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FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

FOR

OTTAWA RETIREMENT RESIDENCE BY SIGNATURE

CATHEDRAL HILLS GP INC. C/O: REICHMANN SENIORS HOUSING DEVELOPMENT CORP.

412 SPARKS STREET

CITY OF OTTAWA

PROJECT NO.: 18-965

MARCH 2019 – REV. 1

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT FOR CATHEDRAL HILLS GP INC. OTTAWA RETIREMENT RESIDENCE BY SIGNATURE 412 SPARKS STREET MARCH 2019 – REV. 1

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PROJECT NO.: 18-965

1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained by Cathedral Hills GP Inc. c/o: Reichmann Seniors Housing Development Corporation to prepare a Functional Servicing and Stormwater Management Report in support of the application for Site Plan Control (SPC) application at 412 Sparks Street. Cathedral Hills GP Inc. is the Tenant for 412 Spark Street and the owner, Cathedral Hill Foundation holds ownership of both this parcel of land and the adjacent 414 Spark Street, Christ Church Cathedral lands.

The subject property is located within the City of Ottawa urban boundary, in the Somerset Ward. As illustrated in ***Figure 1***, below, the subject property is bound by Sparks Street to the north and Queen Street to the south. The subject property measures approximately ***0.196ha*** and is zoned General Mixed-Use (GM27 S206). The subject property also lies within the Mature Neighborhoods Overlay.

Figure 1: Site Location

The subject property is currently entirely gravel and used as a parking lot for the adjacent Cathedral at 414 Sparks Street. The proposed development proposes an 18-storey retirement residence with underground parking. The proposed development consists of: **11 bachelor**; **93 1-bedroom;** and **48 2-bedroom for a total of 152 combined senior apartments and retirement units**.

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

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

Sparks Street:

- 203 mm diameter PVC watermain;
- 450 mm diameter PVC storm sewer; and
- 250 mm diameter PVC sanitary sewer.

Queen Street:

- 406 mm diameter PVC watermain; and
- 225 mm diameter clay combined sewer.

1.2 Required Permits / Approvals

The proposed development is subject to Site Plan Control approval process. The City of Ottawa must approve the engineering report and drawings prior to issuing SPC approval.

1.3 Pre-consultation

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

Quality control is not required for this development as per correspondence with the (Rideau Valley Conservation Authority) RVCA. Pre-consultation correspondence with the RVCA is included in ***Appendix A***.

As the development proposes to service more than one parcel of land through the stormwater management system, it does not meet the criteria required for an exemption under Ontario Regulation 525/98. Therefore, an Environmental Compliance Approval (ECA) will be required for the proposed development. Pre-consultation correspondence with the Ministry of the Environment, Conservation and Parks (MECP) is included 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-2018-04**
    City of Ottawa, June 27, 2018.
    (*ISTB-2018-04*)
- **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.
  (MOECP* Design Guidelines*)
- **Stormwater Planning and Design Manual,**
  Ministry of the Environment, March 2003.
  (MOE SWM Manual)

- **Ontario Building Code Compendium**
  Ministry of Municipal Affairs and Housing Building Development Branch, January 1, 2010 Update.
  (OBC)

- **Cathedral Hill Development - Development Servicing Study**
  Novatech Engineering Consultants Ltd., 2011.
  (DSS)

- **MTO Drainage Management Manual Part 4**
  Ministry of Transportation. 1995-1997.
  (MTO Guidelines)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property lies within the City of Ottawa 1W pressure zone. A local 203 mm diameter watermain exists within the Sparks Street right-of-way and a 406 mm diameter watermain exists within the Queen Street right-of-way, as shown by the ***City Water Distribution Mapping*** located in ***Appendix B***.

3.2 Water Supply Servicing Design

The subject property is proposed to be serviced through two connections; one to the existing 200 mm diameter watermain within Sparks Street and the other to the 406 mm diameter watermain within Queen Street. In accordance with City of Ottawa technical bulletin **ISDTB-2014-02**, redundant service connections will be required due to an anticipated average daily demand greater than 50 m^3/day. The two water services will be looped inside the building to satisfy redundancy.

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
Residential Bachelor Apartment	1.4 P/unit
Residential 1 Bedroom Apartment	1.4 P/unit
Residential 2 Bedroom Apartment	3.1 P/unit
Residential Average Daily Demand	280 L/d/P*
Residential Maximum Daily Demand	3.6 x Average Daily **
Residential Maximum Hourly	5.4 x Average Daily **
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. Above 500 persons, refer to Table 4.2 from City Guidelines.*
-Table updated to reflect ISD-2018-02

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

Table 2
Water Demand and Boundary Conditions
Proposed Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (Sparks) (m H_2O / kPa)	Boundary Condition[3] (Queen) (m H_2O / kPa)
Average Daily Demand	49.3	44.9 / 440.5	43.2 / 423.6
Max Day + Fire Flow	175.2 + 17,000 = 17,175.2	36.4 / 357.1	34.7 / 340.2
Peak Hour	263.4	32.0 / 313.9	33.0 / 323.5

1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.
2) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence; assumed ground elevation for fire flow is 71.0 m. See ***Appendix B.***
3) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence; assumed ground elevation for fire flow is 72.72 m. See ***Appendix B.***

The City of Ottawa was contacted to obtain boundary conditions associated with the estimated water demand, as indicated in the boundary request correspondence included in ***Appendix B***.

The City provided both the anticipated minimum and maximum water pressures, as well as, the estimated water pressure during fire flow scenario for the demands, as indicated by the correspondence in ***Appendix B***. The minimum and maximum pressures fall within the required range identified in ***Table 1***.

The required fire flow (RFF) was estimated in accordance with City of Ottawa Technical Bulletin ***ISTB-2018-02***. Parameters used in calculating the RFF were received from Hobin Architecture Inc. and are included in ***Appendix A*** and summarized below:

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

The RFF for the proposed building is estimated to be ***17,000 L/min*** as per the above assumptions. Calculation sheets per the ***ISTB-2018-02*** can be found in ***Appendix B.***

The property has four (4) adjacent hydrants, listed below, which were used to calculate the available fire flow listed in the subsequent paragraph:

- Three (3) are located along the south side of Queen Street, west of Bay Street; and

- One (1) located on the south side of Sparks Street, directly adjacent to the property.

According to ***Table 18.5.4.3*** of ***ISTB-2018-02***, the available fire flow from the existing hydrants surrounding the building is 18,926 L/min. Based on the estimated available fire flow and the resulting pressure during the fire flow scenario provided by the City of Ottawa, the existing hydrants are able to meet the required fire flow demands of the proposed development.

3.3 Water Supply Conclusion

The subject property is proposed to be serviced through two connections; one to the existing 200 mm diameter water main within Sparks Street and the other to the 406 mm diameter watermain within Queen Street.

The anticipated water demand under the proposed conditions was submitted to the City of Ottawa for establishing boundary conditions. Based on the City's model, the municipal system is capable of delivering water within the ***Water Supply Guidelines*** pressure range.

A certified fire protection system specialist will need to be employed in order to design the building's fire suppression system and confirm the maximum fire flow. The current maximum fire flow that can be supplied to the building exceeds the maximum fire flow required as per ***ISTB-2018-02*** standard.

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 Interceptor Sewer catchment area, as shown by the ***Sanitary & Storm Collection System Maps,*** included in ***Appendix C***. There is an existing 250 mm diameter sanitary sewer within the Sparks Street right-of-way.

4.2 Wastewater Design

The development is proposed to discharge to the existing 250 mm diameter sanitary sewer within Sparks Street.

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

Table 3
Wastewater Design Criteria

Design Parameter	Value
Residential Bachelor Apartment	1.4 P/unit
Residential 1 Bedroom Apartment	1.4 P/unit
Residential 2 Bedroom Apartment	2.1 P/unit
Average Daily Demand	280 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 3.8, Min 2.0 Harmon's Corrector Factor 0.8
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	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	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 4, below, demonstrates the anticipated peak flow from the proposed development. See ***Appendix C*** for associated calculations.

Table 4
Summary of Estimated Proposed Peak Wastewater Flow

Design Parameter	Proposed Flow (L/s)
Estimated Average Dry Weather Flow	1.13
Estimated Peak Dry Weather Flow	3.92
Estimated Peak Wet Weather Flow	3.93

The estimated sanitary flow based on the architectural site plan, provided in ***Drawings/Figures,*** results in a peak wet weather flow of ***3.93 L/s***. Associated calculations are included in ***Appendix C***.

The ***Cathedral Hill Development Servicing Study (DSS),*** by Novatech included a sanitary analysis for the sanitary sewer network within Sparks Street and Bay Street to the point where it discharges to the Interceptor Sewer. The ***DSS*** proposed a sanitary release rate of ***1.35 L/s*** from the subject property. According to the ***DSS,*** the most restrictive leg of sewer lies within Sparks Street and has an available capacity of ***38.48 L/s***. The proposed development results in a ***2.58 L/s*** increase of sanitary flow from the proposed sanitary release rate in the ***DSS***, and therefore, the sewer network has the capacity to accommodate the proposed increase in sanitary flow. The ***DSS*** including the sanitary sewer design sheet and figure are included in ***Appendix C***.

4.3 Wastewater Servicing Conclusions

The site is tributary to the Interceptor Sewer. It is proposed to discharge sanitary flow to the existing 250 mm diameter sanitary sewer within Sparks Street.

The existing sewer network has the available capacity to accommodate the proposed increase in sanitary flow.

The proposed wastewater servicing design conforms to all relevant City Guidelines and Policies.

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Services

Stormwater runoff from the subject property is tributary to the City of Ottawa sewer system. As such, approvals for the proposed development 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 Ottawa River west watershed and is therefore, subject to review by the Rideau Valley Conservation Authority (RVCA). Consultation with the RVCA is included in ***Appendix A***.

The property currently directs flow towards Sparks Street, flow is captured through existing catch basins and is conveyed through the existing sewers within Sparks Street or overland along the major overland flow route. There are three external drainage areas that direct flow onto the subject property. Runoff from ***0.057 ha*** of the Cathedral, adjacent to the subject property, is currently directed to and captured through existing catch basins on the subject site. The flow from the residential properties south of the subject site as well as from the existing cathedral and parking lot west of site, with area of ***0.045 ha*** and ***0.032 ha*** respectively, is also directed onto the subject property.

Minor system flow from Queen Street is conveyed to catch basins within Queen Street, a low point exists fronting the subject property. Based on a review of the topographic survey and 1k mapping received from the City of Ottawa, in the event that the minor system reaches capacity, overland flow from approximately ***1.103 ha***, would spill through the subject property towards Sparks Street. The flow would be captured by the minor system on Sparks Street or be conveyed overland. Major system flow from Sparks Street and the portion of Queen Street discussed above would spill south through the Garden of the Provinces and Territories.

The estimated pre-development peak flows for the 2, 5, and 100-year events are summarized in ***Table 5,*** below:

Table 5
Summary of Existing Peak Storm Flow Rates

City of Ottawa Design Storm	Estimated Peak Flow Rate Internal Site (L/s)	Estimated Peak Flow Rate External Cathedral (L/s)
2-year	35.5	10.9
5-year	48.2	14.8
100-year	97.2	28.3

5.2 Post-development Stormwater Management Targets

Stormwater management quantity control requirements for the proposed development were reviewed with the City of Ottawa. Correspondence is included in ***Appendix A*** and summarized below:

- Control post-development to the 5-year storm event, with a calculated runoff coefficient (no more than 0.5) and a calculated time of concentration no less than 10 minutes. Run-off from the existing cathedral is to be included in target release rate for the site;
- Run-off from the existing Cathedral that currently drains onto the subject property is to be captured and attenuated;
- Run-off from the existing residential properties to the south of the subject site are to be captured and conveyed through the proposed storm system, however, no attenuation is required for the flow conveyed from these properties;
- Major System Flow from Queen Street will need to be directed towards the major overland flow route on Sparks Street; and
- Attenuate storms up to and including the City of Ottawa 100-year design event on site.

Based on the parameters above, the allowable 5-year release rate for the proposed development is ***36.6 L/s***.

5.3 Proposed Stormwater Management System

It is proposed that the stormwater for the proposed development be serviced through a connection to the existing 450 mm diameter storm sewer within Sparks Street.

To achieve the allowable post-development stormwater release rate for the internal site, as well as, the run-off from the existing cathedral that is directed onto the subject site identified in ***Section 5.2***, above, the proposed development will employ flow attenuation through the use of an internal stormwater cistern.

Table 6, below***,*** estimates post-development flow rates and storage requirements.

Table 6
Stormwater Flow Rate Summary

Control Area	5-Year Release Rate (L/s)	5-Year Storage (m^3)	100-Year Release Rate (L/s)	100-Year Storage (m^3)
Unattenuated Areas	12.5	0.0	25.5	0.0
Attenuated Areas	5.6	41.5	11.1	82.9
Total	**18.0**	**41.5**	**36.6**	**82.9**

It is estimated that a total of ***82.9 m^3*** of storage is required to attenuate flow to a release rate of ***18.0 L/s*** for the 5-year event and ***36.6 L/s*** for the 100-year event. Storage and flow calculations are included in ***Appendix D***.

The major system flow from Queen Street, shown as ***EX3*** on drawing ***SWM-1***, is proposed to be directed through the pedestrian access along the west edge of the subject property discharging to Spark Street. The estimated major system flow of ***195.5 L/s*** (100-year subtract 5-year flow) was analyzed at multiple sections through the proposed overland flow route. A maximum flow depth of ***7cm*** was estimated at section B-B shown on ***SWM-1***. A low point exists along the overland flow route at ***CB2***. The CB has been designed with inlet restriction to accept a maximum flow of ***35.7 L/s*** into the internal mechanical system, equal to the 100-year flow from drainage area ***A2*** and ***EX2.*** The major system flow from ***EX3*** was analyzed at the spill point of ***CB2***, shown as section A-A on ***SWM-1***, resulting in an estimated maximum flow depth ***12cm***. The major system flow during the 100-year storm event is contained within the pedestrian access and the depth of flow will not extend to the proposed doors on the subject property or existing door elevations at the Christ Church Cathedral. Refer to ***Appendix D*** for calculations associated with the overland flow route.

The external drainage from the residential properties south of the subject site, shown as **EX4** on drawing ***SWM-1***, will be captured in the proposed stormwater system and will bypass the internal cistern, conveying flow directly to the existing storm sewer within Sparks Street. The catchbasin **CB1**, which collects the drainage from this area as well as area **U2,** has an inlet capacity of ***205 L/s*** which exceeds the combined 100-year flowrate of the two tributary areas. Design Chart 4.19 from the ***MTO Guidelines*** is included in ***Appendix D*** to demonstrate inlet capacity of both **CB1** and **CB2**.

Quality controls are not required, as per correspondence with the RVCA, for the proposed development as there is not any proposed above surface parking. Correspondence with the RVCA is included in ***Appendix A***.

5.4 Stormwater Servicing Conclusions

Post-development stormwater runoff will be required to be restricted to the estimated pre-development 5-year storm events, based on coordination with City of Ottawa. The post-development stormwater allowable release rate to the storm sewer within Sparks Street was calculated to be ***36.6 L/s***. It is estimated that ***82.9 m^3*** of storage will be required by the internal cistern in order to meet this release rate.

Overland flow from ***EX3*** is proposed to be conveyed through the pedestrian access along the west edge of the subject property. There is sufficient capacity in the walkway to convey the major system flow, flow depths will not extend to doorways on the subject property or the existing Christ Church Cathedral.

As per correspondence with the RVCA, quality controls will not be required for the proposed development.

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

6.0 UTILITIES

Utility servicing will be coordinated with the individual utility companies prior to site development.

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 Cathedral Hills GP Inc. c/o: Reichmann Seniors Housing Development Corporation to prepare a Functional Servicing and Stormwater Management Report in support of the application for a Site Plan Control application at 412 Sparks Street. The preceding report outlines the following:

- Based on boundary conditions provided by the City, the existing municipal water infrastructure is capable of providing the proposed development with water within the City's required pressure range;
- The required fire flow (RFF) was estimated in accordance with City of Ottawa Technical Bulletin ***ISTB-2018-02***. The RFF for the proposed building is estimated to be ***17,000 L/min***;
- The proposed development is anticipated to have a peak wet weather flow of ***3.93 L/s*** directed to existing sanitary sewer within Sparks Street. Based on the ***DSS,*** the most constrictive leg of the sanitary sewers will have sufficient capacity to accommodate the flow increase of ***2.58 L/s*** from the proposed development;
- Based on the City requirements, the proposed development will attenuate storm flow to the pre-development 5-year release rates of ***36.6 L/s***;
- Flow for the internal site, as well as, from the adjacent cathedral will be attenuated through the use of an internal cistern providing ***82.9 m^3*** of storage.
- Major system flow from Queen Street is proposed to be conveyed through the pedestrian access along the west side of the subject property.
- It is not anticipated that quality controls will be needed for the proposed development. Confirmation on the stormwater quality control requirements has been requested from the RVCA.

Prepared by,

David Schaeffer Engineering Ltd.

Per: Genavieve Melatti

Reviewed by,

David Schaeffer Engineering Ltd.

Per: Steven L. Merrick, P.Eng

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APPENDIX A

Pre-Consultation

Genavieve Melatti

From: Wu, John <John.Wu@ottawa.ca>
Sent: Friday, October 13, 2017 3:43 PM
To: Steve Merrick
Subject: RE: 412 Sparks St (Cathedral Hill) - Pre-consult follow up

Yes, all is right.

John

From: Steve Merrick [mailto:SMerrick@dsel.ca]
Sent: Friday, October 13, 2017 2:55 PM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Stephanie Morris <morris@fotenn.com>; Adam Fobert <AFobert@dsel.ca>; 'Victoria Lucas' <vlucas@rshdevco.com>; Nitsche, Kersten <Kersten.Nitsche@ottawa.ca>
Subject: 412 Sparks St (Cathedral Hill) - Pre-consult follow up

Hi John,

I just wanted to reach out to follow up on the pre-consultation for the above noted site. I have read through the meeting minutes and wanted to clarify a few items listed below:

1) Target release rate for the site based on current guidelines, 5-year storm event, existing runoff coefficient (no more than 0.5), calculated time of concentration (no less than 10 minutes)

2) Runoff from the existing cathedral currently draining to the subject site to be captured and attenuated, area to be included in the above target release rate calculation

3) Runoff from the existing residential to the south to be captured and conveyed through the proposed storm system, no additional attenuation required for these lands

4) Lands to be part of a long-term lease, the church and proposed development will be under one ownership and therefore be exempt from an ECA

I have also attached a quick sketch roughly delineating the areas discussed above, we will confirm the delineated area as we progress through our design. We hope you can confirm the above storm criteria listed above. Feel free to call if you have any questions or concerns.

Thanks in advance,

Steve Merrick, P.Eng.

Project Manager / Intermediate Designer

DSEL
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cell: (613) 222-7816
email: smerrick <mailto:afobert@DSEL.ca> @DSEL.ca

Genavieve Melatti

From: Melaniel L. <melaniel@hobinarc.com>
Sent: Monday, January 7, 2019 5:08 PM
To: Genavieve Melatti
Cc: Steve Merrick
Subject: Re: 412 Sparks Street - FUS Calculations

Hello Genavieve,

I reviewed this with Doug Brooks and please see our responses below:

- We confirm that the building will be sprinklered
- At the moment, we believe our building will be classified as ISO Class 3 (Non-combustible construction). We have not determined our exterior walls types yet and the structure is not complete, however by what we currently have modeled in 3D you will be safe by saying Class 3. It will most definitely not be a lower class than that.

Melanie

On 1/7/2019 4:18 PM, Genavieve Melatti wrote:

> Hey Melanie,
>
> Happy New Year! I just wanted to follow up on this and see if you had heard back from the mechanical engineer on this yet or if possibly you might be able to help us out with the info.
>
> Once I get the information it will take about 2 weeks for the City to get back to me with boundary conditions.
>
> Let me know if you have any questions.
>
> Genavieve Melatti
> Project Coordinator/ Junior Designer
>
> DSEL
> **david schaeffer engineering ltd.**
>
> 120 Iber Road, Unit 103
> Stittsville, ON K2S 1E9
>
> **phone**: (613) 836-0856 ext. 569
> **email**: gmelatti@DSEL.ca
>
>
>
> **From:** Melaniel L. <melaniel@hobinarc.com>
> **Sent:** Friday, December 21, 2018 12:00 PM
> **To:** Genavieve Melatti <GMelatti@dsel.ca>

Cc: Steve Merrick <SMerrick@dsel.ca>
Subject: Re: 412 Sparks Street - FUS Calculations

Hello Genavieve,

This information will need to come from the mechanical engineer and not me. I will forward your email to Junxiang Guan from Smith + Andersen so he can answer.

Melanie

On 12/21/2018 11:51 AM, Genavieve Melatti wrote:

> Hey Melanie,
>
> I was wondering if you would be able to provide some information for us that is required in order to complete the FUS calculations for this project so that we can submit a request to the City for boundary conditions.
>
> - Would you be able to please confirm the sprinkler systems for the building?
> - I have included the ISO Guide in which sections 1, 2 and 3 on pages 3 to 10 provides definitions to clarify as well as the section from the City's technical bulletin. Note that ISO refers only to fire-resistive for fire ratings not less than 1-hour. Would you be able to provide the ISO class for the building.

A. Determine the type of construction.

- Coefficient *C* in the FUS method is equivalent to coefficient *F* in the ISO method:

Correspondence between FUS and ISO construction coefficients

FUS type of construction	ISO class of construction	Coefficient *C*
Fire-resistive construction	Class 6 (fire resistive)	0.6
	Class 5 (modified fire resistive)	0.6
Non-combustible construction	Class 4 (masonry non-combustible)	0.8
	Class 3 (non-combustible)	0.8
Ordinary construction	Class 2 (joisted masonry)	1.0
Wood frame construction	Class 1 (frame)	1.5

However, the FUS definition of fire-resistive construction is more restrictive than those of ISO construction classes 5 and 6 (modified fire resistive and fire resistive). FUS requires structural members and floors in buildings of fire-resistive construction to have a fire-resistance rating of 3 hours or longer.

- With the exception of fire-resistive construction that is defined differently by FUS and ISO, practitioners can refer to the definitions of the ISO construction classes (and the supporting definitions of the types of materials and assemblies that make up the ISO construction classes) found in the current ISO guide [4] (see Annex i) to help select coefficient *C*.
- To identify the most appropriate type of construction for buildings of mixed construction, the rules included in the current ISO guide [4] can be followed (see Annex i). For a building to be assigned a given classification, the rules require ⅔ (67%) or more of the total wall area and ⅔ (67%) or more of the total floor and roof area of the building to be constructed according to the given construction class or a higher class.
- New residential developments (less than 4 storeys) are predominantly of wood frame construction ($C = 1.5$) or ordinary construction ($C = 1.0$) if exterior walls are of brick or masonry. Residential buildings with exterior walls of brick or masonry veneer and those with less than ⅔ (67%) of their exterior walls made of brick or masonry are considered wood frame construction ($C = 1.5$).

If you have any questions at all please feel free to contact me.

Thank you,

Genavieve Melatti
Project Coordinator/ Junior Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 569
email: gmelatti@DSEL.ca

--
Melanie Lamontagne

Hobin Architecture Incorporated

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Ottawa, Ontario
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t 613-238-7200 x126
f 613-235-2005
e melaniel@hobinarc.com

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e melaniel@hobinarc.com

hobinarc.com

Genavieve Melatti

From: Jamie Batchelor <jamie.batchelor@rvca.ca>
Sent: Wednesday, February 6, 2019 3:00 PM
To: Genavieve Melatti
Cc: Steve Merrick
Subject: Re: 412 Sparks Street Quality Controls

Good Afternoon Genavieve,

Provided no surface parking is being provided, there would be no additional onsite water quality measures requires save and except best management practices.

From: Genavieve Melatti <GMelatti@dsel.ca>
Sent: February 6, 2019 1:27 PM
To: Jamie Batchelor
Cc: Steve Merrick
Subject: RE: 412 Sparks Street Quality Controls

Hey Jamie,

I just wanted to follow up on this email and the quality control requirements for this project. Please let me know if you have any questions.

Thank you,

Genavieve Melatti
Project Coordinator/ Junior Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 569
email: gmelatti@DSEL.ca

From: Genavieve Melatti
Sent: Wednesday, January 2, 2019 10:29 AM
To: 'jamie.batchelor@rvca.ca' <jamie.batchelor@rvca.ca>
Cc: Steve Merrick <SMerrick@dsel.ca>
Subject: 412 Sparks Street Quality Controls

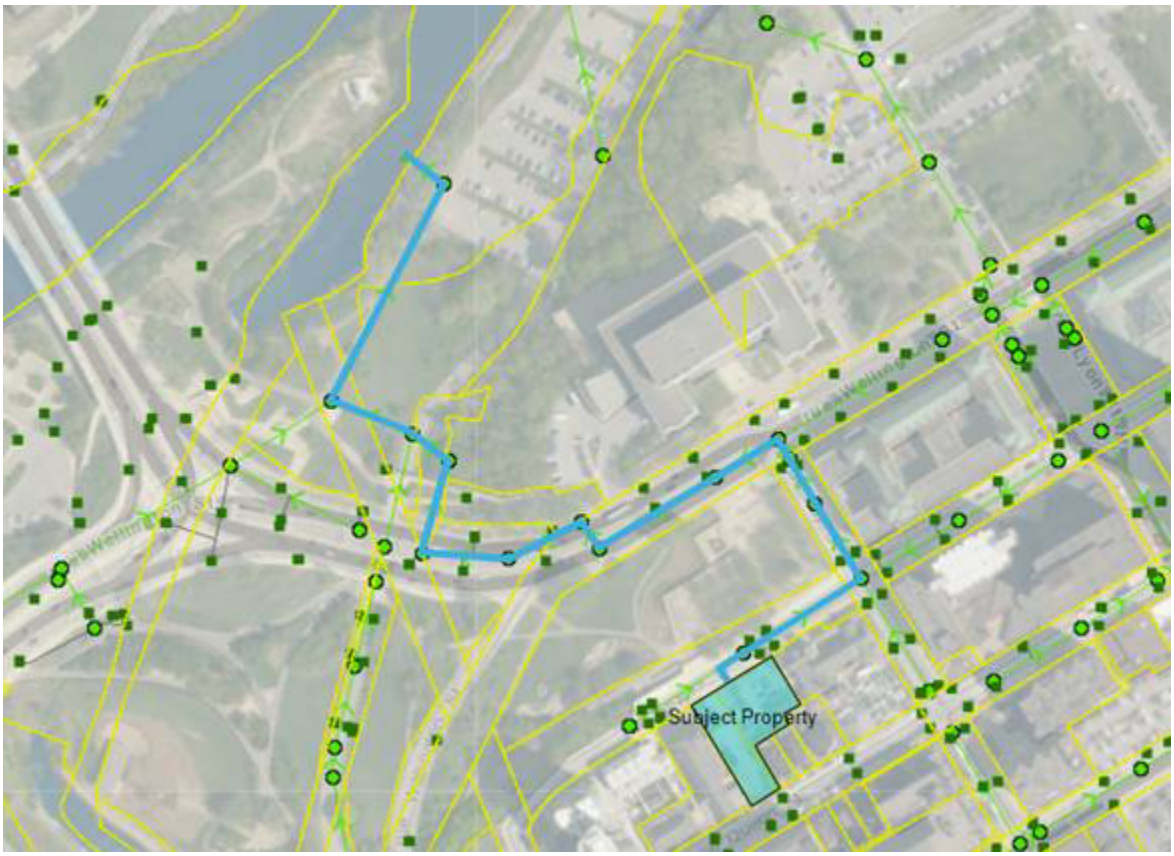
Good morning Jamie,

I wanted to touch base with you regarding the development at 412 Sparks Street. The property falls within the Nepean Creek watershed within the Ottawa River West sub-watershed.

The development an 18-storey residential building with underground parking and no above ground parking. The development would be looking to discharge stormwater to the 450 mm diameter storm sewer within Sparks Street. The stormwater discharged through the storm sewer within Sparks Street travels 650m before discharging to the Ottawa River.

We do not believe that quality controls will be required as the floor is primarily rooftop and landscaped flows.

Would you be able to please confirm if quality controls are required for this proposed development?



Please feel free to call if you have any questions or would like to discuss.

Thank you,

Genavieve Melatti
Project Coordinator/ Junior Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 569
email: gmelatti@DSEL.ca

Genavieve Melatti

From: Genavieve Melatti
Sent: Friday, February 15, 2019 1:35 PM
To: Genavieve Melatti
Subject: FW: 412 Sparks Street - ECA Requirement

From: Diamond, Emily (MECP) [mailto:Emily.Diamond@ontario.ca]
Sent: Saturday, February 2, 2019 9:43 AM
To: Steve Merrick <SMerrick@dsel.ca>
Subject: RE: 412 Sparks Street - ECA Requirement

Hi Steve,

The ministry's position is if the proposed stormwater works is servicing more than one parcel of land, it does not meet the exemption set out in Ontario Regulation 525/98. This would mean that an ECA would be required regardless of who owns the parcels.

Regards,

Emily Diamond
Environmental Officer
Ministry of the Environment, Conservation and Parks
Ottawa District Office
2430 Don Reid Drive
Ottawa, Ontario, K1H 1E1
Tel: 613-521-3450 ext 238
Fax: 613-521-5437
e-mail: emily.diamond@ontario.ca

From: Steve Merrick [mailto:SMerrick@dsel.ca]
Sent: January 31, 2019 5:20 PM
To: Diamond, Emily (MECP) <Emily.Diamond@ontario.ca>
Subject: RE: 412 Sparks Street - ECA Requirement

We are getting pressure from our client to have this resolved. Can you provide input as requested by the City of Ottawa?

Can you forward this email onto someone who can provide input?

Thanks,

Steve Merrick, P.Eng.
Project Manager / Intermediate Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103

Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
cell: (613) 222-7816
email: smerrick@DSEL.ca

From: Steve Merrick
Sent: Thursday, January 24, 2019 8:49 AM
To: 'Diamond, Emily (MOECC)' <Emily.Diamond@ontario.ca>
Subject: RE: 412 Sparks Street - ECA Requirement

Hi Emily,

The City of Ottawa is looking for input on this, feel free to call to discuss.

Thanks,

Steve Merrick, P.Eng.
Project Manager / Intermediate Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
cell: (613) 222-7816
email: smerrick@DSEL.ca

From: Steve Merrick
Sent: Wednesday, December 5, 2018 1:56 PM
To: 'Diamond, Emily (MOECC)' <Emily.Diamond@ontario.ca>
Subject: RE: 412 Sparks Street - ECA Requirement

Hi Emily,

Do you need any more information from us to confirm this? Let us know.

Thanks,

Steve Merrick, P.Eng.
Project Manager / Intermediate Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
cell: (613) 222-7816
email: smerrick@DSEL.ca

From: Steve Merrick
Sent: Tuesday, November 20, 2018 10:29 AM
To: 'Diamond, Emily (MOECC)' <Emily.Diamond@ontario.ca>
Subject: RE: 412 Sparks Street - ECA Requirement

Hi Emily,

I'm hoping to be able to confirm this for the client. Feel free to call if you need any further information.

Thanks,

Steve Merrick, P.Eng.
Project Manager / Intermediate Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
cell: (613) 222-7816
email: smerrick@DSEL.ca

From: Steve Merrick
Sent: Wednesday, November 14, 2018 9:22 AM
To: 'Diamond, Emily (MOECC)' <Emily.Diamond@ontario.ca>
Subject: RE: 412 Sparks Street - ECA Requirement

Hi Emily,

The city has asked that the MOE have the final decision on the below ECA requirement. Can you please let me know in the next week if an ECA is required. Please let me know if you need any further information.

Thanks,

Steve Merrick, P.Eng.
Project Manager / Intermediate Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
cell: (613) 222-7816
email: smerrick@DSEL.ca

From: Steve Merrick
Sent: Thursday, October 18, 2018 9:58 AM
To: 'Diamond, Emily (MOECC)' <Emily.Diamond@ontario.ca>
Subject: 412 Sparks Street - ECA Requirement

Hi Emily,

I am reaching out to you to confirm if an ECA will be required for the stormwater management system to support a proposed development at 412 Sparks Street located within the City of Ottawa, subject property shown below. We have also reached out to the City of Ottawa for their input on this matter.

The City of Ottawa has been pre-consultated on the stormwater management plan and have indicated that the proposed development is required to capture and treat the runoff from the adjacent Christ Church Cathedral Ottawa. Please refer to the attached previously approved stormwater management plan prepared by Novatech, our proposed plan will result in a similar condition to that shown in the attached. Both properties are owned by the Christ Church Cathedral Ottawa, our client has leased the lands at 412 Sparks Street for 99 years from the church. As both properties have the same owner, I do not believe this is the intent of an environmental compliance approval. We hope you can confirm if this meets the exemptions under Section 3 of O.Reg 525.98.

Thanks,

Steve Merrick, P.Eng.
Project Manager / Intermediate Designer

DSEL
david schaeffer engineering ltd.

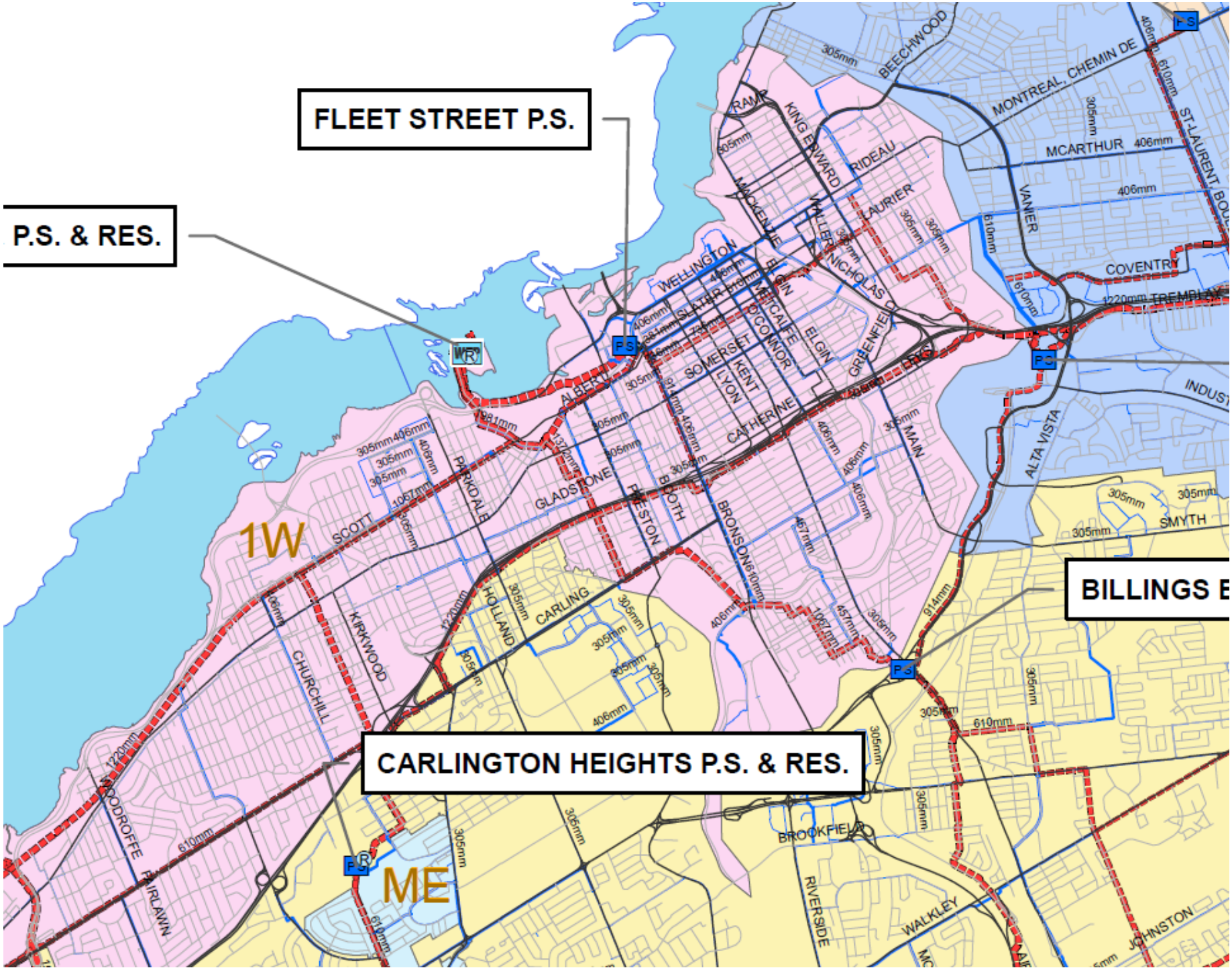
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 561
cell: (613) 222-7816
email: smerrick@DSEL.ca

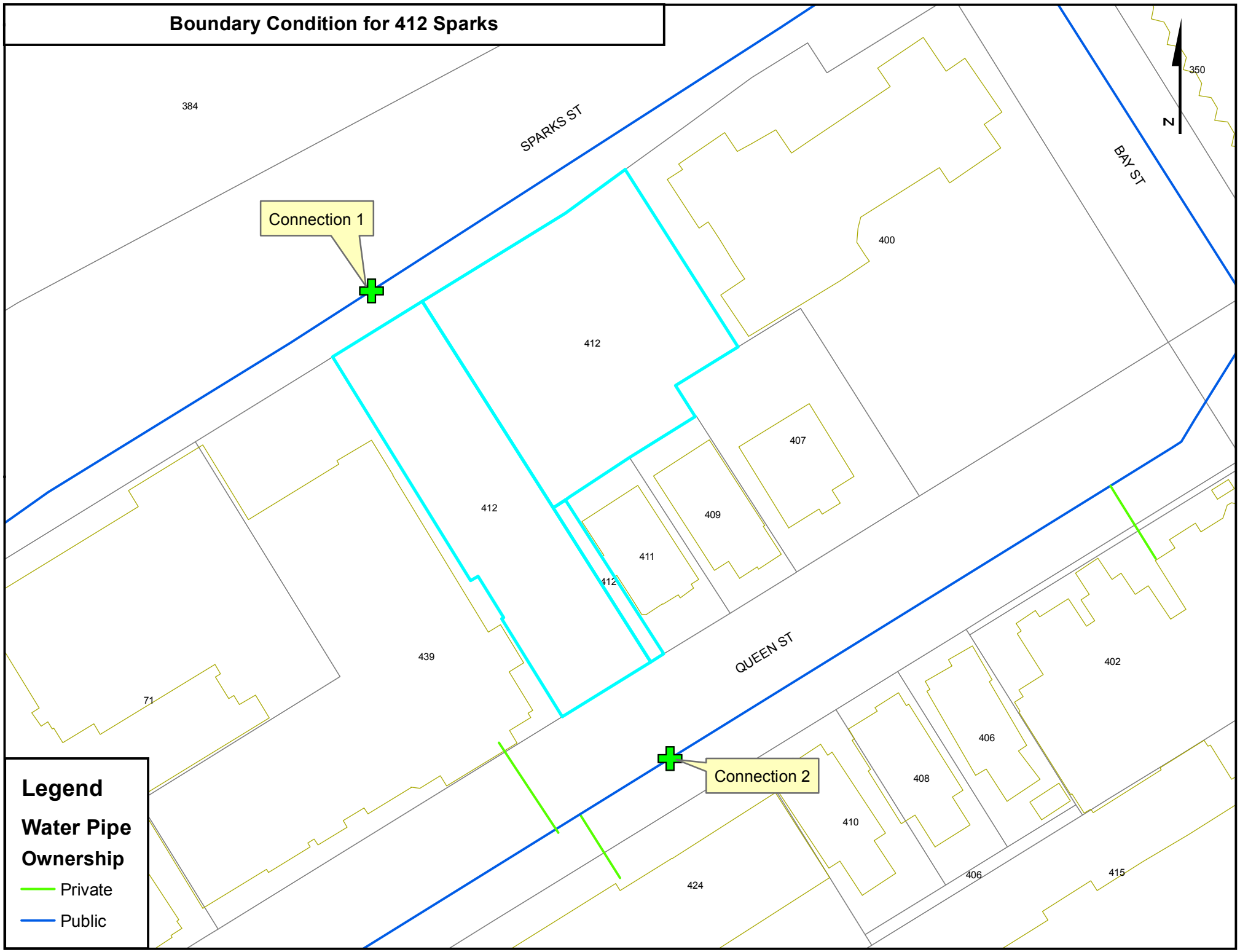
APPENDIX B

Water Supply

City Water Distribution Mapping



Boundary Condition for 412 Sparks



Genavieve Melatti

From: Wu, John <John.Wu@ottawa.ca>
Sent: Thursday, January 10, 2019 10:49 AM
To: Genavieve Melatti
Subject: RE: 412 Sparks Street - Boundary Condition Request
Attachments: 412 Sparks Jan 2019.pdf

Here is the result:

The following are boundary conditions, HGL, for hydraulic analysis at 412 Sparks (zone 1W) assumed to be connected to the 203 mm on Sparks and to the 406 mm on Queen (see attached PDF for location).

Minimum HGL = 107.4 m (Both Connections)

Maximum HGL = 115.9 m (Both Connections)

Max Day (2.92 L/s) + Fire Flow (283 L/s) = 103.0 (Sparks St)

Max Day (2.92 L/s) + Fire Flow (283 L/s) = 105.7 m (Queen St)

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

John

From: Genavieve Melatti <GMelatti@dsel.ca>
Sent: Tuesday, January 08, 2019 9:21 AM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Steve Merrick <SMerrick@dsel.ca>
Subject: 412 Sparks Street - Boundary Condition Request

Good morning John,

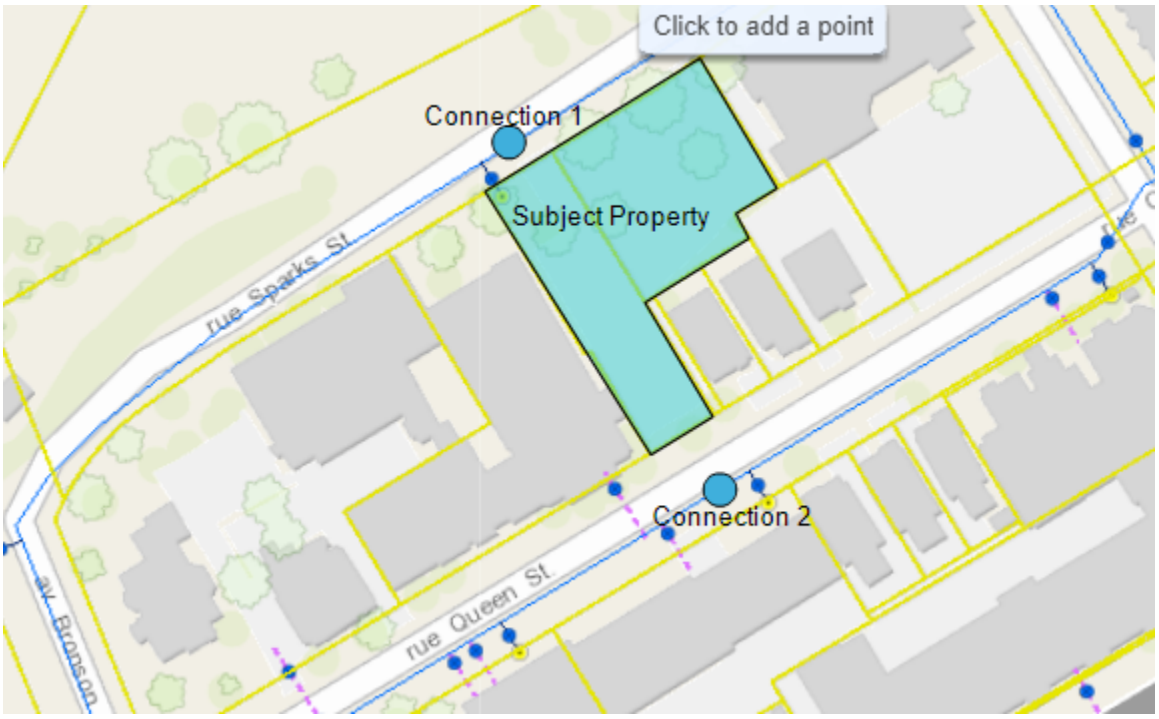
Would we be able to request boundary conditions for the proposed development at 412 Sparks Street:

1. Location of Service / Street Number: 412 Sparks Street

2. Type of development and the fire flow required for the proposed development:

- The proposed development is residential, consisting of a 18-storey apartment building; the building has a footprint of 1073 m^2 and a total floor area of 16,810m^2. The building would consist of 11 bachelor, 93 single bedroom and 48 2-bedroom apartments.

- We are proposing to connect to the existing 203 mm diameter within Sparks Street and the 406 mm diameter watermain within Queen Street shown below.
- The maximum fire flow demand for the proposed development is 17,000 L/min. The calculations and parameters used in these calculations are in the attached FUS calculation sheet.
- We are looking for the boundary conditions at the proposed connection point shown below.



3.

	L/min	L/s
Avg. Daily	49.3	0.82
Max Day	175.2	2.92
Peak Hour	263.4	4.39

In accordance with City of Ottawa technical bulletin **ISDTB-2014-02**, redundant service connections will be required due to an anticipated average daily demand greater than 50 m^3/day.

If you have any questions please feel free to contact me.

Genavieve Melatti
Project Coordinator/ Junior Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext. 569
email: gmelatti@DSEL.ca

'

'

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

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4	-	0
Semi-detached	2.7	-	0
Townhouse	2.7	-	0
Apartment			0
Bachelor	1.4	11	16
1 Bedroom	1.4	93	131
2 Bedroom	2.1	48	101
3 Bedroom	3.1	-	0
Average	1.8	-	0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	248	69.4	48.2	250.0	173.6	375.0	260.4

Institutional / Commercial / Industrial Demand

Property Type	Unit Rate	Units	Avg. Daily m^3/d	Avg. Daily L/min	Max Day m^3/d	Max Day L/min	Peak Hour m^3/d	Peak Hour L/min
Office	75 L/9.3m^2/d	148	1.19	0.8	1.8	1.2	3.2	2.2
Laundry	1,200.0 L/machine/d	3	0.39	0.3	0.6	0.4	1.0	0.7
Restaurant*	125 L/seat/d	-	0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Light	35,000 L/gross ha/d	-	0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Heavy	55,000 L/gross ha/d	-	0.00	0.0	0.0	0.0	0.0	0.0
Total I/CI Demand			1.6	1.1	2.4	1.6	4.3	3.0
Total Demand			**71.0**	**49.3**	**252.4**	**175.2**	**379.2**	**263.4**

* Estimated number of seats at 1 seat per 9.3m^2

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	11367.0	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	18764.4	L/min
	19000.0	**L/min** *rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%
Fire Flow	**16150.0 L/min**

3. Reduction for Sprinkler Protection

Sprinklered - Supervised	-50%
Reduction	**-8075 L/min**

4. Increase for Separation Distance

	Cons. of Exposed Wall	S.D	Lw	Ha	LH	EC	
N	Non-Combustible	>45m	50	0	0	0%	
S	Non-Combustible	3.1m-10m	58	3	174	20%	
E	Non-Combustible	3.1m-10m	22	2	44	18%	
W	Non-Combustible	3.1m-10m	44	3	132	20%	
		% Increase				**58%**	*value not to exceed 75%*

Increase	**9367.0 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

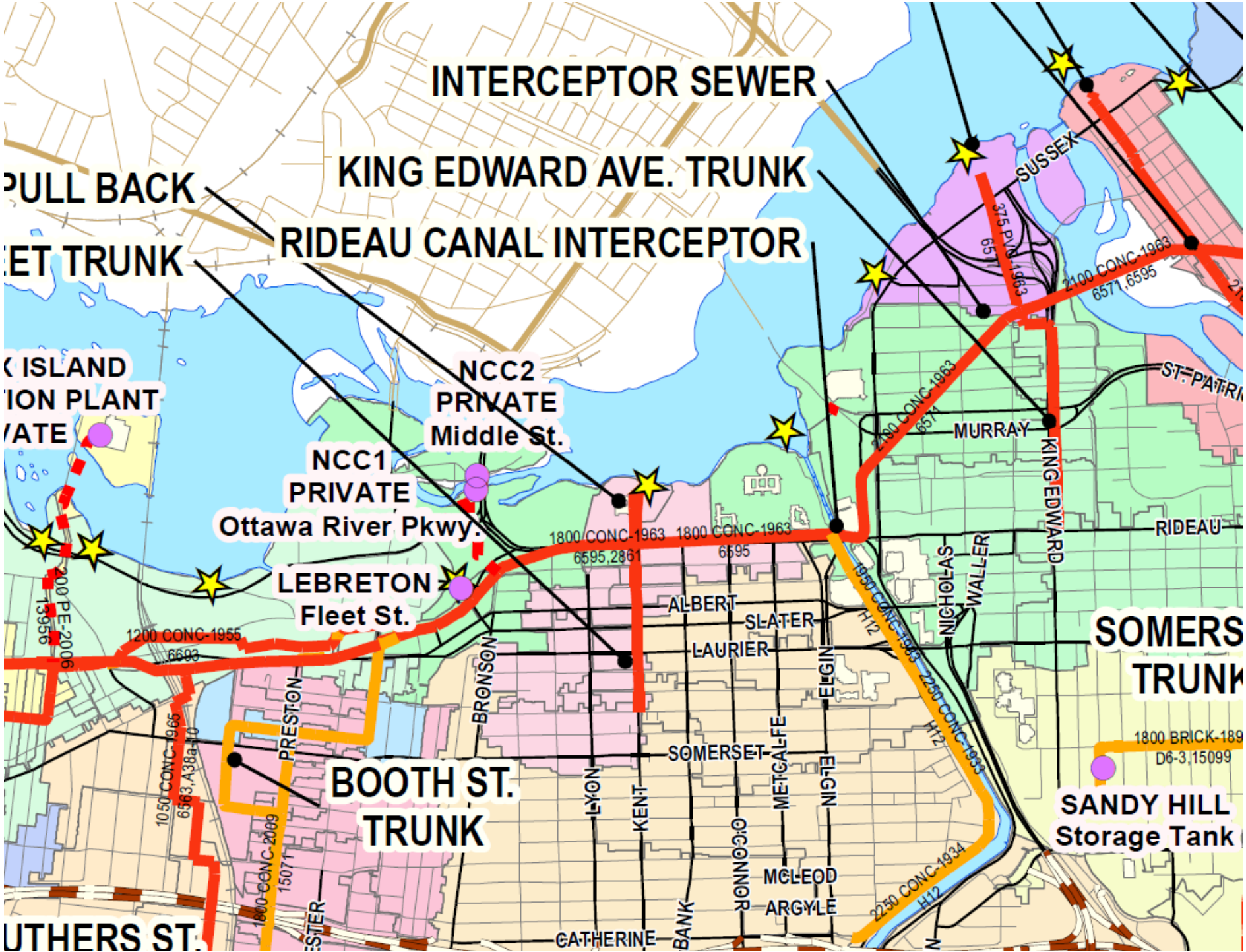
Fire Flow	17442.0	L/min *fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section*
	17000.0	**L/min** *rounded to the nearest 1,000 L/min*

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

APPENDIX C

Wastewater Collection

Sanitary & Storm Distribution Map



Ottawa Retirement Residence by Signature
412 Sparks Street
Proposed Development
Sanitary Flow

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

Site Area 0.196 **ha**

Extraneous Flow Allowances

Infiltration / Inflow (Dry)	**0.01**	**L/s**
Infiltration / Inflow (Wet)	**0.05**	**L/s**
Infiltration / Inflow (Total)	**0.06**	**L/s**

Domestic Contributions

Unit Type	**Unit Rate**	**Units**	**Pop**
Single Family	3.4		0
Semi-detached and duplex	2.7		0
Townhouse	2.7	7	19
Stacked Townhouse	2.3		0
Apartment			
Bachelor	1.4	11	16
1 Bedroom	1.4	93	131
2 Bedroom	2.1	48	101
3 Bedroom	3.1		0
Average	1.8	44	80

Total Pop	**347**	
Average Domestic Flow	**1.12**	**L/s**
Peaking Factor	**3.44**	
Peak Domestic Flow	**3.87**	**L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space*	2.5 $L/m^2/d$		0.00
Industrial - Light**	35,000 L/gross ha/d		0.00
Industrial - Heavy**	55,000 L/gross ha/d		0.00

Average I/C/I Flow	**0.00**
Peak Institutional / Commercial Flow	0.00
Peak Industrial Flow**	0.00
Peak I/C/I Flow	**0.00**

** 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	**1.13 L/s**
Total Estimated Peak Dry Weather Flow Rate	**3.92 L/s**
Total Estimated Peak Wet Weather Flow Rate	**3.93 L/s**

Residential demands, Harmon's Correction Factor, Extraneous Flow Rates and Commercial Peaking Factor established by the City of Ottawa Technical Bulletin ISTB-2018-01. Commercial demands established by City of Ottawa Sewer Design Guidelines Appendix 4A.

Ottawa Retirement Residence by Signature
412 Sparks Street
Proposed Development
Sanitary Flow

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CATHEDRAL HILL DEVELOPMENT

Development Servicing Study

Prepared for 1632540 Ontario Limited

CATHEDRAL HILL DEVELOPMENT
DEVELOPMENT SERVICING STUDY

Prepared for:

1632540 ONTARIO LIMITED
1749 WOODWARD DRIVE
OTTAWA ON K2C 0P9

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.
Suite 200, 240 Michael Cowpland Drive
Kanata, Ontario
K2M 1P6

March 14, 2011

Ref: R-2011-064
Novatech File No. 110098

NOVATECH
ENGINEERING
CONSULTANTS LTD.

March 14, 2011

1632540 Ontario Limited
1749 Woodward Drive
Ottawa, Ontario K2C 0P9

Attention: Mr. Scott Demark

Dear Sir:

Re: Cathedral Hill Development
Development Servicing Study
Our File No.: 110198

Please find enclosed a copy of the Development Servicing Study for the above noted project. Please contact the undersigned if you have any questions or require any additional information.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

M Savic

Miroslav Savic, P. Eng.

MS/sm

cc: City of Ottawa – 9 copies

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TABLE OF CONTENTS

LIST OF APPENDICIES

1.0 INTRODUCTION

Novatech Engineering Consultants Ltd. (Novatech) has prepared this Development Servicing Study in support of the rezoning application for the proposed Cathedral Hill Development.

The subject site is located adjacent to Bronson Avenue and extends easterly between Sparks Street and Queen Street. An existing church and three single houses border the site to the east. The site is occupied by the First Christ Church building, the three storey Roper House adjacent to Bronson Avenue and two townhouses facing Queen Street. Refer to Figure 1: Aerial Photo.

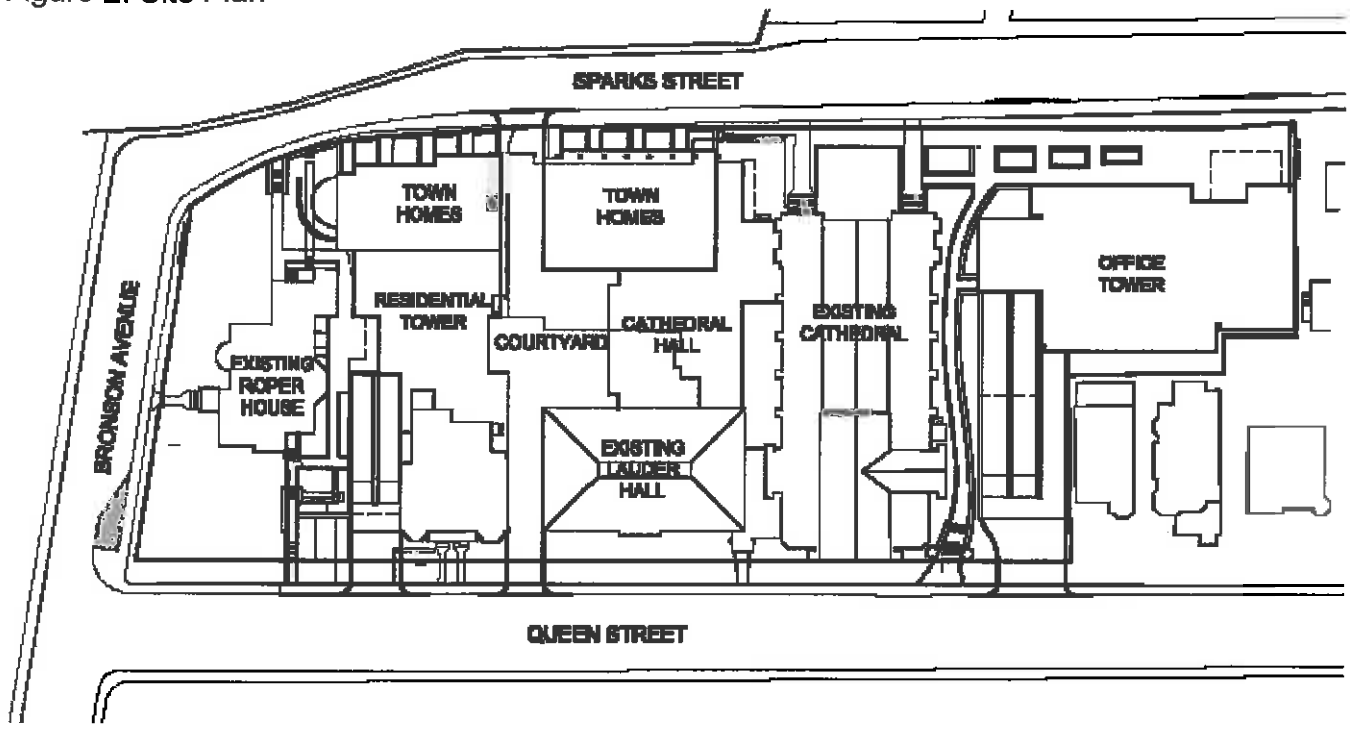
Figure 1: Aerial Photo

A pre-consultation meeting was held with the City of Ottawa on October 6, 2010, and the City followed up with the general submission requirements.

2.0 PROPOSAL

Two building towers and townhouse units are proposed for the site, with some modifications to the First Christ Church. The west condo tower will have 21 storeys on the Queen Street side plus mechanical penthouse and 19 storeys on the Sparks Street side with having a total of a total of 131 units. The east office tower will have a lobby level and 11 floors of office space above. A total of 10 townhouse units are proposed for the site, 8 fasing Sparks Street and 2 fasing Queen Street. Parking will be provided in 2 multi level underground garages. Refer to Figure 2: Site Plan.

Figure 2: Site Plan



3.0 WATER

Currently, the subject site and surrounding area are serviced by a 200mm diameter watermain in Sparks Street, a 300mm diameter watermain in Queen Street and a 150mm diameter watermain in Bronson Avenue. The proposed development will be serviced with two 150mm diameter water services connected to the 200mm diameter Sparks Street watermain.

The flow test data were obtained from the City of Ottawa for the fire hydrants adjacent to the site. The data indicates static pressure at hydrants of 50psi and 60psi. Available fire flow at hydrants is between 1513L/min and 2004 L/min. Refer to Appendix A for the hydrant test data. Based on the information provided by the Architect, both proposed towers (west condo tower and east office tower) will be fully sprinklered.

Population estimates and water demand for the site are calculated as per the City of Ottawa Design Guidelines. Occupancy for the proposed office tower has been provided by the Architect. Based on the above, water demand for the site is calculated as follows (refer to Appendix A for detailed calculation):

- Average Daily Demand 2.14L/s
- Maximum Day Demand 4.54L/s
- Peak Hour Demand 8.56L/s

The City watermain distribution network is sized to provide fire protection for the surrounding area, including the subject site. Booster pumps will likely be required in new towers to provide adequate service pressure on the upper floor levels. Each building will be supplied with sprinkler system and fire department siamese connections that will be provided within 45m of the City hydrants in Sparks Street and Bronson Avenue.

4.0 SANITARY SEWER

The proposed development will be serviced to the 250mm diameter sanitary sewer in Sparks Street. The existing City sewers downstream of the subject site were analyzed to confirm if there is excess capacity to accommodate the proposed development. All existing sewer information (pipe sizes, lengths and inverts) are taken from the City of Ottawa as-built drawings. The analysis ends at the existing sanitary manhole in Bay Street (MH #5 on a sanitary sewer schematic in Appendix B) where there is a 0.8m drop from the Bay sewer to the Wellington sewer.

The peak sanitary flows from the site and contributing downstream areas are calculated using the criteria as per the City of Ottawa design guidelines. Due to lack of available information, the following assumptions are made in the analysis:

- The flows from the block of land east of Bay Street between Albert and Queen (Delta Hotel and an office tower) are outletting to the Bay Street sewer.
- The sanitary service from the government building complex east of Bay Street between Queen and Sparks (Bank of Canada) is connected to the Bay Street sewer.
- The sanitary service from St. Peters Church at the corner of Sparks and Bay Street is connected to the Sparks Street sewer.
- The sanitary service from the existing three storey house facing Bronson Avenue is connected to the Bronson Street sewer.

The computed peak sanitary flow from the proposed development will be approximately 5.92 L/s. The computed sanitary flow from all downstream areas contributing to the Bay Street sewer is approximately 12.35 L/s. Refer to Appendix B for detailed calculations

Based on the analysis, it can be concluded that all sewer pipes in Sparks Street and Bay Street have sufficient capacity to convey flows from the proposed development. Refer to Sanitary Sewer Design Sheet in Appendix B.

5.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

The proposed development will be serviced with two 200mm diameter storm services connected to to the existing 450mm diameter storm sewer in Sparks Street. The Sparks Street sewer is sloped at 0.52% and has a capacity of 214L/s.

The stormwater management criteria for the site have been provided by the City of Ottawa. The 1:100 year post-development runoff will be controlled to the 1:5 year design event with an allowable runoff coefficient of 0.50. The allowable flow for the 0.807ha site was calculated to be 78.9 L/s (refer to Appendix C for detailed calculations).

All post-development runoff in excess of the allowable will be stored and controlled on site prior to being released into the existing storm sewer. The required water quantity control will be achieved by a combination of rooftop storage and the use of two (2) underground storage tanks. The east SWM tank will be approximately 61m3 and located within the east underground parking structure. The west SWM tank will be approximately 117m3 and be located within the west underground parking structure Stormwater from the tanks will be pumped to the two proposed 200mm gravity storm services that outlet to the existing 450mm storm sewer in Sparks St.

The on-site stormwater management system for the site is described in a Stormwater Management Report provided under separate cover as a part of the site plan application.

In addition, rain water harvesting (for irrigation, flushing toilets, etc.) is planned on site as a part of LEED Gold certification for the proposed building towers.

NOVATECH ENGINEERING CONSULTANTS LTD.

Prepared by:

Miroslav Savic, P. Eng.

Reviewed by:

R. S. Cebryk, P. Eng.

APPENDIX A

Watermain Calculations

WATER DEMAND

Cathedral Hill Development

West Condo Tower		
Number of Bachelor Units	24	
Persons per unit	1.4	
Number of 1 Bedroom Units	49	
Persons per unit	1.4	
Number of 2 Bedroom Units	53	
Persons per unit	2.1	
Population	214	
Average Daily Demand	350	L/c/day
Average Daily Demand	0.86	L/s
Maximum Day Demand	2.16	L/s
Peak Hour Demand	**4.76**	**L/s**

East Office Tower		
Number of Floors	11	
Ocupancy per Floor	94	
Total Ocypancy	1034	
Average Daily Demand	75	L/person/day
Average Daily Demand	0.90	L/s
Maximum Day Demand	1.62	L/s
Peak Hour Demand	**2.42**	**L/s**

Loft Units in Townhouses		
Number of units	10	
Persons per unit	2.7	
Population	27	
Average Daily Demand	350	L/c/day
Average Daily Demand	0.11	L/s
Maximum Day Demand	0.27	L/s
Peak Hour Demand	**0.60**	**L/s**

First Christ Church		
Number of Sanctuary Seats	700	
Average Demand	30	L/seat
Average Daily Demand	0.24	L/s
Maximum Day Demand	0.44	L/s
Peak Hour Demand	**0.66**	**L/s**

Roper House		
Number of units	2	
Persons per unit	2.7	
Population	5	
Average Daily Demand	350	L/c/day
Average Daily Demand	0.02	L/s
Maximum Day Demand	0.05	L/s
Peak Hour Demand	**0.12**	**L/s**

Total Water Demand		
Average Daily Demand	2.14	L/s
Maximum Day Demand	4.54	L/s
Peak Hour Demand	**8.56**	**L/s**

Note: the computed flows are approximate and performed for hydrant colour coding purposes, thus these values are not intended for design purposes.

Company:	**Cody Oram Novatech Engineering**
Tel:	**Consultants Ltd. 727-1658**
Fax:	**x272**
Location:	**727-6972 Sparks @ Bronson**
Request_dt:	**10-11-04-**
Email:	**08:06:11**
Inspection	c.oram@novatech-eng.com

Date	Flow Hydrant	Residual Hydrant	Pressure (psi) Static	Dynamic	Pitot	Flow (igpm) actual	@ 20 psi
2009/08/10	6630073	6630105	50	>42	28	741	1513
2009/08/10	6630105	6630106	50	>42	34	817	1667
2009/08/10	6630106	6630008	60	>52	32	792	1889
2009/08/10	6630292	6630008	60	>52	34	817	1948
	6630293	6630008	60	>52	36	840	2004

Murray Crowder
Technical Support
Drinking Water Operations Branch
Environmental Services Department
City of Ottawa
951 Clyde Avenue, Ottawa, On K1Z 5A6
Mail Code 06-65
Tel: (613) 580-2424 x 22231
Fax: (613) 728-4183
e-mail: murray.crowder@ottawa.ca

From: Cody Oram [mailto:c.oram@novatech-eng.com]
Sent: November 02, 2010 4:17 PM
To: Crowder, Murray
Subject: Hydrant Data Request

Hi Murray,

Could you please provide me with the following hydrant flow data for the following Hydrants located within City of Ottawa Map 366-030.

Sparks Street – Hydrant H071
Queen Street – Hydrants H073, H105, H106

I have attached a scan of the site location.

Thank you,
Cody


TURN LANE
WELLINGTON ST
SPARKS ST
366031H008
SPARKS ST
203mm PVC '02
366030H293
366030H106
QUEEN ST
366030H105
366030H292
305mm DI
ALBERT ST
BAY ST
366030H073
BRONSON AVE
152mm DCI
FLEET ST
COMMISSIONER ST
SLATER ST
LAURIER AVE
GLOUCESTER ST
LET ST

APPENDIX B

Sanitary Sewer Calculations

SANITARY FLOWS

Cathedral Hill Development

West Condo Tower		
Number of Bachelor Units	24	
Persons per unit	1.4	
Number of 1 Bedroom Units	49	
Persons per unit	1.4	
Number of 2 Bedroom Units	53	
Persons per unit	2.1	
Population	214	
Average Residential Flow	350	L/c/day
Peak Factor (Harmon Formula)	4.0	
Peak Sanitary Flow	**3.46**	**L/s**

East Office Tower		
Number of Floors	11	
Ocupancy per Floor	94	
Total Ocypancy	1034	
Average office flow	75	L/person
Peak Factor	1.5	
Peak Sanitary Flow	**1.35**	**L/s**

Townhouses and Roper House		
Number of units	12	
Persons per unit	2.7	
Population	32	
Average Residential Flow	350	L/c/day
Peak Factor (Harmon Formula)	4.0	
Peak Sanitary Flow	**0.53**	**L/s**

First Christ Church		
Number of Sanctuary Seats	700	
Average Flow	30	L/seat
Peak Factor	1.5	
Peak Sanitary Flow	**0.36**	**L/s**

Peak Extraneous Flows		
Infiltration Allowance	0.28	L/s/ha
Site Area	0.81	ha
Peak Extraneous Flows	**0.23**	**L/s**

Total Sanitary Flow	**5.92**	**L/s**

Off-Site Flows

St. Peter's Church

Number of Sanctuary Seats	300	
Average Flow	30	L/seat
Peak Factor	1.5	
Peak Sanitary Flow	0.16	L/s
Site Area	0.12	ha
Infiltration Rate	0.03	L/s
Total Sanitary Flow	**0.19**	**L/s**

Government Building Complex

Floor Area	4251	m^2
# of Storeys	13	
Total Floor Area	55263	m^2
Total Persons (assume 1 person/10m^2)	5526	persons
Daily Volume	75	L/day/person
Average Flow	4.80	L/s
Peak Factor	1.50	
Peak Sanitary Flow	7.20	L/s
Site Area	0.51	ha
Infiltration Rate	0.14	L/s
Total Sanitary Flow	**7.34**	**L/s**

3 Storey Residential Building

Number of Units	4	
Persons per Unit	3.1	
Popluation	12.4	
Average Daily Demand	350	L/c/day
Peak Factor (Harmon Formula)	4.00	
Peak Sanitary Flow	0.20	L/s
Site Area	0.02	ha
Infiltration Rate	0.01	L/s
Total Sanitary Flow	**0.21**	**L/s**

Delta Hotel & Office Tower		
Rooms	328	
People per Room	1.5	
Population	492	
Residential Portion	225	L/c/day
Sanitary Flow	1.28	L/s
Mystique Café		
Seats	108	
Average Daily Demand	70	L/seats/day
Sanitary Flow	0.09	L/s
Capital Dining Hall		
Seats	30	
Average Daily Demand	125	L/seat/day
Sanitary Flow	0.04	L/s
Sparks Street Lounge		
Seats	69	
Average Daily Demand	70	L/seat/day
Sanitary Flow	0.06	L/s
Salon and Spa		
Number of Stations	4	
Average Daily Demand	650	L/stations/day
Sanitary Flow	0.03	L/s
Banquet Hall		
Number of Seats	250	
Average Daily Demand	30	L/seats/day
Sanitary Flow	0.09	L/s
Staff		
Number of people	30	
Average Daily Demand	40	L/c/day
Sanitary Flow	0.01	L/s
Office Tower		
Office Area	15800	m^2
Number of People	1580	
Average Daily Demand	75	L/c/day
Average Flow	1.37	L/s
Total Average Flow	2.97	L/s
Peak Factor	1.5	
Total Peak Sanitary Flow	4.46	L/s
Site Area	0.56	ha
Infiltration Rate	0.16	L/s
Total Sanitary Flow	**4.61**	**L/s**

Total Off Site Flow	**12.35**	**L/s**

SPARKS STREET AND BAY STREET SANITARY SEWER DESIGN SHEET

PROJECT : 110198

DESIGNED BY: CJO

CHECKED BY: MS

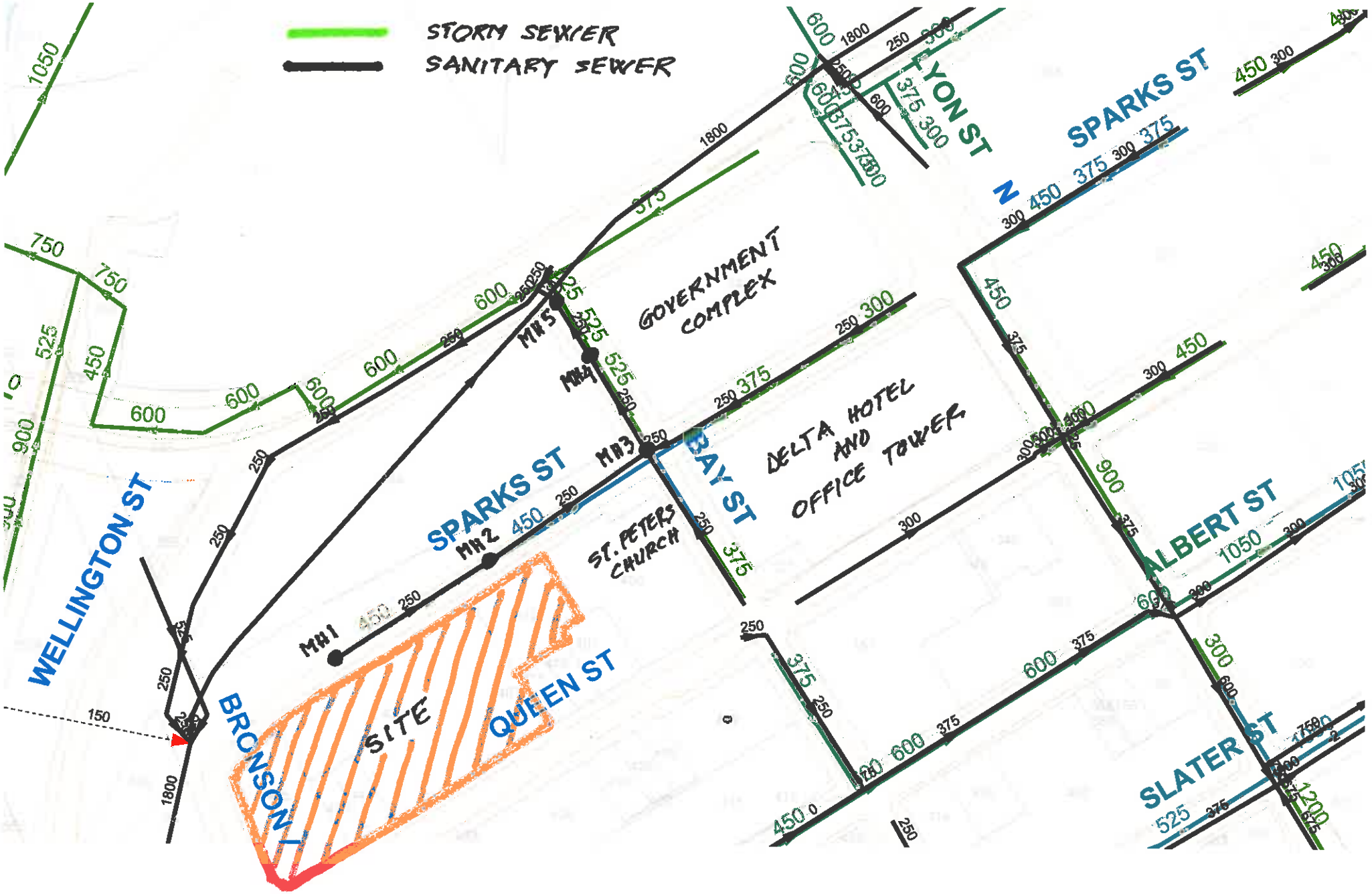
DATE: March 14, 2010

NOVATECH ENGINEERING CONSULTANTS LTD.

Location			Wastewater Flow Q(w)				Design Flow (Qd)	Proposed Sanitary Sewer						
Area I.D.	From MH	To MH	Individual Peak Flow Rate (L/s)	Cumulative Peak Flow Rate (L/s)	Individual Infiltration Rate (L/s)	Cumulative Infiltration Rate (L/s)	Peak Design Flow (L/s)	Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (L/s)	Full Flow Velocity (m/s)	Percentage of Capacity
Sparks Street	1	2	5.70	5.70	0.23	0.23	***5.92***	78.6	250	PVC	0.52	44.74	0.88	13%
	2	3	0.16	5.85	0.03	0.26	***6.11***	69.3	250	PVC	0.52	44.74	0.88	14%
Bay Street	3	4	11.85	17.70	0.31	0.57	***18.27***	42.8	250	PVC	2.40	96.11	1.90	19%
	4	5	0.00	17.70	0.00	0.57	***18.27***	26.2	250	PVC	2.03	88.39	1.74	21%

Notes:

1. Q(d) = Q(w) + Q(i) , where
   Q(d) = Design Flow (L/s)
   Q(w) = Average Wastewater Flow (L/s)
   Q(i) = Extraneous Flow (L/s)
2. Q(i) = 0.28 L/s/ha
3. Population estimate and sanitary flows were calculated as per the City of Ottawa Sewer Design Guidelines (Nov 2004).


LEGEND :
STORM SEWER
SANITARY SEWER
WELLINGTON ST
SPARKS ST
BRONSON
QUEEN ST
BAY ST
YON ST
ALBERT ST
SLATER ST
SITE
GOVERNMENT COMPLEX
DELTA HOTEL AND OFFICE TOWER
ST. PETERS CHURCH
MH1
MH2
MH3
MH4
MH5
N

APPENDIX D

Stormwater Management

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

Existing Drainage Charateristics From Internal Site

Area	0.1960	ha
C	0.85	Rational Method runoff coefficient
L	67.13	m
Up Elev	72.65	m
Dn Elev	71.11	m
Slope	2.3	%
Tc	10.0	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Existing Drainage Charateristics From Existing External Cathed

Area	0.0570	ha
C	0.90	Rational Method runoff coefficient
L	13.35	m
Up Elev	91.2	m
Dn Elev	77.7	m
Slope	101.1	%
Tc	10.0	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Estimated Peak Flow - Internal

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	35.5	48.2	97.2	L/s

Estimated Peak Flow - External Area A1

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	10.9	14.8	28.3	L/s

Total Combined Flow Rate (Internal + Cathedral Contributing Area)

	2-year	5-year	100-year	
Q	46.5	63.1	76.5	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)

Drainage Area Calculations
City of Ottawa Sewer Design Guidelines, 2012

EX1

Area	0.0320	ha
C	0.79	Rational Method runoff coefficient
L	23.7	m
Up Elev	73.76	m
Dn Elev	73.21	m
Slope	2.3	%
Tc	10.0	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Estimated Peak Flow EX1

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	5.4	7.3	15.7	L/s

EX2

Area	0.0570	ha
C	0.83	Rational Method runoff coefficient
L	13.35	m
Up Elev	91.2	m
Dn Elev	77.7	m
Slope	101.1	%
Tc	10.0	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Estimated Peak Flow EX2

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	10.1	13.7	28.3	L/s

EX3

Area	1.1030	ha
C	0.76	Rational Method runoff coefficient
L	140.3	m
Up Elev	74.75	m
Dn Elev	72.57	m
Slope	1.6	%
Tc	18.4	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Estimated Peak Flow EX3

	2-year	5-year	100-year	
i	54.8	74.0	126.4	mm/hr
Q	127.6	172.4	368.1	L/s

EX4

Area	0.0460	ha
C	0.79	Rational Method runoff coefficient
L	19.35	m
Up Elev	73.46	m
Dn Elev	73.19	m
Slope	1.4	%
Tc	10.0	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Estimated Peak Flow EX4

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	7.8	10.6	22.6	L/s

A2

Area	0.0220	ha
C	0.55	Rational Method runoff coefficient
L	38.18	m
Up Elev	73.46	m
Dn Elev	72.58	m
Slope	2.3	%
Tc	10.0	min

2) Time of Concentration per Bransby Williams Formula

$$t_c = \frac{0.605L}{S^{0.2}A^{0.1}}$$

tc, in hours
L, length in km
S, average watershed slope in %
A, area in km^2

Estimated Peak Flow EX4

	2-year	5-year	100-year	
i	76.8	104.2	178.6	mm/hr
Q	2.6	3.5	7.4	L/s

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

Target Flow Rate

Subject Property	0.20	ha	**Cathedral Flow Entering Site**	0.06	ha
C	0.50	Rational Method runoff coefficient	**C**	0.50	Rational Method runoff coefficient
Tc	10.0	min	Tc	10	min

	5-year	100-year		5-year	100-year
i	104.2	178.6	**i**	104.2	178.6
Q	28.4	60.8	**Q**	8.2	17.7

Target Release Rate (Total of Both Internal Flow & Cathedral Flow Combined)

	5-year
Q	36.6 L/s

Estimated Post Development Peak Flow from Unattenuated Area U1

Total Area 0.04 ha
C 0.59 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	7.5	7.5	0.0	0.0	178.6	16.1	16.1	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)

Estimated Post Development Peak Flow from Unattenuated Area U2

Total Area 0.02 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)
10.0	104.2	4.9	4.9	0.0	0.0	178.6	9.4	9.4	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)

Estimated Post Development Peak Flow from both Internal Property & External Cathedral Flow

Total Area 0.22 ha
C 0.85 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	53.6	5.5	48.1	28.9	178.6	108.1	11.1	97.0	58.2
15	83.6	43.0	5.5	37.5	33.7	142.9	86.5	11.1	75.4	67.9
20	70.3	36.2	5.5	30.6	36.8	120.0	72.6	11.1	61.5	73.9
25	60.9	31.3	5.5	25.8	38.7	103.8	62.9	11.1	51.8	77.7
30	53.9	27.8	5.5	22.2	40.0	91.9	55.6	11.1	44.5	80.2
35	48.5	25.0	5.5	19.4	40.8	82.6	50.0	11.1	38.9	81.7
40	44.2	22.7	5.5	17.2	41.3	75.1	45.5	11.1	34.4	82.6
45	40.6	20.9	5.5	15.4	41.5	69.1	41.8	11.1	30.7	82.9
50	37.7	19.4	5.6	13.8	41.5	64.0	38.7	11.1	27.6	82.9
55	35.1	18.1	5.6	12.5	41.3	59.6	36.1	11.1	25.0	82.5
60	32.9	17.0	5.6	11.4	41.0	55.9	33.8	11.1	22.8	81.9
65	31.0	16.0	5.6	10.4	40.6	52.6	31.9	11.1	20.8	81.1
70	29.4	15.1	5.6	9.6	40.1	49.8	30.2	11.1	19.1	80.0
75	27.9	14.4	5.6	8.8	39.6	47.3	28.6	11.1	17.5	78.9
80	26.6	13.7	5.6	8.1	38.9	45.0	27.2	11.1	16.2	77.5
85	25.4	13.1	5.6	7.5	38.2	43.0	26.0	11.1	14.9	76.1
90	24.3	12.5	5.6	6.9	37.4	41.1	24.9	11.1	13.8	74.5
95	23.3	12.0	5.6	6.4	36.6	39.4	23.9	11.1	12.8	72.9
100	22.4	11.5	5.6	6.0	35.8	37.9	23.0	11.1	11.9	71.2
105	21.6	11.1	5.6	5.5	34.9	36.5	22.1	11.1	11.0	69.4
110	20.8	10.7	5.6	5.1	33.9	35.2	21.3	11.1	10.2	67.5

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)

5-year $Q_{attenuated}$	**5.55 L/s**	**100-year $Q_{attenuated}$**	**11.09 L/s**
5-year Max. Storage Required	**41.5 m^3**	**100-year Max. Storage Required**	**82.9 m^3**

Summary of Release Rates and Storage Volumes

Control Area	5-Year Release Rate (L/s)	5-Year Storage (m^3)	100-Year Release Rate (L/s)	100-Year Storage (m^3)
Unattenuated Areas	12.5	0.0	25.5	0.0
Attenutated Areas	5.6	41.5	11.1	82.9
Total	**18.0**	**41.5**	**36.6**	**82.9**

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

Target Flow Rate

EX3	1.10	ha
C	0.76	Rational Method runoff coefficient
Tc	18.4	min

	5-year	**100-year**
i	74.0	126.4
Q	172.2	367.8

Max Flow Through Property

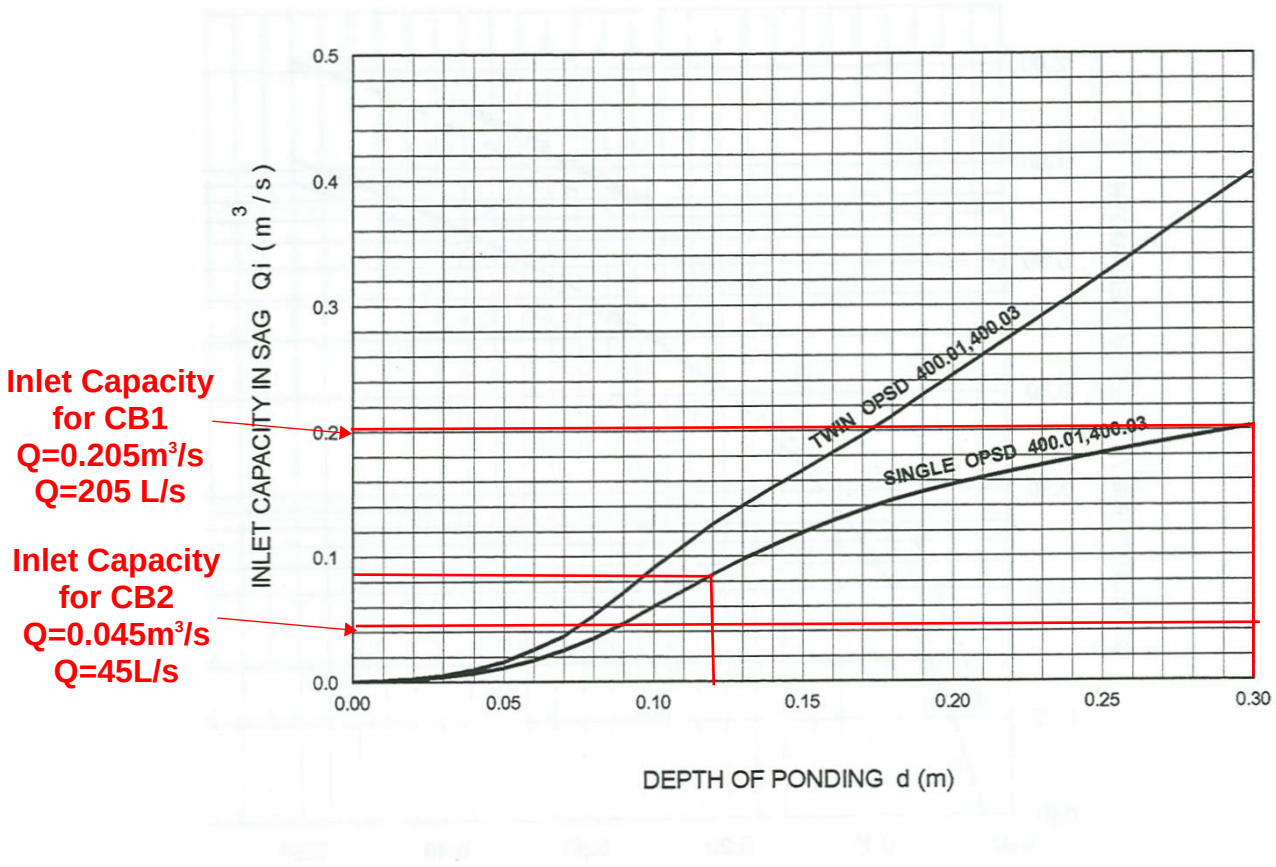
100-year - 5-year		
Q	195.5	L/s

	Flow from EX3 through Spill Point
Invert (m)	71.32
Bottom Width (m)	2.88
Weir Coefficient	1.58
Max Head (m)	0.123018631
Max Flow (L/s)	196

	Capacity of Flow Path (Manning's Equation)
Depth (m)	0.07221522
Width (m)	1.82
Mannings n	0.013
Slope	3.3
Max Flow (L/s)	195.5
Area (m^2)	0.131
Radius (m)	0.034729585

Ottawa Retirement Residence by Signature
412 Sparks Street
Flow Path Calculations

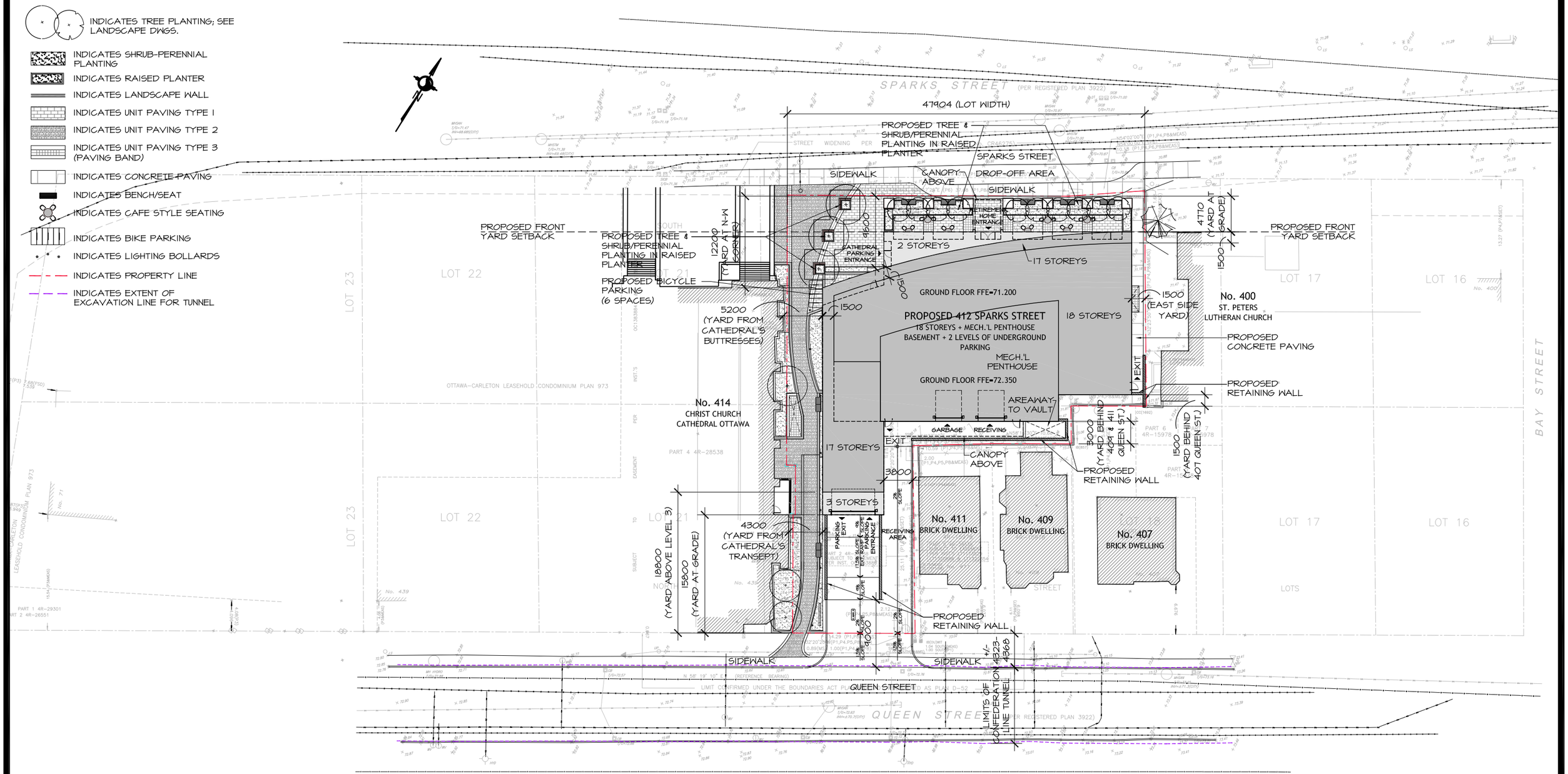
Design Chart 4.19: Inlet Capacity at Road Sag



DRAWINGS / FIGURES

SITE PLAN LEGEND:

- INDICATES TREE PLANTING; SEE LANDSCAPE DWGS.
- INDICATES SHRUB-PERENNIAL PLANTING
- INDICATES RAISED PLANTER
- INDICATES LANDSCAPE WALL
- INDICATES UNIT PAVING TYPE 1
- INDICATES UNIT PAVING TYPE 2
- INDICATES UNIT PAVING TYPE 3 (PAVING BAND)
- INDICATES CONCRETE PAVING
- INDICATES BENCH/SEAT
- INDICATES CAFE STYLE SEATING
- INDICATES BIKE PARKING
- INDICATES LIGHTING BOLLARDS
- INDICATES PROPERTY LINE
- INDICATES EXTENT OF EXCAVATION LINE FOR TUNNEL



OTTAWA RETIREMENT RESIDENCE BY SIGNATURE

Proposed Site Plan

SCALE 1:500 (0 5 10 20 30 40 50ft / 0 1 2 3 4 5 10 15 20.0m)

March 11, 2019

Signature RETIREMENT LIVING

REICHMANN SENIORS HOUSING DEVELOPMENT CORP.

HOBIN ARCHITECTURE