Servicing and Stormwater Management Report - Norberry Residences - 740 Springland Drive

Project # 160401483

Prepared for:
Great Wise Developments

Prepared by:
Stantec Consulting Ltd.

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Sign-off Sheet

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1.0 BACKGROUND

Stantec Consulting Ltd. has been retained by Great Wise Developments to prepare a servicing and stormwater management report in support a zoning By-law amendment and site plan control submission. The development is located at 740 Springland Drive, Norberry Residences Ltd., within the existing Riverside Park Community in the City of Ottawa, displayed in **Figure 1**.

The proposed site is 5.68ha and currently consists of three 6-storey and one 10-storey residential apartment building for a total of 761 units. Each building is independently serviced.

The proposed development includes the construction of three new 5 to 6-storey residential buildings within the existing site property for a total of 287 additional units. The construction will also include modifications to the existing parking areas within the entire site. The proposed design is to have each new building block serviced independently to existing infrastructure, similar to the existing buildings, while revising existing and proposed parking areas as illustrated on the site plan "Site Plan - Norberry Residences" by Alexander Wilson Architect Inc, February 2025, seen in **Appendix E**.

The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the guidelines outlined per consultation with City of Ottawa staff.

Background
April 25, 2025

Figure 1 – Proposed Site Plan Location

2.0 REFERENCES

Documents referenced in preparation of this report include:

- Assessment of Adequacy of Public Services for Great Wise Developments, 740 Springland Drive, Ottawa ON, David Schaeffer Engineering Ltd., September 2017, Revision 1
- City of Ottawa Sewer Design Guidelines, 2nd Ed., City of Ottawa, October 2012
- City of Ottawa Design Guidelines – Water Distribution, Infrastructure Services Department, City of Ottawa, First Edition, July 2010
- Geotechnical Investigation - Proposed Multi Storey Buildings – Norberry Crescent, Paterson Group Inc., March 27, 2019.
- Environmental Noise Control Study - Proposed Multi Storey Buildings – Norberry Crescent, Paterson Group Inc., March 27, 2019.
- Phase 1 Environmental Site Assessment – 2660 Norberry Crescent & 740, 790, 840 Springland Drive, Paterson Group Inc., February 16, 2017.

3.0 POTABLE WATER SERVICING

3.1 EXISTING CONDITIONS

The proposed 740 Springfield Drive development is a part of pressure zone 2C of the City of Ottawa water distribution system. Potable water is supplied to the site via a 200mm watermain within Norberry Crescent and a 300mm watermain on Springland Drive located just south of the Billings Bridge Pump station.

3.2 WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008) and the Ottawa Design Guidelines – Water Distribution (2010). A daily rate of 280 L/cap/day has been applied for the population of the proposed site. The total estimated population count for all three proposed buildings is 517 persons based on a combined unit count of 287 using the average apartment unit density of 1.8 persons/unit set out by the City of Ottawa Water Distribution Guidelines. See **Appendix A.1** for detailed domestic water demand estimates.

The water demand for each building is displayed in **Table 1** below:

Table 1 - Domestic Water Demand Summary

Building ID	Unit Count	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hourly Demand (L/s)
A	103	185	0.60	1.50	3.30
B	94	169	0.55	1.37	3.02
C	90	162	0.53	1.31	2.89
Total	234	517	1.67	4.19	9.21

Ordinary construction was considered in the assessment for fire flow requirements according to the FUS Guidelines. The FUS Guidelines indicate that low hazard occupancies include apartments, dwellings, dormitories, hotels, and schools, and as such, a low hazard occupancy / limited combustible building contents credit was applied. A sprinkler system conforming to NFPA 13 was considered, and a credit applied per FUS Guidelines. Based on calculations per the FUS Guidelines, the maximum required fire flows for this development are 233L/s (14,000L/min for Building B).

Based on Fire Underwriters' Survey (FUS) fire flow demand calculations (see **Appendix A**) the fire flow demands for each of the proposed buildings are displayed in **Table 2** below:

Table 2 - Building Fire Flow Demand Summary

Building ID	Building A	Building B	Building C
FUS Fire flow demand (L/s)	200	233	200

3.3 BOUNDARY CONDITIONS

Boundary conditions for two connection points along the Norberry Crescent 200mm watermain were provided by the City of Ottawa for the three demand scenarios. Connection point one corresponds to building A and connection point two applies to building B and C.

The following is a summary of the boundary conditions received from the City of Ottawa in an email dated April 25, 2025 (see **Appendix A**), and are displayed in **Table 3** below organized by Building ID:

Table 3 - Watermain Boundary Conditions for Hydraulic Analysis

Demand Scenario	**Building A**	**Building B**	**Building C**
Minimum HGL During Peak Hour Demand	125.0m	125.0m	125.0m
Max HGL – Average Day Demand	132.2m	132.2m	132.2m
HGL For Maximum Day + Fire Flow Demands	112.3m	104.5m	104.5m

Finished floor elevations used in the analysis are presented in **Drawing GP-1** found in **Appendix E.**

3.4 PROPOSED SERVICING

Water supply is proposed to be connected to each building independently, feeding directly off the adjacent 200mm watermain on Norberry Crescent. Each building is proposed to be fitted with two 50mm service connections. The two connections per building will be required given the average day demand exceeds 50 m^3/day, as per the City of Ottawa Technical Bulletin ISTB 2014-02. The proposed servicing layout can be found in the **SSP Drawing** found in **Appendix E.**

Per the boundary conditions provided by the City of Ottawa and based on a site elevation of 77.9 m per **Drawing GP-1**, adequate flows are available for the subject site with pressures ranging from 47.1m (67.0 psi) to 54.3m (77.2 psi) under average day and peak hour conditions. This pressure range within the guidelines of 50 - 80 psi based on Ottawa's Design Guidelines for Water Distribution. No additional measures are required to address minimum and maximum pressure conditions.

Under emergency fire flow conditions, the minimum pressure in the distribution system is allowed to drop to 140kPa (20 psi).

Using boundary conditions for the proposed development under maximum day demands and a fire flow requirement of 233L/s per the FUS methodology, it can be confirmed that the system will maintain a residual pressure of approximately 37.8 psi (26.6 m); which is in excess of the required 140 kPa (20 psi). The above demonstrates that the existing watermain within Norberry Crescent can provide adequate fire and domestic flows in excess of flow requirements for the subject site. Existing hydrants along Norberry Crescent provide adequate building coverage and are located within 45m of proposed building fire department connections per Ontario Building Code requirements.

3.5 SUMMARY OF FINDINGS

The proposed development is located in an area of the City's water distribution system that has sufficient capacity to provide both the required domestic and emergency fire flows. Based on boundary conditions as provided by City of Ottawa staff, fire flows are available for this development based on FUS guidelines and as per the City of Ottawa water distribution guidelines.

4.0 WASTEWATER SERVICING

4.1 EXISTING CONDITIONS

The proposed site is surrounded by a 225mm diameter sanitary sewer on Norberry Crescent and a 525mm sanitary sewer on Springland Drive, all of which form part of the Rideau River Collector Sewer catchment area. Both sewers within the adjacent rights-of-way are available to service the proposed buildings.

The four existing residential buildings on site are serviced by the Springland Drive 525mm diameter sanitary sewer adjacent to the subject site.

A residual flow capacity analysis by DSEL was performed based on contributary areas. It was determined in their Assessment of Adequacy of Services Report for Great Wise Developments (2017), see **Appendix B**, that there is a residual capacity of 16.1 L/s available in the north end of the sanitary sewer on Norberry Crescent.

4.2 DESIGN CRITERIA

As outlined in the City of Ottawa's Sewer Design Guidelines the following design criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Full Flow Velocity – 0.6 m/s
- Maximum Full Flow Velocity – 3.0 m/s
- Manning's roughness coefficient for all smooth walled pipes – 0.013
- Average Wastewater Generation – 280L/cap/day
- Peak Factor – 4.0 (Harmon's)
- Extraneous Flow Allowance – 0.33 l/s/ha
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m
- Population Density for Average Apartment– 1.8 pers./apartment

4.3 PROPOSED SERVICING

The proposed buildings will be serviced independently based on an overall waste generation for 517 people in addition to an assumed infiltration rate for the development area. The service connections consist of a 135mm diameter pipe that increases at an immediate manhole to a 200mm diameter pipe which outlets to the existing 225mm diameter sanitary sewer within the Norberry Crescent right of way. The contributing flow considers infiltration for only the building area given that there is only a small service connection pipe at the outer edge of the property

vulnerable to infiltration. The layout for the sanitary service connections can be found in the **OSSP-1 Drawing** in **Appendix E**. The calculations made to determine the projected sanitary outflows are set out in the sanitary design sheet found in **Appendix B** and summarized in **Table 4** below.

Table 4 - Sanitary Outflow Summary

Building ID	Total Sanitary Outflow (L/s)
A	2.2
B	2.0
C	1.9
Total	**6.1 L/s**

The estimated wastewater flow generation for the proposed site changes is 6.1 L/s, which is well within the downstream flow capacity of 16.1 L/s, set out in the Assessment of Adequacy of Public Service by DSEL engineering (September 2017). Therefore, the sanitary outflow from the proposed development is predicted to be well within the capacity of the downstream wastewater infrastructure.

5.0 STORMWATER MANAGEMENT AND SERVICING

5.1 OBJECTIVES

The overall site has been provided stormwater management criteria set out by the City of Ottawa. Stormwater management criteria will be applied for site areas being redeveloped, whereas existing buildings and parking areas to remain will discharge to their contributing sewers per predevelopment conditions.

The site has been divided into subcatchments for both existing and post-development conditions. Each subcatchment is characterized as either developed or undeveloped for the means of determining which criteria applies.

The existing and proposed stormwater drainage areas are displayed in the **SD-1** and **EXSD Drawings** found in **Appendix E.**

5.1.1 Proposed Development Areas

The objective of this stormwater management (SWM) plan is to determine the measures necessary to control the post development peak minor system release rate from the 100-year storm event to that of the 5-year storm under existing conditions for on-site areas to be redeveloped (approximately 1.51ha of the 5.59ha site). Quality control will also be required for runoff associated with the proposed development areas.

5.1.2 Undeveloped Areas

The areas of the site not being redeveloped are not anticipated to require further modifications to the stormwater management plan. Areas not under redevelopment expect negligible change in runoff coefficient values, and thus would indicate no change in stormwater runoff quantity or direction for such areas.

5.2 SWM CRITERIA AND CONSTRAINTS

The stormwater runoff coming from the site are tributary to the Sawmill Creek sub-watershed and is part of the City of Ottawa sewer system. The stormwater management criteria for the proposed site have therefore been set out by City of Ottawa staff and the City of Ottawa Sewer Design Guidelines. The following summarizes the criteria used in the preparation of this stormwater management plan:

- Stormwater runoff from the proposed Building A, B and C and affected adjacent parking lots up to and including the 100-year event to be stored on site and released into the minor system at the 5-year storm release rate for the developed areas under existing conditions, at a maximum rate equivalent to 282.3 L/s for the for the portion of the site that will be developed.
- Maximum 100-year water depth of 0.35 m in parking and access areas
- Provide adequate emergency overflow conveyance (overland flow route) off-site for redeveloped areas. It is of note that some areas not forming part of the site redevelopment area may not have been designed with an overland flow outlet to the municipal right-of-way. Such areas are to remain as per existing conditions.
- Size storm sewers to convey 5-year storm event, assuming only roof controls are imposed. (i.e. provide capacity for system without inlet control devices installed)
- Size storm sewers using an inlet time of concentration (Tc) of 10 minutes.
- Quality control of runoff from the proposed developed areas with a TSS removal efficiency of 80% is to be provided on site prior to discharge into the Norberry Crescent Right of Way.
- Proposed sites to discharge the existing 1200mm diameter storm sewer running east along Springland Drive ROW at the boundary of the subject site and ultimately to Sawmill Creek (City of Ottawa).
- Post-development runoff coefficient (C) value based on proposed impervious areas as per site plan drawing (see **Appendix E**)
- Pre-development runoff coefficient (C) value based on existing impervious areas as per existing conditions / removals drawing (see **Appendix E**)
- Areas under redevelopment to meet City of Ottawa quantity control target of the 5-year event using a runoff coefficient C of 0.5.

5.3 STORMWATER MANAGEMENT DESIGN

The proposed changes to the residential development will consist of adding one five-storey and two six-storey buildings, revisions to existing parking and landscaped areas and associated

servicing infrastructure. The remainder of the site will incur minimal to no changes from its existing conditions.

Stormwater runoff from the proposed development will be directed to the existing storm sewers on Norberry Crescent. Sump pumps and backwater valves will be provided for foundation drainage of the proposed buildings. The proposed site plan and existing storm sewer infrastructure on Norberry Crescent are shown on **Drawing SSP-1**.

5.3.1 Design Methodology

The proposed stormwater management plan is designed to detain runoff on the rooftops and on surface areas to ensure that peak flows after construction will not exceed the target release rates for the site.

Areas of the site incurring changes due to the newly proposed buildings and parking revisions will be controlled where possible via inlet control devices (ICDs) installed within receiving catch basins in order to restrict the peak minor system release rate to the target amount.

Any areas being developed that were left uncontrolled are as a result of grading restrictions, in particular to allow for emergency overland flow runoff from the proposed site and to avoid impacts to existing or proposed building openings. These uncontrolled release rates were compensated for by over controlling in other developed areas where inlet control devices (ICDs) were implemented.

5.3.2 Allowable Release Rate

The Modified Rational Method was used to assess the quantity and volume of runoff generated during post development conditions. The site was subdivided into subcatchments (subareas) tributary to storm sewer inlets, as defined by the location of catchbasins / inlet grates and used in the storm sewer design (see **Appendix C**). A summary of subareas and runoff coefficients is also provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management subcatchments, found in **Appendix E**.

City of Ottawa staff have provided the quantity control criteria for the overall site, with criteria specified for the developed areas. The City of Ottawa staff have outlined that the minor system target criteria for these areas is such that the 100-year post development release rate must be at most equal to the 5-year release rate of the same areas under existing conditions.

In order to determine this 5-year target release rate the Modified Rational Method was employed to assess the rate of runoff for existing conditions for the areas of the site being developed. Runoff coefficients (C) for the identified catchment areas have been calculated

based on actual pervious and impervious areas shown on the existing site plan. C coefficient values have been increased by 25% for the post-development 100-year storm event based on MTO Drainage Manual recommendations.

A summary of the existing subcatchments used to establish the target release rate is displayed below in **Table 5**.

Q = 2.78 CiA
Where: Q = peak flow rate, L/s
A = drainage area, ha
I = rainfall intensity, mm/hr (per Ottawa IDF curves)
C = site runoff coefficient

Table 5: Target Release Rates

Existing Areas to be Developed	Area (ha)	Runoff Coefficient (C value)	5-year $Q_{release}$ (L/s)
EX-6	0.42	0.66	80.7
EX-16	0.48	0.58	80.8
EX-17	0.41	0.90	106.4
Ex-18	0.05	0.20	2.8
Ex-20	0.19	0.21	11.6
Post Development Target			**282.3**

In addition to the above target, proposed areas for redevelopment (Areas L301A, L102A, L103A, L103B, L300A, L303A, RAMP-B, and BLDGA, B and C) are required to meet a peak discharge rate equating to that of the 5-year event using a runoff coefficient of 0.50 and a time of concentration of 10 minutes. Areas F100A and F101A have not been included in the above, as their drainage patterns are relatively unchanged from existing conditions. The above areas total 1.17ha, with a resultant peak release rate target of **169.3L/s**.

5.3.3 Existing Development to Remain

The remaining 4.08ha of the development constituting areas EX1 through EX5, EX7 through EX15, and EX19 are not anticipated to receive significant changes with respect to tributary impervious area, and are not proposed to receive storm sewer modifications.

The area and runoff coefficient for the portions of the site to remain was summarized based on **Drawing SD-1** and **Drawing-EXSD**. The AxC values listed in the table below measure the area multiplied by the runoff coefficient during predevelopment and post-development. The

imperviousness of the subcatchments vary individually based on soft landscaping being added to areas and hard surfacing to others, however, changes to overall AxC are negligible. A summary of the calculated pre-development and post-development AxC values is displayed in **Table 6** below.

Table 6: AxC Comparison Summary for Existing Areas to Remain

Area ID	Pre Development AxC	Post Development AxC
EX-1	0.091	0.094
EX-2	0.094	0.100
EX-3	0.209	0.208
EX-4	0.497	0.432
EX-5	0.208	0.208
EX-7	0.015	0.015
EX-8	0.495	0.464
EX-9	0.055	0.055
EX-10	0.201	0.259
EX-11	0.049	0.056
EX-12	0.209	0.209
EX-13	0.209	0.209
EX-14	0.118	0.132
EX-15	0.034	0.034
EX-19	0.062	0.07
Total	**2.54**	**2.54**

5.3.4 Storage Requirements

The site requires quantity control measures to meet the stormwater release criteria. It is proposed that restricted release rooftop drains are to be used to reduce the peak outflow from the site. Additionally, surface storage on parking areas will be provided. Detailed stormwater management calculations are provided in **Appendix C**.

5.3.4.1 Rooftop Storage

It is proposed to retain stormwater on the rooftops by installing restricted flow roof drains. The following calculations assume the roof will be equipped with Watts drains 25% open, see **Appendix C** for details.

Watts Drainage "Accutrol" roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Accutrol" weir has been used as an example only, and that other products may be specified for use, provided that the total roof drain release rate is restricted to match the maximum rate of release indicated in **Table 7**, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater.

Further details regarding the retention of stormwater on the proposed rooftop during the 5 and 100-year storm events can be found in **Appendix C**.

Table 7: Peak Controlled (Rooftop) 100-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDGA	0.12	0.14	7.4	40.0
BLDGB	0.11	0.14	7.3	36.0
BLDGC	0.12	0.14	7.4	40.0
Total			**22.1**	**116.0**

5.3.4.2 Surface Storage

In addition to rooftop storage, it is proposed to detain stormwater on the surface parking lot areas and in two pipe sections using inlet control devices (ICDs) in the proposed drainage structures. The modified rational method was used to determine the peak volume requirement for the parking areas. **Table 8** summarizes the proposed ICD characteristics.

Table 8: 5 and 100 Year ICD Characteristics

Area ID	Structure ID	Orifice Type	5-year Head (m)	5-year Release Rate (L/s)	100-year Head (m)	100-year Release Rate (L/s)
L103B	CB203	LMF 95	1.48	9.7	1.63	10.2
L103A	CB201	83mm Diameter Orifice	1.58	5.4	1.63	18.7
L102A	CB200B	LMF 80	1.54	7.1	1.66	7.4
L301A	AREA DRAIN 301	127mm Diameter Orifice	1.38	40.2	1.56	42.8
L300A	AREA DRAIN 300	127mm Diameter Orifice	1.38	40.2	1.56	42.8

Area ID	Structure ID	Orifice Type	5-year Head (m)	5-year Release Rate (L/s)	100-year Head (m)	100-year Release Rate (L/s)
L303A	CB207	83mm Diameter Orifice	1.53	12.1	1.62	18.6
Total				**114.7**		**140.3**
Total	**(Including Roof Release)**	***NOTE: Totals may not sum exactly due to rounding**		**134.1**		**162.4**

5.3.5 Uncontrolled Area

A small portion of the site fronting and adjacent to Norberry Crescent (EX-18, UNC-2) could not be graded to enter the site's storm sewer system and will sheet drain uncontrolled on to the adjacent street. The runoff from drainage area F100A flows into a trench drain and is to connect with the adjacent on-site building's internal plumbing. These uncontrolled areas are displayed on **Drawing SD-1. Table 9** and

Table 10 below summarize the 5 and 100-year uncontrolled release rates from the proposed development.

Table 9: Peak Uncontrolled (Tributary) 5-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	$Q_{release}$ (L/s)
F100A	0.11	0.49	15.6
F101A	0.09	0.87	22.7
UNC-2	0.05	0.30	4.6
EX-18	0.07	0.25	4.9
RAMP-B	0.01	0.77	3.6
Total			**51.4**

Table 10: Peak Uncontrolled (Tributary) 100-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	$Q_{release}$ (L/s)
F100A	0.11	0.61	33.4
F101A	0.09	1.00	44.7
UNC-2	0.05	0.38	9.9
EX-18	0.07	0.31	10.4
RAMP-B	0.01	0.96	5.7
Total			**104.2**

5.3.6 Results

The proposed redeveloped areas have a 100-year minor system release rate of 266.6 L/s, which lies below the predevelopment release rate of 282.3 L/s. Additionally, redeveloped areas forming controlled runoff from the site release at less than the target rate of 169.3L/s. Therefore, the proposed stormwater network for the developed areas meets the stormwater management quantity control criteria set out by the City of Ottawa.

These results are quantified in **Table 11** below:

Table 11: Proposed Development Release Rate Summary

Proposed Developed Area of Site		
Flow Classification	**100-year Release Rate (L/s)**	**Target Release Rate (L/s)**
Controlled Runoff	162.4	**169.3**
Uncontrolled Runoff	104.2	
Total	**266.6**	**282.3**

Rainfall events beyond the 100-year storm (climate change event) will spill from the proposed ponding locations as shown along the proposed major overland flow route to adjacent downstream rights of way as depicted on **Drawing GP-1** and identified in **Section 6** below.

5.3.7 Water Quality Control

On-site water quality control is required to provide 80% TSS removal prior to discharging to Springland Drive and ultimately to Sawmill Creek. There are three Stormceptor units (model STC300) proposed downstream of the proposed buildings and parking areas to treat runoff from impervious surfaces prior to release to the existing downstream minor system. The Stormceptors will provide greater than 80% TSS removal per detailed sizing calculations for included in **Appendix C.4**. The Stormceptor units will be privately maintained. The location and general arrangement of the Stormceptor units are indicated on **Drawing SD-1**.

6.0 GRADING AND DRAINAGE

A grading and drainage plan has been prepared which satisfies the stormwater management requirements and any grade raise restrictions for the site. Site grading has been established to provide an overland flow route required for stormwater management directed in its majority towards Norberry Crescent. Grades along the property lines of the site have been set to tie smoothly into the existing grades.

The subject site maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the existing Springland Drive and Norberry Crescent as depicted in **Drawing GP-1**.

7.0 APPROVALS

Ontario Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approvals (ECA) are expected to be required for storm sewer infrastructure including the proposed Stormceptor oil-grit-separators that are intended to serve multiple private parcels corresponding to each building within the overall property. Sanitary, water, and storm sewer connections discharging independently to pre-existing sewer systems are unaffected.

The subject site is not adjacent to any floodplain or watercourse, and no modifications are proposed that would require an application for alteration of a watercourse from the local Conservation Authority under the Lakes and Rivers Improvement Act. The Rideau Valley Conservation Authority will need to be consulted to obtain municipal approval for site development. There are no municipal drains adjacent to this site and no other approvals are required from other regulatory agencies.

8.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was conducted by Paterson Group Inc. in March 2019 titled "*Geotechnical Investigation - Proposed Multi-Storey Buildings Norberry Crescent Ottawa, Ontario*". The following is a summary of existing soil conditions encountered within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson Group report. The subsurface profile at the borehole locations consists of asphaltic concrete followed by a silty sand with gravel fill overlying a hard to stiff silty clay crust and a grey, very stiff to firm silty clay deposit. Glacial till was encountered below the above noted layers consisting of dense to compact silty clay with sand to sandy silt with clay, gravel, cobbles and boulders. Practical refusal to augering on inferred bedrock was encountered in BH 2 to BH 5 and BH 8 at depths ranging between 5.3 to 7.0 m.

It is expected that the long-term groundwater level will be at a depth ranging between 2.5 to 3.5 m below existing grade. It should be noted that the groundwater level is subject to seasonal fluctuations. Therefore, groundwater could vary at the time of construction. (see **Appendix D** for excerpts from the geotechnical report). It is anticipated that groundwater infiltration into the excavations should be controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Geological mapping indicates the subject site is located in an area where the bedrock consists of limestone of the Bobcaygeon Formation. The overburden drift thickness is anticipated to be between 5 to 10 m in depth.

The native soil or approved fill has been considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

Pavement structures for driveways and access routes are provided in **Table 12** and **Table** 13 below.

Table 12 - Recommended Flexible Pavement Structure – Parking Areas

Thickness (mm)	Material Description
50	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**Base –** OPSS Granular A Crushed Stone
300	**Subbase –** OPSS Granular B Type II
-	**Subgrade** – Either fill, in OPSS Granular B Type II material placed over in situ soil or fill.

Table 13 - Recommended Flexible Pavement Structure – Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course –** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**Base –** OPSS Granular A Crushed Stone
300	**Subbase –** OPSS Granular B Type II
-	**Subgrade** – Either fill or OPSS Granular B Type I or II material placed over in situ soil or fill.

9.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

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

- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from entering existing ditches.
- Provide sediment traps and basins during dewatering.
- Install filter cloth between catchbasins and frames.
- Plan construction at proper time to avoid flooding.

Establish material stockpiles away from watercourses, so that barriers and filters may be installed.

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

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

Refer to **Drawing ECDS-1** for the proposed location of silt fences, straw bales, filter cloth and other erosion control structures.

10.0 UTILITIES

Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available within subsurface utility infrastructure within or within close proximity to the subject site. It is anticipated that existing infrastructure will be sufficient to provide the means of distribution for the proposed site. Detailed design of the required utility services will be further investigated as part of the composite utility planning process following design circulation.

11.0 CONCLUSION

11.1 POTABLE WATER

The proposed residential development is located in an area of the City's water distribution system that has sufficient capacity to provide both the required domestic and emergency fire flows. Based on the modeling results and the boundary conditions determined, fire flow demands in excess of 14,000 L/min will be available within the watermain network proposed for the development.

The minimum and maximum pressures of **67.0 psi (461.9 kPa) to 77.2 psi (532.3 kPa)** observed under peak and average day demand conditions are within the acceptable pressure range of 40 psi (275kPa) to 80 psi (552kPa). No additional measures are required to address minimum and maximum pressure conditions.

11.2 SANITARY SERVICING

The proposed buildings are to have their wastewater serviced independently. The proposed sanitary sewer laterals are sufficiently sized to provide gravity drainage for the site. The proposed blocks will be serviced by 200 mm diameter service laterals directing wastewater flows to the existing 225 mm dia. Norberry Crescent sanitary sewer. A backflow preventer will be required for the proposed buildings in accordance with the Ottawa sewer design guidelines and will be coordinated with building mechanical engineers. The proposed sanitary drainage pattern is in accordance with the City of Ottawa Sewer Design guidelines and falls within the outlined downstream sewer capacity set out in the Assessment of Adequacy of Public Service by DSEL engineering (September 2017).

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified by the City of Ottawa staff and with the City of Ottawa Design guidelines. Rooftop, pipe, and surface storage in combination with ICDs are proposed to limit inflow from the site area into the minor system to the required target release rates. Quality control will be achieved by on-site oil grit separators sized to achieve 80% TSS removal as required.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the overall recommendations provided in the Geotechnical Investigation. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing infrastructure.

11.5 UTILITIES

All utilities (Hydro Ottawa, Bell Canada, Rogers Ottawa, and Enbridge Gas) have existing plants in the subject area. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVALS

Ontario Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approvals (ECA) are expected for shared stormwater infrastructure within the subject site.

The Rideau Valley Conservation Authority will need to be consulted to obtain municipal approval for site development.

No other approvals are anticipated to be required from other regulatory agencies.

APPENDICES

Conclusion
April 25, 2025

Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

740 Springland Drive - Domestic Water Demand Estimates

Densities as per City Guidelines:
Avg Apt 1.8 ppu

Building ID	Units	Population	Daily Rate of Demand	Avg Day Demand		Max Day Demand [1]		Peak Hour Demand [2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
A	103	185	280	36.1	0.60	90.1	1.50	198.3	3.30
B	94	169	280	32.9	0.55	82.3	1.37	181.0	3.02
C	90	162	280	31.5	0.53	78.8	1.31	173.3	2.89
Total Site :	**287**	**517**		**100.45**	**1.67**	**251.13**	**4.19**	**552.48**	**9.21**

Demand conversion factors per Table 4.2 of the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03:

The City of Ottawa water demand criteria was used to estimate peak demand rates for residential areas are as follows:

1 maximum day demand rate = 2.5 x average day demand rate for residential

2 maximum hour demand rate = 2.2 x maximum day demand rate for residential

A.2 FIRE FLOW REQUIREMENTS PER FUS

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401483
Project Name: 740 Springland Drive
Date: 4/25/2025
Fire Flow Calculation #: 1
Description: Apartment Building A
Notes: Ordinary Construction structure 6-storey residential apartment building has estimated building footprint 1225 sqm with spinkler system but not supervised per site plan provided by Q9 planning dated Feb 24, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type III - Ordinary Construction / Type IV-C - Mass Timber Construction										1	-
2	Determine Effective Floor Area	Sum of All Floor Areas										NO	-
		1225	1225	1225	1225	1225	1225					7350	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	19000
4	Determine Occupancy Charge	Limited Combustible										-15%	16150
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-6460
		Standard Water Supply										-10%	
		Not Fully Supervised or N/A										0%	
		% Coverage of Sprinkler System										100%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	20	6	> 100	Type III-IV - Unprotected Openings	NO				10%	2423
		East	> 30	60	1	41-60	Type V	NO				0%	
		South	> 30	20	6	> 100	Type III-IV - Unprotected Openings	NO				0%	
		West	20.1 to 30	60	6	> 100	Type III-IV - Unprotected Openings	NO				5%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											12000
		Total Required Fire Flow in L/s											200.0
		Required Duration of Fire Flow (hrs)											2.50
		Required Volume of Fire Flow (m^3)											1800

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401483
Project Name: 740 Springland Drive
Date: 4/25/2025
Fire Flow Calculation #: 2
Description: Apartment Building B
Notes: Ordinary Construction structure 6-storey residential apartment building has estimated building footprint 1096 sqm with spinkler system but not supervised per site plan provided by Q9 planning dated Feb 24, 2025

Step	Task	Notes									Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type III - Ordinary Construction / Type IV-C - Mass Timber Construction									1	-
2	Determine Effective Floor Area	Sum of All Floor Areas									NO	-
		1096	1096	1096	1096	1096	1096				6577	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min									-	18000
4	Determine Occupancy Charge	Limited Combustible									-15%	15300
5	Determine Sprinkler Reduction	Conforms to NFPA 13									-30%	-6120
		Standard Water Supply									-10%	
		Not Fully Supervised or N/A									0%	
		% Coverage of Sprinkler System									100%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?			-	-
		North	20.1 to 30	54	6	> 100	Type III-IV - Unprotected Openings	NO			5%	4437
		East	10.1 to 20	20	5	81-100	Type III-IV - Unprotected Openings	NO			9%	
		South	> 30	54	1	41-60	Type V	NO			0%	
		West	3.1 to 10	20	6	> 100	Type III-IV - Unprotected Openings	NO			15%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min										14000
		Total Required Fire Flow in L/s										233.3
		Required Duration of Fire Flow (hrs)										3.00
		Required Volume of Fire Flow (m^3)										2520

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401483
Project Name: 740 Springland Drive
Date: 4/25/2025
Fire Flow Calculation #: 3
Description: Apartment Building C
Notes: Ordinary construction structure 5-storey residential apartment building has estimated building footprint 1095 sqm with spinkler system but not supervised per site plan provided by Q9 planning dated Feb 24, 2025

Step	Task	Notes									Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type III - Ordinary Construction / Type IV-C - Mass Timber Construction									1	-
2	Determine Effective Floor Area	Sum of All Floor Areas									NO	-
		1215	1215	1215	1215	1215					6075	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min									-	17000
4	Determine Occupancy Charge	Limited Combustible									-15%	14450
5	Determine Sprinkler Reduction	Conforms to NFPA 13									-30%	-5780
		Standard Water Supply									-10%	
		Not Fully Supervised or N/A									0%	
		% Coverage of Sprinkler System									100%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	Firewall / Sprinklered ?			-	-
		North	20.1 to 30	60	5	> 100	Type III-IV - Unprotected Openings	NO			5%	3324
		East	10.1 to 20	20	5	81-100	Type III-IV - Unprotected Openings	NO			9%	
		South	> 30	60	1	41-60	Type V	NO			0%	
		West	10.1 to 20	20	5	81-100	Type III-IV - Unprotected Openings	NO			9%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min										12000
		Total Required Fire Flow in L/s										200.0
		Required Duration of Fire Flow (hrs)										2.50
		Required Volume of Fire Flow (m^3)										1800

A.3 BOUNDARY CONDITIONS

Johnson, Warren

Subject: FW: Norberry Overview

From: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Sent: Friday, April 25, 2025 9:14 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Christine McCuaig <christine@q9planning.com>
Subject: RE: Norberry Overview

HI Kris,

My apologies for the delay. Here are the boundary conditions:

The following are boundary conditions, HGL, for hydraulic analysis at 740 Springland Drive (zone 2W2C) assumed to be connected via two separate **dual connections** (Connection 1 for Building A **AND** Connection 2 for Buildings B&C) to the 203mm watermain on Norberry Crescent (see attached PDF for location).

Connection 1 (Building A):
Minimum HGL: 125.0 m
Maximum HGL: 132.2 m
Max Day + Fire Flow (200 L/s): 112.3 m

Connection 2 (Buildings B & C):
Minimum HGL: 125.0 m
Maximum HGL: 132.2 m
Max Day + Fire Flow (233.3 L/s): 104.5 m

Please refer to Guidelines and Technical bulletin ISDTB-2021-01 concerning residential areas serving 50 or more dwellings.

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. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.
"The IWSD has recently updated their water modelling software. Any significant difference between previously received BC results and newly received BC results could be attributed to this update."

Let me know if you require anything further.

Regards,

Jeff Shillington, P. Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: Tuesday, April 22, 2025 10:19 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Christine McCuaig <christine@q9planning.com>
Subject: RE: Norberry Overview

Good morning Jeff and hope the long weekend was great.

Just want to check in to see if you have heard anything back on the boundary condition request
The owner is quite anxious about this as its tied to some financial obligations with CMHC.

Any help in expediting this would be appreciated

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Lead

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Kilborn, Kris
Sent: Wednesday, April 16, 2025 9:51 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Christine McCuaig <christine@q9planning.com>
Subject: RE: Norberry Overview

Hey Jeff see below. Let me know if you require any additional information

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Lead

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Sent: Wednesday, April 16, 2025 8:50 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Christine McCuaig <christine@q9planning.com>
Subject: RE: Norberry Overview

Hi Kris,

I received the following from the modeling group late yesterday:

Please request Stantec to provide connection locations figure for the buildings where we would provide the BC from. BC requests should include this information.

Regards,

Jeff Shillington, P. Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: Wednesday, April 16, 2025 8:28 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Christine McCuaig <christine@q9planning.com>
Subject: RE: Norberry Overview

Good morning Jeff and hope all is well

The owner wanted me to check back in with you on the Watermain request.
They are in a bit of a time crunch for submission as they are applying for CMHC ACLP financing which is time sensitive.

Any help on getting the revised boundary conditions would be appreciated

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Lead

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Sent: Friday, April 11, 2025 8:32 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Thiffault, Dustin <Dustin.Thiffault@stantec.com>; Johnson, Warren <Warren.Johnson@stantec.com>
Subject: RE: Norberry Overview

Hi Kris,

Yes, I've sent the BC's off. I will send them back to you when I get them.

Jeff

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: Thursday, April 10, 2025 10:01 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Thiffault, Dustin <dustin.thiffault@stantec.com>; Johnson, Warren <Warren.Johnson@stantec.com>
Subject: RE: Norberry Overview

Good morning Jeff

I just wanted to circle back around with you to confirm that you received my email from last Friday and you have forwarded along
To the City water group for review.

Please get back to me at your earliest convenience

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Lead

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Kilborn, Kris
Sent: Friday, April 4, 2025 11:00 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Thiffault, Dustin <Dustin.Thiffault@stantec.com>; Johnson, Warren <Warren.Johnson@stantec.com>
Subject: RE: Norberry Overview

Good morning Jeff and thanks for getting back to me
Please find below and attached updated boundary condition request for you to pass along to the Water Group.

I have also attached the updated sanitary discharge information for your review and acceptance.

Connection #1 (Building A):
Average Day Demand: 36.05 L/min (0.6 L/s)
Max Day Demand: 90.13 L/min (1.5 L/s)
Peak Hour Demand: 198.28 L/min (3.30 L/s)
Fire Flow: 12000 L/min (200 L/s)

Connection #2 (Building B&C)
Average Day Demand: 64.40 L/min (1.07 L/s)
Max Day Demand: 161.00 L/min (2.68 L/s)
Peak Hour Demand: 354.20 L/min (5.90 L/s)
Fire Flow:
Building B – 14000 L/min (233.3 L/s) [Govern]
Building C – 12000 L/min (200 L/s)

Sanitary flow with updated unit number and population would be:
Building A – 2.2 L/s
Building B – 2.0 L/s
Building C – 1.9 L/s

Please let me know if you require any additional information and have a great weekend

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Lead

Mobile: 613 297-0571

Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Sent: Wednesday, April 2, 2025 1:52 PM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Thiffault, Dustin <Dustin.Thiffault@stantec.com>; Johnson, Warren <Warren.Johnson@stantec.com>
Subject: RE: Norberry Overview

Hi Kris,

I just left you a voicemail, but yes, new boundary conditions should be requested and once those are provided your FUS and domestic water calcs should be updated along with updated sanitary calcs.

I don't believe there would be any change to the stormwater, but if there are any changes to the footprints of the buildings and/or parking lots, the stormwater calcs would also need to be updated.

Let me know if you have any further questions.

Regards,

Jeff Shillington, P. Eng.
Senior Project Manager, Development Review, South Branch
Planning, Infrastructure and Economic Development
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: Wednesday, April 2, 2025 11:10 AM
To: Shillington, Jeffrey <jeff.shillington@ottawa.ca>
Cc: Thiffault, Dustin <dustin.thiffault@stantec.com>; Johnson, Warren <Warren.Johnson@stantec.com>
Subject: FW: Norberry Overview

Good morning Jeff and hope all is well

Further to my voice message this morning, I am hoping I could receive some clarification on the updated engineering for the 740 Springland Drive project.
I received the below information from Christine for updates to the servicing report as a result of addition of storeys to the building.

Could you please confirm if you will require a new boundary condition request for this project with updated FUS calcs and I will have prepared and sent over.

Please don't hesitate to call if you have any questions

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Lead

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Christine McCuaig <christine@q9planning.com>
Sent: Monday, March 31, 2025 10:59 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: Fwd: Norberry Overview

Hey Kris,

See below for the Norberry project. We are submitting a revision application to add a single storey. Staff seem alright with it. Please see the Feedback Form comments attached though I have pulled out the engineering one and provided it below. Let me know what you need to move ahead with your work.

Engineering Comments:
12.As the original site plan application was approved and provided that the only change is to add an additional floor to the buildings, this should not affect any previously approved stormwater management design. However, the additional floor will increase sanitary flows and water consumption (domestic and fire flow) calculations. An update to the Servicing Brief with updated sanitary and water calculations to accommodate the additional floor is required.
Feel free to contact Jeff Shillington, Senior Engineer - Infrastructure Applications, for follow-up questions.

Thanks
Christine

Christine McCuaig, RPP MCIP M.Pl
c. 613-850-8345

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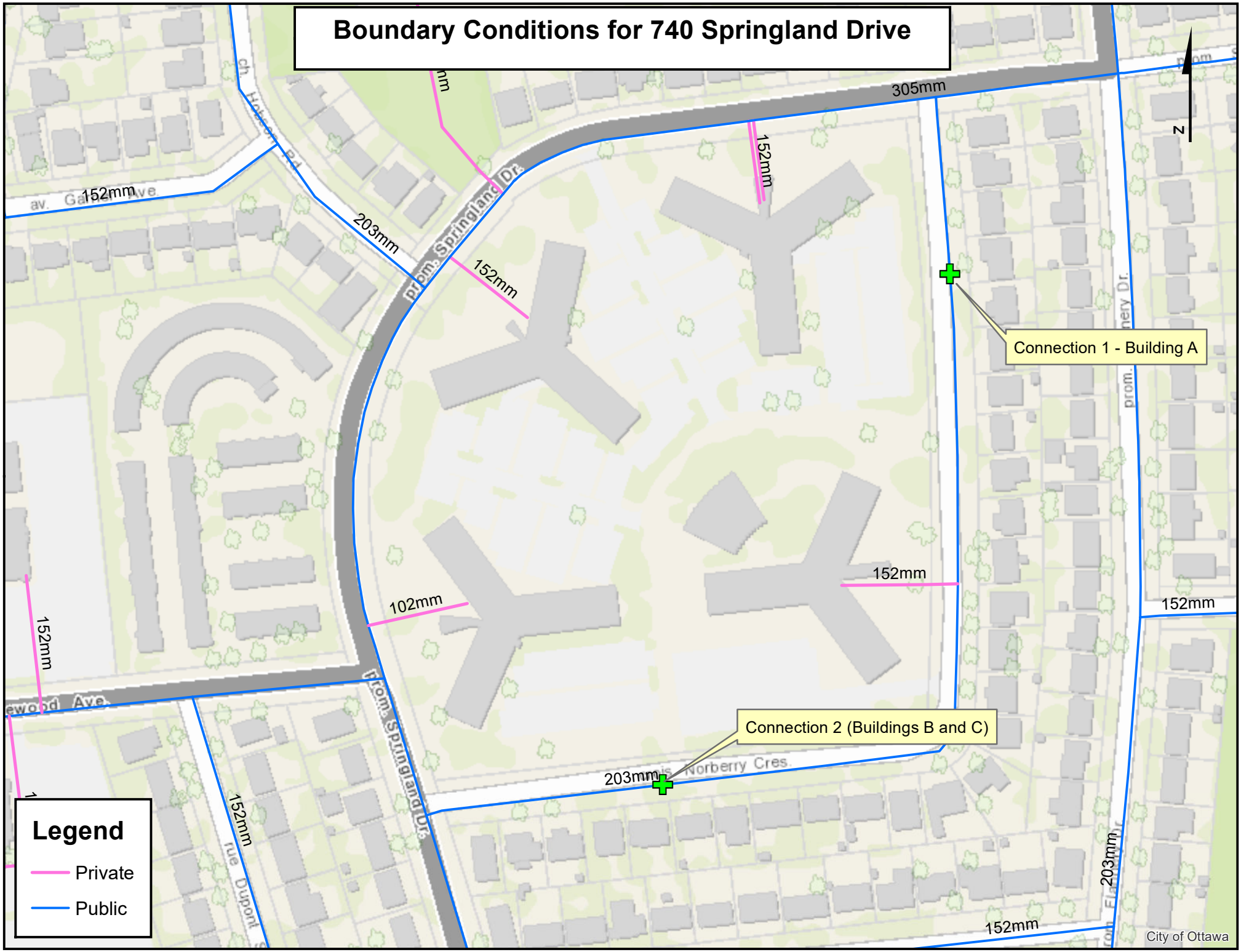
Boundary Conditions for 740 Springland Drive
305mm
152mm
203mm
152mm
152mm
Connection 1 - Building A
152mm
102mm
152mm
152mm
Connection 2 (Buildings B and C)
203mm
152mm
203mm
152mm
Legend
Private
Public
N
City of Ottawa

Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

NORBERRY RESIDENCES

DATE: 4/25/2025
REVISION: 4
DESIGNED BY: ZW
CHECKED BY: KK

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401483

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
BLDG A	BLDG	1	0.12	0	0	103	185	0.12	185	3.53	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.12	0.12	0.0	2.2	4.1	135	PVC	DR 28	1.00	11.5	**18.75%**	0.80	0.51
	1	1A	0.00	0	0	0	0	0.12	185	3.53	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.12	0.0	2.2	11.8	200	PVC	SDR 35	5.85	80.9	**2.67%**	2.54	0.92
																												225							
BLDG B	BLDG	2	0.11	0	0	94	169	0.11	169	3.54	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.11	0.0	2.0	4.3	135	PVC	DR 28	1.00	11.5	**17.16%**	0.80	0.50
	2	2A	0.00	0	0	0	0	0.11	169	3.54	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.11	0.0	2.0	11.4	200	PVC	SDR 35	0.32	18.9	**10.45%**	0.60	0.32
																												225							
BLDG C	BLDG	3	0.12	0	0	90	162	0.12	162	3.54	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.12	0.12	0.0	1.9	2.6	135	PVC	DR 28	1.00	11.5	**16.50%**	0.80	0.50
	3	3A	0.00	0	0	0	0	0.12	162	3.54	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.12	0.0	1.9	12.8	200	PVC	SDR 35	1.55	41.6	**4.57%**	1.31	0.56
																												225							

Conclusion
April 25, 2025

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

NORBERRY RESIDENCES	
DATE:	2021-06-14
REVISION:	3
DESIGNED BY:	WAJ
CHECKED BY:	DCT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401483

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

LOCATION			DRAINAGE AREA																					PIPE SELECTION										
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
BLDGA	BLDG A	EX. MAIN	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	7.4	7.4	7.4	12.8	200	200	CIRCULAR	PVC	SDR 35	1.00	33.3	**22.22%**	1.05	0.70	0.30
																				10.30									600	600									
BLDGB, L303A, RAMP-B	BLDG B	EX. MAIN	0.25	0.00	0.00	0.01	0.11	0.62	0.00	0.00	0.77	0.155	0.155	0.000	0.000	0.000	0.000	0.008	0.008	10.00	76.81	104.19	122.14	178.56	7.3	7.3	44.2	12.9	250	250	CIRCULAR	PVC	SDR 35	1.00	60.4	**73.16%**	1.22	1.17	0.18
																				10.18									525	525									
BLDGC, L300A, L301A	BLDG C	EX. MAIN	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	93.0	93.0	93.0	12.1	300	300	CIRCULAR	PVC	SDR 35	1.40	113.8	**81.75%**	1.62	1.60	0.13
																				10.13									525	525									
L103A	CB 201	STC 103	0.00	0.13	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.000	0.000	0.059	0.059	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	16.9	14.6	200	200	CIRCULAR	PVC	SDR 35	1.00	33.3	**50.83%**	1.05	0.90	0.27
																				10.27																			
L103B	CB 203	STC 103	0.00	0.06	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.000	0.000	0.037	0.037	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	10.6	15.2	200	200	CIRCULAR	PVC	SDR 35	1.00	33.3	**31.80%**	1.05	0.79	0.32
																				10.32																			
	STC 103	EX. MAIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.095	0.000	0.000	0.000	0.000	10.32	75.59	102.52	120.17	175.66	0.0	0.0	27.1	18.3	300	300	CIRCULAR	PVC	SDR 35	4.20	197.1	**13.74%**	2.80	1.63	0.19
																				10.51									450	450									
L102A	CB 200	STC 102	0.00	0.12	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.000	0.000	0.084	0.084	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	24.3	14.2	200	200	CIRCULAR	PVC	SDR 35	1.00	33.3	**72.99%**	1.05	1.00	0.24
	STC 102	EX. MAIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.084	0.000	0.000	0.000	0.000	10.24	75.91	102.96	120.69	176.43	0.0	0.0	24.0	13.4	300	300	CIRCULAR	PVC	SDR 35	4.85	211.8	**11.35%**	3.01	1.64	0.14
																				10.37									450	450									
F101A	CB 204	101	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.76	0.000	0.000	0.000	0.000	0.000	0.000	0.084	0.084	10.00	76.81	104.19	122.14	178.56	0.0	0.0	41.5	8.8	250	250	CIRCULAR	PVC	SDR 35	1.00	60.4	**68.65%**	1.22	1.15	0.13
	101	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.084	10.13	76.32	103.52	121.35	177.40	0.0	0.0	41.2	48.2	375	375	CIRCULAR	PVC	SDR 35	0.25	82.4	**49.98%**	0.78	0.67	1.20
																				11.33									525	525									

C.2 PRE DEVELOPMENT RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401483**
Project: **Norberry Residences**
Date: **25-Jun-19**

SWM Approach:
Post-development to Pre-development flows

Pre-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Tributary	EX-20	Hard	0.003		0.9	0.002		
		Soft	0.187		0.2	0.037		
		Subtotal		0.19			0.0399	0.210
Uncontrolled - Tributary	EX-19	Hard	0.045		0.9	0.041		
		Soft	0.106		0.2	0.021		
		Subtotal		0.151			0.06191	0.410
Uncontrolled - Tributary	EX-18	Hard	0.000		0.9	0.000		
		Soft	0.049		0.2	0.010		
		Subtotal		0.049			0.0098	0.200
Uncontrolled - Tributary	EX-17	Hard	0.408		0.9	0.367		
		Soft	0.000		0.2	0.000		
		Subtotal		0.408			0.3672	0.900
Uncontrolled - Tributary	EX-16	Hard	0.261		0.9	0.235		
		Soft	0.220		0.2	0.044		
		Subtotal		0.481			0.27898	0.580
Uncontrolled - Tributary	EX-15	Hard	0.026		0.9	0.023		
		Soft	0.052		0.2	0.010		
		Subtotal		0.078			0.03354	0.430
Uncontrolled - Tributary	EX-14	Hard	0.072		0.9	0.065		
		Soft	0.265		0.2	0.053		
		Subtotal		0.337			0.11795	0.350
Uncontrolled - Tributary	EX-13	Hard	0.232		0.9	0.209		
		Soft	0.000		0.2	0.000		
		Subtotal		0.232			0.2088	0.900
Uncontrolled - Tributary	EX-12	Hard	0.232		0.9	0.209		
		Soft	0.000		0.2	0.000		
		Subtotal		0.232			0.2088	0.900
Uncontrolled - Tributary	EX-11	Hard	0.032		0.9	0.029		
		Soft	0.101		0.2	0.020		
		Subtotal		0.133			0.04921	0.370
Uncontrolled - Tributary	EX-10	Hard	0.189		0.9	0.170		
		Soft	0.151		0.2	0.030		
		Subtotal		0.34			0.2006	0.590
Uncontrolled - Tributary	EX-9	Hard	0.061		0.9	0.055		
		Soft	0.000		0.2	0.000		
		Subtotal		0.061			0.0549	0.900
Uncontrolled - Tributary	EX-8	Hard	0.511		0.9	0.460		
		Soft	0.177		0.2	0.035		
		Subtotal		0.688			0.49536	0.720
Uncontrolled - Tributary	EX-7	Hard	0.000		0.9	0.000		
		Soft	0.075		0.2	0.015		
		Subtotal		0.0746			0.01492	0.200
Uncontrolled - Tributary	EX-6	Hard	0.277		0.9	0.250		
		Soft	0.145		0.2	0.029		
		Subtotal		0.422			0.27852	0.660
Uncontrolled - Tributary	EX-5	Hard	0.231		0.9	0.208		
		Soft	0.000		0.2	0.000		
		Subtotal		0.231			0.2079	0.900
Uncontrolled - Tributary	EX-4	Hard	0.510		0.9	0.459		
		Soft	0.190		0.2	0.038		
		Subtotal		0.7			0.497	0.710
Uncontrolled - Tributary	EX-3	Hard	0.232		0.9	0.209		
		Soft	0.000		0.2	0.000		
		Subtotal		0.232			0.2088	0.900
Uncontrolled - Tributary	EX-2	Hard	0.058		0.9	0.052		
		Soft	0.211		0.2	0.042		
		Subtotal		0.269			0.09415	0.350
Uncontrolled - Tributary	EX-1	Hard	0.049		0.9	0.044		
		Soft	0.235		0.2	0.047		
		Subtotal		0.284			0.09088	0.320
Total				**5.403**			**3.519**	
Overall Runoff Coefficient= C:								**0.65**

Total Roof Areas	**0.000 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**5.593 ha**
Total Tributary Area to Outlet	**5.593 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**5.593 ha**

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
5	141.18
10	104.19
15	83.56
20	70.25
25	60.90
30	53.93
35	48.52
40	44.18
45	40.63
50	37.65
55	35.12
60	32.94

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 5.5926
C: 0.65

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**1055.18**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: EX-20 — Uncontrolled - Tributary
Area (ha): 0.19
C: 0.21

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	11.56	11.56		
20	70.25	7.79	7.79		
30	53.93	5.98	5.98		
40	44.18	4.90	4.90		
50	37.65	4.18	4.18		
60	32.94	3.65	3.65		
70	29.37	3.26	3.26		
80	26.56	2.95	2.95		
90	24.29	2.69	2.69		
100	22.41	2.49	2.49		
110	20.82	2.31	2.31		
120	19.47	2.16	2.16		

Subdrainage Area: EX-19 — Uncontrolled - Tributary
Area (ha): 0.15
C: 0.41

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	17.93	17.93		
20	70.25	12.09	12.09		
30	53.93	9.28	9.28		
40	44.18	7.60	7.60		
50	37.65	6.48	6.48		
60	32.94	5.67	5.67		
70	29.37	5.06	5.06		
80	26.56	4.57	4.57		
90	24.29	4.18	4.18		
100	22.41	3.86	3.86		
110	20.82	3.58	3.58		
120	19.47	3.35	3.35		

Subdrainage Area: EX-18 — Uncontrolled - Tributary
Area (ha): 0.05
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	2.84	2.84		
20	70.25	1.91	1.91		
30	53.93	1.47	1.47		
40	44.18	1.20	1.20		
50	37.65	1.03	1.03		
60	32.94	0.90	0.90		
70	29.37	0.80	0.80		
80	26.56	0.72	0.72		
90	24.29	0.66	0.66		
100	22.41	0.61	0.61		
110	20.82	0.57	0.57		
120	19.47	0.53	0.53		

Subdrainage Area: EX-17 — Uncontrolled - Tributary
Area (ha): 0.41
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	106.36	106.36		
20	70.25	71.71	71.71		
30	53.93	55.05	55.05		
40	44.18	45.10	45.10		
50	37.65	38.44	38.44		
60	32.94	33.63	33.63		
70	29.37	29.98	29.98		
80	26.56	27.11	27.11		
90	24.29	24.79	24.79		
100	22.41	22.87	22.87		
110	20.82	21.26	21.26		
120	19.47	19.87	19.87		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 5.5926
C: 0.81

Estimated Time of Concentration

tc (min)	I (100 yr) (mm/hr)	Q100yr (L/s)
10	178.56	**2260.38**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: EX-20 — Uncontrolled - Tributary
Area (ha): 0.19
C: 0.26

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	24.76	24.76		
20	119.95	16.63	16.63		
30	91.87	12.74	12.74		
40	75.15	10.42	10.42		
50	63.95	8.87	8.87		
60	55.89	7.75	7.75		
70	49.79	6.90	6.90		
80	44.99	6.24	6.24		
90	41.11	5.70	5.70		
100	37.90	5.26	5.26		
110	35.20	4.88	4.88		
120	32.89	4.56	4.56		

Subdrainage Area: EX-19 — Uncontrolled - Tributary
Area (ha): 0.15
C: 0.51

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	38.41	38.41		
20	119.95	25.81	25.81		
30	91.87	19.76	19.76		
40	75.15	16.17	16.17		
50	63.95	13.76	13.76		
60	55.89	12.03	12.03		
70	49.79	10.71	10.71		
80	44.99	9.68	9.68		
90	41.11	8.84	8.84		
100	37.90	8.15	8.15		
110	35.20	7.57	7.57		
120	32.89	7.08	7.08		

Subdrainage Area: EX-18 — Uncontrolled - Tributary
Area (ha): 0.05
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	6.08	6.08		
20	119.95	4.08	4.08		
30	91.87	3.13	3.13		
40	75.15	2.56	2.56		
50	63.95	2.18	2.18		
60	55.89	1.90	1.90		
70	49.79	1.70	1.70		
80	44.99	1.53	1.53		
90	41.11	1.40	1.40		
100	37.90	1.29	1.29		
110	35.20	1.20	1.20		
120	32.89	1.12	1.12		

Subdrainage Area: EX-17 — Uncontrolled - Tributary
Area (ha): 0.41
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	202.53	202.53		
20	119.95	136.05	136.05		
30	91.87	104.20	104.20		
40	75.15	85.23	85.23		
50	63.95	72.54	72.54		
60	55.89	63.40	63.40		
70	49.79	56.47	56.47		
80	44.99	51.03	51.03		
90	41.11	46.63	46.63		
100	37.90	42.99	42.99		
110	35.20	39.93	39.93		
120	32.89	37.31	37.31		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-16 — Uncontrolled - Tributary
Area (ha): 0.48
C: 0.58

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	80.81	80.81		
20	70.25	54.48	54.48		
30	53.93	41.82	41.82		
40	44.18	34.27	34.27		
50	37.65	29.20	29.20		
60	32.94	25.55	25.55		
70	29.37	22.78	22.78		
80	26.56	20.60	20.60		
90	24.29	18.84	18.84		
100	22.41	17.38	17.38		
110	20.82	16.15	16.15		
120	19.47	15.10	15.10		

Subdrainage Area: EX-15 — Uncontrolled - Tributary
Area (ha): 0.08
C: 0.43

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	9.72	9.72		
20	70.25	6.55	6.55		
30	53.93	5.03	5.03		
40	44.18	4.12	4.12		
50	37.65	3.51	3.51		
60	32.94	3.07	3.07		
70	29.37	2.74	2.74		
80	26.56	2.48	2.48		
90	24.29	2.26	2.26		
100	22.41	2.09	2.09		
110	20.82	1.94	1.94		
120	19.47	1.82	1.82		

Subdrainage Area: EX-14 — Uncontrolled - Tributary
Area (ha): 0.34
C: 0.35

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	34.17	34.17		
20	70.25	23.04	23.04		
30	53.93	17.68	17.68		
40	44.18	14.49	14.49		
50	37.65	12.35	12.35		
60	32.94	10.80	10.80		
70	29.37	9.63	9.63		
80	26.56	8.71	8.71		
90	24.29	7.96	7.96		
100	22.41	7.35	7.35		
110	20.82	6.83	6.83		
120	19.47	6.38	6.38		

Subdrainage Area: EX-13 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.48	60.48		
20	70.25	40.78	40.78		
30	53.93	31.30	31.30		
40	44.18	25.65	25.65		
50	37.65	21.86	21.86		
60	32.94	19.12	19.12		
70	29.37	17.05	17.05		
80	26.56	15.42	15.42		
90	24.29	14.10	14.10		
100	22.41	13.01	13.01		
110	20.82	12.09	12.09		
120	19.47	11.30	11.30		

Subdrainage Area: EX-12 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.48	60.48		
20	70.25	40.78	40.78		
30	53.93	31.30	31.30		
40	44.18	25.65	25.65		
50	37.65	21.86	21.86		
60	32.94	19.12	19.12		
70	29.37	17.05	17.05		
80	26.56	15.42	15.42		
90	24.29	14.10	14.10		
100	22.41	13.01	13.01		
110	20.82	12.09	12.09		
120	19.47	11.30	11.30		

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Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-16 — Uncontrolled - Tributary
Area (ha): 0.48
C: 0.73

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	173.11	173.11		
20	119.95	116.29	116.29		
30	91.87	89.06	89.06		
40	75.15	72.85	72.85		
50	63.95	62.00	62.00		
60	55.89	54.19	54.19		
70	49.79	48.27	48.27		
80	44.99	43.62	43.62		
90	41.11	39.86	39.86		
100	37.90	36.75	36.75		
110	35.20	34.13	34.13		
120	32.89	31.89	31.89		

Subdrainage Area: EX-15 — Uncontrolled - Tributary
Area (ha): 0.08
C: 0.54

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	20.81	20.81		
20	119.95	13.98	13.98		
30	91.87	10.71	10.71		
40	75.15	8.76	8.76		
50	63.95	7.45	7.45		
60	55.89	6.51	6.51		
70	49.79	5.80	5.80		
80	44.99	5.24	5.24		
90	41.11	4.79	4.79		
100	37.90	4.42	4.42		
110	35.20	4.10	4.10		
120	32.89	3.83	3.83		

Subdrainage Area: EX-14 — Uncontrolled - Tributary
Area (ha): 0.34
C: 0.44

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	73.19	73.19		
20	119.95	49.16	49.16		
30	91.87	37.65	37.65		
40	75.15	30.80	30.80		
50	63.95	26.21	26.21		
60	55.89	22.91	22.91		
70	49.79	20.41	20.41		
80	44.99	18.44	18.44		
90	41.11	16.85	16.85		
100	37.90	15.54	15.54		
110	35.20	14.43	14.43		
120	32.89	13.48	13.48		

Subdrainage Area: EX-13 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	115.16	115.16		
20	119.95	77.36	77.36		
30	91.87	59.25	59.25		
40	75.15	48.47	48.47		
50	63.95	41.25	41.25		
60	55.89	36.05	36.05		
70	49.79	32.11	32.11		
80	44.99	29.02	29.02		
90	41.11	26.51	26.51		
100	37.90	24.45	24.45		
110	35.20	22.70	22.70		
120	32.89	21.22	21.22		

Subdrainage Area: EX-12 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	115.16	115.16		
20	119.95	77.36	77.36		
30	91.87	59.25	59.25		
40	75.15	48.47	48.47		
50	63.95	41.25	41.25		
60	55.89	36.05	36.05		
70	49.79	32.11	32.11		
80	44.99	29.02	29.02		
90	41.11	26.51	26.51		
100	37.90	24.45	24.45		
110	35.20	22.70	22.70		
120	32.89	21.22	21.22		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-11 — Uncontrolled - Tributary
Area (ha): 0.13
C: 0.37

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	14.25	14.25		
20	70.25	9.61	9.61		
30	53.93	7.38	7.38		
40	44.18	6.04	6.04		
50	37.65	5.15	5.15		
60	32.94	4.51	4.51		
70	29.37	4.02	4.02		
80	26.56	3.63	3.63		
90	24.29	3.32	3.32		
100	22.41	3.07	3.07		
110	20.82	2.85	2.85		
120	19.47	2.66	2.66		

Subdrainage Area: EX-10 — Uncontrolled - Tributary
Area (ha): 0.34
C: 0.59

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	58.11	58.11		
20	70.25	39.18	39.18		
30	53.93	30.07	30.07		
40	44.18	24.64	24.64		
50	37.65	21.00	21.00		
60	32.94	18.37	18.37		
70	29.37	16.38	16.38		
80	26.56	14.81	14.81		
90	24.29	13.54	13.54		
100	22.41	12.50	12.50		
110	20.82	11.61	11.61		
120	19.47	10.86	10.86		

Subdrainage Area: EX-9 — Uncontrolled - Tributary
Area (ha): 0.06
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	15.90	15.90		
20	70.25	10.72	10.72		
30	53.93	8.23	8.23		
40	44.18	6.74	6.74		
50	37.65	5.75	5.75		
60	32.94	5.03	5.03		
70	29.37	4.48	4.48		
80	26.56	4.05	4.05		
90	24.29	3.71	3.71		
100	22.41	3.42	3.42		
110	20.82	3.18	3.18		
120	19.47	2.97	2.97		

Subdrainage Area: EX-8 — Uncontrolled - Tributary
Area (ha): 0.69
C: 0.72

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	143.48	143.48		
20	70.25	96.74	96.74		
30	53.93	74.26	74.26		
40	44.18	60.85	60.85		
50	37.65	51.85	51.85		
60	32.94	45.37	45.37		
70	29.37	40.45	40.45		
80	26.56	36.58	36.58		
90	24.29	33.45	33.45		
100	22.41	30.86	30.86		
110	20.82	28.67	28.67		
120	19.47	26.81	26.81		

Subdrainage Area: EX-7 — Uncontrolled - Tributary
Area (ha): 0.07
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.32	4.32		
20	70.25	2.91	2.91		
30	53.93	2.24	2.24		
40	44.18	1.83	1.83		
50	37.65	1.56	1.56		
60	32.94	1.37	1.37		
70	29.37	1.22	1.22		
80	26.56	1.10	1.10		
90	24.29	1.01	1.01		
100	22.41	0.93	0.93		
110	20.82	0.86	0.86		
120	19.47	0.81	0.81		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-11 — Uncontrolled - Tributary
Area (ha): 0.13
C: 0.46

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	30.53	30.53		
20	119.95	20.51	20.51		
30	91.87	15.71	15.71		
40	75.15	12.85	12.85		
50	63.95	10.94	10.94		
60	55.89	9.56	9.56		
70	49.79	8.51	8.51		
80	44.99	7.69	7.69		
90	41.11	7.03	7.03		
100	37.90	6.48	6.48		
110	35.20	6.02	6.02		
120	32.89	5.63	5.63		

Subdrainage Area: EX-10 — Uncontrolled - Tributary
Area (ha): 0.34
C: 0.74

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	124.47	124.47		
20	119.95	83.62	83.62		
30	91.87	64.04	64.04		
40	75.15	52.38	52.38		
50	63.95	44.58	44.58		
60	55.89	38.96	38.96		
70	49.79	34.71	34.71		
80	44.99	31.36	31.36		
90	41.11	28.66	28.66		
100	37.90	26.42	26.42		
110	35.20	24.54	24.54		
120	32.89	22.93	22.93		

Subdrainage Area: EX-9 — Uncontrolled - Tributary
Area (ha): 0.06
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	30.28	30.28		
20	119.95	20.34	20.34		
30	91.87	15.58	15.58		
40	75.15	12.74	12.74		
50	63.95	10.85	10.85		
60	55.89	9.48	9.48		
70	49.79	8.44	8.44		
80	44.99	7.63	7.63		
90	41.11	6.97	6.97		
100	37.90	6.43	6.43		
110	35.20	5.97	5.97		
120	32.89	5.58	5.58		

Subdrainage Area: EX-8 — Uncontrolled - Tributary
Area (ha): 0.69
C: 0.90

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	307.37	307.37		
20	119.95	206.48	206.48		
30	91.87	158.14	158.14		
40	75.15	129.35	129.35		
50	63.95	110.09	110.09		
60	55.89	96.22	96.22		
70	49.79	85.71	85.71		
80	44.99	77.45	77.45		
90	41.11	70.77	70.77		
100	37.90	65.25	65.25		
110	35.20	60.60	60.60		
120	32.89	56.62	56.62		

Subdrainage Area: EX-7 — Uncontrolled - Tributary
Area (ha): 0.07
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	9.26	9.26		
20	119.95	6.22	6.22		
30	91.87	4.76	4.76		
40	75.15	3.90	3.90		
50	63.95	3.32	3.32		
60	55.89	2.90	2.90		
70	49.79	2.58	2.58		
80	44.99	2.33	2.33		
90	41.11	2.13	2.13		
100	37.90	1.97	1.97		
110	35.20	1.83	1.83		
120	32.89	1.71	1.71		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-6 — Uncontrolled - Tributary
Area (ha): 0.42
C: 0.66

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	80.68	80.68		
20	70.25	54.39	54.39		
30	53.93	41.76	41.76		
40	44.18	34.21	34.21		
50	37.65	29.15	29.15		
60	32.94	25.51	25.51		
70	29.37	22.74	22.74		
80	26.56	20.57	20.57		
90	24.29	18.81	18.81		
100	22.41	17.35	17.35		
110	20.82	16.12	16.12		
120	19.47	15.07	15.07		

Subdrainage Area: EX-5 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.22	60.22		
20	70.25	40.60	40.60		
30	53.93	31.17	31.17		
40	44.18	25.54	25.54		
50	37.65	21.76	21.76		
60	32.94	19.04	19.04		
70	29.37	16.98	16.98		
80	26.56	15.35	15.35		
90	24.29	14.04	14.04		
100	22.41	12.95	12.95		
110	20.82	12.03	12.03		
120	19.47	11.25	11.25		

Subdrainage Area: EX-4 — Uncontrolled - Tributary
Area (ha): 0.70
C: 0.71

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	143.96	143.96		
20	70.25	97.06	97.06		
30	53.93	74.51	74.51		
40	44.18	61.05	61.05		
50	37.65	52.02	52.02		
60	32.94	45.52	45.52		
70	29.37	40.58	40.58		
80	26.56	36.70	36.70		
90	24.29	33.56	33.56		
100	22.41	30.96	30.96		
110	20.82	28.77	28.77		
120	19.47	26.90	26.90		

Subdrainage Area: EX-3 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.48	60.48		
20	70.25	40.78	40.78		
30	53.93	31.30	31.30		
40	44.18	25.65	25.65		
50	37.65	21.86	21.86		
60	32.94	19.12	19.12		
70	29.37	17.05	17.05		
80	26.56	15.42	15.42		
90	24.29	14.10	14.10		
100	22.41	13.01	13.01		
110	20.82	12.09	12.09		
120	19.47	11.30	11.30		

Subdrainage Area: EX-2 — Uncontrolled - Tributary
Area (ha): 0.27
C: 0.35

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	27.27	27.27		
20	70.25	18.39	18.39		
30	53.93	14.11	14.11		
40	44.18	11.56	11.56		
50	37.65	9.86	9.86		
60	32.94	8.62	8.62		
70	29.37	7.69	7.69		
80	26.56	6.95	6.95		
90	24.29	6.36	6.36		
100	22.41	5.86	5.86		
110	20.82	5.45	5.45		
120	19.47	5.10	5.10		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-6 — Uncontrolled - Tributary
Area (ha): 0.42
C: 0.83

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	172.82	172.82		
20	119.95	116.09	116.09		
30	91.87	88.92	88.92		
40	75.15	72.73	72.73		
50	63.95	61.90	61.90		
60	55.89	54.10	54.10		
70	49.79	48.19	48.19		
80	44.99	43.54	43.54		
90	41.11	39.79	39.79		
100	37.90	36.68	36.68		
110	35.20	34.07	34.07		
120	32.89	31.84	31.84		

Subdrainage Area: EX-5 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	114.67	114.67		
20	119.95	77.03	77.03		
30	91.87	59.00	59.00		
40	75.15	48.26	48.26		
50	63.95	41.07	41.07		
60	55.89	35.89	35.89		
70	49.79	31.97	31.97		
80	44.99	28.89	28.89		
90	41.11	26.40	26.40		
100	37.90	24.34	24.34		
110	35.20	22.61	22.61		
120	32.89	21.12	21.12		

Subdrainage Area: EX-4 — Uncontrolled - Tributary
Area (ha): 0.70
C: 0.89

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	308.38	308.38		
20	119.95	207.16	207.16		
30	91.87	158.66	158.66		
40	75.15	129.78	129.78		
50	63.95	110.45	110.45		
60	55.89	96.53	96.53		
70	49.79	85.99	85.99		
80	44.99	77.70	77.70		
90	41.11	71.00	71.00		
100	37.90	65.46	65.46		
110	35.20	60.80	60.80		
120	32.89	56.81	56.81		

Subdrainage Area: EX-3 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	115.16	115.16		
20	119.95	77.36	77.36		
30	91.87	59.25	59.25		
40	75.15	48.47	48.47		
50	63.95	41.25	41.25		
60	55.89	36.05	36.05		
70	49.79	32.11	32.11		
80	44.99	29.02	29.02		
90	41.11	26.51	26.51		
100	37.90	24.45	24.45		
110	35.20	22.70	22.70		
120	32.89	21.22	21.22		

Subdrainage Area: EX-2 — Uncontrolled - Tributary
Area (ha): 0.27
C: 0.44

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	58.42	58.42		
20	119.95	39.24	39.24		
30	91.87	30.06	30.06		
40	75.15	24.59	24.59		
50	63.95	20.92	20.92		
60	55.89	18.29	18.29		
70	49.79	16.29	16.29		
80	44.99	14.72	14.72		
90	41.11	13.45	13.45		
100	37.90	12.40	12.40		
110	35.20	11.52	11.52		
120	32.89	10.76	10.76		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-1 Uncontrolled - Tributary
Area (ha): 0.28
C: 0.32

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	26.32	26.32		
20	70.25	17.75	17.75		
30	53.93	13.62	13.62		
40	44.18	11.16	11.16		
50	37.65	9.51	9.51		
60	32.94	8.32	8.32		
70	29.37	7.42	7.42		
80	26.56	6.71	6.71		
90	24.29	6.14	6.14		
100	22.41	5.66	5.66		
110	20.82	5.26	5.26		
120	19.47	4.92	4.92		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storage

Subdrainage Area: EX-1 Uncontrolled - Tributary
Area (ha): 0.28
C: 0.40

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	56.39	56.39		
20	119.95	37.88	37.88		
30	91.87	29.01	29.01		
40	75.15	23.73	23.73		
50	63.95	20.20	20.20		
60	55.89	17.65	17.65		
70	49.79	15.72	15.72		
80	44.99	14.21	14.21		
90	41.11	12.98	12.98		
100	37.90	11.97	11.97		
110	35.20	11.12	11.12		
120	32.89	10.39	10.39		

C.3 POST DEVELOPMENT RATIONAL METHOD CALCULATIONS

File No: **160401483**
Project: **Norberry Residences**
Date: **10-Jun-21**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"	Runoff Coefficient "C"	"A x C"	Overall Runoff Coefficient
Uncontrolled - Tributary	RAMP-B	Hard	0.010	0.9	0.009	
		Soft	0.002	0.2	0.000	
		Subtotal		0.012	0.00924	0.770
Controlled - Tributary	L103B	Hard	0.037	0.9	0.034	
		Soft	0.026	0.2	0.005	
		Subtotal		0.064	0.038796	0.610
Controlled - Tributary	L103A	Hard	0.048	0.9	0.043	
		Soft	0.086	0.2	0.017	
		Subtotal		0.134	0.0603	0.450
Controlled - Tributary	L102A	Hard	0.083	0.9	0.075	
		Soft	0.033	0.2	0.007	
		Subtotal		0.116	0.0812	0.700
Uncontrolled - Tributary	F100A	Hard	0.046	0.9	0.041	
		Soft	0.064	0.2	0.013	
		Subtotal		0.110	0.0539	0.490
Roof	BLDGA	Hard	0.115	0.9	0.104	
		Soft	0.000	0.2	0.000	
		Subtotal		0.115	0.1035	0.900
Roof	BLDGC	Hard	0.115	0.9	0.104	
		Soft	0.000	0.2	0.000	
		Subtotal		0.115	0.1035	0.900
Roof	BLDGB	Hard	0.107	0.9	0.096	
		Soft	0.000	0.2	0.000	
		Subtotal		0.107	0.0963	0.900
Controlled - Tributary	L301A	Hard	0.133	0.9	0.120	
		Soft	0.006	0.2	0.001	
		Subtotal		0.139	0.12093	0.870
Controlled - Tributary	L300A	Hard	0.131	0.9	0.118	
		Soft	0.006	0.2	0.001	
		Subtotal		0.137	0.11919	0.870
Controlled - Tributary	L303A	Hard	0.152	0.9	0.137	
		Soft	0.101	0.2	0.020	
		Subtotal		0.253	0.15686	0.620
Uncontrolled - Tributary	F101A	Hard	0.086	0.9	0.078	
		Soft	0.004	0.2	0.001	
		Subtotal		0.090	0.0783	0.870
Uncontrolled - Tributary	UNC-2	Hard	0.008	0.9	0.007	
		Soft	0.046	0.2	0.009	
		Subtotal		0.053	0.01602	0.300
Uncontrolled - Tributary	EX-19	Hard	0.058	0.9	0.053	
		Soft	0.088	0.2	0.018	
		Subtotal		0.146	0.07008	0.480
Uncontrolled - Tributary	EX-18	Hard	0.005	0.9	0.004	
		Soft	0.062	0.2	0.012	
		Subtotal		0.067	0.01675	0.250
Uncontrolled - Tributary	EX-15	Hard	0.026	0.9	0.023	
		Soft	0.052	0.2	0.010	
		Subtotal		0.078	0.03354	0.430
Uncontrolled - Tributary	EX-14	Hard	0.094	0.9	0.085	
		Soft	0.235	0.2	0.047	
		Subtotal		0.329	0.1316	0.400
Uncontrolled - Tributary	EX-13	Hard	0.232	0.9	0.209	
		Soft	0.000	0.2	0.000	
		Subtotal		0.232	0.2088	0.900
Uncontrolled - Tributary	EX-12	Hard	0.232	0.9	0.209	
		Soft	0.000	0.2	0.000	
		Subtotal		0.232	0.2088	0.900
Uncontrolled - Tributary	EX-11	Hard	0.042	0.9	0.038	
		Soft	0.091	0.2	0.018	
		Subtotal		0.133	0.05586	0.420
Uncontrolled - Tributary	EX-10	Hard	0.263	0.9	0.237	
		Soft	0.113	0.2	0.023	
		Subtotal		0.376	0.25944	0.690
Uncontrolled - Tributary	EX-9	Hard	0.061	0.9	0.055	
		Soft	0.000	0.2	0.000	
		Subtotal		0.061	0.05463	0.900
Uncontrolled - Tributary	EX-8	Hard	0.459	0.9	0.413	
		Soft	0.255	0.2	0.051	
		Subtotal		0.714	0.4641	0.650
Uncontrolled - Tributary	EX-7	Hard	0.000	0.9	0.000	
		Soft	0.075	0.2	0.015	
		Subtotal		0.075	0.01492	0.200
Uncontrolled - Tributary	EX-5	Hard	0.231	0.9	0.208	
		Soft	0.000	0.2	0.000	
		Subtotal		0.231	0.2079	0.900
Uncontrolled - Tributary	EX-4	Hard	0.421	0.9	0.379	
		Soft	0.265	0.2	0.053	
		Subtotal		0.686	0.43218	0.630
Uncontrolled - Tributary	EX-3	Hard	0.231	0.9	0.208	
		Soft	0.000	0.2	0.000	
		Subtotal		0.231	0.2079	0.900
Uncontrolled - Tributary	EX-2	Hard	0.065	0.9	0.059	
		Soft	0.204	0.2	0.041	
		Subtotal		0.269	0.09953	0.370
Uncontrolled - Tributary	EX-1	Hard	0.053	0.9	0.047	
		Soft	0.231	0.2	0.046	
		Subtotal		0.284	0.09372	0.330
Total			**5.588**		**3.598**	
Overall Runoff Coefficient= C:						**0.64**

Total Roof Areas	**0.337 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**5.251 ha**
Total Tributary Area to Outlet	**5.588 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**5.588 ha**

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

6/10/2021
City of Ottawa

$I = a/(t + b)^c$

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
5	141.18
10	104.19
15	83.56
20	70.25
25	60.90
30	53.93
35	48.52
40	44.18
45	40.63
50	37.65
55	35.12
60	32.94

Predevelopment Release from Entire Site

Subdrainage Area: Predevelopment Tributary Area to Outl
Area (ha): 5.59
C: 0.65

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)	I (100 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**1055.2**	178.56	**2260.4**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: RAMP-B — Uncontrolled - Tributary
Area (ha): 0.01
C: 0.77

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	3.6	3.6		
10	104.19	2.7	2.7		
15	83.56	2.1	2.1		
20	70.25	1.8	1.8		
25	60.90	1.6	1.6		
30	53.93	1.4	1.4		
35	48.52	1.2	1.2		
40	44.18	1.1	1.1		
45	40.63	1.0	1.0		
50	37.65	1.0	1.0		
55	35.12	0.9	0.9		
60	32.94	0.8	0.8		

Subdrainage Area: L103B — Controlled - Tributary
Area (ha): 0.06
C: 0.61

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	11.2	9.7	1.5	**0.9**
20	70.25	7.6	9.7	0.0	0.0
30	53.93	5.8	9.7	0.0	0.0
40	44.18	4.8	9.7	0.0	0.0
50	37.65	4.1	9.7	0.1	0.3
60	32.94	3.6	9.7	0.0	0.0
70	29.37	3.2	9.7	0.0	0.0
80	26.56	2.9	9.7	0.0	0.0
90	24.29	2.6	9.7	0.0	0.0
100	22.41	2.4	9.7	0.0	0.0
110	20.82	2.2	9.7	0.0	0.0
120	19.47	2.1	9.7	0.0	0.0

Storage: e Above CE

Orifice Diameter: LMF 95 mm
Invert Elevation 75.57 m
T/G Elevation 76.95 m
Max Ponding Depth 0.10 m
Downstream W/L 75.42 m 0.09

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	77.05	1.48	9.7	0.9	16.0	OK

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.13
C: 0.45

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored 0.07	Vstored (m^3)
10	104.19	17.5	5.4	12.1	7.2
20	70.25	11.8	5.4	6.4	**7.6**
30	53.93	9.0	5.4	3.6	6.5
40	44.18	7.4	5.4	2.0	4.8
50	37.65	6.3	5.4	0.9	2.7
60	32.94	5.5	5.4	0.1	0.4
70	29.37	4.9	5.4	0.0	0.0
80	26.56	4.5	5.4	0.0	0.0
90	24.29	4.1	5.4	0.0	0.0
100	22.41	3.8	5.4	0.0	0.0
110	20.82	3.5	5.4	0.0	0.0
120	19.47	3.3	5.4	0.0	0.0

Storage: e Above CE

Orifice Equation: CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 75.57 m
T/G Elevation 76.95 m
Max Ponding Depth 0.20 m
Downstream W/L 75.42 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	77.15	1.58	5.4	7.6	14.3	OK

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

5-YEAR Predevelopment Release from Redeveloped Portions of Site

Subdrainage Area: Redeveloped Site Are
Area (ha): 1.55
C: 0.63

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**282.3**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: RAMP-B — Uncontrolled - Tributary
Area (ha): 0.01
C: 0.96

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	5.7	5.7		
20	119.95	3.9	3.9		
30	91.87	2.9	2.9		
40	75.15	2.4	2.4		
50	63.95	2.1	2.1		
60	55.89	1.8	1.8		
70	49.79	1.6	1.6		
80	44.99	1.4	1.4		
90	41.11	1.3	1.3		
100	37.90	1.2	1.2		
110	35.20	1.1	1.1		
120	32.89	1.1	1.1		

Subdrainage Area: L103B — Controlled - Tributary
Area (ha): 0.06
C: 0.76

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	24.1	10.2	13.9	**8.3**
20	119.95	16.2	10.2	6.0	7.2
30	91.87	12.4	10.2	2.2	4.0
40	75.15	10.1	10.2	0.0	0.0
50	63.95	8.6	10.2	0.0	0.0
60	55.89	7.5	10.2	0.0	0.0
70	49.79	6.7	10.2	0.0	0.0
80	44.99	6.1	10.2	0.0	0.0
90	41.11	5.5	10.2	0.0	0.0
100	37.90	5.1	10.2	0.0	0.0
110	35.20	4.7	10.2	0.0	0.0
120	32.89	4.4	10.2	0.0	0.0

Storage: Surface Storage Above CB

Orifice: LMF 95 CB Storage: 0.71 m3
Invert Elevation 75.57 m
T/G Elevation 76.95 m
Max Ponding Depth 0.25 m
Downstream W/L 75.42 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	77.20	1.63	10.2	8.3	16.0	OK
					7.68	

Subdrainage Area: L103A — Controlled - Tributary
Area (ha): 0.13
C: 0.56

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	37.4	18.7	18.8	**11.3**
20	119.95	25.1	18.7	6.5	7.8
30	91.87	19.3	18.7	0.6	1.1
40	75.15	15.7	18.7	0.0	0.0
50	63.95	13.4	18.7	0.0	0.0
60	55.89	11.7	18.7	0.0	0.0
70	49.79	10.4	18.7	0.0	0.0
80	44.99	9.4	18.7	0.0	0.0
90	41.11	8.6	18.7	0.0	0.0
100	37.90	7.9	18.7	0.0	0.0
110	35.20	7.4	18.7	0.0	0.0
120	32.89	6.9	18.7	0.0	0.0

Storage: Surface Storage Above CE

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm CB Storage: 0.71 m3
Invert Elevation 75.57 m
T/G Elevation 76.95 m
Max Ponding Depth 0.25 m
Downstream W/L 75.42 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	77.20	1.63	18.7	11.3	14.3	OK
					3.06	

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: L102A — Controlled - Tributary
Area (ha): 0.12
C: 0.70

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	23.5	7.1	16.4	9.9
20	70.25	15.9	7.1	8.8	**10.5**
30	53.93	12.2	7.1	5.1	9.1
40	44.18	10.0	7.1	2.9	6.9
50	37.65	8.5	7.1	1.4	4.2
60	32.94	7.4	7.1	0.3	1.2
70	29.37	6.6	7.1	0.0	0.0
80	26.56	6.0	7.1	0.0	0.0
90	24.29	5.5	7.1	0.0	0.0
100	22.41	5.1	7.1	0.0	0.0
110	20.82	4.7	7.1	0.0	0.0
120	19.47	4.4	7.1	0.0	0.0

Storage: e Above CE

Orifice Diameter: LMF 80
Invert Elevation 75.44 m
T/G Elevation 76.82 m
Max Ponding Depth 0.16 m
Downstream W/L 75.30 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	76.98	1.54	7.1	10.5	53.9	OK

Subdrainage Area: F100A — Uncontrolled - Tributary
Area (ha): 0.11
C: 0.49

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	15.6	15.6		
20	70.25	10.5	10.5		
30	53.93	8.1	8.1		
40	44.18	6.6	6.6		
50	37.65	5.6	5.6		
60	32.94	4.9	4.9		
70	29.37	4.4	4.4		
80	26.56	4.0	4.0		
90	24.29	3.6	3.6		
100	22.41	3.4	3.4		
110	20.82	3.1	3.1		
120	19.47	2.9	2.9		

Subdrainage Area: BLDGA — Roof
Area (ha): 0.12 — Maximum Storage Depth 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	30.0	6.3	23.6	14.2	101.1	0.00
20	70.25	20.2	6.4	13.8	**16.5**	105.6	0.00
30	53.93	15.5	6.4	9.1	16.3	105.2	0.00
40	44.18	12.7	6.4	6.3	15.2	103.0	0.00
50	37.65	10.8	6.3	4.5	13.6	99.9	0.00
60	32.94	9.5	6.2	3.3	11.9	94.5	0.00
70	29.37	8.5	6.0	2.4	10.2	89.0	0.00
80	26.56	7.6	5.9	1.8	8.4	83.4	0.00
90	24.29	7.0	5.8	1.2	6.7	77.9	0.00
100	22.41	6.4	5.6	0.9	5.2	71.4	0.00
110	20.82	6.0	5.4	0.6	3.9	63.8	0.00
120	19.47	5.6	5.2	0.4	2.8	56.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Leve	105.56	0.11	6.4	16.5	46.0	0.00

Subdrainage Area: BLDGC — Roof
Area (ha): 0.12 — Maximum Storage Depth 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	30.0	6.3	23.6	14.2	101.1	0.00
20	70.25	20.2	6.4	13.8	**16.5**	105.6	0.00
30	53.93	15.5	6.4	9.1	16.3	105.2	0.00
40	44.18	12.7	6.4	6.3	15.2	103.0	0.00
50	37.65	10.8	6.3	4.5	13.6	99.9	0.00
60	32.94	9.5	6.2	3.3	11.9	94.5	0.00
70	29.37	8.5	6.0	2.4	10.2	89.0	0.00
80	26.56	7.6	5.9	1.8	8.4	83.4	0.00
90	24.29	7.0	5.8	1.2	6.7	77.9	0.00
100	22.41	6.4	5.6	0.9	5.2	71.4	0.00
110	20.82	6.0	5.4	0.6	3.9	63.8	0.00
120	19.47	5.6	5.2	0.4	2.8	56.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Leve	105.56	0.11	6.4	16.5	46.0	0.00

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: L102A — Controlled - Tributary
Area (ha): 0.12
C: 0.88

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	50.4	7.4	43.0	25.8
20	119.95	33.8	7.4	26.5	31.8
30	91.87	25.9	7.4	18.6	**33.4**
40	75.15	21.2	7.4	13.8	33.2
50	63.95	18.0	7.4	10.7	32.0
60	55.89	15.8	7.4	8.4	30.3
70	49.79	14.0	7.4	6.7	28.1
80	44.99	12.7	7.4	5.3	25.6
90	41.11	11.6	7.4	4.2	22.9
100	37.90	10.7	7.4	3.3	20.0
110	35.20	9.9	7.4	2.6	17.0
120	32.89	9.3	7.4	1.9	13.8

Storage: Surface Storage Above CE — CB Storage: 0.71 m3

Orifice Diameter: LMF 80
Invert Elevation 75.44 m
T/G Elevation 76.82 m
Max Ponding Depth 0.28 m
Downstream W/L 75.30 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	77.10	1.66	7.4	33.4	53.9	OK
					20.50	

Subdrainage Area: F100A — Uncontrolled - Tributary
Area (ha): 0.11
C: 0.61

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	33.4	33.4		
20	119.95	22.5	22.5		
30	91.87	17.2	17.2		
40	75.15	14.1	14.1		
50	63.95	12.0	12.0		
60	55.89	10.5	10.5		
70	49.79	9.3	9.3		
80	44.99	8.4	8.4		
90	41.11	7.7	7.7		
100	37.90	7.1	7.1		
110	35.20	6.6	6.6		
120	32.89	6.2	6.2		

Subdrainage Area: BLDGA — Roof
Area (ha): 0.12 — Maximum Storage Depth 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	57.1	7.1	50.0	30.0	129.4	0.00
20	119.95	38.3	7.3	31.1	37.3	138.7	0.00
30	91.87	29.4	7.4	22.0	39.6	141.8	0.00
40	75.15	24.0	7.4	16.6	**40.0**	142.2	0.00
50	63.95	20.4	7.4	13.1	39.3	141.3	0.00
60	55.89	17.9	7.3	10.6	38.0	139.7	0.00
70	49.79	15.9	7.3	8.7	36.4	137.6	0.00
80	44.99	14.4	7.2	7.2	34.5	135.2	0.00
90	41.11	13.1	7.1	6.0	32.5	132.5	0.00
100	37.90	12.1	7.1	5.1	30.3	129.8	0.00
110	35.20	11.3	7.0	4.3	28.1	127.0	0.00
120	32.89	10.5	6.9	3.6	26.0	123.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Leve	142.21	0.14	7.4	40.0	46.0	0.00

Subdrainage Area: BLDGC — Roof
Area (ha): 0.12 — Maximum Storage Depth 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	57.1	7.1	50.0	30.0	129.4	0.00
20	119.95	38.3	7.3	31.1	37.3	138.7	0.00
30	91.87	29.4	7.4	22.0	39.6	141.8	0.00
40	75.15	24.0	7.4	16.6	**40.0**	142.2	0.00
50	63.95	20.4	7.4	13.1	39.3	141.3	0.00
60	55.89	17.9	7.3	10.6	38.0	139.7	0.00
70	49.79	15.9	7.3	8.7	36.4	137.6	0.00
80	44.99	14.4	7.2	7.2	34.5	135.2	0.00
90	41.11	13.1	7.1	6.0	32.5	132.5	0.00
100	37.90	12.1	7.1	5.1	30.3	129.8	0.00
110	35.20	11.3	7.0	4.3	28.1	127.0	0.00
120	32.89	10.5	6.9	3.6	26.0	123.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Leve	142.21	0.14	7.4	40.0	46.0	0.00

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: BLDGB — Roof
Area (ha): 0.11 — Maximum Storage Depth 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	27.9	6.3	21.6	12.9	100.5	0.00
20	70.25	18.8	6.4	12.4	**14.9**	104.5	0.00
30	53.93	14.4	6.4	8.0	14.5	103.7	0.00
40	44.18	11.8	6.3	5.5	13.2	101.0	0.00
50	37.65	10.1	6.2	3.9	11.6	96.3	0.00
60	32.94	8.8	6.1	2.7	9.9	90.5	0.00
70	29.37	7.9	5.9	1.9	8.2	84.6	0.00
80	26.56	7.1	5.8	1.3	6.4	78.7	0.00
90	24.29	6.5	5.6	0.9	4.9	71.9	0.00
100	22.41	6.0	5.4	0.6	3.6	63.7	0.00
110	20.82	5.6	5.2	0.4	2.5	56.0	0.00
120	19.47	5.2	5.0	0.2	1.6	49.5	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Leve	104.51	0.10	6.4	14.9	42.8	0.00

Subdrainage Area: L301A — Controlled - Tributary
Area (ha): 0.14
C: 0.87

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	35.0	40.2	0.0	**0.0**
20	70.25	23.6	40.2	0.0	**0.0**
30	53.93	18.1	40.2	0.0	**0.0**
40	44.18	14.9	40.2	0.0	**0.0**
50	37.65	12.7	40.2	0.0	**0.0**
60	32.94	11.1	40.2	0.0	**0.0**
70	29.37	9.9	40.2	0.0	**0.0**
80	26.56	8.9	40.2	0.0	**0.0**
90	24.29	8.2	40.2	0.0	**0.0**
100	22.41	7.5	40.2	0.0	**0.0**
110	20.82	7.0	40.2	0.0	**0.0**
120	19.47	6.5	40.2	0.0	**0.0**

Storage: e Above CE

Orifice Equation: CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 127.00 mm
Invert Elevation 77.99 m
T/G Elevation 79.37 m
Max Ponding Depth 0.00 m
Downstream W/L 75.30 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	79.37	1.38	40.2	0.0	16.1	OK

Subdrainage Area: L300A — Controlled - Tributary
Area (ha): 0.14
C: 0.87

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	34.5	40.2	0.0	**0.0**
20	70.25	23.3	40.2	0.0	**0.0**
30	53.93	17.9	40.2	0.0	**0.0**
40	44.18	14.6	40.2	0.0	**0.0**
50	37.65	12.5	40.2	0.0	**0.0**
60	32.94	10.9	40.2	0.0	**0.0**
70	29.37	9.7	40.2	0.0	**0.0**
80	26.56	8.8	40.2	0.0	**0.0**
90	24.29	8.0	40.2	0.0	**0.0**
100	22.41	7.4	40.2	0.0	**0.0**
110	20.82	6.9	40.2	0.0	**0.0**
120	19.47	6.5	40.2	0.0	**0.0**

Storage: e Above CE

Orifice Equation: CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 127.00 mm
Invert Elevation 77.89 m
T/G Elevation 79.27 m
Max Ponding Depth 0.00 m
Downstream W/L 75.30 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	79.27	1.38	40.2	0.0	18.7	OK

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: BLDGB — Roof
Area (ha): 0.11 — Maximum Storage Depth 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	53.1	7.0	46.1	27.6	129.0	0.00
20	119.95	35.7	7.3	28.4	34.1	137.9	0.00
30	91.87	27.3	7.3	20.0	36.0	140.6	0.00
40	75.15	22.4	7.3	15.0	**36.0**	140.6	0.00
50	63.95	19.0	7.3	11.7	35.2	139.4	0.00
60	55.89	16.6	7.3	9.4	33.7	137.4	0.00
70	49.79	14.8	7.2	7.6	32.0	135.0	0.00
80	44.99	13.4	7.1	6.3	30.0	132.3	0.00
90	41.11	12.2	7.1	5.2	28.0	129.4	0.00
100	37.90	11.3	7.0	4.3	25.8	126.4	0.00
110	35.20	10.5	6.9	3.6	23.7	122.8	0.00
120	32.89	9.8	6.8	3.0	21.7	118.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Leve	140.63	0.14	7.3	36.0	42.8	0.00

Subdrainage Area: L301A — Controlled - Tributary
Area (ha): 0.14
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	69.0	42.8	26.2	**15.7**
20	119.95	46.4	42.8	3.6	4.3
30	91.87	35.5	42.8	0.0	0.0
40	75.15	29.0	42.8	0.0	0.0
50	63.95	24.7	42.8	0.0	0.0
60	55.89	21.6	42.8	0.0	0.0
70	49.79	19.2	42.8	0.0	0.0
80	44.99	17.4	42.8	0.0	0.0
90	41.11	15.9	42.8	0.0	0.0
100	37.90	14.6	42.8	0.0	0.0
110	35.20	13.6	42.8	0.0	0.0
120	32.89	12.7	42.8	0.0	0.0

Storage: Surface Storage Above CE

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 127.00 mm
Invert Elevation 77.99 m
T/G Elevation 79.37 m
Max Ponding Depth 0.18 m
Downstream W/L 75.30 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	79.55	1.56	42.8	15.7	16.1	OK
					0.35	

Subdrainage Area: L300A — Controlled - Tributary
Area (ha): 0.14
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	68.0	42.8	25.3	**15.2**
20	119.95	45.7	42.8	2.9	3.5
30	91.87	35.0	42.8	0.0	0.0
40	75.15	28.6	42.8	0.0	0.0
50	63.95	24.4	42.8	0.0	0.0
60	55.89	21.3	42.8	0.0	0.0
70	49.79	19.0	42.8	0.0	0.0
80	44.99	17.1	42.8	0.0	0.0
90	41.11	15.7	42.8	0.0	0.0
100	37.90	14.4	42.8	0.0	0.0
110	35.20	13.4	42.8	0.0	0.0
120	32.89	12.5	42.8	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 127.00 mm
Invert Elevation 77.89 m
T/G Elevation 79.27 m
Max Ponding Depth 0.18 m
Downstream W/L 75.30 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	79.45	1.56	42.8	15.2	18.7	OK
					3.55	

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: L303A — Controlled - Tributary
Area (ha): 0.25
C: 0.62

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	45.4	12.1	33.3	20.0
20	70.25	30.6	12.1	18.5	**22.2**
30	53.93	23.5	12.1	11.4	20.5
40	44.18	19.3	12.1	7.2	17.2
50	37.65	16.4	12.1	4.3	12.9
60	32.94	14.4	12.1	2.3	8.1
70	29.37	12.8	12.1	0.7	2.9
80	26.56	11.6	12.1	0.0	0.0
90	24.29	10.6	12.1	0.0	0.0
100	22.41	9.8	12.1	0.0	0.0
110	20.82	9.1	12.1	0.0	0.0
120	19.47	8.5	12.1	0.0	0.0

Storage: e Above CB

Orifice Diameter: 83.00
Invert Elevation 76.33 m
T/G Elevation 77.71 m
Max Ponding Depth 0.15 m
Downstream W/L 75.23 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	77.86	1.53	12.1	22.2	85.1	OK

Subdrainage Area: F101A — Uncontrolled - Tributary
Area (ha): 0.09
C: 0.87

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	22.7	22.7		
20	70.25	15.3	15.3		
30	53.93	11.7	11.7		
40	44.18	9.6	9.6		
50	37.65	8.2	8.2		
60	32.94	7.2	7.2		
70	29.37	6.4	6.4		
80	26.56	5.8	5.8		
90	24.29	5.3	5.3		
100	22.41	4.9	4.9		
110	20.82	4.5	4.5		
120	19.47	4.2	4.2		

Subdrainage Area: UNC-2 — Uncontrolled - Tributary
Area (ha): 0.05
C: 0.30

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.6	4.6		
20	70.25	3.1	3.1		
30	53.93	2.4	2.4		
40	44.18	2.0	2.0		
50	37.65	1.7	1.7		
60	32.94	1.5	1.5		
70	29.37	1.3	1.3		
80	26.56	1.2	1.2		
90	24.29	1.1	1.1		
100	22.41	1.0	1.0		
110	20.82	0.9	0.9		
120	19.47	0.9	0.9		

Subdrainage Area: EX-19 — Uncontrolled - Tributary
Area (ha): 0.15
C: 0.48

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	20.3	20.3		
20	70.25	13.7	13.7		
30	53.93	10.5	10.5		
40	44.18	8.6	8.6		
50	37.65	7.3	7.3		
60	32.94	6.4	6.4		
70	29.37	5.7	5.7		
80	26.56	5.2	5.2		
90	24.29	4.7	4.7		
100	22.41	4.4	4.4		
110	20.82	4.1	4.1		
120	19.47	3.8	3.8		

Subdrainage Area: EX-18 — Uncontrolled - Tributary
Area (ha): 0.07
C: 0.25

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.9	4.9		
20	70.25	3.3	3.3		
30	53.93	2.5	2.5		
40	44.18	2.1	2.1		
50	37.65	1.8	1.8		
60	32.94	1.5	1.5		
70	29.37	1.4	1.4		
80	26.56	1.2	1.2		
90	24.29	1.1	1.1		
100	22.41	1.0	1.0		
110	20.82	1.0	1.0		
120	19.47	0.9	0.9		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: L303A — Controlled - Tributary
Area (ha): 0.25
C: 0.78

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	97.3	18.6	78.7	47.2
20	119.95	65.4	18.6	46.8	56.1
30	91.87	50.1	18.6	31.5	**56.6**
40	75.15	41.0	18.6	22.4	53.6
50	63.95	34.9	18.6	16.3	48.8
60	55.89	30.5	18.6	11.9	42.7
70	49.79	27.1	18.6	8.5	35.8
80	44.99	24.5	18.6	5.9	28.4
90	41.11	22.4	18.6	3.8	20.5
100	37.90	20.7	18.6	2.1	12.3
110	35.20	19.2	18.6	0.6	3.8
120	32.89	17.9	18.6	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm CB Storage: 0.62 m3
Invert Elevation 76.33 m
T/G Elevation 77.71 m
Max Ponding Depth 0.24 m
Downstream W/L 75.23 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	77.95	1.62	18.6	56.6	85.1	OK
					28.46	

Subdrainage Area: F101A — Uncontrolled - Tributary
Area (ha): 0.09
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	44.7	44.7		
20	119.95	30.0	30.0		
30	91.87	23.0	23.0		
40	75.15	18.8	18.8		
50	63.95	16.0	16.0		
60	55.89	14.0	14.0		
70	49.79	12.5	12.5		
80	44.99	11.3	11.3		
90	41.11	10.3	10.3		
100	37.90	9.5	9.5		
110	35.20	8.8	8.8		
120	32.89	8.2	8.2		

Subdrainage Area: UNC-2 — Uncontrolled - Tributary
Area (ha): 0.05
C: 0.38

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	9.9	9.9		
20	119.95	6.7	6.7		
30	91.87	5.1	5.1		
40	75.15	4.2	4.2		
50	63.95	3.6	3.6		
60	55.89	3.1	3.1		
70	49.79	2.8	2.8		
80	44.99	2.5	2.5		
90	41.11	2.3	2.3		
100	37.90	2.1	2.1		
110	35.20	2.0	2.0		
120	32.89	1.8	1.8		

Subdrainage Area: EX-19 — Uncontrolled - Tributary
Area (ha): 0.15
C: 0.60

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	43.5	43.5		
20	119.95	29.2	29.2		
30	91.87	22.4	22.4		
40	75.15	18.3	18.3		
50	63.95	15.6	15.6		
60	55.89	13.6	13.6		
70	49.79	12.1	12.1		
80	44.99	11.0	11.0		
90	41.11	10.0	10.0		
100	37.90	9.2	9.2		
110	35.20	8.6	8.6		
120	32.89	8.0	8.0		

Subdrainage Area: EX-18 — Uncontrolled - Tributary
Area (ha): 0.07
C: 0.31

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	10.4	10.4		
20	119.95	7.0	7.0		
30	91.87	5.3	5.3		
40	75.15	4.4	4.4		
50	63.95	3.7	3.7		
60	55.89	3.3	3.3		
70	49.79	2.9	2.9		
80	44.99	2.6	2.6		
90	41.11	2.4	2.4		
100	37.90	2.2	2.2		
110	35.20	2.0	2.0		
120	32.89	1.9	1.9		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: EX-15 — Uncontrolled - Tributary
Area (ha): 0.08
C: 0.43

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	9.7	9.7		
20	70.25	6.6	6.6		
30	53.93	5.0	5.0		
40	44.18	4.1	4.1		
50	37.65	3.5	3.5		
60	32.94	3.1	3.1		
70	29.37	2.7	2.7		
80	26.56	2.5	2.5		
90	24.29	2.3	2.3		
100	22.41	2.1	2.1		
110	20.82	1.9	1.9		
120	19.47	1.8	1.8		

Subdrainage Area: EX-14 — Uncontrolled - Tributary
Area (ha): 0.33
C: 0.40

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	38.1	38.1		
20	70.25	25.7	25.7		
30	53.93	19.7	19.7		
40	44.18	16.2	16.2		
50	37.65	13.8	13.8		
60	32.94	12.1	12.1		
70	29.37	10.7	10.7		
80	26.56	9.7	9.7		
90	24.29	8.9	8.9		
100	22.41	8.2	8.2		
110	20.82	7.6	7.6		
120	19.47	7.1	7.1		

Subdrainage Area: EX-13 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.5	60.5		
20	70.25	40.8	40.8		
30	53.93	31.3	31.3		
40	44.18	25.6	25.6		
50	37.65	21.9	21.9		
60	32.94	19.1	19.1		
70	29.37	17.0	17.0		
80	26.56	15.4	15.4		
90	24.29	14.1	14.1		
100	22.41	13.0	13.0		
110	20.82	12.1	12.1		
120	19.47	11.3	11.3		

Subdrainage Area: EX-12 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.5	60.5		
20	70.25	40.8	40.8		
30	53.93	31.3	31.3		
40	44.18	25.6	25.6		
50	37.65	21.9	21.9		
60	32.94	19.1	19.1		
70	29.37	17.0	17.0		
80	26.56	15.4	15.4		
90	24.29	14.1	14.1		
100	22.41	13.0	13.0		
110	20.82	12.1	12.1		
120	19.47	11.3	11.3		

Subdrainage Area: EX-11 — Uncontrolled - Tributary
Area (ha): 0.13
C: 0.42

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	16.2	16.2		
20	70.25	10.9	10.9		
30	53.93	8.4	8.4		
40	44.18	6.9	6.9		
50	37.65	5.8	5.8		
60	32.94	5.1	5.1		
70	29.37	4.6	4.6		
80	26.56	4.1	4.1		
90	24.29	3.8	3.8		
100	22.41	3.5	3.5		
110	20.82	3.2	3.2		
120	19.47	3.0	3.0		

Subdrainage Area: EX-10 — Uncontrolled - Tributary
Area (ha): 0.38
C: 0.69

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	75.1	75.1		
20	70.25	50.7	50.7		
30	53.93	38.9	38.9		
40	44.18	31.9	31.9		
50	37.65	27.2	27.2		
60	32.94	23.8	23.8		
70	29.37	21.2	21.2		
80	26.56	19.2	19.2		
90	24.29	17.5	17.5		
100	22.41	16.2	16.2		
110	20.82	15.0	15.0		
120	19.47	14.0	14.0		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: EX-15 — Uncontrolled - Tributary
Area (ha): 0.08
C: 0.54

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	20.8	20.8		
20	119.95	14.0	14.0		
30	91.87	10.7	10.7		
40	75.15	8.8	8.8		
50	63.95	7.5	7.5		
60	55.89	6.5	6.5		
70	49.79	5.8	5.8		
80	44.99	5.2	5.2		
90	41.11	4.8	4.8		
100	37.90	4.4	4.4		
110	35.20	4.1	4.1		
120	32.89	3.8	3.8		

Subdrainage Area: EX-14 — Uncontrolled - Tributary
Area (ha): 0.33
C: 0.50

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	81.7	81.7		
20	119.95	54.9	54.9		
30	91.87	42.0	42.0		
40	75.15	34.4	34.4		
50	63.95	29.2	29.2		
60	55.89	25.6	25.6		
70	49.79	22.8	22.8		
80	44.99	20.6	20.6		
90	41.11	18.8	18.8		
100	37.90	17.3	17.3		
110	35.20	16.1	16.1		
120	32.89	15.0	15.0		

Subdrainage Area: EX-13 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	115.2	115.2		
20	119.95	77.4	77.4		
30	91.87	59.3	59.3		
40	75.15	48.5	48.5		
50	63.95	41.2	41.2		
60	55.89	36.0	36.0		
70	49.79	32.1	32.1		
80	44.99	29.0	29.0		
90	41.11	26.5	26.5		
100	37.90	24.4	24.4		
110	35.20	22.7	22.7		
120	32.89	21.2	21.2		

Subdrainage Area: EX-12 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	115.2	115.2		
20	119.95	77.4	77.4		
30	91.87	59.3	59.3		
40	75.15	48.5	48.5		
50	63.95	41.2	41.2		
60	55.89	36.0	36.0		
70	49.79	32.1	32.1		
80	44.99	29.0	29.0		
90	41.11	26.5	26.5		
100	37.90	24.4	24.4		
110	35.20	22.7	22.7		
120	32.89	21.2	21.2		

Subdrainage Area: EX-11 — Uncontrolled - Tributary
Area (ha): 0.13
C: 0.53

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	34.7	34.7		
20	119.95	23.3	23.3		
30	91.87	17.8	17.8		
40	75.15	14.6	14.6		
50	63.95	12.4	12.4		
60	55.89	10.8	10.8		
70	49.79	9.7	9.7		
80	44.99	8.7	8.7		
90	41.11	8.0	8.0		
100	37.90	7.4	7.4		
110	35.20	6.8	6.8		
120	32.89	6.4	6.4		

Subdrainage Area: EX-10 — Uncontrolled - Tributary
Area (ha): 0.38
C: 0.86

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	161.0	161.0		
20	119.95	108.1	108.1		
30	91.87	82.8	82.8		
40	75.15	67.7	67.7		
50	63.95	57.7	57.7		
60	55.89	50.4	50.4		
70	49.79	44.9	44.9		
80	44.99	40.6	40.6		
90	41.11	37.1	37.1		
100	37.90	34.2	34.2		
110	35.20	31.7	31.7		
120	32.89	29.7	29.7		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: EX-9 — Uncontrolled - Tributary
Area (ha): 0.06
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	15.8	15.8		
20	70.25	10.7	10.7		
30	53.93	8.2	8.2		
40	44.18	6.7	6.7		
50	37.65	5.7	5.7		
60	32.94	5.0	5.0		
70	29.37	4.5	4.5		
80	26.56	4.0	4.0		
90	24.29	3.7	3.7		
100	22.41	3.4	3.4		
110	20.82	3.2	3.2		
120	19.47	3.0	3.0		

Subdrainage Area: EX-8 — Uncontrolled - Tributary
Area (ha): 0.71
C: 0.65

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	134.4	134.4		
20	70.25	90.6	90.6		
30	53.93	69.6	69.6		
40	44.18	57.0	57.0		
50	37.65	48.6	48.6		
60	32.94	42.5	42.5		
70	29.37	37.9	37.9		
80	26.56	34.3	34.3		
90	24.29	31.3	31.3		
100	22.41	28.9	28.9		
110	20.82	26.9	26.9		
120	19.47	25.1	25.1		

Subdrainage Area: EX-7 — Uncontrolled - Tributary
Area (ha): 0.07
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.3	4.3		
20	70.25	2.9	2.9		
30	53.93	2.2	2.2		
40	44.18	1.8	1.8		
50	37.65	1.6	1.6		
60	32.94	1.4	1.4		
70	29.37	1.2	1.2		
80	26.56	1.1	1.1		
90	24.29	1.0	1.0		
100	22.41	0.9	0.9		
110	20.82	0.9	0.9		
120	19.47	0.8	0.8		

Subdrainage Area: EX-5 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.2	60.2		
20	70.25	40.6	40.6		
30	53.93	31.2	31.2		
40	44.18	25.5	25.5		
50	37.65	21.8	21.8		
60	32.94	19.0	19.0		
70	29.37	17.0	17.0		
80	26.56	15.4	15.4		
90	24.29	14.0	14.0		
100	22.41	13.0	13.0		
110	20.82	12.0	12.0		
120	19.47	11.3	11.3		

Subdrainage Area: EX-4 — Uncontrolled - Tributary
Area (ha): 0.69
C: 0.63

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	125.2	125.2		
20	70.25	84.4	84.4		
30	53.93	64.8	64.8		
40	44.18	53.1	53.1		
50	37.65	45.2	45.2		
60	32.94	39.6	39.6		
70	29.37	35.3	35.3		
80	26.56	31.9	31.9		
90	24.29	29.2	29.2		
100	22.41	26.9	26.9		
110	20.82	25.0	25.0		
120	19.47	23.4	23.4		

Subdrainage Area: EX-3 — Uncontrolled - Tributary
Area (ha): 0.23
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	60.2	60.2		
20	70.25	40.6	40.6		
30	53.93	31.2	31.2		
40	44.18	25.5	25.5		
50	37.65	21.8	21.8		
60	32.94	19.0	19.0		
70	29.37	17.0	17.0		
80	26.56	15.4	15.4		
90	24.29	14.0	14.0		
100	22.41	13.0	13.0		
110	20.82	12.0	12.0		
120	19.47	11.3	11.3		

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: EX-9 — Uncontrolled - Tributary
Area (ha): 0.06
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	30.1	30.1		
20	119.95	20.2	20.2		
30	91.87	15.5	15.5		
40	75.15	12.7	12.7		
50	63.95	10.8	10.8		
60	55.89	9.4	9.4		
70	49.79	8.4	8.4		
80	44.99	7.6	7.6		
90	41.11	6.9	6.9		
100	37.90	6.4	6.4		
110	35.20	5.9	5.9		
120	32.89	5.6	5.6		

Subdrainage Area: EX-8 — Uncontrolled - Tributary
Area (ha): 0.71
C: 0.81

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	288.0	288.0		
20	119.95	193.4	193.4		
30	91.87	148.2	148.2		
40	75.15	121.2	121.2		
50	63.95	103.1	103.1		
60	55.89	90.1	90.1		
70	49.79	80.3	80.3		
80	44.99	72.6	72.6		
90	41.11	66.3	66.3		
100	37.90	61.1	61.1		
110	35.20	56.8	56.8		
120	32.89	53.1	53.1		

Subdrainage Area: EX-7 — Uncontrolled - Tributary
Area (ha): 0.07
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	9.3	9.3		
20	119.95	6.2	6.2		
30	91.87	4.8	4.8		
40	75.15	3.9	3.9		
50	63.95	3.3	3.3		
60	55.89	2.9	2.9		
70	49.79	2.6	2.6		
80	44.99	2.3	2.3		
90	41.11	2.1	2.1		
100	37.90	2.0	2.0		
110	35.20	1.8	1.8		
120	32.89	1.7	1.7		

Subdrainage Area: EX-5 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	114.7	114.7		
20	119.95	77.0	77.0		
30	91.87	59.0	59.0		
40	75.15	48.3	48.3		
50	63.95	41.1	41.1		
60	55.89	35.9	35.9		
70	49.79	32.0	32.0		
80	44.99	28.9	28.9		
90	41.11	26.4	26.4		
100	37.90	24.3	24.3		
110	35.20	22.6	22.6		
120	32.89	21.1	21.1		

Subdrainage Area: EX-4 — Uncontrolled - Tributary
Area (ha): 0.69
C: 0.79

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	268.2	268.2		
20	119.95	180.1	180.1		
30	91.87	138.0	138.0		
40	75.15	112.9	112.9		
50	63.95	96.0	96.0		
60	55.89	83.9	83.9		
70	49.79	74.8	74.8		
80	44.99	67.6	67.6		
90	41.11	61.7	61.7		
100	37.90	56.9	56.9		
110	35.20	52.9	52.9		
120	32.89	49.4	49.4		

Subdrainage Area: EX-3 — Uncontrolled - Tributary
Area (ha): 0.23
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	114.7	114.7		
20	119.95	77.0	77.0		
30	91.87	59.0	59.0		
40	75.15	48.3	48.3		
50	63.95	41.1	41.1		
60	55.89	35.9	35.9		
70	49.79	32.0	32.0		
80	44.99	28.9	28.9		
90	41.11	26.4	26.4		
100	37.90	24.3	24.3		
110	35.20	22.6	22.6		
120	32.89	21.1	21.1		

Stormwater Management Calculations

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: EX-2 — Uncontrolled - Tributary
Area (ha): 0.27
C: 0.37

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	28.8	28.8		
20	70.25	19.4	19.4		
30	53.93	14.9	14.9		
40	44.18	12.2	12.2		
50	37.65	10.4	10.4		
60	32.94	9.1	9.1		
70	29.37	8.1	8.1		
80	26.56	7.3	7.3		
90	24.29	6.7	6.7		
100	22.41	6.2	6.2		
110	20.82	5.8	5.8		
120	19.47	5.4	5.4		

Subdrainage Area: EX-1 — Uncontrolled - Tributary
Area (ha): 0.28
C: 0.33

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	27.1	27.1		
20	70.25	18.3	18.3		
30	53.93	14.1	14.1		
40	44.18	11.5	11.5		
50	37.65	9.8	9.8		
60	32.94	8.6	8.6		
70	29.37	7.7	7.7		
80	26.56	6.9	6.9		
90	24.29	6.3	6.3		
100	22.41	5.8	5.8		
110	20.82	5.4	5.4		
120	19.47	5.1	5.1		

5 YEAR SUMMARY TO OUTLET

Tributary Area	1.18 ha
Total 5yr Flow to Sewer	134.1 L/s
Non-Tributary Area	0.33 ha
Total 5yr Flow Uncontrolled	51.4 L/s
Total Area	1.51 ha
Total 5yr Flow	185.5 L/s
Target	282.3 L/s

Project #160401483, Norberry Residences
Modified Rational Method Calculatons for Storag

Subdrainage Area: EX-2 — Uncontrolled - Tributary
Area (ha): 0.27
C: 0.46

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	61.8	61.8		
20	119.95	41.5	41.5		
30	91.87	31.8	31.8		
40	75.15	26.0	26.0		
50	63.95	22.1	22.1		
60	55.89	19.3	19.3		
70	49.79	17.2	17.2		
80	44.99	15.6	15.6		
90	41.11	14.2	14.2		
100	37.90	13.1	13.1		
110	35.20	12.2	12.2		
120	32.89	11.4	11.4		

Subdrainage Area: EX-1 — Uncontrolled - Tributary
Area (ha): 0.28
C: 0.41

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	58.2	58.2		
20	119.95	39.1	39.1		
30	91.87	29.9	29.9		
40	75.15	24.5	24.5		
50	63.95	20.8	20.8		
60	55.89	18.2	18.2		
70	49.79	16.2	16.2		
80	44.99	14.7	14.7		
90	41.11	13.4	13.4		
100	37.90	12.3	12.3		
110	35.20	11.5	11.5		
120	32.89	10.7	10.7		

100 YEAR SUMMARY TO OUTLET

***Proposed Redeveloped Areas of The Site**

Controlled Tributary Area	1.18 ha
Total 100yr Flow to Sewer	162.4 L/s
Uncontrolled Tributary Area	0.33 ha
Total 100yr Flow Uncontrolled	104.2 L/s
Total Area	1.51 ha
Total 100yr Flow	266.6 L/s
Target	282.3 L/s

***Existing Areas of The Site to Remain**

Post Development

Tributary Area	4.076 ha
Total 100yr Flow to Sewer	1,517 L/s

Pre Development

Tributary Area	4.040 ha
Total 100yr Flow to Sewer	1,518 L/s

Project #160401483, Norberry Residences
Roof Drain Design Sheet, Area BLDGA
Standard Watts Model R1100 Accutrol Roof Drain

6/10/2021

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0025	0	0.025	26	0	0	0.025
0.050	0.0006	0.0050	2	0.050	102	1	2	0.050
0.075	0.0007	0.0057	6	0.075	230	4	6	0.075
0.100	0.0008	0.0063	14	0.100	409	8	14	0.100
0.125	0.0009	0.0069	27	0.125	639	13	27	0.125
0.150	0.0009	0.0076	46	0.150	920	19	46	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.5	295.4	1.5	0.082044
5.5	712.6	4.0	0.279992
13.4	1248.9	7.9	0.626922
26.4	1871.9	13.0	1.14689
45.8	2559.8	19.4	1.857939

Rooftop Storage Summary

Total Building Area (sq.m)		1150
Assume Available Roof Area (sq.m)	80%	920
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		8
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		46
Estimated 100 Year Drawdown Time (h)		1.6

115

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m) L/s

	Open	75%	50%	**25%**	Closed
0.025	0.3155	0.31545	0.31545	**0.31545**	0.31545
0.050	0.6309	0.6309	0.6309	**0.6309**	0.31545
0.075	0.9464	0.86749	0.78863	**0.70976**	0.31545
0.100	1.2618	1.10408	0.94635	**0.78863**	0.31545
0.125	1.5773	1.34067	1.10408	**0.86749**	0.31545
0.150	1.8927	1.57726	1.2618	**0.94635**	0.31545

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.006	0.007	-
Depth (m)	0.106	0.142	0.150
Volume (cu.m)	16.5	40.0	46.0
Draintime (hrs)	0.8	1.6	

Project #160401483, Norberry Residences
Roof Drain Design Sheet, Area BLDGB
Standard Watts Model R1100 Accutrol Roof Drain

6/10/2021

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0025	0	0.025	24	0	0	0.025
0.050	0.0006	0.0050	2	0.050	95	1	2	0.050
0.075	0.0007	0.0057	5	0.075	214	4	5	0.075
0.100	0.0008	0.0063	13	0.100	380	7	13	0.100
0.125	0.0009	0.0069	25	0.125	594	12	25	0.125
0.150	0.0009	0.0076	43	0.150	856	18	43	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.4	274.8	1.4	0.07634
5.2	663.0	3.8	0.26051
12.5	1162.1	7.3	0.58331
24.6	1741.7	12.1	1.06711
42.6	2381.7	18.0	1.72869

Rooftop Storage Summary

Total Building Area (sq.m)		1070
Assume Available Roof Area (sq.	80%	856
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		8
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		43
Estimated 100 Year Drawdown Time (h)		1.5

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	**25%**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.050	0.6309	0.6309	0.6309	**0.6309**	0.3155
0.075	0.9464	0.8675	0.7886	**0.7098**	0.3155
0.100	1.2618	1.1041	0.9464	**0.7886**	0.3155
0.125	1.5773	1.3407	1.1041	**0.8675**	0.3155
0.150	1.8927	1.5773	1.2618	**0.9464**	0.3155

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.006	0.007	-
Depth (m)	0.105	0.141	0.150
Volume (cu.m)	14.9	36.0	42.8
Draintime (hrs)	0.7	1.5	

Project #160401483, Norberry Residences
Roof Drain Design Sheet, Area BLDGC
Standard Watts Model R1100 Accutrol Roof Drain

6/10/2021

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0025	0	0.025	26	0	0	0.025
0.050	0.0006	0.0050	2	0.050	102	1	2	0.050
0.075	0.0007	0.0057	6	0.075	230	4	6	0.075
0.100	0.0008	0.0063	14	0.100	409	8	14	0.100
0.125	0.0009	0.0069	27	0.125	639	13	27	0.125
0.150	0.0009	0.0076	46	0.150	920	19	46	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.5	295.4	1.5	0.08204
5.5	712.6	4.0	0.27999
13.4	1248.9	7.9	0.62692
26.4	1871.9	13.0	1.14689
45.8	2559.8	19.4	1.85794

Rooftop Storage Summary

Total Building Area (sq.m)		1150
Assume Available Roof Area (sq.	80%	920
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		8
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		46
Estimated 100 Year Drawdown Time (h)		1.6

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	**25%**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.050	0.6309	0.6309	0.6309	**0.6309**	0.3155
0.075	0.9464	0.8675	0.7886	**0.7098**	0.3155
0.100	1.2618	1.1041	0.9464	**0.7886**	0.3155
0.125	1.5773	1.3407	1.1041	**0.8675**	0.3155
0.150	1.8927	1.5773	1.2618	**0.9464**	0.3155

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.006	0.007	-
Depth (m)	0.106	0.142	0.150
Volume (cu.m)	16.5	40.0	46.0
Draintime (hrs)	0.8	1.6	

WATTS® DRAINAGE

Adjustable Accutrol Weir

Tag: _____

Adjustable Flow Control for Roof Drains

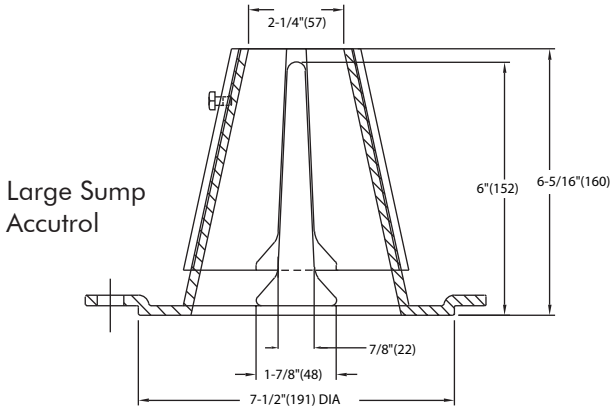
ADJUSTABLE ACCUTROL(for Large Sump Roof Drains only)

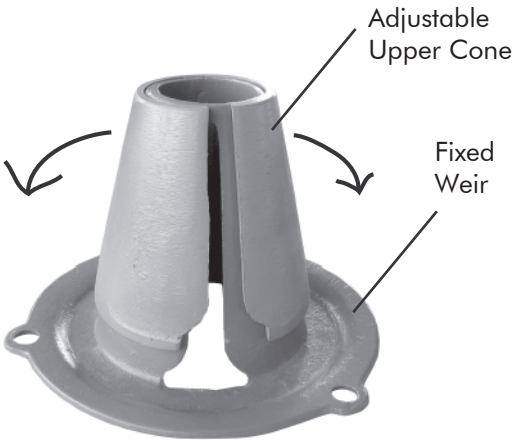
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the 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	Head of Water					
	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	10	10	10	10	10

Job Name _____ Contractor _____

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

Engineer _____ Representative _____

WATTS® DRAINAGE
CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca
CANADA

C.4 OIL/GRIT SEPARATOR SIZING CALCULATIONS

Detailed Stormceptor Sizing Report – STC 101

Project Information & Location			
Project Name	Norberry Crescent	**Project Number**	160401483
City	Ottawa	**State/ Province**	Ontario
Country	Canada	**Date**	7/10/2019
Designer Information		**EOR Information (optional)**	
Name	Cameron Odam	**Name**	
Company	Stantec Consulting Ltd.	**Company**	
Phone #	613-724-4353	**Phone #**	
Email	cameron.odam@stantec.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	STC 101
Recommended Stormceptor Model	STC 300
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	80
PSD	Fine Distribution
Rainfall Station	OTTAWA MACDONALD-CARTIER INT'L A

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary		
Stormceptor Model	**% TSS Removal Provided**	**% Runoff Volume Captured Provided**
STC 300	80	97
STC 750	87	99
STC 1000	88	99
STC 1500	89	99
STC 2000	91	100
STC 3000	92	100
STC 4000	94	100
STC 5000	94	100
STC 6000	95	100
STC 9000	97	100
STC 10000	97	100
STC 14000	98	100
StormceptorMAX	Custom	Custom

Stormceptor
The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology
Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:
• Site parameters
• Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
• Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
• TSS load
• Detention time of the system

Hydrology Analysis
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	Ontario	**Total Number of Rainfall Events**	4093
Rainfall Station Name	OTTAWA MACDONALD-CARTIER INT'L A	**Total Rainfall (mm)**	20978.1
Station ID #	6000	**Average Annual Rainfall (mm)**	567.0
Coordinates	45°19'N, 75°40'W	**Total Evaporation (mm)**	977.6
Elevation (ft)	370	**Total Infiltration (mm)**	9814.3
Years of Rainfall Data	37	**Total Rainfall that is Runoff (mm)**	10186.2

Notes
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.364
Imperviousness %	53.1

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000
0.002	0.035
0.003	0.077

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	90.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	375
Pipe Material	PVC - plastic
Multiple Inlets (Y/N)	Yes
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	STC 101

Site Details

Drainage Area

Total Area (ha)	0.364
Imperviousness %	53.1

Surface Characteristics

Width (m)	121.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

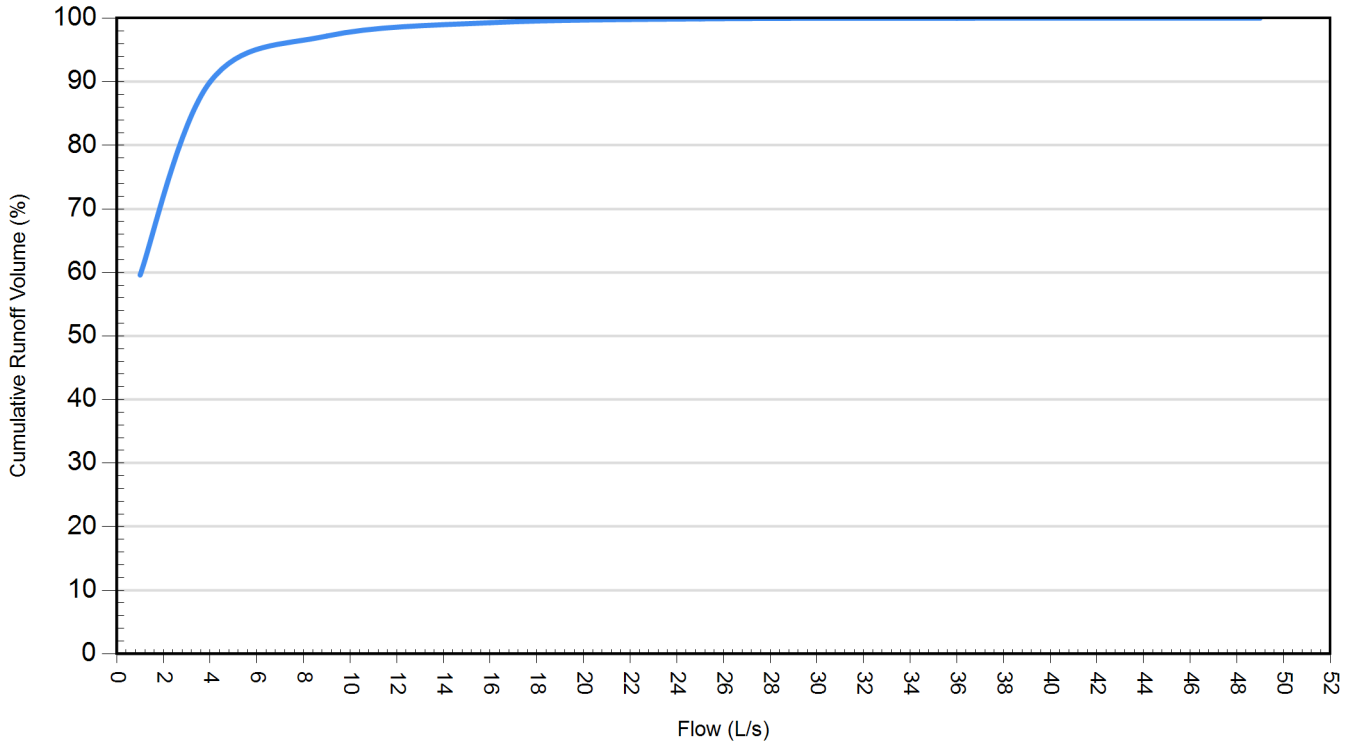
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

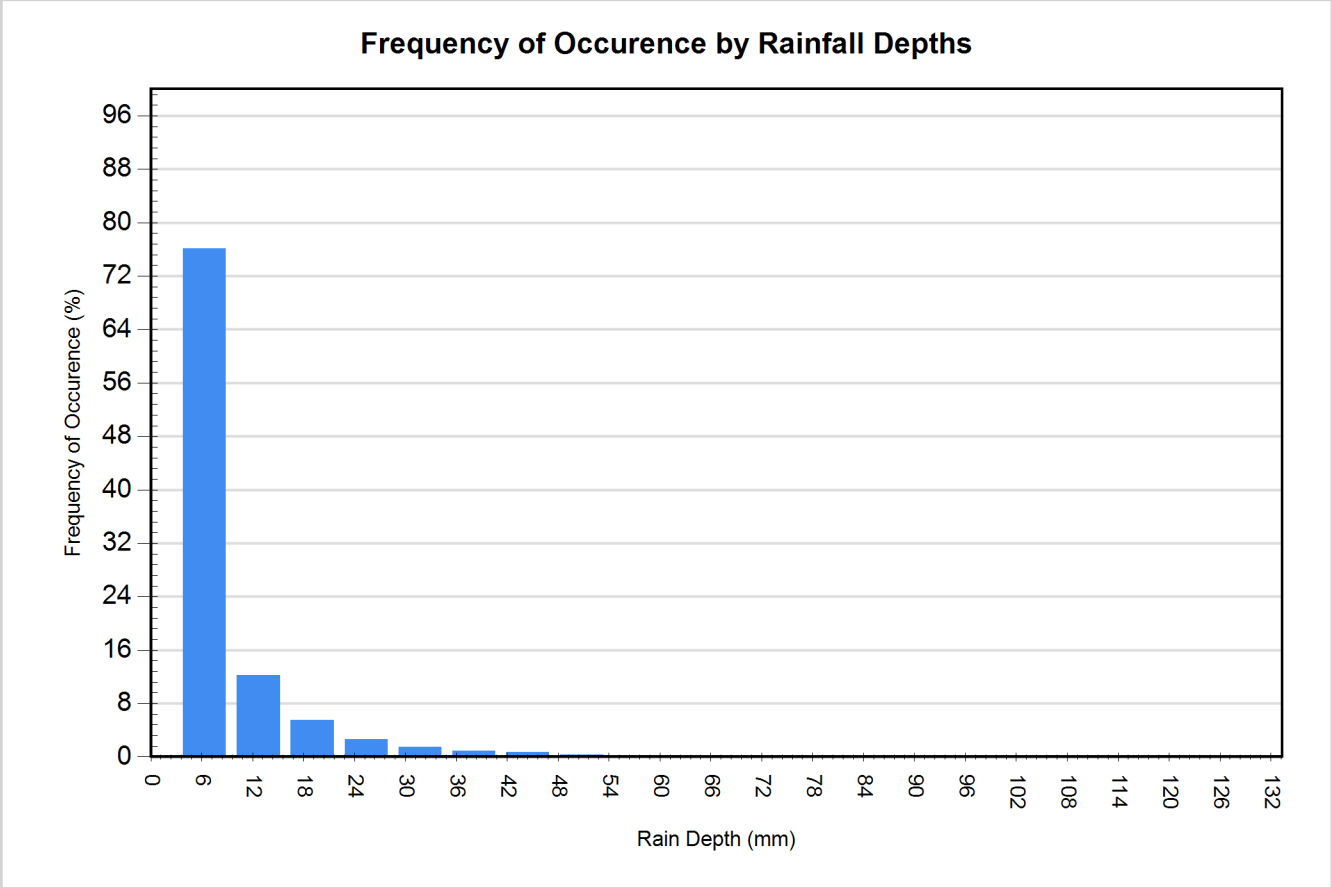
Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	Runoff Volume (m^3)	Volume Over (m^3)	Cumulative Runoff Volume (%)
1	22271	15072	59.6
4	33593	3753	90.0
9	36302	1044	97.2
16	37068	278	99.3
25	37296	50	99.9
36	37343	3	100.0
49	37346	0	100.0

Cumulative Runoff Volume by Runoff Rate

For area: 0.364(ha), imperviousness: 53.1%, rainfall station: OTTAWA MACDONALD-CARTIER INT'L A



Rainfall Event Analysis				
Rainfall Depth (mm)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (mm)**	**Percentage of Annual Volume (%)**
6.35	3113	76.1	5230	24.9
12.70	501	12.2	4497	21.4
19.05	225	5.5	3469	16.5
25.40	105	2.6	2317	11.0
31.75	62	1.5	1765	8.4
38.10	35	0.9	1206	5.8
44.45	28	0.7	1163	5.5
50.80	12	0.3	557	2.7
57.15	7	0.2	378	1.8
63.50	1	0.0	63	0.3
69.85	1	0.0	64	0.3
76.20	1	0.0	76	0.4
82.55	0	0.0	0	0.0
88.90	1	0.0	84	0.4
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0
114.30	1	0.0	109	0.5
120.65	0	0.0	0	0.0
127.00	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Detailed Stormceptor Sizing Report – Norberry 102

Project Information & Location			
Project Name	Norberry Crescent	**Project Number**	160401483
City	Ottawa	**State/ Province**	Ontario
Country	Canada	**Date**	7/10/2019
Designer Information		**EOR Information (optional)**	
Name	Dustin Thiffault	**Name**	
Company	Stantec Consulting Ltd.	**Company**	
Phone #	613-724-4420	**Phone #**	
Email	dustin.thiffault@stantec.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Norberry 102
Recommended Stormceptor Model	STC 300
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	86
PSD	Fine Distribution
Rainfall Station	OTTAWA MACDONALD-CARTIER INT'L A

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary		
Stormceptor Model	**% TSS Removal Provided**	**% Runoff Volume Captured Provided**
STC 300	86	100
STC 750	92	100
STC 1000	93	100
STC 1500	93	100
STC 2000	95	100
STC 3000	96	100
STC 4000	97	100
STC 5000	97	100
STC 6000	98	100
STC 9000	98	100
STC 10000	98	100
STC 14000	99	100
StormceptorMAX	Custom	Custom

Stormceptor
The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology
Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:
• Site parameters
• Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
• Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
• TSS load
• Detention time of the system

Hydrology Analysis
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	Ontario	**Total Number of Rainfall Events**	4093
Rainfall Station Name	OTTAWA MACDONALD-CARTIER INT'L A	**Total Rainfall (mm)**	20978.1
Station ID #	6000	**Average Annual Rainfall (mm)**	567.0
Coordinates	45°19'N, 75°40'W	**Total Evaporation (mm)**	1287.3
Elevation (ft)	370	**Total Infiltration (mm)**	5979.4
Years of Rainfall Data	37	**Total Rainfall that is Runoff (mm)**	13711.4

Notes
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.12
Imperviousness %	71.4

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	90.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	75.30
Stormceptor Outlet Invert Elev (m)	75.25
Stormceptor Rim Elev (m)	77.12
Normal Water Level Elevation (m)	74.52
Pipe Diameter (mm)	300
Pipe Material	PVC - plastic
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	Norberry 102

Site Details

Drainage Area

Total Area (ha)	0.12
Imperviousness %	71.4

Surface Characteristics

Width (m)	69.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

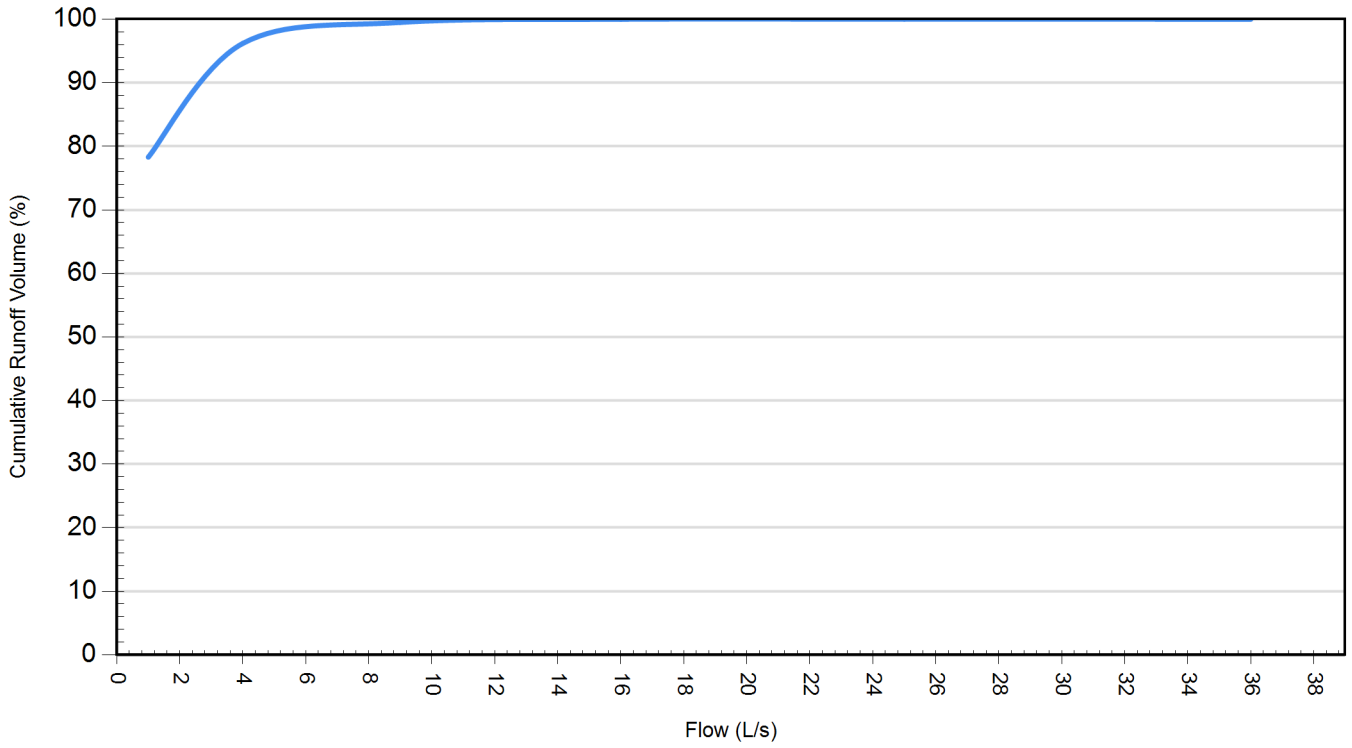
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

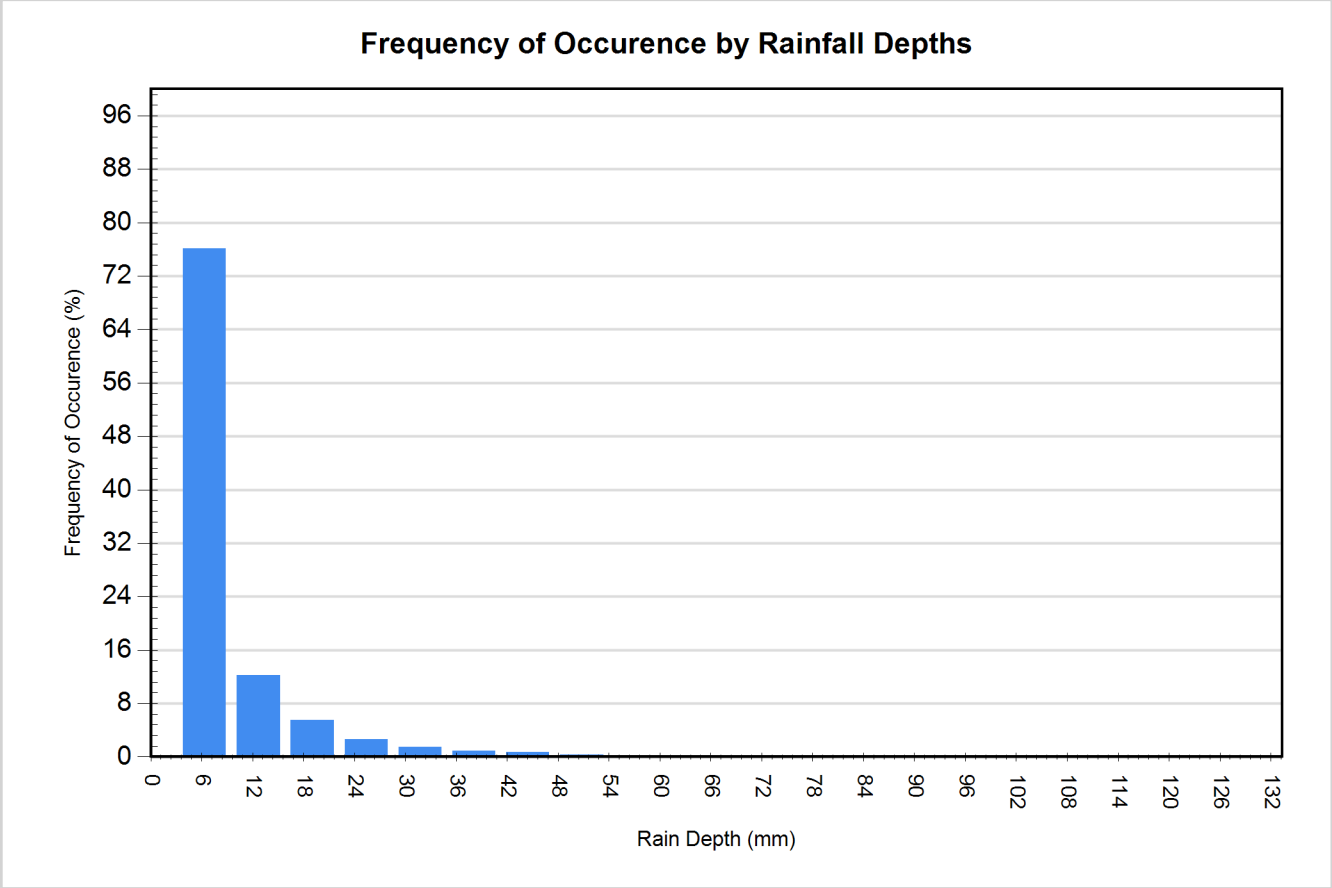
Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	Runoff Volume (m^3)	Volume Over (m^3)	Cumulative Runoff Volume (%)
1	12990	3594	78.3
4	15954	631	96.2
9	16501	84	99.5
16	16583	2	100.0
25	16585	0	100.0
36	16585	0	100.0

Cumulative Runoff Volume by Runoff Rate

For area: 0.12(ha), imperviousness: 71.4%, rainfall station: OTTAWA MACDONALD-CARTIER INT'L A



Rainfall Event Analysis				
Rainfall Depth (mm)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (mm)**	**Percentage of Annual Volume (%)**
6.35	3113	76.1	5230	24.9
12.70	501	12.2	4497	21.4
19.05	225	5.5	3469	16.5
25.40	105	2.6	2317	11.0
31.75	62	1.5	1765	8.4
38.10	35	0.9	1206	5.8
44.45	28	0.7	1163	5.5
50.80	12	0.3	557	2.7
57.15	7	0.2	378	1.8
63.50	1	0.0	63	0.3
69.85	1	0.0	64	0.3
76.20	1	0.0	76	0.4
82.55	0	0.0	0	0.0
88.90	1	0.0	84	0.4
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0
114.30	1	0.0	109	0.5
120.65	0	0.0	0	0.0
127.00	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Detailed Stormceptor Sizing Report – STC 103

Project Information & Location			
Project Name	Norberry Crescent	**Project Number**	160401483
City	Ottawa	**State/ Province**	Ontario
Country	Canada	**Date**	7/10/2019
Designer Information		**EOR Information (optional)**	
Name	Cameron Odam	**Name**	
Company	Stantec Consulting Ltd.	**Company**	
Phone #	613-724-4353	**Phone #**	
Email	cameron.odam@stantec.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	STC 103
Recommended Stormceptor Model	STC 300
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	86
PSD	Fine Distribution
Rainfall Station	OTTAWA MACDONALD-CARTIER INT'L A

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary		
Stormceptor Model	**% TSS Removal Provided**	**% Runoff Volume Captured Provided**
STC 300	86	99
STC 750	92	100
STC 1000	93	100
STC 1500	93	100
STC 2000	95	100
STC 3000	96	100
STC 4000	97	100
STC 5000	97	100
STC 6000	98	100
STC 9000	98	100
STC 10000	98	100
STC 14000	99	100
StormceptorMAX	Custom	Custom

Stormceptor
The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology
Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:
• Site parameters
• Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
• Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
• TSS load
• Detention time of the system

Hydrology Analysis
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	Ontario	**Total Number of Rainfall Events**	4093
Rainfall Station Name	OTTAWA MACDONALD-CARTIER INT'L A	**Total Rainfall (mm)**	20978.1
Station ID #	6000	**Average Annual Rainfall (mm)**	567.0
Coordinates	45°19'N, 75°40'W	**Total Evaporation (mm)**	767.6
Elevation (ft)	370	**Total Infiltration (mm)**	11935.8
Years of Rainfall Data	37	**Total Rainfall that is Runoff (mm)**	8274.7

Notes
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.198
Imperviousness %	42.9

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	90.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	75.42
Stormceptor Outlet Invert Elev (m)	75.37
Stormceptor Rim Elev (m)	77.23
Normal Water Level Elevation (m)	74.52
Pipe Diameter (mm)	300
Pipe Material	PVC - plastic
Multiple Inlets (Y/N)	Yes
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	STC 103

Site Details

Drainage Area

Total Area (ha)	0.198
Imperviousness %	42.9

Surface Characteristics

Width (m)	89.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

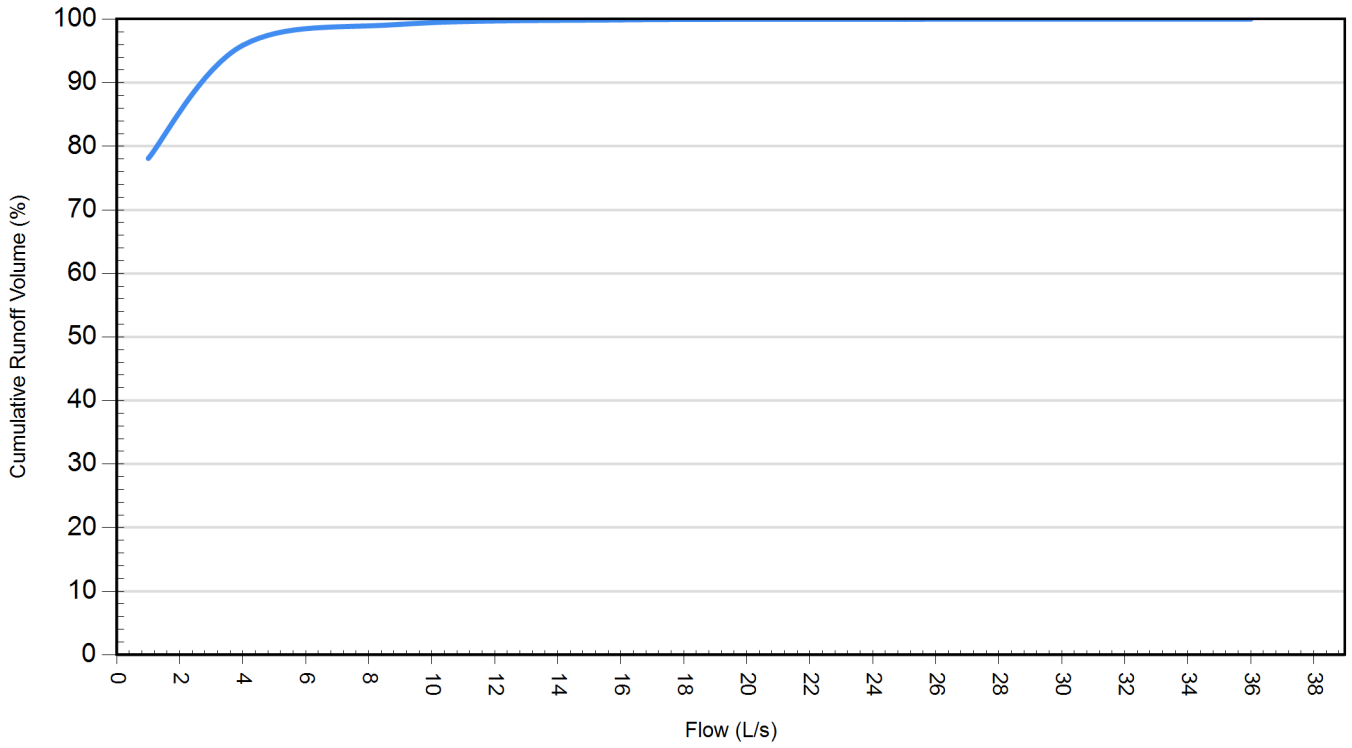
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	Runoff Volume (m^3)	Volume Over (m^3)	Cumulative Runoff Volume (%)
1	12901	3626	78.1
4	15856	672	95.9
9	16402	125	99.2
16	16516	11	99.9
25	16527	0	100.0
36	16527	0	100.0

Cumulative Runoff Volume by Runoff Rate

For area: 0.198(ha), imperviousness: 42.9%, rainfall station: OTTAWA MACDONALD-CARTIER INT'L A



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50.80	12	0.3	557	2.7
57.15	7	0.2	378	1.8
63.50	1	0.0	63	0.3
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88.90	1	0.0	84	0.4
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101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0
114.30	1	0.0	109	0.5
120.65	0	0.0	0	0.0
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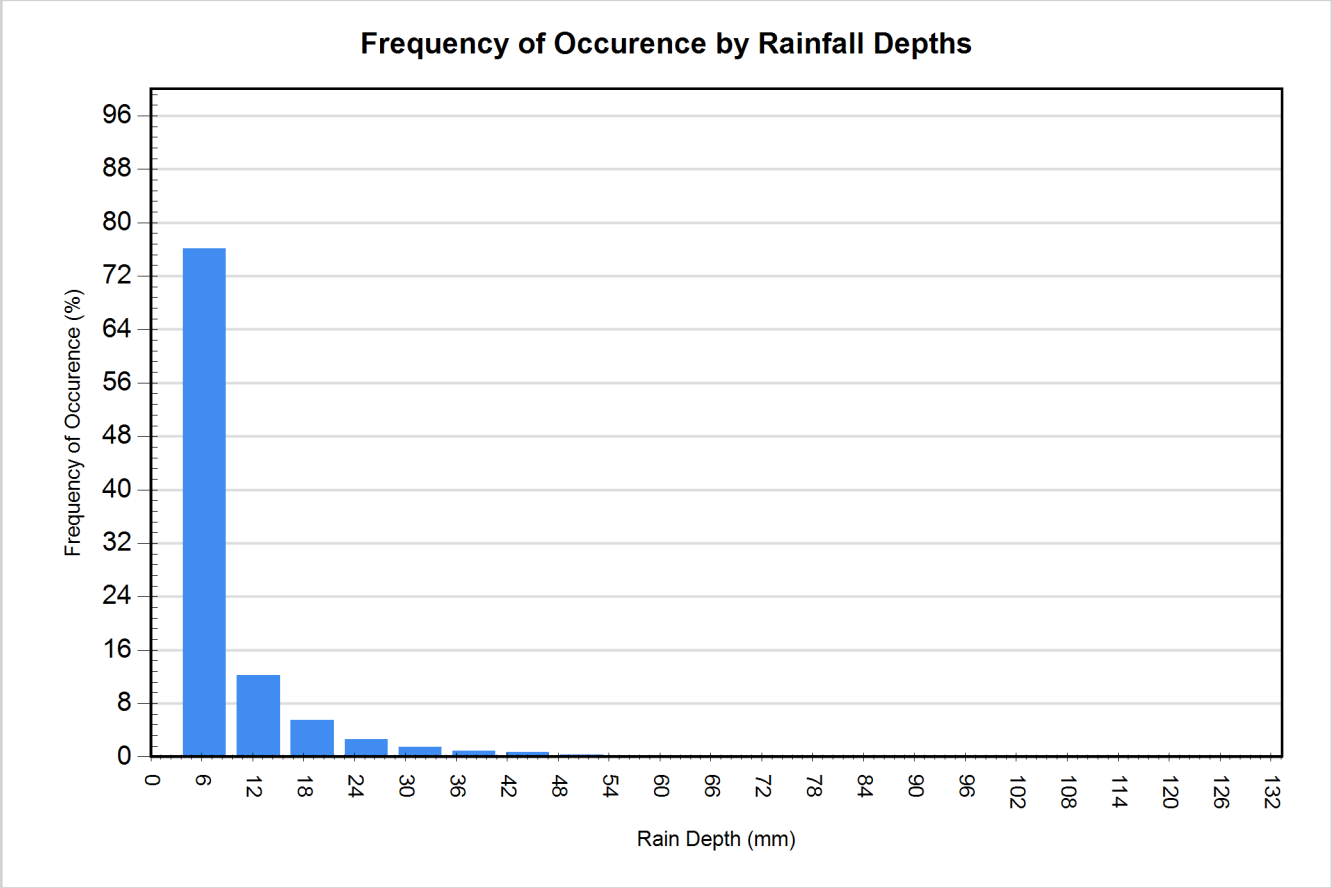

For Stormceptor Specifications and Drawings Please Visit:
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Appendix D GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa, Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Geotechnical Investigation

Proposed Multi-Storey Buildings
Norberry Crescent
Ottawa, Ontario

Prepared For

Greatwise Developments

March 27, 2019

Report PG4834-1

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Greatwise Developments to conduct a geotechnical investigation for the proposed multi-storey residential development to be located at Norberry Crescent in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the current investigation were to:

- ❑ Determine the subsurface conditions by means of boreholes.
- ❑ Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. The report contains Paterson's findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as understood at the time of writing this report.

2.0 Proposed Development

Based on the available drawings, it is our understanding that the proposed development will consist of three, four (4) storey residential slab-on-grade buildings along with associated at-grade parking areas, access lanes, and landscaped areas. It is anticipated that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current investigation was completed on February 25 and 26, 2019. At that time, nine (9) boreholes were advanced to a maximum depth of 6.8 m below existing grade. The borehole locations were distributed in a manner to provide general coverage of the proposed development taking into consideration existing site features. The locations of the boreholes are shown on Drawing PG4834-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a truck-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted with the full-time supervision of Paterson personnel under the direction of a senior engineer. The test hole procedure consisted of augering to the required depths at the selected locations, and sampling and testing the overburden.

Sampling and In-situ Testing

Soil samples were recovered with a 50 mm diameter split-spoon sample or from the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to Paterson's laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are presented as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Overburden thickness was also evaluated during the course of the investigation by dynamic cone penetration testing (DCPT) at BH 4. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at its tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

Undrained shear strength tests were conducted in cohesive soils with a field vane apparatus.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1.

Groundwater

Flexible polyethylene standpipes were installed in a number of boreholes to permit monitoring of the groundwater levels subsequent to the completion of the current sampling program. The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data Sheets in Appendix 1.

3.2 Field Survey

The boreholes completed during the field investigation were selected in the field and surveyed by Paterson personnel. The ground surface elevations at the borehole locations were referenced to a temporary benchmark (TBM), consisting of a catch basin cover located within the eastern parking area adjacent to 840 Springland Drive. An arbitrary elevation of 100.00 m was assigned to the TBM. The locations of the boreholes and the ground surface elevation at each borehole location are presented on Drawing PG4834-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples recovered from the subject site were visually examined in our laboratory to review the field logs. All samples will be stored in the laboratory for a period of one (1) month after the issuance of this report. They will then be discarded unless we are otherwise directed.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the potential for exposed ferrous metals and the sulphate potential against subsurface concrete structures. The results are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is presently occupied by four existing multi-storey residential buildings, a parking structure with one level of above-grade parking situated between the existing building at 660 Norberry Crescent and Norberry Crescent, a central slab-on-grade recreational building, accompanying access lanes and at-grade parking.

The ground surface across the subject site is relatively flat and at grade with Norberry Crescent and Springland Drive. The majority of the site is surfaced with asphalt parking areas and grass/tree covered landscaped areas. The subject site is bordered by Norberry Crescent along the south and east, and Springland Drive along the north and west borders.

4.2 Subsurface Profile

Overburden

The subsurface profile at the borehole locations consists of asphaltic concrete followed by a silty sand with gravel fill overlying a hard to stiff silty clay crust and a grey, very stiff to firm silty clay deposit. Glacial till was encountered below the above noted layers consisting of dense to compact silty clay with sand to sandy silt with clay, gravel, cobbles and boulders.

Practical refusal to augering on inferred bedrock was encountered in BH 2 to BH 5 and BH 8 at depths ranging between 5.3 to 7.0 m. Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets provided in Appendix 1.

Bedrock

Based on available geological mapping, the subject site is located in an area where the bedrock consists of limestone of the Bobcaygeon Formation. The overburden drift thickness is anticipated to be between 5 to 10 m in depth.

Atterberg Limit Testing

A total of 4 atterberg limit tests, as well as associated moisture content tests, were completed on the recovered silty clay samples at selected locations throughout the subject site. The results of the Atterberg limits tests are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1. The tested silty clay samples classify as inorganic clay of low plasticity (CL), inorganic clay of high plasticity (CH) and inorganic clay and silt of low plasticity (CL-ML) in accordance with the Unified Soil Classification System.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 1	1.5	44	18.0	26	18.2	CL
BH 2	0.75	26	15	11	14.9	CL
BH 4	2.3	53	18	35	18.1	CH
BH 5	0.75	22	15	6	15.2	CL-ML

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content;
CH: Inorganic Clay of High Plasticity CL: Inorganic Clay of Low Plasticity
CL-ML: Inorganic Clay and Silt of Low Plasticity

Shrinkage Testing

The results of the shrinkage limit test indicate a shrinkage limit of 18% and a shrinkage ratio of 1.92.

4.3 Groundwater

Groundwater levels were measured in the piezometers at the borehole locations on March 5, 2019. The measured groundwater level (GWL) readings are presented in Table 2 below.

Table 2 - Groundwater Measurements at Monitoring Well Locations			
Test Hole Location	**Ground Surface Elevation (m)**	**GW Level Reading (m)**	**GW Level Elev. (m)**
BH 1	**100.13**	**2.04**	**98.09**
BH 2	**99.99**	**1.31**	**98.68**
BH 3	**100.05**	**BLOCKED**	**n/a**
BH 4	**99.56**	**3.33**	**96.23**
BH 5	**100.30**	**BLOCKED**	**n/a**
BH 6	**100.20**	**1.15**	**99.05**
BH 7	**100.12**	**1.69**	**98.43**
BH 8	**100.64**	**1.75**	**98.89**
BH 9	**100.87**	**1.30**	**99.57**

It should be noted that groundwater measurements can be influenced by surface water infiltrating the backfilled boreholes and moisture perched within the silty clay deposit. The long-term groundwater table can also be estimated based on consistency, moisture levels and colour of the recovered soil samples. Based on our field observations and experience with the local area, it is expected that the long-term groundwater level will be at a depth ranging between 2.5 to 3.5 m below existing grade. It should be noted that the groundwater level is subject to seasonal fluctuations. Therefore, groundwater could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. The proposed multi-storey buildings are anticipated to be founded on shallow footings placed on an undisturbed hard to stiff brown to grey silty clay, glacial till, or engineered fill placed over an undisturbed bearing medium.

Due to the presence of a sensitive silty clay layer at the site, the proposed development will be subjected to grade raise restrictions. Permissible grade raise recommendations are discussed in Subsection 5.3.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under the proposed building, paved areas, pipe bedding and other settlement sensitive structures.

Consideration could be given to leaving the existing fill free of significant amounts of deleterious fill and other construction remnants under the proposed buildings floor slabs outside the lateral support of the proposed footings. However, it is recommended that the existing fill for the slab-on-grade be approved by the geotechnical consultant at the time of construction. It is recommended that the existing fill be proof-rolled using an adequate compaction equipment making several passes. Any poor performance areas should be sub-excavated and replaced with OPSS Granular A crushed stone or Granular B Type II and compacted to 98% of the material's SPMDD.

Fill Placement

Fill placed for grading beneath the structure(s) or other settlement sensitive areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The engineered fill should be placed in maximum 300 mm thick lifts and compacted to 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where surface settlement is a minor concern. The backfill materials should be spread in thin lifts and at a minimum compacted by the tracks of the spreading equipment to minimize voids. If the non-specified backfill is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Shallow Foundation

Footings placed on an undisturbed, hard to stiff brown silty clay bearing surface or compact glacial till can be designed using a bearing resistance value at Serviceability Limit States (SLS) of **150 kPa** and a factored bearing resistance value at Ultimate Limit States (ULS) of **250 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS. Footings founded on engineered fill placed on undisturbed bearing medium can be designed using the above noted bearing resistance values.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Settlement

Footings designed using the bearing resistance value at SLS provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Permissible Grade Raise

Based on the existing borehole coverage and results of the undrained shear strength testing completed within the underlying cohesive soils, a permissible grade raise restriction of **1.0 m** is provided for design purposes for the subject site.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered at this site. The soils underlying the subject site are not susceptible to liquefaction. Refer to the latest revision of the Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Slab-on-Grade Construction

With the removal of topsoil and deleterious fill, such as those containing organic materials, within the footprint of the proposed building, the native soil or approved fill is considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

It is recommended that the upper 200 mm of sub-floor fill consist of Granular A crushed stone. All backfill materials within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas, access lanes and heavy truck parking.

Table 3 - Recommended Flexible Pavement Structure - Parking Areas	
Thickness (mm)	**Material Description**
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, OPSS Granular B Type II material placed over in situ soil or fill	

Table 4 - Recommended Flexible Pavement Structure - Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill or OPSS Granular B Type I or II material placed over in situ soil or fill	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing load carrying capacity.

Due to the impervious nature of the subgrade materials consideration should be provided to installing subdrains during the pavement construction. The subdrains should extend in four orthogonal directions and longitudinally when placed along a curb. The clear crushed stone surrounding the drainage lines or the pipe, should be wrapped with suitable filter cloth. The subdrain inverts should be shaped to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

A perimeter foundation drainage system is optional for the proposed structures. However, it is still recommended that a perimeter foundation system be used where structures susceptible to frost heave such as sidewalks, are proposed within the perimeter of the proposed building. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear stone, placed at the footing level around the exterior perimeter of the structure. The clear stone or the pipe itself should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and are not recommended for re-use as backfill against the foundation walls unless used in conjunction with a composite drainage system (such as Delta Drain 6000 or equivalent). Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m of soil cover alone, or a combination of soil cover and foundation insulation, should be provided. More details regarding foundation insulation can be provided, if requested.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be excavated at acceptable slopes or should be retained by shoring systems from the beginning of the excavation until the structure is backfilled.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. Below the groundwater lever, flatter slopes, such as 3H:1V, could be required due to the presence of loose silty and/or sandy silt. The subsurface soils are considered to be a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects. The side slopes of excavations in bedrock can be cut quasi-vertically (i.e. 1H:10V).

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 95% of the SPMDD.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce the potential differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

To reduce long term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively fry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

It is anticipated that groundwater infilitration into the excavations should be controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

6.7 Corrosion Potential and Sulphate

The results on analytical testing show that the sulphate content is less than 0.1%. The results are indicative that Type 10 Portland Cement (Type GU) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity in indicative of a moderate to very aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Restrictions

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations within the north portion of the subject site. Sieve analysis testing was also completed on selected soil samples. The above noted soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Subsection 4.2 and in Appendix 1.

Area 1 - Glacial Till (Building B)

No tree planting restrictions are required for the subject area (Building B) due to the absence of a silty clay deposit within the future location of the proposed residential building (southwest portion of the site).

Area 2 - Low to Medium Sensitivity Area (Buildings A and C)

A low to medium sensitivity clay soil was encountered across the remainder of the subject site. Based on our Atterberg Limits test results, the modified plasticity limit does not exceed 40% in all the boreholes locations where silty clay was encountered. The following tree planting setbacks are recommended for the low to medium sensitivity area. Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). Tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the conditions noted below are met.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❑ Review of the grading plan from a geotechnical perspective.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slope in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Greatwise Developments or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Drew Petahtegoose, EIT

Faisal Abou-Seido, P.Eng.

Report Distribution:

- ❑ Greatwise Developments (4 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Buildings - Norberry Crescent
Ottawa, Ontario

DATUM TBM - Top of catchbasin cover located within the eastern parking area, adjacent to 840 Springland Drive. An arbitrary elevation of 100.00m was assigned to the TBM.

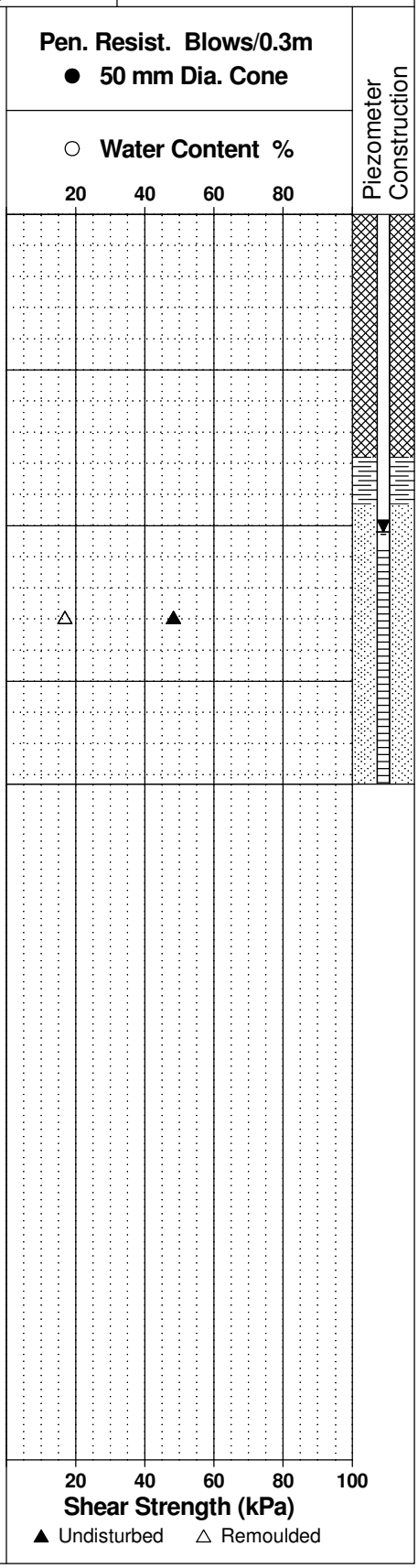
REMARKS

FILE NO. PG4834

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.13
Asphaltic concrete 0.08		AU	1				
FILL: Brown silty sand with gravel		SS	2	56	50+	1	99.13
1.37							
Stiff, brown **SILTY CLAY**		SS	2	88	5	2	98.13
- firm and grey by 2.1m depth							
3.05						3	97.13
GLACIAL TILL: Loose, grey silty sand with clay and gravel 3.66		SS	3	54	8		
End of Borehole							
(GWL @ 2.04m - March 5, 2019)							



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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

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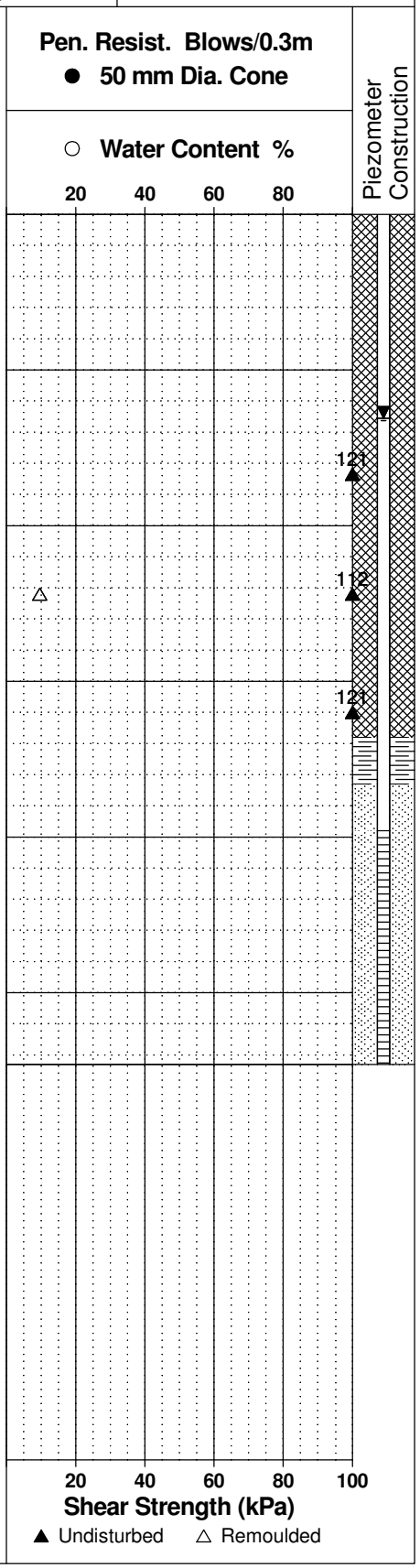
REMARKS

FILE NO. PG4834

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.99
Asphaltic concrete 0.08							
FILL: Brown silty sand with gravel		AU	1				
0.76						1	98.99
Compact, brown **SANDY SILT,** trace clay		SS	2		11		
1.37							
Very stiff, brown **SILTY CLAY**						2	97.99
- grey by 2.1m depth							
3.05						3	96.99
GLACIAL TILL: Loose, grey silt with clay, gravel, cobbles and boulders		SS	3	67	3	4	95.99
		SS	4	79	6	5	94.99
5.46		SS	5		50+		
End of Borehole							
Practical refusal to augering at 5.46m depth							
(GWL @ 1.31m - March 5, 2019)							



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Ottawa, Ontario

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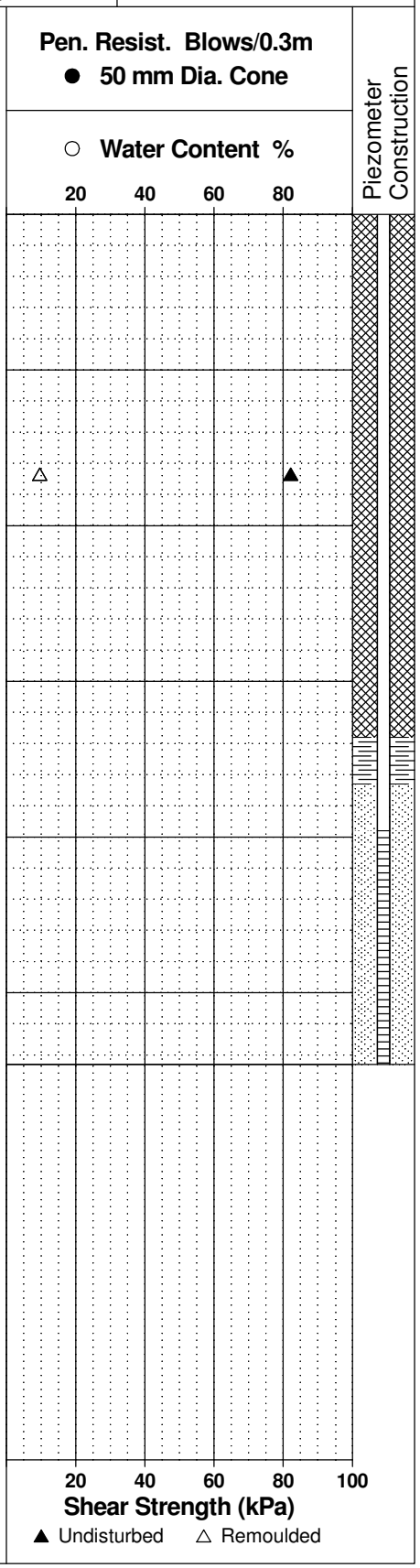
REMARKS

FILE NO. PG4834

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.08						0	100.05
FILL: Brown silty sand with gravel and crushed stone 0.60		AU	1				
Stiff, brown **SILTY CLAY**		SS	2	75	11	1	99.05
1.98						2	98.05
GLACIAL TILL: Loose to compact, grey sandy silt with gravel, cobbles and boulders		SS	3	54	13	3	97.05
		SS	4	33	8		
		SS	5	46	11	4	96.05
		SS	6	0	50+	5	95.05
5.46		SS	7	100	50+		
End of Borehole							
Practical refusal to augering at 5.46m depth							
(Piezometer blocked at 0.50m depth - March 5, 2019)							



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SOIL PROFILE AND TEST DATA

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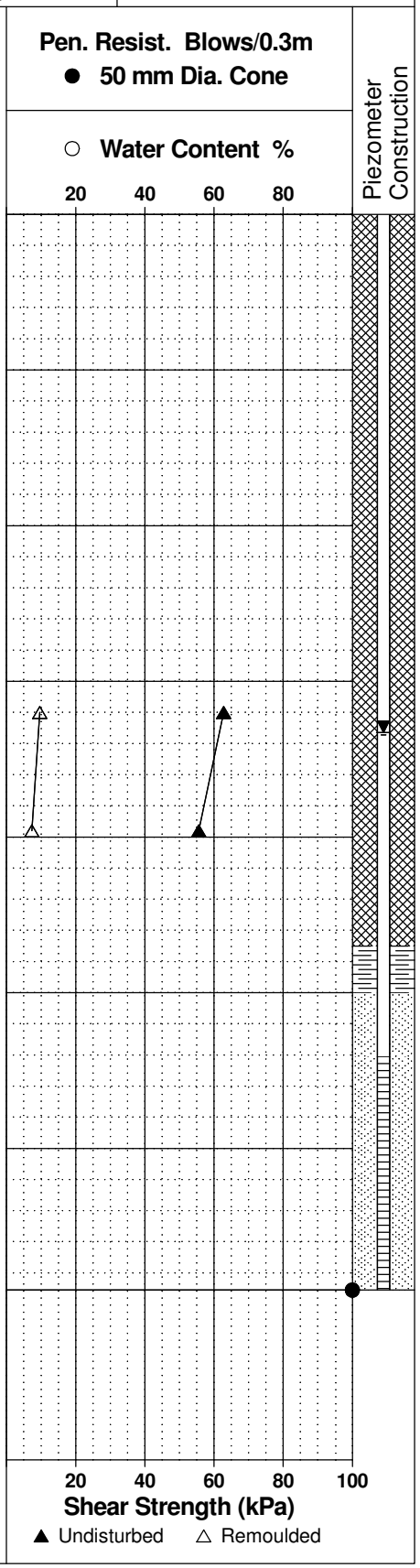
REMARKS

FILE NO. PG4834

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.05						0	99.56
Concrete 0.15		AU	1				
FILL: Brown silty sand with gravel		SS	2	72	50+	1	98.56
1.52							
Compact to loose, brown **SILTY SAND,** with gravel, trace clay		SS	3		11	2	97.56
2.44							
		SS	4	71	4	3	96.56
Stiff, grey **SILTY CLAY**						4	95.56
4.47							
		SS	5		3	5	94.56
GLACIAL TILL: Very loose, grey clayey silt with sand and gravel		SS	6		P	6	93.56
		SS	7		3		
6.70							
Dynamic Cone Penetration Test commenced at 6.70m depth. 6.91							
End of Borehole							
Practical DCPT refusal at 6.91m depth							
(GWL @ 3.33m - March 5, 2019)							



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REMARKS

FILE NO. PG4834

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	100.30		
Asphaltic concrete 0.08		AU	1						
FILL: Brown silty sand with gravel									
1.07		SS	2	46	8	1	99.30		
Very stiff to stiff, brown **SILTY CLAY** with sand		SS	3	67	10	2	98.30		
- grey by 2.1m depth		SS	4	50	10				
3.35		SS	5	67	10	3	97.30		
		SS	6	100	11	4	96.30		
GLACIAL TILL: Loose to compact, grey sandy silt with gravel, cobbles and boulders		SS	7	100	12	5	95.30		
		SS	8	100	4	6	94.30		
		SS	9	71	12				
6.81									
End of Borehole									
Practical refusal to augering at 6.81m depth									
(Piezometer blocked - March 5, 2019)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

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REMARKS TBM.

FILE NO. PG4834

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	100.20		
Asphaltic concrete 0.08									
FILL: Brown silty sand with gravel		AU	1						
0.76									
Firm to stiff, brown **SILTY CLAY**		SS	2	62	11	1	99.20		
- grey by 1.4m depth						2	98.20		
						3	97.20	106	
3.35									
End of Borehole									
(Piezometer blocked at 1.15m depth - March 5, 2019)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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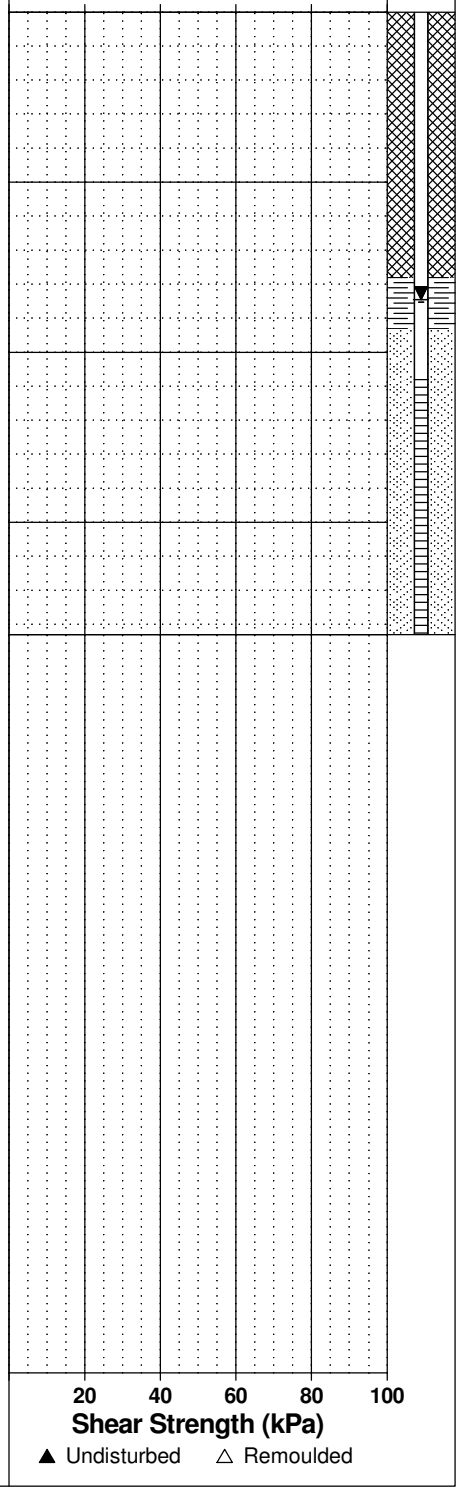
REMARKS

FILE NO. PG4834

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.12
Asphaltic concrete 0.08		AU	1				
FILL: Brown silty sand with gravel		SS	2	67	58	1	99.12
1.37							
Grey **SILTY CLAY**		SS	3	83	3	2	98.12
1.88							
GLACIAL TILL: Loose, grey silty clay with sand, gravel, cobbles and boulders		SS	4	75	7	3	97.12
		SS	5	29	10		
3.66							
End of Borehole							
(GWL @ 1.69m - March 5, 2019)							



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SOIL PROFILE AND TEST DATA

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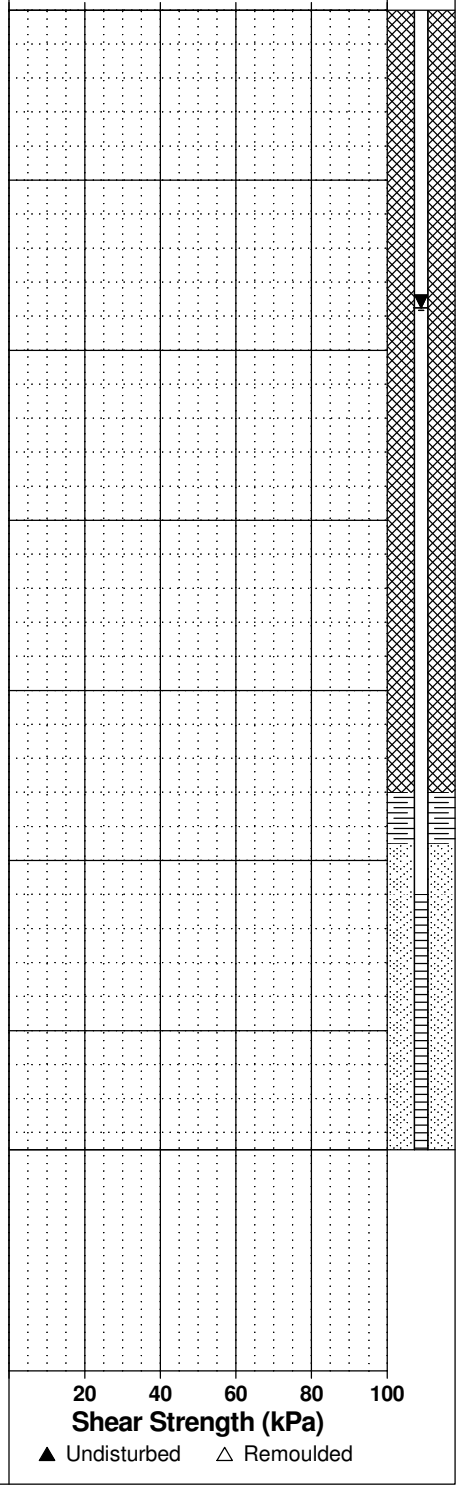
REMARKS TBM.

FILE NO. PG4834

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	100.64		
Asphaltic concrete 0.08		AU	1						
FILL: Brown silty sand with gravel		SS	2	50	50+	1	99.64		
1.37									
		SS	3	33	9	2	98.64		
		SS	4	46	9				
		SS	5	75	8	3	97.64		
GLACIAL TILL: Loose to compact, brown silty clay with sand and gravel		SS	6	50	11	4	96.64		
		SS	7	33	5	5	95.64		
		SS	8	29	13				
		SS	9	83	2	6	94.64		
6.70									
End of Borehole									
(GWL @ 1.75m - March 5, 2019)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

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REMARKS TBM.

FILE NO. PG4834

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger **DATE** February 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
Asphaltic concrete 0.08		AU	1			0	100.87		
FILL: Brown silty sand with gravel		SS	2		50+	1	99.87		
1.37		SS	3	38	10	2	98.87		
		SS	4	67	8	3	97.87		
GLACIAL TILL: Loose, grey silty clay with sand and gravel		SS	5	33	7	4	96.87		
		SS	6	33	6	5	95.87		
		SS	7	50	7	6	94.87		
		SS	8	21	3				
		SS	9	50	7				
6.70									
End of Borehole									
(GWL @ 1.30m - March 5, 2019)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

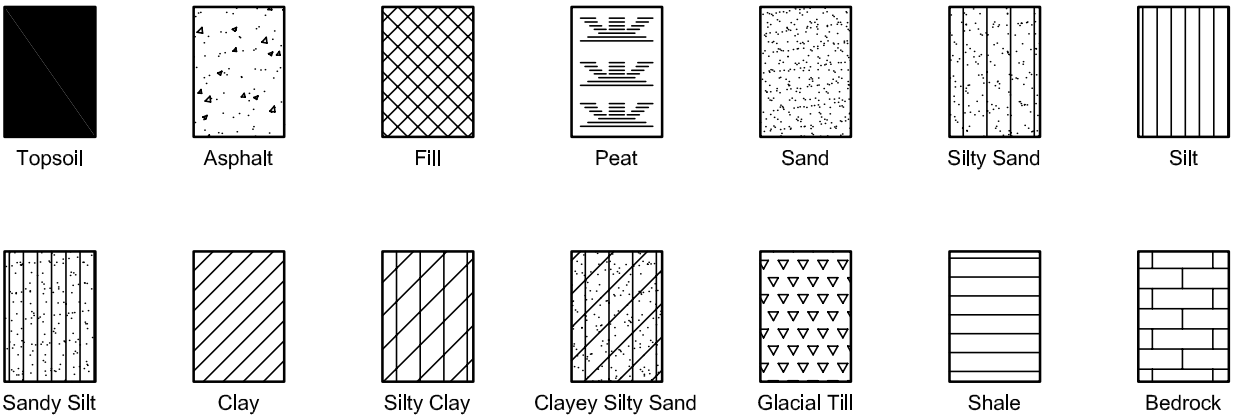
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

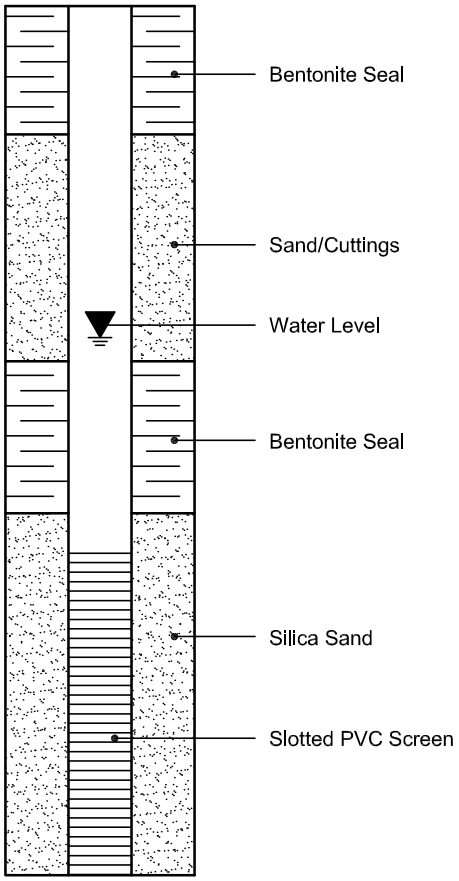
SYMBOLS AND TERMS (continued)

STRATA PLOT

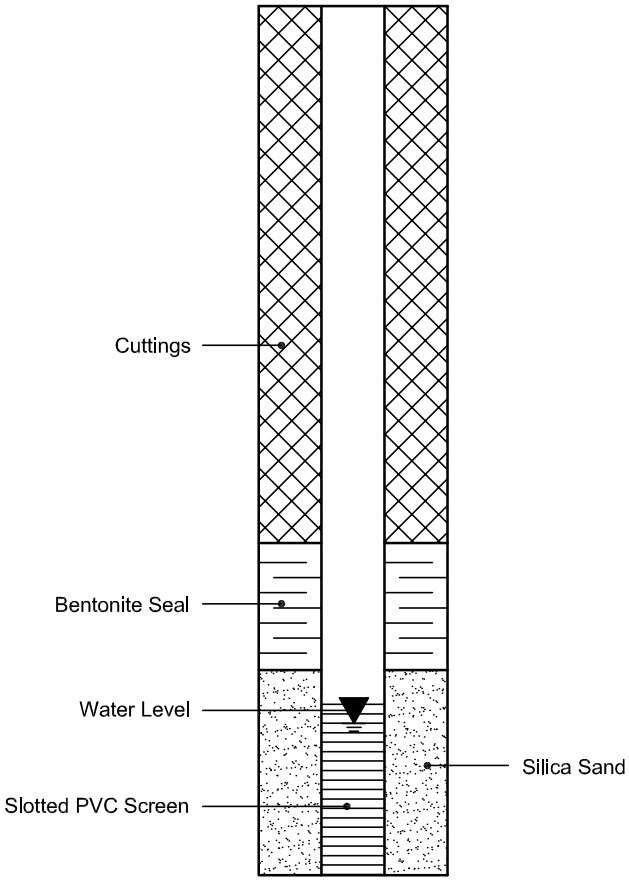


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: Paterson Group Consulting Engineers

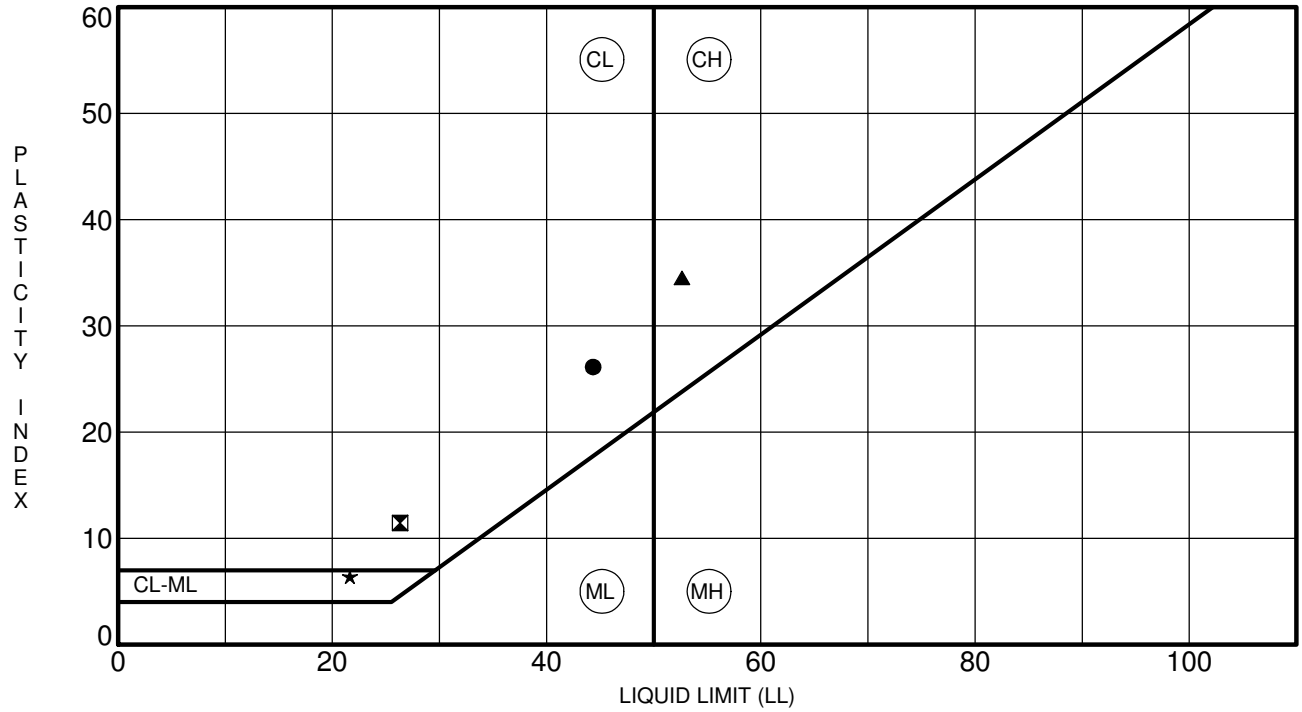
Client PO: 26036

Report Date: 01-Mar-2019

Order Date: 26-Feb-2019

Project Description: PG4834

	Client ID:	BH1 SS3	-	-	-
	Sample Date:	02/25/2019 13:00	-	-	-
	Sample ID:	1909218-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	76.0	-	-	-
General Inorganics					
pH	0.05 pH Units	7.70	-	-	-
Resistivity	0.10 Ohm.m	26.3	-	-	-
Anions					
Chloride	5 ug/g dry	83	-	-	-
Sulphate	5 ug/g dry	86	-	-	-



Specimen Identification			LL	PL	PI	Fines	Classification
●	**BH 1**	**SS 3**	**44**	**18**	**26**		**CL - Inorganic clays of low plasticity**
⧓	**BH 2**	**SS 2**	**26**	**15**	**11**		**CL - Inorganic clays of low plasticity**
▲	**BH 4**	**SS 4**	**53**	**18**	**35**		**CH - Inorganic clays of high plasticity**
★	**BH 5**	**SS 2**	**22**	**15**	**6**		**CL-ML - Inorganic clay & silt with low plasticity**

CLIENT	**Greatwise Developments**	FILE NO.	**PG4834**
PROJECT	**Geotechnical Investigation - Proposed Multi-Storey Buildings - Norberry Crescent**	DATE	**25 Feb 19**

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4834-1 - TEST HOLE LOCATION PLAN

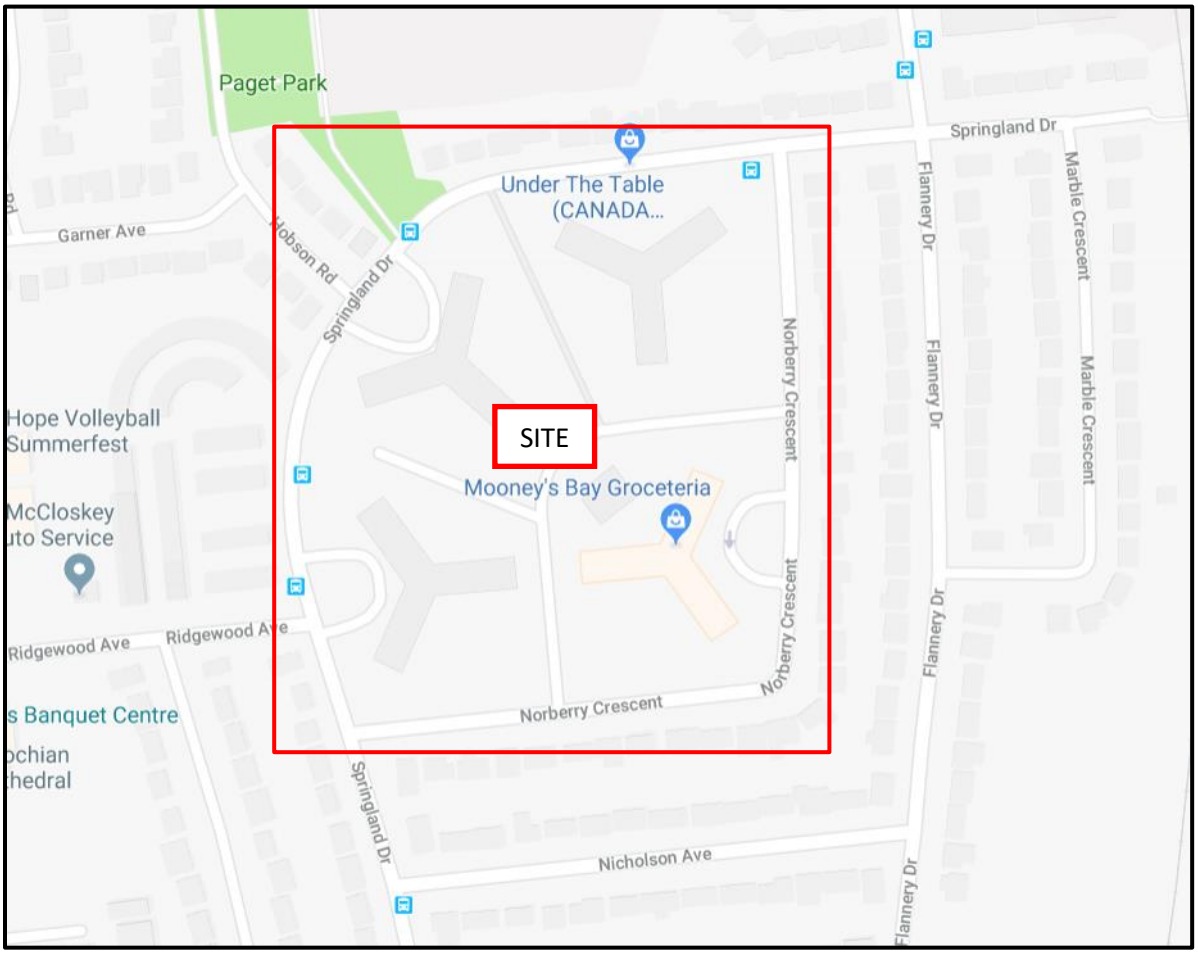
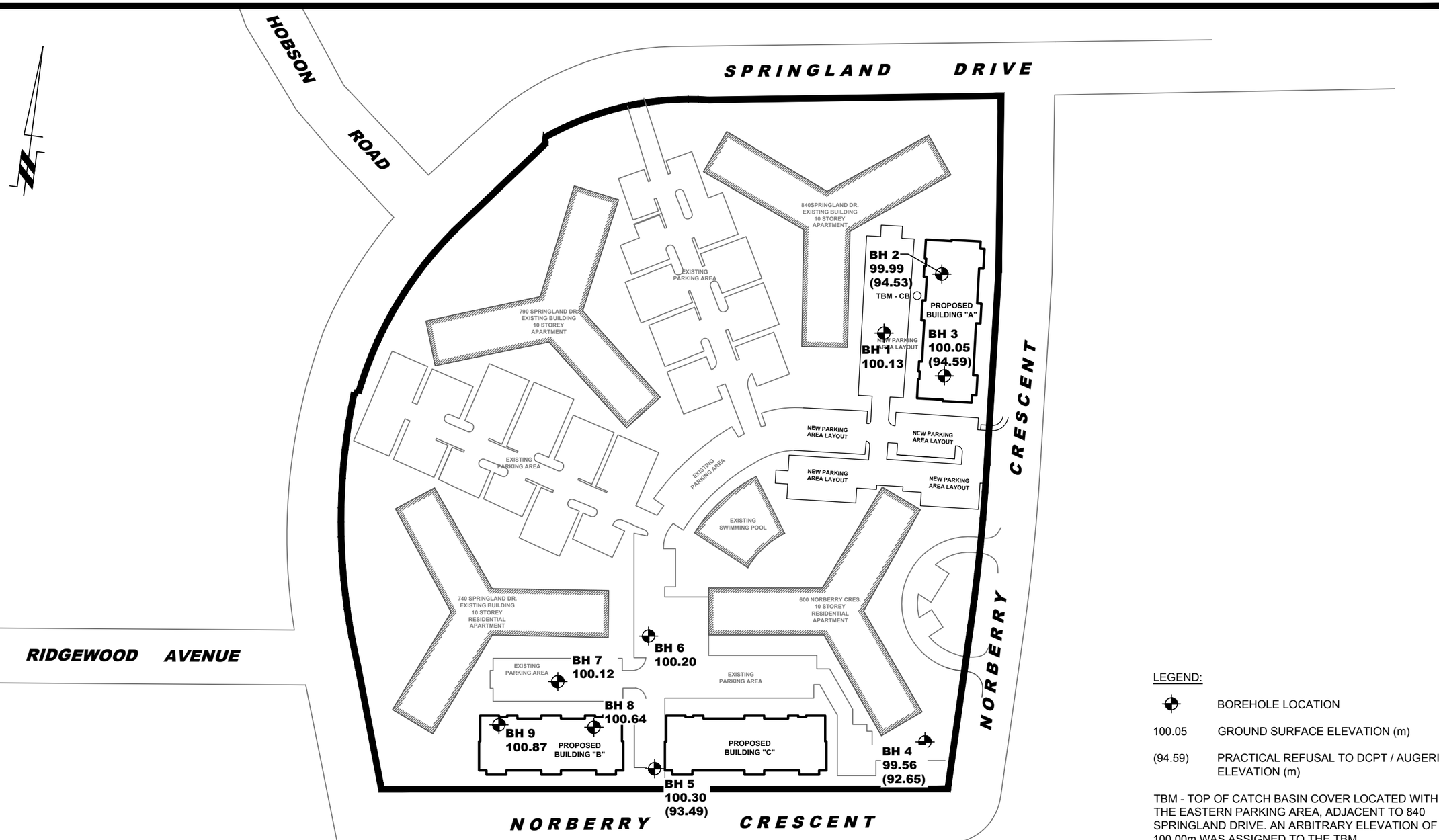


FIGURE 1

KEY PLAN

patersongroup



LEGEND:

⊕	BOREHOLE LOCATION
100.05	GROUND SURFACE ELEVATION (m)
(94.59)	PRACTICAL REFUSAL TO DCPT / AUGERING ELEVATION (m)

TBM - TOP OF CATCH BASIN COVER LOCATED WITHIN THE EASTERN PARKING AREA, ADJACENT TO 840 SPRINGLAND DRIVE. AN ARBITRARY ELEVATION OF 100.00m WAS ASSIGNED TO THE TBM

SCALE: 1:1500

0 25 50 75 100m

patersongroup
consulting engineers

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NO.	REVISIONS	DATE	INITIAL

GREATWISE DEVELOPMENTS

GEOTECHNICAL INVESTIGATION
PROP. MULTI-STOREY BUILDINGS - NORBERRY CRESCENT

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 03/2019
Drawn by: MPG	Report No.: PG4834-1
Checked by: NC	PG4834-1
Approved by: DJG	Revision No.:

p:\autocad drawings\geotechnical\pg48xx\pg4834\pg4834-1 thtp.dwg

Appendix E DRAWINGS

PROJECT INFORMATION

ZONING	R5B[2459] (H)18	
LOT AREA	13.808 acres	55,880.0 sq. m. 601,490 sq. ft.
DEVELOPMENT TYPE	PLANNED UNIT DEVELOPMENT	
BUILDING HEIGHT		18.6 M
FRONT YARD SETBACK		3.0 M
CORNER SIDE YARD SETBACK		3.0 M

BUILDING STATISTICS - EXISTING

LOT COVERAGE

PAVED SURFACE =	23 990.0 sq. m.	42.93%
BUILDING FOOTPRINT =	14 250.0 sq. m.	25.50%
LANDSCAPE OPEN SPACE =	17 640.0 sq. m.	31.57%
TOTAL =	55 880.0 sq. m.	100.0%

BUILDING HEIGHTS

740 SPRINGLAND	18.0 M - 6 STOREYS
790 SPRINGLAND	18.0 M - 6 STOREYS
840 SPRINGLAND	18.0 M - 6 STOREYS
2660 NORBERRY	30.0 M - 10 STOREYS

UNIT COUNT - PER BUILDING

740 SPRINGLAND	168 UNITS
790 SPRINGLAND	171 UNITS
840 SPRINGLAND	171 UNITS
2660 NORBERRY	251 UNITS
TOTAL	761 UNITS

CAR PARKING - OVERALL SITE EXISTING

COVERED	145 SPACES
ABOVE GRADE	88 SPACES
SURFACE	526 SPACES
TOTAL	759 SPACES
RESIDENTIAL:	741 SPACES (0.97/UNIT)
VISITOR:	18 SPACES (0.02/UNIT)

BUILDING STATISTICS - PROPOSED

FRONT YARD SETBACK	REQUIRED: 3.0 M MIN. PROPOSED: VARIES - 6.0 M MIN.
CORNER SIDE YARDS SETBACK	REQUIRED: 3.0 M MIN. PROPOSED: VARIES - 6.0 M MIN.

BUILDING HEIGHTS

BUILDING 'A'	18.5 M - 6 STOREYS
BUILDING 'B'	18.6 M - 6 STOREYS
BUILDING 'C'	17.2 M - 5 STOREYS

BUILDING FOOTPRINT

BUILDING 'A'	1 225.0 m2 [13 186 sq. ft.]
BUILDING 'B'	1 096.2 m2 [11 799 sq. ft.]
BUILDING 'C'	3 936.5 m2 [42 370 sq. ft.]
TOTAL NEW:	6 257.7 m2 [67 357 sq. ft.]

UNIT COUNT - PER BUILDING

BUILDING 'A'	103 UNITS
BUILDING 'B'	94 UNITS
BUILDING 'C'	90 UNITS
TOTAL NEW:	287 UNITS

AMENITY SPACE - PER BUILDING

BUILDING 'A' - REQUIRED (6M2/UNIT, 3M2 COMMON MINIMUM)	618 M2
BUILDING 'A' - PROVIDED, PRIVATE:	0 M2
BUILDING 'A' - PROVIDED, COMMON:	742 M2
BUILDING 'A' - PROVIDED, TOTAL:	742 M2
BUILDING 'B' - REQUIRED (6M2/UNIT, 3M2 COMMON MINIMUM)	564 M2
BUILDING 'B' - PROVIDED, PRIVATE:	0 M2
BUILDING 'B' - PROVIDED, COMMON:	564 M2
BUILDING 'B' - PROVIDED, TOTAL:	564 M2
BUILDING 'C' - REQUIRED (6M2/UNIT, 3M2 COMMON MINIMUM)	540 M2
BUILDING 'C' - PROVIDED, PRIVATE:	0 M2
BUILDING 'C' - PROVIDED, COMMON:	715 M2
BUILDING 'C' - PROVIDED, TOTAL:	715 M2

BUILDING STATISTICS - TOTAL SITE

LOT COVERAGE

PAVED SURFACE =	14 220.0 sq. m.	25.45%
BUILDING FOOTPRINT =	20 507.7 sq. m.	36.70%
LANDSCAPE OPEN SPACE =	21 152.3 sq. m.	37.85%
TOTAL =	55 880.0 sq. m.	100%

UNIT COUNT - OVERALL

EXISTING	761 UNITS
PROPOSED	287 UNITS
TOTAL:	1048 UNITS

CAR PARKING - OVERALL PROVIDED

COVERED	248 SPACES
ABOVE GRADE	115 SPACES
SURFACE	486 SPACES
TOTAL (INCLUDES 104 VISITOR SPACES)	849 SPACES

REDUCED SIZE PARKING SPACES:
2.4 x 4.6m MIN. 369 SPACES (MAX 50% SPACES [425])

REQUIRED PARKING:

RESIDENTIAL:	692 SPACES (0.66/UNIT)
VISITOR:	104 SPACES (0.1/UNIT AFTER 12)
	796 SPACES

BIKE STORAGE - NEW CONSTRUCTION ONLY

BUILDING 'A':	
ENCLOSED:	28 SPACES
EXTERIOR:	32 SPACES
TOTAL:	60 SPACES
REQUIRED:	52 SPACES
BUILDING 'B':	
ENCLOSED:	14 SPACES
EXTERIOR:	34 SPACES
TOTAL:	48 SPACES
REQUIRED:	47 SPACES
BUILDING 'C':	
ENCLOSED:	29 SPACES
EXTERIOR:	16 SPACES
TOTAL:	45 SPACES
REQUIRED:	45 SPACES
SITE TOTAL:	153 SPACES
REQUIRED:	144 SPACES

LEGAL DESCRIPTION

TOPOGRAPHICAL PLAN OF

BLOCK A
REGISTERED PLAN 749 and
BLOCK D
REGISTERED PLAN 775
CITY OF OTTAWA
Prepared by Annis, O'Sullivan, Vollebekk Ltd.

DRAWING NOTES:

1. PROPERTY LINE
2. 3.0m FRONTYARD SETBACK LINE
3. NEW VISITOR PARKING IN EXISTING ENTRANCE DRIVEWAY
4. PROPOSED PAD-MOUNT TRANSFORMER
5. EXISTING VEHICLE RAMP (TO BE REPLACED)
6. SEE LANDSCAPE PLAN FOR NEW LANDSCAPING
7. FIRE HYDRANT - EXISTING
8. 6.0 METRE WIDE FIRE ACCESS ROUTE
9. SIAMESE CONNECTION
10. EXTERIOR BIKE STORAGE ON CONCRETE PAD. SEE LANDSCAPE PLANS
11. 1:12 SLOPE MAX. B/F RAMP C/W 920mm HIGH HANDRAIL
12. EXISTING GAS METERS
13. LINE OF EXISTING GARAGE TO BE REMOVED
14. NEW ENTRANCE TO COVERED PARKING GARAGE - SEE FLOOR PLANS
15. NEW RETAINING WALL - SEE CIVIL
16. EXISTING SIDEWALK TO BE REMOVED
17. EXTEND EXISTING ASPHALT SIDEWALK
18. LINE OF EXISTING ENTRANCE CANOPY ABOVE
19. EXISTING LOADING/GARBAGE STORAGE BAY
20. LINE OF 5x5M SITE TRIANGLE
21. LINE OF 3x3M SITE TRIANGLE
22. 2.0M WIDE CONCRETE SIDEWALK AS PER CITY STANDARDS. DEPRESSED CURBS & TWSI AT ALL INTERSECTIONS AS PER SC 7.1
23. LINE OF LIMITING DISTANCE FROM EXISTING BUILDING, UNLIMITED PERMITTED OPENINGS (7.5M)
24. ENCLOSED BIKE STORAGE C/W 1.8M H. CHAIN-LINK FENCE ON CONCRETE PAD. HORIZONTAL SPACES AS PER CITY BYLAWS (1.8M/0.6Mw). SEE LANDSCAPE
25. HATCH INDICATES LOCATION OF TEMPORARY SNOW STORAGE
26. PATCH/REPAIR EXISTING ASPHALT SURFACES AS REQUIRED. SEE CIVIL FOR GRADING
27. B/F PARKING SPACES, TYPE A & B AS PER CITY STANDARDS.
28. SEE LANDSCAPE DRAWINGS FOR SIDEWALK DETAIL
29. LINE OF NEW BELOW-GRADE GARAGE
30. STEPS UP TO NEW DECK. SEE GRADING PLAN
31. EXIT STAIRS, C/W PRE-FINISHED METAL HANDRAIL
32. 1.83 x 3.05m PATIO, TYP.

SITE PLAN SYMBOLS:

- SIDEWALKS / WALKING SURFACE
- NOT USED
- CONCRETE PAVERS, SEE LANDSCAPE AND CIVIL
- NEW/REPAIRED ASPHALT PARKING SURFACE AND CURBS. SEE CIVIL
- TEMPORARY SNOW STORAGE LOCATION
- OPEN LANDSCAPE AREA FOR AMENITY SPACE CALCULATIONS
- PROPERTY LINE
- 3.0 M FRONT & CORNER SETBACK LINE
- 6.0 M PROP. MIN. BLG. SETBACK LINE
- LINE OF SIGHT TRIANGLE
- EXISTING GAS LINE
- EXISTING U/G HYDRO LINE
- EXISTING U/G BELL LINE
- EXISTING WATER LINE
- 1.8M H. CHAINLINK FENCE
- BIKE RACK
- ENTRANCE / EXIT DOOR
- FIRE HYDRANT
- SIAMESE CONNECTION
- VEHICULAR DIRECTION
- EXISTING TREE TO BE REMOVED - SEE LANDSCAPE PLANS
- EXISTING TREE TO REMAIN
- STREET LIGHT
- EXISTING PARKING SPACE TO BE REMOVED
- EXISTING 2.6M x 5.2M PARKING SPACE
- NEW 2.6M x 5.2M PARKING SPACE
- NEW 2.4M x 5.2M PARKING SPACE, COMPLETE WITH IDENTIFICATION SIGNAGE FOR COMPACT CARS
- NEW 2.4M x 4.6M PARKING SPACE, COMPLETE WITH IDENTIFICATION SIGNAGE FOR COMPACT CARS
- NEW PAD-MOUNT TRANSFORMER

NOTE:
SEE LANDSCAPE FOR ALL SURFACE MATERIAL AND PATTERN

PROJECT DEVELOPER

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CIVIL ENGINEER

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www.stantec.com

LANDSCAPE ARCHITECT

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SURVEYOR

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E-Mail: EdH@aovltd.com

[redacted]

DO NOT SCALE DRAWINGS

CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH THE WORK.

DRAWINGS NOT TO BE USED FOR CONSTRUCTION UNLESS STAMPED AND SIGNED BY THE CONSULTANT.

THESE DRAWINGS HAVE BEEN DESIGNED IN COMFORMANCE WITH THE ONTARIO BUILDING CODE.

Revisions

Revision Number	Revision Date	Revision Description
1	2021-09-27	REVISED SITE PLAN CONTROL
2	2022-05-16	REVISED SITE PLAN CONTROL
3	2022-08-19	REVISED SITE PLAN CONTROL
5	2024-12-11	ISSUED FOR CLIENT REVIEW

[redacted]

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f: 613.545.1411

Stamp

Project

NORBERRY RESIDENCES

2640, 2710, 2730 NORBERRY CRESCENT,
OTTAWA, ONTARIO

Drawing

SITE PLAN
Proposed Submission

Drawn By	Checked By: -
Scale	Date: 2025-02-24 1:16:26 PM
Project No. 2062	Revision: 5
Drawing No. A011	

1:1

GENERAL NOTES AND SPECIFICATIONS

1. ALL MATERIALS AND CONSTRUCTION METHODS TO BE IN ACCORDANCE WITH OPS AND CITY OF OTTAWA STANDARD SPECIFICATIONS AND DRAWINGS AND OPSD SUPPLEMENT. ONTARIO PROVINCIAL STANDARDS WILL APPLY WHERE NO CITY STANDARDS ARE AVAILABLE.
2. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED AND BEAR COST OF SAME INCLUDING WATER PERMIT AND ASSOCIATED COSTS.
3. SERVICE AND UTILITY LOCATIONS ARE APPROXIMATE. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING SERVICES AND UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING LOCATES FROM ALL UTILITY COMPANIES TO LOCATE EXISTING UTILITIES PRIOR TO EXCAVATION. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTION AND REINSTATEMENT.
4. ALL DISTURBED AREAS SHALL BE REINSTATED TO EQUAL OR BETTER CONDITION TO THE SATISFACTION OF THE ENGINEER & THE CITY. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH OPSD 509.010 AND OPSS 310.
5. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE "OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATION FOR CONSTRUCTION PROJECTS". THE GENERAL CONTRACTOR SHALL BE DEEMED TO BE THE CONSTRUCTOR AS DEFINED IN THE ACT.
6. THE CONTRACTOR SHALL SUBMIT AN EROSION AND SEDIMENTATION CONTROL PLAN THAT WILL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE PROTECTION FOR RECEIVING STORM SEWERS OR DRAINAGE DURING CONSTRUCTION ACTIVITIES. THIS PLAN SHALL INCLUDE BUT NOT BE LIMITED TO CATCH BASINS INSERTS, STRAW BALE CHECK DAMS AND SEDIMENT CONTROLS AROUND ALL DISTURBED AREAS. DEWATERING SHALL BE PUMPED INTO SEDIMENT TRAPS. REFER TO DRAWING EC/DS-1 FOR CONCEPTUAL EROSION AND SEDIMENT CONTROL MEASURES.
7. SITE PLAN PREPARED BY ALEXANDER WILSON ARCHITECT INC. DATED FEBRUARY 24, 2025.
8. ORIGINAL REGISTERED SURVEY PLANS (4-R PLANS) FOR SUBDIVISION OF PART OF LOT 23 (J.C.) PREPARED BY HENRY R. FARLEY DATED JANUARY 18, 1961 AND DECEMBER 19, 1962.
9. TOPOGRAPHIC SURVEY SUPPLIED BY ANNIS , O'SULLIVAN, VOLLEBEKK LTD. DATED MAY 8 2019.

   JOB BENCHMARK: TOP OF SPINDLE OF FIRE HYDRANT ON NORBERRY CRESCENT SOUTH OF PROPOSED SITE. ELEV=78.31

   BEARINGS ARE GRID, DERIVED FROM CANNET 2016 REAL TIME NETWORK GPS OBSERVATIONS AND ARE REFERENCED TO SPECIFIED CONTROL POINTS 01919680005 AND 01919680105. MTM ZONE 9 (76°30' WEST LONGITUDE) NAD-83 (ORIGINAL). FOR BEARING COMPARISONS. A ROTATION OF 0°33'10" COUNTER-CLOCKWISE WAS APPLIED TO BEARINGS ON PLANS P1, P2, P3 & P4.

   ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM.
10. REFER TO LANDSCAPE ARCHITECTURE PLAN FOR ALL LANDSCAPING FEATURES (ie. TREES, WALKWAYS, PARK DETAILS, NOISE BARRIERS, FENCES etc.)
11. GEOTECHNICAL INVESTIGATION PG4834-REVISION 1 PREPARED BY PATERSON GROUP, DATED APRIL 28, 2020. GEOTECHNICAL INFORMATION PRESENTED ON THESE DRAWINGS MAY BE INTERPOLATED FROM THE ORIGINAL REPORT. REFER TO ORIGINAL GEOTECHNICAL REPORT FOR ADDITIONAL DETAILS AND TO VERIFY ASSUMPTIONS MADE HEREIN.
12. STREET LIGHTING TO CITY OF OTTAWA STANDARDS.
13. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED. DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO ENGINEER.
14. THERE WILL BE NO SUBSTITUTION OF MATERIALS UNLESS PRIOR WRITTEN APPROVAL BY THE CONTRACT ADMINISTRATOR AND DIRECTOR OF ENGINEERING HAS BEEN OBTAINED.
15. HERITAGE OPERATIONS UNIT OF THE ONTARIO MINISTRY OF CULTURE TO BE NOTIFIED IF DEEPLY BURRIED ARCHEOLOGICAL REMAINS ARE FOUND ON THE PROPERTY DURING CONSTRUCTION ACTIVITIES.

ROADWORKS

1. ALL TOPSOIL AND ORGANIC MATERIAL TO BE STRIPPED FROM WITHIN THE FULL RIGHT OF WAY PRIOR TO CONSTRUCTION.
2. SUB-EXCAVATE SOFT AREAS & FILL WITH GRANULAR 'B' COMPACTED IN 0.30m LAYERS.
3. ALL GRANULAR FOR ROADS SHALL BE COMPACTED TO A MINIMUM OF 100% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
4. ROAD SUBDRAINS SHALL BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARD R1.
5. ASPHALT WEAR COURSE SHALL NOT BE PLACED UNTIL THE VIDEO INSPECTION OF SEWERS & NECESSARY REPAIRS HAVE BEEN CARRIED OUT TO THE SATISFACTION OF THE CONSULTANT.
6. CONTRACTOR TO OBTAIN A ROAD OCCUPANCY PERMIT 48 HOURS PRIOR TO COMMENCING ANY WORK WITHIN THE MUNICIPAL ROAD ALLOWANCE IF REQUIRED BY THE MUNICIPALITY. ALL WORK ON THE MUNICIPAL RIGHT OF WAY AND EASEMENTS TO BE INSPECTED BY THE MUNICIPALITY PRIOR TO BACKFILLING.
7. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD R10, AND OPSD 509.010, AND OPSS 310.
8. CONCRETE CURBS SHALL BE CONSTRUCTED AS PER CITY STANDARD SC1.1.
9. CONCRETE SIDEWALKS SHALL BE CONSTRUCTED AS PER CITY STANDARD SC1.4.
10. PAVEMENT CONSTRUCTION AS PER GEOTECHNICAL INVESTIGATION PG4834-REVISION 1 PREPARED BY PATERSON GROUP, DATED DECEMBER 10, 2019.

    HEAVY DUTY ASPHALT
    40mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE
    50mm HL8 OR SUPERPAVE 19.0 ASPHALTIC CONCRETE
    150mm OPSS GRANULAR A BASE
    300mm OPSS GRANULAR B TYPE II

    LIGHT DUTY ASPHALT
    50mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE
    150 OPSS GRANULAR 'A' BASE
    300 OPSS GRANULAR 'B' TYPE II

WATER SUPPLY SERVICING

1. THE CONTRACTOR SHALL CONSTRUCT WATERMAIN, WATER SERVICES, CONNECTIONS & APPURTENANCES AS PER CITY OF OTTAWA SPECIFICATIONS & SHALL CO-ORDINATE AND PAY ALL RELATED COSTS INCLUDING THE COST OF CONNECTION, INSPECTION & DISINFECTION BY CITY PERSONNEL.
2. WATER SERVICES ARE TO BE PVC PIPE AS PER CITY OF OTTAWA STANDARD W26 (UNLESS OTHERWISE NOTED). WATER SERVICE TO BE TERMINATED 1.0m FROM THE FACE OF BUILDING UNLESS OTHERWISE NOTED. STAND POST TO BE INSTALLED AT PROPERTY LINE.
3. WATER VALVES TO BE INSTALLED AS PER CITY OF OTTAWA STANDARD W24.
4. WATERMAIN TRENCH AND BEDDING SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STD. W17 UNLESS OTHERWISE SPECIFIED. BEDDING AND COVER MATERIAL TO BE SPECIFIED BY PROJECT GEOTECHNICAL CONSULTANT.
5. SERVICE CONNECTIONS SHALL BE INSTALLED A MINIMUM OF 2400mm FROM ANY CATCHBASIN, MANHOLE, OR OBJECT THAT MAY CONTRIBUTE TO FREEZING. THERMAL INSULATION SHALL BE INSTALLED ON ALL PROPOSED CB'S ON THE W/M STREET SIDE WHERE 2400mm SEPARATION CANNOT BE ACHIEVED.(AS PER CITY OF OTTAWA W22 & W23)
6. CATHODIC PROTECTION TO BE SUPPLIED ON METALLIC FITTINGS AS PER CITY OF OTTAWA W40 AND W42.
7. ALL WATERMAIN BENDS, JOINTS, TEES AND PLUGS SHALL BE MECHANICALLY RESTRAINED IN ACCORDANCE WITH CITY OF OTTAWA STANDARDS.
8. WATERMAIN TO HAVE MIN. 2.4m COVER. WHERE WATERMAIN COVER IS LESS THAN 2.4m, INSULATION TO BE SUPPLIED IN ACCORDANCE WITH CITY STANDARD W22.
9. WATERMAINS MUST COMPLY WITH MINIMUM HORIZONTAL AND VERTICAL CLEARANCES IN ACCORDANCE WITH LOCAL PROVINCIAL GUIDELINES AND THE APPLICABLE BUILDING AND PLUMBING CODE. WHERE HORIZONTAL SEPARATIONS CANNOT BE ACHIEVED, APPROVAL FROM THE ENGINEER MUST BE OBTAINED AND A MINIMUM 500mm VERTICAL SEPARATION MUST BE MAINTAINED.
10. WATERMAIN CROSSINGS ABOVE AND BELOW SEWERS TO BE INSTALLED AS PER CITY OF OTTAWA STANDARD W25 AND W25.2.
11. PRESSURE REDUCING VALVES (PRV'S) IF REQUIRED, TO BE INSTALLED AS PER ONTARIO PLUMBING CODE.
12. ALL WATERMAINS SHALL BE HYDROSTATICALLY TESTED IN ACCORDANCE WITH THE CITY OF OTTAWA AND ONTARIO GUIDELINES UNLESS OTHERWISE DIRECTED. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED.
13. ALL WATERMAINS SHALL BE BACTERIALOGICALLY TESTED IN ACCORDANCE WITH THE CITY OF OTTAWA AND ONTARIO GUIDELINES. ALL CHLORINATED WATER TO BE DISCHARGED AND PRETREATED TO ACCEPTABLE LEVELS PRIOR TO DISCHARGE. ALL DISCHARGED WATER MUST BE CONTROLLED AND TREATED SO AS NOT TO ADVERSELY EFFECT THE ENVIRONMENT. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT ALL MUNICIPAL AND/OR PROVINCIAL REQUIREMENTS ARE FOLLOWED.

STORM AND SANITARY SEWERS

1. SEWERS 375mm DIA. OR SMALLER SHALL BE PVC SDR35. SEWERS LARGER THAN 375mm SHALL BE CONCRETE CSA A 257.2 CLASS 100D AS PER OPSD 807.010.
2. ALL STORM AND SANITARY SEWER BEDDING SHALL BE INSTALLED AS PER CITY OF OTTAWA STANDARDS S6 AND S7. CLASS 'B' BEDDING, UNLESS OTHERWISE NOTED. SUITABLE BEDDING AND COVER MATERIAL TO BE SPECIFIED BY GEOTECHNICAL CONSULTANT.
3. STORM AND SANITARY MANHOLES SHALL BE 1200mm DIAMETER IN ACCORDANCE WITH OPSD-701.01 (UNLESS OTHERWISE NOTED) c/w FRAME AND COVER AS PER CITY OF OTTAWA S24, S24.1, AND S25 WHERE APPLICABLE. CATCH BASIN MANHOLE FRAME AND COVERS PER S19, S28, AND S28.1 WHERE APPLICABLE. ALL STORM MANHOLES WITH SEWERS 900mm DIA. SEWERS AND OVER IN SIZE SHALL BE BENCHED. ALL OTHER STORM MANHOLES SHALL BE COMPLETED WITH 300mm SUMPS AS PER CITY STANDARDS. SANITARY MANHOLES SHALL NOT HAVE SUMPS.
4. ALL SEWERS CONSTRUCTED WITH GRADES 0.50% OR LESS, TO BE INSTALLED WITH LASER AND CHECKED WITH LEVEL INSTRUMENT PRIOR TO BACKFILLING.
5. FOR STORM SEWER INSTALLATION (EXCLUDING CB LEADS) THE MINIMUM DEPTH OF COVER OVER THE CROWN OF THE SEWER IS 2.0m. FOR SANITARY SEWERS THE MINIMUM DEPTH OF COVER IS 2.5m OVER PIPE OBVERT.
6. ALL STORM SERVICES TO BE EQUIPPED WITH APPROVED BACKWATER VALVES AS PER CITY STANDARD S14. ALL SANITARY SERVICES TO BE EQUIPPED WITH APPROVED BACKWATER VALVES AS PER CITY STANDARD S14.2.
7. STORM AND SANITARY SERVICE LATERALS TO BE SDR 28 INSTALLED AT MIN. 1.0% SLOPE. SINGLE STORM SERVICES TO BE 100mmØ. SINGLE SANITARY SERVICES TO BE 135mmØ. (SERVICES TO BE CAPPED 1.0m OFF BUILDING FACE)
8. CATCH BASINS SHALL BE INSTALLED IN ACCORDANCE WITH CITY STANDARDS S1, S2, S3 c/w FRAME AND GRATE AS PER S19.1. CURB INLET FRAME AND GRATE PER S22 AND S23. PROVIDE 150mm ADJUSTED SPACERS. ALL CATCH BASINS SHALL HAVE SUMPS (600mm DEEP). STREET CATCH BASIN LEADS SHALL BE 200mm DIA.(MIN) PVC DR 35 AT 1.0% GRADE WHERE NOT OTHERWISE SHOWN ON PLAN. CATCH BASINS WILL BE INSTALLED WITH INLET CONTROL DEVICES (ICD) AS PER ICD SCHEDULE ON STORM DRAINAGE PLAN.
9. STREET CATCH BASINS TO BE INSTALLED c/w SUBDRAINS 3m LONG IN FOUR ORTHOGONAL DIRECTIONS OR LONGITUDINALLY WHEN PLACED ALONG A CURB, AND AT AN ELEVATION OF 300mm BELOW SUBGRADE LEVEL.
10. CLAY SEALS TO BE INSTALLED AS PER CITY STANDARD DRAWING S8. THE SEALS SHOULD BE AT LEAST 1.5m LONG AND SHOULD EXTEND FROM TRENCH WALL TO TRENCH WALL, GENERALLY. THE SEALS SHOULD EXTEND FROM THE FROST LINE AND FULLY PENETRATE THE BEDDING, SUBBEDDING AND COVER MATERIAL. THE BARRIERS SHOULD CONSIST OF RELATIVELY DRY AND COMPACTABLE BROWN SILTY CLAY PLACED IN MAXIMUM 225mm THICK LOOSE LAYERS AND COMPACTED TO A MINIMUM OF 95% OF THE MATERIAL'S SPMDD. THE CLAY SEALS SHOULD BE PLACED AT THE SITE BOUNDARIES AND AT STRATEGIC LOCATIONS AT NO MORE THAN 60 M INTERVALS IN THE SERVICE TRENCHES.
11. GRANULAR "A" SHALL BE PLACED TO A MINIMUM THICKNESS OF 300 mm AROUND ALL STRUCTURES WITHIN PAVEMENT AREA AND COMPACTED TO A MINIMUM OF 95% STANDARD PROCTOR DENSITY.
12. CONTRACTOR SHALL PERFORM LEAKAGE TESTING, IN THE PRESENCE OF THE CONSULTANT, FOR SANITARY SEWERS IN ACCORDANCE WITH OPSS 410 AND OPSS 407. CONTRACTOR SHALL PERFORM VIDEO INSPECTION OF ALL STORM AND SANITARY SEWERS. A COPY OF THE VIDEO AND INSPECTION REPORT SHALL BE SUBMITTED TO THE CONSULTANT FOR REVIEW.
13. ANY SEWER ABANDONMENT TO BE CONDUCTED ACCORDING TO CITY OF OTTAWA STANDARD S11.4
14. SEWERS WITH LESS THAN 2.0m COVER TO BE INSULATED IN ACCORDANCE WITH CITY STANDARD W22.

GRADING

1. ALL GRANULAR BASE & SUB BASE COURSE MATERIALS SHALL BE COMPACTED TO 98% STANDARD PROCTOR MAX. DRY DENSITY.
2. SUB-EXCAVATE SOFT AREAS & FILL WITH GRANULAR 'B' COMPACTED IN 0.30m LAYERS.
3. ALL DISTURBED GRASSED AREAS SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER, WITH SOD ON MIN. 100mm TOPSOIL. THE RELOCATION OF TREES AND SHRUBS SHALL BE SUBJECT TO APPROVAL BY THE PROJECT LANDSCAPE ARCHITECT OR ENGINEER.
4. EMBANKMENTS TO BE SLOPED AT MIN. 3:1, UNLESS OTHERWISE SPECIFIED.
5. ALL SWALES TO BE MIN. 0.15m DEEP WITH MIN. 3:1 SIDE SLOPES UNLESS OTHERWISE NOTED. THE MINIMUM LONGITUDINAL SLOPE TO BE 1.5% OR 1.0% WHEN PERFORATED SUBDRAIN IS INSTALLED.
6. ALL ROOF DRAINS TO DISCHARGE TO THE INTERNAL STORMWATER PLUMBING AND NOT BE DIRECTED TO THE BUILDING FOUNDATION DRAIN.
7. TOP OF GRATE (T/G) ELEVATIONS FOR ALL STREET CATCHBASINS SHOWN ON PLANS. REFER TO THE ELEVATION AT EDGE OF PAVEMENT, OR GUTTERLINE WHERE APPLICABLE.
8. ALL RETAINING WALLS GREATER THAN 1.0m IN HEIGHT ARE TO BE DESIGNED, APPROVED, AND STAMPED BY STRUCTURAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO.
9. FENCES OR RAILINGS ARE REQUIRED FOR RETAINING WALLS GREATER THAN 0.60m IN HEIGHT.
10. EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE SITE.
11. ALL NECESSARY CLEARING AND GRUBBING SHALL BE COMPLETED BY THE CONTRACTOR. REVIEW WITH CONTRACT ADMINISTRATOR AND THE CITY OF OTTAWA PRIOR TO TREE CUTTING.
12. REFER TO DRAWING EC DS-1 FOR EROSION AND SEDIMENT CONTROL DETAILS.

Best Management Practices

CONTRACTOR TO PROVIDE EROSION AND SEDIMENT CONTROLS (BEST MANAGEMENT PRACTICES) DURING CONSTRUCTION OF THIS PROJECT.

EROSION MUST BE MINIMIZED AND SEDIMENTS MUST BE REMOVED FROM CONSTRUCTION SITE RUN-OFF IN ORDER TO PROTECT DOWNSTREAM AREAS. DURING ALL CONSTRUCTION, EROSION AND SEDIMENTATION SHOULD BE CONTROLLED BY THE FOLLOWING TECHNIQUES:

1. LIMIT THE EXTENT OF EXPOSED SOILS AT ANY GIVEN TIME.
2. REVEGETATE EXPOSED AREAS AND SLOPES AS SOON AS POSSIBLE.
3. MINIMIZE AREA TO BE CLEARED AND GRUBBED.
4. PROTECT EXPOSED SLOPES WITH PLASTIC OR SYNTHETIC MULCHES.
5. INSTALL CATCH BASIN INSERTS OR EQUIVALENT IN ALL PROPOSED CATCH BASINS AND CATCH BASIN MANHOLES AND IN ALL EXISTING CATCH BASINS THAT WILL RECEIVE RUN-OFF FROM THE SITE.
6. A SILT FENCE SHALL BE INSTALLED AROUND THE PERIMETER OF ALL AND ANY STOCKPILES OF MATERIAL TO BE USED OR REMOVED FROM SITE. (LOCATION TO BE DETERMINED)
7. A VISUAL INSPECTION SHALL BE DONE DAILY ON SEDIMENT CONTROL MEASURES AND CLEANED OF ANY ACCUMULATED SILT AS REQUIRED. THE DEPOSITS WILL BE DISPOSED OFF SITE AS PER THE REQUIREMENTS OF THE CONTRACT.
8. SEDIMENT CONTROL BARRIERS MAY ONLY BE REMOVED TEMPORARILY WITH APPROVAL OF CONTRACT ADMINISTRATOR TO ACCOMMODATE CONSTRUCTION OPERATIONS. ALL AFFECTED BARRIERS MUST BE REINSTATED AT NIGHT WHEN CONSTRUCTION IS COMPLETED. NO REMOVAL WILL OCCUR IF THERE IS A SIGNIFICANT RAINFALL EVENT ANTICIPATED (>10mm) UNLESS A NEW DEVICE HAS BEEN INSTALLED TO PROTECT EXISTING STORM AND SANITARY SEWER SYSTEMS, OR DOWNSTREAM WATERCOURSES.
9. NO REFUELING OR CLEANING OF EQUIPMENT IS PERMITTED NEAR ANY EXISTING WATERWAY.
10. CONTRACTOR SHALL REMOVE SEDIMENT CONTROL MEASURES WHEN, IN THE OPINION OF THE CONTRACT ADMINISTRATOR, THE MEASURE(S) IS NO LONGER REQUIRED. NO CONTROL MEASURES SHALL BE PERMANENTLEY REMOVED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE CONTRACT ADMINISTRATOR.
11. THE CONTRACTOR SHALL PERIODICALLY, OR WHEN REQUESTED BY THE CONTRACT ADMINISTRATOR, CLEAN OUT ACCUMULATED SEDIMENTS AS REQUIRED.
12. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO THE WATERCOURSE. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.
13. CONTRACTOR SHALL INSTALL MUD MATS AT ENTRANCE TO THE SITE.
14. STORMWATER SWALES TO BE COVERED WITH HYDRO-SEED AND MULCH.

LEGEND

SERVICES

- PROPOSED WATERMAIN
- PROPOSED VALVE AND VALVE BOX
- PROPOSED FIRE HYDRANT
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED STORMCEPTOR
- PROPOSED CATCHBASIN
- PROPOSED AREA DRAIN
- CIRCULAR ORIFICE (SEE DWG SD-1)
- EXISTING WATERMAIN
- EXISTING VALVE AND VALVE BOX
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING CATCHBASIN
- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.
- PROPOSED WATER METER
- PROPOSED REMOTE WATER METER

STORM DRAINAGE

- AREA ID (BLDG)
- RUNOFF COEFFICIENT (1.00 / 0.90)
- STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- DIRECTION OF OVERLAND FLOW
- PROPOSED STORM SEWER
- PROPOSED STORMCEPTOR
- PROPOSED CATCHBASIN
- PROPOSED AREA DRAIN
- CIRCULAR ORIFICE (SEE DWG SD-1)
- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.

EROSION CONTROL

- PROPOSED SILT FENCE BOUNDARY AS PER OPSD 219.110
- PROPOSED CATCH BASIN PROTECTION AS PER DETAIL.
- PROPOSED MUD MAT LOCATION

REMOVALS

- EXISTING WATERMAIN
- EXISTING VALVE AND VALVE BOX
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING CATCHBASIN
- OHW — EXISTING OVERHEAD WIRE
- B — B — EXISTING OVERHEAD WIRE
- H — H — EXISTING OVERHEAD WIRE
- C — EXISTING OVERHEAD WIRE
- TV — TV — EXISTING OVERHEAD WIRE
- ORIGINAL GROUND ELEVATIONS (+65.00 / +65.00*)
- TOP OF CURB / WALL ELEVATION
- CURB TO BE REMOVED
- ASPHALT/CONCRETE/VEGETATION TO BE REMOVED

GRADING

- ORIGINAL GROUND ELEVATIONS (+65.00 / +65.00*)
- EXISTING TOP OF CURB / WALL ELEVATION
- × 99.99 — PROPOSED ELEVATION
- × 99.99* — PROPOSED TOP OF CURB ELEVATION
- × 99.99 / 98.88 — PROPOSED ELEVATION / EXISTING ELEVATION
- 2.0% — FLOW DIRECTION AND GRADE
- FF=99.99 — FINISHED FIRST FLOOR ELEVATION
- TF=99.99 — TOP OF FOUNDATION ELEVATION
- USF=99.99 — UNDERSIDE OF FOOTING ELEVATION
- TERRACING 3:1 SLOPE MAXIMUM (UNLESS OTHERWISE SHOWN)
- PROPOSED SWALE
- DIRECTION OF OVERLAND FLOW
- PROPOSED VALVE BOX
- PROPOSED SANITARY SEWER MANHOLE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED CATCHBASIN
- Dc — PROPOSED DEPRESSED CURB LOCATIONS
- EXISTING VALVE AND VALVE BOX
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING CATCHBASIN
- PROPOSED TRANSFORMER LOCATION
- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED LIGHT DUTY ASPHALT
- MAXIMUM 100-YR PONDING LIMITS
- PROPOSED RETAINING WALL. RETAINING WALLS GREATER THAN 1.0m IN HEIGHT TO BE DESIGN BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO. RAILINGS REQUIRED WHEN WALL IS 0.6m IN HEIGHT OR GREATER.

EXISTING STORM DRAINAGE

- AREA ID (BLDG)
- RUNOFF COEFFICIENT (1.00 / 0.90)
- STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- DIRECTION OF OVERLAND FLOW
- EXISTING STORM SEWER
- EXISTING CATCHBASIN

SCHEDULE OF ROOF RELEASE RATES

DRAINAGE AREA ID	DRAIN TYPE	# DRAINS	100 YEAR HEAD (m)	100 YEAR RELEASE RATE (L/s)
BLDGA	WATTS R1100 ACCUTROL (25% OPEN)	8	0.142	7.4
BLDGB	WATTS R1100 ACCUTROL (25% OPEN)	8	0.141	7.3
BLDGC	WATTS R1100 ACCUTROL (25% OPEN)	8	0.142	7.4

SCHEDULE OF INLET CONTROL DEVICES

CATCHBASIN ID	TRIBUTARY AREA ID	100YR HEAD (m)	100YR RELEASE RATE (L/s)	ICD TYPE
CB 200	L102A	1.66	7.4	IPEX TEMPEST LMF 80
CB 201	L103A	1.63	18.7	83mmØ ORIFICE
CB 203	L103B	1.63	10.2	IPEX TEMPEST LMF 95
AREA DRAIN 303	L303A	1.62	18.6	83mmØ ORIFICE
AREA DRAIN 300	L300A	1.56	42.8	127mmØ ORIFICE
AREA DRAIN 301	L301A	1.56	42.8	127mmØ ORIFICE

Stantec

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
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Legend

APPROVED ☐ REFUSED ☐

THIS ____ DAY OF _____, 20____

LILY XU, MCIP, RPP, MANAGER
DEVELOPMENT REVIEW SOUTH
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

9	REVISED SITE PLAN	WAJ	DCT	25.04.25
8	REVISED SITE PLAN	WAJ	DCT	21.09.21
7	REVISED SITE PLAN	WAJ	DCT	21.06.14
6	REVISED SITE PLAN	WAJ	DCT	20.09.16
5	REVISED SITE PLAN	WAJ	DCT	20.08.21
4	REVISED AS PER CITY COMMENTS	WAJ	DCT	20.05.04
3	REVISED AS PER CITY COMMENTS	WAJ	DCT	19.12.13
2	ISSUED FOR REVIEW	WAJ	DCT	19.07.19
1	ISSUED FOR BUILDING PERMIT, BUILDINGS A & B	WAJ	DCT	19.06.27
Revision		By	Appd.	YY.MM.DD
File Name: 160401483-D8		WAJ	KJK	19.04.03
		Dwn.	Chkd.	Dsgn. YY.MM.DD

Permit-Seal

Client/Project
NORBERRY PROPERTIES LIMITED
333 Wilson Ave, Suite 200. Toronto, ON

NORBERRY RESIDENCES

OTTAWA, ON

Title
NOTES AND LEGEND PLAN

Project No. 160401483
Scale
Drawing No. NL-1
Sheet 1 of 7
Revision 9

D07-12-19-0099

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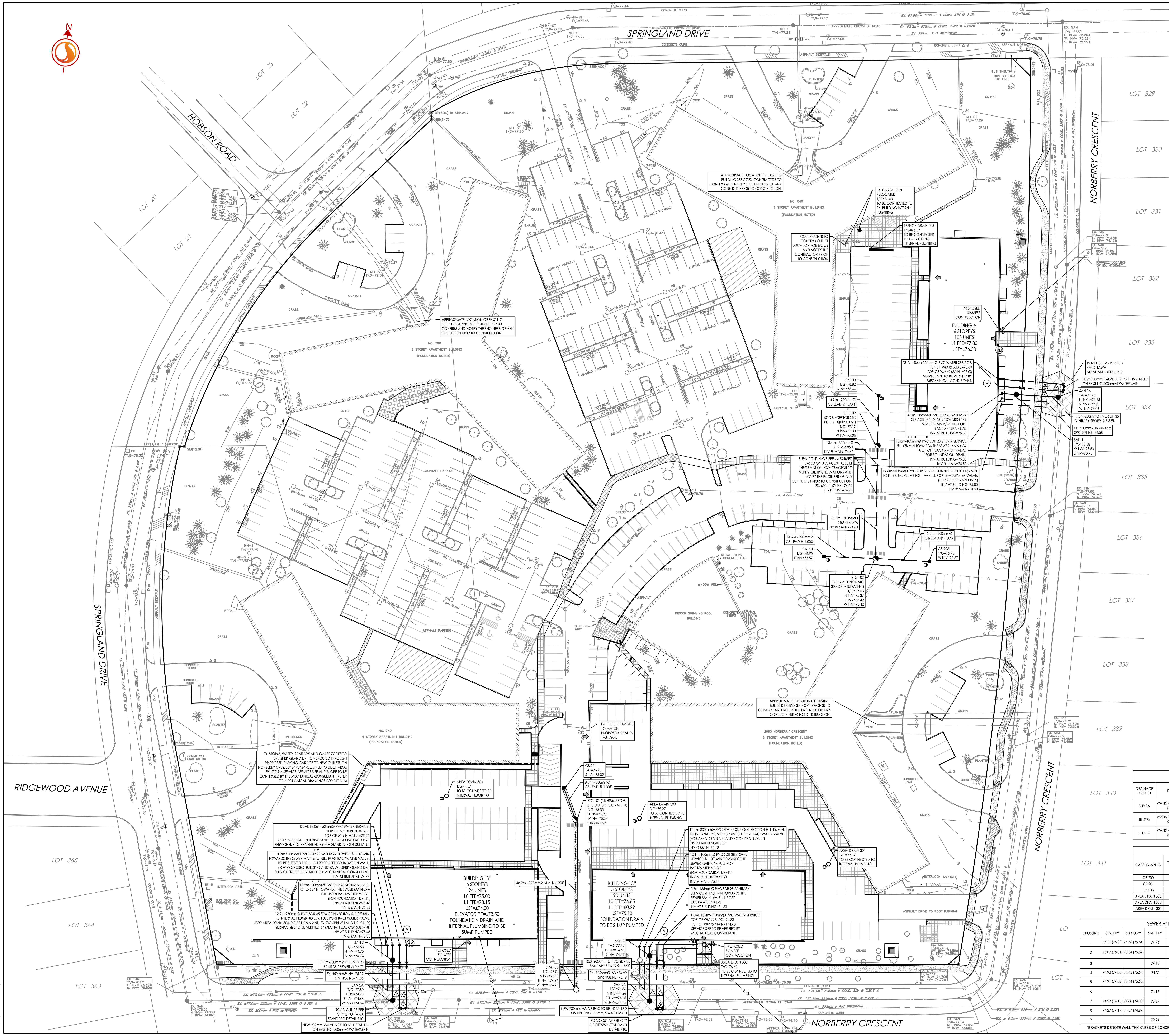

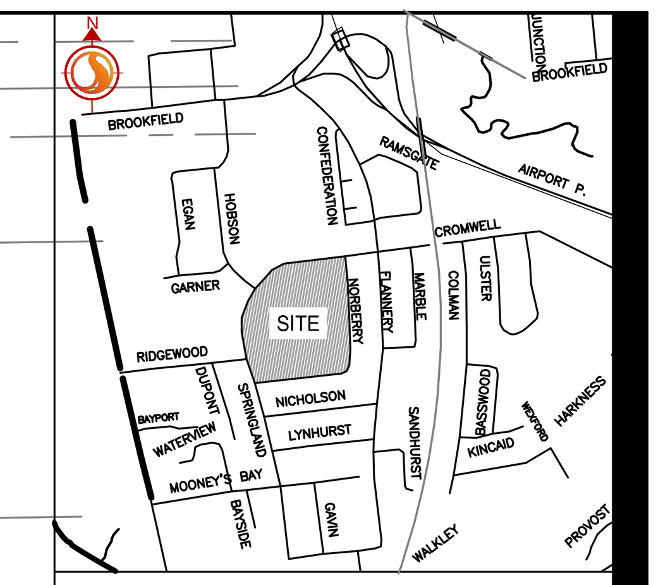

KEY PLAN
N.T.S

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Legend

- PROPOSED WATERMAIN
- PROPOSED VALVE AND VALVE BOX
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED STORMCEPTOR
- PROPOSED CATCHBASIN
- PROPOSED AREA DRAIN
- CIRCULAR ORIFICE (SEE DWG SD-1)
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- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.
- PROPOSED WATER METER
- PROPOSED REMOTE WATER METER
- APPROXIMATE ROOF DRAIN AND SCUPPER LOCATIONS (REFER TO ARCHITECTURAL DRAWINGS FOR DETAILS)
- PROPOSED SNOW STORAGE LOCATION
- PROPOSED ROAD CUT
- PROPOSED CLAY SEAL

NOTES:
1. FINAL SERVICE LATERAL SIZE, LOCATION AND ELEVATION TO BE CONFIRMED BY MECHANICAL CONSULTANT.
2. SERVICE LATERALS TO CONNECT TO EXISTING MAIN AS PER CITY STANDARD S11.
3. CONTRACTOR TO LOCATE EXISTING SERVICES AND ANY CONFLICTS WITH EXISTING SERVICING MUST BE REPORTED TO THE ENGINEER PRIOR TO CONTINUING WITH CONSTRUCTION.

APPROVED ☐ REFUSED ☐

THIS _____ DAY OF ____________, 20____

LILY XU, MCIP, RPP, MANAGER
DEVELOPMENT REVIEW SOUTH
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

SCHEDULE OF ROOF RELEASE RATES

DRAINAGE AREA ID	DRAIN TYPE	# DRAINS	100 YEAR HEAD (m)	100 YEAR RELEASE RATE (L/s)
BLDGA	WATTS R1100 ACCUTROL (25% OPEN)	8	0.142	7.4
BLDGB	WATTS R1100 ACCUTROL (25% OPEN)	8	0.141	7.3
BLDGC	WATTS R1100 ACCUTROL (25% OPEN)	8	0.142	7.4

SCHEDULE OF INLET CONTROL DEVICES

CATCHBASIN ID	TRIBUTARY AREA ID	100YR HEAD (m)	100YR RELEASE RATE (L/s)	ICD TYPE
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AREA DRAIN 303	L303A	1.62	18.6	83mmØ ORIFICE
AREA DRAIN 300	L300A	1.56	42.8	127mmØ ORIFICE
AREA DRAIN 301	L301A	1.56	42.8	127mmØ ORIFICE

SEWER AND WATERMAIN CROSSING TABLE

CROSSING	STM INV*	STM OBV*	SAN INV*	SAN OBV*	WTR TOP	WTR BTM	NOTES
1	75.11 (75.03)	75.56 (75.64)	74.76	74.96			
2	75.09 (75.01)	75.54 (75.62)			76.27	76.12	DEFLECT WATER SERVICE OVER STORM AS PER W25.2 AND INSULATE AS PER W22
3			74.62	74.85	75.50	75.35	DEFLECT WATER SERVICE OVER SANITARY AS PER W25.2 AND INSULATE AS PER W22
4	74.92 (74.83)	75.45 (75.54)	74.31	74.51			
5	74.91 (74.82)	75.44 (75.53)			74.32	74.17	DEFLECT WATER SERVICE UNDER STORM AS PER W25
6			74.13	74.36	75.01	74.86	DEFLECT WATER SERVICE OVER SANITARY AS PER W25.2 AND INSULATE AS PER W22
7	74.28 (74.18)	74.88 (74.98)	73.27	73.47			
8	74.27 (74.17)	74.87 (74.97)			75.62	75.47	DEFLECT WATER SERVICE OVER STORM AS PER W25.2 AND INSULATE AS PER W22
9			72.94	73.17	75.05	74.90	

*BRACKETS DENOTE WALL THICKNESS OF CONCRETE PIPE

	Revision	By	Appd.	YY.MM.DD
9	REVISED SITE PLAN	WAJ	DCT	25.04.25
8	REVISED SITE PLAN	WAJ	DCT	21.09.21
7	REVISED SITE PLAN	WAJ	DCT	21.06.14
6	REVISED SITE PLAN	WAJ	DCT	20.09.16
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2	ISSUED FOR REVIEW	WAJ	DCT	19.07.19
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File Name:	Dwn.	Chkd.	Dsgn.	YY.MM.DD
160401483-DB	WAJ	KJK	WAJ	19.04.03

Permit-Seal

Client/Project
NORBERRY PROPERTIES LIMITED
333 Wilson Ave, Suite 200. Toronto, ON

NORBERRY RESIDENCES

OTTAWA, ON

Title
SITE SERVICING PLAN

Project No. 160401483
Scale 1:500 (0 5 15 25m)
Drawing No. SSP-1
Sheet 3 of 7
Revision 9

D07-12-19-0099

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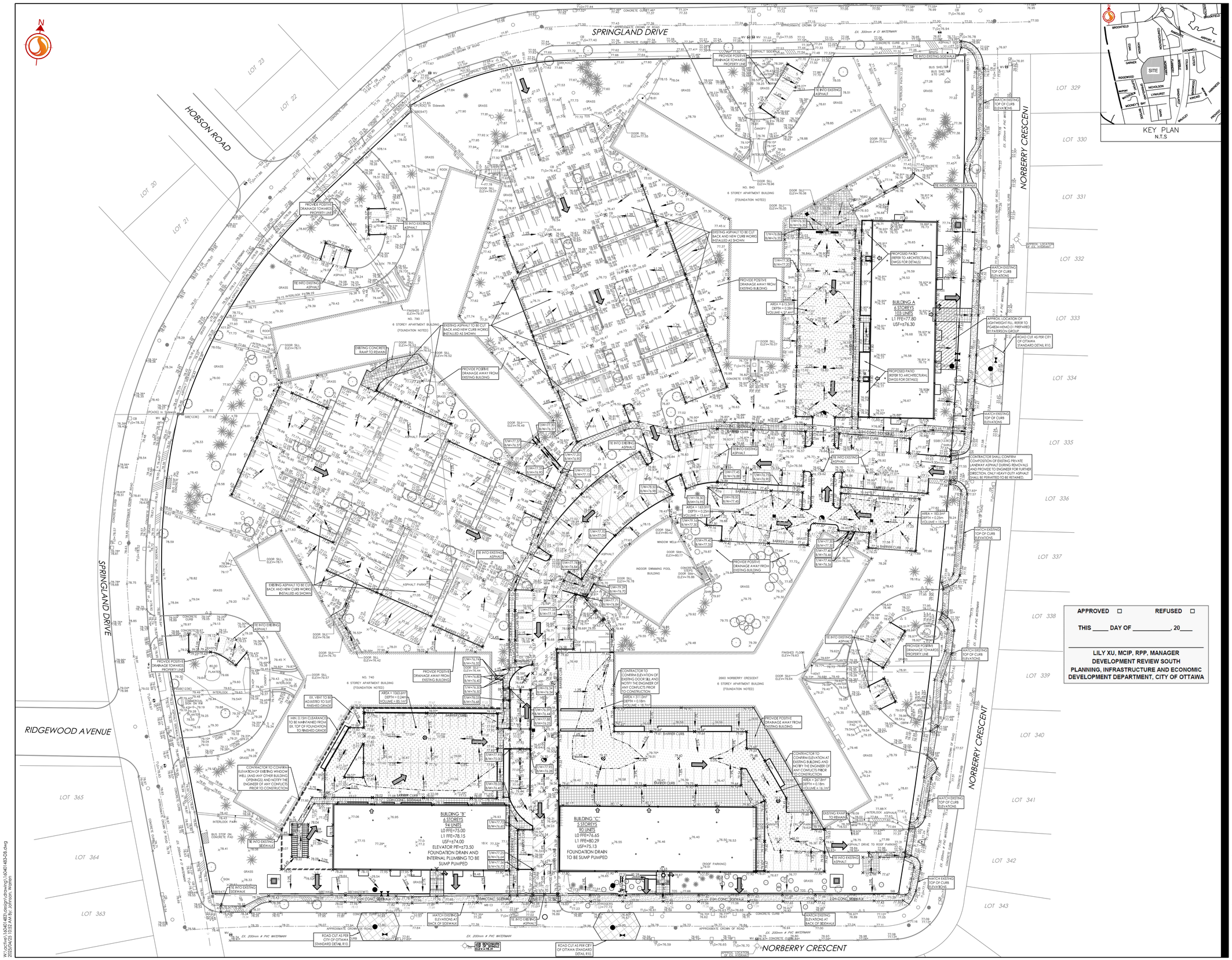

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ORIGINAL SHEET - ARCH D

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Legend

- ORIGINAL GROUND ELEVATIONS
- EXISTING TOP OF CURB / WALL ELEVATION
- PROPOSED ELEVATION
- PROPOSED TOP OF CURB ELEVATION
- PROPOSED ELEVATION / EXISTING ELEVATION
- FLOW DIRECTION AND GRADE
- FF=99.99 FINISHED FIRST FLOOR ELEVATION
- TF=99.99 TOP OF FOUNDATION ELEVATION
- USF=99.99 UNDERSIDE OF FOOTING ELEVATION
- TERRACING 3:1 SLOPE MAXIMUM (UNLESS OTHERWISE SHOWN)
- PROPOSED SWALE
- DIRECTION OF OVERLAND FLOW
- PROPOSED VALVE BOX
- PROPOSED SANITARY SEWER MANHOLE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED CATCHBASIN
- DC PROPOSED DEPRESSED CURB LOCATIONS
- BARRIER / MOUNTABLE PROPOSED MOUNTABLE/BARRIER CURB LOCATION
- EXISTING VALVE AND VALVE BOX
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING CATCHBASIN
- PROPOSED TRANSFORMER LOCATION
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- MAXIMUM 100-YR PONDING LIMITS
- PROPOSED RETAINING WALL. RETAINING WALLS GREATER THAN 1.0m IN HEIGHT TO BE DESIGN BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO. RAILINGS REQUIRED WHEN WALL IS 0.6m IN HEIGHT OR GREATER.
- PROPOSED SNOW STORAGE LOCATION
- PROPOSED ROAD CUT
- PROPOSED TACTILE WALKING SURFACE INDICATOR (TWSI) AS PER SC 7.3
- APPROX. LOCATION OF LIGHTWEIGHT FILL. REFER TO PG4834-MEMO.01 PREPARED BY PATERSON GROUP

9	REVISED SITE PLAN	WAJ	DCT	25.04.25
8	REVISED SITE PLAN	WAJ	DCT	21.09.21
7	REVISED SITE PLAN	WAJ	DCT	21.06.14
6	REVISED SITE PLAN	WAJ	DCT	20.09.16
5	REVISED SITE PLAN	WAJ	DCT	20.08.21
4	REVISED AS PER CITY COMMENTS	WAJ	DCT	20.05.04
3	REVISED AS PER CITY COMMENTS	WAJ	DCT	19.12.13
2	ISSUED FOR REVIEW	WAJ	DCT	19.07.19
1	ISSUED FOR BUILDING PERMIT, BUILDINGS A & B	WAJ	DCT	19.06.27
Revision		By	Appd.	YY.MM.DD
File Name: 160401483-DB		WAJ	KJK	WAJ 19.04.03
		Dwn.	Chkd.	Dsgn. YY.MM.DD

APPROVED ☐ REFUSED ☐

THIS _____ DAY OF _____, 20____

LILY XU, MCIP, RPP, MANAGER
DEVELOPMENT REVIEW SOUTH
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

Permit-Seal

Client/Project

NORBERRY PROPERTIES LIMITED
333 Wilson Ave, Suite 200. Toronto, ON

NORBERRY RESIDENCES

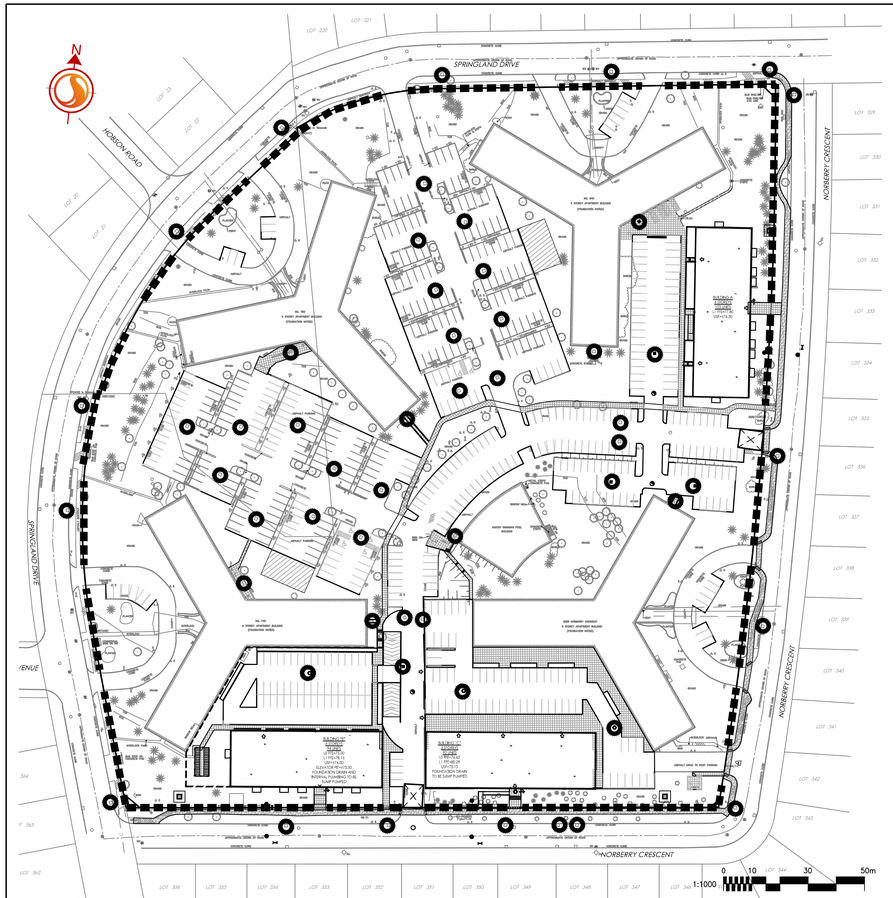
OTTAWA, ON

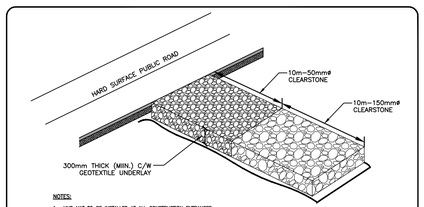
Title

GRADING PLAN

Project No.	Scale	Revision
160401483	1:500 (0 5 15 25m)	9
Drawing No.	Sheet	
GP-1	4 of 7	

D07-12-19-0099

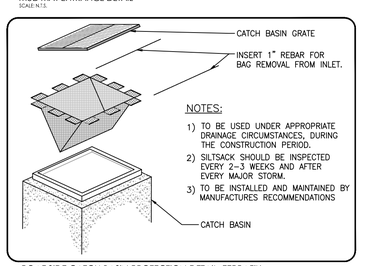




NOTES:

1. MUD MAT TO BE INSTALLED AT ALL CONSTRUCTION ENTRANCES
2. MUD MAT TO EXTEND FULL WIDTH OF ENTRANCE
3. IN THE CASE THAT THE ACCESS CROSSES A CULVERT OR DITCH, SEDIMENT FENCING SHOULD BE INSTALLED ALONG THE EDGES OF THE ACCESS TO PREVENT SEDIMENT FROM BEING WASHED AWAY WITH RUNOFF.
4. THE GRANULAR MATERIAL WILL REQUIRE PERIODIC REPLACEMENT AS IT BECOMES CONTAMINATED BY VEHICLE TRAFFIC.
5. SEDIMENT SHALL BE CLEANED FROM PUBLIC ROADS AT THE END OF EACH DAY.
6. STORM INLETS BOTH ON AND IN THE PROXIMITY OF THE SITE SHALL BE PROTECTED WITH INLET CONTROL MEASURES PRIOR TO ROAD CLEANING ACTIVITIES.

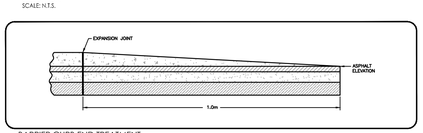
MUD MAT ENTRANCE DETAIL
SCALE N.T.S.



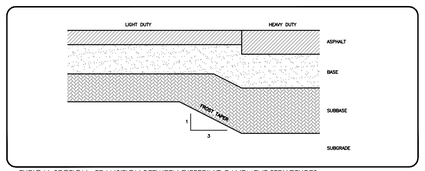
NOTES:

1) TO BE USED UNDER APPROPRIATE DRAINAGE CIRCUMSTANCES, DURING THE CONSTRUCTION PERIOD.
2) SILTSACK SHOULD BE INSPECTED EVERY 2–3 WEEKS AND AFTER EVERY MAJOR STORM.
3) TO BE INSTALLED AND MAINTAINED BY MANUFACTURES RECOMMENDATIONS

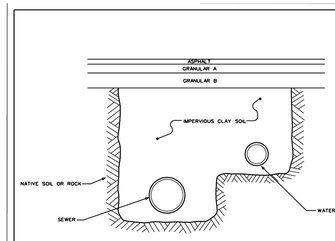
ROADSIDE CATCH BASIN PROTECTION DETAIL: TERRAFIX SILTSACK
SCALE N.T.S.



BARRIER CURB END TREATMENT
SCALE N.T.S.



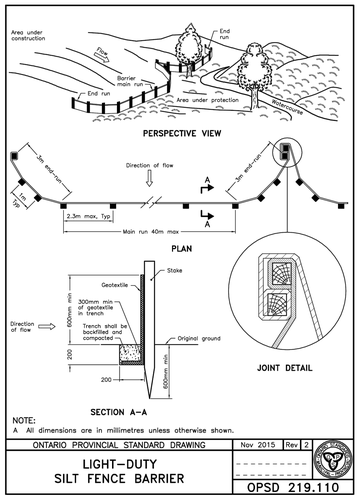
TYPICAL SECTION - TRANSITION BETWEEN DIFFERING PAVEMENT STRUCTURES
SCALE N.T.S.



NOTES:

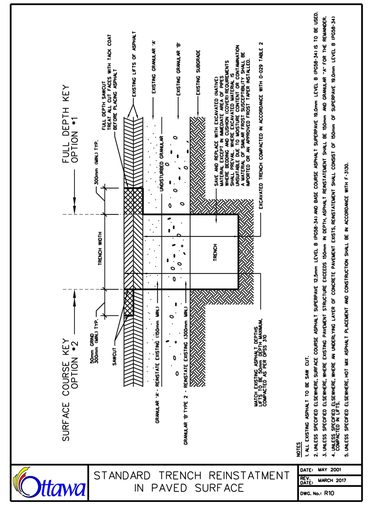
1. CLAY SEAL TO EXTEND FROM BOTTOM OF TRENCH EXCAVATION TO UNDERSIDE OF ROAD STRUCTURE.
2. CLAY SEAL TO EXTEND FULL TRENCH WIDTH TO EXISTING NATIVE SOILS WITH A MINIMUM THICKNESS OF 1.0m ALONG PIPES.
3. CLAY SEAL TO BE LOCATED SO THAT NO PIPE JOINTS ARE WITHIN THE CLAY SEAL MATERIAL.

Ottawa	CLAY SEAL FOR PIPE TRENCHES	DATE: MAY 2001 REV. DATE: MARCH 2006 DWG. No.: S8

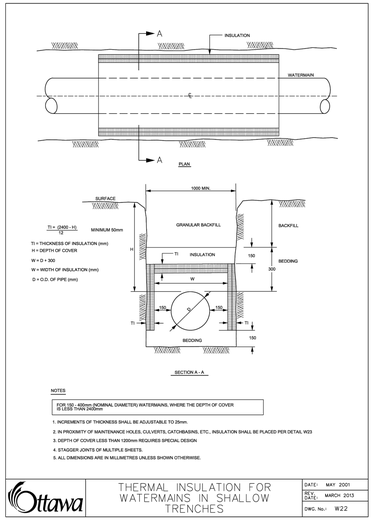


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
LIGHT–DUTY SILT FENCE BARRIER		OPSD 219.110



Ottawa	STANDARD TRENCH REINSTATMENT IN PAVED SURFACE	DATE: MAY 2001 REV. DATE: MARCH 2017 DWG. No.: R10

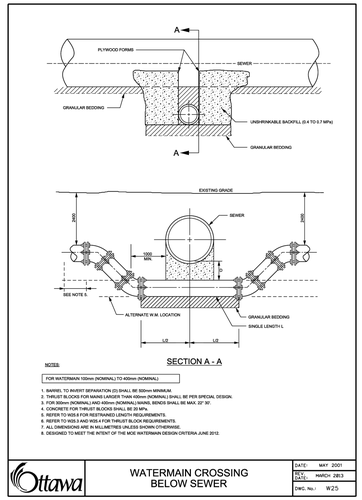


NOTES

FOR 150 – 400mm (NOMINAL DIAMETER) WATERMAINS, WHERE THE DEPTH OF COVER IS LESS THAN 2400mm

1. INCREMENTS OF THICKNESS SHALL BE ADJUSTABLE TO 25mm.
2. IN PROXIMITY OF MAINTENANCE HOLES, CULVERTS, CATCHBASINS, ETC., INSULATION SHALL BE PLACED PER DETAIL W23
3. DEPTH OF COVER LESS THAN 1200mm REQUIRES SPECIAL DESIGN
4. STAGGER JOINTS OF MULTIPLE SHEETS.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

Ottawa	THERMAL INSULATION FOR WATERMAINS IN SHALLOW TRENCHES	DATE: MAY 2001 REV. DATE: MARCH 2013 DWG. No.: W22

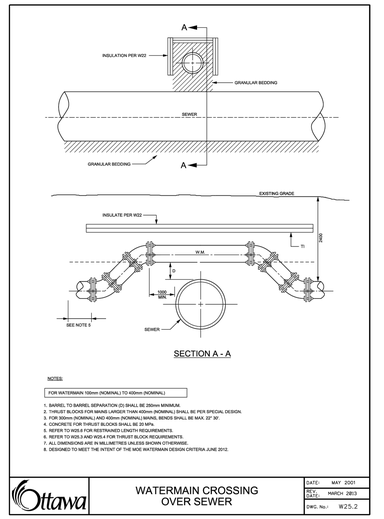


NOTES:

FOR WATERMAIN 100mm (NOMINAL) TO 400mm (NOMINAL)

1. BARREL TO INVERT SEPARATION (D) SHALL BE 500mm MINIMUM.
2. THRUST BLOCKS FOR MAINS LARGER THAN 400mm (NOMINAL) SHALL BE PER SPECIAL DESIGN.
3. FOR 300mm (NOMINAL) AND 400mm (NOMINAL) MAINS, BENDS SHALL BE MAX. 22° 30'.
4. CONCRETE FOR THRUST BLOCKS SHALL BE 20 MPa.
5. REFER TO W26.6 FOR RESTRAINED LENGTH REQUIREMENTS.
6. REFER TO W26.3 AND W26.4 FOR THRUST BLOCK REQUIREMENTS.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
8. DESIGNED TO MEET THE INTENT OF THE MOE WATERMAIN DESIGN CRITERIA JUNE 2012.

Ottawa	WATERMAIN CROSSING BELOW SEWER	DATE: MAY 2001 REV. DATE: MARCH 2013 DWG. No.: W25

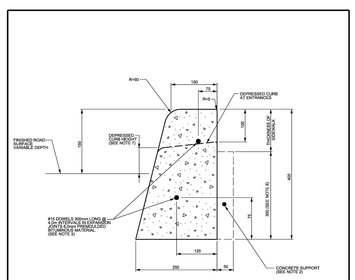


NOTES:

FOR WATERMAIN 100mm (NOMINAL) TO 400mm (NOMINAL)

1. BARREL TO BARREL SEPARATION (D) SHALL BE 250mm MINIMUM.
2. THRUST BLOCKS FOR MAINS LARGER THAN 400mm (NOMINAL) SHALL BE PER SPECIAL DESIGN.
3. FOR 300mm (NOMINAL) AND 400mm (NOMINAL) MAINS, BENDS SHALL BE MAX. 22° 30'.
4. CONCRETE FOR THRUST BLOCKS SHALL BE 20 MPa.
5. REFER TO W26.6 FOR RESTRAINED LENGTH REQUIREMENTS.
6. REFER TO W26.3 AND W26.4 FOR THRUST BLOCK REQUIREMENTS.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
8. DESIGNED TO MEET THE INTENT OF THE MOE WATERMAIN DESIGN CRITERIA JUNE 2012.

Ottawa	WATERMAIN CROSSING OVER SEWER	DATE: MAY 2001 REV. DATE: MARCH 2013 DWG. No.: W25.2



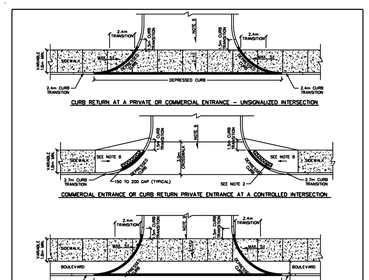
CONCRETE BARRIER CURB

NOTES:

1. THE FULL CURB DEPTH SHALL BE CARRIED THROUGH THE DEPRESSED ACCESS CROSSING.
2. A CONCRETE SUPPORT IS REQUIRED WHEN INLET ADJACENT TO THE SIDEWALK.
3. IF AN EXTRUSION CURBING MACHINE IS USED, THE EXPANSION BITUMINOUS MATERIAL AND THE #15 DOWELS ARE TO BE PLACED AT THE END OF THE EXTRUSION.
4. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
5. DUMMY JOINTS SHALL BE 20mm DEEP, FRONT, BACK AND TOP OF SECTION AT 2m SPACING.
6. FOR DEPRESSED CURB AT ENTRANCES USE 250.
7. DEPRESSED CURB HEIGHT - FOR PEDESTRIAN CURB RAMPS 0 TO 6 mm AND FOR PRIVATE ENTRANCES 0 TO 20mm.

N.T.S.

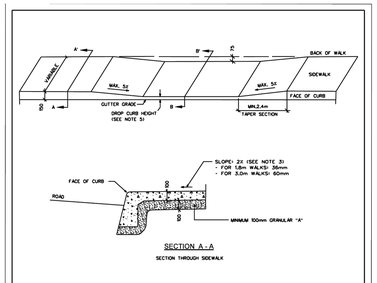
Ottawa	CONCRETE BARRIER CURB FOR GRANULAR BASE PAVEMENT (MODIFIED OPSD-600.110)	DATE: JANUARY 2003 REV. DATE: MARCH 2014 DWG. No.: SC1.1



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. APPROVED 610 C. WIDTH OF CURB RAMP (150MM) TACTILE WALKING SURFACE INDICATOR, 610 C. WIDTH OF CURB RAMP (150MM) TACTILE WALKING SURFACE INDICATOR, 24" DEEP AS PER SC4.
3. CURB DETAILS SEE SC1.1, SC1.2 AND SC1.3.
4. SIDEWALK DETAILS SEE SC2 AND SC3.
5. CURB RAMPS AS PER SC6 AND SC7.
6. CONTROLLED MEANS SIGNALIZED OR A 4–WAY STOP INTERSECTION.
7. SUBJECT TO AVOIDANCE OF MEDIANS, CROSSWALK LINES TO BE CENTRED ON THE CURB RAMP.
8. FOR CURB RAMPS, SLOPE OF 2% TO 5%, MAXIMUM 8%.
9. MAXIMUM SLOPE VARIES, SEE PRIVATE APPROACH BYLAW

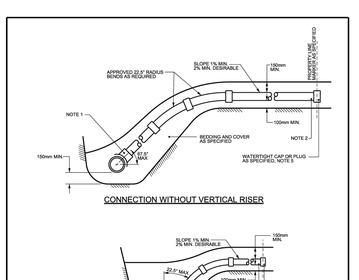
Ottawa	CURB RETURN ENTRANCES	DATE: MARCH 2007 REV. DATE: MARCH 2017 DWG. No.: SC7.1



NOTES:

1. IN ALL DEPRESSED ACCESS CROSSINGS, INCLUDING TAPER SECTION, CONCRETE SLABS SHALL BE 100mm IN DEPTH WITH 150x150MM MW5.5 x MW5.5 REINFORCING MESH ON 150mm GRANULAR 'A'.
2. SIDEWALK CROSSFALL SHALL BE 2% TOWARDS THE ROAD UNLESS SHOWN OTHERWISE.
3. THE MINIMUM SLOPE IS NOT TO EXCEED 2%.
4. THE MAXIMUM SLOPE IS NOT TO EXCEED 4% FOR VEHICLE ACCESS RAMPS.
5. DROP CURB HEIGHT MINIMUM 0mm, DESIRED 15mm, MAXIMUM 25mm.

Ottawa	TRADITIONAL VEHICLE ACCESS CROSSING	DATE: MAY 2001 REV. DATE: MARCH 2007 DWG. No.: SC8



NOTES:

1. ALL DIAMETERS OF SERVICE CONNECTIONS THAT HAVE NOMINAL DIAMETERS NO GREATER THAN 50% OF THE NOMINAL DIAMETER OF THE RIGID SEWER PIPE SHALL BE MADE USING A BELL END INSERT AS PER S11.2 OR AN APPROVED RUBBER GASKETED INSERT, INSTALLED ABOVE THE SPRING LINE.
2. SANITARY SERVICES TO BE 135mm AND STORM SERVICES TO BE 100mm FOR NEW RESIDENCES UNLESS SPECIFIED OTHERWISE. SERVICE PIPE AND RADIUS BENDS TO BE APPROVED CSA B182.1 SERIES PRODUCTS UNLESS SPECIFIED OTHERWISE.
3. APPROVED CONTROLLED SETTLEMENT JOINTS OPTIONAL FOR SERVICE CONNECTIONS TO MAIN SEWERS UP TO 5m DEEP. WHERE APPROVED CONNECTIONS TO BE LAID OVER 5m DEEP REQUIRE APPROVED CONTROLLED SETTLEMENT JOINTS.
4. VERTICAL RISER SHALL BE SAME AS SERVICE PIPE UNLESS OTHERWISE SPECIFIED.
5. CAP OR PLUG AT THE PROPERTY LINE SHALL BE ADEQUATELY BRACED TO WITHSTAND TESTING PRESSURE.
6. FOR NEW CONSTRUCTION, INSERTS MUST BE INSTALLED ON THE MAIN PIPE BEFORE THAT PIPE IS LAID. FOR SERVICES/BRANCHES 375mm DIA. OR LESS, APPROVED "CORED TEES" MAY BE USED.
7. APPROVED CUT-IN TOOL MUST BE USED FOR FIELD MADE CONNECTIONS.
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

N.T.S.

Ottawa	SEWER SERVICE CONNECTIONS FOR RIGID MAIN SEWER PIPE (MODIFIED OPSD-1006.010)	DATE: MARCH 2006 REV. DATE: MARCH 2014 DWG. No.: S11

Stantec

Stantec Consulting Ltd.
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Ottawa ON
Tel. 613.722.4420
www.stantec.com

Legend

PROPOSED SILT FENCE BOUNDARY AS PER OPSD 219.110
PROPOSED CATCH BASIN PROTECTION AS PER DETAIL.
PROPOSED MUD MAT LOCATION

Best Management Practices

CONTRACTOR TO PROVIDE EROSION AND SEDIMENT CONTROLS (BEST MANAGEMENT PRACTICES) DURING CONSTRUCTION OF THIS PROJECT.
EROSION MUST BE MINIMIZED AND SEDIMENTS MUST BE REMOVED FROM CONSTRUCTION SITE RUN-OFF IN ORDER TO PROTECT DOWNSTREAM AREAS. DURING ALL CONSTRUCTION, EROSION AND SEDIMENTATION SHOULD BE CONTROLLED BY THE FOLLOWING TECHNIQUES:

1. LIMIT THE EXTENT OF EXPOSED SOILS AT ANY GIVEN TIME.
2. REVEGETATE EXPOSED AREAS AND SLOPES AS SOON AS POSSIBLE.
3. MINIMIZE AREA TO BE CLEARED AND GRUBBED.
4. PROTECT EXPOSED SLOPES WITH PLASTIC OR SYNTHETIC MULCHES.
5. INSTALL CATCH BASIN INSERTS OR EQUIVALENT IN ALL PROPOSED CATCH BASINS AND CATCH BASIN MANHOLES AND IN ALL EXISTING CATCH BASINS THAT WILL RECEIVE RUN-OFF FROM THE SITE.
6. A SILT FENCE SHALL BE INSTALLED AROUND THE PERIMETER OF ALL AND ANY STOCKPILES OF MATERIAL TO BE USED OR REMOVED FROM SITE. (LOCATION TO BE DETERMINED)
7. A VISUAL INSPECTION SHALL BE DONE DAILY ON SEDIMENT CONTROL MEASURES AND CLEANED OF ANY ACCUMULATED SILT AS REQUIRED. THE DEPOSITS WILL BE DISPOSED OFF SITE AS PER THE REQUIREMENTS OF THE CONTRACT.
8. SEDIMENT CONTROL BARRIERS MAY ONLY BE REMOVED TEMPORARILY WITH APPROVAL OF CONTRACT ADMINISTRATOR TO ACCOMMODATE CONSTRUCTION OPERATIONS. ALL AFFECTED BARRIERS MUST BE REINSTATED AT NIGHT WHEN CONSTRUCTION IS COMPLETED. NO REMOVAL WILL OCCUR IF THERE IS A SIGNIFICANT RAINFALL EVENT ANTICIPATED (+10mm) UNLESS A NEW DEVICE HAS BEEN INSTALLED TO PROTECT EXISTING STORM AND SANITARY SEWER SYSTEMS, OR DOWNSTREAM WATERCOURSES.
9. NO REFUELING OR CLEANING OF EQUIPMENT IS PERMITTED NEAR ANY EXISTING WATERWAY.
10. CONTRACTOR SHALL REMOVE SEDIMENT CONTROL MEASURES WHEN, IN THE OPINION OF THE CONTRACT ADMINISTRATOR, THE MEASURE(S) IS NO LONGER REQUIRED. NO CONTROL MEASURES SHALL BE PERMANENTLEY REMOVED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE CONTRACT ADMINISTRATOR.
11. THE CONTRACTOR SHALL PERIODICALLY, OR WHEN REQUESTED BY THE CONTRACT ADMINISTRATOR, CLEAN OUT ACCUMULATED SEDIMENTS AS REQUIRED.
12. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO THE WATERCOURSE. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.
13. CONTRACTOR SHALL INSTALL MUD MATS AT ENTRANCE TO THE SITE.
14. STORMWATER SWALES TO BE COVERED WITH HYDRO-SEED AND MULCH.

APPROVED ☐ REFUSED ☐

THIS _____ DAY OF _____, 20____

LILY XU, MCIP, RPP, MANAGER
DEVELOPMENT REVIEW SOUTH
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

Revision	By	Appd.	YY.MM.DD
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2 ISSUED FOR REVIEW	WAJ	DCT	19.07.19
1 ISSUED FOR BUILDING PERMIT, BUILDINGS A & B	WAJ	DCT	19.06.27
File Name: 160401483-08	Dwn.	Chkd.	Dsgn. YY.MM.DD
	WAJ	KJK	WAJ 19.04.03

Permit-Seal

Client/Project

NORBERRY PROPERTIES LIMITED
333 Wilson Ave, Suite 200. Toronto, ON

NORBERRY RESIDENCES

OTTAWA, ON

Title

EROSION CONTROL PLAN AND DETAIL SHEET

Project No.	Scale	
160401483	AS SHOWN	
Drawing No.	Sheet	Revision
EC/DS-1	5 of 7	9

D07-12-19-0099

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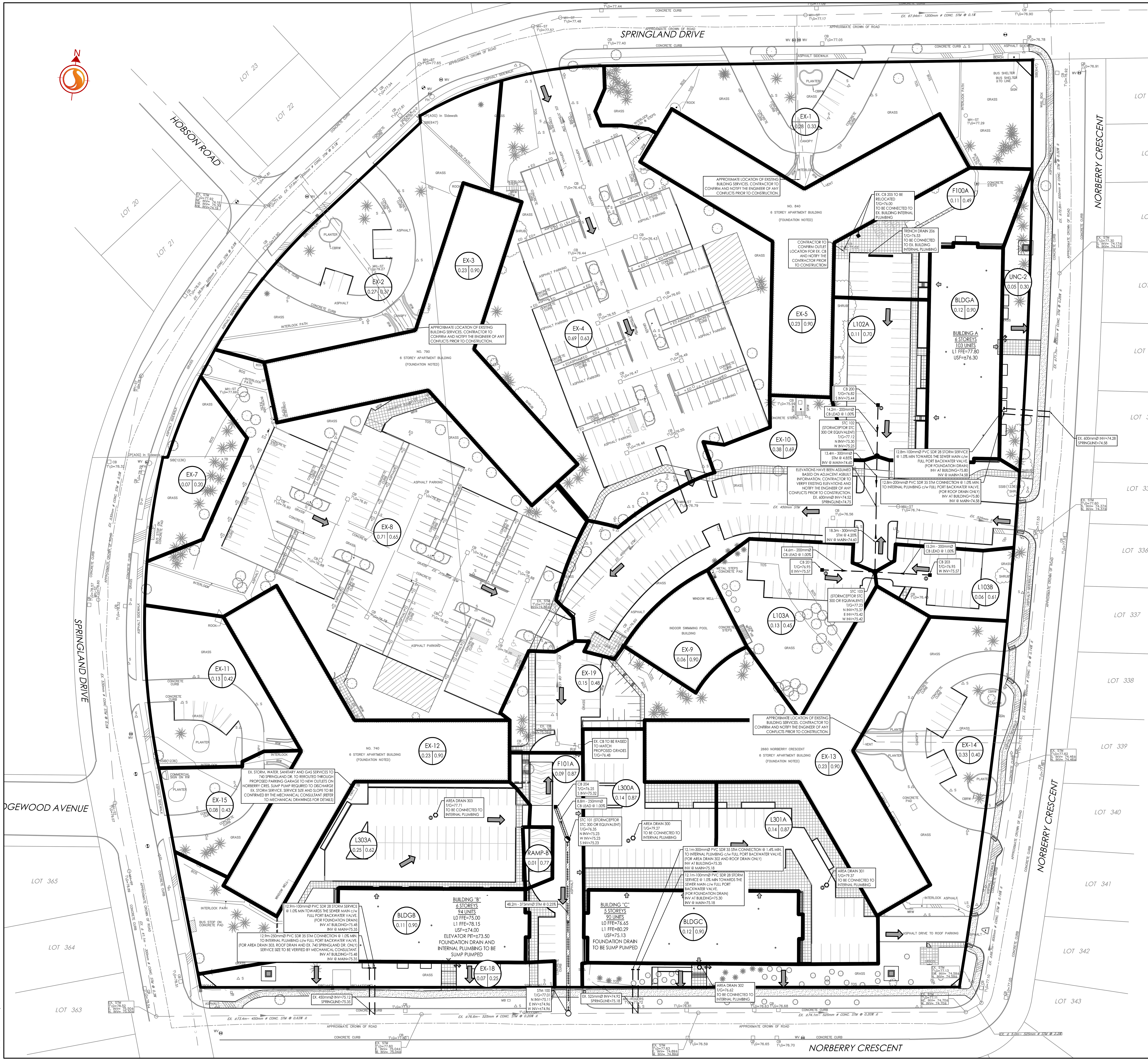

SCHEDULE OF ROOF RELEASE RATES

DRAINAGE AREA ID	DRAIN TYPE	# DRAINS	100 YEAR HEAD (m)	100 YEAR RELEASE RATE (L/s)
BLDGA	WATTS R1100 ACCUTROL (25% OPEN)	8	0.142	7.4
BLDGB	WATTS R1100 ACCUTROL (25% OPEN)	8	0.141	7.3
BLDGC	WATTS R1100 ACCUTROL (25% OPEN)	8	0.142	7.4

SCHEDULE OF INLET CONTROL DEVICES

CATCHBASIN ID	TRIBUTARY AREA ID	100YR HEAD (m)	100YR RELEASE RATE (L/s)	ICD TYPE
CB 200	L102A	1.66	7.4	IPEX TEMPEST LMF 80
CB 201	L103A	1.63	18.7	83mmØ ORIFICE
CB 203	L103B	1.63	10.2	IPEX TEMPEST LMF 95
AREA DRAIN 303	L303A	1.62	18.6	83mmØ ORIFICE
AREA DRAIN 300	L300A	1.56	42.8	127mmØ ORIFICE
AREA DRAIN 301	L301A	1.56	42.8	127mmØ ORIFICE

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Legend

- BLDG / 1.00 / 0.90 — AREA ID; RUNOFF COEFFICIENT; STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- DIRECTION OF OVERLAND FLOW
- PROPOSED STORM SEWER
- PROPOSED STORMCEPTOR
- PROPOSED CATCHBASIN
- PROPOSED AREA DRAIN
- CIRCULAR ORIFICE (SEE DWG SD-1)
- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.
- APPROXIMATE ROOF DRAIN AND SCUPPER LOCATIONS (REFER TO ARCHITECTURAL DRAWINGS FOR DETAILS)

APPROVED ☐ **REFUSED** ☐

THIS _____ DAY OF ____________, 20____

LILY XU, MCIP, RPP, MANAGER
DEVELOPMENT REVIEW SOUTH
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

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Permit-Seal

Client/Project

NORBERRY PROPERTIES LIMITED
333 Wilson Ave, Suite 200. Toronto, ON

NORBERRY RESIDENCES

OTTAWA, ON

Title

STORM DRAINAGE PLAN

Project No. 160401483

Scale 1:500 (0 5 15 25m)

Drawing No. SD-1

Sheet 7 of 7

Revision 9

D07-12-19-0099