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36 Years

Adelaide Apartments Tower Expansion

Stormwater Management and Servicing Brief

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STORMWATER MANAGEMENT AND SERVICING BRIEF

Adelaide Apartments Tower Expansion

Prepared By:

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January 5th, 2016
September 20th, 2016
January 25th, 2019
Revised: May 31st, 2019

Novatech File: 116070
Ref No. R-2016-076

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May 31st, 2019

City of Ottawa
Planning and Growth Management Department
Development Review (Urban Services)
110 Laurier Avenue West
Ottawa, Ontario
K1P 1J1

Attention: **Abdul Mottalib**

Re: Adelaide Apartments Tower Expansion – Stormwater and Servicing Brief

Enclosed is a copy of the revised 'Stormwater Management and Servicing Brief' for the proposed development at Preston Square in the City of Ottawa. This brief is submitted in support of the site plan application and demonstrates how the site will be serviced with sanitary, storm, and water infrastructure.

Should you have any questions, please contact me.

NOVATECH

Greg MacDonald, P.Eng.
Director, Land Development and Public Sector Infrastructure

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

PLANS

1.0 INTRODUCTION

The proposed development is located at Preston Square which is a 2.1 hectare (ha) urban mixed-use development located north of Aberdeen Street, between Preston Street and Rochester Street, as shown in **Figure 1 – Key Plan**.

The proposed development will consist of a 30-storey, 228-unit residential tower, located on top of the existing four-storey common underground parking structure on the Preston Square site. The proposed tower will connect to the existing 8-storey Adelaide residential building. An additional floor will be added to the existing Adelaide building, which will include 24 units. In addition to the Adelaide building (referred to as Block B), the property also contains three existing commercial towers, referred to as Blocks A, C and D. See **Figure 2 – Existing Conditions** for illustration.

A Stormwater Management and Servicing Brief was previously submitted in support of a Site Plan application for the proposed development in 2016. The concept for the proposed development has since been revised and is presented in this revised report.

1.1 Purpose

This servicing brief addresses the approach to site servicing and stormwater management for the proposed development and is being submitted in support of a site plan control application.

The objective of the site servicing design is to conform to the requirements of the City of Ottawa, to provide suitable sewage outlets and to ensure that a domestic water supply and appropriate fire protection are provided for the proposed development.

Servicing criteria, expected sewage flows and water demands for the proposed development have been established using the City of Ottawa design guidelines for sewer systems and water distribution.

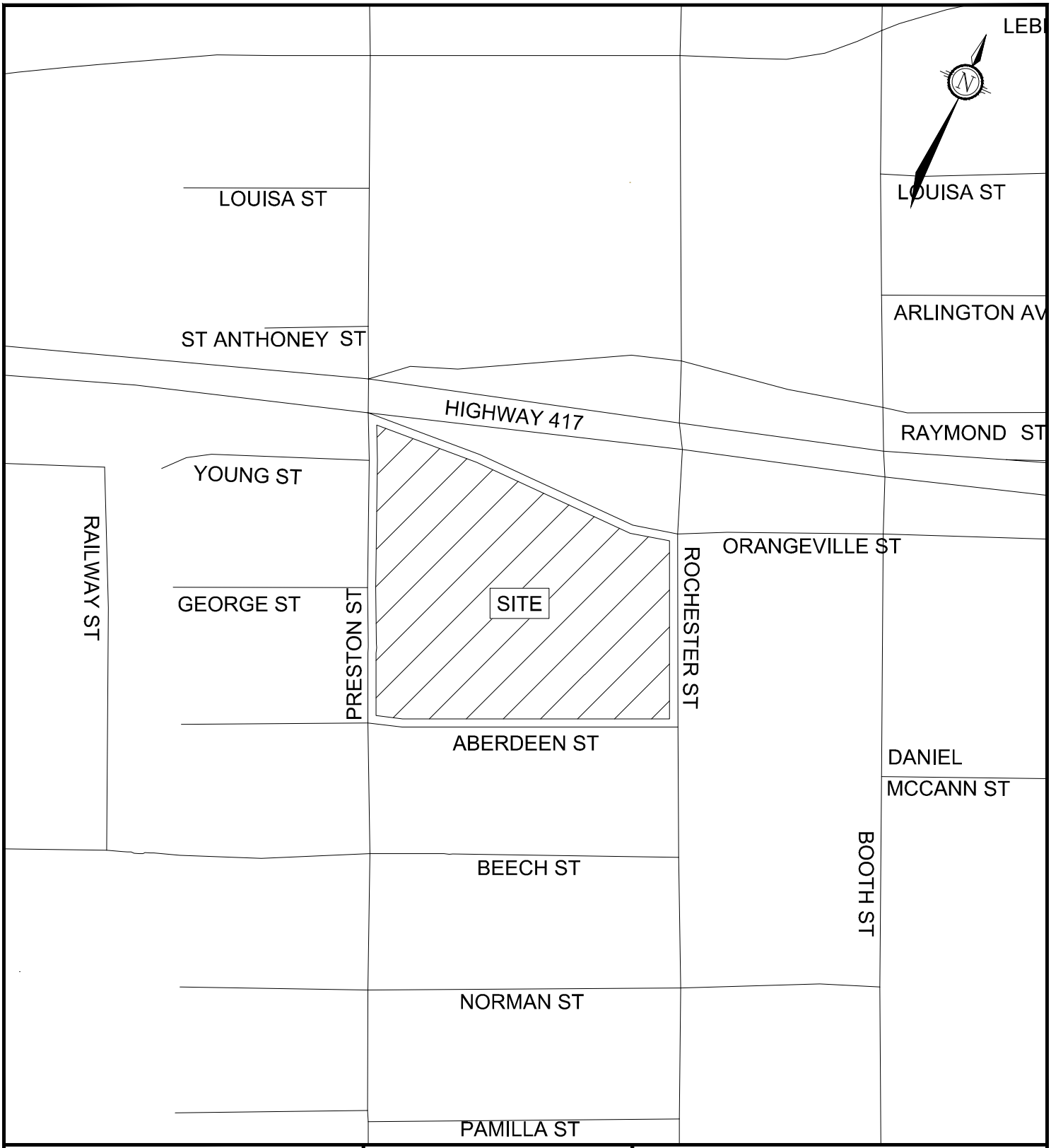
The City of Ottawa Servicing Study Guidelines for Development Applications requires that a Development Servicing Study Checklist be included to confirm that each applicable item is deemed complete and ready for review by City of Ottawa Infrastructure Approvals. A completed checklist in enclosed in **Appendix A.**

2.0 SANITARY SEWER

The proposed development will be serviced by a new 200mm dia. sanitary service that will outlet to an existing 1200mm dia. municipal sewer on Aberdeen Street. This sewer flows west on Aberdeen Street before discharging into the existing 1650mm dia. combined trunk sewer on Preston Street which flows north.

2.1 Design Criteria

The City of Ottawa design criteria were used to calculate the theoretical proposed sanitary flows. The following design criteria were taken from Section 4 – 'Sanitary Sewer Systems' of the City of Ottawa Sewer Design Guidelines, incorporating the revisions as per Technical Bulletin ISTB-2018-01.



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KEY PLAN

PROPOSED ADELAIDE TOWER

DATE	JOB	FIGURE
NOV 2018	115090	FIGURE 1

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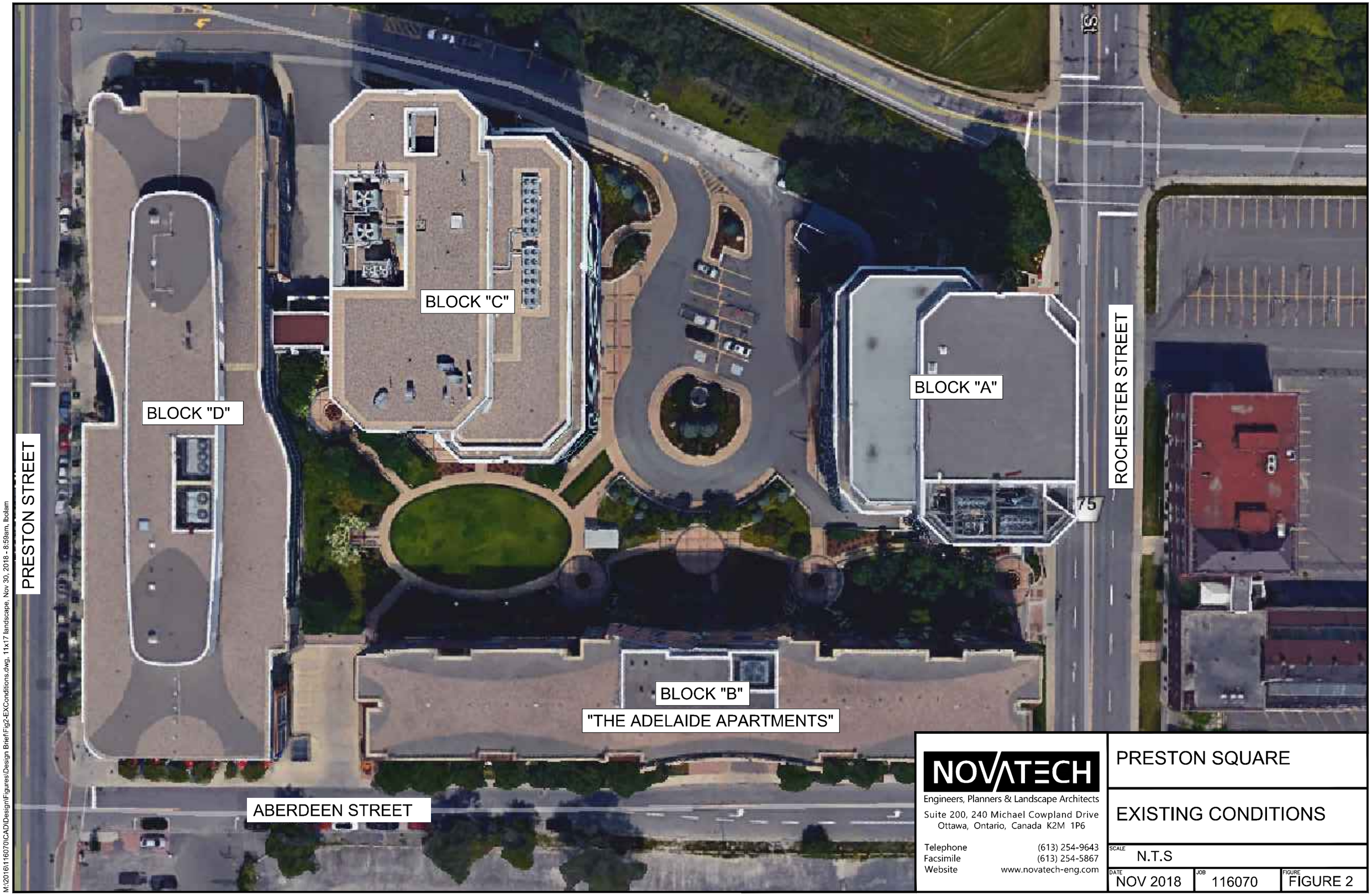

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PRESTON SQUARE

EXISTING CONDITIONS

SCALE N.T.S

DATE NOV 2018 | JOB 116070 | FIGURE FIGURE 2

SHT11X17.DWG - 279mmX432mm

Residential Population Densities
- Residential Units (1-bedroom Apartment): 1.4 people / unit
- Residential Units (2-bedroom Apartment): 2.1 people / unit

Residential Flows
- Average Daily Residential Sewage Flow: 280 L / person / day
- Residential Peaking Factor: Per Harmon Equation (Max. 4.0, Correction Factor=0.8)

Extraneous Flows
N/A

The proposed development is located within an existing development as described in Section **1.0** above. The proposed sanitary service is solely dedicated to the new Tower. The proposed development will not increase the extraneous flows currently generated by the site and therefore its value has been omitted from the proposed sanitary flow calculations. Therefore, the following sanitary flow calculations represent the net increase in sanitary flows from the site.

2.2 Proposed Sanitary Flows

Table 2.2 details the sanitary design flows for the proposed development.

Table 2.2: Theoretical Sanitary Design Flows for Proposed Development

Building	Use	Unit Count	Design Population (people)	Average Flow (L/s)	Peak Flow (L/s)
New Tower	Residential	216 x 1-bdrm 12 x 2-bdrm	328	1.06	3.54 [1]
1-storey Addition		22 x 1-bdrm 2 x 2-bdrm	35	0.11	0.38 [1]
Total		**252 Units**	**363**	**1.17**	**3.92**

[1] Excluding extraneous flow.

Based on Manning's Equation, a 200mm dia. sanitary gravity service at a minimum slope of 1.0% has a full flow conveyance capacity of approximately 34.2 L/s, which is sufficient to convey the theoretical sanitary design flows calculated above. Refer to the Sanitary Sewer Design Sheet in **Appendix B** for detailed calculations.

3.0 STORMWATER MANAGEMENT

3.1 Existing Site Stormwater Management

Stormwater flows from the Preston Square site are currently split into two drainage areas, as described in the *Stomwater Management Report Tower C and Block D City Gate Corporation*, dated October 2005 (R-2005-116) by Novatech, summarized as follows:

- Drainage Area 1 (northern part of the site): Flows are conveyed to the existing 1650mm dia. combined sewer on Preston Street via an on-site 1200mm diameter super pipe. The on-site super pipe utilizes a 250mm diameter orifice at its outlet to control the flows. Flows from the roofs of Buildings A and C are controlled by roof drains.

- Drainage Area 2 (southern part of the site): Flows are conveyed to the existing 1200mm dia. combined sewer on Aberdeen Street. Flows from the roofs of Buildings B (The Adelaide Apartments) and D are controlled by roof drains.

3.2 Stormwater Management Design Criteria and Methodology

The stormwater management criteria and objectives for the site (as per the above referenced 2005 report) are as follows:

- Provide a dual drainage system (i.e. minor and major system flows).
- Control the post-development flows from the site to allowable release rates corresponding to the 5-year and 100-year peak flows using a runoff coefficient of 0.4 and a 20-minute rainfall intensity derived from City of Ottawa IDF curves, as specified by the City of Ottawa. Post-development peak flows will be controlled for storms up to and including the 100-year design event, prior to being released into the municipal combined sewers in Aberdeen Street and Preston Street.
- Provide guidelines to ensure that site preparation and construction is in accordance with the current best management practices for erosion and sediment control.

The stormwater management design for the proposed development is based on the methodology implemented in the above referenced 2005 report.

The Modified Rational Method was used to determine the storage volume(s) required to control the post-development runoff flows to the allowable release rates and to determine the size of the control structure(s).

3.3 Allowable Release Rates

The allowable release rates for the site for the 5-year and the 100-year design events were calculated using the Rational Method and are summarized in **Table 3.3**.

Table 3.3: Allowable Release Rates

Area	Allowable Release Rate (L/s)	
	5-year	100-year
Area 1 (1.304 ha)	101.5 L/s	174.0 L/s
Area 2 (0.802 ha)	62.4 L/s	107.0 L/s
Total (Site)	163.9 L/s	281.0 L/s

Refer to **Appendix C** for detailed calculations.

3.4 Post-Development Site Conditions

The area of the site to be developed will be split between the two drainage areas as shown on attached drawing **116070-STM**. A brief description of the various sub-catchment areas is as follows:

- Drainage Area 1: Runoff from the street-level areas around the exterior of the new Tower will drain uncontrolled via podium drains and catchbasins to the existing 1200mm dia. superpipe. Flows from this superpipe to the combined sewer on Preston Street will continue to be controlled by an orifice at the outlet of the pipe.
- Drainage Area 2: Runoff from the proposed Tower roof (Area B-2) and the new roof on the proposed 9th floor addition to the Adelaide Apartment building (Area B-1) will be controlled by roof drains. There will be 10 roof drains on the new roof of the Adelaide Apartment building and 12 roof drains on the roof of the new Tower. These roof drains will outlet to the combined sewer in Aberdeen Street.

The rest of the site is unchanged.

3.4.1 Drainage Area 1

Controlled Flow from Block A and C Roofs (Area 1-R)

The flows from the roof areas in Area 1 are attenuated by controlled flow roof drains. There are 14 existing roof drains in Area 1 (6 and 8 roof drains for Blocks A and C respectively). The roof drains on average discharge 1.0 L/s, so flows from the roofs of existing buildings A (Area 1-"A") and C (Area 1-"C") are controlled to approximately 14 L/s for the 5-year and 100-year design events.

Refer to the *Stomwater Management Report Tower C And Block D City Gate Corporation*, (R-2005-116) dated October 2005 by Novatech for details.

Controlled Surface Flow (Area 1-A)

The flows from surface areas in Area 1 are currently attenuated by a 250mm dia. orifice plug type ICD installed within the 300mm dia. outlet pipe of MH1. Stormwater runoff from this drainage area is temporarily stored in an underground superpipe prior to being discharged into the municipal storm sewer system. Additional storage is available in the existing catchbasins and manholes. **Table 3.4-A** summarizes the existing available storage volumes for Area 1.

Table 3.4-A – Area 1 Available Existing Storage Volumes

Item	Area (m^2)	Depth (m)	Length (m)	Approximate Storage Volume (m^3)
1200mm dia. superpipe	1.17	N/A	99.80	116.8
CB 3 (600mmx600mm)	0.36	= 60.35 - 59.37 = 0.98	N/A	0.4
CB 1 (600mmx600mm)	0.36	= 60.35 - 58.98 = 1.37	N/A	0.5
MH1 (2440mm dia.)	4.67	= 60.35 - 58.50 = 1.85	N/A	8.6

STM 1 (1300mm dia.)	1.32	= 60.35 - 58.46 = 1.89	N/A	2.5
STM 2 (1200mm dia.)	1.13	= 60.35 - 58.65 = 1.70	N/A	1.9
Total				**130.7 m³**

The design release rate for flows from the surface areas of Area 1 was set to meet the allowable release rate for Area 1, taking into account the existing controlled flows from the roof areas. The Modified Rational Method was used to determine the storage volume required for this catchment area.

Table 3.4-B summarizes the post-development flows and the required storage volumes for runoff from the surface areas for the 5-year and the 100-year design events for Area 1.

Table 3.4-B: Summary of Area 1 Post-Development Flows and Required Storage Volume

Design Event	Roof Areas	Surface Areas			Total Flow for Area 1 (L/s)
	Controlled Flow (L/s)	Uncontrolled Flow (L/s)	Design Release Rate (L/s)	Storage Volume Required (m³)	
5-year	14	135.6	87.5	69 m³	101.5
100-year	14	232.5	160.0	112 m³	174.0

The existing available storage volume is greater than the storage volume required for the 100-year design event, therefore there is adequate existing storage available to meet the required storage volumes for Area 1.

Inlet Control Device (ICD) Sizing

To achieve the design release rate to the combined sewer on Preston Street, a new orifice will need to be installed. This orifice has been sized using the following orifice equation:

Q = CA(2gh)^0.5
Where: Q = Discharge (m³/s) = 100-year design release rate (0.160 m³/s)
C = 0.61 (circular hole)
h = head required (m) = 1.88m (value chosen for no ponding)
g = 9.81 m/s²
A = Area of Orifice (m²)

0.160 = 0.61*A(2*9.81*1.88)^0.5
∴ A = 0.0432 m^2
∴ D = 0.234 m

To achieve the design release rate to the combined sewer, a new Tempest MHF ICD SQ 234mm orifice will be installed at the outlet to existing MH1 (2440mm diameter). A shop drawing of the proposed ICD has been attached in **Appendix C.** Refer to the **General Plan of Services** for the location of existing manhole MH1.

3.4.2 Drainage Area 2

Controlled Flow from Block D (Area 2-"D")

Runoff from the roof of Building D is currently controlled by roof drains. There are 8 existing roof drains on Building D, which will remain. These existing controlled flow roof drains discharge on average 1.0 L/s. Therefore, there is a total controlled flow of approximately 8 L/s for the 5-year and 100-year design events from the roof of Building D.

Controlled Flow from Building B and New Tower (Areas 2-"B1" and 2-"B2")

The post-development flows from roof areas 2-"B1" (the Adelaide) and 2-"B2" (the new Tower) will be attenuated by the use of controlled flow roof drains. Watts Adjustable Flow Control Roof Drains set at ¼ weir opening exposed are proposed.

A total of ten (10) roof drains are proposed on the Adelaide building and fourteen (14) roof drains are proposed on the new Tower. The controlled release rate, ponding depth, required and maximum storage volumes for both the 5-year and 100-year design events are summarized in the **Table 3.4-C** below.

Table 3.4-C: Areas 2-"B1" and 2-"B2" Controlled Flow Building Roof Drains

Roof Drain ID	Controlled Flow (L/s)		Ponding Depth (m)		Storage Vol. Required (m^3)		Max. Storage Available (m^3)
	5-year	100-year	5-year	100-year	5-year	100-year	
2-"B1" (RD1 – RD10)	7.9	8.7	0.07-0.11	0.13-0.14	31.7	64.6	74.8
2-"B2" (RD11-RD24)	9.8	11.1	0.05-0.08	0.10-0.14	2.5	7.4	8.9

Refer to **Appendix C** for Modified Rational Method calculations and Watts adjustable flow control roof drain information.

Uncontrolled Surface Flow (Area 2-A)

The post-development flows from the surface areas of Area 2 will remain uncontrolled. **Table 3.4-D** summarizes the post-development flows for Area 2.

Table 3.4-D: Summary of Area 2 Post-Development Flows

Design Event	Roof Areas	Surface Areas	Total Flow for Area 2 (L/s)	
	Controlled Flow (L/s)	Uncontrolled Flow (L/s)		
5-year	25.7 L/s	33.9 L/s	59.6 L/s	< Allowable Rate of 62.4 L/s
100-year	27.8 L/s	58.1 L/s	85.9	< Allowable Rate of 107.0 L/s

3.5 Summary of Site Post-Development Flows

Table 3.5 summarizes the total post-development flows from the site.

Table 3.5: Site Post-Development Stormwater Flows

Area	Post-Development Flows (L/s)	
	5-year	**100-year**
1	101.5	174.0
2	59.6	85.9
Total Site	**161.1 L/s**	**259.9 L/s**
	< 163.9 L/s Site Allowable Release Rate	**< 281.0 L/s Site Allowable Release Rate**

As the 100-year total site post-development stormwater flow is less than the 100-year site allowable release rate to the municipal combined sewer system, there is remaining capacity for the net increase of approximately 3.9 L/s in peak sanitary flow from the proposed development.

3.6 Major Overland Drainage

The site was originally designed to direct major overland drainage flows in excess of the 100-year event flow overland towards Preston and Aberdeen Street. The proposed development will maintain the existing overland flow patterns.

4.0 WATERMAIN

The proposed development will be serviced with twin 150 mm dia. PVC DR 18 services that will connect to the existing 200mm dia. watermain on Aberdeen Street.

4.1 Design Criteria

The City of Ottawa design criteria were used to calculate the theoretical water demands for the proposed development. The following design criteria were taken from Section 4 of the Ottawa Design Guidelines – Water Distribution:

Residential

- Residential Units (1-bedroom apartment): 1.4 people / unit
- Residential Units (2-bedroom apartment): 2.1 people / unit
- Average Day Demand Residential: 350 L / person / day
- Residential Maximum Day Demand: 2.5 x Avg. Day Demand
- Residential Peak Hour Demand: 2.2 x Max Day Demand

4.2 Average, Maximum Day and Peak Hour Demands

The theoretical water demands for the proposed development are given in **Table 4.2**, based on the design criteria above.

Table 4.2: Theoretical Design Water Demands for Proposed Development

Building	Use	Average Water Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
New Tower	Residential	1.33	3.32	7.31
1-storey Addition		0.14	0.35	0.78
Total		**1.47 L/s**	**3.68 L/s**	**8.09 L/s**

Refer to **Appendix D** for detailed calculations.

4.3 Water Supply for Fire-Fighting

The Fire Underwriters Survey (FUS) was used to estimate fire flow requirements for the proposed Tower. In the absence of detailed architectural information, some assumptions were made regarding the building construction. A fire-resistive construction was assumed due to the large size and type of occupancy for the proposed building. Also, the proposed Tower will be fully sprinklered and supplied with a fire department siamese connection(s), located within 45m of the existing on-site fire hydrant adjacent to Tower A.

The fire flow requirements include both sprinkler system and hose allowances in accordance with the OBC and NFPA 13. The sprinkler system will be designed by the fire protection (sprinkler) contractor at the detailed design stage as this process involves detailed hydraulic calculations based on building layout, pipe runs, head losses, fire pump requirements, etc. Booster pumps will be required to provide adequate service pressure on the upper floors.

It should be noted that fire flow requirements calculated using the FUS method tend to generate higher values when compared to flows being calculated using the OBC and NFPA. In the previous 2016 version of this report, the fire flow required for the proposed Tower was calculated using OBC to be 550 US gpm, or 35 L/s. Since then the building design has been updated.

The calculated fire flow demand for the updated proposed Tower using FUS is 67 L/s (4,000 L/min). Refer to **Appendix D** for detailed FUS calculations.

4.4 Boundary Conditions and Summary of Watermain Analysis Results

Water demands and fire flow requirements for the proposed development were provided to the City of Ottawa. These values were used to generate the municipal watermain network boundary conditions. **Table 4.4-A** summarizes the boundary conditions provided by the City of Ottawa for the existing municipal watermain network.

Table 4.4-A: Hydraulic Boundary Condition Provided by the City

Municipal Watermain Boundary Condition	Aberdeen St Watermain
Minimum HGL	107.0 m
Maximum HGL	115.0 m
Max Day + Fire Flow	107.5 m

Refer to **Appendix D** for a copy of the correspondence from the City of Ottawa.

Table 4.4-B summarizes the theoretical water demands for the Tower under the various operating conditions and compares the anticipated operating pressures at the watermains to the normal operating pressures outlined in the City of Ottawa Design Guidelines. It is assumed that hydraulic losses in the 150mm water services are negligible. Furthermore, the proposed Tower will be equipped with booster pumps to increase pressure for the upper floors.

Table 4.4-B: Water Analysis Results Summary

Condition	Water Service Connection Location	Total Water Demand (L/s)	Approximate Design Operating Pressures (psi) / Relative Head (m) [1]	Normal Municipal Operating Pressures (psi)
Average Demand	Aberdeen Street	1.33	72 psi (50.55 m)	50-70 psi
Max Day + Fire Flow Demand		70.33	61 psi (43.05 m)	20 psi (Min.)
Peak Hour Demand		7.33	61 psi (42.55 m)	40-70 psi

1 – The building finished floor elevation is approximately 64.45 m.

As the approximate design operating pressure for the Average Demand condition is higher than the normal municipal operating pressure range, a pressure check will be completed at completion of construction to determine if pressure control is required.

As indicated in the summary table above, the existing watermain in Aberdeen Street should have sufficient water supply for the proposed Tower.

5.0 Erosion & Sediment Control

To mitigate erosion and to prevent sediment from entering the storm sewer system, temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter bags will be placed under the grates of nearby catchbasins, manholes and will remain in place until construction is completed.
- Silt fencing will be placed per OPSS 577 and OPSD 219.110 along the surrounding construction limits, where applicable.
- Mud mats will be installed at the site entrances.
- Street sweeping and cleaning will be performed, as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site.
- On-site dewatering is to be directed to a sediment trap and/or gravel splash pad and discharged safely to an approved outlet as directed by the engineer.

The temporary erosion and sediment control measures will be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures will be undertaken.

6.0 CONCLUSIONS

This report has been prepared in support of a site plan control application for the proposed development at Preston Square. The proposed development will consist of a new 30-storey residential Tower and the addition of a single storey to the existing 8-storey Adelaide Apartments residential building.

The conclusions are as follows:

- The proposed development will include a total of ±252 residential units.
- The new residential Tower will be serviced by extending new services to the municipal watermain and combined sewer in Aberdeen Street.
- On-site stormwater quantity control will be provided by using controlled roof drains and the existing stormwater management infrastructure, which includes controlled outlets. The existing inlet control device will be adapted. A new 234mm dia. orifice plug type ICD will be installed at the Preston Street stormwater outlet to the combined municipal sewer.
- As total combined stormwater and sanitary flows to the municipal combined sewer system will meet the allowable site flows, the municipal combined sewers in the adjacent streets are estimated to have adequate capacity to accommodate the proposed development.
- The proposed Tower will be sprinklered and supplied with a fire department Siamese connection. The Siamese connection will be located within 45m of an existing private fire hydrant in Preston Square. Based on hydraulic boundary conditions provided by the City of Ottawa, the existing municipal water system has adequate capacity to accommodate the proposed development.
- On-site stormwater quality control is not required, nor being provided.
- Temporary erosion and sediment controls will be provided during construction.

It is recommended that this Stormwater Management and Servicing Brief be approved for implementation.

NOVATECH

Prepared by:

Lydia Bolam, P.Eng.
Project Engineer

Reviewed By:

Greg MacDonald, P.Eng.
Director, Land Development and Public Sector Infrastructure

APPENDIX A

Development Servicing Study Checklist

Project Name: Adelaide Tower Expansion
Project Number: 116070
Date: January 2019

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
Executive Summary (for larger reports only).	NA		
Date and revision number of the report.	Y	Cover	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y		Figure 1 & Dwgs.
Plan showing the site and location of all existing services.	Y		Dwg. 116070-GP
Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Y	1.0	
Summary of Pre-consultation Meetings with City and other approval agencies.	N/A		
Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Y	1.1	
Statement of objectives and servicing criteria.	Y	1.1	
Identification of existing and proposed infrastructure available in the immediate area.	Y	2.0 - 4.0	Dwg. 116070-GP
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	N/A		
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Y		Dwg. 116070-GR

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	N/A		
Proposed phasing of the development, if applicable.	N/A		
Reference to geotechnical studies and recommendations concerning servicing.	N/A		
All preliminary and formal site plan submissions should have the following information:	Y		
Metric scale	Y		
North arrow (including construction North)	Y		
Key plan	Y		
Name and contact information of applicant and property owner	Y		
Property limits including bearings and dimensions	Y		
Existing and proposed structures and parking areas	Y		
Easements, road widening and rights-of-way	Y		
Adjacent street names	Y		

Development Servicing Study Checklist

4.2 Water	Addressed (Y/N/NA)	Section	Comments
Confirm consistency with Master Servicing Study, if available.	N/A		
Availability of public infrastructure to service proposed development.	Y		
Identification of system constraints.	Y	4.0	
Identify boundary conditions.	Y	4.0	
Confirmation of adequate domestic supply and pressure.	Y	4.0	
Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Y	4.0	
Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Y	4.0	
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	N/A		
Address reliability requirements such as appropriate location of shut-off valves.	N		Detailed Design Requirement
Check on the necessity of a pressure zone boundary modification.	N/A		
Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	N		Fire Demand Checked Only
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y	4.0	
Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	N/A		
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y	4.0	
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N		

Development Servicing Study Checklist

4.3 Wastewater	Addressed (Y/N/NA)	Section	Comments
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed	Y	2.0	
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A		
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N/A		
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	2.0	
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Y	2.0	
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	N/A		
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	2.0	Dwg. 116070-GP
Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A		
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A		
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A		
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A		
Special considerations such as contamination, corrosive environment etc.	N/A		

Development Servicing Study Checklist

4.4 Stormwater	Addressed (Y/N/NA)	Section	Comments
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y	3.0	
Analysis of the available capacity in existing public infrastructure.	Y	3.0	
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	Y		116070-STM
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y	3.0	
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Y	3.0	
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y	3.0	
Set-back from private sewage disposal systems.	N/A		
Watercourse and hazard lands setbacks.	N/A		
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N/A		
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A		
Storage requirements (complete with calcs) and conveyance capacity for minor (5 yr) and major (100 yr) events.	Y	3.0	
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N/A		
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Y	3.0	
Any proposed diversion of drainage catchment areas from one outlet to another.	N/A		

Development Servicing Study Checklist

4.4 Stormwater	Addressed (Y/N/NA)	Section	Comments
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM	Y	3.0	Dwgs. 116070-GP, -GR and - STM
If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	Y	3.0	
Identification of potential impacts to receiving watercourses.	N/A		
Identification of municipal drains and related approval requirements.	N/A		
Description of how the conveyance and storage capacity will be achieved for the development.	Y	3.0	
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Y	3.0	100 Year HGL not available
Inclusion of hydraulic analysis including HGL elevations.	N		
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Y	5.0	
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A		
Identification of fill constrains related to floodplain and geotechnical investigation.	N/A		

Development Servicing Study Checklist

4.5 Approval and Permit Requirements	Addressed (Y/N/NA)	Section	Comments
Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	N/A		
Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N		
Changes to Municipal Drains.	N		
Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	N/A		

4.6 Conclusion	Addressed (Y/N/NA)	Section	Comments
Clearly stated conclusions and recommendations.	Y	6.0	
Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A		
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y		

APPENDIX B

Sanitary Design Sheet

PROJECT #: 116070
PROJECT NAME: ADELAIDE APARTMENTS TOWER EXPANSION **SANITARY SEWER DESIGN SHEET**

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION			RESIDENTIAL FLOW						EXTRANEOUS FLOW		TOTAL FLOWS		
Area ID	Use	Total Area	Number of Units 1-bdrm	Number of Units 2-bdrm	Design Population	Avg Flow	Peak Factor	Res. Peak Flow	Infiltration Allowance Dry Weather (I/I dry)	Infiltration Allowance Wet Weather (I/I wet)	Average Dry Weather Flow (ADWF)	Peak Dry Weather Flow (PDWF)	Peak Wet Weather Flow (PWWW)
		(ha)	-	-	(persons)	(l/s)	-	(l/s)	(l/s)	(l/s)	(l/s)	(l/s)	(l/s)
THEORETICAL POST-DEVELOPMENT													
Existing Building	Residential	N/A	79	79	277	0.90	3.33	2.99			0.90	2.99	2.99
New 1-storey addition	Residential	N/A	22	2	35	0.11	3.33	0.38			0.11	0.38	0.38
Subtotal			101	81	312	1.01	3.33	3.37			**1.01**	**3.37**	**3.37**
New Tower	Residential	N/A	216	12	328	1.06	3.33	3.54			1.06	3.54	3.54
Total			317	93	640	2.07	3.33	6.91			**2.07**	**6.91**	**6.91**

Design Parameters:

Residential Population Densities
1-bedroom Apartment 1.40 people / unit
2-bedroom Apartment 2.10 people / unit

Average Sanitary Flows
Residential 280 L/c/d

Peak Extraneous Flows
N/A - Refer to SWM and Servicing brief

Peaking Factors
Residential Harmon Equation, K=0.8

Designed: LGB
Checked: GJM

Date: January 16, 2019

APPENDIX C

Stormwater Design Sheets and Roof Drain and ICD Information

PROJECT #: 116070
PROJECT NAME: ADELAIDE TOWER EXPANSION
LOCATION: CITY OF OTTAWA

STORMWATER MANAGEMENT DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

Allowable Site Flows									Target Allowable Flows (L/s) C = 0.4	
Description	*A (ha)*	*A imp (ha) C=0.9*	*A grav (ha) C=0.6*	*A perv (ha) C=0.2*	C_5	C_{100}	Uncontrolled Flows (L/s)			
							5 year	100 year	5-Yr (L/s)	100-Yr (L/s)
1 - BUILDINGS A AND C	1.304						N/A	N/A	101.5	174.0
2 - BUILDINGS B AND D (ADELAIDE), TOWER EXPANSION	0.802						N/A	N/A	62.4	107.0
	2.11							**TOTAL**	**163.9**	**281.0**
									t_c=20mins *i=70mm/hr*	t_c=20mins *i=120mm/hr*

Post - Development : Uncontrolled Site Flows									
Area	Description	*A (ha)*	*A imp (ha) C=0.9*	*A grav (ha) C=0.6*	*A perv (ha) C=0.2*	C_5	C_{100}	Uncontrolled Flow (L/s)	
								5 year	100 year
1-R	Controlled roof drains - Buildings C and A	0.240	0.240	0	0	0.90	0.90	42.0	72.1
1-A	Surface runoff	1.064	0.692	0	0.3724	0.66	0.66	135.6	232.5
	Sub-Total	**1.304**	**0.932**	**0.00**	**0.37**	0.70	0.70	**177.7**	**304.6**
2-D	Controlled roof drains - Building D	0.322	0.322	0	0	0.90	0.90	56.4	96.7
2-B1	Controlled roof drains - Adelaide Building (B1)	0.198	0.198	0	0	0.90	0.90	34.6	59.3
2-B2	Controlled roof drains - New Tower (B2)	0.072	0.072	0	0	0.90	0.90	12.5	21.5
2-R	*Sub-total: (Area 2 roof areas)*	*0.591*	*0.591*	*0*	*0*	*0.90*	*0.90*	*103.5*	*177.4*
2-A	Surface runoff	0.211	0.189	0	0.0225	0.83	0.83	33.9	58.1
	Sub-Total	**0.802**	**1.371**	**0.00**	**0.02**	1.54	1.54	**137.4**	**235.5**
	2.11							t_c=20mins *i=70mm/hr*	t_c=20mins *i=120mm/hr*

Post - Development : Total Flows for Controlled Site						
Area	Description	Flow (L/s)		Storage Required (m^3)		Provided (m^3)
		5 year	100 year	5 year	100 year	
1-R	Controlled roof drains - Buildings C and A	14.0	14.0	33.9	74.7	Assume >75
1-A	Surface runoff	87.5	160.0	68.6	111.6	111.6
	Sub-Total (Area 1)	**101.5**	**174.0**	**102.5**	**186.3**	**186.6**
2-D	Controlled roof drains - Building D	8.0	8.0	Refer to 'Tower C and Block D' SWM Report		
2-B1	Controlled roof drains - Adelaide Building (B1)	7.9	8.7	31.7	64.6	74.8
2-B2	Controlled roof drains - New Tower (B2)	9.8	11.1	2.5	7.4	8.9
2-R	*Sub-Total (Area 2 roof areas)*	*25.7*	*27.8*	*34.3*	*71.9*	*83.7*
2-A	Surface runoff	33.9	58.1	-	-	-
	Sub-Total (Area 2)	**59.6**	**85.9**	**34.3**	**71.9**	**83.7**
	TOTAL (SITE - AREA 1 + AREA 2)	**161.1**	**259.9**			

ADELAIDE TOWER EXPANSION
PROJECT NO: 116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 1-A Controlled Flow-Surface Area

OTTAWA IDF CURVE

Area = 1.064 ha — Qallow = 87.5 L/s
C = 0.66 — Vol(max) = 68.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	273.52	186.02	55.81
10	104.19	201.87	114.37	68.62
15	83.56	161.89	74.39	66.95
20	70.25	136.11	48.61	58.33
25	60.90	117.98	30.48	45.72
30	53.93	104.48	16.98	30.57
35	48.52	94.00	6.50	13.65
40	44.18	85.60	-1.90	-4.55
45	40.63	78.72	-8.78	-23.72
50	37.65	72.95	-14.55	-43.65
55	35.12	68.05	-19.45	-64.19
60	32.94	63.83	-23.67	-85.23
65	31.04	60.15	-27.35	-106.68
70	29.37	56.91	-30.59	-128.49
75	27.89	54.03	-33.47	-150.61
90	24.29	47.06	-40.44	-218.39
105	21.58	41.81	-45.69	-287.82
120	19.47	37.72	-49.78	-358.44
135	17.76	34.42	-53.08	-429.96
150	16.36	31.70	-55.80	-502.20

ADELAIDE TOWER EXPANSION
PROJECT NO: 116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 1-A Controlled Flow-Surface Area

OTTAWA IDF CURVE

Area = 1.064 ha — Qallow = 160.0 L/s
C = 0.66 — Vol(max) = 111.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	470.22	310.23	93.07
10	178.56	345.95	185.96	111.57
15	142.89	276.85	116.86	105.17
20	119.95	232.40	72.41	86.89
25	103.85	201.20	41.21	61.81
30	91.87	177.99	18.00	32.40
35	82.58	159.99	0.00	0.00
40	75.15	145.59	-14.40	-34.56
45	69.05	133.78	-26.21	-70.76
50	63.95	123.91	-36.08	-108.25
55	59.62	115.52	-44.47	-146.76
60	55.89	108.29	-51.70	-186.11
65	52.65	102.00	-57.99	-226.16
70	49.79	96.46	-63.53	-266.81
75	47.26	91.55	-68.44	-307.96
90	41.11	79.65	-80.34	-433.84
105	36.50	70.71	-89.28	-562.45
120	32.89	63.73	-96.26	-693.06
135	30.00	58.12	-101.87	-825.17
150	27.61	53.49	-106.50	-958.46

Structures	Size (mm)	Area (m^2)	T/G	Inv IN	Inv OUT
STM MH2	1200	1.13	60.50	58.65	58.65
STM MH1	1300	1.33	60.50	58.46	58.46
MH1	2440	4.68	60.65	58.55	58.50
CB 1	600 x 600	0.36	60.50	58.98	58.98
CB 3	600 x 600	0.36	60.50	59.37	59.37

PI = 3.14159265
pipe I.D.= 1220 (1200 nominal)
U/G Pipe Volume
End Area 1.169 (m^2)
Total Length 99.8 (m)
Pipe Volume 116.7 (m^3)

U/G Pipe Size	1200MM
Pipe Segment	
Centre-Centre Length	
Inside Structure	1.2
U/G Storage Length	99.8

Area A-1: Storage Table

		Underground Storage							Surface Storage				Total Storage
Elevation (m)	**System Head (m)**	STM MH2 Volume (m^3)	STM MH1 Volume (m^3)	MH1 Volume (m^3)	CB 1 Volume (m^3)	CB 3 Volume (m^3)	1200mm dia. Pipe Storage (m^3)	**Total U/G Volume (m^3)**					**Volume (m^3)**
58.46													**0.0**
58.50	-0.15		0.00				0.00	0.00					**0.0**
58.65	0.00		0.25	0.70			26.95	27.52					**27.5**
58.98	0.33	0.37	0.69	2.24	0.00		45.91	49.08					**49.1**
59.00	0.35	0.40	0.72	2.34	0.01		51.90	55.22					**55.2**
59.37	0.72	0.81	1.21	4.07	0.14	0.00	59.88	66.11					**66.1**
59.50	0.85	0.96	1.38	4.68	0.19	0.05	116.66	123.92					**123.9**
59.75	1.10	1.24	1.71	5.84	0.28	0.14	116.66	125.88					**125.9**
60.00	1.35	1.53	2.04	7.01	0.37	0.23	116.66	127.84					**127.8**
60.25	1.60	1.81	2.38	8.18	0.46	0.32	116.66	129.81					**129.8**
60.50	1.85	2.09	2.71	9.35	0.55	0.41	116.66	131.77					**131.8**

Inlet Control Device - Circular Plug	
1:100 Yr	
Flow (L/s) =	160.0
Head (m) =	1.85
Elevation (m) =	**60.35**
Outlet Pipe Dia.(mm) =	300
Volume (m3) =	111.6
1:5 Yr	
Flow (L/s) =	87.5
Head (m) =	0.55
Elevation (m) =	**59.05**
Outlet Pipe Dia.(mm) =	300
Volume (m3) =	68.6

Maximum Ponding Depth	**(cm)**
1:100 Yr	**0**
1:5 Yr	**0**

Orifice Size - 1:100 yr Flow Check		
Q=0.62xAx(2gh)^0.5		
	1:100 yr	Flow Check
Q (m^3/s) =	0.1600	**0.1606**
g (m/s^2) =	9.81	9.81
h (m) =	**1.85**	1.85
A (m^2) =	**0.042831746**	**0.04301**
D (m) =	**0.233527457**	**0.23400**
D (mm) =	**234**	234.0

1:5 yr Flow Check	
	1:5 yr
Q (m^3/s) =	0.0876
g (m/s^2) =	9.81
h (m) =	**0.55**
A (m^2) =	**0.04301**
D (m) =	**0.234**
D (mm) =	**234**

ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:5 YEAR EVENT

AREA 1-R **Controlled Roof Drains**

OTTAWA IDF CURVE

Area =	0.240	ha	Qallow =	14.00	L/s
C =	0.90		Vol(max) =	33.9	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	84.77	70.77	21.23
10	104.19	62.57	48.57	29.14
15	83.56	50.17	36.17	32.56
20	70.25	42.18	28.18	33.82
25	60.90	36.57	22.57	33.85
30	53.93	32.38	18.38	33.09
35	48.52	29.13	15.13	31.78
40	44.18	26.53	12.53	30.08
45	40.63	24.40	10.40	28.07
50	37.65	22.61	8.61	25.83
55	35.12	21.09	7.09	23.40
60	32.94	19.78	5.78	20.81
65	31.04	18.64	4.64	18.10
70	29.37	17.64	3.64	15.28
75	27.89	16.75	2.75	12.36
90	24.29	14.58	0.58	3.16
105	21.58	12.96	-1.04	-6.55
120	19.47	11.69	-2.31	-16.63

ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:100 YEAR EVENT

AREA 1-R **Controlled Roof Drains**

OTTAWA IDF CURVE

Area =	0.240	ha	Qallow =	14.00	L/s
C =	0.90		Vol(max) =	74.7	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	145.74	131.74	39.52
10	178.56	107.22	93.22	55.93
15	142.89	85.81	71.81	64.62
20	119.95	72.03	58.03	69.63
25	103.85	62.36	48.36	72.54
30	91.87	55.17	41.17	74.10
35	82.58	49.59	35.59	74.73
40	75.15	45.12	31.12	74.70
45	69.05	41.46	27.46	74.15
50	63.95	38.40	24.40	73.21
55	59.62	35.80	21.80	71.95
60	55.89	33.56	19.56	70.43
65	52.65	31.61	17.61	68.69
70	49.79	29.90	15.90	66.77
75	47.26	28.38	14.38	64.69
90	41.11	24.69	10.69	57.71
105	36.50	21.92	7.92	49.87
120	32.89	19.75	5.75	41.42

Watts Accutrol Flow Control Roof Drains: RD-100-A-ADJ set to 1/4 Exposed

Design Event	Flow/Drain (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3) Required	Storage (m^3) Provided
1:5 Year	1.00	14.00	10	33.9	39.0
1:100 Year	1.00	14.00	15	74.7	126.0

Roof Drain Storage Table for AVERAGE RD

Elevation	Area RD 1	Total Volume
m	m^2	m^3
0.00	0	0
0.05	17	0.4
0.10	77	2.8
0.15	171	9.0

APPROXIMATE ONLY

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain** **#1**

OTTAWA IDF CURVE

Area =	0.023	ha	Qallow =	0.80	L/s
C =	0.90		Vol(max) =	4.3	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	8.29	7.49	2.25
10	104.19	6.12	5.32	3.19
15	83.56	4.91	4.11	3.70
20	70.25	4.13	3.33	3.99
25	60.90	3.58	2.78	4.16
30	53.93	3.17	2.37	4.26
35	48.52	2.85	2.05	4.30
40	44.18	2.59	1.79	4.31
45	40.63	2.39	1.59	4.28
50	37.65	2.21	1.41	4.23
55	35.12	2.06	1.26	4.17
60	32.94	1.93	1.13	4.08
65	31.04	1.82	1.02	3.99
70	29.37	1.72	0.92	3.88
75	27.89	1.64	0.84	3.77
90	24.29	1.43	0.63	3.38
105	21.58	1.27	0.47	2.94
120	19.47	1.14	0.34	2.47

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain** **#1**

OTTAWA IDF CURVE

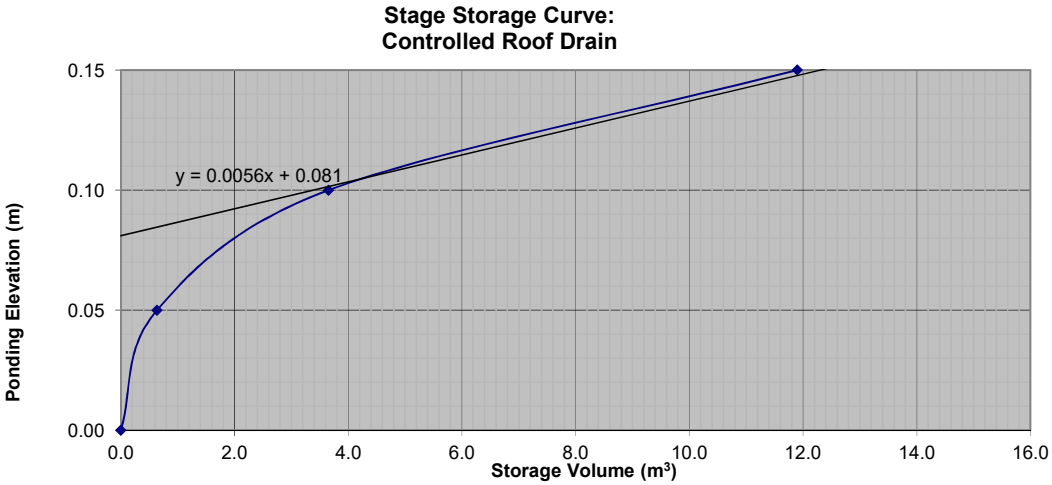
Area =	0.023	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	8.7	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	14.25	13.38	4.01
10	178.56	10.49	9.62	5.77
15	142.89	8.39	7.52	6.77
20	119.95	7.04	6.17	7.41
25	103.85	6.10	5.23	7.84
30	91.87	5.39	4.52	8.14
35	82.58	4.85	3.98	8.36
40	75.15	4.41	3.54	8.50
45	69.05	4.05	3.18	8.60
50	63.95	3.76	2.89	8.66
55	59.62	3.50	2.63	8.68
60	55.89	3.28	2.41	8.68
65	52.65	3.09	2.22	8.66
70	49.79	2.92	2.05	8.63
75	47.26	2.77	1.90	8.57
90	41.11	2.41	1.54	8.34
105	36.50	2.14	1.27	8.02
120	32.89	1.93	1.06	7.64

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.80	0.80	10.6	4.3	4.5
1:100 Year	0.87	0.87	13.0	8.7	8.8

Roof Drain Storage Table for RD #1

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	25.5	0.6
0.10	95.1	3.7
0.15	234.7	11.9



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **2**

OTTAWA IDF CURVE

Area =	0.022	ha	Qallow =	0.80	L/s
C =	0.90		Vol(max) =	3.9	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	7.69	6.89	2.07
10	104.19	5.68	4.88	2.93
15	83.56	4.55	3.75	3.38
20	70.25	3.83	3.03	3.63
25	60.90	3.32	2.52	3.78
30	53.93	2.94	2.14	3.85
35	48.52	2.64	1.84	3.87
40	44.18	2.41	1.61	3.86
45	40.63	2.21	1.41	3.82
50	37.65	2.05	1.25	3.75
55	35.12	1.91	1.11	3.67
60	32.94	1.79	0.99	3.58
65	31.04	1.69	0.89	3.47
70	29.37	1.60	0.80	3.36
75	27.89	1.52	0.72	3.24
90	24.29	1.32	0.52	2.82
105	21.58	1.18	0.38	2.37
120	19.47	1.06	0.26	1.87

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **2**

OTTAWA IDF CURVE

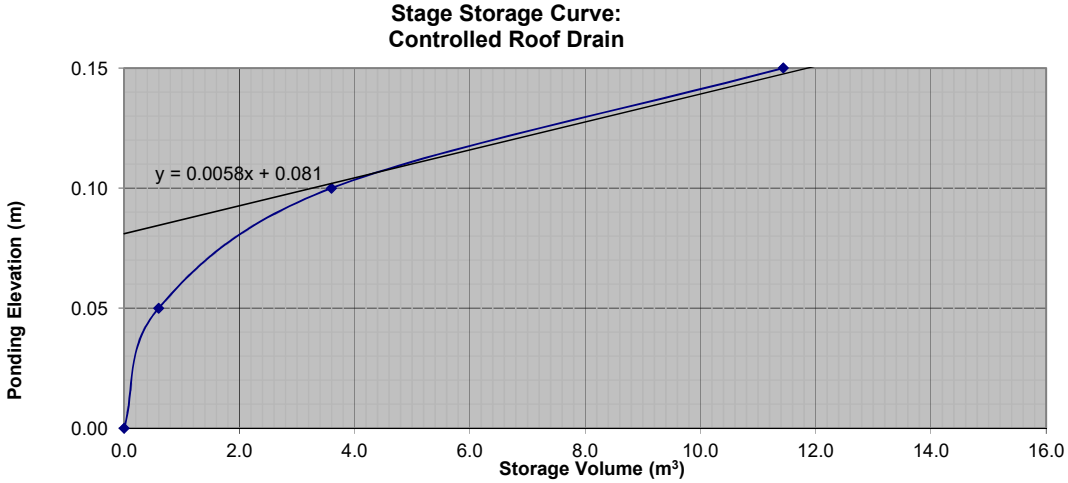
Area =	0.022	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	7.8	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	13.22	12.35	3.70
10	178.56	9.73	8.86	5.31
15	142.89	7.78	6.91	6.22
20	119.95	6.53	5.66	6.80
25	103.85	5.66	4.79	7.18
30	91.87	5.00	4.13	7.44
35	82.58	4.50	3.63	7.62
40	75.15	4.09	3.22	7.74
45	69.05	3.76	2.89	7.81
50	63.95	3.48	2.61	7.84
55	59.62	3.25	2.38	7.85
60	55.89	3.04	2.17	7.83
65	52.65	2.87	2.00	7.79
70	49.79	2.71	1.84	7.74
75	47.26	2.57	1.70	7.67
90	41.11	2.24	1.37	7.39
105	36.50	1.99	1.12	7.04
120	32.89	1.79	0.92	6.64

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.80	0.80	10.6	3.9	4.3
1:100 Year	0.87	0.87	13.0	7.8	8.4

Roof Drain Storage Table for RD # 2

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	24	0.6
0.10	95.9	3.6
0.15	217.7	11.4



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **3**

OTTAWA IDF CURVE

Area =	0.027	ha	Qallow =	0.80	L/s
C =	0.90		Vol(max) =	5.2	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	9.43	8.63	2.59
10	104.19	6.96	6.16	3.70
15	83.56	5.58	4.78	4.30
20	70.25	4.69	3.89	4.67
25	60.90	4.07	3.27	4.90
30	53.93	3.60	2.80	5.04
35	48.52	3.24	2.44	5.13
40	44.18	2.95	2.15	5.16
45	40.63	2.71	1.91	5.17
50	37.65	2.52	1.72	5.15
55	35.12	2.35	1.55	5.10
60	32.94	2.20	1.40	5.04
65	31.04	2.07	1.27	4.97
70	29.37	1.96	1.16	4.88
75	27.89	1.86	1.06	4.78
90	24.29	1.62	0.82	4.44
105	21.58	1.44	0.64	4.04
120	19.47	1.30	0.50	3.60

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **3**

OTTAWA IDF CURVE

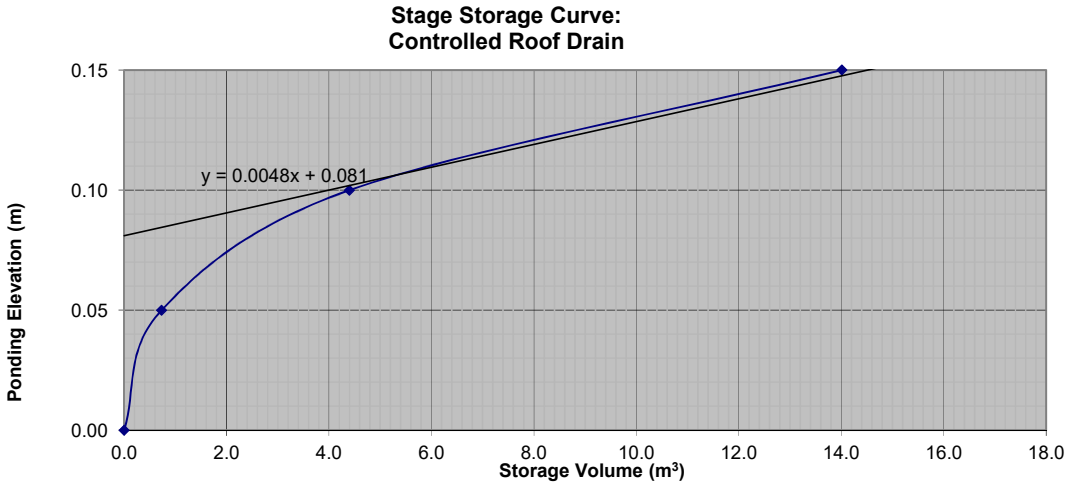
Area =	0.027	ha	Qallow =	0.88	L/s
C =	0.90		Vol(max) =	10.3	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	16.21	15.33	4.60
10	178.56	11.93	11.05	6.63
15	142.89	9.55	8.67	7.80
20	119.95	8.01	7.13	8.56
25	103.85	6.94	6.06	9.09
30	91.87	6.14	5.26	9.46
35	82.58	5.52	4.64	9.74
40	75.15	5.02	4.14	9.94
45	69.05	4.61	3.73	10.08
50	63.95	4.27	3.39	10.18
55	59.62	3.98	3.10	10.24
60	55.89	3.73	2.85	10.27
65	52.65	3.52	2.64	10.28
70	49.79	3.33	2.45	10.27
75	47.26	3.16	2.28	10.25
90	41.11	2.75	1.87	10.08
105	36.50	2.44	1.56	9.82
120	32.89	2.20	1.32	9.49

Watts Accutrol Flow Control Roof Drains:			RD-100-A-ADJ set to 1/4 Exposed		
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.80	0.80	10.6	5.2	5.2
1:100 Year	0.88	0.88	13.1	10.3	10.4

Roof Drain Storage Table for RD # 3

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	29.3	0.7
0.10	117.4	4.4
0.15	267	14.0



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **4**

OTTAWA IDF CURVE

Area =	0.018	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	3.0	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	6.44	5.65	1.70
10	104.19	4.76	3.97	2.38
15	83.56	3.81	3.02	2.72
20	70.25	3.21	2.42	2.90
25	60.90	2.78	1.99	2.98
30	53.93	2.46	1.67	3.01
35	48.52	2.21	1.42	2.99
40	44.18	2.02	1.23	2.94
45	40.63	1.85	1.06	2.87
50	37.65	1.72	0.93	2.79
55	35.12	1.60	0.81	2.68
60	32.94	1.50	0.71	2.57
65	31.04	1.42	0.63	2.44
70	29.37	1.34	0.55	2.31
75	27.89	1.27	0.48	2.17
90	24.29	1.11	0.32	1.72
105	21.58	0.98	0.19	1.23
120	19.47	0.89	0.10	0.71

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **4**

OTTAWA IDF CURVE

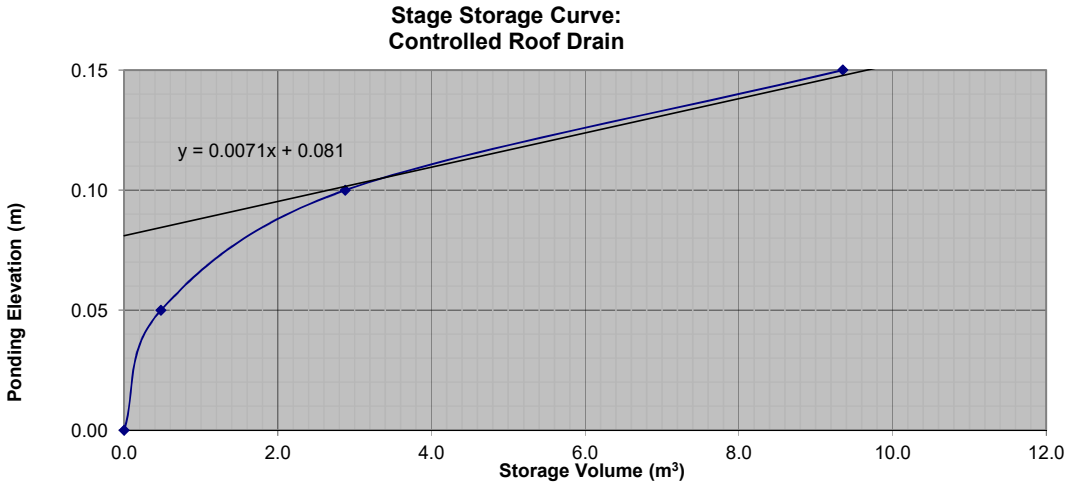
Area =	0.018	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	6.2	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	11.08	10.21	3.06
10	178.56	8.15	7.28	4.37
15	142.89	6.52	5.65	5.09
20	119.95	5.47	4.60	5.52
25	103.85	4.74	3.87	5.80
30	91.87	4.19	3.32	5.98
35	82.58	3.77	2.90	6.09
40	75.15	3.43	2.56	6.14
45	69.05	3.15	2.28	6.16
50	63.95	2.92	2.05	6.15
55	59.62	2.72	1.85	6.11
60	55.89	2.55	1.68	6.05
65	52.65	2.40	1.53	5.98
70	49.79	2.27	1.40	5.89
75	47.26	2.16	1.29	5.79
90	41.11	1.88	1.01	5.43
105	36.50	1.67	0.80	5.01
120	32.89	1.50	0.63	4.54

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.79	0.79	10.2	3.0	3.0
1:100 Year	0.87	0.87	13.8	6.2	8.0

Roof Drain Storage Table for RD # 4

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	19.2	0.5
0.10	76.7	2.9
0.15	182.4	9.4



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **5**

OTTAWA IDF CURVE

Area =	0.007	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	0.7	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	2.59	1.80	0.54
10	104.19	1.91	1.12	0.67
15	83.56	1.53	0.74	0.67
20	70.25	1.29	0.50	0.60
25	60.90	1.12	0.33	0.49
30	53.93	0.99	0.20	0.36
35	48.52	0.89	0.10	0.21
40	44.18	0.81	0.02	0.05
45	40.63	0.75	-0.04	-0.12
50	37.65	0.69	-0.10	-0.30
55	35.12	0.64	-0.15	-0.48
60	32.94	0.60	-0.19	-0.67
65	31.04	0.57	-0.22	-0.86
70	29.37	0.54	-0.25	-1.06
75	27.89	0.51	-0.28	-1.25
90	24.29	0.45	-0.34	-1.86
105	21.58	0.40	-0.39	-2.48
120	19.47	0.36	-0.43	-3.12

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **5**

OTTAWA IDF CURVE

Area =	0.007	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	1.6	m3

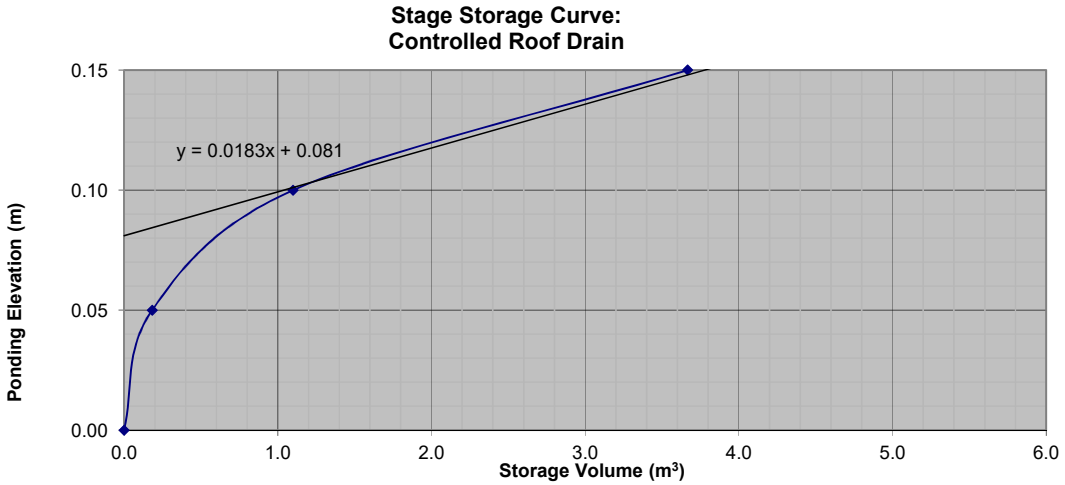
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	4.45	3.58	1.07
10	178.56	3.27	2.40	1.44
15	142.89	2.62	1.75	1.58
20	119.95	2.20	1.33	1.60
25	103.85	1.90	1.03	1.55
30	91.87	1.68	0.81	1.47
35	82.58	1.51	0.64	1.35
40	75.15	1.38	0.51	1.22
45	69.05	1.27	0.40	1.07
50	63.95	1.17	0.30	0.91
55	59.62	1.09	0.22	0.74
60	55.89	1.03	0.16	0.56
65	52.65	0.97	0.10	0.37
70	49.79	0.91	0.04	0.18
75	47.26	0.87	0.00	-0.02
90	41.11	0.75	-0.12	-0.63
105	36.50	0.67	-0.20	-1.26
120	32.89	0.60	-0.27	-1.92

Watts Accutrol Flow Control Roof Drains: RD-100-A-ADJ set to 1/4 Exposed

Design Event	Flow (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3) Required	Storage (m^3) Provided
1:5 Year	0.79	0.79	10.2	0.7	1.1
1:100 Year	0.87	0.87	12.7	1.6	2.5

Roof Drain Storage Table for RD # 5

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	7.3	0.2
0.10	29.4	1.1
0.15	73.3	3.7



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **6**

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	1.1	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	3.41	2.62	0.79
10	104.19	2.52	1.73	1.04
15	83.56	2.02	1.23	1.11
20	70.25	1.70	0.91	1.09
25	60.90	1.47	0.68	1.02
30	53.93	1.30	0.51	0.92
35	48.52	1.17	0.38	0.80
40	44.18	1.07	0.28	0.67
45	40.63	0.98	0.19	0.52
50	37.65	0.91	0.12	0.36
55	35.12	0.85	0.06	0.19
60	32.94	0.80	0.01	0.02
65	31.04	0.75	-0.04	-0.15
70	29.37	0.71	-0.08	-0.34
75	27.89	0.67	-0.12	-0.52
90	24.29	0.59	-0.20	-1.10
105	21.58	0.52	-0.27	-1.69
120	19.47	0.47	-0.32	-2.30

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **6**

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	2.5	m3

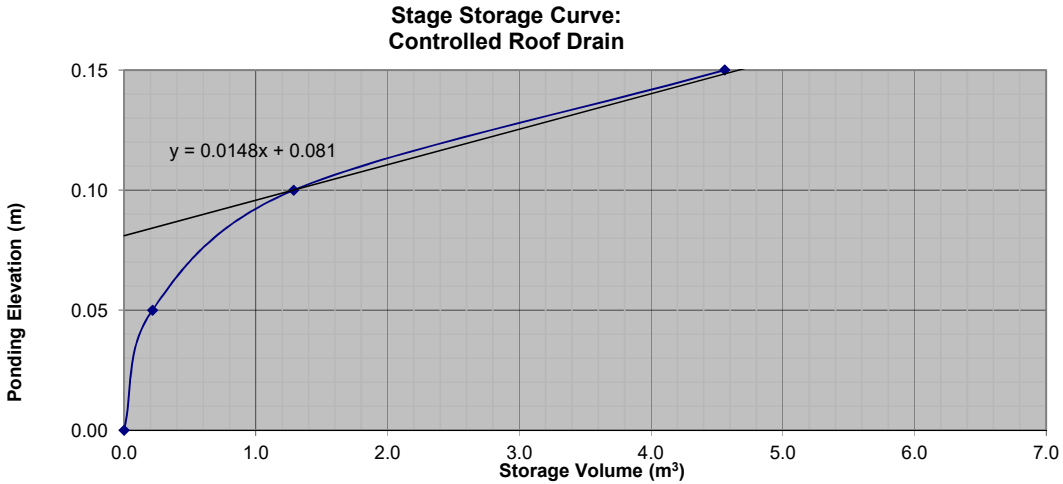
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	5.87	5.00	1.50
10	178.56	4.32	3.45	2.07
15	142.89	3.45	2.58	2.33
20	119.95	2.90	2.03	2.43
25	103.85	2.51	1.64	2.46
30	91.87	2.22	1.35	2.43
35	82.58	2.00	1.13	2.36
40	75.15	1.82	0.95	2.27
45	69.05	1.67	0.80	2.16
50	63.95	1.55	0.68	2.03
55	59.62	1.44	0.57	1.88
60	55.89	1.35	0.48	1.73
65	52.65	1.27	0.40	1.57
70	49.79	1.20	0.33	1.40
75	47.26	1.14	0.27	1.22
90	41.11	0.99	0.12	0.67
105	36.50	0.88	0.01	0.08
120	32.89	0.80	-0.07	-0.54

Watts Accutrol Flow Control Roof Drains: RD-100-A-ADJ set to 1/4 Exposed

Design Event	Flow (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3) Required	Storage (m^3) Provided
1:5 Year	0.79	0.79	10.2	1.1	1.4
1:100 Year	0.87	0.87	12.7	2.5	3.1

Roof Drain Storage Table for RD # 6

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	8.6	0.2
0.10	34.3	1.3
0.15	96.6	4.6



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **7**

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.71	L/s
C =	0.90		Vol(max) =	0.3	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	1.72	1.01	0.30
10	104.19	1.27	0.56	0.34
15	83.56	1.02	0.31	0.28
20	70.25	0.86	0.15	0.18
25	60.90	0.74	0.03	0.05
30	53.93	0.66	-0.05	-0.10
35	48.52	0.59	-0.12	-0.25
40	44.18	0.54	-0.17	-0.41
45	40.63	0.50	-0.21	-0.58
50	37.65	0.46	-0.25	-0.75
55	35.12	0.43	-0.28	-0.93
60	32.94	0.40	-0.31	-1.11
65	31.04	0.38	-0.33	-1.29
70	29.37	0.36	-0.35	-1.48
75	27.89	0.34	-0.37	-1.67
90	24.29	0.30	-0.41	-2.24
105	21.58	0.26	-0.45	-2.82
120	19.47	0.24	-0.47	-3.40

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **7**

OTTAWA IDF CURVE

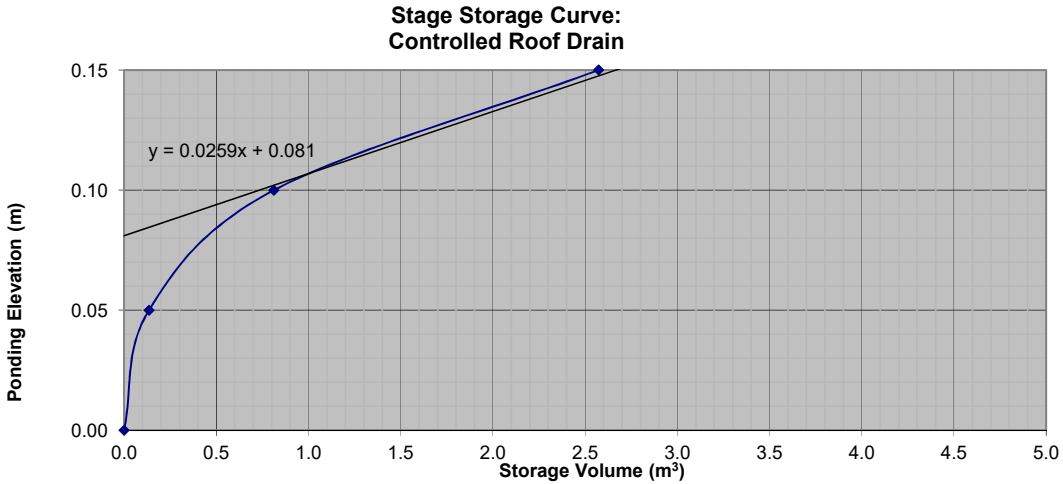
Area =	0.005	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	0.8	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	2.96	2.09	0.63
10	178.56	2.18	1.31	0.78
15	142.89	1.74	0.87	0.78
20	119.95	1.46	0.59	0.71
25	103.85	1.27	0.40	0.59
30	91.87	1.12	0.25	0.45
35	82.58	1.01	0.14	0.29
40	75.15	0.92	0.05	0.11
45	69.05	0.84	-0.03	-0.08
50	63.95	0.78	-0.09	-0.27
55	59.62	0.73	-0.14	-0.47
60	55.89	0.68	-0.19	-0.68
65	52.65	0.64	-0.23	-0.89
70	49.79	0.61	-0.26	-1.11
75	47.26	0.58	-0.29	-1.32
90	41.11	0.50	-0.37	-1.99
105	36.50	0.44	-0.43	-2.68
120	32.89	0.40	-0.47	-3.38

Watts Accutrol Flow Control Roof Drains:			RD-100-A-ADJ set to 1/4 Exposed		
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.71	0.71	7.6	0.3	0.4
1:100 Year	0.87	0.87	12.7	0.8	1.8

Roof Drain Storage Table for RD # 7

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	5.4	0.1
0.10	21.7	0.8
0.15	48.7	2.6



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **8**

OTTAWA IDF CURVE

Area =	0.027	ha	Qallow =	0.82	L/s
C =	0.90		Vol(max) =	5.2	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	9.49	8.67	2.60
10	104.19	7.01	6.19	3.71
15	83.56	5.62	4.80	4.32
20	70.25	4.72	3.90	4.69
25	60.90	4.10	3.28	4.91
30	53.93	3.63	2.81	5.05
35	48.52	3.26	2.44	5.13
40	44.18	2.97	2.15	5.16
45	40.63	2.73	1.91	5.16
50	37.65	2.53	1.71	5.14
55	35.12	2.36	1.54	5.09
60	32.94	2.22	1.40	5.02
65	31.04	2.09	1.27	4.94
70	29.37	1.98	1.16	4.85
75	27.89	1.88	1.06	4.75
90	24.29	1.63	0.81	4.39
105	21.58	1.45	0.63	3.98
120	19.47	1.31	0.49	3.52

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **8**

OTTAWA IDF CURVE

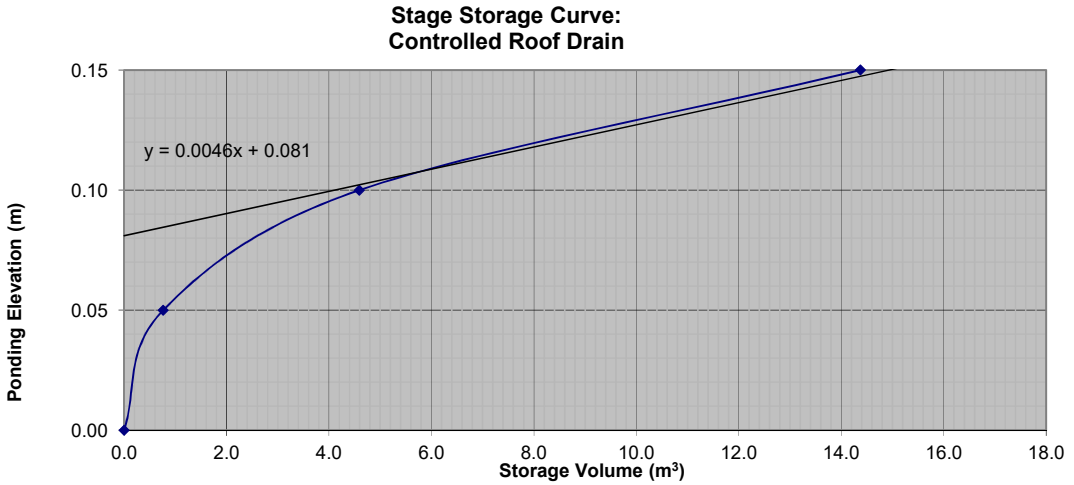
Area =	0.027	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	10.4	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	16.32	15.45	4.64
10	178.56	12.01	11.14	6.68
15	142.89	9.61	8.74	7.87
20	119.95	8.07	7.20	8.64
25	103.85	6.98	6.11	9.17
30	91.87	6.18	5.31	9.56
35	82.58	5.55	4.68	9.84
40	75.15	5.05	4.18	10.04
45	69.05	4.64	3.77	10.19
50	63.95	4.30	3.43	10.29
55	59.62	4.01	3.14	10.36
60	55.89	3.76	2.89	10.40
65	52.65	3.54	2.67	10.42
70	49.79	3.35	2.48	10.41
75	47.26	3.18	2.31	10.39
90	41.11	2.76	1.89	10.23
105	36.50	2.45	1.58	9.98
120	32.89	2.21	1.34	9.66

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.82	0.82	11.0	5.2	6.3
1:100 Year	0.87	0.87	13.8	10.4	12.3

Roof Drain Storage Table for RD # 8

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	30.6	0.8
0.10	122.5	4.6
0.15	268.8	14.4



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **9**

OTTAWA IDF CURVE

Area =	0.022	ha	Qallow =	0.80	L/s
C =	0.90		Vol(max) =	3.9	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	7.77	6.97	2.09
10	104.19	5.74	4.94	2.96
15	83.56	4.60	3.80	3.42
20	70.25	3.87	3.07	3.68
25	60.90	3.35	2.55	3.83
30	53.93	2.97	2.17	3.91
35	48.52	2.67	1.87	3.93
40	44.18	2.43	1.63	3.92
45	40.63	2.24	1.44	3.88
50	37.65	2.07	1.27	3.82
55	35.12	1.93	1.13	3.74
60	32.94	1.81	1.01	3.65
65	31.04	1.71	0.91	3.55
70	29.37	1.62	0.82	3.43
75	27.89	1.54	0.74	3.31
90	24.29	1.34	0.54	2.90
105	21.58	1.19	0.39	2.45
120	19.47	1.07	0.27	1.96

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **9**

OTTAWA IDF CURVE

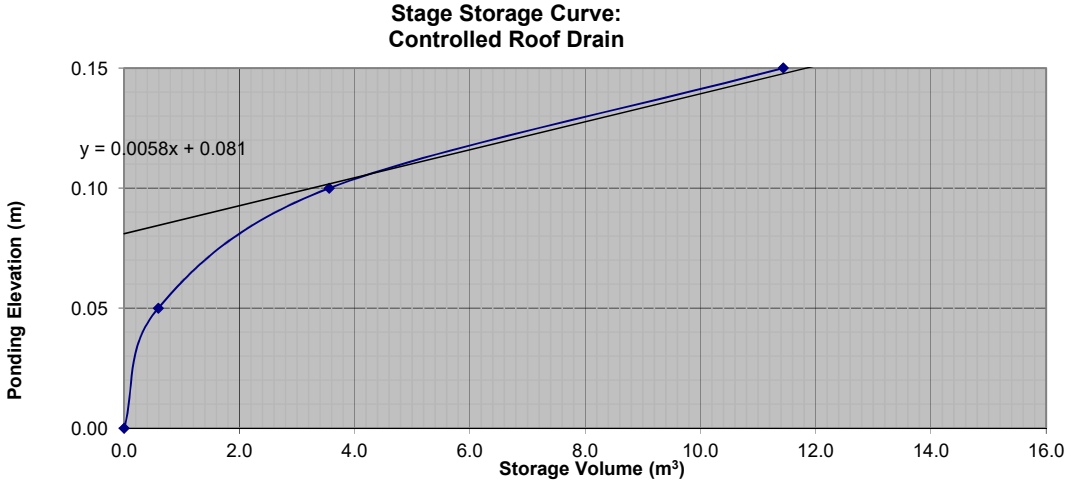
Area =	0.022	ha	Qallow =	0.87	L/s
C =	0.90		Vol(max) =	8.0	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	13.37	12.50	3.75
10	178.56	9.83	8.96	5.38
15	142.89	7.87	7.00	6.30
20	119.95	6.61	5.74	6.88
25	103.85	5.72	4.85	7.27
30	91.87	5.06	4.19	7.54
35	82.58	4.55	3.68	7.72
40	75.15	4.14	3.27	7.84
45	69.05	3.80	2.93	7.92
50	63.95	3.52	2.65	7.96
55	59.62	3.28	2.41	7.96
60	55.89	3.08	2.21	7.95
65	52.65	2.90	2.03	7.91
70	49.79	2.74	1.87	7.86
75	47.26	2.60	1.73	7.80
90	41.11	2.26	1.39	7.53
105	36.50	2.01	1.14	7.18
120	32.89	1.81	0.94	6.78

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.80	0.80	10.5	3.9	3.9
1:100 Year	0.87	0.87	13.8	8.0	9.7

Roof Drain Storage Table for RD # 9

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	23.7	0.6
0.10	95	3.6
0.15	220.1	11.4



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **10**

OTTAWA IDF CURVE

Area =	0.023	ha	Qallow =	0.81	L/s
C =	0.90		Vol(max) =	4.2	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	8.15	7.34	2.20
10	104.19	6.01	5.20	3.12
15	83.56	4.82	4.01	3.61
20	70.25	4.05	3.24	3.89
25	60.90	3.51	2.70	4.06
30	53.93	3.11	2.30	4.14
35	48.52	2.80	1.99	4.18
40	44.18	2.55	1.74	4.18
45	40.63	2.35	1.54	4.14
50	37.65	2.17	1.36	4.09
55	35.12	2.03	1.22	4.02
60	32.94	1.90	1.09	3.93
65	31.04	1.79	0.98	3.83
70	29.37	1.70	0.89	3.72
75	27.89	1.61	0.80	3.60
90	24.29	1.40	0.59	3.20
105	21.58	1.25	0.44	2.75
120	19.47	1.12	0.31	2.26

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **10**

OTTAWA IDF CURVE

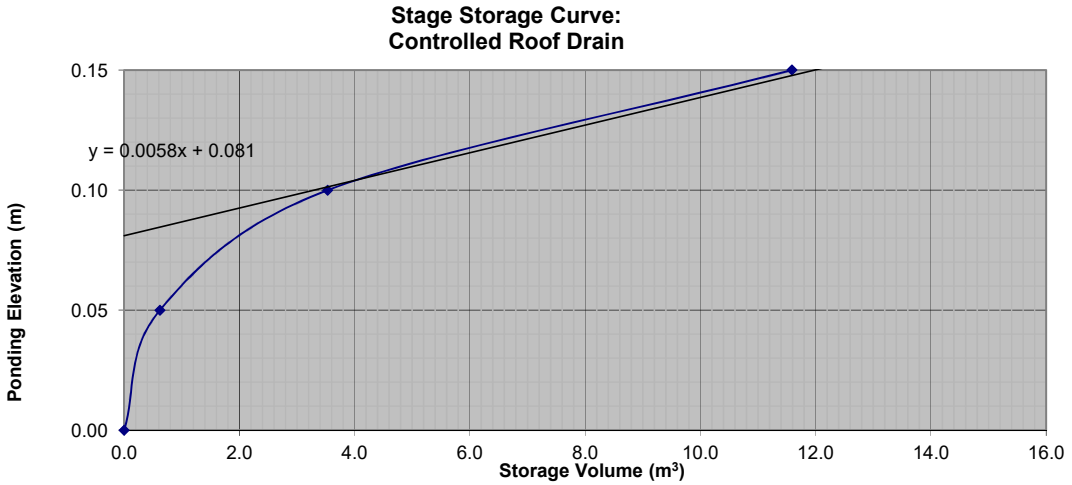
Area =	0.023	ha	Qallow =	0.90	L/s
C =	0.90		Vol(max) =	8.4	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	14.01	13.11	3.93
10	178.56	10.31	9.41	5.64
15	142.89	8.25	7.35	6.61
20	119.95	6.92	6.02	7.23
25	103.85	5.99	5.09	7.64
30	91.87	5.30	4.40	7.92
35	82.58	4.77	3.87	8.12
40	75.15	4.34	3.44	8.25
45	69.05	3.99	3.09	8.33
50	63.95	3.69	2.79	8.37
55	59.62	3.44	2.54	8.39
60	55.89	3.23	2.33	8.37
65	52.65	3.04	2.14	8.34
70	49.79	2.87	1.97	8.29
75	47.26	2.73	1.83	8.22
90	41.11	2.37	1.47	7.95
105	36.50	2.11	1.21	7.60
120	32.89	1.90	1.00	7.19

Watts Accutrol Flow Control Roof Drains:			RD-100-A-ADJ set to 1/4 Exposed		
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.81	0.81	11.0	4.2	4.8
1:100 Year	0.90	0.90	13.8	8.4	9.8

Roof Drain Storage Table for RD # 10

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	24.9	0.6
0.10	91.5	3.5
0.15	230.7	11.6



ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:5 YEAR EVENT

AREA 2-R **Controlled Roof Drain #** **11+12**

OTTAWA IDF CURVE

Area = 0.004 ha Qallow = 0.71 L/s

C = 0.90 Vol(max) = 0.2 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	1.48	0.77	0.23
10	104.19	1.09	0.38	0.23
15	83.56	0.87	0.16	0.15
20	70.25	0.73	0.02	0.03
25	60.90	0.64	-0.07	-0.11
30	53.93	0.56	-0.15	-0.26
35	48.52	0.51	-0.20	-0.43
40	44.18	0.46	-0.25	-0.59
45	40.63	0.42	-0.29	-0.77
50	37.65	0.39	-0.32	-0.95
55	35.12	0.37	-0.34	-1.13
60	32.94	0.34	-0.37	-1.32
65	31.04	0.32	-0.39	-1.50
70	29.37	0.31	-0.40	-1.69
75	27.89	0.29	-0.42	-1.88
90	24.29	0.25	-0.46	-2.46
105	21.58	0.23	-0.48	-3.05
120	19.47	0.20	-0.51	-3.65

ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:100 YEAR EVENT

AREA 2-R **Controlled Roof Drain #** **11+12**

OTTAWA IDF CURVE

Area = 0.004 ha Qallow = 0.79 L/s

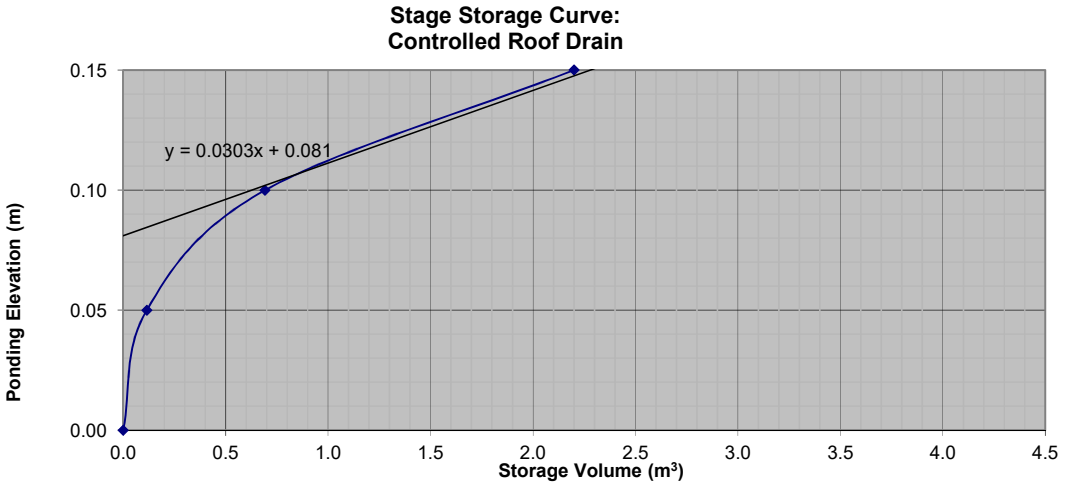
C = 0.90 Vol(max) = 0.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	2.54	1.75	0.52
10	178.56	1.87	1.08	0.65
15	142.89	1.49	0.70	0.63
20	119.95	1.25	0.46	0.56
25	103.85	1.09	0.30	0.44
30	91.87	0.96	0.17	0.31
35	82.58	0.86	0.07	0.15
40	75.15	0.79	0.00	-0.01
45	69.05	0.72	-0.07	-0.18
50	63.95	0.67	-0.12	-0.36
55	59.62	0.62	-0.17	-0.55
60	55.89	0.58	-0.21	-0.74
65	52.65	0.55	-0.24	-0.93
70	49.79	0.52	-0.27	-1.13
75	47.26	0.49	-0.30	-1.33
90	41.11	0.43	-0.36	-1.94
105	36.50	0.38	-0.41	-2.57
120	32.89	0.34	-0.45	-3.21

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow per RD (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.71	1.42	7.6	0.7	0.9
1:100 Year	0.79	1.58	10.2	1.9	2.1

Roof Drain Storage Table for RD # 11+12

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	4.6	0.1
0.10	18.5	0.7
0.15	41.8	2.2



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **13,15,17**

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.71	L/s
C =	0.90		Vol(max) =	0.1	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	1.19	0.48	0.14
10	104.19	0.88	0.17	0.10
15	83.56	0.70	-0.01	0.00
20	70.25	0.59	-0.12	-0.14
25	60.90	0.51	-0.20	-0.29
30	53.93	0.45	-0.26	-0.46
35	48.52	0.41	-0.30	-0.63
40	44.18	0.37	-0.34	-0.81
45	40.63	0.34	-0.37	-0.99
50	37.65	0.32	-0.39	-1.18
55	35.12	0.30	-0.41	-1.37
60	32.94	0.28	-0.43	-1.56
65	31.04	0.26	-0.45	-1.75
70	29.37	0.25	-0.46	-1.94
75	27.89	0.24	-0.47	-2.14
90	24.29	0.20	-0.51	-2.73
105	21.58	0.18	-0.53	-3.33
120	19.47	0.16	-0.55	-3.93

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **13,15,17**

OTTAWA IDF CURVE

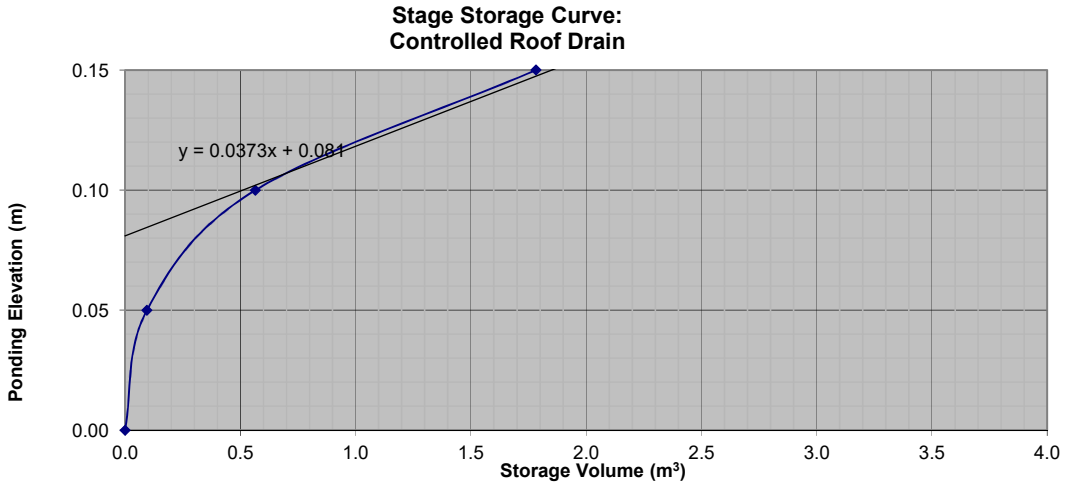
Area =	0.003	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	0.4	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	2.05	1.26	0.38
10	178.56	1.51	0.72	0.43
15	142.89	1.20	0.41	0.37
20	119.95	1.01	0.22	0.27
25	103.85	0.88	0.09	0.13
30	91.87	0.77	-0.02	-0.03
35	82.58	0.70	-0.09	-0.20
40	75.15	0.63	-0.16	-0.38
45	69.05	0.58	-0.21	-0.56
50	63.95	0.54	-0.25	-0.75
55	59.62	0.50	-0.29	-0.95
60	55.89	0.47	-0.32	-1.15
65	52.65	0.44	-0.35	-1.35
70	49.79	0.42	-0.37	-1.55
75	47.26	0.40	-0.39	-1.76
90	41.11	0.35	-0.44	-2.39
105	36.50	0.31	-0.48	-3.04
120	32.89	0.28	-0.51	-3.69

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.71	2.13	7.6	0.4	0.8
1:100 Year	0.79	2.37	10.2	1.3	1.7

Roof Drain Storage Table for RD # 13,15,17

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	3.8	0.1
0.10	15	0.6
0.15	33.7	1.8



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **14,16,18**

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.71	L/s
C =	0.90		Vol(max) =	0.1	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	1.20	0.49	0.15
10	104.19	0.89	0.18	0.11
15	83.56	0.71	0.00	0.00
20	70.25	0.60	-0.11	-0.13
25	60.90	0.52	-0.19	-0.29
30	53.93	0.46	-0.25	-0.45
35	48.52	0.41	-0.30	-0.62
40	44.18	0.38	-0.33	-0.80
45	40.63	0.35	-0.36	-0.98
50	37.65	0.32	-0.39	-1.17
55	35.12	0.30	-0.41	-1.35
60	32.94	0.28	-0.43	-1.54
65	31.04	0.26	-0.45	-1.74
70	29.37	0.25	-0.46	-1.93
75	27.89	0.24	-0.47	-2.12
90	24.29	0.21	-0.50	-2.71
105	21.58	0.18	-0.53	-3.31
120	19.47	0.17	-0.54	-3.92

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **14,16,18**

OTTAWA IDF CURVE

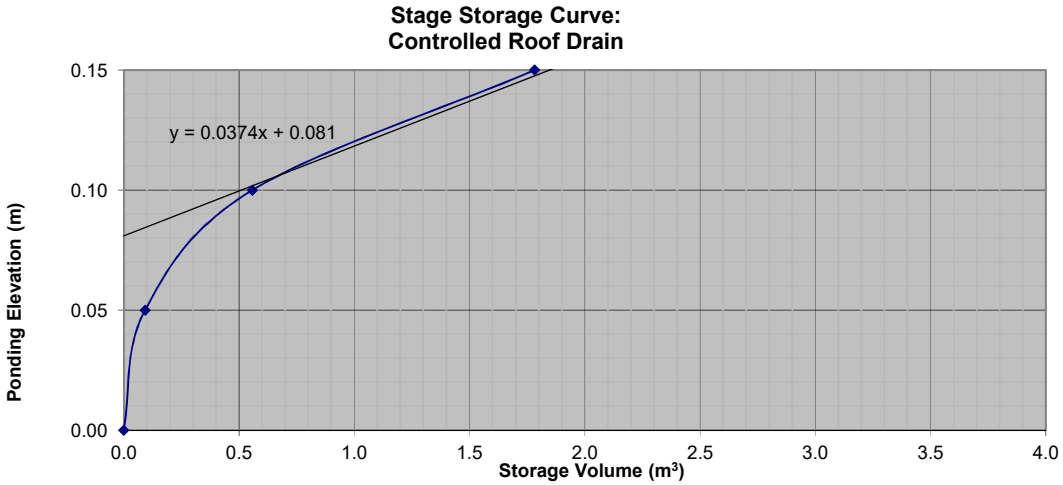
Area =	0.003	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	0.4	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	2.07	1.28	0.38
10	178.56	1.52	0.73	0.44
15	142.89	1.22	0.43	0.39
20	119.95	1.02	0.23	0.28
25	103.85	0.89	0.10	0.14
30	91.87	0.78	-0.01	-0.01
35	82.58	0.70	-0.09	-0.18
40	75.15	0.64	-0.15	-0.36
45	69.05	0.59	-0.20	-0.54
50	63.95	0.55	-0.24	-0.73
55	59.62	0.51	-0.28	-0.93
60	55.89	0.48	-0.31	-1.13
65	52.65	0.45	-0.34	-1.33
70	49.79	0.42	-0.37	-1.53
75	47.26	0.40	-0.39	-1.74
90	41.11	0.35	-0.44	-2.37
105	36.50	0.31	-0.48	-3.02
120	32.89	0.28	-0.51	-3.67

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.71	2.13	7.6	0.4	0.8
1:100 Year	0.79	2.37	10.2	1.3	1.7

Roof Drain Storage Table for RD # 14,16,18

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	3.7	0.1
0.10	14.9	0.6
0.15	34.1	1.8



ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:5 YEAR EVENT

AREA 2-R **Controlled Roof Drain #** **19+20**

OTTAWA IDF CURVE

Area = 0.004 ha Qallow = 0.71 L/s

C = 0.90 Vol(max) = 0.2 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	1.46	0.75	0.22
10	104.19	1.07	0.36	0.22
15	83.56	0.86	0.15	0.14
20	70.25	0.72	0.01	0.02
25	60.90	0.63	-0.08	-0.12
30	53.93	0.56	-0.15	-0.28
35	48.52	0.50	-0.21	-0.44
40	44.18	0.46	-0.25	-0.61
45	40.63	0.42	-0.29	-0.79
50	37.65	0.39	-0.32	-0.97
55	35.12	0.36	-0.35	-1.15
60	32.94	0.34	-0.37	-1.33
65	31.04	0.32	-0.39	-1.52
70	29.37	0.30	-0.41	-1.71
75	27.89	0.29	-0.42	-1.90
90	24.29	0.25	-0.46	-2.48
105	21.58	0.22	-0.49	-3.07
120	19.47	0.20	-0.51	-3.67

ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:100 YEAR EVENT

AREA 2-R **Controlled Roof Drain #** **19+20**

OTTAWA IDF CURVE

Area = 0.004 ha Qallow = 0.79 L/s

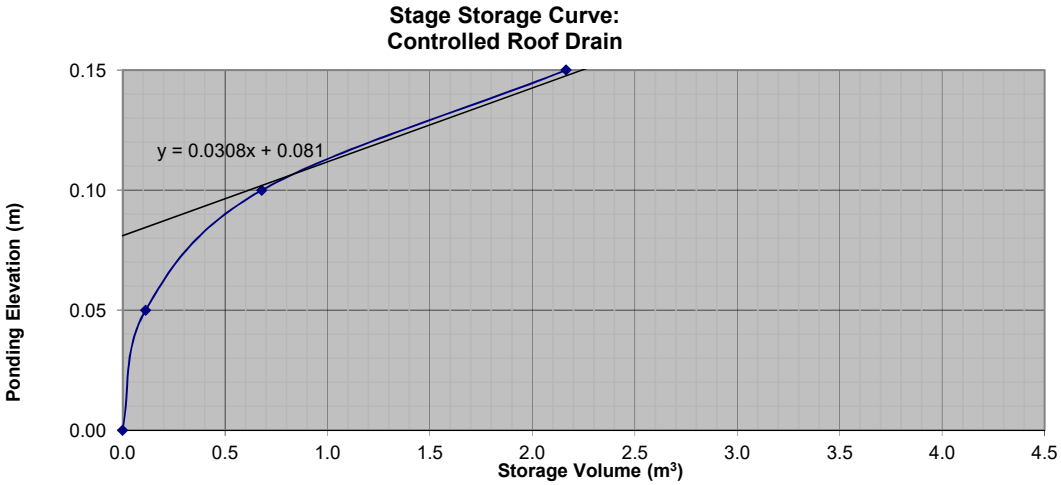
C = 0.90 Vol(max) = 0.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	2.50	1.71	0.51
10	178.56	1.84	1.05	0.63
15	142.89	1.47	0.68	0.61
20	119.95	1.24	0.45	0.54
25	103.85	1.07	0.28	0.42
30	91.87	0.95	0.16	0.28
35	82.58	0.85	0.06	0.13
40	75.15	0.77	-0.02	-0.04
45	69.05	0.71	-0.08	-0.21
50	63.95	0.66	-0.13	-0.39
55	59.62	0.61	-0.18	-0.58
60	55.89	0.58	-0.21	-0.77
65	52.65	0.54	-0.25	-0.96
70	49.79	0.51	-0.28	-1.16
75	47.26	0.49	-0.30	-1.36
90	41.11	0.42	-0.37	-1.98
105	36.50	0.38	-0.41	-2.61
120	32.89	0.34	-0.45	-3.25

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.71	1.42	7.6	0.4	0.6
1:100 Year	0.79	1.58	10.2	1.3	1.4

Roof Drain Storage Table for RD # 19+20

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	4.5	0.1
0.10	18.2	0.7
0.15	41.2	2.2



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **21**

OTTAWA IDF CURVE

Area =	0.002	ha	Qallow =	0.63	L/s
C =	0.90		Vol(max) =	0.0	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	0.76	0.13	0.04
10	104.19	0.56	-0.07	-0.04
15	83.56	0.45	-0.18	-0.16
20	70.25	0.38	-0.25	-0.30
25	60.90	0.33	-0.30	-0.46
30	53.93	0.29	-0.34	-0.61
35	48.52	0.26	-0.37	-0.78
40	44.18	0.24	-0.39	-0.94
45	40.63	0.22	-0.41	-1.11
50	37.65	0.20	-0.43	-1.29
55	35.12	0.19	-0.44	-1.46
60	32.94	0.18	-0.45	-1.63
65	31.04	0.17	-0.46	-1.81
70	29.37	0.16	-0.47	-1.99
75	27.89	0.15	-0.48	-2.16
90	24.29	0.13	-0.50	-2.70
105	21.58	0.12	-0.51	-3.24
120	19.47	0.10	-0.53	-3.79

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **21**

OTTAWA IDF CURVE

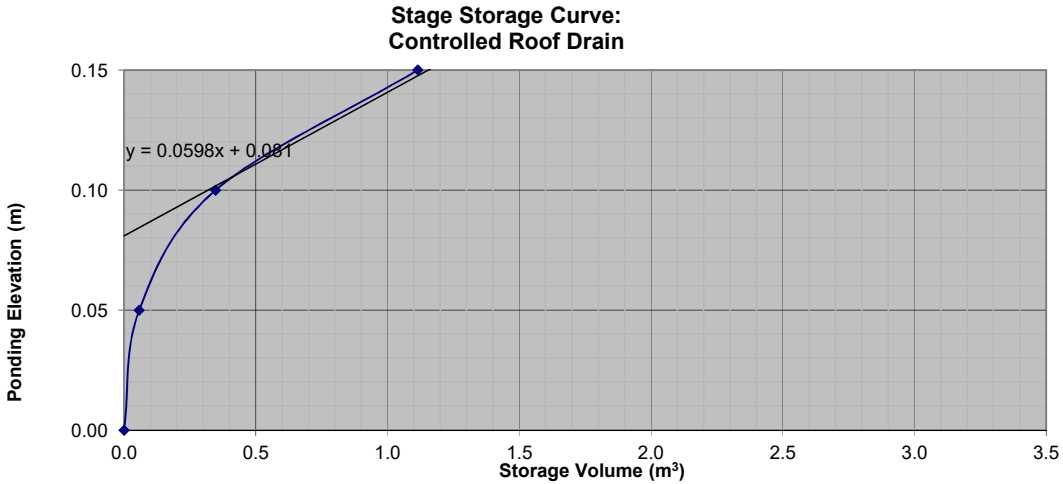
Area =	0.002	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	0.2	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	1.30	0.51	0.15
10	178.56	0.96	0.17	0.10
15	142.89	0.77	-0.02	-0.02
20	119.95	0.64	-0.15	-0.18
25	103.85	0.56	-0.23	-0.35
30	91.87	0.49	-0.30	-0.54
35	82.58	0.44	-0.35	-0.73
40	75.15	0.40	-0.39	-0.93
45	69.05	0.37	-0.42	-1.13
50	63.95	0.34	-0.45	-1.34
55	59.62	0.32	-0.47	-1.55
60	55.89	0.30	-0.49	-1.77
65	52.65	0.28	-0.51	-1.98
70	49.79	0.27	-0.52	-2.20
75	47.26	0.25	-0.54	-2.42
90	41.11	0.22	-0.57	-3.08
105	36.50	0.20	-0.59	-3.75
120	32.89	0.18	-0.61	-4.42

Watts Accutrol Flow Control Roof Drains:			RD-100-A-ADJ set to 1/4 Exposed		
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.63	0.63	5.1	0.04	0.05
1:100 Year	0.79	0.79	10.2	0.2	0.4

Roof Drain Storage Table for RD # 21

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	2.3	0.1
0.10	9.3	0.3
0.15	21.4	1.1



ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **22**

OTTAWA IDF CURVE

Area =	0.002	ha	Qallow =	0.63	L/s
C =	0.90		Vol(max) =	0.1	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	0.86	0.23	0.07
10	104.19	0.63	0.00	0.00
15	83.56	0.51	-0.12	-0.11
20	70.25	0.43	-0.20	-0.24
25	60.90	0.37	-0.26	-0.39
30	53.93	0.33	-0.30	-0.54
35	48.52	0.29	-0.34	-0.70
40	44.18	0.27	-0.36	-0.87
45	40.63	0.25	-0.38	-1.03
50	37.65	0.23	-0.40	-1.20
55	35.12	0.21	-0.42	-1.37
60	32.94	0.20	-0.43	-1.55
65	31.04	0.19	-0.44	-1.72
70	29.37	0.18	-0.45	-1.90
75	27.89	0.17	-0.46	-2.07
90	24.29	0.15	-0.48	-2.60
105	21.58	0.13	-0.50	-3.14
120	19.47	0.12	-0.51	-3.68

ADELAIDE TOWER EXPANSION
116070
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA 2-R **Controlled Roof Drain #** **22**

OTTAWA IDF CURVE

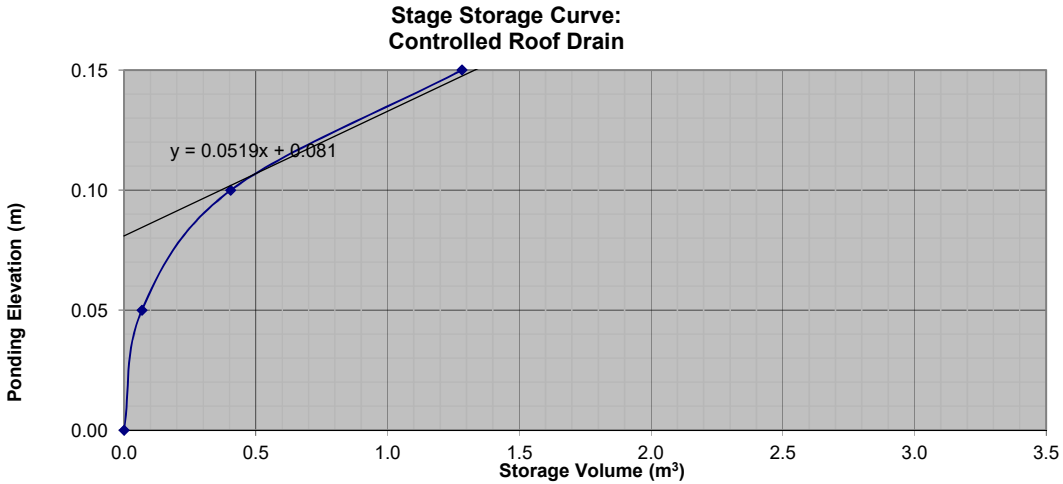
Area =	0.002	ha	Qallow =	0.79	L/s
C =	0.90		Vol(max) =	0.2	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	1.48	0.69	0.21
10	178.56	1.09	0.30	0.18
15	142.89	0.87	0.08	0.07
20	119.95	0.73	-0.06	-0.07
25	103.85	0.63	-0.16	-0.24
30	91.87	0.56	-0.23	-0.42
35	82.58	0.50	-0.29	-0.60
40	75.15	0.46	-0.33	-0.80
45	69.05	0.42	-0.37	-1.00
50	63.95	0.39	-0.40	-1.20
55	59.62	0.36	-0.43	-1.41
60	55.89	0.34	-0.45	-1.62
65	52.65	0.32	-0.47	-1.83
70	49.79	0.30	-0.49	-2.05
75	47.26	0.29	-0.50	-2.26
90	41.11	0.25	-0.54	-2.92
105	36.50	0.22	-0.57	-3.58
120	32.89	0.20	-0.59	-4.25

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3) Required**	**Provided**
1:5 Year	0.63	0.63	5.1	0.07	0.07
1:100 Year	0.79	0.79	10.2	0.2	0.4

Roof Drain Storage Table for RD # 22

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	2.7	0.1
0.10	10.8	0.4
0.15	24.3	1.3



ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:5 YEAR EVENT

AREA 2-R **Controlled Roof Drain #** **23+24**

OTTAWA IDF CURVE

Area = 0.004 ha Qallow = 0.71 L/s

C = 0.90 Vol(max) = 0.2 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	1.42	0.71	0.21
10	104.19	1.05	0.34	0.20
15	83.56	0.84	0.13	0.12
20	70.25	0.70	-0.01	-0.01
25	60.90	0.61	-0.10	-0.15
30	53.93	0.54	-0.17	-0.30
35	48.52	0.49	-0.22	-0.47
40	44.18	0.44	-0.27	-0.64
45	40.63	0.41	-0.30	-0.82
50	37.65	0.38	-0.33	-1.00
55	35.12	0.35	-0.36	-1.18
60	32.94	0.33	-0.38	-1.37
65	31.04	0.31	-0.40	-1.55
70	29.37	0.29	-0.42	-1.74
75	27.89	0.28	-0.43	-1.94
90	24.29	0.24	-0.47	-2.52
105	21.58	0.22	-0.49	-3.11
120	19.47	0.20	-0.51	-3.71

ADELAIDE TOWER EXPANSION

116070

REQUIRED STORAGE - 1:100 YEAR EVENT

AREA 2-R **Controlled Roof Drain #** **23+24**

OTTAWA IDF CURVE

Area = 0.004 ha Qallow = 0.79 L/s

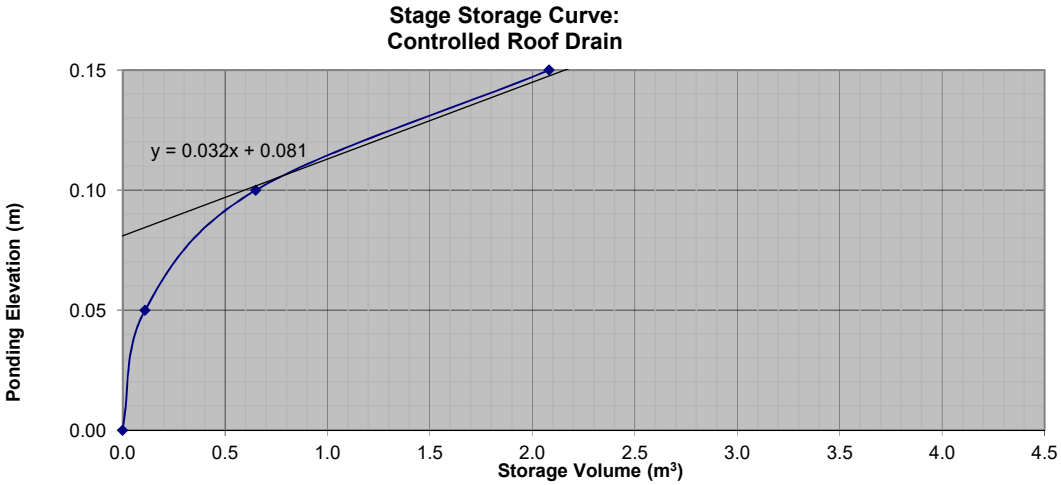
C = 0.90 Vol(max) = 0.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	2.44	1.65	0.49
10	178.56	1.79	1.00	0.60
15	142.89	1.43	0.64	0.58
20	119.95	1.20	0.41	0.50
25	103.85	1.04	0.25	0.38
30	91.87	0.92	0.13	0.24
35	82.58	0.83	0.04	0.08
40	75.15	0.75	-0.04	-0.09
45	69.05	0.69	-0.10	-0.26
50	63.95	0.64	-0.15	-0.45
55	59.62	0.60	-0.19	-0.63
60	55.89	0.56	-0.23	-0.83
65	52.65	0.53	-0.26	-1.02
70	49.79	0.50	-0.29	-1.22
75	47.26	0.47	-0.32	-1.42
90	41.11	0.41	-0.38	-2.04
105	36.50	0.37	-0.42	-2.67
120	32.89	0.33	-0.46	-3.31

Watts Accutrol Flow Control Roof Drains:		RD-100-A-ADJ set to 1/4 Exposed			
Design Event	**Flow (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.71	1.42	7.6	0.4	0.6
1:100 Year	0.79	1.58	10.2	1.2	1.3

Roof Drain Storage Table for RD # 23+24

Elevation	Area	Total Volume
m	m^2	m^3
0.00	0	0
0.05	4.4	0.1
0.10	17.2	0.7
0.15	40.1	2.1



WATTS®	Adjustable Accutrol Weir Tag: _____	Adjustable Flow Control for Roof Drains

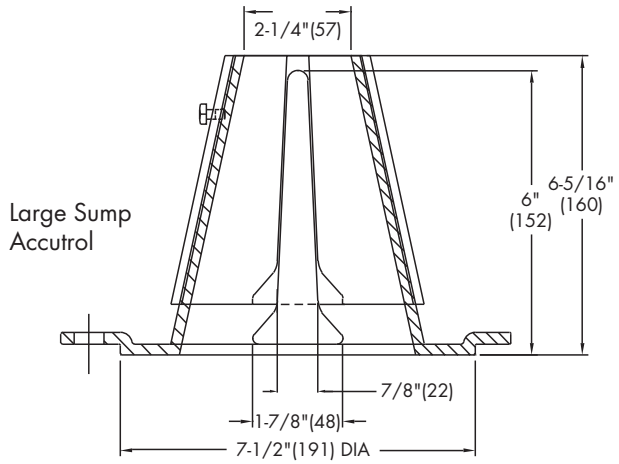
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

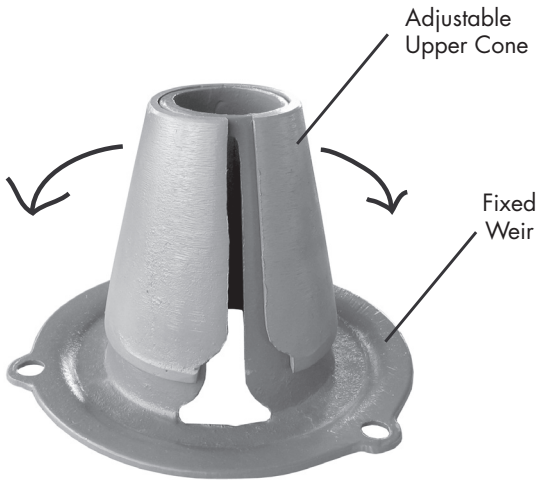
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name _____ Contractor _____

Job Location _____ Contractor's P.O. No. _____

Engineer _____ Representative _____

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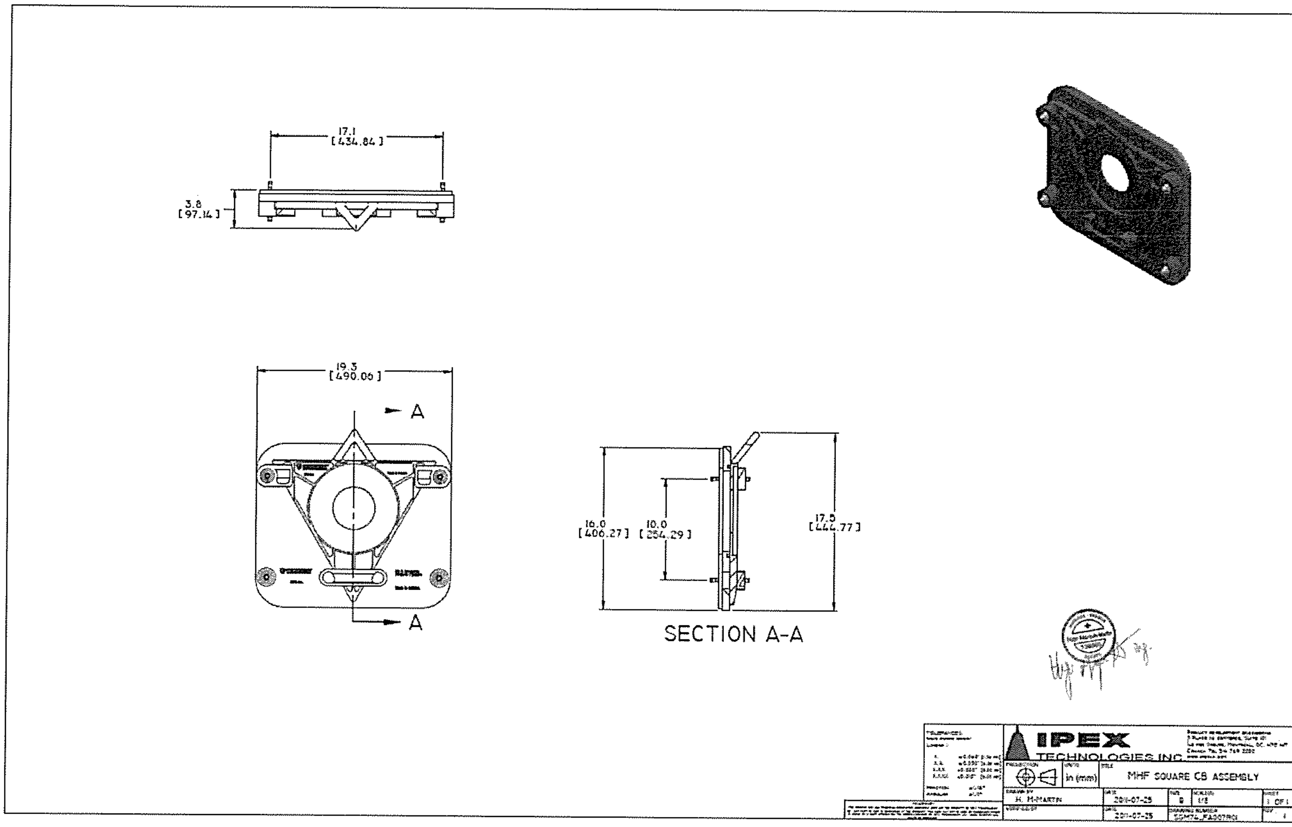
Tempest MHF ICD SQ Shop Drawing



APPENDIX D

Water Demands, Boundary Conditions and FUS Calculation

NOVATECH
Engineers, Planners & Landscape Architects

Adelaide Apartments Tower
PRELIMINARY WATER DEMAND CALCULATIONS

JOB NO. 116070

Water Demand (Proposed)

Building	Residential			Commercial	Demands (L/s)		
	Units		Total Pop'n (pers)	Office Employees (pers)	Average Day	Max. Daily	Peak Hour
	1 Bdrm	2 Bdrm					
New	216	12	328	0	1.33	3.32	7.31
Addition	22	2	35	0	0.14	0.35	0.78
Total	**238**	**14**	**363**	**0**	**1.47**	**3.68**	**8.09**

Notes:

Residential Densities (from City of Ottawa data):
- 1 Bedroom Apartment = 1.4 cap/unit
- 2 Bedroom Apartment = 2.1 cap/unit

Avg. Day Demand:
- Residential = 350 L/cap/day

Max. Daily Demand:
- Residential = 2.5 x Avg. Day

Peak Hour Demand:
- Residential = 2.2 x Max. Day

Prepared By:
NOVATECH
Date: January 21, 2019

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 116070
Project Name: Adelaide Apartments - Tower Addition
Date: 24/01/19
Input By: LGB
Reviewed By: GJM

Legend: Input by User; No Information or Input Required

Building Description: New residential Tower (with fire wall between ex. Adelaide building)
Fire Resistive Construction

Step			Choose		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame		1.5	0.6	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)	Yes	0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	750			
		Number of Floors/Storeys	29			
		Protected Openings (1 hr)	Yes			
		Area of structure considered (m^2)			**1,125**	
	F	**Base fire flow without reductions**				**4,000**
		F = 220 C (A)$^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**3,400**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-1,360**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	10.1 - 20 m		15%	**1,870**
		East Side	10.1 - 20 m		15%	
		South Side	2Hr Fire Wall		10%	
		West Side	10.1 - 20 m		15%	
				Cumulative Total	**55%**	
Results						
6	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**4,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**67**
				or	USGPM	1,057
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	1.5
		Required Volume of Fire Flow (m^3)			m^3	360

Lydia Bolam

From: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>
Sent: Thursday, May 30, 2019 2:53 PM
To: Lydia Bolam
Cc: Mottalib, Abdul
Subject: FW: Adelaide Tower Expansion - Watermain Boundary Conditions Request (D02-02-19-0023 / D07-12-19-0023)
Attachments: Adelaide Tower May 2019.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Lydia,

As requested.

--

Thanks,

Mohammad Abdul Mottalib, P. Eng.
Extension: 27798

From: …….
Sent: May 30, 2019 9:22 AM
To: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>
Subject: RE: Adelaide Tower Expansion - Watermain Boundary Conditions Request (D02-02-19-0023 / D07-12-19-0023)

The following are boundary conditions, HGL, for hydraulic analysis at Adelaide Tower (zone 1W) assumed to be connected to the 203mm on Aberdeen (see attached PDF for location).

Minimum HGL = 107.0m

Maximum HGL = 115.0m

MaxDay + Fireflow (67L/s) = 107.5m

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.

From: Lydia Bolam <l.bolam@novatech-eng.com>
Sent: May 28, 2019 10:09 AM

To: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>
Cc: Greg MacDonald <g.Macdonald@novatech-eng.com>
Subject: Adelaide Tower Expansion - Watermain Boundary Conditions Request (D02-02-19-0023 / D07-12-19-0023)

Good morning Abdul,

I would like to request the municipal watermain boundary conditions near the proposed Adelaide Tower Expansion development, located at Preston Square (300 Preston Street / 17 Aberdeen Street). This is as per your request in the City SPA comments letter received earlier this month. The location of the proposed water service and the existing on site fire hydrant are shown on the attached screenshot.

The theoretical water demands for the proposed high-rise residential Tower and the 1-storey addition to the existing Adelaide residential building are as follows:

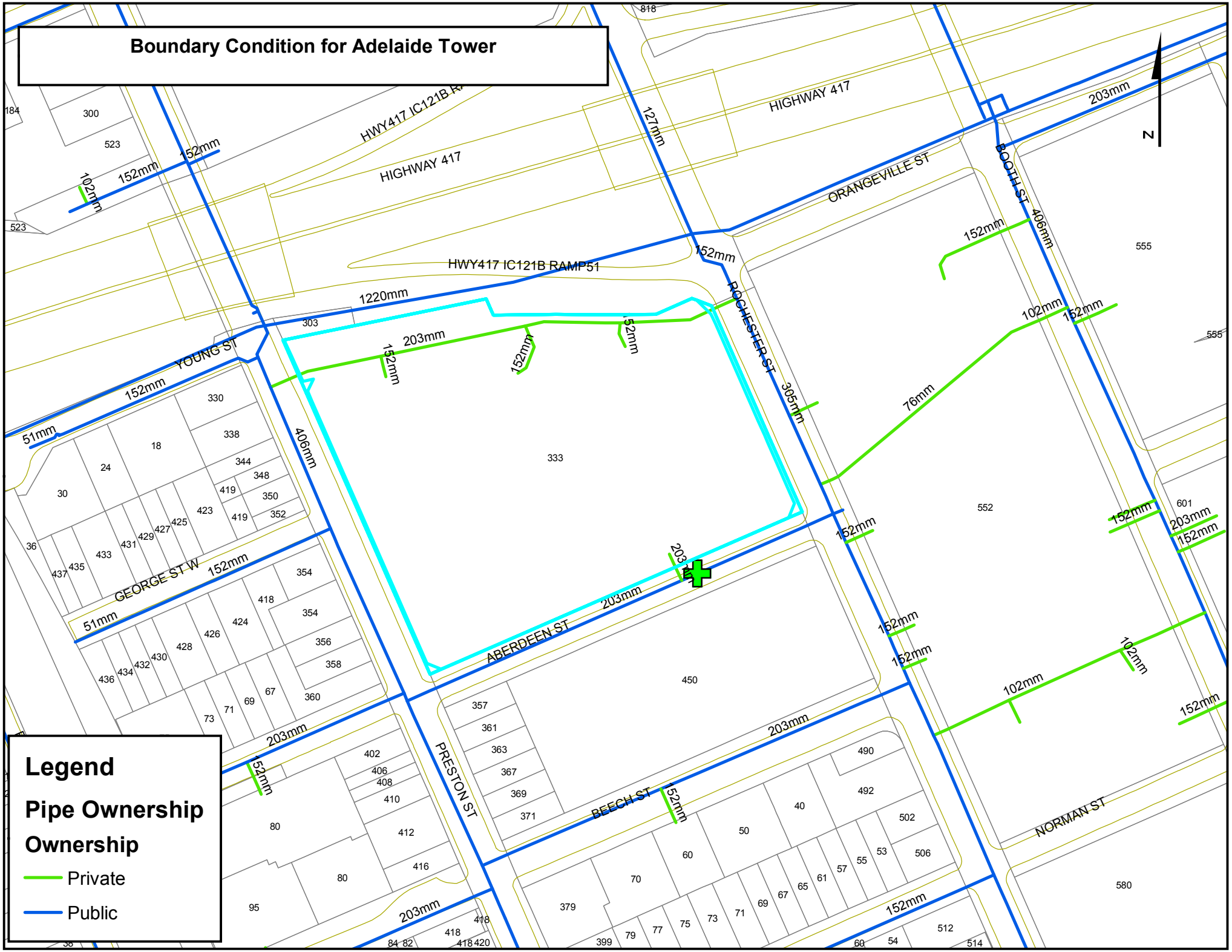
Building	Use	Average Water Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
New Tower	Residential	1.33	3.32	7.31
1-storey Addition		0.14	0.35	0.78
Total		**1.47 L/s**	**3.68 L/s**	**8.09 L/s**

Based on the Fire Underwriters Survey (FUS) Guidelines, the fire flow for the proposed building is approximately 67 L/s (see attached FUS calculations sheet).

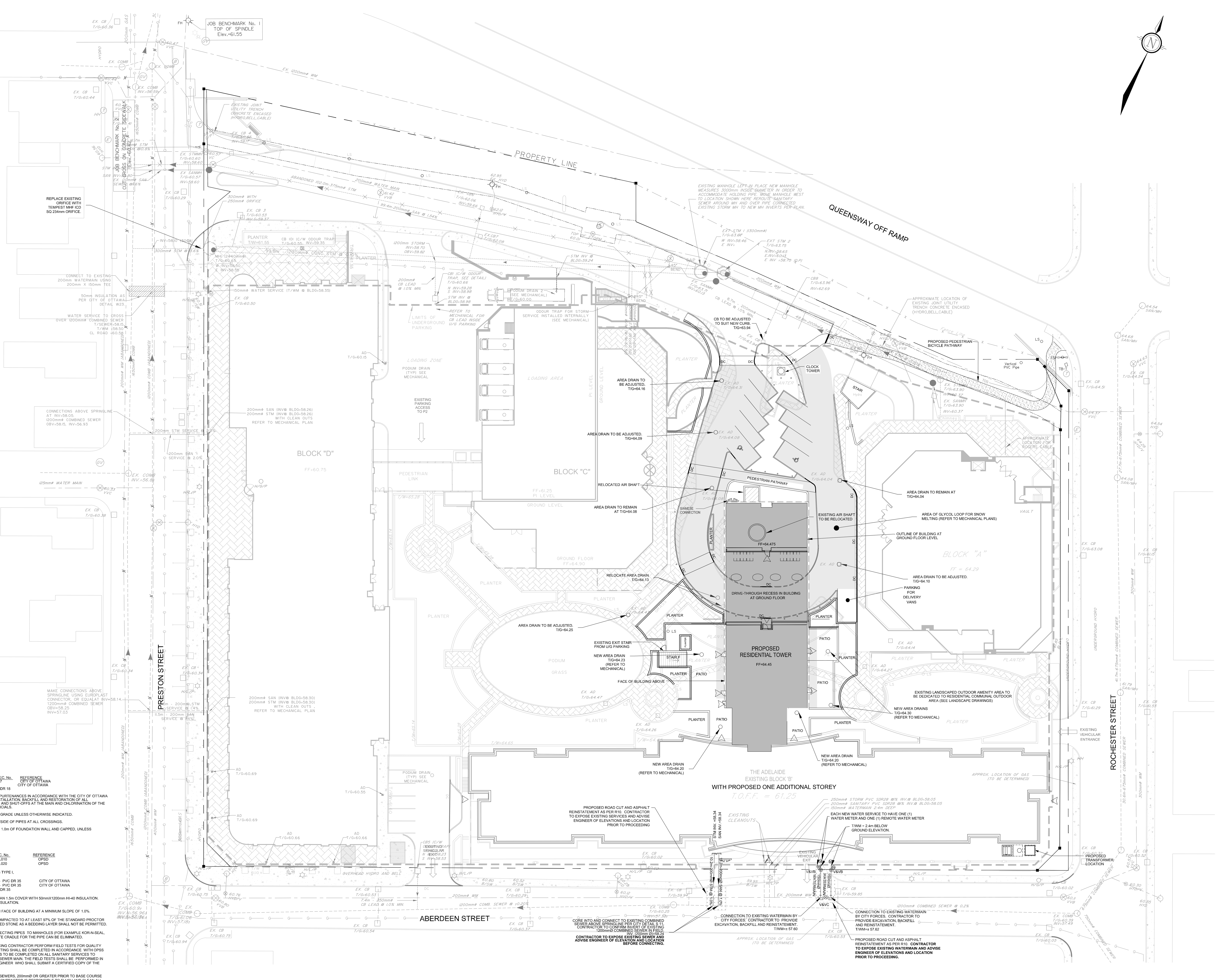
Please let me know if you have any questions or would like to discuss anything.

Kind regards,

Lydia Bolam, B.Eng., EIT
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext:276 | Fax: 613.254.5867


Boundary Condition for Adelaide Tower
HIGHWAY 417
HWY417 IC121B RAMP51
ORANGEVILLE ST
BOOTH ST
ROCHESTER ST
YOUNG ST
GEORGE ST W
ABERDEEN ST
PRESTON ST
BEECH ST
NORMAN ST
N
Legend
Pipe Ownership
Ownership
Private
Public

DRAWINGS



WATERMAIN NOTES:

1. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
WATERMAIN TRENCHING	W17	CITY OF OTTAWA
THERMAL INSULATION IN SHALLOW TRENCHES	W22	CITY OF OTTAWA
WATERMAIN	PVC DR 18	

2. SUPPLY AND CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS. EXCAVATION, INSTALLATION, BACKFILL AND RESTORATION OF ALL WATERMAINS BY THE CONTRACTOR. CONNECTIONS AND SHUT-OFFS AT THE MAIN AND CHLORINATION OF THE WATER SYSTEM SHALL BE PERFORMED BY CITY OFFICIALS.
3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED.
4. PROVIDE MINIMUM 0.25m CLEARANCE BETWEEN OUTSIDE OF PIPES AT ALL CROSSINGS.
5. WATER SERVICE IS TO BE CONSTRUCTED TO WITHIN 1.0m OF FOUNDATION WALL AND CAPPED, UNLESS OTHERWISE INDICATED.

SEWER NOTES:

1. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
CATCHBASIN (600x600mm)	705.010	OPSD
CB, FRAME & COVER	400.020	OPSD
SEWER TRENCH - BEDDING (GRANULAR A) COVER (GRANULAR A OR GRANULAR B TYPE I, WITH MAXIMUM PARTICLE SIZE=25mm)		
STORM SEWER	S11 - PVC DR 35	CITY OF OTTAWA
SANITARY SEWER	S11 - PVC DR 35	CITY OF OTTAWA
CATCHBASIN LEAD	PVC DR 35	

2. INSULATE ALL PIPES (SAN/STM) THAT HAVE LESS THAN 1.5m COVER WITH 50mmX1200mm HI-40 INSULATION. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION.
3. SERVICES ARE TO BE CONSTRUCTED TO 1.0m FROM FACE OF BUILDING AT A MINIMUM SLOPE OF 1.0%.
4. PIPE BEDDING, COVER AND BACKFILL ARE TO BE COMPACTED TO AT LEAST 97% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. THE USE OF CLEAR CRUSHED STONE AS A BEDDING LAYER SHALL NOT BE PERMITTED.
5. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTING PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). THE CONCRETE CRADLE FOR THE PIPE CAN BE ELIMINATED.
6. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.
7. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS, 200mmØ OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES.
8. ALL CATCHBASINS TO BE CONNECTED AS PER CITY OF OTTAWA STANDARD DRAWING S11.1
9. CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GENERAL PLAN OF SERVICES INDICATING ALL SERVICING AS-BUILT INFORMATION SHOWN ON THIS PLAN. AS-BUILT INFORMATION MUST INCLUDE: PIPE MATERIAL, SIZES, LENGTHS, SLOPES, INVERT AND T/G ELEVATIONS, STRUCTURE LOCATIONS, VALVE AND HYDRANT LOCATIONS, T/WM ELEVATIONS AND ANY ALIGNMENT CHANGES, ETC.
10. ROOF DRAINS TO BE WATTS ADJUSTABLE FLOW CONTROL ROOF DRAINS SET AT $\frac{1}{4}$ WEIR OPENING.

2019-05-30 1:11 PM

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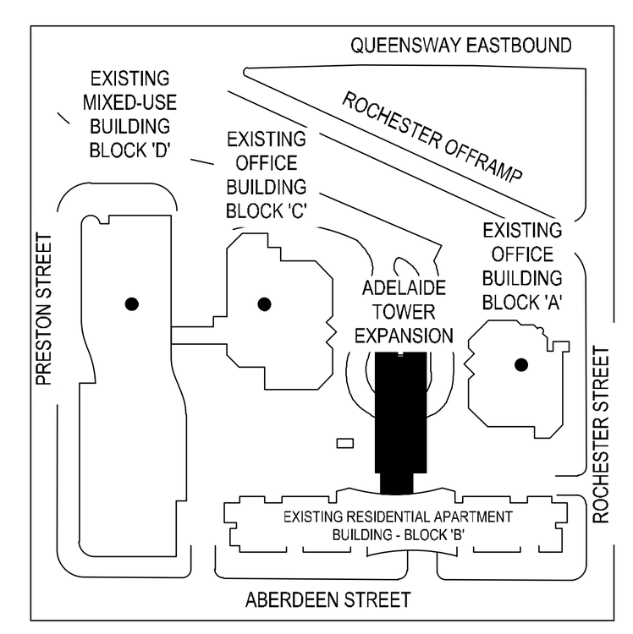
ISSUES

No.	DESCRIPTION	DATE
1.	ISSUED FOR SPA	2016/09/20
2.	REVISED PER CITY COMMENTS	2016/12/14
3.	REVISED PARKING ALONG ENTRANCE	2017/04/07
4.	PATH ADDED FROM ROCHESTER	2017/05/24
5.	SIAMESE CONNECTION, DEPRESSED CURBS AND FIRE TRUCK ROUTE ADDED	2017/07/12
6.	REVISED SITE PLAN APPLICATION	2019/01/11
7.	ISSUED FOR COORDINATION	2019/04/02
8.	ISSUED FOR SPA RE-SUBMISSION	2019/05/30

KEYPLAN



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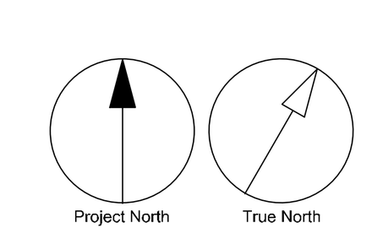

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PROJECT

ADELAIDE TOWER EXPANSION

17 Aberdeen Street
Ottawa, Ontario, Canada
K1S 3J3

PROJECT NO: 116070	
DRAWN BY: **LGB**	CHECKED BY: **GJM**
PROJECT MGR: **GJM**	APPROVED BY: **GJM**
SCALE: **1:250**	DATE: **2019-01-04**

SHEET TITLE

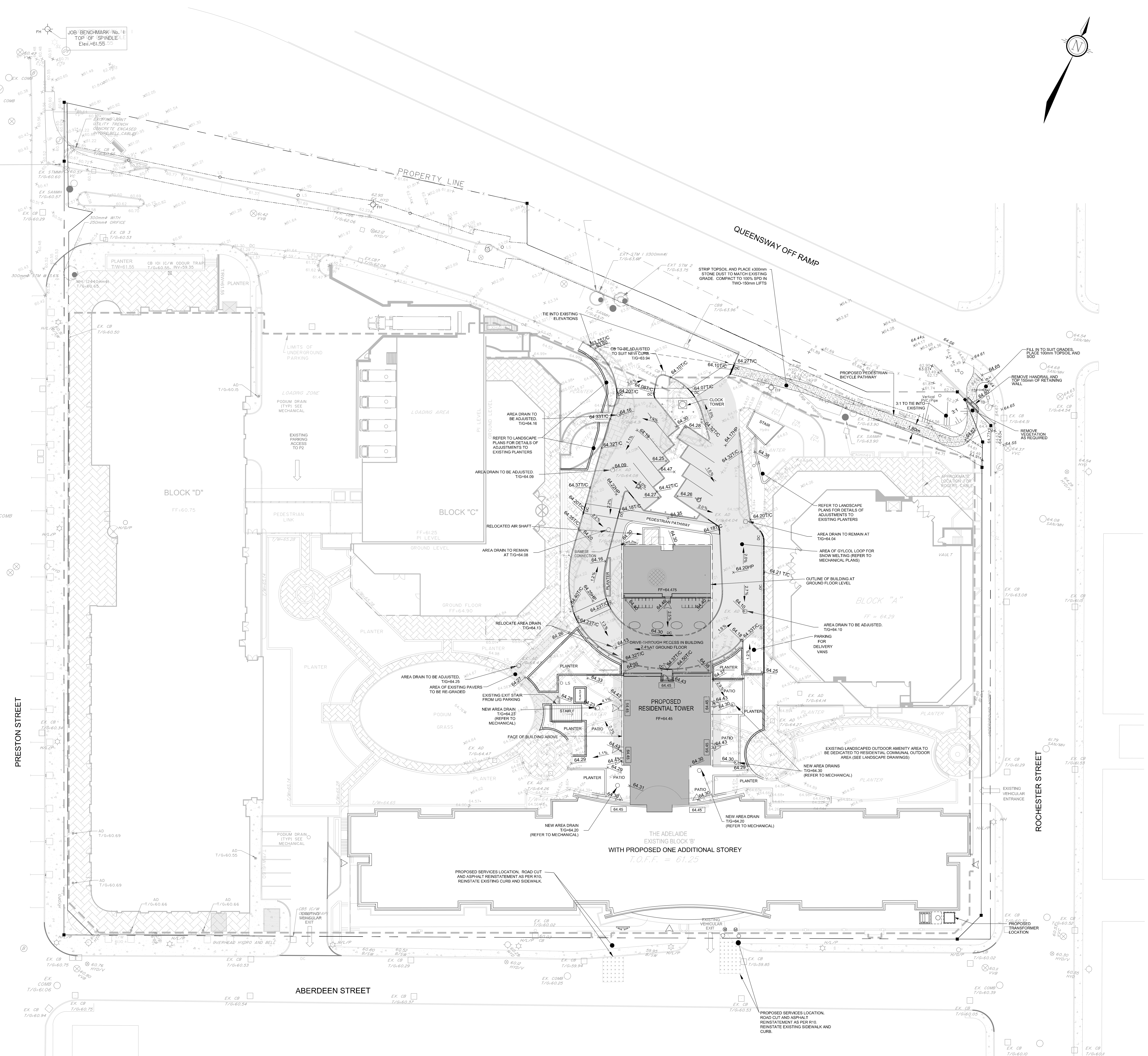
GENERAL PLAN OF SERVICES

SHEET NUMBER C.100 | ISSUE 8

SCALE CHECK 1 in 10mm

D07-12-19-0023

City of Ottawa Project #: D07-12-19-0023



GRADING NOTES:

1. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS AS DIRECTED BY THE SITE ENGINEER OR GEOTECHNICAL ENGINEER.
2. EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF GRANULARS.
3. ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUB-EXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.
4. THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 100% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5. MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
6. ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
7. ALL CURBS SHALL BE BARRIER CURB (150mm) UNLESS OTHERWISE NOTED AND CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.1).
8. REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GRADING PLAN INDICATING AS-BUILT ELEVATIONS OF ALL DESIGN GRADES SHOWN ON THIS PLAN.
14. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

GENERAL NOTES:

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $5,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER.
6. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
7. ALL ELEVATIONS ARE GEODETIC.
8. THE GEOTECHNICAL CONSULTANT IS TO REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.
9. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.
10. REFER TO STORMWATER MANAGEMENT REPORT(R-2016-076) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
11. SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
12. PROVIDE LINE/PARKING PAINTING.

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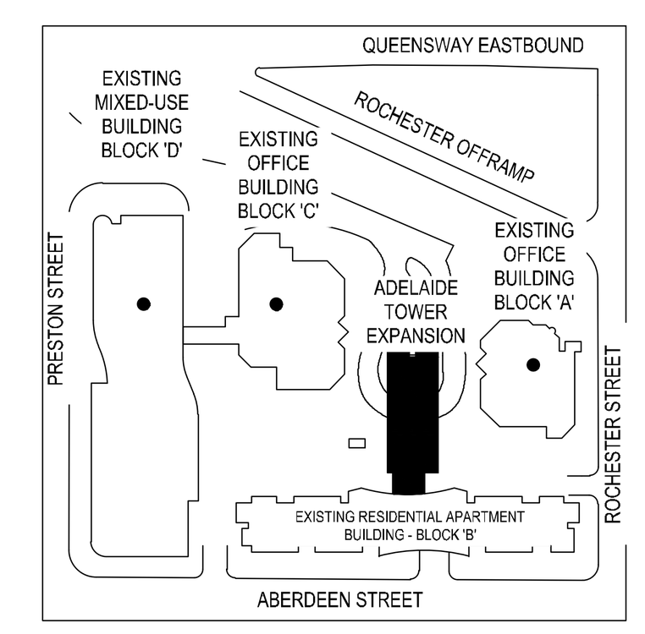
KEYPLAN



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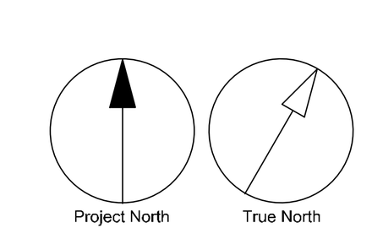

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PROJECT

ADELAIDE TOWER EXPANSION

17 Aberdeen Street
Ottawa, Ontario, Canada
K1S 3J3

PROJECT NO: 116070

DRAWN BY: **MWC/LGB**	CHECKED BY: **LGB**
PROJECT MGR: **GJM**	APPROVED BY: **GJM**
SCALE: **1:250**	DATE: **2019-01-04**

SHEET TITLE

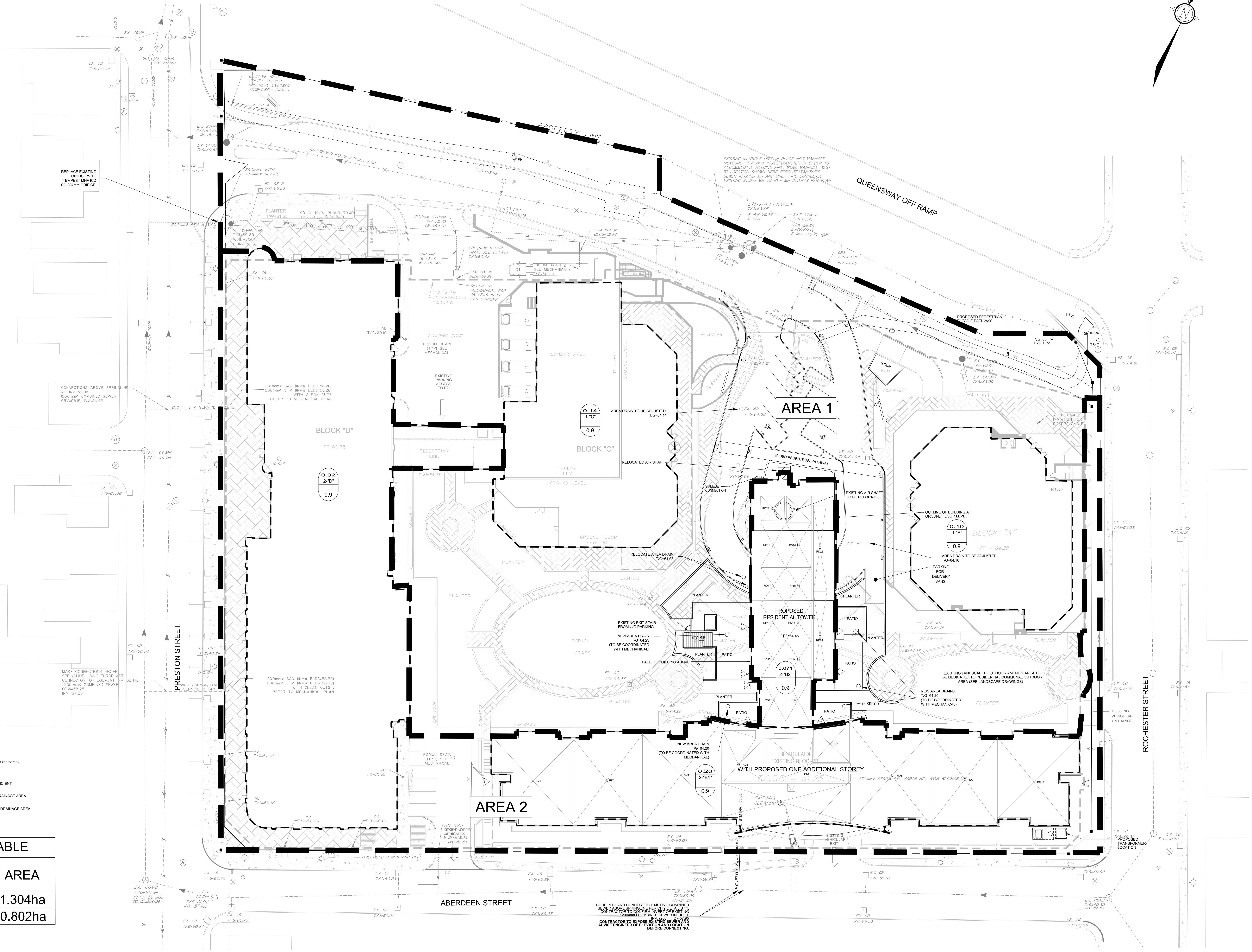
GRADING PLAN

SHEET NUMBER C.101 | ISSUE 8

SCALE CHECK 1 in 10mm

2019-05-30 1:11 PM

City of Ottawa Project #: D07-12-19-0023



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ISSUES

No.	DESCRIPTION	DATE
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2.	REVISED AS PER CITY COMMENTS	2016/12/14
3.	REVISED PARKING ALONG ENTRANCE	2016/04/07
4.	REVISED FOR SPA. ISSUED WITH SWM BRIEF.	2019/01/25

KEYPLAN

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SCALE: **1:250**	DATE: **2018-11-30**

SHEET TITLE

STORM DRAINAGE AREA PLAN

SHEET NUMBER **C.103** ISSUE **4**

SCALE CHECK 10mm 1 in

LEGEND

0.210 — DRAINAGE AREA (hectares)
A — AREA ID
0.77 — RUN-OFF COEFFICIENT
ROOF STORM DRAINAGE AREA
ON-SITE STORM DRAINAGE AREA

AREA TABLE	
AREA #	AREA
1	1.304ha
2	0.802ha

NOTES

1. REFER TO THE 'STORMWATER MANAGEMENT AND SERVICING BRIEF' (R-2016-076) DATED JANUARY 2019 PREPARED BY NOVATECH FOR DRAINAGE AND STORMWATER MANAGEMENT DETAILS.
2. ALL CONTROLLED FLOW ROOF DRAINS FOR THE PROPOSED BUILDING TO BE WATTS ADJUSTABLE ACCUTROL ROOF DRAINS AT $\frac{1}{4}$ WEIR OPENING EXPOSED.

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