SERVICING AND STORMWATER MANAGEMENT REPORT

Project No.: 0CP-18-0070 – 263 Greensway Avenue, Ottawa, ON

Prepared for:

Manor Park Management, c/o Anand Aggarwal
231 Brittany Drive, Unit D
Ottawa, ON
K1L 0R8

May 2018

McINTOSH PERRY

Executive Summary

Developing a site within the City of Ottawa requires meeting a predefined set of requirements outlined in the City of Ottawa Sewer Design Guidelines (SDG) - 2012 along with meeting the local conservation authority requirements (Rideau Valley Conservation Authority - RVCA) and provincial requirements (Ministry of Environmental and Climate Change – MOECC). Site specific requirements are discussed and outlined in the pre-consultation meeting with the City of Ottawa before the detailed design process is initiated.

This report describes an innovative and cost-efficient design solution for the site servicing (water, sanitary, and storm) and stormwater management (SWM) requirements in order to develop this site. The Rideau Valley Conservation Authority (RVCA) will not require quality protections at this time as the distance between the proposed connection and the outlet of the existing main is more than 2 kilometres. Catch basins located on site will have a sump of 0.6 as per OPSD 705.010 to however promote sedimentation of suspended solids.

Evaluation of the proposed site plan in addition to a review of the site grading and soil characteristics was completed. Our review identified that parking storage is the optimal design solution to meet the SWM requirements. The parking storage will contain stormwater runoff from the terrace, parking as well as some of the landscaped and grassed area of the site. The on-site storage is a direct result of the inlet control device within manhole one, used to reduce the stromwater runoff flows before outletting to the existing main. The evaluation of proposed development, existing site characteristics and surrounding municipal infrastructure suggest that the parking retention will be a sufficient solution to the site constraints.

The proposed sanitary, storm and water services will utilize the existing infrastructure surrounding the site to service the development. Therefore, it is our professional opinion that this site located at 263 Greensway Avenue is able to be developed and fully serviced for the proposed residential building development.

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1.0 PROJECT DESCRIPTION

1.1 Purpose

This report will address the servicing (water, sanitary, and storm) and stormwater management requirements (SWM) associated with the proposed development located at 263 Greensway Avenue within the City of Ottawa.

1.2 Site Description

The property is located at 263 Greensway Avenue. The legal description of the land is Plan 29, Part Lots 4,5 & 6. The land in question covers approximately 0.45 ha and is located on the corner of Greensway Avenue and Mark Avenue, southwest of Vanier Parkway and northwest of Montreal Road. The Rideau River runs approximately 250m southwest of the site. The site is situated within the Rideau River Flood Plain.

The existing site is currently developed with a two-storey residential building and is likely serviced with sanitary and water services from infrastructure running along Greensway Avenue. Due to the planned development of the site, the existing service will remain and continue to service the existing building on the property. The current private entrance will be removed and replaced with a new private entrance with depressed curb, as per city standard SC1.1, to match existing conditions on Greensway Avenue.

The proposed development consists of a 1,139 m², six storey residential building. Vehicular access to the site from Greensway avenue will lead to provided aboveground and underground parking. Some at grade amenity space will be provided northeast of the proposed building. A bicycle path connecting Greensway Avenue to Vanier Parkway will also be provided. There will be pedestrian access to the building from both Vanier Parkway and Greensway Avenue.

Figure 1: Key Map – 263 Greensway Avenue, Vanier.

2.0 BACKGROUND STUDIES

Background studies that have been completed for the site include a review of the City of Ottawa as-built drawings, a topographical survey of the site, a geotechnical report and a Phase I & II Environmental Site Assessment (ESA).

As-built drawings of the existing services within the vicinity of the site were reviewed in order to determine proper servicing and stormwater management schemes for the site.

A topographic survey of the site was completed by Fairhall, Moffatt & Woodland Limited dated May 4th, 2016 and can be found under separate cover.

The following reports have previously been completed and are available under separate cover:

- Geotechnical Investigation completed by Paterson Group dated May, 2018.
- Phase I ESA completed by Paterson Group dated May 7th, 2018.
- Phase II ESA completed by Paterson Group dated May 14th, 2018.

3.0 PRE-CONSULTATION SUMMARY

City of Ottawa Staff have been pre-consulted regarding this proposed development by email on March 12th, 2018. Specific design parameters to be incorporated within this design include the following:

- Control 5 through 100-year post-development flows to the 5-year pre-development flows with a combined C value to a maximum of 0.50 with a time of concentration of 15 minutes.

Correspondence with the City can be found in Appendix 'A'.

4.0 EXISTING SERVICES

The existing site is serviced with sanitary and water connections. The sanitary service crosses the front of the lot where it is connected within the easement located southeast of the property. It is further directed towards Montreal Road. The existing connections will continue to service the existing building on the property.

4.1 Greensway Avenue

There is an existing 200mm diameter sanitary sewer as well as a 450mm diameter storm sewer located within Greensway Avenue. The 450mm storm sewer services catch basins along both sides of Greensway Avenue. The existing storm and sanitary sewers increase in size at the Greensway Avenue and Wayling Avenue intersection. The existing sanitary sewer begins at the Greensway Avenue and Mark Avenue intersection.

Also located within the Greensway Avenue is a 200mm diameter watermain. The watermain services the other properties located on Greensway Avenue including the existing site.

Overhead utilities are available along the back of the property and gas services are available along the subject section of Greensway Avenue.

4.2 Mark Avenue

There is an existing 300mm diameter sanitary sewer as well as a 450mm diameter storm sewer located within Mark Avenue. The 450mm storm sewer services catch basins located on both sides of Mark Avenue and continues along Greensway Avenue. The existing 300mm diameter sanitary line begins on Montreal Road where it further crosses to Mark Avenue within an easement.

Also located within Mark Avenue is a 200mm diameter watermain. The watermain services the other properties located on Mark Avenue including the existing site.

A fire hydrant is located directly across from the front of property along the north side of Mark Avenue.

5.0 SERVICING PLAN

5.1 Proposed Servicing Overview

The proposed storm and water services will be connected via infrastructure within Greensway Avenue. Services will be located within the entrance to the site. The proposed sanitary service will connect to the existing main extending from Mark Avenue to Montreal Road within the easement.

5.2 Proposed Water Design

A new 50 mm PVC water lateral will be connected to the existing 200 mm PVC watermain within Greensway Avenue, complete with a water valve located at the property line.

The proposed building will be equipped with a sprinkler system; fire protection will also be provided by the existing hydrant immediately across from the site along Mark Avenue. The required fire protection from the Ontario Building Code (OBC) is 5,400 L/min (See Appendix 'B' for calculation). The required fire protection from the Fire Underwriters Survey (FUS) is 15,000 L/min (provided for information purposes only).

The water demands for the new building have been calculated as per the Ottawa Design Guidelines. The demands have been calculated for a residential building. Residential demands are as follows: the average and maximum daily demands are 0.55 L/s and 1.38 L/s respectively. The maximum hourly demand was calculated as 3.03 L/s (Refer to Appendix 'B' for flow details). Boundary conditions have been requested, however were not be available for submission with this report.

5.3 Proposed Sanitary Design

A new 135 mm diameter gravity sanitary service will be connected to the existing 300mm sanitary main within the easement located southwest of the site.

The peak design flow for the proposed site was determined to be 0.59 L/s, however, for pipe design, a more conservative peak design flow of 2.96 L/s was used. This flow takes into account the infiltration of the entire area and is also calculated based on a 2.3p/p/u rate for residential area. Using the calculated peak design flow, the proposed 135 mm diameter lateral has sufficient capacity to convey the flows (See Appendix 'C' for detailed calculations). It is anticipated that there will be no issues with capacity constraints within the proposed lateral or within the existing sanitary main within the easement as the amount of flow leaving the site is minimal.

5.4 Proposed Storm Design

The majority of the site will be composed of the proposed building as well as parking area. The hard surface areas of the site will be captured and restricted within the proposed storm network. The south grassed portion of the site will sheet flow to the parking area where it will also be captured and restricted and finally, the northeast and north grassed areas will flow unrestricted towards Vanier Parkway. The proposed storm network will restrict and convey the stormwater runoff towards the existing infrastructure along Greensway Avenue.

The quantity of stromwater runoff will be restricted in MH1, located at the west corner of the property, with the use of a Hydrovex 125VHV-2 inlet control device. The inlet control device will restrict the 100-year post-development runoff to the 5-year pre-development runoff, as per the City's requirements. The stormwater management design will be further detailed in Section 6.0.

The site will be constructed with adequate grading to ensure major overflow to the west corner of the site. The direction and location of overland sheet flow has been indicated on the Site Grading Plan (C101).

5.5 Site Utilities

All relevant utility companies (telephone – Bell and Rogers, gas – Enbridge and hydro – Hydro Ottawa) will be contacted prior to construction in order to confirm adequate utility servicing for the site. The services are anticipated to be connected from the relocated infrastructure within the back of the property. Gas is anticipated to connect to the existing main along Greensway Avenue.

5.6 Service Locations/Cover

The proposed storm and water services will be placed under the new entrance to the site and the sanitary service will be placed under the south parking area. Hydro, telephone and cable will be primarily above ground to relocated infrastructure located at the back of the property.

All minimum cover requirements are as per City of Ottawa Standards. Separation distances between the storm, water and sanitary sewer will be maintained as per Ministry of the Environment and Climate Change requirements.

6.0 PROPOSED STORMWATER MANAGEMENT

6.1 Design Criteria and Methodology

Stormwater management for this site will be maintained through positive drainage away from the proposed buildings and into a new underground storm sewer system within the site. This SWM plan will implement quantity control strategies. The storm runoff will enter the pipe system through a catch basin (CB) and landscape catch basins located on the site. The restricted stormwater runoff will be directed to the existing sewer within Greensway Avenue; similarly, overland flow will mostly be directed towards Greensway Avenue. The northwest portion of the site will have its overland flow directed towards Vanier Parkway.

Through per-consultation with the Rideau Valley Conservation Authority (RVCA), no quality control will be required as the storm outlet is more than 2km away from the site. The quantitative and qualitative properties of the storm runoff for both the pre and post-development flows are further detailed below.

6.2 Runoff Calculations

Runoff calculations presented in this report are derived using the Rational Method, given as:

$$Q = 2.78CIA \quad \text{(L/s)}$$

Where C = Runoff coefficient
I = Rainfall intensity in mm/hr (City of Ottawa IDF curves)
A = Drainage area in hectares

It is recognized that the rational method tends to overestimate runoff rates. As a by-product of using extremely conservative prediction method, any facilities that are sized using these results are expected to function as intended in real world conditions.

In conjunction with the City of Ottawa Sewer Design Guidelines the following coefficients were used to develop a balanced 'C' for each drainage area:

Asphalt, Building roofs, Concrete	0.90
Gravel	0.60
Grass, undeveloped areas	0.20

As per the City of Ottawa Sewer Design Guidelines, the 5-year balanced 'C' value must be increased by 25% for a 100-year storm event to a maximum of 1.0.

The pre-development and post-development flows shall both be calculated using a time of concentration (Tc) of 10 and 10 minutes.

6.2.1 Pre-Development Drainage

Pre-development drainage consists of the overland sheet flow runoff from the existing paved parking lot and the roof runoff of the existing building. There currently no existing flow restrictions for the site. The existing drainage areas are demonstrated as area A1 and A2 on drawing CP-18-0070 PRE (Appendix 'D').

Table 1: Pre-Development Runoff Summary

					Q (L/s)	
Area	Drainage Area (ha)	C (5-Yr)	C (100-Yr)	Tc (min)	5-Year	100-Year
A1	0.04	0.90	1.00	10	9	18
A2	0.42	0.50	0.86	10	60	178
Total	0.45				70	196

(See Appendix 'F' for Calculations)

6.2.2 Post-Development Drainage

The post development drainage scheme for the proposed development consists of two regions describing tributary areas for runoff to be captured and restricted within the storm network and unrestricted runoff. Drawing CP-18-0070 POST (Appendix 'E') indicates the limits of drainage areas B1-B11.

Table 2: Post-Development Restricted Runoff Summary

					Q (L/s)	
Drainage Area ID	Total Area (ha)	C (5-Yr)	C (100-Yr)	Tc	5-Year	100-Year
B1	0.04	0.90	1.00	10	9	18
B2	0.05	0.62	0.70	10	9	18
B3	0.06	0.71	0.79	10	12	24
B4	0.06	0.70	0.79	10	12	24
B5	0.09	0.90	1.00	10	23	43
B6	0.02	0.90	1.00	10	6	11
B7	0.01	0.90	1.00	10	2	5
B8	0.01	0.90	1.00	10	3	5
B9	0.09	0.42	0.48	10	11	23
B10	0.01	0.20	0.25	10	1	1
B11	0.01	0.34	0.40	10	1	3
Total	0.45				90	173

(See Appendix 'F' for Calculations)

Runoff from Area B1 will remain as in pre-development conditions as the area is not being re-developed. Runoff flows from Area B2-B4 will sheet flow on the grass to the parking area where it will be captured though CB1, CBMH1 and CBMH2 and before outletting to the existing infrastructure along Greensway Avenue. Runoff from Area B5 will be captured via roof drains and stormwater runoff from Area B6 will be captured within a trench drain in the parking garage. The remaining runoff from Area B7-B11 will mostly sheet flow towards the existing

infrastructure along Vanier Parkway. See Appendix 'F' for calculations. Runoff restriction and quality control will be further detailed in Sections 6.3 and 6.4.

6.3 Quantity Control

After discussing the quantity control criteria for the site with the City staff, the total post-development runoff for this site has to be restricted to meet the 5-year pre-development flow rate with a maximum runoff coefficient of 0.5. A time of concentration of 15 minutes was also initially required for the site (See Appendix 'A' for pre-consultation notes). When calculating, the pre-development runoff coefficient was higher than 0.5 and therefore the 0.5 runoff coefficient was used to obtain the allowable release rate. Based on the historical use of the site, the time of concentration of 15 minutes was deemed excessive as the site has been a gravel/asphalt driveway for several decades. A new time of concentration based on the Airport formula has been calculated. The new calculated time of concentration of 10 minutes was used to obtain the runoff flow release rate (Refer to calculations in Appendix 'F').

Table 3: Allowable Release Rate

Area	Drainage Area (ha)	Balanced Runoff Coefficient	Tc (min)	Allowable Release Rate (L/S)
A1	0.04	0.90	10	9
A2	0.42	0.50	10	60
Total	0.45			70

(See Appendix 'F' for Calculations)

Area B1 will remain unchanged as it is the existing building and therefore has been omitted in the calculation of restricted post-development flows. The Table below presents the runoff from Area B1.

Table 4: Post-Development Runoff - Area B1

	Post-Development Unrestricted (L/S)		Post-Development Restricted (L/S)		
Drainage Area ID	5-year	100-Year	5-Year	100-Year	Restricted/ Unrestricted
B1	9	18	9	18	Unrestricted

(See Appendix 'F' for Calculations)

Reducing post-development flows will be achieved by using an inlet control device and roof drains. It will consequently create the need for on-site storage. Runoff from Areas B2-B5 will be restricted as detailed in the Table below.

Table 5: Post-Development Ruoff Summary – Area B2-B11

	Post-Development Unrestricted (L/S)		Post-Development Restricted (L/S)		
Drainage Area ID	5-year	100-Year	5-Year	100-Year	Restricted/ Unrestricted
B2	9	18	21	21	Restricted
B3	12	24			
B4	12	24			
B5	23	43	1	2	
B6	6	11	6	11	Unrestricted
B7	2	5	2	5	
B8	3	5	3	5	
B9	11	23	11	23	
B10	1	1	1	1	
B11	1	3	1	3	
Total	81	155	46	70	

(See Appendix 'F' for Calculations)

Runoff from area B2-B4 will be capture through catch basins and catch basin manholes, located within the outside parking area. The stormwater runoff will be conveyed through the storm network towards MH1 located within area B7 in the west corner of the property, where a Hydrovex 125VHV-2 inlet control device will restrict the flow to 21 L/s with a design head of 3.3m. The restriction by the inlet control device will result in a water surface elevation of 56.17m and 56.25 for the 5-year and 100-year storm event, respectively. Area B5 will be restricted via 2 roof drains. The roof drains will restrict the stormwater runoff to 1.32 L/s with a head of 55mm based on 75% of the roof area. The restricted flow from the roof will further flow to a lateral connected to the storm network past the restriction device. Storage will be provided on site over the parking surface and on grassed areas such as along the existing building and east of the parking ramp.

The table below details the required and provided storage volumes for 5-year and 100-year storm event to meet the requirements.

Table 6: On-Site Storage Summary

Location	5-yr Storage Required (m^3)	5-yr Storage Available (m^3)	5-yr Depth of Ponding (m)	100-yr Storage Required (m^3)	100-yr Storage Available (m^3)	100-yr Depth of Ponding (m)
Area B2-B4	9	9	0.12	31	31	0.2
Area B5	24	28	0.04	46	49	0.1

(See Appendix 'F' for Calculations)

In the event that there is a rainfall above the 100-year storm event, or a blockage within the storm network, an emergency overland flow route has been provided such that the stormwater runoff will be conveyed towards the west corner of the site away from the building, and into Greensway Avenue. Another flow route towards Vanier Parkway has also been provided. An elevation difference of 0.56 m has been provided from the finished floor (56.83m) of the building to the overland flow route elevation (56.27m).

6.4 Quality Control

The development of this lot will employ Best Management Practices (BMP's) wherever possible. The intent of implementing stormwater BMP's is to ensure that water quality and quantity concerns are addressed at all stages of development. Lot level BMP's typically include temporary retention of the parking lot runoff, minimizing ground slopes and maximizing landscaped areas. Some of these BMP's cannot be provided for this site due to site constraints and development requirements.

As per the discussions with the RVCA, the outlet to the existing storm infrastructure within Greensway Avenue is further than 2km from the connection point and therefore will not require any quality protection at this time. The combination of the above BMP's and the proposed flow control measures will however still aid in the protection of the natural environment.

7.0 SEDIMENT EROSION CONTROL

The site-grading contractor is responsible for ensuring sediment control structures are installed in accordance with the Removals, Sediment & Erosion Control Plan as indicated. Silt fences shall be installed on site before construction or earth-moving operations begin, as shown on the Removals, Sediment & Erosion Control Plan.

Geosock is to be installed under the grates of all existing structures along the frontage of the site and any new structures immediately upon installation. The Geosock is to be removed only after all areas have been paved and vegetation has been established. Care shall be taken at the removal stage to ensure that any silt that has accumulated is properly handled and disposed of. Removal of silt fences without prior removal of the sediments shall not be permitted.

At the discretion of the project manager, municipal staff or conservation authority, additional silt control devices shall be installed at designated locations.

8.0 SUMMARY

- A new 1,139 m^2 6-storey residential building will be constructed on the site located at 263 Greensway Avenue.
- A new 200 mm diameter sanitary service will be installed and connected to the existing 300 mm diameter sewer.
- A new 50 mm diameter water lateral will be extended from the existing 200 mm diameter main within Greensway Avenue.
- A new storm network will be installed onsite and will connect to the existing 450mm diameter storm sewer that services catch basins within Greensway Avenue.
- As discussed with the City of Ottawa staff, the stormwater management design will ensure that the post-development flow rates are restricted to the 5-year pre-development flow rate calculated with a C value of 0.5.
- Storage for the 5- through 100-year storm events will mostly be provided on the paved area within the parking lot.
- As per discussed with the Rideau Valley Conservation Authority staff, no quality protection is required. Nevertheless, best management practices will be employed.

9.0 RECOMMENDATIONS

Based on the information presented in this report dated May 2018, we recommend that City of Ottawa approve this Servicing and Stormwater Management Report in support of the proposed 6-storey residential building located at 263 Greensway Avenue.

The sediment and erosion control plan outlined in Section 7.0 and detailed in the Grading and Drainage Plan notes are to be implemented by the contractor.

This report is respectfully being submitted for approval.

Ryan Kennedy, P.Eng.
Practice Area Lead, Land Development
McIntosh Perry Consulting Engineers
T: 613.836.2184 x 2243
E: r.kennedy@mcintoshperry.com

10.0 STATEMENT OF LIMITATIONS

This report was produced for the exclusive use of Manor Park Management. The purpose of the report is to assess the existing stormwater management system and provide recommendations and designs for the post-construction scenario that are in compliance with the guidelines and standards from the Ministry of the Environment and Climate Change, City of Ottawa and local approval agencies. McIntosh Perry reviewed the site information and background documents listed in Section 2.0 of this report. While the previous data was reviewed by McIntosh Perry and site visits were performed, no field verification/measures of any information were conducted.

Any use of this review by a third party, or any reliance on decisions made based on it, without a reliance report is the responsibility of such third parties. McIntosh Perry accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this review.

The findings, conclusions and/or recommendations of this report are only valid as of the date of this report. No assurance is made regarding any changes in conditions subsequent to this date. If additional information is discovered or becomes available at a future date, McIntosh Perry should be requested to re-evaluate the conclusions presented in this report, and provide amendments, if required.

APPENDIX A: CITY OF OTTAWA PRE-CONSULTATION NOTES

McINTOSH PERRY

From: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Sent: March-29-18 8:45 AM
To: Tyler Ferguson
Cc: Laure-Anne Larose; Ryan Kennedy
Subject: RE: 263 Greensway Avenue - Criteria

Hi Tyler

As indicated in my earlier e-mail, with this form of development, we can be flexible and as such will accept the Tc of 15 min.

Richard Buchanan, CET

Project Manager, Development Approvals
Planning, Infrastructure and Economic Development Department
Planning & Growth Management Branch
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ottawa.ca/planning / ottawa.ca/urbanisme

From: Tyler Ferguson [mailto:t.ferguson@mcintoshperry.com]
Sent: Wednesday, March 28, 2018 6:14 PM
To: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Cc: Laure-Anne Larose <l.larose@mcintoshperry.com>; Ryan Kennedy <r.kennedy@mcintoshperry.com>
Subject: RE: 263 Greensway Avenue - Criteria

Hi Richard,

We have reviewed the stormwater management criteria for the site at 263 Greensway Avenue, and based on the historical use of the site, the time of concentration seems rather high. Using the images available within geoOttawa, the site has been a gravel/asphalt driveway for quite some time. We calculated a time of concentration based on the Airport formula as per the below for the site.

Tc = (3.26(1.1-c)L^0.5/S^0.33)

c = 0.77 (Balanced Runoff Coefficient)
L = 99 m (Watershed length)
S = 1.08% (Average slope of watershed)

The result of this calculation produced a time of concentration for the existing site of 10 minutes. With this in mind we are wondering if it would be possible to reduce the time of concentration for pre-development flow. Can the Tc for pre-development be changed from 20 minutes to 15 minutes? The "C" factor of 0.5 would remain.

Let us know your thoughts and we could potentially set up a quick phone call to discuss.

Thanks,

Tyler Ferguson, EIT
Engineering Intern
115 Walgreen Road, R.R. 3, Carp, ON K0A 1L0
T. 613.836.2184 (ext 2242) | **F.** 613.836.3742
t.ferguson@mcintoshperry.com | www.mcintoshperry.com

From: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Sent: March-12-18 10:21 AM
To: Laure-Anne Larose <l.larose@mcintoshperry.com>
Subject: RE: 263 Greensway Avenue - Criteria

Good Morning Laure-Anne,

Stormwater Management is as follows

Flow leaving the site (up to the 1:100 year storm event) cannot exceed a 1: 5 year storm event using a "C" factor of 0.5 with a Tc of 20 minutes.
It is obvious that entrance grades into underground parking cannot be below the 1:100 year storm event (on-site and off-site influences since it is in a flood plain).

For development that only have internal building works and no outside works, there may be justification to be flexible in applying any criteria.

Richard Buchanan, CET

Project Manager, Development Approvals
Planning, Infrastructure and Economic Development Department
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From: Laure-Anne Larose [mailto:l.larose@mcintoshperry.com]
Sent: Monday, March 12, 2018 8:53 AM
To: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Subject: 263 Greensway Avenue - Criteria

Good Morning,

I am currently working on the stormwater management for the site located at 263 Greensway Avenue. A pre-consultation meeting has already took place; following my review of the pre-consultation meeting, only some information was provided regarding the site criteria for storm water management (parking garage elevations to be above 100-yr storm). Could you provide me with more details on the stormwater management criteria for this site?

Thank you,

Laure - Anne Larose, EIT

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McINTOSH PERRY

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From: Jamie Batchelor <jamie.batchelor@rvca.ca>
Sent: April-19-18 8:57 AM
To: Tyler Ferguson
Cc: Laure-Anne Larose
Subject: RE: 263 Greensway - Flood Plain

Good Morning Tyler,

The elevation you have cited is correct. As for the first floor, that would be the ground floor which must be 0.3 metre above the 1:100 year flood elevation.

From: Tyler Ferguson [mailto:t.ferguson@mcintoshperry.com]
Sent: Tuesday, April 10, 2018 5:20 PM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Laure-Anne Larose <l.larose@mcintoshperry.com>
Subject: RE: 263 Greensway - Flood Plain

Hi Jamie,

Just wondering if you could confirm the 100-year flood elevation that is to be used for our site. I believe you told Laure-Anne over the phone that an elevation of 56.53m was to be used for our site. Can you confirm?

Thanks,

Tyler Ferguson, EIT
Engineering Intern
T. 613.836.2184 (ext 2242) | **F.** 613.836.3742

From: Jamie Batchelor [mailto:jamie.batchelor@rvca.ca]
Sent: March-06-18 11:38 AM
To: Laure-Anne Larose <l.larose@mcintoshperry.com>
Cc: Tyler Ferguson <t.ferguson@mcintoshperry.com>
Subject: RE: 263 Greensway - Flood Plain

Good Morning Laure-Anne,

As a follow up to our conversation this morning I have attached the RVCA floodplain mapping and cross sections for the area.

I can also confirm that the storm sewers flow path fronting on the Vanier Parkway and on Greensway Avenue travel over 2 km to an outlet at the Ottawa River. In the opinion of the RVCA, the distance of the outlet is sufficiently far that onsite quality controls would have a negligible impact on surface water improvement. Therefore the RVCA would not require any additional onsite water quality controls aside from BMP's.

From: Laure-Anne Larose [mailto:l.larose@mcintoshperry.com]
Sent: Monday, March 05, 2018 3:49 PM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Tyler Ferguson <t.ferguson@mcintoshperry.com>
Subject: 263 Greensway - Flood Plain

Hi Jamie,

I am currently working on the grading and servicing for the site located as 263 Greensway Avenue in Vanier. I would like to clarify; as per the pre-consultation notes with the City, the underground parking garage and entrances to the building have to be at 0.3m above the 100-year flood levels in addition to the 0.3m that the City requires, is this correct?

Also, would you be able to provide me with an elevation of water for the 100-year flood level.

Thank you,

Laure - Anne Larose, EIT
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APPENDIX B: EXISTING WATERMAIN FLOW AND FIRE PROTECTION CALCULATIONS

McINTOSH PERRY

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CP-18-0070 - 263 Greensway - Fire Underwriters Survey (FUS) Fire Calculations

Project:	263 Greensway
Project No.:	CP-18-0070
Designed By:	LAL
Checked By:	RPK
Date:	27/04/2018

From the Fire Underwriters Survey (1999)

From Part II – Guide for Determination of Required Fire Flow Copyright I.S.O.:

F = 220 x C x √A Where:

F = Required fire flow in liters per minute

C = Coefficient related to the type of construction.

A = The total floor area in square meters (including all storey's, but excluding basements at least 50 percent below grade) in the building being considered.

A. Determine The Coefficient Related To The Type Of Construction

The building is considered to be of ordinary construction type. Therefore,

C = 1.00

B. Determine Ground Floor Area

As provided by the Architect:

Floor Area (One Floor) = 940.69 m²

Total Floor Area = 5,644.14 m²

This floor area represents the final build-out of the development; as outlined on the Site Plan drawing.

C. Determine Height in Storeys

From Architectural Drawings:

Number of Storeys = 6.00

D. Calculate Required Fire Flow

F = 220 x C x √A

F = 220.00 X 1.00 X √ 5644.14

F = 16,528.05 L/min.

F = 17,000.00 L/min.

E. Determine Increase or Decrease Based on Occupancy

From note 2, Page 18 of the Fire Underwriter Survey:

Non-Combustible

-25%

Occupancy Decrease = -4,250.00 L/min.

F = 12,750.00 L/min.

CP-18-0070 - 263 Greensway - Fire Underwriters Survey (FUS) Fire Calculations

F. Determine the Decrease, if any for Sprinkler Protection

From note 3, Page 18 of the Fire Underwriter Survey:

- The flow requirement may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of the system.
- The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards.
- Additional credit of 10% if water supply is standard for both the system and fire department hose lines
- If sprinkler system is fully supervised system, an additional 10% credit is granted
- The entire building will be installed with a fully automated, standardized with the City of Ottawa Fire Department and fully supervised.
- Therefore the value obtained in Step E is reduced by 30% (The building is sprinklered with a standard system and fire department hose lines)

Reduction = 12,750.00 L/min. X 30%

Reduction = 3,825.00 L/min.

G. Determine the Total Increase for Exposures

From note 4, Page 18 of the Fire Underwriter Survey:

- Exposure distance to the existing building to the east of the proposed building is over 45m away. Building to the north is 19.30m, to the south 10.38m and to the west 18.25m.
- There are no existing buildings surrounding the remainder of the site that are within 45m.
- Therefore the charge for exposure is 45% of the value obtained in Step E.

Increase = 12,750.00 L/min. X 45%

Increase = 5,737.50 L/min.

H. Determine the Total Fire Demand

- To the answer obtained in E, substract the value obtained in F and add the value obtained in G
- Fire flow should be no less than 2,000L/min. and the maximum value shoul not exceed 45,000L/min.
- The fire flow must be rounded to the nearest 1,000L/min.

F = 12,750.00 L/min. - 3,825.00 L/min. + 5,737.50 L/min.

F = 14,662.50 L/min.

F = 15,000.00 L/min.

Therefore, after rounding to the nearest 1,000 L/min, the total required fire flow for the development is 15,000 L/min (5,283 GPM).

McINTOSH PERRY

CP-18-0070 - 263 Greensway - OBC Fire Calculations

Project:	263 Greensway
Project No.:	CP-18-0070
Designed By:	LAL
Checked By:	RPK
Date:	27/04/2018

Ontario 2006 Building Code Compendium (Div. B - Part 3)

***Water Supply for Fire-Fighting* - Store/Office & Warhouse Building**

Building is classified as Group : D, E and F2 up to 2 Storeys (from table 3.2.2.55)
Building is of noncombustable construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2, including loadbearging walls, columns and arches.

From Div. B A-3.2.5.7. of the Ontario Building Code - 3. Building On-Site Water Supply:

(a) Q = K x V x Stot

where:

Q = minimum supply of water in litres

K = water supply coefficient from Table 1

V = total building volume in cubic metres

Stot = total of spatial coefficient values from the property line exposures on all sides as obtained from the formula:

Stot = 1.0 + [Sside1+Sside2+Sside3+...etc.]

K	**10**	(from Table 1 pg A-31) (Worst case occupancy {E / F2} 'K' value used)
V	**16,932**	(Total building volume in m³.)
Stot	**1.0**	(From figure 1 pg A-32)
Q =	**169,324.20 L**	

			From Figure 1 (A-32)
Snorth	19.3	m	0.0
Seast	45+	m	0.0
Ssouth	10.38	m	0.0
Swest	18.25	m	0.0

*approximate distances

From Table 2: Required Minimum Water Supply Flow Rate (L/s)

5400 L/min (if Q >162,000 and <190,000 L)
1427 gpm

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McINTOSH PERRY

CP-18-0070 - 263 Greensway - Water Demands

Project:	263 Greensway
Project No.:	CP-18-0070
Designed By:	LAL
Checked By:	RPK
Date:	27/04/2018
Residents per Unit	136.00 People

AVERAGE DAILY DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	***350***	***L/c/d***
Industrial - Light	35,000	L/gross ha/d
Industrial - Heavy	55,000	L/gross ha/d
Shopping Centres	2,500	L/(1000m² /d
Hospital	900	L/(bed/day)
Schools	70	L/(Student/d)
Trailer Parks no Hook-Ups	340	L/(space/d)
Trailer Park with Hook-Ups	800	L/(space/d)
Campgrounds	225	L/(campsite/d)
Mobile Home Parks	1,000	L/(Space/d)
Motels	150	L/(bed-space/d)
Hotels	225	L/(bed-space/d)
Tourist Commercial	28,000	L/gross ha/d
Othe Commercial	28,000	L/gross ha/d
AVERAGE DAILY DEMAND	**0.55**	**L/s**

MAXIMUM DAILY DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	***2.5 x avg. day***	***L/c/d***
Industrial	1.5 x avg. day	L/gross ha/d
Commercial	1.5 x avg. day	L/gross ha/d
Institutional	1.5 x avg. day	L/gross ha/d
MAXIMUM DAILY DEMAND	**1.38**	**L/s**

MAXIMUM HOUR DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	***2.2 x max. day***	***L/c/d***
Industrial	1.8 x max. day	L/gross ha/d
Commercial	1.8 x max. day	L/gross ha/d
Institutional	1.8 x max. day	L/gross ha/d
MAXIMUM HOUR DEMAND	**3.03**	**L/s**

WATER DEMAND DESIGN FLOWS PER UNIT COUNT
CITY OF OTTAWA - WATER DISTRIBUTION GUIDELINES, JULY 2010

APPENDIX C: SANITARY SEWER CALCULATIONS

McINTOSH PERRY

1. BUILDING OCCUPANCY

The maximum number of bedroom units will be 76 units as per the floors plans and the attached unit break down from the Architect.

2. DAILY VOLUME IN LITRES

As per the extract of the City of Ottawa Sewer Design Guidelines, Appendix 4-A; Daily Sewage Flow for Dwellings;

- Each Dwelling unit of bachelor
    - 275 Liters/Dwelling/Day
- Each Dwelling unit of 1 bedrooms
    - 275 Liters/Dwelling/Day
- Each Dwelling unit of 2 bedrooms
    - 1100 Liters/Dwelling/Day
- Each Dwelling unit of 3 bedrooms
    - 1600 Liters/Dwelling/Day

3. PEAK FLOW (Q/P)

- $Q_{BACHELOR}(p) = F_{BACHELOR} \times P_{BACHELOR}$ Where:

  $F_{BACHELOR}$ = 275 Litres/Dwelling/Day (as per City of Ottawa Sewer Design Guidelines)

  $P_{BACHELOR}$ = 8 Units (as per Site Plan)

- Therefore, $Q_{BACHELOR}(p) = (275) \times (8) =$ <u>2,200 L/Day (0.025 L/sec)</u>

- $Q_{2\text{-}BED}(p) = F_{1\text{-}BED} \times P_{1\text{-}BED}$ Where:

  $F_{1\text{-}BED}$ = 275 Litres/Dwelling/Day (as per City of Ottawa Sewer Design Guidelines)

  $P_{1\text{-}BED}$ = 35 Units (as per Site Plan)

- Therefore, $Q_{1\text{-}BED}(p) = (275) \times (35) =$ <u>9,625 L/Day (0.111 L/sec)</u>
-

- $Q_{2\text{-BED}}(p) = F_{2\text{-BED}} \times P_{2\text{-BED}}$ Where:

  $F_{2\text{-BED}}$ = 1100 Litres/Dwelling/Day (as per City of Ottawa Sewer Design Guidelines)

  $P_{2\text{-BED}}$ = 27 Units (as per Site Plan)

- Therefore, $Q_{2\text{-BED}}(p)$ = (1,100) x (27) = 29,700 L/Day (0.344 L/sec)
- $Q_{3\text{-BED}}(p) = F_{3\text{-BED}} \times P_{3\text{-BED}}$ Where:

  $F_{3\text{-BED}}$ = 1600 Litres/Dwelling/Day (as per City of Ottawa Sewer Design Guidelines)

  $P_{3\text{-BED}}$ = 6 Units (as per Site Plan)

- Therefore, $Q_{3\text{-BED}}(p)$ = (1,600) x (6) = 9,600 L/Day (0.111 L/sec)
- $Q_{TOTAL}(p) = Q_{BACHELOR} + Q_{1\text{-BED}} + Q_{2\text{-BED}} + Q_{3\text{-BED}}$ Where:

  $Q_{BACHELOR}$ = 2,200 L/Day

  $Q_{1\text{-BED}}$ = 9,625 L/Day

  $Q_{2\text{-BED}}$ = 29,700 L/Day

  $Q_{3\text{-BED}}$ = 9,600 L/Day

- Therefore, $Q_{TOTAL}(p)$ = (2,200) + (9,625) + (29,700) + (9,600) = **51,125 L/Day (0.59 L/sec)**

SANITARY SEWER DESIGN SHEET

PROJECT: 263 Greensway Avenue
LOCATION: VANIER
CLIENT: Anand Aggarwal

McINTOSH PERRY

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			FLOW	SEWER DATA								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	30	31
STREET	AREA ID	FROM MH	TO MH	UNIT TYPES				AREA	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	AREA (ha)						PEAK FLOW (L/s)	AREA (ha)		FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	FLOW DEPTH (mm)	VELOCITY (actual) (m/s)	AVAILABLE CAPACITY	
				SF	SD	TH	APT	(ha)	IND	CUM			INSTITUTIONAL		COMMERCIAL		INDUSTRIAL			IND	CUM										L/s	(%)
													IND	CUM	IND	CUM	IND	CUM													
							76	0.45	174.8	174.8	4.00	2.83		0.00		0.00		0.00	0.00	0.45	0.45	0.13	2.96	8.48	26.45	135	0.50	0.574	55.6	0.525	5.52	65.12

Design Parameters:

Residential			ICI Areas			
						Peak Factor
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	50,000	L/Ha/day	1.5
APT	2.3	p/p/u	COM	50,000	L/Ha/day	1.5
Other	60	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: LAL

Checked: RPK

Project No.: CP-18-0070

No.	Revision	Date
1.		

Date: 22/05/2018

Sheet No: 1 of 1

APPENDIX D: PRE-DEVELOPMENT DRAINAGE PLAN

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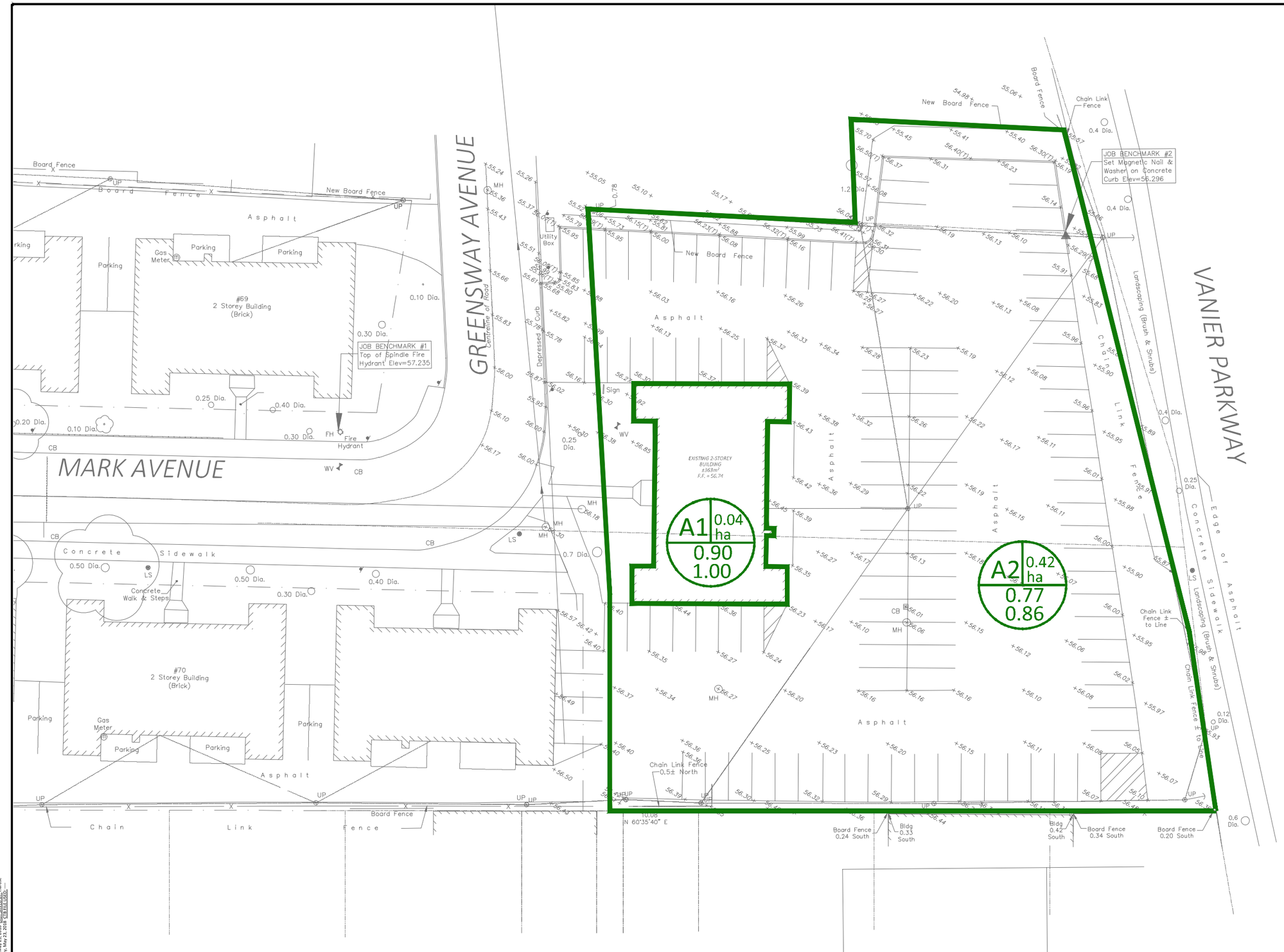
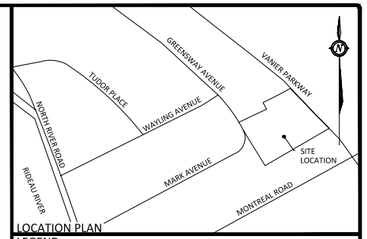
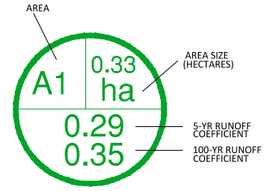




LOCATION PLAN

LEGEND



No.	Revision/Issue	Date
1	ISSUED FOR SITE PLAN CONTROL	MAY 24/2018

Check and verify **all** dimensions before proceeding with the work

Do not scale drawings

SCALE 1 : 200

0 10 20 Metres

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Client:
Manor Park Management
231 BRITTANY, SUITE D
OTTAWA, ON
K1L 0R8

Project:
263 GREENSWAY AVENUE
SIX STOREY RESIDENTIAL BUILDING
VANIER ON

Drawing Title:
PRE-DEVELOPMENT DRAINAGE AREAS

Scale:	1:200
Drawn by:	L.A.L
Checked By:	R.P.K.
Designed By:	L.A.L

Project Number: CP-18-0070

Drawing Number: PRE

FILENAME: H:\01 Project - Proposals\2018 Jobs\CP-18-0070 Anand Aggarwal_ Greensway Apartment Manor Park_263 Greensway Avenue\Civil\15 - Drawing\CP-18-0070 - PRESENTATION.dwg
LAST PLOTTED: Wednesday, May 23, 2018 4:38:11 PM by Lance

APPENDIX E: POST-DEVELOPMENT DRAINAGE PLAN

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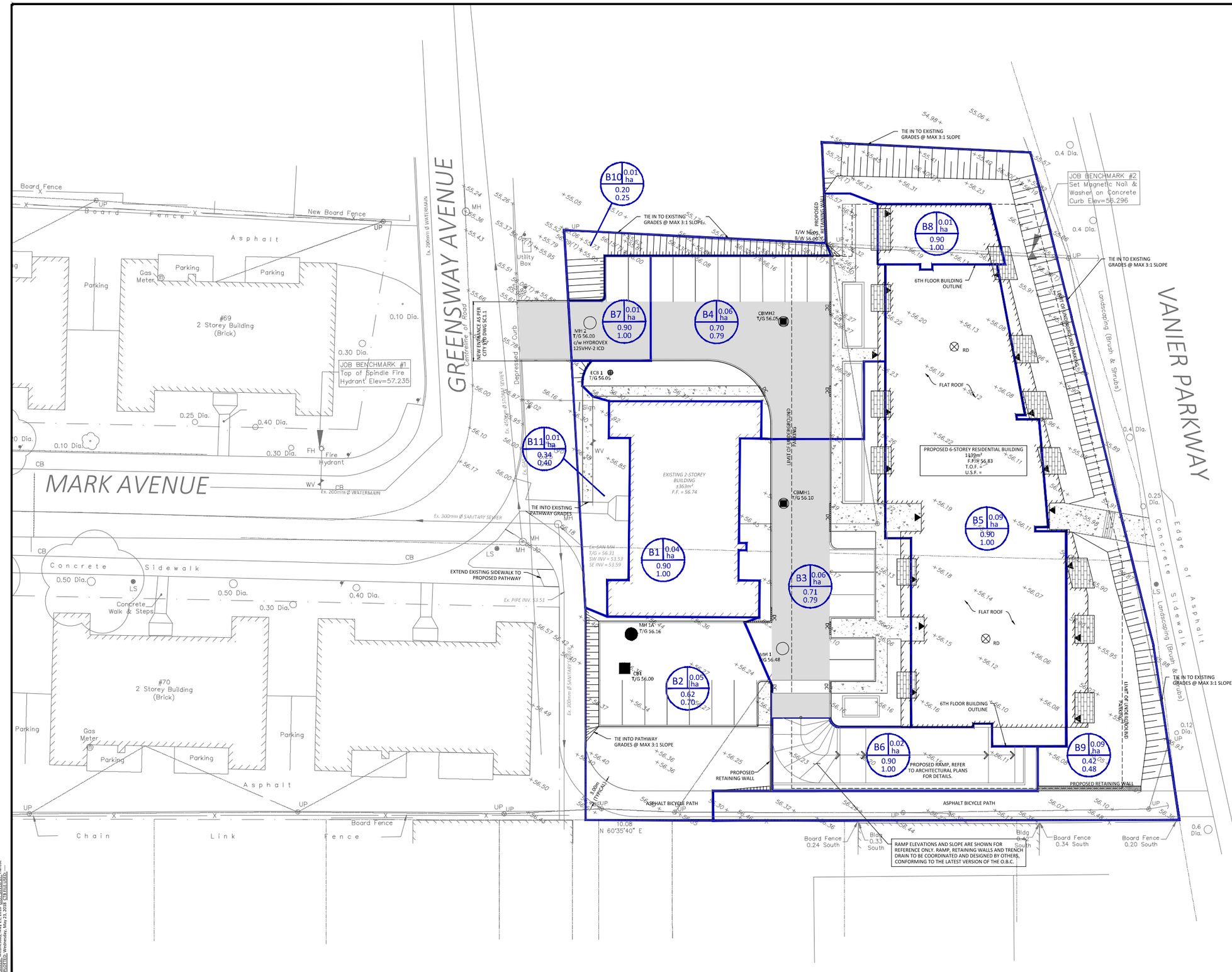

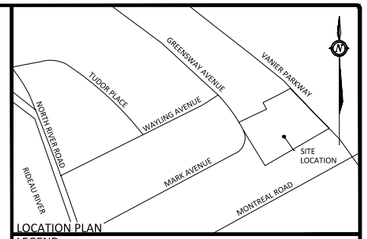

LOCATION PLAN

LEGEND

AREA — B1 — 2.10 ha — AREA SIZE (HECTARES)

0.20 — 5-YR RUNOFF COEFFICIENT

0.25 — 100-YR RUNOFF COEFFICIENT

No.	Revision/Issue	Date
1	ISSUED FOR SITE PLAN CONTROL	MAY 24/2018

Check and verify all dimensions before proceeding with the work

Do not scale drawings

SCALE 1 : 200

0 10 20 Metres

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Client:
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231 BRITTANY, SUITE D
OTTAWA, ON
K1L 0R8

Project:
263 GREENSWAY AVENUE
SIX STOREY RESIDENTIAL BUILDING
VANIER ON

Drawing Title:
POST-DEVELOPMENT DRAINAGE AREAS

Scale:	1:200
Drawn by:	L.A.L
Checked By:	R.P.K.
Designed By:	L.A.L

Project Number: CP-18-0070

Drawing Number: POST

FILENAME: H:\01 Project - Proposals\2018 Jobs\CP-18-0070 Anand Aggarwal, Greensway Apartment Manor Park_ 263 Greensway Avenue\Civil\15 - Drawing\CP-18-0070 - PRESENTATION.dwg
LAST SAVED: Thursday, May 24, 2018 11:16 AM by Lance
LAST PLOTTED: Wednesday, May 23, 2018 4:31 PM by Lance

APPENDIX F: STORMWATER MANAGEMENT CALCULATIONS

McINTOSH PERRY

CP-18-0070 - 263 Greensway Avenue - Time of Concentration Calculations

Time of Concentration Pre-Development

Drainage Area ID	Sheet Flow Distance (m)	Slope of Land (%)	Tc (min) (5-Year)	Tc (min) (100-Year)
A1				
A2	**99**	**1.08**	10	8

Tc= (3.26(1.1-c)L^0.5/S^0.33)

c= Blanced Runoff Coefficient

L= Length of drainage area

S= Average slope of watershed

CP-18-0070 - 263 Greensway Avenue - Runoff Calculations

Pre-Development Runoff Coefficient

Area	Drainage Area (ha)	Roof/Asphalt/ Concrete (m^2)	C	Gravel (m^2)	C	Treed/Grass Area (m^2)	C	Average C (5-year)	Average C (100-year)
A1	0.04	363	0.90	0	0.60	0	0.20	0.90	1.00
A2	0.42	3401	0.90	0	0.60	771	0.20	0.77	0.86

Pre-Development Runoff Calculations

					I (mm/hr)		Q (L/s)	
Area	Drainage Area (ha)	C (5-Yr)	C (100-Yr)	Tc (min)	5-Year	100-Year	5-Year	100-Year
A1	0.04	0.90	1.00	10	104.2	178.6	9	18
A2	0.42	0.50	0.86	10	104.2	178.6	60	178
Total	**0.45**						**70**	**196**

Post-Development Runoff Coefficient

Area	Drainage Area (ha)	Roof/Asphalt/ Concrete (m^2)	C	Gravel (m^2)	C	Treed/Grass Area (m^2)	C	Average C (5-year)	Average C (100-year)
B1	0.04	364	0.90	0	0.60	0	0.20	0.90	1.00
B2	0.05	303	0.90	0	0.60	200	0.20	0.62	0.70
B3	0.06	434	0.90	0	0.60	165	0.20	0.71	0.79
B4	0.06	440	0.90	0	0.60	177	0.20	0.70	0.79
B5	0.09	876	0.90	0	0.60	0	0.20	0.90	1.00
B6	0.02	222	0.90	0	0.60	0	0.20	0.90	1.00
B7	0.01	94	0.90	0	0.60	0	0.20	0.90	1.00
B8	0.01	98	0.90	0	0.60	0	1.20	0.90	1.00
B9	0.09	292	0.90	0	0.60	657	0.20	0.42	0.48
B10	0.01	0	0.90	0	0.60	90	0.20	0.20	0.25
B11	0.01	25	0.90	0	0.60	100	0.20	0.34	0.40

Post-Development Runoff Calculations

					I (mm/hr)		Q (L/s)	
Drainage Area ID	Total Area (ha)	C (5-Yr)	C (100-Yr)	Tc	5-Year	100-Year	5-Year	100-Year
B1	0.04	0.90	1.00	10	104.2	178.6	9	18
B2	0.05	0.62	0.70	10	104.2	178.6	9	18
B3	0.06	0.71	0.79	10	104.2	178.6	12	24
B4	0.06	0.70	0.79	10	104.2	178.6	12	24
B5	0.09	0.90	1.00	10	104.2	178.6	23	43
B6	0.02	0.90	1.00	10	104.2	178.6	6	11
B7	0.01	0.90	1.00	10	104.2	178.6	2	5
B8	0.01	0.90	1.00	10	104.2	178.6	3	5
B9	0.09	0.42	0.48	10	104.2	178.6	11	23
B10	0.01	0.20	0.25	10	104.2	178.6	1	1
B11	0.01	0.34	0.40	10	104.2	178.6	1	3
Total	**0.45**						**90**	**173**

Post-Development Restricted Runoff Calculations

	Post-Development Unrestricted (L/S)		Post-Development Restricted (L/S)		
Drainage Area ID	5-year	100-Year	5-Year	100-Year	Restricted/ Unrestricted
B2	9	18	21	21	Restricted
B3	12	24			
B4	12	24			
B5	23	43	1	2	Unrestricted
B6	6	11	6	11	
B7	2	5	2	5	
B8	3	5	3	5	
B9	11	23	11	23	
B10	1	1	1	1	
B11	1	3	1	3	
Total	**79**	**152**	**46**	**70**	

	Post-Development		Post-Development		
Drainage Area ID	5-year	100-Year	5-Year	100-Year	Restricted/ Unrestricted
B1	9	18	9	18	Unrestricted

CP-18-0070 - 263 Greensway Avenue - STORAGE REQUIREMENTS

Storage Requirements for Area B2-B5

5-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	104.2	36	21	15	9
20	70.3	24	21	3	4
30	53.9	19	21	-3	-5
40	44.2	15	21	-6	-15
50	37.7	13	21	-8	-25

Maximum Storage Required 5-year =	9	m^3

100-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	178.6	70	21	48	29
20	120.0	47	21	25	31
30	91.9	36	21	14	26
40	75.1	29	21	8	19
50	64.0	25	21	4	11
60	55.9	22	21	0	1
70	49.8	19	21	-2	-8
80	45.0	18	21	-4	-19
90	41.1	16	21	-5	-29
100	37.9	15	21	-7	-40

Maximum Storage Required 100-year =	31	m^3

Storage Occupied In Area B2-B5

5-Year Storm Event

		Water Elev. (m) =		56.17		
Location	T/G	INV. (out)	Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
CB 1	56.00	53.27	58.0	0.17	2.90	5.2
CBMH 1	56.10	53.07	6.8	0.07	3.10	0.3
CBMH 2	56.05	52.95	44.7	0.12	3.22	2.9
LSCB 1	56.05	52.87	5.9	0.12	3.30	0.4

Storage Available (m^3) = 9	*
Storage Required (m^3) = 9	

100-YEAR STORM EVENT

		Water Elev. (m) =		56.25		
Location	T/G	INV. (out)	Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
CB 1	56.00	53.27	118.4	0.25	2.98	13.2
CBMH 1	56.10	52.96	50.2	0.15	3.29	2.9
CBMH 2	56.05	52.95	184.4	0.20	3.30	13.0
LSCB 1	56.05	52.87	25.2	0.20	3.38	1.8

Storage Available (m^3) = 31	*
Storage Required (m^3) = 31	

*Available Storage calcualted from AutoCAD

Storage Requirements for Area B6

5-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
60	32.9	7	1	6	23
70	29.4	6	1	5	23
80	26.6	6	1	5	23
90	24.3	5	1	4	24
100	22.4	5	1	4	24
110	20.8	5	1	4	24
120	19.5	4	1	3	24
130	18.3	4	1	3	24
140	17.3	4	1	3	24
150	16.4	4	1	3	24
160	15.6	3	1	2	23

Maximum Storage Required 5-year =	24	m^3

100-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
60	55.9	14	2	12	43
70	49.8	12	2	10	44
80	45.0	11	2	9	45
90	41.1	10	2	8	45
100	37.9	9	2	8	45
110	35.2	9	2	7	45
120	32.9	8	2	6	46
130	30.9	8	2	6	46
140	29.2	7	2	5	45
150	27.6	7	2	5	45

Maximum Storage Required 100-year =	46	m^3

Storage Occupied In Area B6

5-Year Storm Event

Roof Storage			
Location	*Area (m^2)	Depth (m)	Volume (m^3)
Roof Drain	699.70	0.040	28
		Total	28

Storage Available (m^3) =	28
Storage Required (m^3) =	24

100-Year Storm Event

Roof Storage			
Location	*Area (m^2)	Depth (m)	Volume (m^3)
Roof Drain	699.70	0.070	49
		Total	49

Storage Available (m^3) =	49
Storage Required (m^3) =	46

*Area is calcualted using 75% of the total roof area

CP-18-0070 - 263 Greensway Avenue - ROOF DRAINS

Roof Drain Flow For Flat Roof (B5)

Flow Rate Vs. Build-Up (One Weir)	
Metric	
Depth (mm)	Flow (L/s)
15	0.18
20	0.24
25	**0.30**
30	0.36
35	0.42
40	0.48
45	0.54
50	0.60
55	**0.66**

*Roof Drain model to be Accutrol Weirs, See attached sheets

*Roof Drain Flow information taken from Watts Drainage website

Roof Drain Flow		
Flow (l/s)	Storage Depth (mm)	2 Roof Drains Flow (l/s)
0.18	15	0.36
0.24	20	0.48
0.30	**25**	0.60
0.36	30	0.72
0.42	35	0.84
0.48	40	0.96
0.54	45	1.08
0.60	50	1.20
0.66	**55**	1.32
0.72	60	1.44
0.78	65	1.56
0.84	70	1.68
0.90	75	1.80
0.96	80	1.92
1.02	85	2.04
1.08	90	2.16
1.14	95	2.28
1.20	100	2.40
1.26	105	2.52
1.32	110	2.64
1.38	115	2.76
1.44	120	2.88
1.50	125	3.00
1.56	130	3.12
1.62	135	3.24
1.68	140	3.36
1.74	145	3.48
1.80	150	3.60

Note: The flow leaving through a restricted roof drain is based on flow vs. head information

John Meunier - Hydrovex VHV ICD Curves

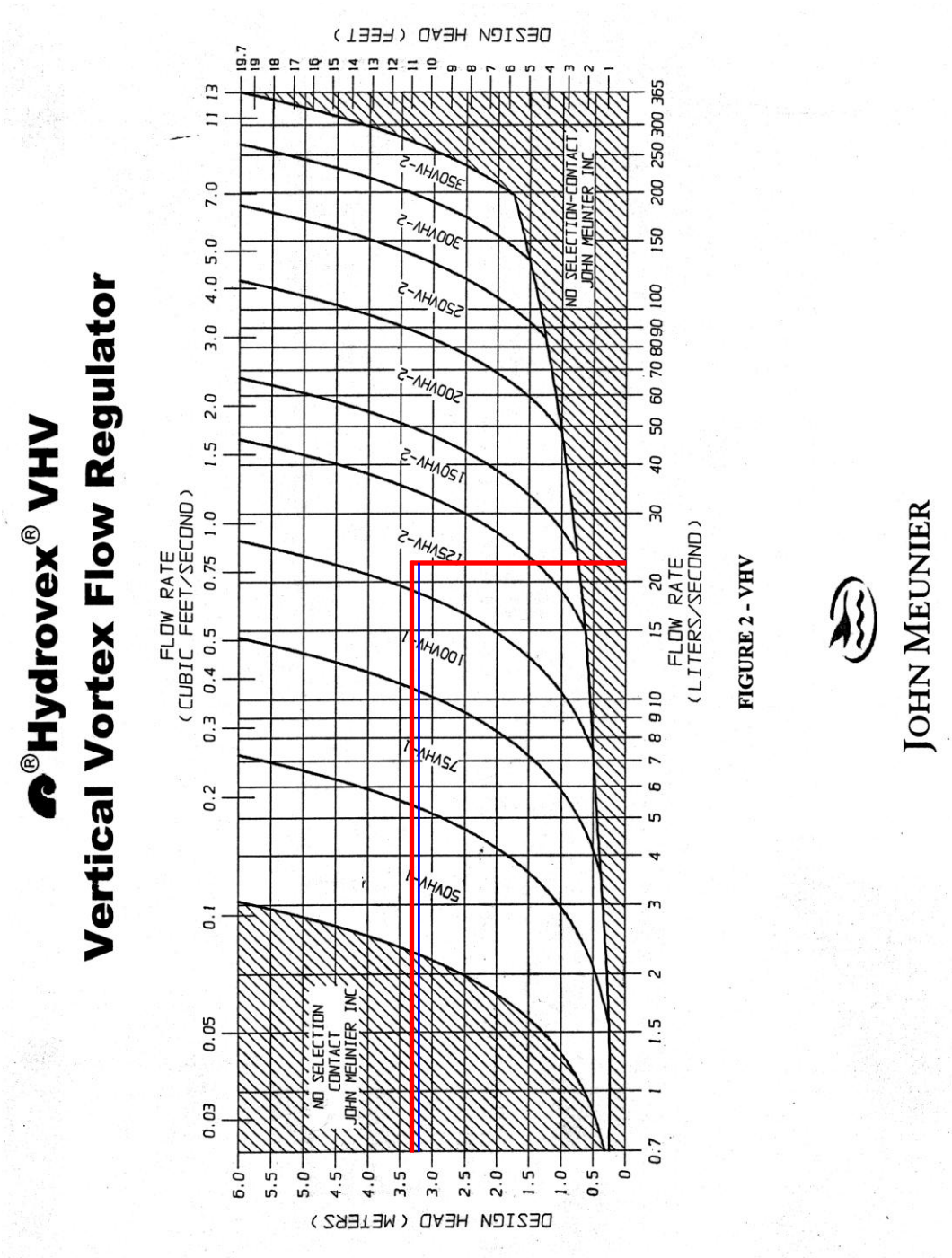

FIGURE 2 - VHV