **11.82 L/s**
5-Year Max. Storage Required **0.1 m^3** **100-year Max. Storage Required** **1.7 m^3**
Est. 5-Year Storage Elevation **92.80 m** **Est. 100-year Storage Elevation** **93.56 m**

Area ID A110A
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.05						0.0	0.0	0.00
TG	93.55	0.36	93.09	0.46	0.46	0.2	0.2	11.7	0.00
Max Ponding	93.85	531	93.09	0.76	0.30	54.5	54.7	15.0	1.01

* V=Incremental storage volume
**V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB110A** **Dia** 90
Total Area 0.094 ha
C 0.80 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	21.8	12.1	9.7	5.8	178.6	46.6	13.0	33.6	20.2
20	70.3	14.7	12.1	2.6	3.1	120.0	31.3	13.0	18.3	21.9
30	53.9	11.3	11.3	0.0	0.0	91.9	24.0	13.0	11.0	19.7
40	44.2	9.2	9.2	0.0	0.0	75.1	19.6	13.0	6.6	15.8
50	37.7	7.9	7.9	0.0	0.0	64.0	16.7	13.0	3.7	11.0
60	32.9	6.9	6.9	0.0	0.0	55.9	14.6	13.0	1.6	5.6
70	29.4	6.1	6.1	0.0	0.0	49.8	13.0	13.0	0.0	0.0
80	26.6	5.5	5.5	0.0	0.0	45.0	11.7	13.0	0.0	0.0
90	24.3	5.1	5.1	0.0	0.0	41.1	10.7	13.0	0.0	0.0
100	22.4	4.7	4.7	0.0	0.0	37.9	9.9	13.0	0.0	0.0
110	20.8	4.3	4.3	0.0	0.0	35.2	9.2	13.0	0.0	0.0
120	19.5	4.1	4.1	0.0	0.0	32.9	8.6	13.0	0.0	0.0
130	18.3	3.8	3.8	0.0	0.0	30.9	8.1	13.0	0.0	0.0
140	17.3	3.6	3.6	0.0	0.0	29.2	7.6	13.0	0.0	0.0
150	16.4	3.4	3.4	0.0	0.0	27.6	7.2	13.0	0.0	0.0
160	15.6	3.2	3.2	0.0	0.0	26.2	6.9	13.0	0.0	0.0
170	14.8	3.1	3.1	0.0	0.0	25.0	6.5	13.0	0.0	0.0
180	14.2	3.0	3.0	0.0	0.0	23.9	6.2	13.0	0.0	0.0
190	13.6	2.8	2.8	0.0	0.0	22.9	6.0	13.0	0.0	0.0
200	13.0	2.7	2.7	0.0	0.0	22.0	5.7	13.0	0.0	0.0
210	12.6	2.6	2.6	0.0	0.0	21.1	5.5	13.0	0.0	0.0
220	12.1	2.5	2.5	0.0	0.0	20.4	5.3	13.0	0.0	0.0
230	11.7	2.4	2.4	0.0	0.0	19.7	5.1	13.0	0.0	0.0
240	11.3	2.4	2.4	0.0	0.0	19.0	5.0	13.0	0.0	0.0
250	10.9	2.3	2.3	0.0	0.0	18.4	4.8	13.0	0.0	0.0
260	10.6	2.2	2.2	0.0	0.0	17.8	4.7	13.0	0.0	0.0

5-Year Qattenuated **12.05 L/s** **100-year $Q_{attenuated}$** **13.03 L/s**
5-Year Max. Storage Required **5.8 m^3** **100-year Max. Storage Required** **21.9 m^3**
Est. 5-Year Storage Elevation **93.58 m** **Est. 100-year Storage Elevation** **93.67 m**

Area ID A106 &, A107
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	91.37						0.0	0.0	0.00
TG	93.50	1.4	93.09	0.41	0.41	0.6	0.6	28.7	0.01
Max Ponding	93.80	1,333.0	93.09	0.71	0.30	137.8	138.3	37.7	1.02

* V=Incremental storage volume
** V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CBMH106** **Dia** 145
Total Area 0.448 ha
C 0.82 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	106.7	31.8	74.9	44.9	178.6	222.2	37.7	184.6	110.7
20	70.3	71.9	31.8	40.2	48.2	120.0	149.3	37.7	111.6	133.9
30	53.9	55.2	31.8	23.4	42.2	91.9	114.3	37.7	76.7	138.0
40	44.2	45.2	31.8	13.5	32.3	75.1	93.5	37.7	55.9	134.1
50	37.7	38.6	31.8	6.8	20.3	64.0	79.6	37.7	41.9	125.8
60	32.9	33.7	31.8	2.0	7.0	55.9	69.6	37.7	31.9	114.9
70	29.4	30.1	30.1	0.0	0.0	49.8	62.0	37.7	24.3	102.1
80	26.6	27.2	27.2	0.0	0.0	45.0	56.0	37.7	18.3	88.0
90	24.3	24.9	24.9	0.0	0.0	41.1	51.2	37.7	13.5	72.9
100	22.4	22.9	22.9	0.0	0.0	37.9	47.2	37.7	9.5	57.1
110	20.8	21.3	21.3	0.0	0.0	35.2	43.8	37.7	6.2	40.6
120	19.5	19.9	19.9	0.0	0.0	32.9	40.9	37.7	3.3	23.6
130	18.3	18.7	18.7	0.0	0.0	30.9	38.5	37.7	0.8	6.2
140	17.3	17.7	17.7	0.0	0.0	29.2	36.3	37.7	0.0	0.0
150	16.4	16.8	16.8	0.0	0.0	27.6	34.4	37.7	0.0	0.0
160	15.6	15.9	15.9	0.0	0.0	26.2	32.7	37.7	0.0	0.0
170	14.8	15.2	15.2	0.0	0.0	25.0	31.1	37.7	0.0	0.0
180	14.2	14.5	14.5	0.0	0.0	23.9	29.7	37.7	0.0	0.0
190	13.6	13.9	13.9	0.0	0.0	22.9	28.5	37.7	0.0	0.0
200	13.0	13.4	13.4	0.0	0.0	22.0	27.4	37.7	0.0	0.0
210	12.6	12.9	12.9	0.0	0.0	21.1	26.3	37.7	0.0	0.0
220	12.1	12.4	12.4	0.0	0.0	20.4	25.4	37.7	0.0	0.0
230	11.7	12.0	12.0	0.0	0.0	19.7	24.5	37.7	0.0	0.0
240	11.3	11.6	11.6	0.0	0.0	19.0	23.7	37.7	0.0	0.0
250	10.9	11.2	11.2	0.0	0.0	18.4	22.9	37.7	0.0	0.0
260	10.6	10.9	10.9	0.0	0.0	17.8	22.2	37.7	0.0	0.0

5-Year Qattenuated **31.78 L/s** **100-year $Q_{attenuated}$** **37.65 L/s**
5-Year Max. Storage Required **48.2 m^3** **100-year Max. Storage Required** **138.0 m^3**
Est. 5-Year Storage Elevation **93.60 m** **Est. 100-year Storage Elevation** **93.80 m**

Area ID A104A
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	19.6	0.00
Max Ponding	93.85	890.6	93.09	0.76	0.35	106.0	106.2	26.7	1.10

* V=Incremental storage volume
** V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB104A** **Dia** 120
Total Area 0.276 ha
C 0.90 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	71.9	21.8	50.1	30.1	178.6	136.9	25.1	111.8	67.1
20	70.3	48.5	21.8	26.7	32.1	120.0	92.0	25.1	66.9	80.3
30	53.9	37.2	21.8	15.4	27.8	91.9	70.4	25.1	45.4	81.7
40	44.2	30.5	21.8	8.7	20.9	75.1	57.6	25.1	32.5	78.1
50	37.7	26.0	21.8	4.2	12.7	64.0	49.0	25.1	24.0	71.9
60	32.9	22.7	21.8	1.0	3.5	55.9	42.9	25.1	17.8	64.0
70	29.4	20.3	20.3	0.0	0.0	49.8	38.2	25.1	13.1	55.1
80	26.6	18.3	18.3	0.0	0.0	45.0	34.5	25.1	9.4	45.3
90	24.3	16.8	16.8	0.0	0.0	41.1	31.5	25.1	6.5	34.9
100	22.4	15.5	15.5	0.0	0.0	37.9	29.1	25.1	4.0	24.0
110	20.8	14.4	14.4	0.0	0.0	35.2	27.0	25.1	1.9	12.7
120	19.5	13.4	13.4	0.0	0.0	32.9	25.2	25.1	0.2	1.1
130	18.3	12.6	12.6	0.0	0.0	30.9	23.7	25.1	0.0	0.0
140	17.3	11.9	11.9	0.0	0.0	29.2	22.3	25.1	0.0	0.0
150	16.4	11.3	11.3	0.0	0.0	27.6	21.2	25.1	0.0	0.0
160	15.6	10.7	10.7	0.0	0.0	26.2	20.1	25.1	0.0	0.0
170	14.8	10.2	10.2	0.0	0.0	25.0	19.2	25.1	0.0	0.0
180	14.2	9.8	9.8	0.0	0.0	23.9	18.3	25.1	0.0	0.0
190	13.6	9.4	9.4	0.0	0.0	22.9	17.6	25.1	0.0	0.0
200	13.0	9.0	9.0	0.0	0.0	22.0	16.9	25.1	0.0	0.0
210	12.6	8.7	8.7	0.0	0.0	21.1	16.2	25.1	0.0	0.0
220	12.1	8.3	8.3	0.0	0.0	20.4	15.6	25.1	0.0	0.0
230	11.7	8.1	8.1	0.0	0.0	19.7	15.1	25.1	0.0	0.0
240	11.3	7.8	7.8	0.0	0.0	19.0	14.6	25.1	0.0	0.0
250	10.9	7.5	7.5	0.0	0.0	18.4	14.1	25.1	0.0	0.0
260	10.6	7.3	7.3	0.0	0.0	17.8	13.7	25.1	0.0	0.0

5-Year Qattenuated **21.76 L/s** | **100-year $Q_{attenuated}$** **25.06 L/s**
5-Year Max. Storage Required **32.1 m^3** | **100-year Max. Storage Required** **81.7 m^3**
Est. 5-Year Storage Elevation **93.61 m** | **Est. 100-year Storage Elevation** **93.77 m**

Area ID A104B
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	7.7	0.01
Max Ponding	93.80	864	93.09	0.71	0.30	88.2	88.3	10.1	2.43

* V=Incremental storage volume
** V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB104B** **Dia** 75
Total Area 0.166 ha
C 0.90 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	43.2	8.4	34.9	20.9	178.6	82.3	9.3	73.0	43.8
20	70.3	29.2	8.4	20.8	25.0	120.0	55.3	9.3	46.0	55.2
30	53.9	22.4	8.4	14.0	25.2	91.9	42.4	9.3	33.0	59.5
40	44.2	18.3	8.4	10.0	24.0	75.1	34.7	9.3	25.3	60.8
50	37.7	15.6	8.4	7.3	21.8	64.0	29.5	9.3	20.2	60.5
60	32.9	13.7	8.4	5.3	19.1	55.9	25.8	9.3	16.4	59.2
70	29.4	12.2	8.4	3.8	16.1	49.8	23.0	9.3	13.6	57.3
80	26.6	11.0	8.4	2.7	12.8	45.0	20.7	9.3	11.4	54.8
90	24.3	10.1	8.4	1.7	9.3	41.1	19.0	9.3	9.6	52.0
100	22.4	9.3	8.4	0.9	5.7	37.9	17.5	9.3	8.2	48.9
110	20.8	8.6	8.4	0.3	1.9	35.2	16.2	9.3	6.9	45.6
120	19.5	8.1	8.1	0.0	0.0	32.9	15.2	9.3	5.8	42.1
130	18.3	7.6	7.6	0.0	0.0	30.9	14.2	9.3	4.9	38.4
140	17.3	7.2	7.2	0.0	0.0	29.2	13.4	9.3	4.1	34.6
150	16.4	6.8	6.8	0.0	0.0	27.6	12.7	9.3	3.4	30.6
160	15.6	6.5	6.5	0.0	0.0	26.2	12.1	9.3	2.8	26.6
170	14.8	6.2	6.2	0.0	0.0	25.0	11.5	9.3	2.2	22.5
180	14.2	5.9	5.9	0.0	0.0	23.9	11.0	9.3	1.7	18.3
190	13.6	5.6	5.6	0.0	0.0	22.9	10.6	9.3	1.2	14.0
200	13.0	5.4	5.4	0.0	0.0	22.0	10.1	9.3	0.8	9.7
210	12.6	5.2	5.2	0.0	0.0	21.1	9.7	9.3	0.4	5.3
220	12.1	5.0	5.0	0.0	0.0	20.4	9.4	9.3	0.1	0.9
230	11.7	4.8	4.8	0.0	0.0	19.7	9.1	9.3	0.0	0.0
240	11.3	4.7	4.7	0.0	0.0	19.0	8.8	9.3	0.0	0.0
250	10.9	4.5	4.5	0.0	0.0	18.4	8.5	9.3	0.0	0.0
260	10.6	4.4	4.4	0.0	0.0	17.8	8.2	9.3	0.0	0.0

5-Year Qattenuated **8.36 L/s** **100-year $Q_{attenuated}$** **9.33 L/s**
5-Year Max. Storage Required **25.2 m^3** **100-year Max. Storage Required** **60.8 m^3**
Est. 5-Year Storage Elevation **93.59 m** **Est. 100-year Storage Elevation** **93.71 m**

Area ID A108
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	7.7	0.01
Max Ponding	93.80	1,040	93.09	0.71	0.30	106.0	106.1	10.1	2.92

* V=Incremental storage volume
** V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB108A** **Dia** 75
Total Area 0.169 ha
C 0.90 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	44.0	8.3	35.8	21.5	178.6	83.8	9.1	74.7	44.8
20	70.3	29.7	8.3	21.4	25.7	120.0	56.3	9.1	47.2	56.7
30	53.9	22.8	8.3	14.5	26.1	91.9	43.1	9.1	34.0	61.3
40	44.2	18.7	8.3	10.4	25.0	75.1	35.3	9.1	26.2	62.8
50	37.7	15.9	8.3	7.6	22.9	64.0	30.0	9.1	20.9	62.8
60	32.9	13.9	8.3	5.7	20.4	55.9	26.2	9.1	17.1	61.7
70	29.4	12.4	8.3	4.1	17.4	49.8	23.4	9.1	14.3	60.0
80	26.6	11.2	8.3	3.0	14.2	45.0	21.1	9.1	12.0	57.7
90	24.3	10.3	8.3	2.0	10.8	41.1	19.3	9.1	10.2	55.1
100	22.4	9.5	8.3	1.2	7.2	37.9	17.8	9.1	8.7	52.2
110	20.8	8.8	8.3	0.5	3.5	35.2	16.5	9.1	7.4	49.0
120	19.5	8.2	8.2	0.0	0.0	32.9	15.4	9.1	6.3	45.7
130	18.3	7.7	7.7	0.0	0.0	30.9	14.5	9.1	5.4	42.2
140	17.3	7.3	7.3	0.0	0.0	29.2	13.7	9.1	4.6	38.6
150	16.4	6.9	6.9	0.0	0.0	27.6	13.0	9.1	3.9	34.8
160	15.6	6.6	6.6	0.0	0.0	26.2	12.3	9.1	3.2	30.9
170	14.8	6.3	6.3	0.0	0.0	25.0	11.7	9.1	2.6	27.0
180	14.2	6.0	6.0	0.0	0.0	23.9	11.2	9.1	2.1	23.0
190	13.6	5.7	5.7	0.0	0.0	22.9	10.7	9.1	1.7	18.9
200	13.0	5.5	5.5	0.0	0.0	22.0	10.3	9.1	1.2	14.7
210	12.6	5.3	5.3	0.0	0.0	21.1	9.9	9.1	0.8	10.5
220	12.1	5.1	5.1	0.0	0.0	20.4	9.6	9.1	0.5	6.2
230	11.7	4.9	4.9	0.0	0.0	19.7	9.2	9.1	0.1	1.9
240	11.3	4.8	4.8	0.0	0.0	19.0	8.9	9.1	0.0	0.0
250	10.9	4.6	4.6	0.0	0.0	18.4	8.6	9.1	0.0	0.0
260	10.6	4.5	4.5	0.0	0.0	17.8	8.4	9.1	0.0	0.0

5-Year Qattenuated **8.26 L/s** **100-year $Q_{attenuated}$** **9.10 L/s**
5-Year Max. Storage Required **26.1 m^3** **100-year Max. Storage Required** **62.8 m^3**
Est. 5-Year Storage Elevation **93.57 m** **Est. 100-year Storage Elevation** **93.68 m**

Area ID A103A
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

	Surface Storage					Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	18.0	0.00
Max Ponding	93.85	747	93.09	0.76	0.35	89.1	89.2	24.5	1.01

* V=Incremental storage volume
** V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB103A** **Dia** 115
Total Area 0.106 ha
C 0.90 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	27.6	18.4	9.2	5.5	178.6	52.6	19.5	33.1	19.9
20	70.3	18.6	18.4	0.2	0.2	120.0	35.3	19.5	15.8	19.0
30	53.9	14.3	14.3	0.0	0.0	91.9	27.1	19.5	7.6	13.6
40	44.2	11.7	11.7	0.0	0.0	75.1	22.1	19.5	2.7	6.4
50	37.7	10.0	10.0	0.0	0.0	64.0	18.8	19.5	0.0	0.0
60	32.9	8.7	8.7	0.0	0.0	55.9	16.5	19.5	0.0	0.0
70	29.4	7.8	7.8	0.0	0.0	49.8	14.7	19.5	0.0	0.0
80	26.6	7.0	7.0	0.0	0.0	45.0	13.2	19.5	0.0	0.0
90	24.3	6.4	6.4	0.0	0.0	41.1	12.1	19.5	0.0	0.0
100	22.4	5.9	5.9	0.0	0.0	37.9	11.2	19.5	0.0	0.0
110	20.8	5.5	5.5	0.0	0.0	35.2	10.4	19.5	0.0	0.0
120	19.5	5.2	5.2	0.0	0.0	32.9	9.7	19.5	0.0	0.0
130	18.3	4.8	4.8	0.0	0.0	30.9	9.1	19.5	0.0	0.0
140	17.3	4.6	4.6	0.0	0.0	29.2	8.6	19.5	0.0	0.0
150	16.4	4.3	4.3	0.0	0.0	27.6	8.1	19.5	0.0	0.0
160	15.6	4.1	4.1	0.0	0.0	26.2	7.7	19.5	0.0	0.0
170	14.8	3.9	3.9	0.0	0.0	25.0	7.4	19.5	0.0	0.0
180	14.2	3.8	3.8	0.0	0.0	23.9	7.0	19.5	0.0	0.0
190	13.6	3.6	3.6	0.0	0.0	22.9	6.7	19.5	0.0	0.0
200	13.0	3.5	3.5	0.0	0.0	22.0	6.5	19.5	0.0	0.0
210	12.6	3.3	3.3	0.0	0.0	21.1	6.2	19.5	0.0	0.0
220	12.1	3.2	3.2	0.0	0.0	20.4	6.0	19.5	0.0	0.0
230	11.7	3.1	3.1	0.0	0.0	19.7	5.8	19.5	0.0	0.0
240	11.3	3.0	3.0	0.0	0.0	19.0	5.6	19.5	0.0	0.0
250	10.9	2.9	2.9	0.0	0.0	18.4	5.4	19.5	0.0	0.0
260	10.6	2.8	2.8	0.0	0.0	17.8	5.2	19.5	0.0	0.0

5-Year Qattenuated **18.43 L/s** **100-year $Q_{attenuated}$** **19.47 L/s**
5-Year Max. Storage Required **5.5 m^3** **100-year Max. Storage Required** **19.9 m^3**
Est. 5-Year Storage Elevation **93.52 m** **Est. 100-year Storage Elevation** **93.58 m**

Area ID A103B
Available Sub-surface Storage

Total Subsurface Storage (m^3) 0.0

Stage Attenuated Areas Storage Summary

		Surface Storage				Surface and Subsurface Storage			
	Stage	Ponding	100-Year HGL	Head (Stage to 100-year HGL)	delta d	V*	V_{acc}**	$Q_{release}$†	$V_{drawdown}$
	(m)	(m^2)	(m)	(m)	(m)	(m^3)	(m^3)	(L/s)	(hr)
Orifice INV	92.00						0.0	0.0	0.00
TG	93.50	0.36	93.09	0.41	0.41	0.1	0.1	7.7	0.01
Max Ponding	93.80	751	93.09	0.71	0.30	76.7	76.9	10.1	2.12

* V=Incremental storage volume
** V_{acc}=Total surface and sub-surface
† $Q_{release}$ = Release rate calculated from orifice equation

Orifice Location **CB103B** **Dia** 75
Total Area 0.079 ha
C 0.90 Rational Method runoff coefficient *Note: Rational Method Coefficient "C" increased by 25% for 100-year calculations*

	5-Year					100-year				
t_c (min)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)	i (mm/hr)	Q_{actual}‡ (L/s)	$Q_{release}$ (L/s)	Q_{stored} (L/s)	V_{stored} (m^3)
10	104.2	20.6	7.9	12.7	7.6	178.6	39.2	8.3	30.8	18.5
20	70.3	13.9	7.9	6.0	7.2	120.0	26.3	8.3	18.0	21.6
30	53.9	10.7	7.9	2.7	4.9	91.9	20.2	8.3	11.8	21.3
40	44.2	8.7	7.9	0.8	2.0	75.1	16.5	8.3	8.1	19.6
50	37.7	7.4	7.4	0.0	0.0	64.0	14.0	8.3	5.7	17.1
60	32.9	6.5	6.5	0.0	0.0	55.9	12.3	8.3	3.9	14.1
70	29.4	5.8	5.8	0.0	0.0	49.8	10.9	8.3	2.6	10.8
80	26.6	5.2	5.2	0.0	0.0	45.0	9.9	8.3	1.5	7.3
90	24.3	4.8	4.8	0.0	0.0	41.1	9.0	8.3	0.7	3.7
100	22.4	4.4	4.4	0.0	0.0	37.9	8.3	8.3	0.0	0.0
110	20.8	4.1	4.1	0.0	0.0	35.2	7.7	8.3	0.0	0.0
120	19.5	3.8	3.8	0.0	0.0	32.9	7.2	8.3	0.0	0.0
130	18.3	3.6	3.6	0.0	0.0	30.9	6.8	8.3	0.0	0.0
140	17.3	3.4	3.4	0.0	0.0	29.2	6.4	8.3	0.0	0.0
150	16.4	3.2	3.2	0.0	0.0	27.6	6.1	8.3	0.0	0.0
160	15.6	3.1	3.1	0.0	0.0	26.2	5.8	8.3	0.0	0.0
170	14.8	2.9	2.9	0.0	0.0	25.0	5.5	8.3	0.0	0.0
180	14.2	2.8	2.8	0.0	0.0	23.9	5.2	8.3	0.0	0.0
190	13.6	2.7	2.7	0.0	0.0	22.9	5.0	8.3	0.0	0.0
200	13.0	2.6	2.6	0.0	0.0	22.0	4.8	8.3	0.0	0.0
210	12.6	2.5	2.5	0.0	0.0	21.1	4.6	8.3	0.0	0.0
220	12.1	2.4	2.4	0.0	0.0	20.4	4.5	8.3	0.0	0.0
230	11.7	2.3	2.3	0.0	0.0	19.7	4.3	8.3	0.0	0.0
240	11.3	2.2	2.2	0.0	0.0	19.0	4.2	8.3	0.0	0.0
250	10.9	2.2	2.2	0.0	0.0	18.4	4.0	8.3	0.0	0.0
260	10.6	2.1	2.1	0.0	0.0	17.8	3.9	8.3	0.0	0.0

5-Year Qattenuated **7.91 L/s** **100-year $Q_{attenuated}$** **8.34 L/s**
5-Year Max. Storage Required **7.6 m^3** **100-year Max. Storage Required** **21.6 m^3**
Est. 5-Year Storage Elevation **93.53 m** **Est. 100-year Storage Elevation** **93.30 m**

Summary of Release Rates and Storage Volumes

Control Area	5-Year Release Rate (L/s)	5-Year Required Storage (m^3)	100-Year Release Rate (L/s)	100-Year Required Storage (m^3)	100-Year Available Storage (m^3)
U1	3.1	0.0	6.6	0.0	0.0
U2	14.8	0.0	28.3	0.0	0.0
U3	17.7	0.0	37.8	0.0	0.0
METRO	24.2	55.5	31.9	126.8	317.5
RET A	7.5	10.7	10.0	25.3	73.6
A109	9.6	0.0	14.7	3.5	4.3
A110B	5.9	0.1	11.8	1.7	46.9
A110A	12.1	5.8	13.0	21.9	54.7
A104A	21.8	32.1	25.1	81.7	106.2
A104B	8.4	25.2	9.3	60.8	88.3
A108	8.3	26.1	9.1	62.8	106.1
A103A	18.4	5.5	19.5	19.9	89.2
A103B	7.9	7.6	8.3	21.6	76.9
A106 &, A107	31.8	48.2	37.7	138.0	138.3
Total	**191.2**	**216.9**	**263.1**	**563.9**	**1102.0**

										Sewer Data								
Area ID	**Up**	**Down**	**Area**	**C**	**Indiv AxC**	**Acc AxC**	**T_C**	**I**	**Q**	**DIA**	**Slope**	**Length**	**$A_{hydraulic}$**	**R**	**Velocity**	**Qcap**	**Time Flow**	**Q / Q full**
			(ha)	**(-)**			**(min)**	**(mm/hr)**	**(L/s)**	**(mm)**	**(%)**	**(m)**	**(m^2)**	**(m)**	**(m/s)**	**(L/s)**	**(min)**	**(-)**
U3	STM112	STM111	0.122	0.50	0.06	0.06	10.0	104.2	17.7	300	0.40	75	0.071	0.075	0.87	61.2	1.4	0.29
A110A,A110B ,U2	STM111	STM110	0.211	0.80	0.17	0.23	11.4	97.1	62.0	375	0.40	68.4	0.110	0.094	1.00	110.9	1.1	0.56
RET A	STM110	STM108	0.093	0.90	0.08	0.31	12.6	92.3	68.9	375	0.30	76.3	0.110	0.094	0.87	96.0	1.5	0.72
						0.31	14.04											
A105B	CBMH107	CBMH106	0.205	0.85	0.17	0.17	10.0	104.2	50.4	300	0.50	20.8	0.071	0.075	0.97	68.4	0.4	0.74
A105A	CBMH106	STM104	0.243	0.80	0.19	0.37	10.4	102.3	104.8	375	0.50	12.2	0.110	0.094	1.12	124.0	0.2	0.85
						0.37	10.5											
	STM105	STM104			0.00	0.00	10.0	104.2	0.0	300	0.50	24.3	0.071	0.075	0.97	68.4	0.4	0.00
						0.00	10.4											
A104A&A104B	STM104	STM103	0.442	0.90	0.40	0.77	10.5	101.4	215.9	525	0.50	39.1	0.216	0.131	1.40	304.1	0.5	0.71
						0.77	11.0											
METRO			0.401	0.90	0.36	0.36	10.0	104.2	31.9									
						0.36	10.0											
A109	STM109	STM108	0.083	0.40	0.03	0.39	10.0	104.2	41.5	375	0.50	39.8	0.110	0.094	1.12	124.0	0.6	0.33
						0.39	10.6											
A108	STM108	STM103	0.169	0.90	0.15	0.86	14.0	86.8	207.2	525	0.28	51.5	0.216	0.131	1.05	227.6	0.8	0.91
						0.86	14.9											
A103A&A103B	STM103	STM102	0.190	0.90	0.17	1.80	14.9	84.0	419.4	750	0.30	39.8	0.442	0.188	1.38	609.8	0.5	0.69
A102	STM102	STM101			0.00	1.80	15.3	82.5	411.7	750	0.20	23.0	0.442	0.188	1.13	497.9	0.3	0.83
A101	STM101	Fut. MH 904			0.00	1.80	15.7	81.4	406.5	750	0.20	34.2	0.442	0.188	1.13	497.9	0.5	0.82
						1.80	16.19											

**Controlled 100-year Building Flow

NOTE RE: PROPOSED UNDERGROUND SERVICING IN EXISTING PAVEMENT

PROPOSED UNDERGROUND SERVICING WITHIN EXISTING PAVEMENT TO BE CONSTRUCTED AS PER THE FOLLOWING:
1. PROPOSED UNDERGROUND SERVICES TO BE CONSTRUCTED IN VERTICAL TRENCH AND BACKFILLED WITH UNSHRINKABLE FILL
2. CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION
3. ANY DISTURBED AREAS, INCLUDING CURB, SIDEWALK AND BOULEVARD, TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER
4. ALL REMOVED ASPHALT PAVEMENT TO BE DEPOSITED OFF SITE
5. ALL WORKS INCLUDING REMOVAL AND RESTORATION TO THE SATISFACTION OF CITY OF OTTAWA

RE: TEST PIT/BOREHOLE EXCAVATIONS

ANY DISTURBED MATERIAL ENCOUNTERED BELOW THE SUBGRADE LEVEL WITHIN A BUILDING FOOTPRINT TO BE SUB-EXCAVATED AND BACKFILLED WITH COMPACTED ENGINEERED FILL AS PER GEOTECHNICAL ENGINEERS RECOMMENDATION.

NOTE RE: GREENBANK ROAD FUTURE SERVICING

THE LOCATION OF DENOTED FUTURE STORM/SANITARY MANHOLES, AND STREET CATCHBASINS AS SHOWN ON DRAWINGS, IS FOR ILLUSTRATION PURPOSES ONLY TO IDENTIFY ASSUMED DRAINAGE BOUNDARY AREAS. THE FINAL LOCATION OF SAID SERVICES ARE TO BE FINALIZED AT THE DETAILED DESIGN STAGE.

NOTE

FOR WATERMAIN STUBS, 2.4m MIN. COVER TO BE PROVIDED

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES

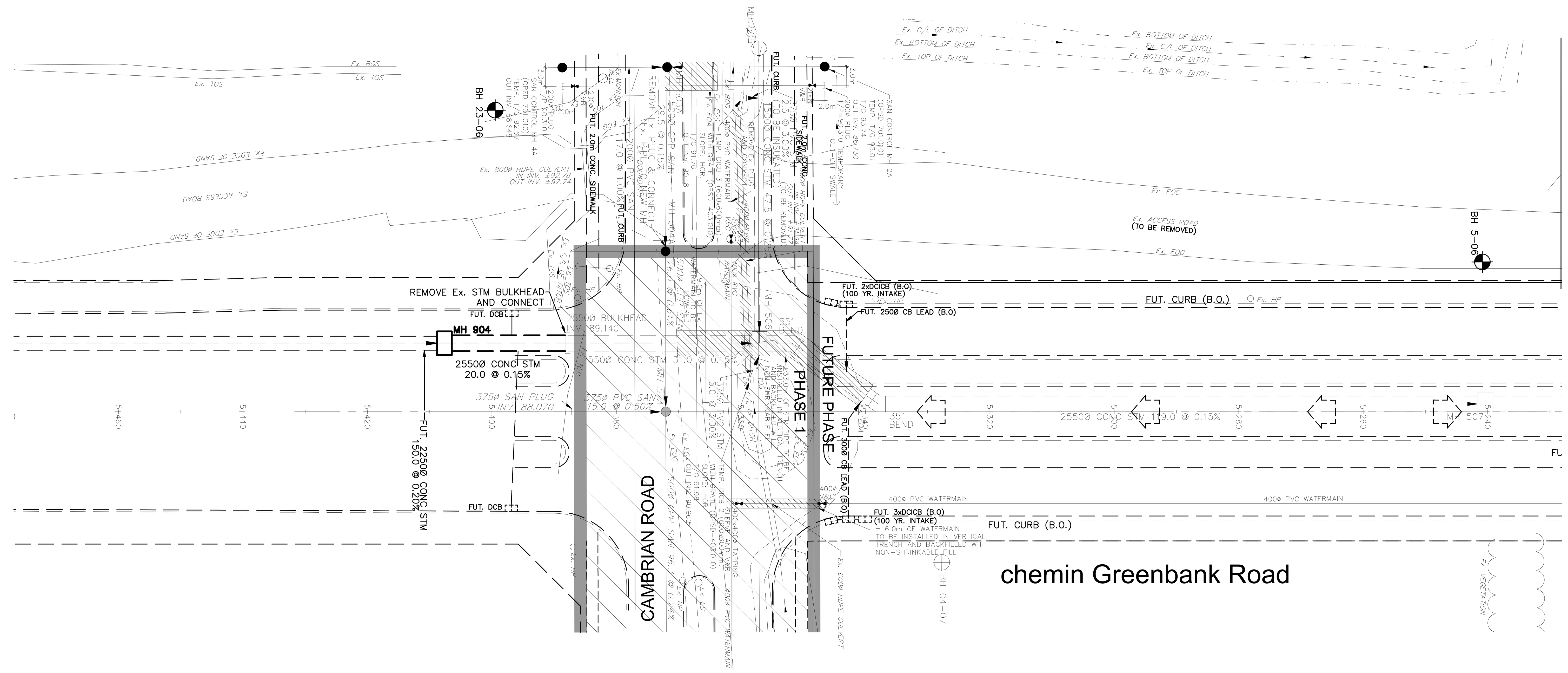
CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION

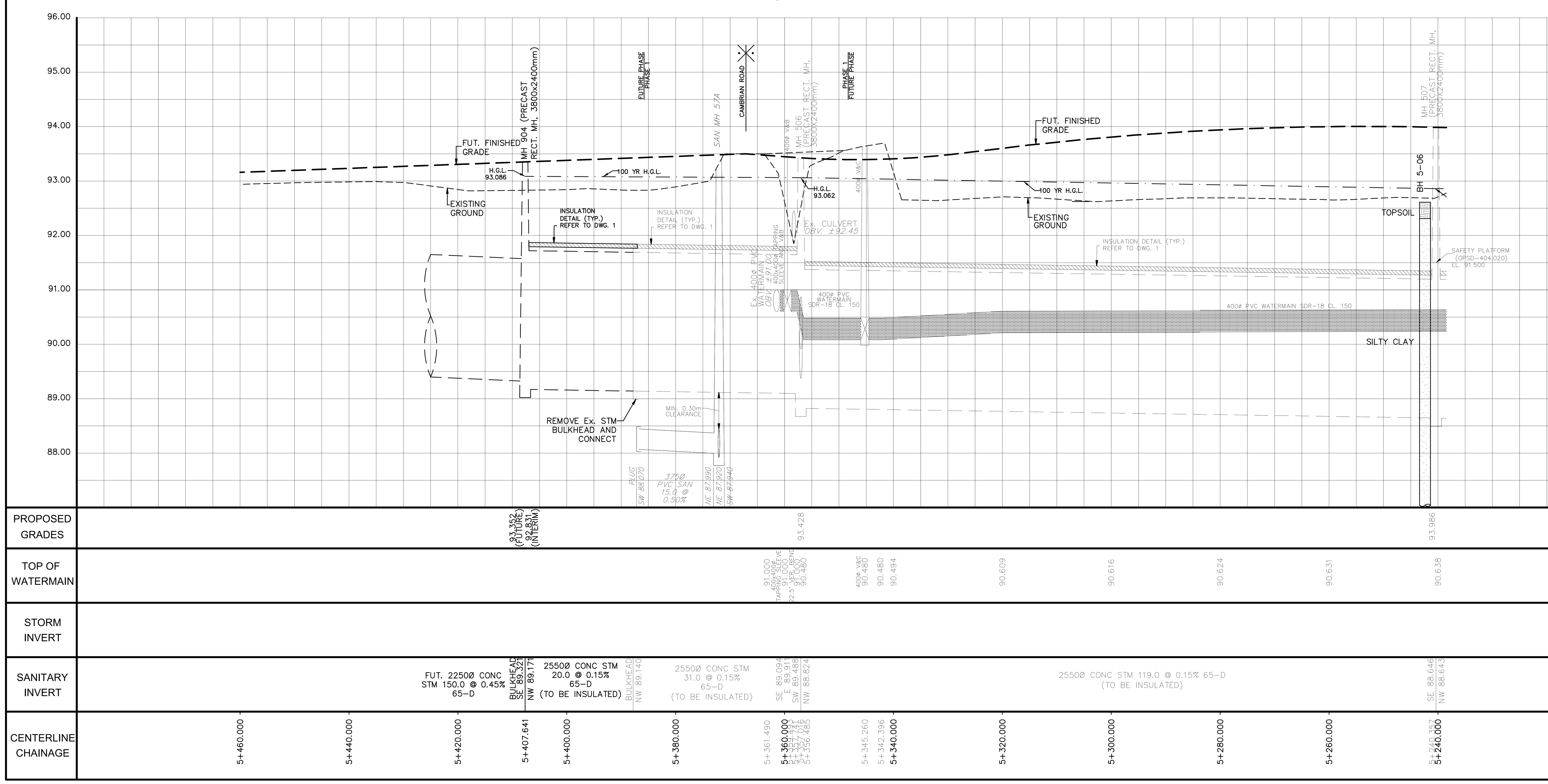
NOTE:

ALL EXISTING POST & WIRE FENCE, CULVERTS, UTILITY WIRE / POLES, TREES, SHRUBS ETC. WITHIN LOTS, BLOCKS AND ROADS TO BE REMOVED, UNLESS OTHERWISE NOTED

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

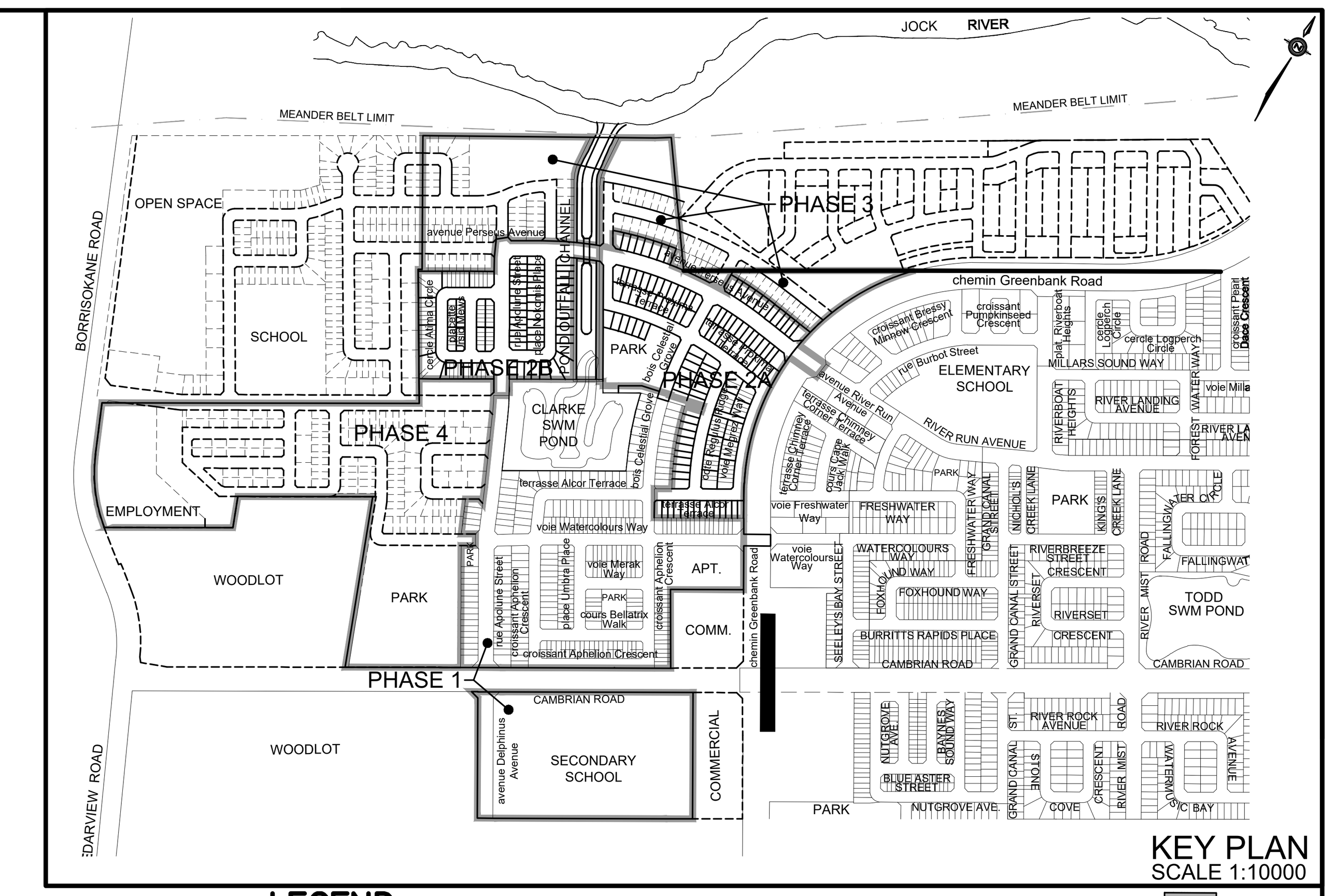
PRELIMINARY DESIGN FOR FUTURE chemin Greenbank Road REFER TO STANTEC PROJECT No. 163600994





NOTE RE: SEWER BEDDING

SEWER TRENCH AND BEDDING SHALL BE AS PER CITY OF OTTAWA STD. S6 AND S7, CLASS 'B' BEDDING UNLESS OTHERWISE NOTED.



LEGEND

CROSS; 45° BEND; LATERAL; HYDRANT, VALVE & VB; TEE; VALVE & VC; VALVE & VB; 22.5° BEND; 11.25° BEND; REDUCER; CAP; SANITARY MAINTENANCE HOLE; CAP; STREET CATCHBASIN & LEAD; STREET CATCHBASIN WITH CLOSED LID & LEAD; STORM MAINTENANCE HOLE; CURB INLET CATCHBASIN & LEAD; CATCHBASIN/ MAINTENANCE HOLE; INTERCONNECTED CATCH BASIN & LEADS; CAP; SINGLE SERVICE LOCATION (ST, SAN & WM); SINGLE SERVICE LOCATION (ST, SAN & WM); TEE CATCHBASIN; PERFORATED PIPE; ELBOW CATCHBASIN; DITCH AND CULVERT

HYDRO SWITCHGEAR; HYDRO TRANSFORMER; STREET LIGHT STANDARD; CONCRETE SIDEWALK; CURB & DEPRESSED CURB; ASPHALT SIDEWALK; CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED); NOISE BARRIER (2.5m UNLESS OTHERWISE NOTED); DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL); CONSTRUCTION FENCE; POST AND RAIL FENCE; PHASING LIMITS; PROPERTY BOUNDARY; BOREHOLE (BH), TEST PIT (TP), MONITORING WELL LOCATION, CONCEPTUAL WELL LOCATION — AS PER GEOTECHNICAL REPORT; TOP OF FOUNDATION ELEVATION; FINISHED FLOOR ELEVATION; UNDERSIDE OF FOOTING ELEVATION; NUMBER OF RISERS; LOTS EQUIPPED WITH SUMP PUMP (REFER TO DETAIL ON DWG. 3); UNITS REQUIRING PRESSURE REDUCING VALVES; WALKOUT UNITS; SLAB ON GRADE; OVERLAND FLOW DIRECTION; EXTERNAL OVERLAND FLOW DIRECTION; EMERGENCY OVERLAND FLOW DIRECTION; TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6, SC7, SC7.1, SC7.2, SC7.3); PREVIOUS PHASES; CLAY SEAL (REFER TO GENERAL NOTES. No.18. ON DWG. No. 1, AND GEOTECHNICAL CONSULTANT'S SPECIFICATIONS)

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-100-00. SURVEY DATED FEBRUARY 22, 2017. CITY OF OTTAWA 2K MAPPING, RECEIVED ON JANUARY 18, 2016.

LEGAL INFORMATION

CALCULATED DRAFT PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-100-00 (HALF MOON BAY WEST PHASE 2), RECEIVED ON OCTOBER 11, 2019.

BENCH MARK No. 0011964U3710

ELEVATIONS ARE GEODETIC AND ARE REFERRED TO THE PUBLISHED BENCHMARK NUMBER 0011965U3710 HAVING AN ELEVATION OF 71.724m.

ELEVATION = 71.724 m

No.	BY	DATE	DESCRIPTION	BY
8	P.P.	20-02-25	UPDATED AS PER REVISED CULVERT FOUNDATION DESIGN	
7	P.P.	20-01-17	5th SUBMISSION	
6	P.P.	19-12-18	CHANNEL CULVERT & SANITARY SEWER CROSSING REVISIONS	
5	P.P.	19-11-06	UPDATED AS PER REVISED M-PLAN AND CUP	
4	P.P.	19-09-12	4th SUBMISSION	
3	P.P.	19-07-05	3rd SUBMISSION	
2	P.P.	19-06-12	2nd SUBMISSION	
1	P.P.	19-02-22	1st SUBMISSION	

Ottawa CITY OF OTTAWA

PROJECT No. 18-1082

LICENSED PROFESSIONAL ENGINEER P.E.MORENO PICKART 100215995 20-02-25 PROVINCE OF ONTARIO

PLAN AND PROFILE OF
chemin Greenbank Road
(STA. 5+220.000 TO STA. 5+420.000)

© DSEL

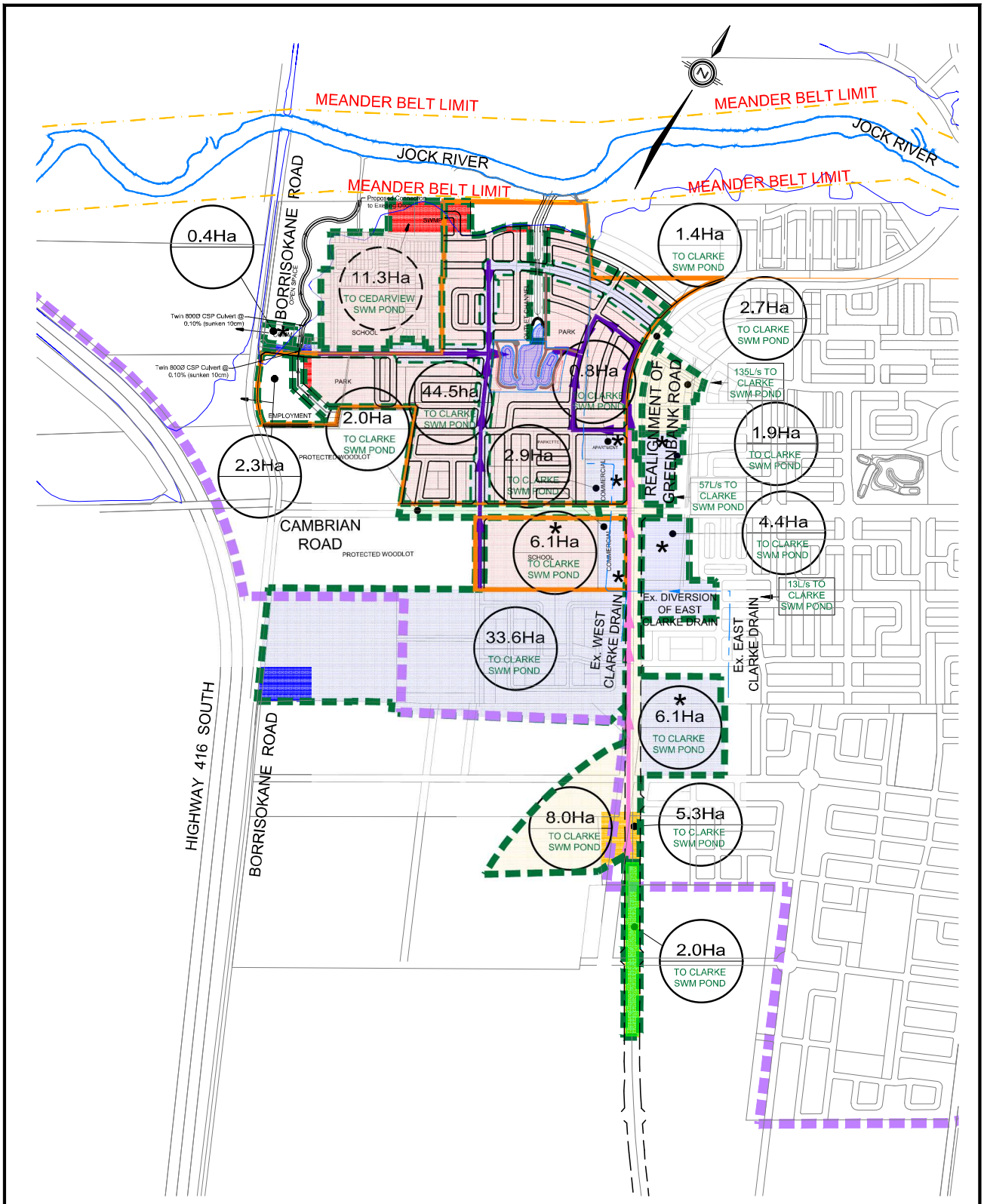
MATTAMY (HALF MOON BAY) LIMITED

HALF MOON BAY WEST SUBDIVISION
PHASES 2A & 2B

DSEL david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

DRAWN BY: V.W./S.L.	CHECKED BY: P.P./C.M.	DRAWING NO.	SHEET NO.
DESIGNED BY: W.L./C.M.	CHECKED BY: K.M.		32
SCALE: H1:500 ,V1:50	DATE: FEB 2019		

CITY FILE No. D07-16-16-0023 P1 CITY PLAN No. 17586



LEGEND

- SITE BOUNDARY
- LIMIT OF BARRHAVEN SOUTH COMMUNITY
- STORM TRUNK
- STORM TRUNK BY OTHERS
- 100 YEAR FLOOD LINE
- DRAINAGE AREA BOUNDARY

5.0Ha TO CLARKE SWM POND — DRAINAGE AREA / DRAINAGE AREA DESTINATION

7.0Ha TO CLARKE SWM POND — EXTERNAL DRAINAGE AREA / EXTERNAL DRAINAGE AREA DESTINATION

- 2 YEAR CAPTURE AREA
- 5 YEAR CAPTURE AREA
- 10 YEAR CAPTURE AREA
- 5 YEAR CAPTURE AREA, NO 100 YEAR STORAGE
- 100 YEAR CAPTURE AREA
- * ONSITE 100 YEAR CONTROL

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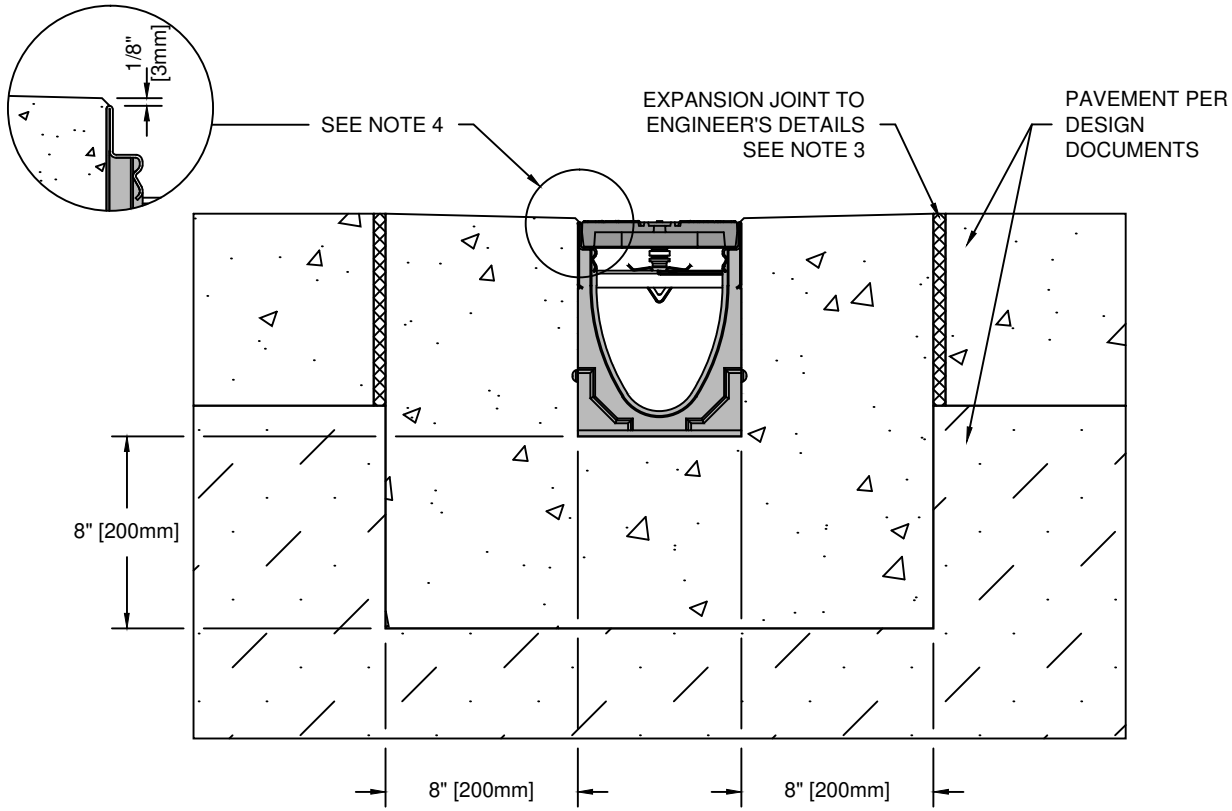
Fax. (613) 836-7183
www.DSEL.ca

HALF MOON BAY WEST
STORM DRAINAGE PLAN (MINOR)

CITY OF OTTAWA

DATE: OCTOBER 2017
SCALE: 1:10000
PROJECT No.: 16-888
FIGURE: 8



NOTES:

1. IT IS NECESSARY TO ENSURE MINIMUM DIMENSIONS SHOWN ARE SUITABLE FOR EXISTING GROUND CONDITIONS. *ENGINEERING ADVICE MAY BE REQUIRED.*
2. MINIMUM CONCRETE STRENGTH OF 4,000 PSI IS RECOMMENDED. CONCRETE SHOULD BE VIBRATED TO ELIMINATE AIR POCKETS.
3. EXPANSION AND CONTRACTION CONTROL JOINTS AND REINFORCEMENT ARE RECOMMENDED TO PROTECT CHANNEL AND CONCRETE SURROUND. *ENGINEERING ADVICE MAY BE REQUIRED.*
4. THE FINISHED LEVEL OF THE CONCRETE SURROUND MUST BE APPROX. 1/8" [3mm] ABOVE THE TOP OF THE CHANNEL EDGE.
5. CONCRETE BASE THICKNESS SHOULD MATCH SLAB THICKNESS. ENGINEERING ADVICE MAY BE REQUIRED TO DETERMINE PROPER LOAD CLASS.
6. REFER TO ACO'S LATEST INSTALLATION INSTRUCTIONS FOR FURTHER DETAILS.

SPECIFICATION CLAUSE

K100 KLASSIKDRAIN - LOAD CLASS E

GENERAL

THE SURFACE DRAINAGE SYSTEM SHALL BE POLYMER CONCRETE K100 CHANNEL SYSTEM WITH GALVANIZED STEEL EDGE RAILS AS MANUFACTURED BY ACO POLYMER PRODUCTS, INC.

MATERIALS

CHANNELS SHALL BE MANUFACTURED FROM POLYESTER RESIN POLYMER CONCRETE WITH AN INTEGRALLY CAST-IN GALVANIZED STEEL EDGE RAIL. MINIMUM PROPERTIES OF POLYMER CONCRETE WILL BE AS FOLLOWS:

COMPRESSIVE STRENGTH:	14,000 PSI
FLEXURAL STRENGTH:	4,000 PSI
TENSILE STRENGTH:	1,500 PSI
WATER ABSORPTION:	0.07%
FROST PROOF	YES
DILUTE ACID AND ALKALI RESISTANT	YES
B117 SALT SPRAY TEST COMPLIANT	YES

THE SYSTEM SHALL BE 4" (100mm) NOMINAL INTERNAL WIDTH WITH A 5.1" (130mm) OVERALL WIDTH AND A BUILT-IN SLOPE OF 0.5%. CHANNEL INVERT SHALL HAVE DEVELOPED "V" SHAPE. ALL CHANNELS SHALL BE INTERLOCKING WITH A MALE/FEMALE JOINT.

THE COMPLETE DRAINAGE SYSTEM SHALL BE BY ACO POLYMER PRODUCTS, INC. ANY DEVIATION OR PARTIAL SYSTEM DESIGN AND/OR IMPROPER INSTALLATION WILL VOID ANY AND ALL WARRANTIES PROVIDED BY ACO POLYMER PRODUCTS, INC.

CHANNEL SHALL WITHSTAND LOADING TO PROPER LOAD CLASS AS OUTLINED BY EN 1433. GRATE TYPE SHALL BE APPROPRIATE TO MEET THE SYSTEM LOAD CLASS SPECIFIED AND INTENDED APPLICATION. GRATES SHALL BE SECURED USING 'QUICKLOK' BOLTLESS LOCKING SYSTEM. CHANNEL AND GRATE SHALL BE CERTIFIED TO MEET THE SPECIFIED EN 1433 LOAD CLASS. THE SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.

K1-E-ECP

DATE: 08/24/15

K100 - KLASSIKDRAIN - LOAD CLASS: E

Exposed Concrete Pavement

INSTALLATION DRAWING - ACO DRAIN

ACO Polymer Products, Inc.

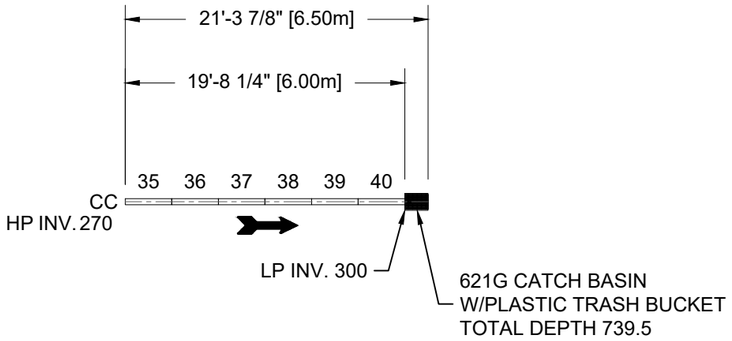
825 W. Beechcraft St
Casa Grande, AZ 85122
Tel: 520-421-9988
Fax: 520-421-9899

9470 Pinecone Dr.
Mentor, OH 44060
Tel: 440-639-7230
Fax: 440-639-7235

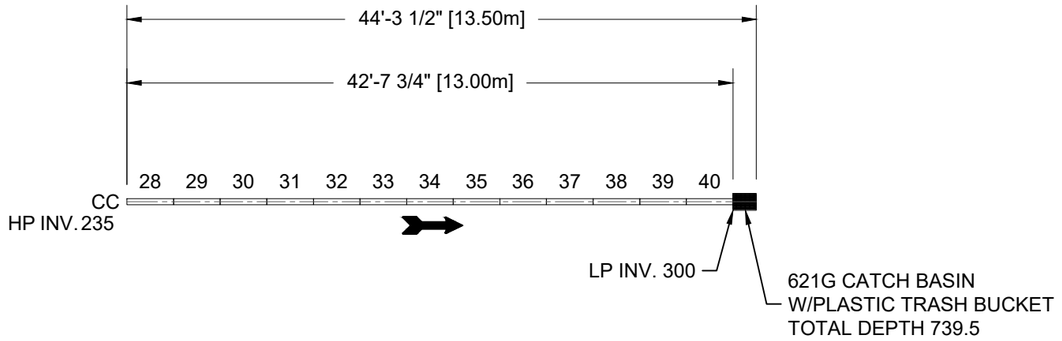
4211 Pleasant Rd.
Fort Mill, SC 29708
Tel: 440-639-7230
Fax: 803-802-1063

Arizona Tel: 888-490-9552 e-mail: sales@acousa.com Ohio Tel: 800-543-4764 www.acousa.com South Carolina Tel: 800-543-4764

TD - 1



TD - 2



GENERAL NOTES

1. IT IS CUSTOMERS RESPONSIBILITY TO ENSURE THAT EACH PRODUCT IS FIT FOR IT'S INTENDED PURPOSE AND THAT THE ACTUAL CONDITIONS ARE SUITABLE.
2. IT IS THE CUSTOMERS RESPONSIBILITY TO FOLLOW ACO POLYMER PRODUCTS, INC. INSTALLATION INSTRUCTIONS FOR EACH PRODUCT. SEEK ENGINEERING ADVISE FOR INSTALLATIONS NOT ILLUSTRATED IN THE INSTALLATION GUIDELINES.
3. FOR FURTHER PRODUCT INFORMATION, CUT SHEETS, SPECIFICATIONS AND INSTALLATION INSTRUCTIONS, PLEASE VISIT US AT OUR WEBSITE: WWW.ACOUSA.COM.
4. ACO IS NOT RESPONSIBLE TO ENSURE PROPER FLOW TO SYSTEMS OUTLETS OR CATCH BASINS, REFER TO GRADING PLANS. ALL TRENCH DRAIN LAYOUTS ARE DESIGNED AT 0.0% LONGITUDINAL PAVEMENT SLOPE UNLESS OTHERWISE NOTED.

TRENCH NOTES

1. ALL FABRICATIONS TO BE COMPLETED BY INSTALLING CONTRACTOR.
2. DIMENSIONS ARE FROM OUTSIDE TO OUTSIDE

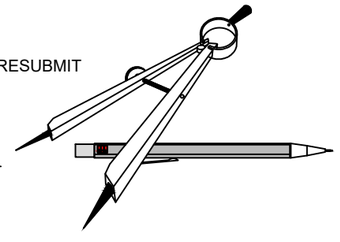
ALL DRAWINGS ARE AS ACCURATE AS THE INFORMATION SUPPLIED. ALL REASONABLE CARE HAS BEEN TAKEN IN COMPILING THE INFORMATION WITHIN. PLEASE REVIEW THIS INFORMATION FOR ACCURACY.

☐ APPROVED ☐ REVISE AND RESUBMIT
☐ APPROVED AS NOTED ☐ REJECTED

SIGNED: _____

DATE: _____

COMMENTS:



LEGEND

CHANNEL	CC = CLOSING CAP
CENTER LINE	OC = OUTLET CAP
INSTALLATION DIRECTION OF CHANNEL	INV = INVERT
	HP = HIGH POINT
	LP = LOW POINT
VOA = VERTICAL OUTLET ADAPTER	BO = BOTTOM OUTLET
BAU = BRICKSLOT ACCESS UNIT	

METRO GREENBANK ON		TRENCH DRAIN LAYOUT			
		SYSTEM(S) **K100**		GRATE(S) **461Q SLOTTED D.I.**	
DRAWN BY: **KZ**	EMAIL: kyle.zheng@aco.com	**REVISIONS**			
		NO.	DESCRIPTION	DATE	BY
DATE **08-13-2020**	CHECKED BY:	A	-	-	-
		B			
SHEET NO. **SHEET 1 OF 1**	DESIGN SERV. NO. REV. **920-558**	C			

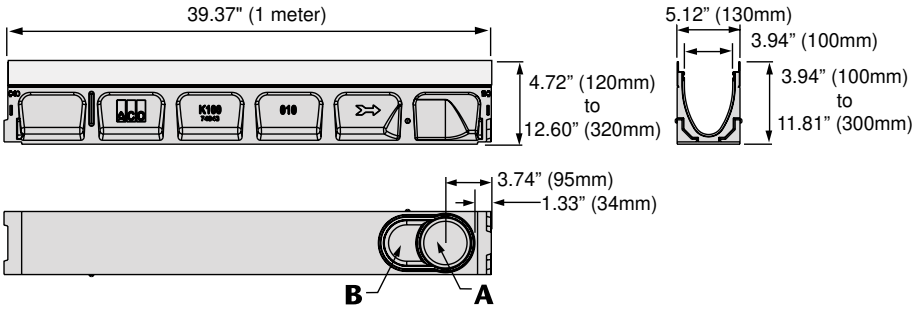
CANADA

ACO SYSTEMS LTD.
2910 BRIGHTON RD
OAKVILLE, ON
L6H 5S3
TEL: (905)-829-0665
FAX: (905)-829-2908
EMAIL: info@acocan.ca
WEB: www.acocan.com

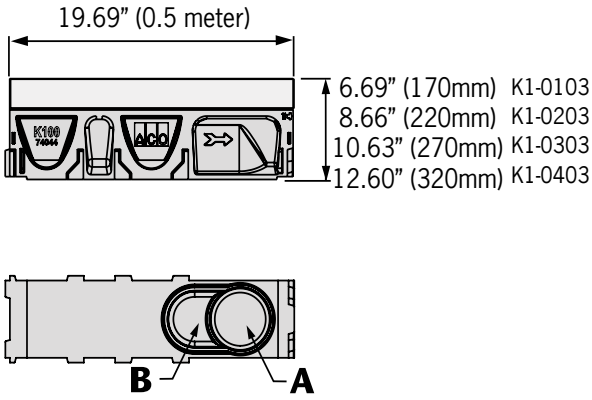
CANADIAN

KlassikDrain - K100 Galvanized steel edge rail channel system

One meter channel

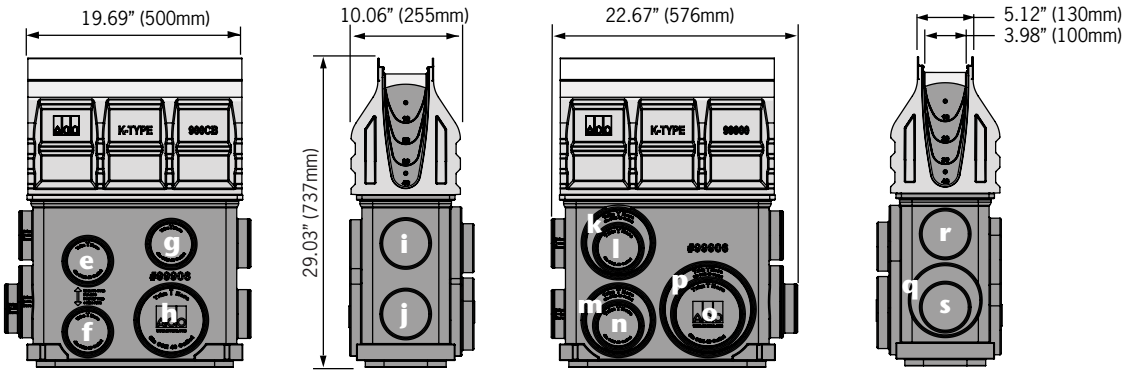


Half meter channel



Knock-outs included on every 5th channel

Type K901G In-line catch basin



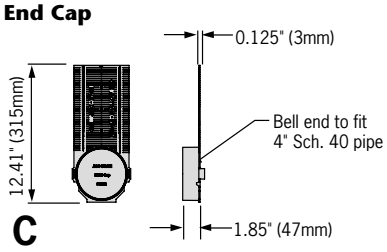
Total capacity =
10.49 gallons

Outlet flow rates

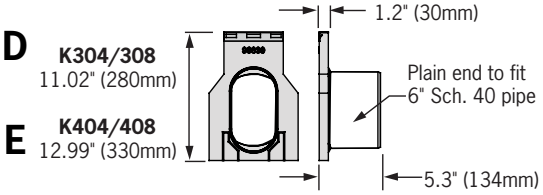
Outlet	Product	Outlet size (Sch. 40)	Invert Depth	GPM	CFS
A	Bottom outlet - K00	4" round	3.94"	108	0.24
A	Bottom outlet - K40	4" round	11.81"	187	0.42
B	Bottom outlet - K00	6" oval	3.94"	177	0.39
B	Bottom outlet - K40	6" oval	11.81"	306	0.68
C	End outlet - K20	4" round	7.87"	132	0.29
C	End outlet - K40	4" round	11.81"	171	0.38
D	K1-308-6 6" outlet cap	6" oval	9.84"	233	0.52
E	K1-408-6 6" outlet cap	6" oval	11.81"	264	0.59
F	Type K1-901G	4" round	19.30"	226	0.50
G	Type K1-901G	4" round	25.67"	265	0.59
H	Type K1-901G	4" round	25.30"	263	0.59
I	Type K1-901G	4" round	18.56"	222	0.49
J	Type K1-901G	6" round	25.85"	586	1.30
K	Type K1-901G	4" round	26.43"	269	0.60
L	Type K1-901G	4" round	19.36"	227	0.51
M	Type K1-901G	6" round	27.30"	604	1.35
N	Type K1-901G	6" round	19.99"	505	1.12
O	Type K1-901G	8" round	27.30"	1051	2.34
P	Type K1-901G	6" round	26.43"	593	1.32
Q	Type K1-901G	4" round	27.17"	273	0.61
R	Type K1-901G	4" round	20.68"	235	0.52
S	Type K1-901G	4" round	18.99"	224	0.50
T	Type K1-901G	6" round	27.17"	6.02	1.34

Note: These are the pipe flow rates at the specified outlet, **NOT** channel flow rates. Catch basin flow rates are without trash bucket - using trash bucket reduces flow.

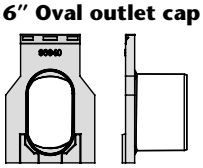
End Cap



6" Oval inlet cap



6" Oval outlet cap



ACO Specification Information

ACO DRAIN

KlassikDrain - K100 Galvanized steel edge rail channel system

Description	Part No.	Invert Inches[2]	Invert mm[2]	Weight Lbs.
K1-00 Neutral channel - 39.37" (1m)[1]	**74041**	**3.94**	**100**	**28.1**
K1-1 Sloped channel - 39.37" (1m)	**74001**	4.13	105	28.1
K1-2 Sloped channel - 39.37" (1m)	**74002**	4.33	110	28.9
K1-3 Sloped channel - 39.37" (1m)	**74003**	4.53	115	29.7
K1-4 Sloped channel - 39.37" (1m)	**74004**	4.72	120	30.5
K1-5 Sloped channel - 39.37" (1m)[1]	**74005**	4.92	125	31.3
K1-6 Sloped channel - 39.37" (1m)	**74006**	5.12	130	32.1
K1-7 Sloped channel - 39.37" (1m)	**74007**	5.31	135	32.9
K1-8 Sloped channel - 39.37" (1m)	**74008**	5.51	140	33.7
K1-9 Sloped channel - 39.37" (1m)	**74009**	5.71	145	34.5
K1-10 Sloped channel - 39.37" (1m)[1]	**74010**	5.91	150	35.3
K1-010 Neutral channel - 39.37" (1m)[1]	**74043**	**5.91**	**150**	**35.3**
K1-0103 Neutral channel - 19.69" (0.5m)[1]	**74044**	**5.91**	**150**	**17.0**
K1-11 Sloped channel - 39.37" (1m)	**74011**	6.10	155	36.1
K1-12 Sloped channel - 39.37" (1m)	**74012**	6.30	160	36.9
K1-13 Sloped channel - 39.37" (1m)	**74013**	6.50	165	37.7
K1-14 Sloped channel - 39.37" (1m)	**74014**	6.69	170	38.5
K1-15 Sloped channel - 39.37" (1m)[1]	**74015**	6.89	175	39.3
K1-16 Sloped channel - 39.37" (1m)	**74016**	7.09	180	40.1
K1-17 Sloped channel - 39.37" (1m)	**74017**	7.28	185	40.9
K1-18 Sloped channel - 39.37" (1m)	**74018**	7.48	190	41.7
K1-19 Sloped channel - 39.37" (1m)	**74019**	7.68	195	42.5
K1-20 Sloped channel - 39.37" (1m)[1]	**74020**	7.87	200	43.4
K1-020 Neutral channel - 39.37" (1m)[1]	**74045**	**7.87**	**200**	**43.4**
K1-0203 Neutral channel - 19.69" (0.5m)[1]	**74046**	**7.87**	**200**	**20.5**
K1-21 Sloped channel - 39.37" (1m)	**74021**	8.07	205	44.2
K1-22 Sloped channel - 39.37" (1m)	**74022**	8.27	210	45.0
K1-23 Sloped channel - 39.37" (1m)	**74023**	8.46	215	45.8
K1-24 Sloped channel - 39.37" (1m)	**74024**	8.66	220	46.6
K1-25 Sloped channel - 39.37" (1m)[1]	**74025**	8.86	225	47.4
K1-26 Sloped channel - 39.37" (1m)	**74026**	9.06	230	48.2
K1-27 Sloped channel - 39.37" (1m)	**74027**	9.25	235	49.0

Description	Part No.	Invert Inches[2]	Invert mm[2]	Weight Lbs.
K1-28 Sloped channel - 39.37" (1m)	**74028**	9.45	240	49.8
K1-29 Sloped channel - 39.37" (1m)	**74029**	9.65	245	50.6
K1-30 Sloped channel - 39.37" (1m)[1]	**74030**	9.84	250	51.4
K1-030 Neutral channel - 39.37" (1m)[1]	**74047**	**9.84**	**250**	**51.4**
K1-0303 Neutral channel - 19.69" (0.5m)[1]	**74048**	**9.84**	**250**	**24.0**
K1-31 Sloped channel - 39.37" (1m)	**74031**	10.04	255	52.2
K1-32 Sloped channel - 39.37" (1m)	**74032**	10.24	260	53.0
K1-33 Sloped channel - 39.37" (1m)	**74033**	10.43	265	53.8
K1-34 Sloped channel - 39.37" (1m)	**74034**	10.63	270	54.6
K1-35 Sloped channel - 39.37" (1m)[1]	**74035**	10.83	275	55.4
K1-36 Sloped channel - 39.37" (1m)	**74036**	11.02	280	56.2
K1-37 Sloped channel - 39.37" (1m)	**74037**	11.22	285	57.0
K1-38 Sloped channel - 39.37" (1m)	**74038**	11.42	290	57.9
K1-39 Sloped channel - 39.37" (1m)	**74039**	11.61	295	58.7
K1-40 Sloped channel - 39.37" (1m)[1]	**74040**	11.81	300	59.5
K1-040 Neutral channel - 39.37" (1m)[1]	**74049**	**11.81**	**300**	**59.5**
K1-0403 Neutral channel - 19.69" (0.5m)[1]	**74050**	**11.81**	**300**	**27.5**
K1-901G In-line catch basin - 19.69" (0.5m)[3]	**94608**	28.81	701.9	52.6
K1-621G catch basin - 19.69" (0.5m)[3]	**94617**	28.84	732.5	55.8
K1-631G catch basin - 19.69" (0.5m)[4]	**94631**	40.84	1037.4	65.8
K1-Series 600 Optional plastic riser	**99902**	-	-	10.0
Foul air trap - fits both 900 & 600 series basins	**90854**	-	-	1.2
K1-304-6 6" Inlet Cap	**96839**	9.84	250	5.2
K1-308-6 6" Outlet Cap	**96840**	9.84	250	5.0
K1-404-6 6" Inlet Cap	**96834**	11.81	300	6.0
K1-408-6 6" Outlet Cap	**96836**	11.81	300	5.8
Universal end cap	**96822**	11.81	300	0.4
Debris strainer for 4" bottom knockout	**93488**	-	-	0.2
4" Oval to 6" round outlet adapter	**95140**	-	-	1.1
K1-Installation device	**97477**	-	-	2.8
Grate removal tool	**01318**	-	-	0.3
K1-QuickLok locking bar	**02899**	-	-	0.1

Notes:
1. This channel offers a bottom knockout feature; 4" round/6" oval.
2. Inverts shown are for the male end; for female invert depth subtract 5mm (≈0.2") from the male invert (except for neutral channels, where it will be same as male invert). To calculate the overall channel depth add 20mm (≈0.8") to invert depth.
3. This catch basin kit includes a polymer concrete top, removable Quicklok locking bar, trash bucket and plastic base. Select an appropriate grate.
4. This catch basin kit includes a polymer concrete top, removable Quicklok locking bar, deep trash bucket, plastic riser and plastic base. Select an appropriate grate.

Specifications

General
The surface drainage system shall be ACO Drain K100 complete with gratings secured with 'QuickLok' locking as manufactured by ACO, Inc. or approved equal.

Materials
The trench system bodies shall be manufactured from polyester polymer concrete with the minimum properties as follows:

Compressive strength:	14,000 psi
Flexural strength:	4,000 psi
Water absorption	0.07%
Frost proof	YES
Salt proof	YES
Dilute acid and alkali resistant	YES

The nominal clear opening shall be 4" (100mm) with overall width of 5.12" (130mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% or with neutral invert and have a wall thickness of at least 0.50" (13mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The galvanized steel edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 3/32" (2.5mm) thick.

Grates
Grates shall be specified. See separate ACO Spec Info grate sheets for details. After removal of grates and 'QuickLok' bar there shall be uninterrupted access to the trench to aid maintenance.

Installation
The trench drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

ACO, Inc.
Northeast Sales Office
9470 Pinecone Drive
Mentor, OH 44060
Tel: (440) 639-7230
Toll free: (800) 543-4764
Fax: (440) 639-7235

West Sales Office
825 W. Beechcraft St.
Casa Grande, AZ 85122
Tel: (520) 421-9988
Toll Free: (888) 490-9552
Fax: (520) 421-9899

Southeast Sales Office
4211 Pleasant Road
Fort Mill, SC 29708
Toll free: (800) 543-4764
Fax: (803) 802-1063

Electronic Contact:
info@ACODrain.us
www.ACODrain.us

Type 461Q Ductile iron slotted grate

ACO Specification Information

Product Features

- Certified to EN 1433 Load Class E - 135,000 lbs - 2,788 psi
- Uses 'QuickLok' boltless locking system
- Suitable for use with K100, KS100, C100, H100-8, H100-10, H100K-8 H100KS-8, and NW100 channels
- Manufactured from ductile iron to ASTM A 536-84 - Grade 65-45-12
- E-coated for improved resistance against rust
- Bicycle Tire Penetration Resistant to AS 3996 - 2006

Specifications

General

The surface drainage system shall be ACO Drain K100, KS100, C100, H100-8, H100-10, H100K-8, H100KS-8, and NW100 channels* complete with ACO Type 461Q Ductile iron slotted grate with 'QuickLok' locking as manufactured by ACO Polymer Products, Inc. or similar approved.

Materials

The covers shall be manufactured from ductile iron and have ***minimum*** properties as follows:

- ***Independently certified to meet Load Class E to EN 1433 - 135,000 lbs - 2,788 psi***
- ***Ductile iron to ASTM A 536-84 - Grade 65-45-12***
- ***Intake area of 46.94 sq. in. (302.84 cm²) per half meter of grate***

The overall width of 4.84" (123mm) and overall length of 19.69" (500mm). Slots measure at a maximum of 3.95" (100.2mm).

Installation

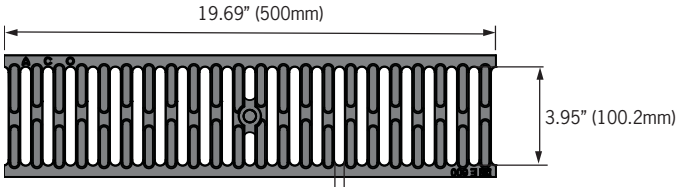
The trench drain system and grates shall be installed in accordance with the manufacturer's installation instructions and recommendations.

* delete as appropriate

ACO DRAIN

Type 461Q Ductile iron slotted grate

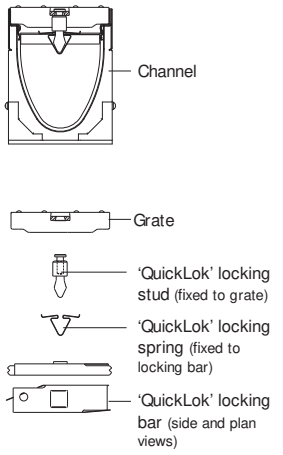
Plan view



Side elevation

Description	Part No.	Length inches *(mm)*	Width inches *(mm)*	Weight lbs.
QuickLok grate				
Type 461Q Ductile iron slotted grate	**96752**	19.69 (*500*)	4.84 (*123*)	10.2
QuickLok locking bar	**02899**	-	-	0.1
QuickLok grate removal tool	**01318**	-	-	0.3

'QuickLok' locking mechanism



ACO 'QuickLok' is a patented boltless locking system, grates are removed and replaced with the minimum time and effort for ease of maintenance. The unique design provides a positive 'snap down' fit into the locking bar. A stud is fixed to the grate which 'locks' into the spring clip in the locking bar.

The 'QuickLok' stud is made from stainless steel and high density nylon, the locking bar and clip are stainless steel, for use in both general purpose and corrosive environments.

ACO Polymer Products, Inc.

Northeast Sales Office
P.O. Box 245
Chardon, OH 44024
Tel: (440) 285-7000
Toll free: (800) 543-4764
Fax: (440) 285-7005

West Sales Office
P.O. Box 12067
Casa Grande, AZ 85130
Tel: (520) 421-9988
Toll Free: (888) 490-9552
Fax: (520) 421-9899

Southeast Sales Office
4211 Pleasant Road
Fort Mill, SC 29708
Toll free: (800) 543-4764
Fax: (803) 802-1063

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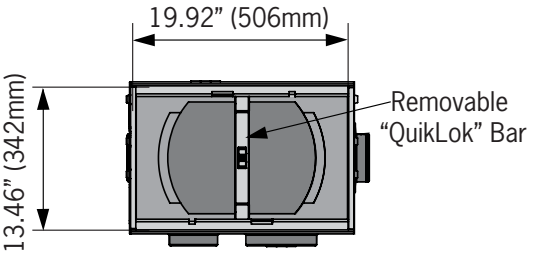
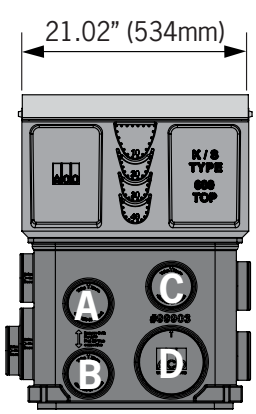
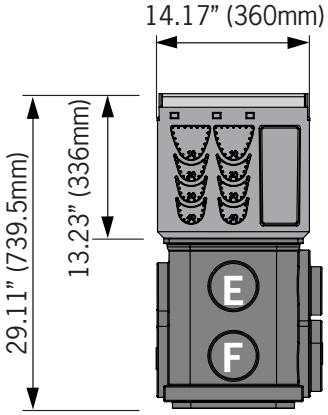
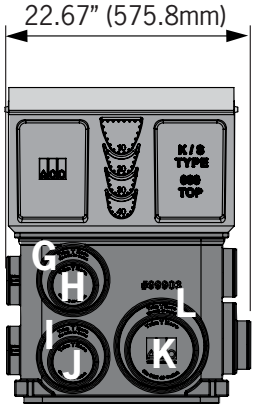
K1-621G Catch Basin

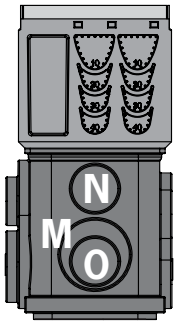
K1-621G Catch Basin











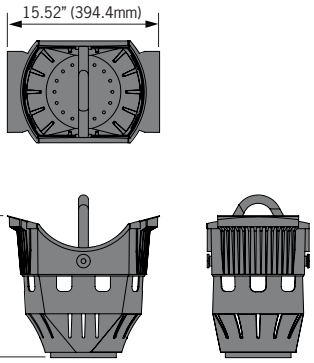
Outlet flow rates

Outlet	Product	Outlet size (Sch. 40)	Invert Depth	GPM	CFS
A	Type K1-621G	4" round	21.29"	239	0.53
B	Type K1-621G	4" round	27.79"	276	0.62
C	Type K1-621G	4" round	19.72"	229	0.51
D	Type K1-621G	6" round	27.79"	610	1.36
E	Type K1-621G	4" round	19.84"	230	0.51
F	Type K1-621G	4" round	26.34"	269	0.60
G	Type K1-621G	6" round	20.62"	514	1.15
H	Type K1-621G	4" round	20.07"	231	0.52
I	Type K1-621G	6" round	27.76"	609	1.36
J	Type K1-621G	4" round	27.19"	273	0.61
K	Type K1-621G	6" round	27.19"	602	1.34
L	Type K1-621G	8" round	27.76"	1061	2.36
M	Type K1-621G	6" round	26.28"	591	1.32
N	Type K1-621G	4" round	19.15"	225	0.50
O	Type K1-621G	4" round	25.86"	266	0.59

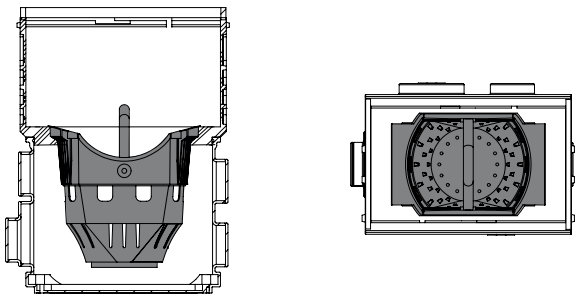
Notes:
1. These are the pipe flow rates at the specified outlet, **NOT** channel flow rates.
*Flow rates without trash bucket - using trash bucket or filter bag reduces flow rates.

2. 4" diameter foul air trap, part# 90854, can be fitted to catch basin base at outlet positions A/B and E/F

Trash Bucket



Note: Openings in trash bucket are 35.7"^{2} (23,033mm^2)



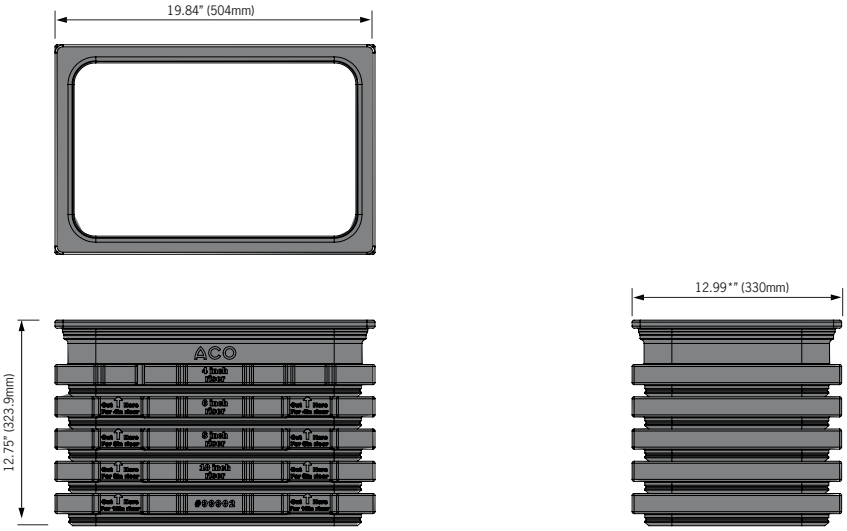
Note: Trash bucket position within K1-621G catch basin body and base

ACO DRAIN

K1-621G Catch Basin

Description	Part No.	Invert Depth inches	Invert Depth *mm*	Weight lbs.
Type K1-621G Catch basin assembly - top, removable "QuikLok" bar, trash bucket & base	**94617**	28.86	733.2	55.8
Catch Basin Components				
Type 600 optional riser	**99902**	40.86	1038	10.0
Foul air trap - fits both Type 900 & Type 600 basins	**90854**	-	-	1.2
QuickLok grate removal tool	**01318**	-	-	0.3

Optional riser detail (Part# 99902)



Notes:
1. Riser can be cut down in 1" (25mm) increments.
2. Addition of riser will alter the outflow rates of base as shown on table overleaf.

Specifications

General
The catch basin shall be ACO Drain K1-621G Catch Basin - comprising of top section, trash bucket and base as manufactured by ACO, Inc. or similar approved.

Materials
The top unit body shall be manufactured from polyester polymer concrete with minimum properties as follows:

Compressive strength:	14,000 psi
Flexural strength:	4,000 psi
Water absorption	0.07%
Frost proof	YES
Salt proof	YES
Dilute acid and alkali resistant	YES

The nominal clear opening shall be 13.46" (342mm) wide by 19.92" (506mm) long. Overall width of 22.70" (575.8mm) by 15.38" (390.6mm) long. Type K1-621G catch basin assembly has overall depth of 29.11" (739.5mm). Polymer concrete top units shall incorporate a cast in galvanized steel frame manufactured with drillouts for channel connection and have a wall thickness of at least 0.59" (15mm). Top units shall have horizontal cast in anchoring key features on the outside to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The base unit shall be a LLDPE plastic molding and incorporate molded plastic pipe stubbs to facilitate pipe connection.

Optional Riser
Optional riser can be useful between polymer concrete top unit and LLDPE base unit. Use of riser is determined by acess and local building codes.

Grates
Grates shall be specified. See separate ACO Spec Info grate sheets for details. After removal of grates and 'QuickLok' bar there shall be uninterrupted access to the catch basin to aid maintenance. Accepts all half-meter ACO K300 Drainlok grates or K300 Quicklok grates with optional QL bar.

Installation
The trench drain/catch basin system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

ACO, Inc.
Northeast Sales Office
9470 Pinecone Drive
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Tel: (440) 639-7230
Toll free: (800) 543-4764
Fax: (440) 639-7235

West Sales Office
825 W. Beechcraft St.
Casa Grande, AZ 85122
Tel: (520) 421-9988
Toll Free: (888) 490-9552
Fax: (520) 421-9899

Southeast Sales Office
4211 Pleasant Road
Fort Mill, SC 29708
Toll free: (800) 543-4764
Fax: (803) 802-1063

Follow us on

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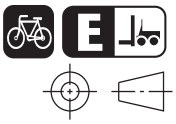
info@ACODrain.us
www.ACODrain.us

Type 861Q Ductile iron slotted grate



Product Features

- Certified to EN 1433 Load Class E - 135,000 lbs - 2,788 psi
- Uses 'QuickLok' boltless locking system
- Suitable for use with K300, KS300, H300K-13, and H300KS-13 channels and 621G, 621S, 631G, 631S catch basins
- Manufactured from ductile iron to ASTM A 536-84 - Grade 65-45-12
- E- coated for improved resistance against rust
- Bicycle Tire Penetration Resistant to AS 3996 - 2006

Specifications

General

The surface drainage system shall be ACO Drain K300, KS300, H300K-13, and H300KS-13, channels* and 621G, 621S, 631G, and 631S catch basins complete with ACO Type 861Q Ductile iron slotted grate with 'QuickLok' locking as manufactured by ACO Polymer Products, Inc. or similar approved.

Materials

The covers shall be manufactured from ductile iron and have ***minimum*** properties as follows:

- ***Independently certified to meet Load Class E to EN 1433 - 135,000 lbs - 2,788 psi***
- ***Ductile iron to ASTM A 536-84 - Grade 65-45-12***
- ***Intake area of 128.71 sq. in. (803.39 cm²) per half meter of grate***

The overall width of 13.31" (338mm) and overall length of 19.69" (500mm). Slots measure at a maximum of 5.71" (145mm).

Installation

The trench drain system and grates shall be installed in accordance with the manufacturer's installation instructions and recommendations.

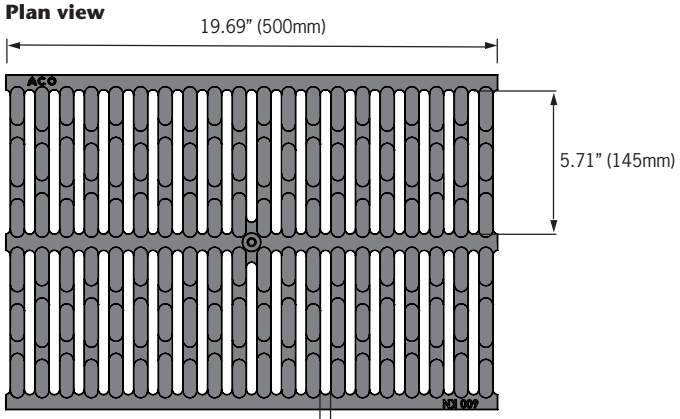
* delete as appropriate

ACO Specification Information

ACO DRAIN

Type 861Q Ductile iron slotted grate

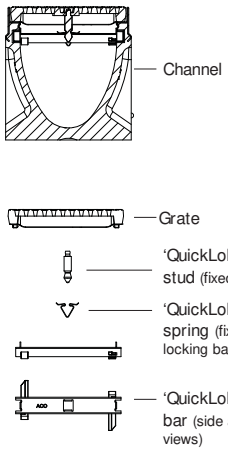
Plan view



Side elevation

Description	Part No.	Length inches *(mm)*	Width inches *(mm)*	Weight lbs.
QuickLok grate				
Type 861Q Ductile iron slotted grate	**10431**	19.69 (*500*)	13.35 (*339*)	48.0
QuickLok locking bar	**10458**	-	-	0.5
QuickLok grate removal tool	**01318**	-	-	0.3

'QuickLok' locking mechanism



ACO 'QuickLok' is a patented boltless locking system, grates are removed and replaced with the minimum time and effort for ease of maintenance. The unique design provides a positive 'snap down' fit into the locking bar. A stud is fixed to the grate which 'locks' into the spring clip in the locking bar.

The 'QuickLok' stud is made from stainless steel and high density nylon, the locking bar and clip are stainless steel, for use in both general purpose and corrosive environments.

ACO Polymer Products, Inc.

Northeast Sales Office
P.O. Box 245
Chardon, OH 44024
Tel: (440) 285-7000
Toll free: (800) 543-4764
Fax: (440) 285-7005

West Sales Office
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Casa Grande, AZ 85130
Tel: (520) 421-9988
Toll Free: (888) 490-9552
Fax: (520) 421-9899

Southeast Sales Office
4211 Pleasant Road
Fort Mill, SC 29708
Toll free: (800) 543-4764
Fax: (803) 802-1063

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info@ACODrain.us
www.ACODrain.us

Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services

Project Details

Date: 2020-08-13

Project Name : METRO GREENBANK
Project Number : 920 558
Street Address, City :
State zip code :

Customer

Company :
Contact Name :
Street Address, City :
State zip code :
Phone :
Email :

Input Data

Location :

Number	Catchment Description	Area [m²]	C	D [min]	F [a]	I [mm/hr]	Catchment Surface Type	Installation
1	TD1	168.0	0.90	0	0	150	Asphalt	E600
2	TD2	336.0	0.90	0	0	150	Asphalt	E600

Channel type	Catchment (s)	Catchment Area [m²]	C_m	Total run length [m]	Application
TD1	1	168.00	0.90	6.50	
TD2	2	336.00	0.90	13.50	

Notes

ACO SYSTEMS LTD.

1-2880 BRIGHTON RD
L6H5S3 OAKVILLE, ONTARIO

Prepared By : KYLE ZHENG
Phone : 905-829-0665
Email : KYLE.ZHENG@ACO.COM
Website : WWW.ACOCAN.CA

Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services

Project Details

Date: 2020-08-13

Project Name	: METRO GREENBANK
Project Number	: 920 558
Street Address, City	:
State zip code	:

Input

Channel type		: TD1
Trench drain system		: K100
Sloping, Neutral or Combination layout		:
Roughness Coefficient (Strickler) inverse Mannings		: 95
Invert Type		: Channel Slope
Type of Outlet		: sump unit-DN/OD200
Run Length	[m]	: 6.50
Catchment Area	[m²]	: 168
Runoff Coefficient	[C_m]	: 0.90
Hydraulic run length	[m]	: 6.50

All run segments combine to give the total run lenth.

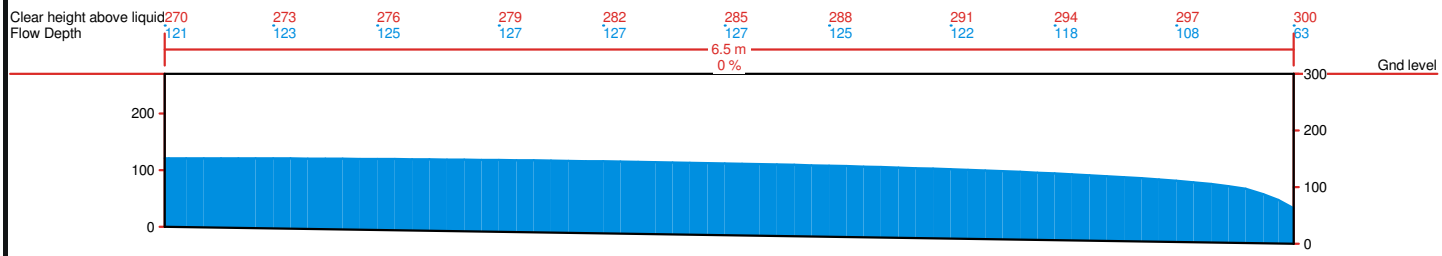
Section		1	2	3	4	5	6	7	8	9	10
Internal Width	[mm]	98									
Upstream Invert	[mm]	270									
Downstream Invert	[mm]	300									
Run Length	[m]	7									
Groundslope	[%]	0.000									

Results

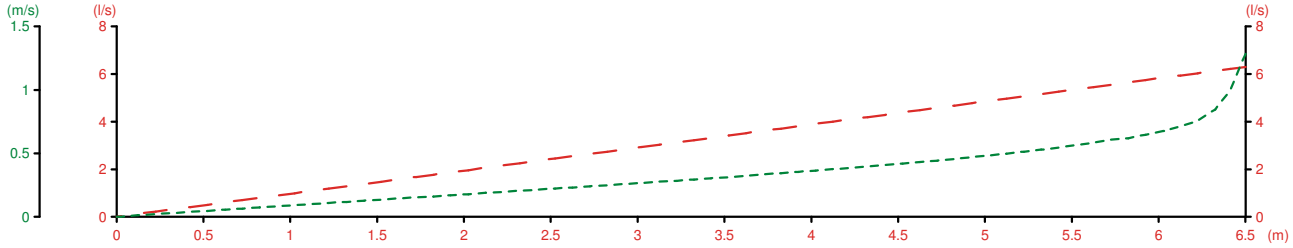
Discharge	[l/s]	: 6.30	
Flow Velocity	[m/s]	: 1.28	
Minimum Freeboard	[mm]	: 149.08, X = 0.00 m	(Freeboard Depth)
Drain Capacity Utilised	[%]	: 32.21	

Level of liquid

All depths are in mm



Flow Velocity and Flow Rate



Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services

Project Details

Project Name	: METRO GREENBANK
Project Number	: 920 558
Street Address, City	:
State zip code	:

Channel type		: TD1
Trench drain system		: K100
Sloping, Neutral or Combination layout		:
Type of Outlet		: sump unit-DN/OD200
Run Length	[m]	: 6.50
Hydraulic run length	[m]	: 6.50

Notes

Installation

Legend
LC = Load Class according to EN1433 (A15; B125; C250; D400; E600; F900)
SU = Catch Basin
AU = Access Unit
VO = Vertical Outlet
FO = Free Outflow
EO = End Outlet
LO = Lateral Outlet
A = Adapter
P = Plate

Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services

Project Details

Date: 2020-08-13

Project Name	: METRO GREENBANK
Project Number	: 920 558
Street Address, City	:
State zip code	:

Input

Channel type		: TD2
Trench drain system		: K100
Sloping, Neutral or Combination layout		:
Roughness Coefficient (Strickler) inverse Mannings		: 95
Invert Type		: Channel Slope
Type of Outlet		: sump unit-DN/OD200
Run Length	[m]	: 13.50
Catchment Area	[m²]	: 336
Runoff Coefficient	[C_m]	: 0.90
Hydraulic run length	[m]	: 13.50

All run segments combine to give the total run lenth.

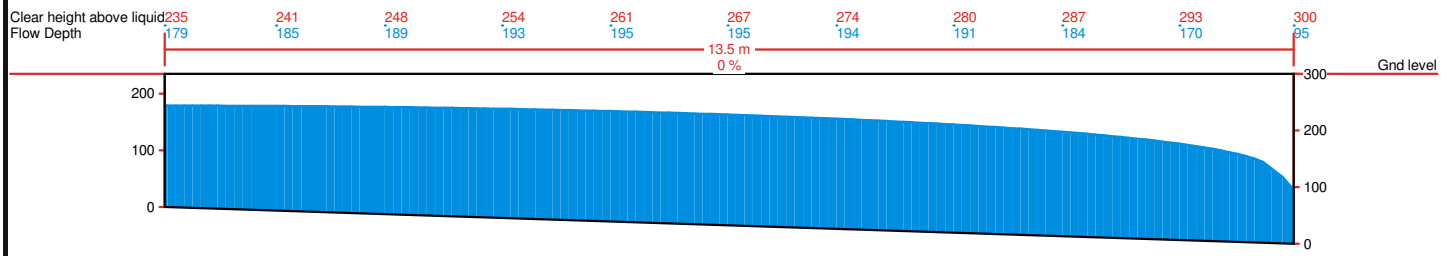
Section		1	2	3	4	5	6	7	8	9	10
Internal Width	[mm]	98									
Upstream Invert	[mm]	235									
Downstream Invert	[mm]	300									
Run Length	[m]	14									
Groundslope	[%]	0.000									

Results

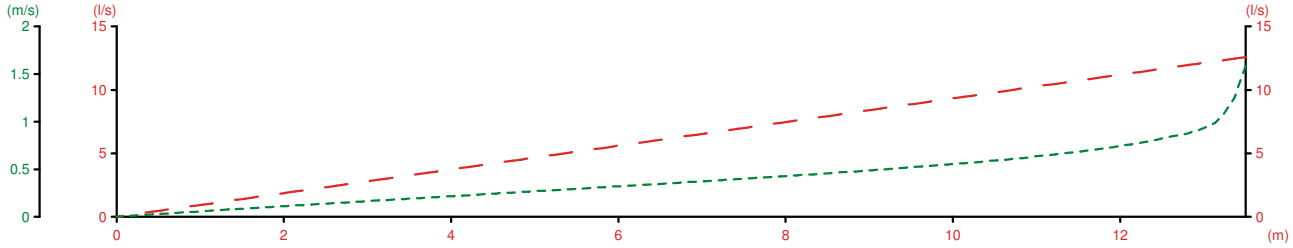
Discharge	[l/s]	: 12.60	
Flow Velocity	[m/s]	: 1.58	
Minimum Freeboard	[mm]	: 56.29, X = 0.00 m	(Freeboard Depth)
Drain Capacity Utilised	[%]	: 71.30	

Level of liquid

All depths are in mm



Flow Velocity and Flow Rate



Trench Hydraulic Calculation for ACO Drainage Systems

ACO Technical Services

Project Details

Project Name	: METRO GREENBANK
Project Number	: 920 558
Street Address, City	:
State zip code	:

Channel type		: TD2
Trench drain system		: K100
Sloping, Neutral or Combination layout		:
Type of Outlet		: sump unit-DN/OD200
Run Length	[m]	: 13.50
Hydraulic run length	[m]	: 13.50

Notes

Installation

Legend
LC = Load Class according to EN1433 (A15; B125; C250; D400; E600; F900)
SU = Catch Basin
AU = Access Unit
VO = Vertical Outlet
FO = Free Outflow
EO = End Outlet
LO = Lateral Outlet
A = Adapter
P = Plate

ACO KlassikDrain - K100 w/ 461Q – Specifications:

General
The surface drainage system shall be ACO KlassikDrain K100 complete with Type 461Q class "E" slotted ductile Iron gratings secured with 'QuickLok' boltless locking mechanism as manufactured by ACO Systems Ltd. For technical assistance or supply information, please contact ACO Canada (905)-829-0665 or info@acocan.ca.

Materials
The trench system bodies shall be manufactured from polymer concrete with minimum properties as follows:

Compressive strength: 14,000 psi
Flexural strength: 4,000 psi
Water absorption 0.07%
Frost proof
Salt proof
Dilute acid and alkali resistant

The nominal clear opening shall be 4.00" (100mm) with overall width of 5.12" (130mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% or with neutral invert and have a wall thickness of at least 0.50" (13mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring features on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The galvanized steel edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 3/32" (2.5mm) thick.

Grates
The grates shall be Type 461 slotted ductile iron with 'QuickLok' boltless locking mechanism as manufactured by ACO Systems Ltd. After removal of the grates and 'QuickLok' bar there shall be uninterrupted access to the trench to aid in maintenance.

Materials
The grates shall be manufactured from ductile iron and have **minimum** properties as follows;
- **Independently certified to meet Load Class E to DIN 19580 - 135,000 lbs - 2,788 psi.**
- **Ductile iron to ASTM A 536-84 - Grade 65-45-12.**
- **Intake area of 20.79 sq. in. (134.13cm²) per half meter of grate.**

The overall width of 4.84" (123mm) and overall length of 19.69" (500mm). Slots measure 3.94" (100mm) by 0.39" (10mm) per half meter of grate.

Installation
The trench drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

2.2 Findings of the Functional Servicing and Stormwater Management Report

The ***Functional Servicing and Stormwater Management Report*** (DSEL, December 2016) established the stormwater control criteria, the pond location and the general stormwater management scheme.

The proposed stormwater management facility is to be designed with the following characteristics:

- **Water Quality Control:** The permanent pool should be sized for an enhanced level of protection. A 40 m^3/ha active volume portion for water quality control should be provided in accordance with the ***SWMP Design Manual***.
- A sediment forebay shall be provided.
- Emergency overflow conveyance will be provided to safely pass emergency flows.

A summary of the required SWM pond characteristics is provided in Table 1.

3.0 DRAINAGE ANALYSIS

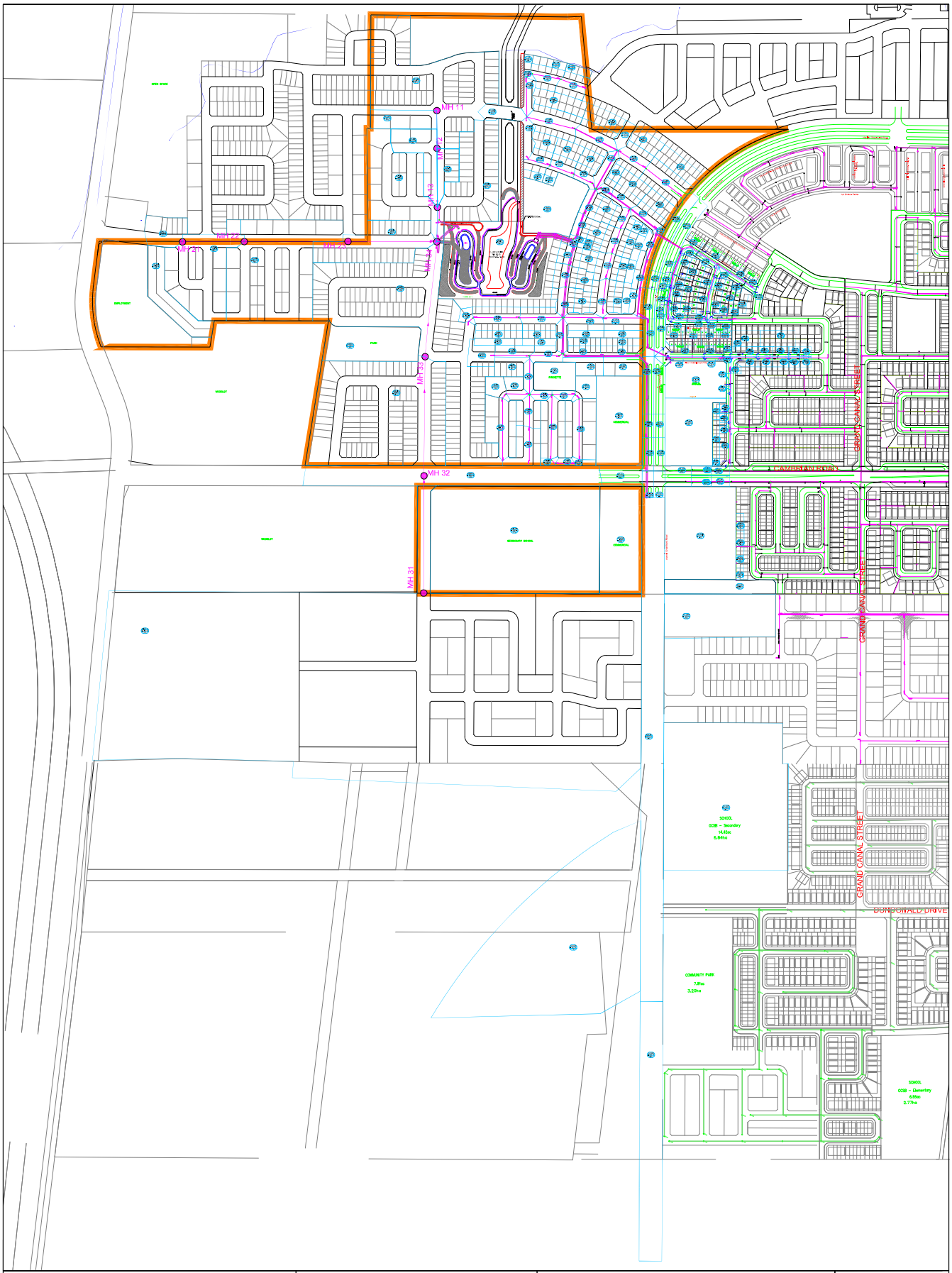
The pond design characteristics and requirements, based on a 123.414 ha total drainage area to the pond (121.656 ha contributing minor system flows requiring quality control treatment), as shown in ***Figure 2***, are summarized in ***Table 1*** as follows:

Table 1
SWM Pond Design Characteristics

Item	Target	Comments
Drainage Area	123.414 ha total; 121.656 ha minor flows	121.121 ha future development, 0.535 ha existing Half Moon Bay park block, 1.758 ha major flows only from existing Half Moon Bay subdivision
Imperviousness	67%	
Required Permanent Pool Volume	21,655 m^3	Based on 178.00 m^3/ha (1)
Required Quality Control Volume	4,866 m^3	40 m^3/ha
Allowable Release Rate for Quality Control	141 L/s	Minimum extended detention time between 24 to 48 hours (2)

(1) Note: Interpolated for 67% imperviousness, enhanced protection level for wet pond, as per Table 3.2 of the SWM Planning and Design Manual. Refer to Tables B-1 and B-2 of ***Appendix B***.
(2) Refer to Tables B-3 and B-4 of ***Appendix B***.

Furthermore, the detailed design of the facility has been completed in general conformance with the ***SWMP Design Manual***.



J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
GATINEAU (819) 243-6858
OTTAWA (613) 836-3884

CLIENT:

DSEL
david schaeffer engineering ltd
120 IBER ROAD, UNIT 103
STITTSVILLE, ONTARIO, K2S 1E9
(613) 836-0856

PROJECT:

HALF MOON BAY WEST
SUBDIVISION

SCALE:

0 75 150 225 300 375m

TITLE: PROPOSED DRAINAGE AREA TO SWM FACILITY

FIGURE 2

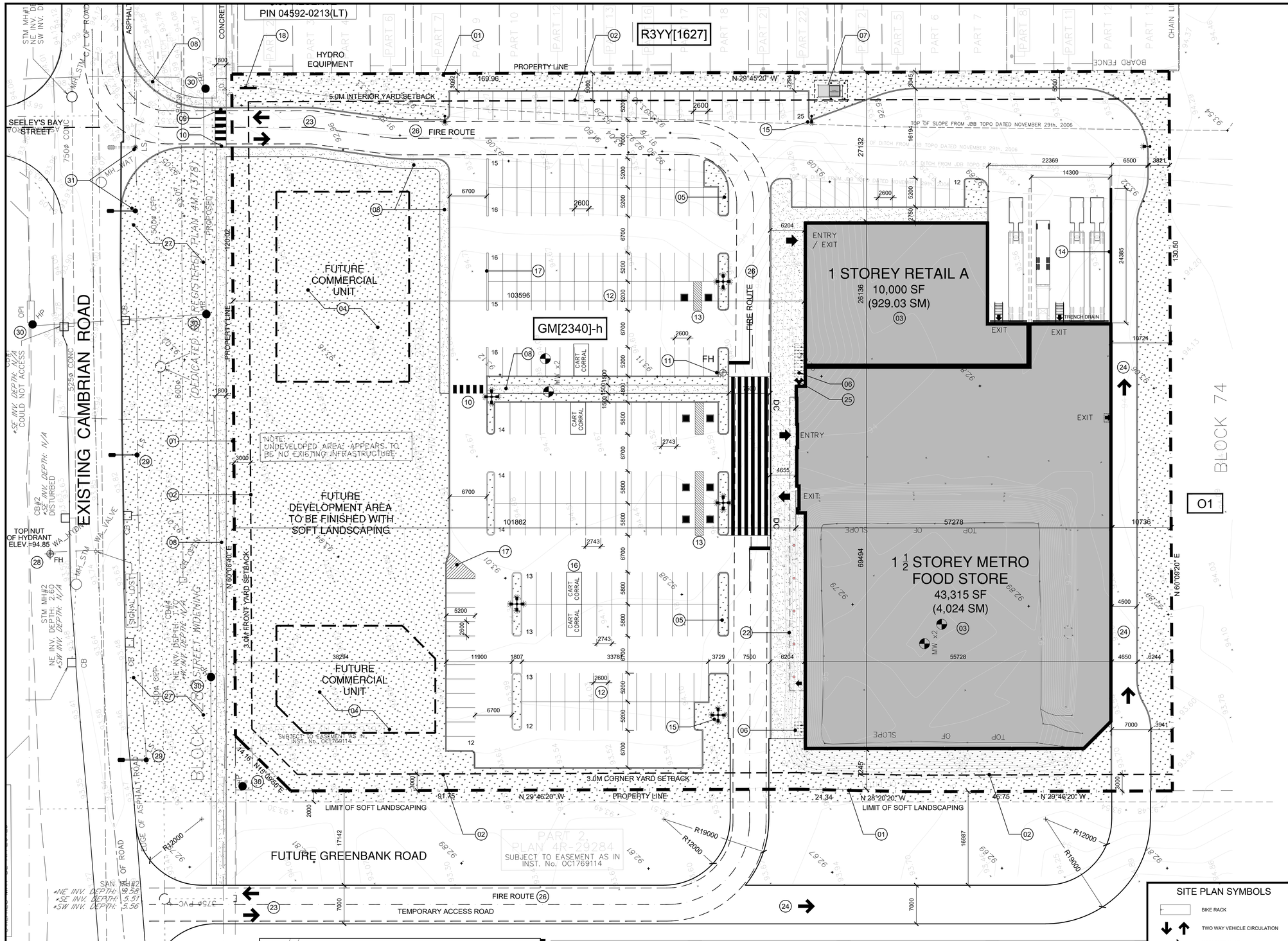
LEGEND:

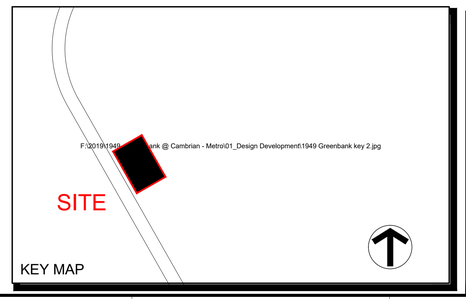
- LIMITS OF SUBDIVISION
- MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
- MAJOR SYSTEM FLOW DIRECTION
- FIRST DIRECTION OF EXCESS MAJOR SYSTEM FLOW AT LOW POINT
- LP100NW — LOW POINT
- A100NW / 0.068 ha / 75% — SUB-CATCHMENT ID / SUB-CATCHMENT AREA / TOTAL IMPERVIOUSNESS

No.	BY	DATE	DESCRIPTION	BY

DESIGNED :	
DRAWN :	PW
VERIFIED :	LP
APPROVED :	LP
DATE	PROJECT No.
Oct/17	598(07)-17

DRAWINGS / FIGURES





PROJECT INFORMATION

ZONING		GM[2340]-h
SITE AREA		22,063.0 sq. m. (237,484) sq. ft.
BUILDING HEIGHT		6 Storeys or 24.0 M
FRONT YARD SETBACK		3.0 M
CORNER YARD SETBACK		3.0 M
INTERIOR YARD SETBACK		5.0 M
REAR YARD SETBACK		0.0 M
LANDSCAPE BUFFER AROUND A PARKING LOT		3.0 M
LOADING SPACE - METRO		1
LOADING SPACE - RETAIL 'A'		0
PARKING - FOOD STORE	- 3.4 PER 100m² OF G.F.A.	99
PARKING - RETAIL	- 3.4 PER 100m² OF G.F.A.	24

PROJECT STATISTICS

GROSS BUILDING - AREAS

GFA - CITY OF OTTAWA'S DEFINITION	
RETAIL FOOD - METRO	2,921.3 sq. m. (31,445) sq. ft.
RETAIL STORE 'A' (ESTIMATE)	696.8 sq. m. (7,500) sq. ft.
TOTAL AREA	3,618.1 sq. m. (38,945) sq. ft.
GFA - BUILDING FOOTPRINT	
RETAIL FOOD - METRO	4,024.0 sq. m. (43,315) sq. ft.
RETAIL STORE 'A'	929.0 sq. m. (10,000) sq. ft.
TOTAL AREA	4,953.1 sq. m. (53,315) sq. ft.

CAR PARKING

REQUIRED

METRO - RETAIL FOOD	- 3.4 PER 100 m² OF GFA	99
RETAIL - BLDG 'A'	- 3.4 PER 100 m² OF GFA	24
TOTAL		123

PROVIDED

METRO - RETAIL FOOD	- 4.3 PER 1,000 ft² OF FOOTPRINT AREA	190
RETAIL - BLDG 'A'		30
TOTAL		220

METRO PARKING SPACE	2.74 x 5.75 m	62
STANDARD PARKING SPACE	2.6 x 5.2 m	150
SMALL CAR PARKING SPACE	2.4 x 4.6 m	0
BARRIER FREE SPACE - TYPE A	3.4 x 5.2 m	4
BARRIER FREE SPACE - TYPE B	2.4 x 5.2 m	4

BICYCLE PARKING

REQUIRED

COMMERCIAL RETAIL	- 1.0 PER 250m² OF G.F.A.	14
PROVIDED		16

LOADING

PROVIDED

COMMERCIAL RETAIL	- 2,000m² & OVER OF G.F.A.	2
COMMERCIAL CAFÉ	- 0m² TO 350m² OF G.F.A.	1
TOTAL		3

LOT COVERAGE

PAVED SURFACE =	9,993.5 sq. m.	45.3%
BUILDING FOOTPRINT =	4,921.0 sq. m.	22.3%
LANDSCAPE OPEN SPACE =	7,148.5 sq. m.	32.4%
TOTAL =	22,063.0 sq. m.	100.0%

DRAWING NOTES

1. PROPERTY LINE
2. BUILDING SETBACK LINE
3. PROPOSED COMMERCIAL BUILDING
4. FUTURE DEVELOPMENT AREA
5. LANDSCAPE ISLAND WITH 150mm BARRIER CURB
6. BICYCLE PARKING SPACES (0.6 x 1.8M) WITH RACK
7. HYDRO EQUIPMENT
8. CONCRETE SIDEWALK, WIDTH AS NOTED
9. TWSI TO BE LOCATED AND INSTALLED AS PER CITY REQUIREMENTS
10. PEDESTRIAN CROSS WALK WITH DEPRESSED CURBS
11. FIRE HYDRANT
12. STANDARD PARKING SPACE (2.6 X 5.2 M)
13. BARRIER FREE PARING SPACE
14. DROPPED GARBAGE / LOADING BAYS WITH SCREEN WALL
15. LIGHT STANDARD - LOCATION TO BE CONFIRMED
16. CART CORRAL
17. PAINTED ISLAND AND OR CURBS
18. PYLON SIGN
19. ELECTRIC VEHICLE SPACE WITH CHARGING STATION
20. FAMILY PARKING SPACE WITH SIGNAGE
21. WATER STORAGE TANK, SEE CIVIL
22. BUILDING CANOPY
23. 2 WAY ACCESS DRIVEWAY / ROAD
24. 1 WAY ACCESS DRIVEWAY / ROAD
25. SIAMESE CONNECTION
26. FIRE ROUTE
27. SOFT LANDSCAPING
28. EXISTING FIRE HYDRANT
29. EXISTING LIGHT STANDARD
30. EXISTING HYDRO POLE
31. RELOCATE EXISTING LIGHT STANDARD

SITE PLAN SYMBOLS

- BIKE RACK
- TWO WAY VEHICLE CIRCULATION
- MAIN ENTRANCE
- SERVICE DOOR / FIRE EXIT
- PROPERTY LINE
- ZONING SETBACKS
- PARKING LOT LIGHTING
- BARRIER FREE PARING SPACE AS PER PARKING BYLAW SECTION 3.1
  TYPE 'A' = 3.4M X 5.2M
  TYPE 'B' = 2.4M X 5.2M
  ACCESS AISLE = 1.5M WIDE
- BUILDING ROOF DRAINS

IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND TO REPORT ALL ERRORS AND/OR OMISSIONS TO THE ARCHITECT.

ALL CONTRACTORS MUST COMPLY WITH ALL PERTINENT CODES AND BY-LAWS.

THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT.

DO NOT SCALE DRAWINGS.

NOTATION SYMBOLS:

- (00) INDICATES DRAWING NOTES, LISTED ON EACH SHEET.
- <00> INDICATES ASSEMBLIE TYPE; REFER TO TYPICAL ASSEMBLIES SCHEDULE.
- <00> INDICATES WINDOW TYPE; REFER TO WINDOW ELEVATIONS AND DETAILS ON A900 SERIES.
- (000) INDICATES DOOR TYPE; REFER TO DOOR SCHEDULE AND DETAILS ON A900 SERIES.
- DETAIL NUMBER
- 00 TITLE (SHEET NUMBER) SCALE
- DETAIL REFERENCE PAGE
- DETAIL CROSS REFERENCE PAGE

No.	DESCRIPTION	DATE
3	ISSUED FOR SITE PLAN CONTROL	Aug. __, 20
2	ISSUED FOR CONSULTANT REVIEW	July 9, 20
1	ISSUED FOR CONSULTANT REVIEW	June 25, 20

REVISIONS:

ARCHITECT SEAL:

NORTH ARROW:

SEAL DATE: STAMP DATE

CLIENT:

F:\2019\1949 - Greenbank @ Cambrian - Metro\01_Design Development\metro red logo.jpg

25 Vickers Rd Bldg A 2 Floor, Etobicoke Ont M9B 1C1
Tel: 416-234-6118 Fax 416-234-6927

ARCHITECT:

J:\1-1000_RLA Standards\Libraries (Logos)\RLA LOGO FINAL address medium.jpg

PROJECT TITLE:

METRO - BARRHAVEN
GREENBANK ROAD @ CAMBRIAN ROAD
OTTAWA ONTARIO

SHEET TITLE:

SITE PLAN

DRAWN: RV | CHECKED: R.V.

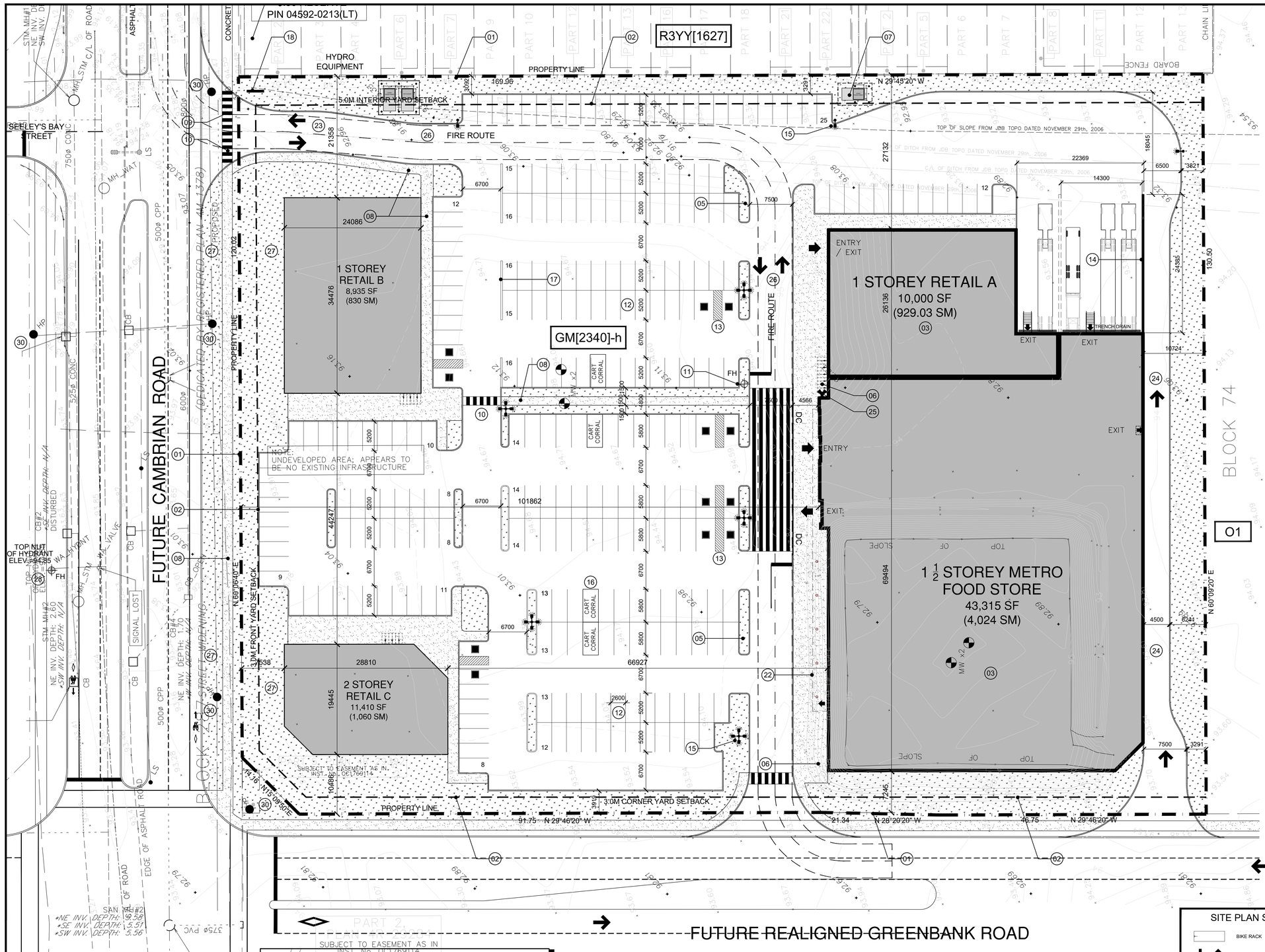
SCALE: 1:300

PROJECT No. 1949

SHEET No. SP-1

1 SP-1 SITE PLAN
SCALE = 1 : 300

TRANSPORTATION ENGINEER	CGH Transportation Inc. 13 Markham Avenue Ottawa, ON K2G 3Z1 Tel: (343) 999-9117 Email: Christopher.Gordon@CGHTransportation.com
LANDSCAPE ARCHITECT	Gino J. Aiello Landscape Architect 110 Didsbury Road Unit 9, Ottawa, Ontario K2E 0C2 Tel: (613) 852-1343 Cell: (613) Email: gino@giala.com
URBAN PLANNER	**FoTenn Consultants Inc.** 396 Cooper Street, Unit 300 Ottawa, ON Canada, K2P 2H7 Tel.: (613) 730-5709 Fax: (613) 730-1136 E-Mail: posen@fotenn.com
PROJECT DEVELOPER	**Metro Ontario Inc.** 5150 Spectrum Way, Suite 401, Mississauga, ON, L4W 5G2 Tel: (416) 234-6158 Cell: (416) 523-6168 Fax: (416) 234-6927 E-Mail: Antony.Cannell@metro.ca
GEOTECHNICAL ENGINEER	**paterson group** 154 Colonnade Road South Ottawa, Ontario K2E 7J5 Tel: 613.226-7381 Email: DGilbert@Patersongroup.ca
CIVIL ENGINEER	David Schaeffer Engineering ltd. 120 Iber Road, Unit 203 Stittsville, ON K2S 1E9 Tel: (613) 836-0856 Fax: (613) 836-7183 Email: smerrick@dsel.ca
SURVEYOR	J.D. Barnes Limited 2430 Don Reid Drive, Suite 204, Ottawa, Ontario, K1H 1E1 Tel: (613) 731-7244 Fax: (613) 731-8955 Cell: (613) 852-9260 E-Mail: cfox@jdbarnes.com
LEGAL DESCRIPTION	PLAN OF SURVEY SHOWING TOPOGRAPHIC DETAIL OF PART OF LOT 10 CONCESSION 3 (RIDEAU FRONT) CITY OF OTTAWA



1 SP-2 ULTIMATE SITE PLAN
SCALE = 1 : 300

PROJECT INFORMATION

ZONING		GM[2340]-h
SITE AREA		22,063.0 sq. m. (237,484) sq. ft.
BUILDING HEIGHT		6 Storeys or 24.0 M
FRONT YARD SETBACK		3.0 M
CORNER YARD SETBACK		3.0 M
INTERIOR YARD SETBACK		5.0 M
REAR YARD SETBACK		0.0 M
LANDSCAPE BUFFER AROUND A PARKING LOT		3.0 M
LOADING SPACE - METRO		1
LOADING SPACE - RETAIL 'A'		0
PARKING - FOOD STORE	- 3.4 PER 100m² OF G.F.A.	99
PARKING - RETAIL	- 3.4 PER 100m² OF G.F.A.	96

PROJECT STATISTICS

GROSS BUILDING - AREAS

GFA - CITY OF OTTAWA'S DEFINITION	
RETAIL FOOD - METRO	2,921.3 sq. m. (31,445) sq. ft.
RETAIL STORE 'A' (ESTIMATE)	696.8 sq. m. (7,500) sq. ft.
RETAIL STORE 'B' (ESTIMATE)	622.5 sq. m. (6,700) sq. ft.
RETAIL STORE 'C' (ESTIMATE)	795.0 sq. m. (8,557) sq. ft.
TOTAL AREA	5,035.1 sq. m. (54,197) sq. ft.
GFA - BUILDING FOOTPRINT	
RETAIL FOOD - METRO	4,024.0 sq. m. (43,315) sq. ft.
RETAIL STORE 'A'	929.0 sq. m. (10,000) sq. ft.
RETAIL STORE 'B'	830.0 sq. m. (8,935) sq. ft.
RETAIL STORE 'C'	1,060.0 sq. m. (11,410) sq. ft.
TOTAL AREA	6,843.0 sq. m. (73,650) sq. ft.

CAR PARKING

REQUIRED		
METRO - RETAIL FOOD	- 3.4 PER 100 m² OF GFA	99
RETAIL - BLDG 'A'	- 3.4 PER 100 m² OF GFA	24
RETAIL - BLDG 'B'	- 3.4 PER 100 m² OF GFA	21
RETAIL - BLDG 'C'	- 3.4 PER 100 m² OF GFA	27
TOTAL		123
PROVIDED		
METRO - RETAIL FOOD	- 4.3 PER 1,000 ft² OF FOOTPRINT AREA	190
RETAIL - BLDG 'A'		30
RETAIL - BLDG 'B'		25
RETAIL - BLDG 'C'		29
TOTAL		274
METRO PARKING SPACE	2.74 x 5.75 m	62
STANDARD PARKING SPACE	2.6 x 5.2 m	200
SMALL CAR PARKING SPACE	2.4 x 4.6 m	0
BARRIER FREE SPACE - TYPE A	3.4 x 5.2 m	6
BARRIER FREE SPACE - TYPE B	2.4 x 5.2 m	6

BICYCLE PARKING

REQUIRED		
COMMERCIAL RETAIL	- 1.0 PER 250m² OF G.F.A.	20
PROVIDED		24

LOADING

PROVIDED		
COMMERCIAL RETAIL	- 2,000m² & OVER OF G.F.A.	2
COMMERCIAL CAFÉ	- 0m² TO 350m² OF G.F.A.	1
TOTAL		3

LOT COVERAGE

PAVED SURFACE =	10,464.1 sq. m.	47.4%
BUILDING FOOTPRINT =	6,281.0 sq. m.	28.5%
LANDSCAPE OPEN SPACE =	5,317.9 sq. m.	24.1%
TOTAL =	22,063.0 sq. m.	100.0%

DRAWING NOTES

1. PROPERTY LINE
2. BUILDING SETBACK LINE
3. PROPOSED COMMERCIAL BUILDING
4. FUTURE DEVELOPMENT AREA
5. LANDSCAPE ISLAND WITH 150mm BARRIER CURB
6. BICYCLE PARKING SPACES (0.6 x 1.8M) WITH RACK
7. HYDRO EQUIPMENT
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SITE PLAN SYMBOLS

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- DETAIL CROSS REFERENCE PAGE

No.	DESCRIPTION	DATE
2	ISSUED FOR SITE PLAN CONTROL	Aug. 11, 20
1	ISSUED FOR CONSULTANT REVIEW	July 9, 20

REVISIONS:

ARCHITECT SEAL:

SEAL DATE: STAMP DATE

NORTH ARROW:

CLIENT:

25 Vickers Rd Bldg A 2 Floor, Etobicoke Ont M9B 1C1
Tel: 416-234-6118 Fax 416-234-6927

ARCHITECT:

PROJECT TITLE:

METRO - BARRHAVEN
GREENBANK ROAD @ CAMBRIAN ROAD
OTTAWA ONTARIO

SHEET TITLE:

ULTIMATE SITE PLAN

DRAWN:	CHECKED:
RV	R.V.
SCALE: 1:300	SHEET No. SP-2
PROJECT No. 1949	

TRANSPORTATION ENGINEER	LANDSCAPE ARCHITECT	URBAN PLANNER
CGH Transportation Inc. 13 Markham Avenue Ottawa, ON K2G 3Z1 Tel: (343) 999-9117 Email: Christopher.Gordon@CGHTransportation.com	Gino J. Aiello Landscape Architect 110 Didsbury Road Unit 9, Ottawa, Ontario K2E 0C2 Tel: (613) 852-1343 Cell: (613) Email: gino@giala.com	**FoTenn Consultants Inc.** 396 Cooper Street, Unit 300 Ottawa, ON Canada, K2P 2H7 Tel.: (613) 730-5709 Fax: (613) 730-1136 E-Mail: posen@fotenn.com
GEOTECHNICAL ENGINEER	CIVIL ENGINEER	SURVEYOR
paterson group 154 Colonnade Road South Ottawa, Ontario K2E 7J5 Tel: 613.226-7381 Email: DGilbert@Patersongroup.ca	David Schaeffer Engineering ltd. 120 Iber Road, Unit 203 Stittsville, ON K2S 1E9 Tel: (613) 836-0856 Fax: (613) 836-7183 Email: smerrick@dsel.ca	J.D. Barnes Limited 2430 Don Reid Drive, Suite 204, Ottawa, Ontario, K1H 1E1 Tel: (613) 731-7244 Fax: (613) 731-8955 Cell: (613) 852-9260 E-Mail: cfox@jdbarnes.com

PROJECT DEVELOPER	LEGAL DESCRIPTION
Metro Ontario Inc. 5150 Spectrum Way, Suite 401, Mississauga, ON, L4W 5G2 Tel: (416) 234-6158 Cell: (416) 523-6168 Fax: (416) 234-6927 E-Mail: Antony.Cannell@metro.ca	PLAN OF SURVEY SHOWING TOPOGRAPHIC DETAIL OF PART OF LOT 10 CONCESSION 3 (RIDEAU FRONT) CITY OF OTTAWA

PAPER SIZE: ISO Full Bleed B1 (707.00 X 1000.00 MM) | PLOT DATE: Tuesday, August 11, 2020 | PLOT SCALE: 1:1 | PEN STYLE: 0-RLA-MASTER-100%.ctb | Z:\Projects\19-1135_Metro - Greenbank Rd\B_Design\B2_Drawings\B2-3_Resources\Architect\2020-08-11\1949 Greenbank Metro SP-1 2020 08 11.dwg