Site Servicing and Stormwater Management Brief – Petrie's Landing Block 6, 7 and 8, Ottawa, ON

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Sign-off Sheet

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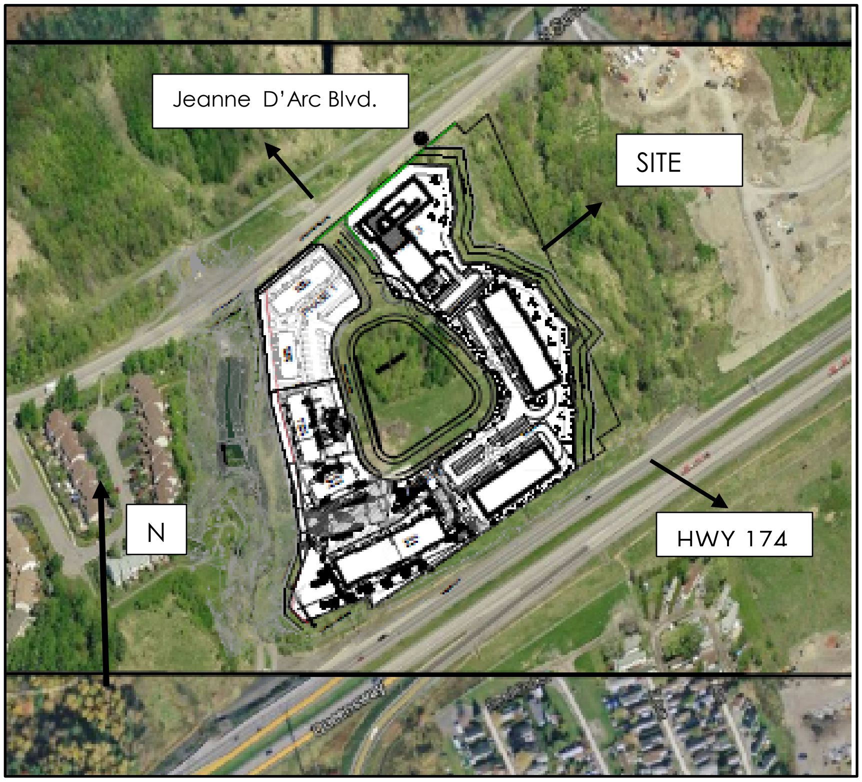
1.0 INTRODUCTION AND OBJECTIVE

The following site servicing and stormwater management (SWM) report has been revised to address City of Ottawa (City) and Rideau Valley Conservation Authority (RVCA) comments on the first engineering submission of June 2017 for site plan control application (City File D07-12-17-0093). Specifically, site servicing has been revised to reflect a new site plan, grading changes to provide 300 mm clearance from maximum ponding grade to the proposed entrance grade at the underground ramps, grading changes along the back of the proposed buildings to minimize uncontrolled areas discharging to Bellevue Creek, and grading changes to direct drainage from the area west of the proposed building in Block 6 towards the proposed site storm sewer system. The drawings have been revised to reflect the above-mentioned changes and revised results of the SWM analysis are summarized in this report.

Stantec Consulting Ltd. has been retained by Brigil Homes to prepare the following site servicing and stormwater management (SWM) brief to satisfy the City of Ottawa Site Plan Control Application process. The 2.14 ha site is located on Prestige Circle, with the Highway 174 to the south, Jeanne D'Arc Boulevard to the north, a residential development to the east, and Brisebois Creek and its associated stormwater management (SWM) facility to the west in the city of Ottawa (see **Figure 1** below).

Block 6 of the proposed development makes up 0.61 ha of the proposed site and consists of a four-storey residential building with associated surface and underground parking, and landscaped areas. Block 7 of the proposed development makes up 0.76 ha of the proposed site and consists of a four-storey residential building with associated surface and underground parking, and landscaped areas. Similarly, Block 8 of the proposed development makes up 0.77 ha of the proposed site and consists of a four-storey residential building with associated surface and underground parking, and landscaped areas. A copy of the proposed site plan prepared by Neuf Architects Inc. can be found in **Appendix B**.

Figure 1: Site Location



1.1 BACKGROUND

Blocks 6 and 7 of the proposed development are within Phase 2 of the Petrie's Landing Development which was previously designed by IBI Group in February 2014 in support of a site plan application for phase 2 and subsequently approved by the City of Ottawa (see report excerpts in **Appendix E**). Phase 1 and Blocks 3, 4 and 5 within Phase 2 of the overall development have been built.

However, the site plan within Blocks 6 and 7 has changed and the proposed site plan for Block 8, previously referenced as Phase 3, has been added to the site plan application.

1.2 OBJECTIVE

This site servicing and SWM brief has been prepared to present a servicing scheme that is free of conflicts and which utilizes the existing infrastructure as obtained from available as-built drawings. Infrastructure requirements for water supply, sanitary and storm sewer services are presented in this report.

Criteria and constraints provided by the background documents have been used as a basis for the servicing design of the proposed development. Specific elements and potential development constraints to be addressed are as follows:

- Prepare a grading plan in accordance with the proposed site plan and existing grades
- Storm Sewer Servicing
  - Define major and minor conveyance systems in conjunction with the grade control plan
  - Determine the stormwater management storage requirements to meet the allowable release rates for the site
  - Size and design inlet control devices (ICDs) to restrict minor system peak flows and meet the target release rates from the site
- Wastewater Servicing
  - Size the sanitary service laterals
- Water Servicing
  - Provide feeds to the proposed buildings from the existing 200 mm diameter watermain along Prestige Circle
  - Watermain servicing for the development is to be able to provide average day and maximum day (including peak hour) demands (i.e. non-emergency conditions) at pressures within the acceptable range of 40 to 80 psi (275 to 552 kPa)
  - Provide Fire Underwriter Survey (FUS) fire demand calculations and ensure fire demands for the proposed buildings are equal or below the values assumed in the hydraulic analysis presented in the background documents

The accompanying drawings included in the back of this report illustrate the internal servicing scheme for the site.

2.0 REFERENCES

The following background studies have been referenced during the servicing design of the proposed site:

- *Design Brief Petrie's Landing II Phase 2, IBI Group., February 7, 2014*
- *Geotechnical Investigation*, Proposed Multi-Storey Buildings Block 6, 7 and 8 – Petrie's Landing II, Ottawa, Ontario, Paterson group, May 24, 2017
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012
- *Technical Bulletin ISDTB-2014-01,* City of Ottawa, February 2014
- *Technical Bulletin PIEDTB -2016-01,* City of Ottawa, September 6, 2016

3.0 WATER DISTRIBUTION

Given that the revised site plan has nearly the same proposed population (two units less in Block 7), same building floor space and water servicing layout, it is expected that the resulting water demands and pressures will be practically the same as outlined in the previous submission which are summarized in the sub-sections below.

3.1 BACKGROUND

The four-storey buildings within Blocks 6, 7 and 8 are proposed to be apartment buildings with underground parking. The proposed buildings in Block 6, 7 and 8 have total floor space of approximately 1,530 m^2 (0.15 ha), 1,980 m^2 (0.20 ha), and 2,484 m^2 (0.25 ha) respectively, and are proposed to connect to the existing 200 mm diameter watermain along Prestige Circle as shown on the Site Plan (see **Drawing SSP-1**).

A detailed hydraulic analysis for the overall Petrie's Landing Development was included in the 2014 Petrie's Landing Design Brief prepared by IBI (see **Appendix E**). However, the FUS calculations for the proposed buildings generated higher fire flow demands than the values assumed in IBI's hydraulic analysis. As a result, the hydraulic analysis for the overall development has been revised using the same boundary conditions as per IBI's model, but with the revised water and fire flow demands for the proposed Blocks 6, 7 and 8 as shown in the following sections. Detailed calculations and the revised hydraulic model results have been included in **Appendix A**.

3.2 WATER DEMANDS

Water demands were calculated using the City of Ottawa Water Distribution Guidelines (July, 2010) to determine the typical operating pressures to be expected at the buildings. A daily rate of 350 L/cap/day has been applied for the population of the proposed site. Population densities have been assumed as 1.4 persons/unit for one bedroom units and 2.1 persons/unit for two bedroom units. The Maximum Day (MXDY) residential demand was determined by multiplying the Average Day (AVDY) demand by a factor of 2.5 and the Peak Hour (PKHR) residential demand was determined by multiplying the MXDY demand by a factor of 2.2. The estimated demands are summarized in **Table 1**.

Table 1: Estimated Water Demands

Building ID	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Block 6	122	0.49	1.23	2.17
Block 7	140	0.57	1.42	3.12
Block 8	141	0.57	1.43	3.15
Total	**403**	**1.63**	**4.08**	**8.98**

The fire flow requirements were calculated in accordance with the Fire Underwriters Survey (FUS) and determined to be approximately 15,000 L/min (250 L/s) for Block 6, 15,000 L/min (250 L/s) for Block 7, and 20,000 L/min (333 L/s) for Block 8. Wood frame 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 and sprinkler systems was applied to the calculations. A two-hour fire separation has been considered at the center of block 7 to reduce the fire flow requirements.

The boundary conditions listed below were provided by the City of Ottawa to IBI Group and used in their 2014 hydraulic analysis for the overall development, which included buildings one to eight. Since the number of apartment units has not drastically increased in the proposed site plan, the previous boundary conditions were considered reasonable and a conservative estimate and were used in the revised hydraulic analysis for the overall site (see model results in **Appendix A**).

Peak Hour = 108.0m

Max Day + Fire Flow = 110.0m

Average Day = 115.0m

3.3 HYDRAULIC MODEL RESULTS

The desired normal operating pressure range as per the City of Ottawa 2010 Water Distribution Design Guidelines is 345 kPa (50 psi) to 552kPa (80 psi) and no *less than 276kPa (40 psi)* at ground elevation. Furthermore, the maximum pressure at any point in the water distribution should not exceed 100 psi as per the Ontario Building/Plumbing Code; pressure reducing measures are required to service areas where pressures *greater than 552kPa (80 psi)* are anticipated.

A hydraulic model of the water supply system was created by Stantec to assess the proposed watermain layout under the above demands and during fire flow scenarios. Results of the hydraulic modeling demonstrate that adequate flows are available for the proposed buildings as shown in **Table 2**.

Table 2: Hydraulic Model Results Summary

Model Node ID	Average Day Analysis Pressure (psi)	Peak Hour Analysis Pressure (psi)
BLDG6	82.02	71.94
BLDG7	83.16	73.08
BLDG8	85.16	75.11

The above table shows that under normal operating conditions, pressures at ground level of the proposed buildings range from **72 psi** to **85 psi**. These values exceed the desired pressure range of 80 psi as defined by MOECC and City of Ottawa design guidelines. As a result, it is recommended that pressure reducing valves be installed. Results of the hydraulic model analysis can be found in **Appendix A**.

A fire flow analysis was carried out using the hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and fire flow requirements per the FUS methodology. Results of the modeling analysis indicate that flows in excess of the required fire flow rate can be delivered while still maintaining a residual pressure of 140 kPa (20 psi). Results of the hydraulic modeling are included for reference in **Appendix A**.

3.4 SUMMARY OF FINDINGS

Based on the results of the hydraulic analysis, it is recommended that pressure reducing valves be installed at each building to ensure normal operating pressures remain within City of Ottawa required limits. The hydraulic model also indicates that fire flow requirements can be achieved at all locations while still maintaining the minimum residual pressure per City requirements.

4.0 SANITARY SEWER

As illustrated on **Drawing SSP-1**, sanitary servicing for the proposed development will be provided through the existing 300 mm diameter sanitary sewer along Prestige Circle.

The proposed 2.14 ha development will consist of three four-storey apartment buildings, surface parking, underground parking, and associated access infrastructure. The anticipated wastewater peak flows generated from the proposed development are summarized in **Table 3** below:

Table 3: Estimated Wastewater Peak Flow

Block	Residential Units				Infiltration Flow (L/s)	Total Peak Flow (L/s)
	# of Units	Population	Peak Factor	Peak Flow (L/s)		
Block 6	79	142	4.0	2.30	0.16	2.46
Block 7	90	162	4.0	2.63	0.23	2.86
Block 8	93	167	4.0	2.71	0.21	2.92
					Overall Site Peak Flow:	**8.24**

1. Average residential flow based on 350 L/p/day
2. Peak factor for residential units calculated using Harmon's formula
3. The exact number of one and two bedroom apartments is not available at this time and as such, an average population of 1.8 persons/unit was used in the calculations
4. Infiltration flow based on 0.28 L/s/ha.

The Prestige Circle sanitary sewer design was based on the applicable City of Ottawa Design Guidelines and a preliminary concept plan for the overall Prestige Circle Development which consisted of 248 apartments and 170 retirements units for a total of 418 units.

The current concept plan for the overall development consists of 418 units, broken-down as follows:

- Existing Phase 1: 40 units
- Existing Phase 2: 116 units
- Proposed Block 6: 79 units
- Proposed Block 7: 90 units
- Proposed Block 8: 93 units

A detailed sanitary sewer design sheet for the proposed development is included in **Appendix C**. 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.

All underground parking drains should be connected to the internal building plumbing.

4.1 SANITARY SEWER DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the Ministry of the Environment and Climate Change's (MOECC) Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- 1.4 persons/residential unit (1 bedroom)
- 2.1 persons/residential unit (2 bedroom)
- 1.8 person/residential unit (when number of bedroom not available)
- Harmon's Formula for Peak Factor – Max = 4.0
- Extraneous Flow Allowance – 0.28 L/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this stormwater management (SWM) plan is to determine the measures necessary to control the quantity of stormwater released from the proposed development to the required levels, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

The stormwater management criteria for the proposed site are based on IBI's 2014 Petrie's Landing II Phase 2 Site Servicing Report and City of Ottawa Sewer Design Guidelines (2012). The following summarizes the criteria used in the preparation of this stormwater management plan:

- Stormwater runoff from the proposed Blocks 6, 7, and 8 up to and including the 100-year event to be stored on site and released into the minor system at a maximum rate of 290.6 L/s
- Maximum 100-year water depth of 0.3 m in parking and access areas
- Provide adequate emergency overflow conveyance (overland flow route) off-site
- 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 development to be provided in the downstream Brisebois Creek SWM Facility prior to discharge into the Ottawa River
- Post-development runoff coefficient (C) value based on proposed impervious areas as per site plan drawing (see **Appendix B**)

5.3 STORMWATER MANAGEMENT DESIGN

The proposed 2.14 ha residential development consists of three (3) four-storey buildings with underground parking, landscaped areas and associated servicing infrastructure. The overall imperviousness of the site is 54% (C = 0.58).

Stormwater runoff from the proposed development will be directed to the existing storm sewers on Prestige Circle which ultimately discharge into the Brisebois Creek SWM Facility. 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 Prestige Circle are shown on **Drawing SSP-1**.

5.3.1 Design Methodology

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

Due to the proposed site plan layout and grading restrictions, a landscaped portion of the site backing into the existing ravine east of the site could not be graded to enter the site's storm system and as such it will sheet drain uncontrolled. Runoff from this uncontrolled area is included in the overall site discharge calculations.

5.3.2 Water Quantity Control

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 D**). A summary of subareas and runoff coefficients is provided in **Appendix D**, and **Drawing SD-1** indicates the stormwater management subcatchments.

5.3.3 Allowable Release Rate

IBI's 2014 Petrie's Landing II Phase 2 Site Servicing Report outlines the quantity control criteria for the overall site. The report outlines that the minor system target criteria for Phase 2 is 361.87 L/s and 99.5 L/s for Phase 3.

The existing portion of Phase 2 discharges 170.77 L/s in the 100-year storm based on the ICD schedule, 100-year minor system capture from a parking ramp area, and runoff from 0.35 ha of uncontrolled area. As a result, the minor system peak flow target from Block 6 and 7 which are within Phase 2 is 191.1 L/s (140 L/s/ha). Similarly, the minor system peak flow target for the proposed Block 8 which corresponds to Phase 3 is 99.5 L/s. Minor system peak flows from the overall proposed development will be restricted to 290.6 L/s.

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 be used to reduce the peak outflow from the site. Additionally, underground storage will be provided in Block 6 and surface storage will be provided on parking areas. **Drawing SD-1** indicates the design release rate from the rooftops. Stormwater management calculations are provided in **Appendix D**.

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 fully open, see **Appendix D** for details.

Watts roof drain data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Watts" roof drain has been used as an example only and that other products may be specified for use, provided that the roof release rate is restricted to match the maximum rate of release indicated in **Table 4** and **Table 5** and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater.

Table 4 and **Table 5** provide details regarding the retention of stormwater on the proposed rooftop during the 5 and 100-year storm events. Refer to **Appendix D** for details.

Table 4: Peak Controlled (Rooftop) 5-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDG Block 6	0.153	0.11	7.05	24.5
BLDG Block 7	0.197	0.11	9.77	30.3
BLDG Block 8	0.236	0.11	12.15	35.4

Table 5: Peak Controlled (Rooftop) 100-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDG Block 6	0.153	0.15	9.28	54.6
BLDG Block 7	0.197	0.15	12.89	67.8
BLDG Block 8	0.236	0.14	16.00	79.9

5.3.4.2 Surface and Underground Storage

In addition to rooftop storage, it is proposed to detain stormwater in a 16m-section of 750mm diameter storm sewer connected to CBMH100B in Block 6, and on the surface parking lot areas through the use of inlet control devices (ICDs) in the catch basins/catchbasin manholes. The proposed 750mm diameter pipe will provide approximately 7 m^3 of underground storage. The modified rational method was used to determine the peak volume requirement for the parking areas. **Table 6** and **Table 7** summarize the proposed ICD characteristics.

Table 6: 5-Year ICD Characteristics

Area ID	Catchbasin ID	Orifice Type	Head (m)	Release Rate (L/s)
F100B	CB100A	LMF70	1.95	6.04
F100C	CB100B	120mm Diameter Orifice	1.95	42.67
F201A	CB200B	90mm Diameter Orifice	1.82	11.63
F200B	CB200A	LMF70	1.96	6.04
F300A	CB300A	LMF70	1.95	6.02
F203B	CB203A	83mm Diameter Orifice	2.99	7.18
F201B	CB200C	LMF70	1.79	5.77
F202B	CB202A	83mm Diameter Orifice	1.36	4.92

1. 5-year runoff from F202B is less than 83mm diameter ICD release rate at 1.38 m head.

Table 7: 100-Year ICD Characteristics

Area ID	Catchbasin ID	Orifice Type	Head (m)	Release Rate (L/s)
F100B	CB100A	LMF70	2.10	6.27
F100C	CBMH100B	120mm Diameter Orifice	2.00	43.22
F201A	CB200B	90mm Diameter Orifice	1.86	23.44
F200B	CB200A	LMF70	2.06	6.19
F300A	CB300A	LMF70	2.10	6.25
F203B	CB203A	83mm Diameter Orifice	3.03	15.39
F201B	CB200C	LMF70	1.92	5.98
F202B	CB202A	83mm Diameter Orifice	1.36	10.55

5.3.5 Uncontrolled Area

A small portion of the site fronting Prestige Circle and backing onto the ravine (see areas UNC-1, UNC-2, and UNC-3 on **Drawing SD-1**) could not be graded to enter the site's storm system and as such it will sheet drain uncontrolled. However, as can be seen on the storm drainage plan prepared by IBI for the entire site in 2014 (see report excerpts in **Appendix E**), the area behind the proposed buildings was not included the SWM calculations and was assumed to drain towards the ravine. **Table 8** and **Table 9** summarize the 5 and 100-year uncontrolled release rates from the proposed development.

Table 8: Peak Uncontrolled (Non-tributary) 5-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.203	0.20	10	11.8
UNC-2	0.039	0.20	10	2.3
UNC-3	0.368	0.20	10	21.3

Table 9: Peak Uncontrolled (Non-tributary) 100-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.203	0.25	10	25.2
UNC-2	0.039	0.25	10	4.8
UNC-3	0.368	0.25	10	45.7

5.3.6 Results

The proposed buildings will have underground parking and as such, it is proposed that the proposed parking ramps be equipped with trench drains to capture the 100-year runoff. In addition, it is recommended that the proposed buildings be equipped with sump pumps and backwater valves. **Table 10** and **Table 11** demonstrate that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflows for the site.

Table 10: Estimated Discharge from Site (5-Year)

<table>
<tr><th>Block</th><th>Area Type</th><th>Area ID</th><th>V_{stored} (m³)</th><th>Q_{release} (L/s)</th><th>Target (L/s)</th></tr>
<tr><td rowspan="3">BLOCK 6</td><td>Controlled – Surface (Includes Roof area)</td><td>F100B, F100C, R100A, F203B</td><td>39.3</td><td>62.9</td><td rowspan="7">290.6</td></tr>
<tr><td>Parking Ramp Area</td><td>F203A</td><td>-</td><td>8.6</td></tr>
<tr><td colspan="2">Total Block 6</td><td>39.3</td><td>71.5</td></tr>
<tr><td rowspan="4">BLOCK 7</td><td>Controlled – Surface (Includes Roof area)</td><td>F201A, F201B, F200B, F202B, R200A</td><td>37.0</td><td>38.1</td></tr>
<tr><td>Parking Ramp Area</td><td>F202A</td><td>-</td><td>12.6</td></tr>
<tr><td>Uncontrolled Areas</td><td>UNC-1, UNC-2</td><td>-</td><td>14.0</td></tr>
<tr><td colspan="2">Total Block 7</td><td>37.0</td><td>64.7</td></tr>
</table>

Block	Area Type	Area ID	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 8	Controlled – Surface (Includes Roof area)	F300A, R300A	54.6	18.2	
	Parking Ramp Area	F300B	-	7.8	
	Uncontrolled Areas	UNC-4	-	21.3	
		Total Block 8	**54.6**	**47.3**	

Table 11: Estimated Discharge from Site (100-Year)

Block	Area Type	Area ID	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 6	Controlled – Surface (Includes Roof area)	F100B, F100C, R100A. F203B	119.1	74.2	**290.6**
	Parking Ramp Area	F203A	-	16.4	
		Total Block 6	**119.1**	**90.6**	
BLOCK 7	Controlled – Surface (Includes Roof area)	F201A, F201B, F200B, F202B, R200A	93.8	59.1	
	Parking Ramp Area	F202A	-	25.3	
	Uncontrolled Areas	UNC-2, UNC-3	-	30.0	
		Total Block 7	**93.8**	**114.4**	
BLOCK 8	Controlled – Surface (Includes Roof area)	F300A, R300A	128.8	22.3	
	Parking Ramp Area	F300B	-	14.9	
	Uncontrolled Areas	UNC-3	-	45.7	
		Total Block 8	**128.8**	**82.9**	

As can be seen in the above tables, the proposed ICDs and storage provided restrict post development peak flows from site areas to 183.5 L/s and 287.9 L/s in the 5-year and 100-year storm events respectively. The 100-year discharge from the site is below the overall site target peak outflow of 290.6 L/s. It is important to note that the ICDs have been sized to keep the minimum release rate at 6 L/s as per City comments.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 2.14 ha in area. The site has significant grade change from the southwestern property limit adjacent to Brisebois Creek to the northeastern limit adjacent to Jeanne D'Arc Boulevard. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, to meet minimum cover requirements for storm and sanitary sewers, and to provide sufficient cover over top of the underground parking garage. Site grading has been established to provide emergency overland flow routes for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes to the existing Prestige Circle ROW and to the existing ravine the east of the proposed development as depicted on **Drawings GP-1** and **SD-1**.

7.0 UTILITIES

The subject site has existing plants within Prestige Circle to provide Hydro, Bell, Gas and Cable servicing for the proposed development as existing residential development to the west was constructed as part of Phase 1. 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.

8.0 APPROVALS

As the site will be under private ownership and discharges to a pre-existing sewer system, Ontario Ministry of Environment and Climate Change(MOECC) Environmental Compliance Approval (ECAs, formerly Certificates of Approval (CofA)) under the Ontario Water Resources Act are not expected to be a requirement for the development to proceed.

A portion of the proposed Block 8 is within 120 m of the Petrie Island Provincially Significant Wetland, and as such, it is within the RVCA's regulatory jurisdiction. As a result, written approval from the RVCA is required under Ontario Regulation 174/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" under Section 28 of the Conservation Authorities Act.

Requirement for an MOECC Permit to Take Water (PTTW) for pumping during construction of the underground parking levels will be confirmed by the geotechnical consultant.

9.0 EROSION 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.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.
9. Installation of a mud matt to prevent mud and debris from being transported off site.
10. Installation of a silt fence to prevent sediment runoff.

The contractor will, at every rainfall, 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 silt traps at catch basins.

Refer to **Drawing EC-DS** for the proposed location of silt fences, and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was completed by Paterson Group Ltd. in May 24, 2017. The report summarizes the existing soil conditions within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson report (Excerpts included in **Appendix E**).

Subsurface soil conditions within the subject area were determined from 6 boreholes distributed across the proposed site. In general soil stratigraphy consisted of topsoil or fill underlain by a silty clay deposit layer.

Groundwater levels were measured on July 16, 2007 and on May 1, 2017 and vary in elevation from 1.6 to 5.5 m below the original ground surface.

A permissible grade raise restriction is recommended within the Paterson Group report due to the encounter of deep silty clay deposits of up to a maximum depth of 30.4 m. A 2.0m grade raise restrictions was accounted for in the grading design of the property.

The required pavement structure for the local roadways is outlined in Error! Reference source not found. and Error! Reference source not found. below:

Table 12: Pavement Structure – Car Only 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 situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

Table 13: Pavement Structure – Access Lanes and Heavy Truck Parking Areas

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

11.0 CONCLUSIONS

11.1 WATER SERVICING

The 200 mm diameter watermain on Prestige Circle provides adequate fire flow capacity as per the Fire Underwriters Survey. The service connections will also be capable of providing anticipated demand but exceeds the maximum objective pressure of 552 kPa (80 psi). Therefore, pressure reducing measures, such as a pressure reducing valve, will be required to service the proposed buildings per the Ontario Plumbing Code. The minimum anticipated pressure of 496 kPa (72 psi) is sufficient to provide the highest floors with an acceptable equivalent pressure provided the internal plumbing is sized to minimize head loss, otherwise a booster pump could be required.

11.2 SANITARY SERVICING

The proposed sanitary sewer lateral is sufficiently sized to provide gravity drainage for the site. The proposed blocks will be serviced by a 200 mm diameter service lateral directing wastewater flows to the existing 300 mm dia. Prestige Circle sanitary sewer. A backflow preventer will be required for the proposed building 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 wastewater section of IBI Group's Design Brief for Petrie's Landing II Phase 2 and with the City of Ottawa Sewer Design guidelines.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through the stormwater management section of IBI Group's Design Brief for Petrie's Landing and with the City of Ottawa Design guidelines. Rooftop, underground 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.

The proposed buildings will have underground parking and as such, it is recommended that the proposed parking ramps be equipped with trench drains to capture the 100-year runoff. In addition, it is recommended that the proposed buildings be equipped with sump pumps and backwater valves.

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 APPROVAL / PERMITS

Ministry of the Environment and Climate Change (MOECC) Environmental Compliance Approvals (ECA) are not expected to be required for the subject site as the site is private and will remain under singular ownership. Written approval from the Rideau Valley Conservation Authority (RVCA) is required under Ontario Regulation 174/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" under Section 28 of the Conservation Authorities Act for the portion of the site within 120 m of a significant wetland. A Permit to Take Water may be required for pumping requirements for construction of underground parking level. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

POTABLE WATER SERVICING ANALYSIS

Appendix A

Block 6-8 Petries Landing - Domestic Water Demand Estimates

Building ID	Units	Population	Daily Rate of Demand [1]	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Block 6	79	122	350	29.6	0.49	74.0	1.23	162.8	2.71
Block 7	92	140	350	34.0	0.57	85.1	1.42	187.2	3.12
Block 8	93	141	350	34.4	0.57	85.9	1.43	189.0	3.15
Total Site :				**98.0**	**1.63**	**245.0**	**4.08**	**539.0**	**8.98**

Water demand criteria used to estimate peak demand rates for residential areas are as follows:

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

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

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 6

Notes:

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method								
Step	**Task**	**Term**	**Options**	**Multiplier Associated with Option**	**Choose:**	**Value Used**	**Unit**	**Total Fire Flow (L/min)**
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	**Enter Ground Floor Area of One Unit**	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,533 / Square Metres (m2)	6,132	Area in Square Meters (m^2)	
4	**Obtain Required Fire Flow without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						**26,000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**22,100**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-6,630**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-2,210**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	45.1m or greater	0	0.1	m	**2,210**
			East Side	30.1 to 45.0m	0.05			
			South Side	45.1m or greater	0			
			West Side	30.1 to 45.0m	0.05			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**15,000**
		Total Required Fire Flow (above) in L/s:						**250**
		Required Duration of Fire Flow (hrs)						**3.25**
		Required Volume of Fire Flow (m^3)						**2,925**

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 7 - 1

Notes:

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,178 Square Metres (m2)	4,712	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						23,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	19,550
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-5,865
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-1,955
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	Fire Wall	0.1	0.15	m	2,933
			East Side	45.1m or greater	0			
			South Side	30.1 to 45.0m	0.05			
			West Side	45.1m or greater	0			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**15,000**
		Total Required Fire Flow (above) in L/s:						**250**
		Required Duration of Fire Flow (hrs)						**3.25**
		Required Volume of Fire Flow (m^3)						**2,925**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 7-2

Notes:

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			806 Square Metres (m2)	3,224	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) ($F = 220 * C * \sqrt{A}$) Round to nearest 1000L/min						**19,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**16,150**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-4,845**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-1,615**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	30.1 to 45.0m	0.05	0.15	m	**2,423**
			East Side	45.1m or greater	0			
			South Side	Fire Wall	0.1			
			West Side	45.1m or greater	0			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**12,000**
		Total Required Fire Flow (above) in L/s:						**200**
		Required Duration of Fire Flow (hrs)						**2.50**
		Required Volume of Fire Flow (m^3)						**1,800**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 8

Notes:

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			2,484 Square Metres (m2)	9,936	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						33,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	28,050
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-8,415
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-2,805
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	45.1m or greater	0	0.1	m	2,805
			East Side	45.1m or greater	0			
			South Side	30.1 to 45.0m	0.05			
			West Side	30.1 to 45.0m	0.05			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**20,000**
		Total Required Fire Flow (above) in L/s:						**333**
		Required Duration of Fire Flow (hrs)						**4.50**
		Required Volume of Fire Flow (m^3)						**5,400**

Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
10	0.00	52.00	115	89.56	617.50
11	0.00	55.06	115	85.21	587.51
12	0.00	55.06	115	85.21	587.51
13	0.00	51.90	115	89.7	618.46
14	0.00	52.10	115	89.42	616.53
BLDG1	0.29	55.71	115	84.28	581.09
BLDG2	0.29	56.60	115	83.02	572.41
BLDG3	0.67	56.70	115	82.87	571.37
BLDG6	0.49	57.30	115	82.02	565.51
BLDG7	0.57	56.50	115	83.16	573.37
BLDG8	0.57	55.09	115	85.16	587.16

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	1000	14	25.84	900	130	2.88	0.00
10	BLDG8	12	28.03	200	110	-1.63	0.05
11	12	11	7.05	200	110	-0.20	0.01
12	12	13	88.97	200	110	-1.42	0.05
13	13	10	7.80	400	120	-1.42	0.01
2	14	10	19.33	400	120	2.88	0.02
3	10	11	84.72	200	110	1.46	0.05
4	BLDG1	11	51.80	200	110	-1.25	0.04
5	BLDG2	BLDG1	32.66	200	110	-0.96	0.03
6	BLDG3	BLDG2	62.45	200	110	-0.67	0.02
7	BLDG3	BLDG6	72.85	200	110	0.00	0.00
8	BLDG6	BLDG7	34.69	200	110	-0.49	0.02
9	BLDG7	BLDG8	55.50	200	110	-1.06	0.03

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
10	0.00	52.00	108.00	79.61	548.90
11	0.00	55.06	107.95	75.19	518.42
12	0.00	55.06	107.95	75.19	518.42
13	0.00	51.90	108.00	79.75	549.86
14	0.00	52.10	108.00	79.47	547.93
BLDG1	1.60	55.71	107.93	74.23	511.80
BLDG2	1.60	56.60	107.92	72.95	502.98
BLDG3	3.69	56.70	107.91	72.80	501.94
BLDG6	2.71	57.30	107.91	71.94	496.01
BLDG7	3.12	56.50	107.91	73.08	503.87
BLDG8	3.15	55.09	107.93	75.11	517.87

Pipe Results

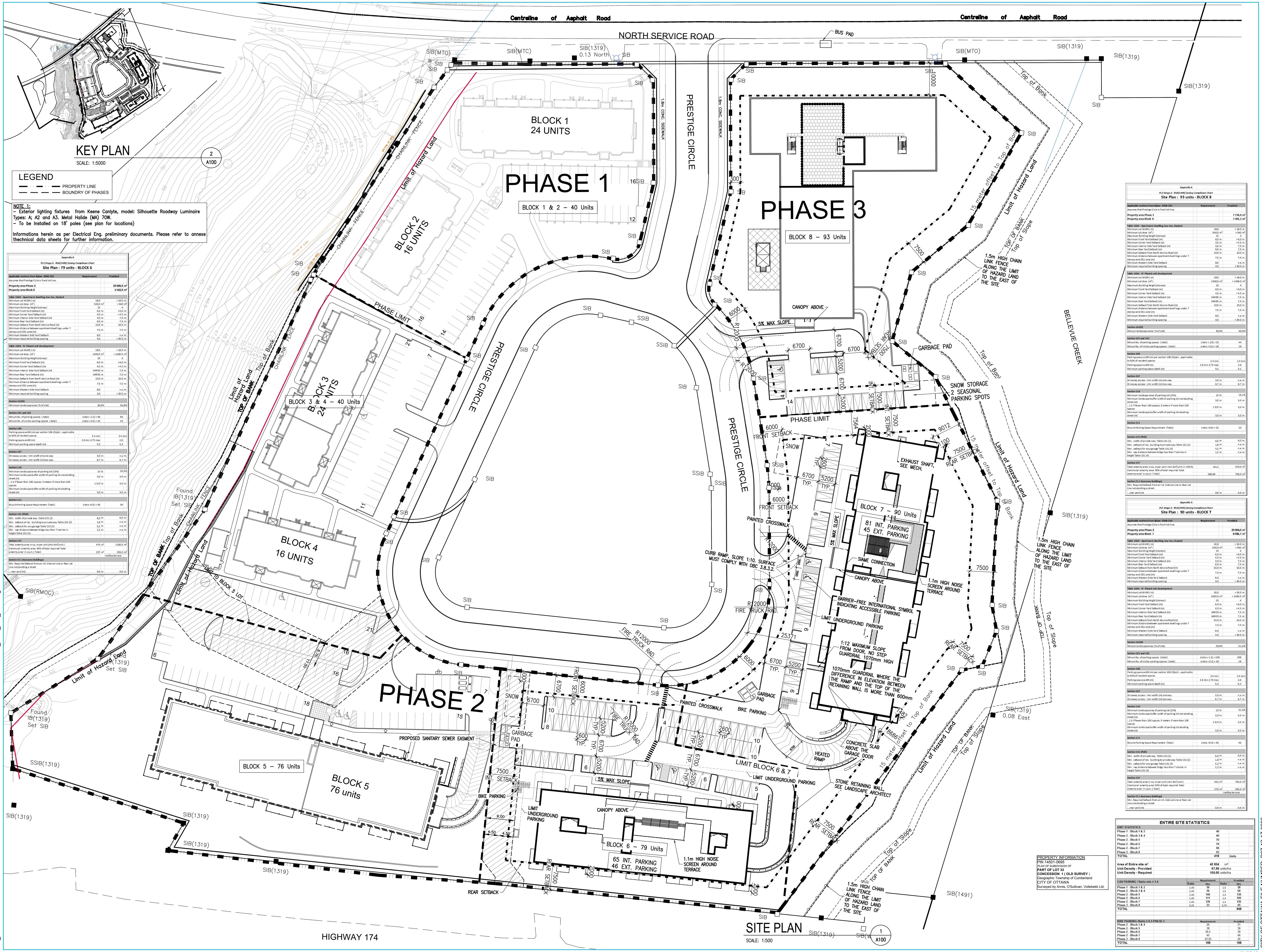
ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1	1000	14	25.84	900	130	15.87	0.02
10	BLDG8	12	28.03	200	110	-8.95	0.29
11	12	11	7.05	200	110	-1.13	0.04
12	12	13	88.97	200	110	-7.83	0.25
13	13	10	7.80	400	120	-7.83	0.06
2	14	10	19.33	400	120	15.87	0.13
3	10	11	84.72	200	110	8.04	0.26
4	BLDG1	11	51.80	200	110	-6.92	0.22
5	BLDG2	BLDG1	32.66	200	110	-5.32	0.17
6	BLDG3	BLDG2	62.45	200	110	-3.72	0.12
7	BLDG3	BLDG6	72.85	200	110	0.03	0.00
8	BLDG6	BLDG7	34.69	200	110	-2.68	0.09
9	BLDG7	BLDG8	55.50	200	110	-5.80	0.18

Hydraulic Model Results -Fire Flow Analysis

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
BLDG1	0.73	77.15	531.93	109.98	335	31.59	217.81	380.02	20	137.90
BLDG2	0.73	75.89	523.25	109.98	289	34.86	240.35	343.11	20	137.90
BLDG3	1.68	75.74	522.21	109.98	182	55.49	382.59	319.67	20	137.90
BLDG6	1.23	74.89	516.35	109.98	250	40.23	277.38	323.11	20	137.90
BLDG7	1.42	76.03	524.21	109.98	250	44.52	306.96	344.5	20	137.90
BLDG8	1.43	78.04	538.07	109.98	333	41.23	284.27	428.91	20	137.90

PROPOSED SITE PLAN

Appendix B



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SCEAU Seal

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CLIENT Client

OUVRAGE Project
PETRIES LANDING
BLOCK 6, 7 & 8

EMPLACEMENT Location: ORLEANS, ON
NO PROJET No.: 10498.03

NO	RÉVISION	DATE (aa.mm.jj)
A	CITY VALIDATION	2016-12-15
B	Site plan revision	2017-03-27
C	Site Plan Application	2017-06-13
D	For client review	2017-09-20
E	Site plan control_1st review	2017-11-15

Préliminaire
NE PAS UTILISER POUR CONSTRUCTION

CITY OF OTTAWA FILE NUMBER: D07-12-17-0093

DESSINÉ PAR Drawn by: A.B.
VÉRIFIÉ PAR Checked by: ANT. C.
DATE (aa.mm.jj): 17.11.15
ÉCHELLE Scale: INDIQUÉE
TITRE DU DESSIN Drawing Title: **Site Plan**
RÉVISION Revision: E
NO. DESSIN Dwg Number: A100

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#15546

SANITARY SEWER CALCULATIONS

Appendix C

SUBDIVISION:

SUBDIVISION: Petries Landing Block 6-8

DATE:	November 30, 2017
REVISION:	2
DESIGNED BY:	MJS
CHECKED BY:	AP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 1604-01331

XML Conversion

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	0.60 L/s/ha	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL	0.40 L/s/ha	MANNINGS n	0.013
PEAKING FACTOR (COMM., INST.):	1.5	INSTITUTIONAL	0.60 L/s/ha	BEDDING CLASS	C
PERSONS / 2 Bedroom apt.	2.1	INFILTRATION	0.28 L/s/ha	MINIMUM COVER	2.50 m
PERSONS / 1 bedroom apt.	1.4				
PERSONS / average apt.	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INDUST		INSTIT		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS 2 bed	UNITS 1 bed	UNITS avg	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (L/s)	TOTAL FLOW (L/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (L/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
R1A , G1A	BLK 6	SAN1	0.150	0	0	79	142	0.15	142	4.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.404	0.40	0.00	0.554	0.55	0.16	2.46	21.1	200	PVC	SDR-28	1.00	33.31	7.38	1.05	0.52
	SAN1	EX.MH2A	0.000	0	0	0	0	0.15	142	4.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.40	0.00	0.000	0.55	0.16	2.46	11.0	200	PVC	SDR-35	0.45	22.34	11.01	0.70	0.39
R2A , G2A	BLK 7	SAN2	0.197	0	0	90	162	0.20	162	4.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.640	0.64	0.00	0.837	0.84	0.23	2.86	3.2	200	PVC	SDR-28	1.00	33.31	8.58	1.05	0.54
	SAN2	EX.MH21A	0.000	0	0	0	0	0.20	162	4.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.64	0.00	0.000	0.84	0.23	2.86	15.7	200	PVC	SDR-35	1.00	33.31	8.58	1.05	0.54
R3A , G3A	BLK 8	SAN3	0.236	0	0	93	167	0.24	167	4.00	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.511	0.51	0.00	0.747	0.75	0.21	2.92	8.5	200	PVC	SDR-28	1.00	33.31	8.77	1.05	0.54
	SAN3	EX.MH6A	0.000	0	0	0	0	0.24	167	4.00	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.51	0.00	0.000	0.75	0.21	2.92	22.9	200	PVC	SDR-35	1.00	33.31	8.77	1.05	0.54

STORMWATER MANAGEMENT CALCULATIONS

Appendix D

Stantec

Brigil - Petrie's Landing II - Block 6, 7, and 8

DATE:	22-Jan-2018
REVISION:	2
DESIGNED BY:	MJS
CHECKED BY:	AMP

FILE NUMBER: 1604-01231

STORM SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

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

	1:5 yr	1:100 yr			
a =	998.071	1735.688	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.053	6.014	MINIMUM COVER:	2.00	m
c =	0.814	0.820	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA																PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (5-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (-)	ACCUM. AREA (5YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	ACCUM. AREA (100YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$Q_{CONTROL}$ ROOF (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETER (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)
BLOCK 6																														
F100B	CB100A	STM 100	0.134	0.000	0.000	0.70	0.134	0.094	0.094	0.000	0.000	0.000	10.00	104.19	178.56	0.0	0.0	27.1	32.3	200	200	CIRCULAR	PVC	-	1.00	33.3	**81.5%**	1.05	1.04	0.52
													10.52																	
F100C	CBMH100B	STM 100	0.165	0.000	0.000	0.76	0.165	0.125	0.125	0.000	0.000	0.000	10.00	104.19	178.56	0.0	0.0	36.3	8.5	250	250	CIRCULAR	PVC	-	1.00	60.4	**60.1%**	1.22	1.10	0.13
													10.13																	
R100A	BLOCK 6	STM 100	0.000	0.000	0.153	0.90	0.000	0.000	0.000	0.000	0.000	0.000	10.00	104.19	178.56	9.3	9.3	9.3	10.9	250	250	CIRCULAR	PVC	-	1.00	60.4	**15.4%**	1.22	0.74	0.25
													10.25																	
	STM 100	STUB	0.000	0.000	0.000	0.00	0.299	0.000	0.219	0.000	0.000	0.000	10.52	101.53	173.95	0.0	9.3	71.1	12.5	375	375	CIRCULAR	PVC	-	0.69	145.6	**48.8%**	1.32	1.12	0.19
													10.70																	
BLOCK 7																														
F203B	CB 203A	STM 203	0.124	0.000	0.000	0.20	0.124	0.025	0.025	0.000	0.000	0.000	10.00	104.19	178.56	0.0	0.0	7.2	14.3	200	200	CIRCULAR	PVC	-	1.00	33.3	**21.5%**	1.05	0.69	0.34
F203A	STM203	STM 201	0.000	0.033	0.000	0.90	0.124	0.000	0.025	0.033	0.030	0.030	10.34	102.41	175.47	0.0	0.0	21.5	45.7	200	200	CIRCULAR	PVC	-	1.00	33.3	**64.6%**	1.05	0.97	0.79
													11.13																	
F202B	CB202A	STM 202	0.085	0.000	0.000	0.20	0.085	0.017	0.017	0.000	0.000	0.000	10.00	104.19	178.56	0.0	0.0	4.9	13.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**14.8%**	1.05	0.62	0.35
F202A	STM 202	STM 201	0.000	0.051	0.000	0.85	0.085	0.000	0.017	0.051	0.043	0.043	10.35	102.36	175.39	0.0	0.0	26.0	28.6	200	200	CIRCULAR	PVC	-	0.80	29.8	**87.1%**	0.94	0.95	0.50
													10.86																	
F201A, F201B	STM 201	STM 200	0.119	0.000	0.000	0.64	0.328	0.076	0.118	0.084	0.000	0.073	11.13	98.57	168.83	0.0	0.0	66.5	50.2	375	375	CIRCULAR	PVC	-	0.25	87.7	**75.9%**	0.79	0.77	1.09
													12.22																	
F200B	CB 200A	STM 200	0.064	0.000	0.000	0.68	0.064	0.044	0.044	0.000	0.000	0.000	10.00	104.19	178.56	0.0	0.0	12.6	16.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**37.8%**	1.05	0.82	0.33
													10.33																	
R200A	BLOCK 7	STM 200	0.000	0.000	0.197	0.90	0.000	0.000	0.000	0.000	0.000	0.000	10.00	104.19	178.56	12.9	12.9	12.9	1.7	250	250	CIRCULAR	PVC	-	1.00	60.4	**21.4%**	1.22	0.80	0.04
													10.04																	
	STM 200	STUB	0.000	0.000	0.000	0.00	0.392	0.000	0.161	0.084	0.000	0.073	12.22	93.76	160.51	0.0	12.9	87.5	9.8	375	375	CIRCULAR	PVC	-	1.00	175.3	**49.9%**	1.59	1.36	0.12
													12.34																	
BLOCK 8																														
F300B	TRENCH DRAIN 8	STM 301	0.000	0.030	0.000	0.90	0.000	0.000	0.000	0.030	0.027	0.027	10.00	104.19	178.56	0.0	0.0	13.4	19.3	200	200	CIRCULAR	PVC	-	1.00	33.3	**40.2%**	1.05	0.83	0.39
	STM 301	STM 300	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.030	0.000	0.027	10.39	102.20	175.11	0.0	0.0	13.1	18.0	250	250	CIRCULAR	PVC	-	0.50	42.7	**30.8%**	0.86	0.64	0.47
													10.86																	
F300A	CB 300A	STM 300	0.139	0.000	0.000	0.80	0.139	0.111	0.111	0.000	0.000	0.000	10.00	104.19	178.56	0.0	0.0	32.2	15.8	200	200	CIRCULAR	PVC	-	1.00	33.3	**96.6%**	1.05	1.09	0.24
													10.24																	
R300A	BLOCK 8	STM 300	0.000	0.000	0.236	0.90	0.000	0.000	0.000	0.000	0.000	0.000	10.00	104.19	178.56	16.0	16.0	16.0	6.8	250	250	CIRCULAR	PVC	-	1.00	60.4	**26.5%**	1.22	0.85	0.13
													10.13																	
	STM 300	STUB	0.000	0.000	0.000	0.00	0.139	0.000	0.111	0.030	0.000	0.027	10.86	99.87	171.09	0.0	16.0	59.7	22.4	375	375	CIRCULAR	PVC	-	1.00	175.3	**34.0%**	1.59	1.21	0.31
													11.17																	

Stormwater Management Calculations

File No: **160401331**
Project: **Petries Landing - Block 6, 7 and 8**
Date: **22-Jan-18**

SWM Approach:
Limit site to 191.1 L/s for Blocks 6 and 7 and 99.5 L/s for Block 8

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Block ID	Runoff Coefficient Table Sub-catchment Area Catchment Type	ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Phase 2 - Block 6	Controlled - Tributary	Parking Block 6 (F100B)	Hard	0.096		0.9	0.086		
			Soft	0.038		0.2	0.008		
		Subtotal			0.134			0.094	0.700
	Controlled - Tributary	Parking Block 6 (F100C)	Hard	0.132		0.9	0.119		
			Soft	0.033		0.2	0.007		
		Subtotal			0.165			0.125	0.760
	100-year Capture - Tributary	Parking Ramp Block 6 (F203A)	Hard	0.033		0.9	0.030		
			Soft	0.000		0.2	0.000		
		Subtotal			0.033			0.030	0.900
	Roof - Tributary	BLDG Block 6 (R100A)	Hard	0.153		0.9	0.138		
			Soft	0.000		0.2	0.000		
		Subtotal			0.153			0.138	0.900
	Controlled - Tributary	Landscaped Area Block 6 (F203B)	Hard	0.000		0.9	0.000		
			Soft	0.124		0.2	0.025		
		Subtotal			0.124			0.025	0.200
		Total Block 6 =		**0.609 ha**		**0.68**			
Phase 2 - Block 7	Controlled - Tributary	Parking Block 7 (F201A)	Hard	0.042		0.9	0.037		
			Soft	0.013		0.2	0.003		
		Subtotal			0.055			0.040	0.730
	Controlled - Tributary	Parking Block 7 (F201B)	Hard	0.033		0.9	0.030		
			Soft	0.031		0.2	0.006		
		Subtotal			0.064			0.036	0.560
	Controlled - Tributary	Parking Block 7 (F200B)	Hard	0.044		0.9	0.039		
			Soft	0.020		0.2	0.004		
		Subtotal			0.064			0.044	0.680
	100-year Capture - Tributary	Parking Ramp Block 7 (F202A)	Hard	0.047		0.9	0.043		
			Soft	0.004		0.2	0.001		
		Subtotal			0.051			0.043	0.850
	Roof - Tribuatry	BLDG Block 7 (R200A)	Hard	0.197		0.9	0.177		
			Soft	0.000		0.2	0.000		
		Subtotal			0.197			0.177	0.900
	Controlled - Tributary	Landscaped Area Block 7 (F202B)	Hard	0.000		0.9	0.000		
			Soft	0.085		0.2	0.017		
		Subtotal			0.085			0.017	0.200
	Uncontrolled - Non Tributary	Uncontrolled Block 7 (UNC-1)	Hard	0.000		0.9	0.000		
		Subtotal	Soft	0.203		0.2	0.041		
					0.203			0.041	0.200
	Uncontrolled - Non Tributary	Uncontrolled Block 7 (UNC-2)	Hard	0.000		0.9	0.000		
		Subtotal	Soft	0.039		0.2	0.008		
					0.039			0.008	0.200
		Total Block 7 =		**0.758 ha**		**0.54**			
Phase 3 - Block 8	Controlled - Tributary	Parking Block 8 (F300A)	Hard	0.119		0.9	0.107		
			Soft	0.020		0.2	0.004		
		Subtotal			0.139			0.111	0.800
	100-year Capture - Tributary	Parking Ramp Block 8 (F300B)	Hard	0.030		0.9	0.027		
			Soft	0.000		0.2	0.000		
		Subtotal			0.030			0.027	0.900
	Roof	BLDG Block 8 (R300A)	Hard	0.236		0.9	0.212		
			Soft	0.000		0.2	0.000		
		Subtotal			0.236			0.212	0.900
	Uncontrolled - Non Tributary	Uncontrolled Block 8 (UNC-3)	Hard	0.000		0.9	0.000		
		Subtotal	Soft	0.368		0.2	0.074		
					0.368			0.074	0.200
		Total Block 8 =		**0.773 ha**		**0.55**			
	Total				**2.140**			**1.241**	
	Overall Runoff Coefficient= C:								**0.58**

Total Roof Areas	**0.586**	**ha**
Total Parking Ramp Areas	**0.114**	**ha**
Total Surface Areas (Controlled)	**0.830**	**ha**
Total Surface Areas (Uncontrolled)	**0.610**	**ha**
Total Site Area .	**2.140**	**ha**
Area to Sewer	**1.530**	**ha**

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
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

Target Release from Blocks 6 and 7

SWM Approach: Limit site to 191.1 L/s for Blocks 6 and 7 and 99.5 L/s for Block 8
Area (ha): 1.367
C: 0.60

Qtarget (L/s)	Qtarget (L/s/ha)
191.10	140

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG Block 6 (R100A) Roof - Tributary
Area (ha): 0.153 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	39.95	6.60	33.35	20.01	104.7	0.00
20	70.25	26.94	6.99	19.95	23.94	110.8	0.00
30	53.93	20.68	7.05	13.63	**24.54**	111.7	0.00
40	44.18	16.94	6.98	9.96	23.90	110.7	0.00
50	37.65	14.44	6.87	7.57	22.71	108.9	0.00
60	32.94	12.63	6.73	5.91	21.26	106.6	0.00
70	29.37	11.26	6.57	4.69	19.69	104.2	0.00
80	26.56	10.19	6.42	3.77	18.09	101.7	0.00
90	24.29	9.31	6.24	3.07	16.57	99.0	0.00
100	22.41	8.59	6.04	2.55	15.31	95.7	0.00
110	20.82	7.98	5.85	2.14	14.10	92.7	0.00
120	19.47	7.46	5.66	1.80	12.97	89.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	111.68	0.11	7.05	24.54	57.30	0.00

Subdrainage Area: Parking Block 6 (F100B) Controlled - Tributary
Area (ha): 0.134
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	27.17	6.04	21.13	12.68
20	70.25	18.32	6.04	12.28	14.74
30	53.93	14.06	6.04	8.02	14.44
40	44.18	11.52	6.04	5.48	13.16
50	37.65	9.82	6.04	3.78	11.34
60	32.94	8.59	6.04	2.55	9.19
70	29.37	7.66	6.04	1.62	6.81
80	26.56	6.93	6.04	0.89	4.26
90	24.29	6.33	6.04	0.30	1.60
100	22.41	5.84	6.04	0.00	0.00
110	20.82	5.43	6.04	0.00	0.00
120	19.47	5.08	6.04	0.00	0.00

Storage: Above CB

Orifice Equation:	LMF70	
Invert Elevation	55.12	m
T/G Elevation	56.92	m
Max Ponding Depth	0.15	m
Downstream W/L	53.59	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	57.07	1.95	6.04	14.74	46.40	OK

Subdrainage Area: Parking Block 6 (F100C) Controlled - Tributary
Area (ha): 0.165
C: 0.76

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	36.32	36.32	0.00	0.00
20	70.25	24.49	24.49	0.00	0.00
30	53.93	18.80	18.80	0.00	0.00
40	44.18	15.40	15.40	0.00	0.00
50	37.65	13.13	13.13	0.00	0.00
60	32.94	11.48	11.48	0.00	0.00
70	29.37	10.24	10.24	0.00	0.00
80	26.56	9.26	9.26	0.00	0.00
90	24.29	8.47	8.47	0.00	0.00
100	22.41	7.81	7.81	0.00	0.00
110	20.82	7.26	7.26	0.00	0.00
120	19.47	6.79	6.79	0.00	0.00

Storage: Above CB

Orifice Equation:	Q = CdA(2gh)^0.5	
Orifice Diameter:	120.00	mm
Invert Elevation	54.73	m
T/G Elevation	56.53	m
Max Ponding Depth	0.15	m
Downstream W/L	53.59	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	56.68	1.95	42.67	0.00	20.97	OK

Project #160401331, Petries Landing - Block 6, 7 and 8
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

Target Release from Block 8

SWM Approach: Limit site to 191.1 L/s for Blocks 6 and 7 and 99.5 L/s for Block 8
Area (ha): 0.773
C: 0.55

Qtarget (L/s)	Qtarget (L/s/ha)
99.50	129

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG Block 6 (R100A) Roof - Tributary
Area (ha): 0.153 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	76.08	8.37	67.70	40.62	132.7	0.00
20	119.95	51.11	9.02	42.09	50.50	143.0	0.00
30	91.87	39.14	9.24	29.90	53.83	146.4	0.00
40	75.15	32.02	9.28	22.73	**54.56**	147.2	0.00
50	63.95	27.25	9.25	18.00	54.00	146.6	0.00
60	55.89	23.81	9.17	14.65	52.74	145.3	0.00
70	49.79	21.21	9.06	12.16	51.06	143.5	0.00
80	44.99	19.17	8.93	10.24	49.14	141.6	0.00
90	41.11	17.52	8.80	8.72	47.08	139.4	0.00
100	37.90	16.15	8.66	7.49	44.95	137.2	0.00
110	35.20	15.00	8.52	6.48	42.79	135.0	0.00
120	32.89	14.02	8.37	5.64	40.62	132.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	147.16	0.15	9.28	54.56	57.30	0.00

Subdrainage Area: Parking Block 6 (F100B) Controlled - Tributary
Area (ha): 0.134
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	58.20	6.27	51.93	31.16
20	119.95	39.10	6.27	32.83	39.40
30	91.87	29.94	6.27	23.68	42.62
40	75.15	24.49	6.27	18.23	43.74
50	63.95	20.85	6.27	14.58	43.74
60	55.89	18.22	6.27	11.95	43.03
70	49.79	16.23	6.27	9.96	41.84
80	44.99	14.67	6.27	8.40	40.31
90	41.11	13.40	6.27	7.13	38.52
100	37.90	12.35	6.27	6.09	36.52
110	35.20	11.47	6.27	5.21	34.37
120	32.89	10.72	6.27	4.45	32.08

Storage: Surface Storage Above CB

Orifice Equation:	LMF70	
Invert Elevation	55.12	m
T/G Elevation	56.92	m
Max Ponding Depth	0.30	m
Downstream W/L	53.59	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	57.22	2.10	6.27	43.74	46.40	OK
					2.66	

Subdrainage Area: Parking Block 6 (F100C) Controlled - Tributary
Area (ha): 0.165
C: 0.95

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	77.81	43.22	34.59	20.76
20	119.95	52.27	43.22	9.05	10.86
30	91.87	40.03	40.03	0.00	0.00
40	75.15	32.75	32.75	0.00	0.00
50	63.95	27.87	27.87	0.00	0.00
60	55.89	24.36	24.36	0.00	0.00
70	49.79	21.70	21.70	0.00	0.00
80	44.99	19.61	19.61	0.00	0.00
90	41.11	17.91	17.91	0.00	0.00
100	37.90	16.52	16.52	0.00	0.00
110	35.20	15.34	15.34	0.00	0.00
120	32.89	14.33	14.33	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation:	Q = CdA(2gh)^0.5	
Orifice Diameter:	120.00	mm
Invert Elevation	54.73	m
T/G Elevation	56.53	m
Max Ponding Depth	0.20	m
Downstream W/L	53.59	m

Where C = 0.61

Pipe Storage		
Length	Size	Volume
16.0	750	7.07

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.73	2.00	43.22	20.76	20.97	OK
					0.21	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Ramp Block 6 (F203A) — 100-year Capture - Tributary
Area (ha): 0.033
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	104.19	8.60	8.60	0.00	0.00	0.00
20	70.25	5.80	5.80	0.00	0.00	0.00
30	53.93	4.45	4.45	0.00	0.00	0.00
40	44.18	3.65	3.65	0.00	0.00	0.00
50	37.65	3.11	3.11	0.00	0.00	0.00
60	32.94	2.72	2.72	0.00	0.00	0.00
70	29.37	2.43	2.43	0.00	0.00	0.00
80	26.56	2.19	2.19	0.00	0.00	0.00
90	24.29	2.01	2.01	0.00	0.00	0.00
100	22.41	1.85	1.85	0.00	0.00	0.00
110	20.82	1.72	1.72	0.00	0.00	0.00
120	19.47	1.61	1.61	0.00	0.00	0.00

Subdrainage Area: Landscaped Area Block 6 (F203B) — Controlled - Tributary
Area (ha): 0.124
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	7.18	7.18	0.00	0.00	
20	70.25	4.84	4.84	0.00	0.00	
30	53.93	3.72	3.72	0.00	0.00	
40	44.18	3.05	3.05	0.00	0.00	
50	37.65	2.60	2.60	0.00	0.00	
60	32.94	2.27	2.27	0.00	0.00	
70	29.37	2.03	2.03	0.00	0.00	
80	26.56	1.83	1.83	0.00	0.00	
90	24.29	1.67	1.67	0.00	0.00	
100	22.41	1.54	1.54	0.00	0.00	
110	20.82	1.44	1.44	0.00	0.00	
120	19.47	1.34	1.34	0.00	0.00	

Storage: : Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 53.65 m
T/G Elevation 56.64 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	56.64	2.99	7.18	0.00	0.30	OK

Block 6 Peak Flow Summary

Total Area = **0.609** **ha** — **Volume =** **39.28** **m^3**
Q target = 85.2 L/s
Q unc = 0.0 L/s
Qramp = 8.6 L/s
Qroof = 7.0 L/s
Qpark = 55.9 L/s

Qtotal = **72** **L/s**

Subdrainage Area: BLDG Block 7 (R200A) — Roof - Tribuatry
Area (ha): 0.197 — 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	51.36	9.23	42.13	25.28	104.5	0.00
20	70.25	34.63	9.73	24.90	29.88	110.1	0.00
30	53.93	26.58	9.77	16.81	**30.27**	110.6	0.00
40	44.18	21.78	9.64	12.13	29.12	109.2	0.00
50	37.65	18.56	9.45	9.11	27.33	107.0	0.00
60	32.94	16.24	9.23	7.01	25.24	104.5	0.00
70	29.37	14.48	8.99	5.49	23.04	101.8	0.00
80	26.56	13.09	8.73	4.37	20.96	98.8	0.00
90	24.29	11.97	8.41	3.56	19.21	95.3	0.00
100	22.41	11.04	8.12	2.92	17.55	91.9	0.00
110	20.82	10.26	7.84	2.42	15.98	88.8	0.00
120	19.47	9.60	7.58	2.01	14.50	85.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	110.57	0.11	9.77	30.27	72.80	0.00

Subdrainage Area: Parking Ramp Block 7 (F202A) — 100-year Capture - Tributary
Area (ha): 0.051
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	104.19	12.56	12.56	0.00	0.00	0.00
20	70.25	8.47	8.47	0.00	0.00	0.00
30	53.93	6.50	6.50	0.00	0.00	0.00
40	44.18	5.32	5.32	0.00	0.00	0.00
50	37.65	4.54	4.54	0.00	0.00	0.00
60	32.94	3.97	3.97	0.00	0.00	0.00
70	29.37	3.54	3.54	0.00	0.00	0.00
80	26.56	3.20	3.20	0.00	0.00	0.00
90	24.29	2.93	2.93	0.00	0.00	0.00
100	22.41	2.70	2.70	0.00	0.00	0.00
110	20.82	2.51	2.51	0.00	0.00	0.00
120	19.47	2.35	2.35	0.00	0.00	0.00

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Ramp Block 6 (F203A) — 100-year Capture - Tributary
Area (ha): 0.033
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	16.38	16.38	0.00	0.00	0.00
20	119.95	11.00	11.00	0.00	0.00	0.00
30	91.87	8.43	8.43	0.00	0.00	0.00
40	75.15	6.89	6.89	0.00	0.00	0.00
50	63.95	5.87	5.87	0.00	0.00	0.00
60	55.89	5.13	5.13	0.00	0.00	0.00
70	49.79	4.57	4.57	0.00	0.00	0.00
80	44.99	4.13	4.13	0.00	0.00	0.00
90	41.11	3.77	3.77	0.00	0.00	0.00
100	37.90	3.48	3.48	0.00	0.00	0.00
110	35.20	3.23	3.23	0.00	0.00	0.00
120	32.89	3.02	3.02	0.00	0.00	0.00

Subdrainage Area: Landscaped Area Block 6 (F203B) — Controlled - Tributary
Area (ha): 0.124
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	15.39	15.39	0.00	0.00	
20	119.95	10.34	10.34	0.00	0.00	
30	91.87	7.92	7.92	0.00	0.00	
40	75.15	6.48	6.48	0.00	0.00	
50	63.95	5.51	5.51	0.00	0.00	
60	55.89	4.82	4.82	0.00	0.00	
70	49.79	4.29	4.29	0.00	0.00	
80	44.99	3.88	3.88	0.00	0.00	
90	41.11	3.54	3.54	0.00	0.00	
100	37.90	3.27	3.27	0.00	0.00	
110	35.20	3.03	3.03	0.00	0.00	
120	32.89	2.83	2.83	0.00	0.00	

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 53.65 m
T/G Elevation 56.64 m
Max Ponding Depth 0.04 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.68	3.03	15.39	0.00	0.30	OK
					0.30	

Block 6 Peak Flow Summary

Total Area = **0.609** **ha** — **Volume =** **119.06** **m^3**
Q target = 85.2 L/s
Q unc = 0.0 L/s
Qramp = 16.4 L/s
Qroof = 9.3 L/s
Qparking = 64.9 L/s

Qtotal = **91** **L/s** **5.38 L/s**

Subdrainage Area: BLDG Block 7 (R200A) — Roof - Tribuatry
Area (ha): 0.197 — 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	97.79	11.73	86.06	51.64	132.8	0.00
20	119.95	65.69	12.59	53.10	63.72	142.6	0.00
30	91.87	50.31	12.86	37.45	67.41	145.6	0.00
40	75.15	41.15	12.89	28.26	**67.83**	145.9	0.00
50	63.95	35.03	12.81	22.22	66.66	145.0	0.00
60	55.89	30.61	12.66	17.95	64.62	143.3	0.00
70	49.79	27.27	12.48	14.79	62.11	141.3	0.00
80	44.99	24.64	12.28	12.36	59.33	139.0	0.00
90	41.11	22.51	12.07	10.45	56.41	136.6	0.00
100	37.90	20.76	11.85	8.90	53.42	134.2	0.00
110	35.20	19.28	11.64	7.64	50.43	131.8	0.00
120	32.89	18.02	11.42	6.59	47.46	129.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	145.95	0.15	12.89	67.83	72.80	0.00

Subdrainage Area: Parking Ramp Block 7 (F202A) — 100-year Capture - Tributary
Area (ha): 0.051
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	25.32	25.32	0.00	0.00	0.00
20	119.95	17.01	17.01	0.00	0.00	0.00
30	91.87	13.03	13.03	0.00	0.00	0.00
40	75.15	10.65	10.65	0.00	0.00	0.00
50	63.95	9.07	9.07	0.00	0.00	0.00
60	55.89	7.92	7.92	0.00	0.00	0.00
70	49.79	7.06	7.06	0.00	0.00	0.00
80	44.99	6.38	6.38	0.00	0.00	0.00
90	41.11	5.83	5.83	0.00	0.00	0.00
100	37.90	5.37	5.37	0.00	0.00	0.00
110	35.20	4.99	4.99	0.00	0.00	0.00
120	32.89	4.66	4.66	0.00	0.00	0.00

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Uncontrolled Block 7 (UNC-1) Uncontrolled - Non Tributary
Area (ha): 0.203
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	104.19	11.76	11.76	0.00	0.00	0.00
20	70.25	7.93	7.93	0.00	0.00	0.00
30	53.93	6.09	6.09	0.00	0.00	0.00
40	44.18	4.99	4.99	0.00	0.00	0.00
50	37.65	4.25	4.25	0.00	0.00	0.00
60	32.94	3.72	3.72	0.00	0.00	0.00
70	29.37	3.32	3.32	0.00	0.00	0.00
80	26.56	3.00	3.00	0.00	0.00	0.00
90	24.29	2.74	2.74	0.00	0.00	0.00
100	22.41	2.53	2.53	0.00	0.00	0.00
110	20.82	2.35	2.35	0.00	0.00	0.00
120	19.47	2.20	2.20	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 7 (UNC-2) Uncontrolled - Non Tributary
Area (ha): 0.039
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	104.19	2.26	2.26	0.00	0.00	0.00
20	70.25	1.52	1.52	0.00	0.00	0.00
30	53.93	1.17	1.17	0.00	0.00	0.00
40	44.18	0.96	0.96	0.00	0.00	0.00
50	37.65	0.82	0.82	0.00	0.00	0.00
60	32.94	0.71	0.71	0.00	0.00	0.00
70	29.37	0.64	0.64	0.00	0.00	0.00
80	26.56	0.58	0.58	0.00	0.00	0.00
90	24.29	0.53	0.53	0.00	0.00	0.00
100	22.41	0.49	0.49	0.00	0.00	0.00
110	20.82	0.45	0.45	0.00	0.00	0.00
120	19.47	0.42	0.42	0.00	0.00	0.00

Subdrainage Area: Parking Block 7 (F201A) Controlled - Tributary
Area (ha): 0.055
C: 0.73

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	11.63	11.63	0.00	0.00
20	70.25	7.84	11.63	0.00	0.00
30	53.93	6.02	11.63	0.00	0.00
40	44.18	4.93	11.63	0.00	0.00
50	37.65	4.20	11.63	0.00	0.00
60	32.94	3.68	11.63	0.00	0.00
70	29.37	3.28	11.63	0.00	0.00
80	26.56	2.96	11.63	0.00	0.00
90	24.29	2.71	11.63	0.00	0.00
100	22.41	2.50	11.63	0.00	0.00
110	20.82	2.32	11.63	0.00	0.00
120	19.47	2.17	11.63	0.00	0.00

Storage: : Above CB

Orifice Equation: Q = CdA(2gh)^0.5
Orifice Diameter: 90.00 mm
Invert Elevation 54.55 m
T/G Elevation 56.32 m
Max Ponding Depth 0.05 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	56.37	1.82	11.63	0.00	1.10	OK

Subdrainage Area: Parking Block 7 (F201B) Controlled - Tributary
Area (ha): 0.064
C: 0.56

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	10.38	5.77	4.61	2.77
20	70.25	7.00	5.77	1.23	1.48
30	53.93	5.37	5.77	0.00	0.00
40	44.18	4.40	5.77	0.00	0.00
50	37.65	3.75	5.77	0.00	0.00
60	32.94	3.28	5.77	0.00	0.00
70	29.37	2.93	5.77	0.00	0.00
80	26.56	2.65	5.77	0.00	0.00
90	24.29	2.42	5.77	0.00	0.00
100	22.41	2.23	5.77	0.00	0.00
110	20.82	2.07	5.77	0.00	0.00
120	19.47	1.94	5.77	0.00	0.00

Storage: : Above CB

Orifice Equation: LMF70

Invert Elevation 54.67 m
T/G Elevation 56.34 m
Max Ponding Depth 0.12 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	56.46	1.79	5.77	2.77	14.50	OK

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Uncontrolled Block 7 (UNC-1) Uncontrolled - Non Tributary
Area (ha): 0.203
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	25.19	25.19	0.00	0.00	0.00
20	119.95	16.92	16.92	0.00	0.00	0.00
30	91.87	12.96	12.96	0.00	0.00	0.00
40	75.15	10.60	10.60	0.00	0.00	0.00
50	63.95	9.02	9.02	0.00	0.00	0.00
60	55.89	7.89	7.89	0.00	0.00	0.00
70	49.79	7.02	7.02	0.00	0.00	0.00
80	44.99	6.35	6.35	0.00	0.00	0.00
90	41.11	5.80	5.80	0.00	0.00	0.00
100	37.90	5.35	5.35	0.00	0.00	0.00
110	35.20	4.97	4.97	0.00	0.00	0.00
120	32.89	4.64	4.64	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 7 (UNC-2) Uncontrolled - Non Tributary
Area (ha): 0.039
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	4.84	4.84	0.00	0.00	0.00
20	119.95	3.25	3.25	0.00	0.00	0.00
30	91.87	2.49	2.49	0.00	0.00	0.00
40	75.15	2.04	2.04	0.00	0.00	0.00
50	63.95	1.73	1.73	0.00	0.00	0.00
60	55.89	1.52	1.52	0.00	0.00	0.00
70	49.79	1.35	1.35	0.00	0.00	0.00
80	44.99	1.22	1.22	0.00	0.00	0.00
90	41.11	1.11	1.11	0.00	0.00	0.00
100	37.90	1.03	1.03	0.00	0.00	0.00
110	35.20	0.95	0.95	0.00	0.00	0.00
120	32.89	0.89	0.89	0.00	0.00	0.00

Subdrainage Area: Parking Block 7 (F201A) Controlled - Tributary
Area (ha): 0.055
C: 0.91

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	24.91	23.44	1.47	0.88
20	119.95	16.74	23.44	0.00	0.00
30	91.87	12.82	23.44	0.00	0.00
40	75.15	10.48	23.44	0.00	0.00
50	63.95	8.92	23.44	0.00	0.00
60	55.89	7.80	23.44	0.00	0.00
70	49.79	6.95	23.44	0.00	0.00
80	44.99	6.28	23.44	0.00	0.00
90	41.11	5.74	23.44	0.00	0.00
100	37.90	5.29	23.44	0.00	0.00
110	35.20	4.91	23.44	0.00	0.00
120	32.89	4.59	23.44	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 90.00 mm
Invert Elevation 54.55 m
T/G Elevation 56.32 m
Max Ponding Depth 0.09 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.41	1.86	23.44	0.88	1.10	OK
					0.22	

Subdrainage Area: Parking Block 7 (F201B) Controlled - Tributary
Area (ha): 0.064
C: 0.70

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	22.24	5.98	16.26	9.76
20	119.95	14.94	5.98	8.96	10.76
30	91.87	11.44	5.98	5.47	9.84
40	75.15	9.36	5.98	3.38	8.12
50	63.95	7.97	5.98	1.99	5.97
60	55.89	6.96	5.98	0.99	3.55
70	49.79	6.20	5.98	0.22	0.94
80	44.99	5.60	5.98	0.00	0.00
90	41.11	5.12	5.98	0.00	0.00
100	37.90	4.72	5.98	0.00	0.00
110	35.20	4.38	5.98	0.00	0.00
120	32.89	4.10	5.98	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: LMF70

Invert Elevation 54.67 m
T/G Elevation 56.34 m
Max Ponding Depth 0.25 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.59	1.92	5.98	10.76	14.50	OK
					3.74	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Block 7 (F200B) — Controlled - Tributary
Area (ha): 0.064
C: 0.68

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	12.61	6.04	6.57	3.94
20	70.25	8.50	6.04	2.46	2.95
30	53.93	6.52	6.04	0.49	0.87
40	44.18	5.35	5.35	0.00	0.00
50	37.65	4.56	4.56	0.00	0.00
60	32.94	3.99	3.99	0.00	0.00
70	29.37	3.55	3.55	0.00	0.00
80	26.56	3.21	3.21	0.00	0.00
90	24.29	2.94	2.94	0.00	0.00
100	22.41	2.71	2.71	0.00	0.00
110	20.82	2.52	2.52	0.00	0.00
120	19.47	2.36	2.36	0.00	0.00

Storage: : Above CB

Orifice Equation: LMF70
Invert Elevation 54.41 m
T/G Elevation 56.22 m
Max Ponding Depth 0.15 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	56.37	1.96	6.04	3.94	24.50	OK

Subdrainage Area: Landscaped Area Block 7 (F202B) — Controlled - Tributary
Area (ha): 0.085
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	4.92	4.92	0.00	0.00
20	70.25	3.32	3.32	0.00	0.00
30	53.93	2.55	2.55	0.00	0.00
40	44.18	2.09	2.09	0.00	0.00
50	37.65	1.78	1.78	0.00	0.00
60	32.94	1.56	1.56	0.00	0.00
70	29.37	1.39	1.39	0.00	0.00
80	26.56	1.26	1.26	0.00	0.00
90	24.29	1.15	1.15	0.00	0.00
100	22.41	1.06	1.06	0.00	0.00
110	20.82	0.98	0.98	0.00	0.00
120	19.47	0.92	0.92	0.00	0.00

Storage: : Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 53.47 m
T/G Elevation 54.83 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	54.83	1.36	4.92	0.00	0.00	

Block 7 Peak Flow Summary

Total Area = **0.758** **ha** — **Volume =** **36.97** **m^3**
Q target = 105.9 L/s
Q unc = 14.0 L/s
Qramp = 12.6 L/s
Qroof = 9.8 L/s
Qparking = 28.4 L/s

Qtotal = **65** **L/s**

Subdrainage Area: Parking Block 8 (F300A) — Controlled - Tributary
Area (ha): 0.139
C: 0.80

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	32.21	6.02	26.19	15.71
20	70.25	21.72	6.02	15.69	18.83
30	53.93	16.67	6.02	10.65	19.17
40	44.18	13.66	6.02	7.64	18.33
50	37.65	11.64	6.02	5.62	16.85
60	32.94	10.18	6.02	4.16	14.98
70	29.37	9.08	6.02	3.06	12.84
80	26.56	8.21	6.02	2.19	10.50
90	24.29	7.51	6.02	1.49	8.02
100	22.41	6.93	6.02	0.90	5.42
110	20.82	6.44	6.02	0.41	2.73
120	19.47	6.02	6.02	0.00	0.00

Storage: : Above CB

Orifice Equation: LMF70
Invert Elevation 52.97 m
T/G Elevation 54.77 m
Max Ponding Depth 0.15 m
Downstream W/L 51.46 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	54.92	1.95	6.02	19.17	71.90	OK

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

L

Subdrainage Area: Parking Block 7 (F200B) — Controlled - Tributary
Area (ha): 0.064
C: 0.85

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	27.00	6.19	20.81	12.49
20	119.95	18.14	6.19	11.95	14.34
30	91.87	13.89	6.19	7.70	13.86
40	75.15	11.36	6.19	5.17	12.41
50	63.95	9.67	6.19	3.48	10.44
60	55.89	8.45	6.19	2.26	8.14
70	49.79	7.53	6.19	1.34	5.62
80	44.99	6.80	6.19	0.61	2.94
90	41.11	6.22	6.19	0.02	0.13
100	37.90	5.73	5.73	0.00	0.00
110	35.20	5.32	5.32	0.00	0.00
120	32.89	4.97	4.97	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: LMF70
Invert Elevation 54.41 m
T/G Elevation 56.22 m
Max Ponding Depth 0.25 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.47	2.06	6.19	14.34	24.50	OK

Subdrainage Area: Landscaped Area Block 7 (F202B) — Controlled - Tributary
Area (ha): 0.085
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	10.55	10.55	0.00	0.00
20	119.95	7.09	7.09	0.00	0.00
30	91.87	5.43	5.43	0.00	0.00
40	75.15	4.44	4.44	0.00	0.00
50	63.95	3.78	3.78	0.00	0.00
60	55.89	3.30	3.30	0.00	0.00
70	49.79	2.94	2.94	0.00	0.00
80	44.99	2.66	2.66	0.00	0.00
90	41.11	2.43	2.43	0.00	0.00
100	37.90	2.24	2.24	0.00	0.00
110	35.20	2.08	2.08	0.00	0.00
120	32.89	1.94	1.94	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 53.47 m
T/G Elevation 54.83 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	54.83	1.36	10.55	0.00	0.00	

Block 7 Peak Flow Summary

Total Area = **0.758** **ha** — **Volume =** **93.81** **m^3**
Q target = 105.9 L/s
Q unc = 30.0 L/s
Qramp = 25.3 L/s
Qroof = 12.9 L/s
Qparking = 46.2 L/s

Qtotal = **114** **L/s** — **8.45 L/s**

13.84 L/s

Subdrainage Area: Parking Block 8 (F300A) — Controlled - Tributary
Area (ha): 0.139
C: 0.91

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	62.96	6.25	56.71	34.03
20	119.95	42.30	6.25	36.04	43.25
30	91.87	32.39	6.25	26.14	47.05
40	75.15	26.50	6.25	20.24	48.59
50	63.95	22.55	6.25	16.30	48.89
60	55.89	19.71	6.25	13.46	48.44
70	49.79	17.56	6.25	11.30	47.47
80	44.99	15.86	6.25	9.61	46.13
90	41.11	14.50	6.25	8.24	44.51
100	37.90	13.36	6.25	7.11	42.67
110	35.20	12.41	6.25	6.16	40.65
120	32.89	11.60	6.25	5.35	38.49

Storage: Surface Storage Above CB

Orifice Equation: LMF70
Invert Elevation 52.97 m
T/G Elevation 54.77 m
Max Ponding Depth 0.30 m
Downstream W/L 51.46 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	55.07	2.10	6.25	48.89	71.90	OK
					23.01	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG Block 8 (R300A) Roof
Area (ha): 0.236 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	61.52	11.57	49.95	29.97	101.9	0.00
20	70.25	41.48	12.13	29.35	35.22	106.8	0.00
30	53.93	31.84	12.15	19.69	**35.44**	107.0	0.00
40	44.18	26.09	11.98	14.11	33.86	105.5	0.00
50	37.65	22.23	11.73	10.50	31.50	103.3	0.00
60	32.94	19.45	11.45	8.01	28.82	100.8	0.00
70	29.37	17.34	11.07	6.27	26.34	97.5	0.00
80	26.56	15.68	10.67	5.01	24.07	94.0	0.00
90	24.29	14.34	10.29	4.05	21.89	90.6	0.00
100	22.41	13.23	9.93	3.30	19.83	87.4	0.00
110	20.82	12.30	9.59	2.71	17.88	84.4	0.00
120	19.47	11.50	9.26	2.23	16.06	81.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	107.01	0.11	12.15	35.44	94.40	0.00

Subdrainage Area: Parking Ramp Block 8 (F300B) 100-year Capture - Tributary
Area (ha): 0.030
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	104.19	7.82	7.82	0.00	0.00	0.00
20	70.25	5.27	5.27	0.00	0.00	0.00
30	53.93	4.05	4.05	0.00	0.00	0.00
40	44.18	3.32	3.32	0.00	0.00	0.00
50	37.65	2.83	2.83	0.00	0.00	0.00
60	32.94	2.47	2.47	0.00	0.00	0.00
70	29.37	2.20	2.20	0.00	0.00	0.00
80	26.56	1.99	1.99	0.00	0.00	0.00
90	24.29	1.82	1.82	0.00	0.00	0.00
100	22.41	1.68	1.68	0.00	0.00	0.00
110	20.82	1.56	1.56	0.00	0.00	0.00
120	19.47	1.46	1.46	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 8 (UNC-3) Uncontrolled - Non Tributary
Area (ha): 0.368
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	104.19	21.32	21.32	0.00	0.00	0.00
20	70.25	14.37	14.37	0.00	0.00	0.00
30	53.93	11.03	11.03	0.00	0.00	0.00
40	44.18	9.04	9.04	0.00	0.00	0.00
50	37.65	7.70	7.70	0.00	0.00	0.00
60	32.94	6.74	6.74	0.00	0.00	0.00
70	29.37	6.01	6.01	0.00	0.00	0.00
80	26.56	5.43	5.43	0.00	0.00	0.00
90	24.29	4.97	4.97	0.00	0.00	0.00
100	22.41	4.58	4.58	0.00	0.00	0.00
110	20.82	4.26	4.26	0.00	0.00	0.00
120	19.47	3.98	3.98	0.00	0.00	0.00

Block 8 Peak Flow Summary

Total Area = **0.773** **ha** **Volume =** **54.61** **m^3**
Q target = 99.5 L/s

Q unc = 21.3 L/s
Qramp = 7.8 L/s
Qroof = 12.2 L/s
Qparking = 6.0 L/s

Q total = **47** **L/s**

Overall Site Release Rate
Q target = 290.6 L/s
Q total = 183.6 L/s

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG Block 8 (R300A) Roof
Area (ha): 0.236 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	117.15	14.68	102.46	61.48	129.3	0.00
20	119.95	78.70	15.69	63.00	75.61	138.2	0.00
30	91.87	60.27	15.99	44.29	79.72	140.8	0.00
40	75.15	49.30	16.00	33.30	**79.92**	140.9	0.00
50	63.95	41.96	15.88	26.08	78.24	139.8	0.00
60	55.89	36.67	15.69	20.98	75.54	138.1	0.00
70	49.79	32.67	15.46	17.21	72.28	136.1	0.00
80	44.99	29.52	15.20	14.32	68.72	133.9	0.00
90	41.11	26.97	14.94	12.04	65.00	131.5	0.00
100	37.90	24.87	14.67	10.20	61.21	129.1	0.00
110	35.20	23.10	14.39	8.70	57.43	126.8	0.00
120	32.89	21.58	14.11	7.47	53.81	124.2	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	140.90	0.14	16.00	79.92	94.40	0.00

Subdrainage Area: Parking Ramp Block 8 (F300B) 100-year Capture - Tributary
Area (ha): 0.030
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	14.89	14.89	0.00	0.00	0.00
20	119.95	10.00	10.00	0.00	0.00	0.00
30	91.87	7.66	7.66	0.00	0.00	0.00
40	75.15	6.27	6.27	0.00	0.00	0.00
50	63.95	5.33	5.33	0.00	0.00	0.00
60	55.89	4.66	4.66	0.00	0.00	0.00
70	49.79	4.15	4.15	0.00	0.00	0.00
80	44.99	3.75	3.75	0.00	0.00	0.00
90	41.11	3.43	3.43	0.00	0.00	0.00
100	37.90	3.16	3.16	0.00	0.00	0.00
110	35.20	2.94	2.94	0.00	0.00	0.00
120	32.89	2.74	2.74	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 8 (UNC-3) Uncontrolled - Non Tributary
Area (ha): 0.368
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	45.67	45.67	0.00	0.00	0.00
20	119.95	30.68	30.68	0.00	0.00	0.00
30	91.87	23.50	23.50	0.00	0.00	0.00
40	75.15	19.22	19.22	0.00	0.00	0.00
50	63.95	16.36	16.36	0.00	0.00	0.00
60	55.89	14.30	14.30	0.00	0.00	0.00
70	49.79	12.73	12.73	0.00	0.00	0.00
80	44.99	11.51	11.51	0.00	0.00	0.00
90	41.11	10.51	10.51	0.00	0.00	0.00
100	37.90	9.69	9.69	0.00	0.00	0.00
110	35.20	9.00	9.00	0.00	0.00	0.00
120	32.89	8.41	8.41	0.00	0.00	0.00

Block 8 Peak Flow Summary

Total Area = **0.773** ha **Volume =** **128.81** **m^3**
Q target = 99.5 L/s

Q unc = 45.7 L/s
Qramp = 14.9 L/s
Qroof = 16.0 L/s
Q parking = 6.3 L/s

Q total = **82.8** **L/s** **-16.69** **L/s**

Overall Site Release Rate
Q target = 290.6 L/s
Q total = 287.7 L/s

Project #160401331, Petries Landing - Block 6, 7 and 8
Roof Drain Design Sheet, Area R100A Block 6
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0016	0	0.025	32	0	0	0.025
0.050	0.0006	0.0032	2	0.050	127	2	2	0.050
0.075	0.0009	0.0047	7	0.075	287	5	7	0.075
0.100	0.0013	0.0063	17	0.100	509	10	17	0.100
0.125	0.0016	0.0079	33	0.125	796	16	33	0.125
0.150	0.0019	0.0095	57	0.150	1146	24	57	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.9	588.7	1.9	0.163526
6.9	1065.3	5.0	0.459429
16.7	1555.8	9.8	0.891604
32.9	2052.0	16.2	1.461607
57.0	2551.0	24.1	2.170218

Rooftop Storage Summary

Total Building Area (sq.m)		1433	Excludes known areas with no roof storage available
Assume Available Roof Area (sq.m)	80%	1146	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		5	
Max. Allowable Depth of Roof Ponding (m)		0.15	* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).
Max. Allowable Storage (cu.m)		57	
Estimated 100 Year Drawdown Time (h)		2.1	

* 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	0.6309
0.075	**0.9464**	0.86749	0.78863	0.70976	0.6309
0.100	**1.2618**	1.10408	0.94635	0.78863	0.6309
0.125	**1.5773**	1.34067	1.10408	0.86749	0.6309
0.150	**1.8927**	1.57726	1.2618	0.94635	0.6309

Calculation Results

	5yr	**100yr**	**Available**
Qresult (cu.m/s)	0.007	0.009	-
Depth (m)	0.112	0.147	0.150
Volume (cu.m)	24.5	54.6	57.3
Draintime (hrs)	1.167	2.097	

Project #160401331, Petries Landing - Block 6, 7 and 8
Roof Drain Design Sheet, Area BLDG Block 7
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0022	0	0.025	40	0	0	0.025
0.050	0.0006	0.0044	3	0.050	162	2	3	0.050
0.075	0.0009	0.0066	9	0.075	364	6	9	0.075
0.100	0.0013	0.0088	22	0.100	647	12	22	0.100
0.125	0.0016	0.0110	42	0.125	1011	21	42	0.125
0.150	0.0019	0.0132	73	0.150	1456	31	73	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
2.4	534.2	2.4	0.148393
8.8	966.7	6.4	0.416914
21.2	1411.9	12.5	0.809095
41.8	1862.1	20.6	1.32635
72.5	2314.9	30.7	1.969386

Rooftop Storage Summary

Total Building Area (sq.m)		1820	Excludes known areas with no roof storage available
Assume Available Roof Area (sq.m)	80%	1456	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		7	
Max. Allowable Depth of Roof Ponding (m)		0.15	* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).
Max. Allowable Storage (cu.m)		73	
Estimated 100 Year Drawdown Time (h)		1.9	

* 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	0.6309
0.075	**0.9464**	0.86749	0.78863	0.70976	0.6309
0.100	**1.2618**	1.10408	0.94635	0.78863	0.6309
0.125	**1.5773**	1.34067	1.10408	0.86749	0.6309
0.150	**1.8927**	1.57726	1.2618	0.94635	0.6309

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.010	0.013	-
Depth (m)	0.111	0.146	0.150
Volume (cu.m)	30.3	67.8	72.8
Draintime (hrs)	1.036	1.872	

Project #160401331, Petries Landing - Block 6, 7 and 8
Roof Drain Design Sheet, Area BLDG Block 8
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0028	0	0.025	52	0	0	0.025
0.050	0.0006	0.0057	3	0.050	210	3	3	0.050
0.075	0.0009	0.0085	12	0.075	472	8	12	0.075
0.100	0.0013	0.0114	28	0.100	839	16	28	0.100
0.125	0.0016	0.0142	55	0.125	1311	27	55	0.125
0.150	0.0019	0.0170	94	0.150	1888	40	94	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
3.1	538.8	3.1	0.149661
11.4	974.9	8.3	0.420477
27.5	1423.9	16.2	0.81601
54.2	1878.0	26.7	1.337687
94.0	2334.7	39.8	1.986219

Rooftop Storage Summary

Total Building Area (sq.m)		2360	Excludes known areas with no roof storage available
Assume Available Roof Area (sq.m)	80%	1888	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		9	
Max. Allowable Depth of Roof Ponding (m)		0.15	* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).
Max. Allowable Storage (cu.m)		94	
Estimated 100 Year Drawdown Time (h)		1.8	

* 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	0.6309
0.075	**0.9464**	0.86749	0.78863	0.70976	0.6309
0.100	**1.2618**	1.10408	0.94635	0.78863	0.6309
0.125	**1.5773**	1.34067	1.10408	0.86749	0.6309
0.150	**1.8927**	1.57726	1.2618	0.94635	0.6309

Calculation Results

	5yr	**100yr**	**Available**
Qresult (cu.m/s)	0.012	0.016	-
Depth (m)	0.107	0.141	0.150
Volume (cu.m)	35.4	79.9	94.4
Draintime (hrs)	0.971	1.757	

BACKGROUND REPORTS EXCERPTS

Appendix E

3223701 CANADA INC
C/O BRIGIL HOMES

DESIGN BRIEF
PETRIE'S LANDING II
PHASE 2

31464.5.2.2

REVISED AUGUST 2012
REVISED OCTOBER 2012
REVISED NOVEMBER 2012
REVISED AUGUST 2013
REVISED NOVEMBER 2013
REVISED FEBRUARY 7, 2014

- Pavement Structure:

Layer		Thickness (mm)	
		Car Parking Areas	Local Streets & Heavy Traffic Areas (Fire Route)
Wear Course:	Superpave 12.5 Asphaltic Concrete	50	40
Binder Course:	Superpave 19.0 Asphaltic Concrete		50
Base:	OPSS Granular "A" Crushed Stone	150	150
Sub-Base:	OPSS Granular "B" Type II	300	400

- Minimum Performance Grade (PG) 58-34 asphalt cement should be used;
- 3.0 m long sub-drain should be installed at each catchbasin.

The geotechnical report also provides guidelines regarding the permissible maximum grade raise(s) for the property without additional construction measures such as pre-loading, raft foundation, deep foundations or others approved alternatives such as light weight fill. The maximum grade raises vary between 1.8 m to 4.0 m depending on the building type and percentage of consolidation considered.

It should be noted that a copy of the proposed grading for the subject site has been forwarded to Paterson Group for its review and confirmation of its compliance with the grade raise recommendations.

2. MUNICIPAL SERVICES

As the Prestige Circle sewers and watermain were designed to accommodate the anticipated development along its perimeter, a simple extension of the main-line services into each sub-block will provide servicing for each of the buildings. The main design parameters for the various municipal services were designed as per the applicable City of Ottawa requirements and have been summarized in the sub-sections below.

2.1 Water Distribution

Prior to the detailed design of Prestige Circle, boundary conditions for the watermain at the intersection of Tenth Line Road and North Service Road were provided by City staff. Based on the proposed concept plan, grading and the existing boundary conditions, a 200mm diameter watermain loop complete with hydrants was proposed. The supporting hydraulic analysis demonstrated that the following municipal requirements and Fire Underwriters recommended flows for protection will be exceeded:

- Average daily demand 350 l/cap/day (residential)
  15,000 l/Ha/day (institutional)

- Peak daily demand 875 l/cap/day (residential)
  22,500 l/Ha/day (institutional)

- Peak hour demand 1,925 l/cap/day (residential)
  40,500 l/Ha/day (institutional)

- Fire flow rate 8,000 l/min (townhouses & 3-storey apartments)
  15,000 l/min (institutional)

- Minimum hydraulic grade line during max hour – 275 kPa

- Minimum hydraulic grade line during max day and fire flows – 140 kPa

Hence, the water servicing to Phase 2 will simply be accomplished through a number of connections to the 200mm diameter watermain along Prestige Circle.

Refer to Appendix C for the hydraulic analysis.

2.2 Wastewater

2.2.1 EXISTING CONDITIONS

In 2002 the 900mm diameter Ottawa River Sub Trunk sanitary sewer was constructed by the City of Ottawa to accommodate the Petrie's Landing II lands as well as additional lands upstream.

The sub-trunk detailed design was prepared by Stantec Consulting Ltd. It included a flow allowance of 50,000 l/Ha/d with a peaking factor of 1.5 for the Petrie's Landing II property.

The Prestige Circle sanitary sewer design was based on the applicable City of Ottawa Design Guidelines and the preliminary concept plan which originally proposed 248 apartments and 170 retirement units for a total of 418 units.

The current concept plan for the overall development is now proposing a total of 405 units. The breakdown is as follows:

- Existing Phase 1: 40 units
- Phase 2 (subject phase): 268 units
- Future Phase 3: 97 units

Thus, the number of units is within the allocated number as based on the original concept plan and associated sanitary sewer design.

It should also be noted that the distribution of the population along the perimeter of Prestige Circle will have no negative impact on the sanitary sewer as it has a significant level of residual capacity distributed along its entire length which provides flexibility in the design of the locations for the proposed block connections. Refer to Appendix D for Petrie's Landing design sheet and drawing.

2.2.2 DESIGN CRITERIA

The sanitary flows for Block 2 were determined based on the following design criteria which includes, but is not limited to the following:

- Population: 1.8 persons per apartment/condo unit
- Domestic Flow: 350 l/cap per day
- Domestic Peak Factor: Harmon Formula
- Institutional: 50,000 l/d/Ha
- Institutional Peak Factor: 1.5
- Extraneous Flow: 0.28 l/s/Ha
- Minimum Pipe Size: 200 mm diameter
- Maximum Velocity 3.0 m/s
- Minimum Velocity 0.6 m/s

Refer to Appendix D for the resulting sanitary design sheet and drawing.

2.3 Storm Sewer

2.3.1 EXISTING CONDITIONS

In 1995, *McNeely Engineering Consultants Ltd.* was commissioned by the former Township of Cumberland to prepare a Master Drainage Plan (MDP) for the area surrounding and including the Petrie's Landing II lands. The report states that stormwater flows from the development are to be directed to the Brisebois Creek SWM facility prior to its discharge to the Ottawa River. This will ensure that quality control constraints are met. The report also recommended that post-development flows from the proposed Petrie's Landing II lands site be limited to 150 l/s/ha in order to insure that the downstream SWM facility meets its design targets.

With the above-noted constraints in mind, the overall stormwater management design for the subdivision took into account the two proposed phases within the development. Hence, both phases 1 and 2 were allocated 61.6 L/s and 461.35L/s respectively.

However, Phase 2 has subsequently been reduced in size and a third phase has been created. Thus, the initial allocation of 461.35 L/s for Phase 2 has been distributed proportionally based on the areas of the new Phases 2 and 3. The resulting flow allocation for Phase 2 is 361.87 L/s.

2.3.2 DESIGN PARAMETERS

The rational method in combination with the following parameters was used in the sizing of the storm sewer minor system for Block 2:

- **Design Storms**

  The 5 year design storm event was used in the evaluation of the site, consistent with the City of Ottawa Sewer Design Guidelines (November, 2004).

- **Run-Off Coefficients**

  The run-off coefficients utilized for the minor system design were derived from analysis of representative samples of drainage areas within the proposed Phase. Coefficients of 0.20 and 0.90 were utilized in the analysis to represent landscaped versus hard surface areas.

- **Time of Concentration**

  Inlet times of 10 min. for parking/hard surface areas were utilized as per the City of Ottawa Sewer Design Guidelines (November 2004).

3. STORMWATER MANAGMENT

Phase 2 is 2.91 Ha in size and as previously noted was reallocated 361.87 L/s as minor system flow as a result of its new area.

Of the 2.91 Ha design area, a total of 0.55 Ha has been left to discharge uncontrolled from the site due to grading or other constraints that do not feasibly allow for collection and control of runoff. Based on a 100-year event, where the runoff coefficient of the uncontrolled area is equal to an average of 0.30, the uncontrolled flow rate can be determined as follows:

- $\mathbf{Q_{Uncontrolled}}$ = 2.78*C*$\mathbf{i_{100yr}}$*A, where:

  C = Average site runoff coefficient uncontrolled area
  = 0.30

  $\mathbf{i_{100yr}}$ = Intensity of 100-year storm event (mm/hr)
  = $1735.688 * (T_c + 6.014)^{-0.820}$
  = 178.56 mm/hr; where T_c = 20 minutes

  A = Uncontrolled Area (Ha)
  = 0.55 ha

  Therefore,

- $\mathbf{Q_{Uncontrolled}}$ = 2.78 X 0.30 X 119.95mm/hr X 0.55 Ha = 55.02 L/s

Additionally, an area of the site equivalent to 0.27 Ha is taken up by depressed parking ramps, which must accommodate the 100-year flow. This flow rate can also be calculated as:

$$Q_{parking} = \mathbf{2.78 * C * i_{100yr} * A}$$

$$= 2.78 * 0.80 * 119.95 * 0.27$$

$$= \mathbf{107.22\ L/s}$$

The maximum allowable release rate from the remainder of the site can then be determined as:

$$Q_{max\ allowable} = Q_{restricted} - Q_{uncontrolled} - Q_{parking}$$

$$= 361.87\ L/s - 55.02\ L/s - 107.22\ L/s$$

$$= \mathbf{199.62\ L/s}$$

Restricting flow into the minor system from the controlled portion of the site will be achieved through the use of inlet control devices and surface ponding. The size and type of each inlet control device was determined via the Modified Rational Method and are a function of the size of the drainage area and the amount of surface storage available on-site.

Any runoff generated from storms in excess of the site's release rate will be stored on-site and gradually released into the minor system so as not to surcharge the proposed sewers. Ponding storage will be provided at specific locations. Overland flow routes have been provided in the grading and surface designs to permit emergency overflow drainage from the site.

Refer to Appendix E for the modified rational method calculations, inlet control device sizing and ponding plan.

4. GRADING

As per standard practice, the design of the site grading takes into account a number of factors. Efforts are made to ensure that the proposed grading will tie in well with the surrounding areas. This includes matching the existing grades at controlling areas, such as property lines, existing roadways and geotechnical restraint lines, where no modification of the existing grades is permissible.

Other factors, such as stormwater management and geotechnical grade raise limitations also play a part in the grading of the site. Major overflow routes have been provided in order to ensure that emergency overflow can be conveyed from the site when required. Where possible, some areas have been graded to maximize on-site ponding. The depth of water has been limited to a maximum of 0.30 m at all locations.

5. UTILITIES

As part of Prestige Circle's second and final phase of construction, all utility purveyors will be extending their current plant within the Right-of-Way in order to provide servicing to Phase 2 and future Phase 3. As part of the detail design for Phase 2, servicing designs from Hydro One, Rogers, Bell and Enbridge have been requested.

FUS WATER SUPPLY FOR PUBLIC FIRE PROTECTION 1991

EXAMPLES OF REQUIRED FIRE FLOWS (REVISED)

For convenience in making general estimates some examples of required fire flows in typical buildings are provided below. In establishing fire flows for areas of a Municipality as yet undeveloped, but where a broad range of commercial, institutional, residential and industrial occupancies may be expected to be created under modern building code requirements, an outside design figure of 15,000 L/min appears likely to be suitable. When very large or high fire load buildings are probable, 25,000 L/min is more appropriate. It should be noted particularly that the tendency to install automatic sprinkler protection in large area and high hazard industrial and commercial buildings is a key factor in keeping required fire flows within ecomonically acceptable limits in many cases.

The following examples suppose no significant exposures to other buildings nor sprinkler protection unless specified. Where areas are given they are ground areas unless specified.

DETACHED DWELLINGS (TOTAL FLOOR AREAS)

— Under 100 m² = 2,000 L/min
  101 m² — 200 m² = 3,000 L/min
  Over 200 m² = 4,000 L/min

— Add for exposures to similar buildings on both sides:

Over 30 m	- nil
30 — 10 m	add 1,000 L/min
10 — 3 m	add 2,000 L/min
less than 3 m	see Note "D", if Frame. Brick, add 3,000 L/min.

— If wood shingle or shake roofs are prevalent,add 2,000 to 4,000 L/min.

— Modern residential subdivisions of 1 and 2 storey single family homes detached 3 to 6 m require usually 4,000 to 5,000 L/min.

— Old congested two and three family tenements detached less than 3 m and running the length of the block may require 15,000 to 25,000 L/min and should be calculated according to Note "D".

— Modern Row or Town House groups may require 6,000 to 10,000 L/min including adjoining exposures, providing required fire separations are adequate.

APARTMENT BUILDINGS

— 3 storeys, frame, 300 m² = 7,000 L/min and exposure coverage.

— 4 storeys, brick, 2,000 m² = 15,000 L/min and exposure coverage.

— 3 or more storeys, fire resistive, 5,600 m² with cut off shafts and stairs = 10,000 L/min and exposure coverage.

INSTITUTIONAL BUILDINGS

— 1 storey, fire resistive school of 2,300 m² = 5,000 L/min

— 3 storey, brick ordinary school of 2,300 m² = 15,000 L/min

— 3 or more storey, fire resistive hospital with adequate floor separations 1,000 m², no exposures = 4,000 L/min.

INDUSTRIAL BUILDINGS

— Typical industrial park, 1 storey ordinary, area 3,700 m² with average combustible contents fire load =14,000 L/min.

— Frame warehouse 1 storey, moderate contents fire load 3,700 m² = 20,000 L/min.

— Warehouse high fire load contents, brick non-combustible, 1 storey, 14,000 m² = 25,000 L/min.
  With full adequate automatic sprinkler protection (item 3, P.13) 13,000 L/min.

— Traditional 3 storey brick , ordinary factory with high fire load. 9,300 m² = 35,000 L/min.

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : PETRIE'S LANDING II - PHASE 2
LOCATION : CITY OF OTTAWA
DEVELOPER : BRIGIL PLATINUM

FILE: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK
PAGE : 1 OF 1

NODE	RESIDENTIAL				NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND
	UNITS		GROSS RES. (ha)	POP'N	INDTRL (ha.)	COMM. (ha.)	INST. (ha.)										(l/min)
	TH	APT						Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total	
BLK1		40		72				0.29	0.00	0.29	0.73	0.00	0.73	1.60	0.00	1.60	8,000
BLK2		40		72				0.29	0.00	0.29	0.73	0.00	0.73	1.60	0.00	1.60	8,000
BLK3A		92		166				0.67	0.00	0.67	1.68	0.00	1.68	3.69	0.00	3.69	8,000
BLK5		76		137				0.55	0.00	0.55	1.39	0.00	1.39	3.05	0.00	3.05	8,000
BLK6		76		137				0.55	0.00	0.55	1.39	0.00	1.39	3.05	0.00	3.05	8,000
BLK7		0		0				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,000
BLK8		88		158				0.64	0.00	0.64	1.60	0.00	1.60	3.53	0.00	3.53	15,000
TOTALS	**0**	**412**	**0**	**742**	**0.00**	**0.00**	**0.00**	**2.99**	**0.00**	**2.99**	**7.52**	**0.00**	**7.52**	**16.52**	**0.00**	**16.52**	

ASSUMPTIONS

RESIDENTIAL DENSITIES

- Townhouse (TH) 2.7 p / p / u
- Apartment (APT) 1.8 p / p / u

AVG. DAILY DEMAND

- Residential 350 l / cap / day
- Institutional 15,000 l / ha / day

MAX. DAILY DEMAND

- Residential 875 l / cap / day
- Institutional 22,500 l / ha / day

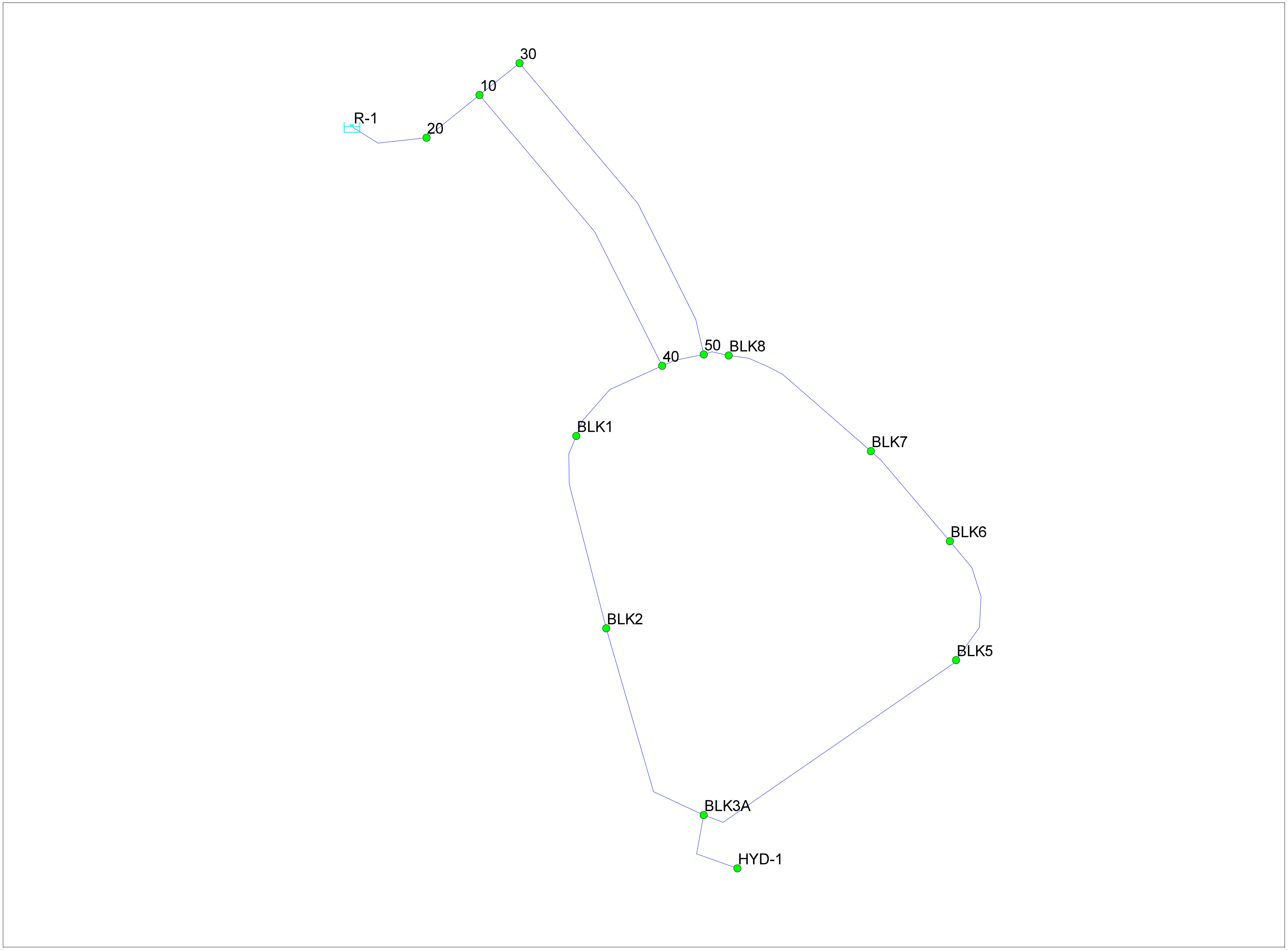
MAX. HOURLY DEMAND

- Residential 1,925 l / cap / day
- Institutional 40,500 l / ha / day

FIRE FLOW

- Townhouses 8,000 l / min
- 3-Storey Apartments 8,000 l / min
- Institutional 15,000 l / min

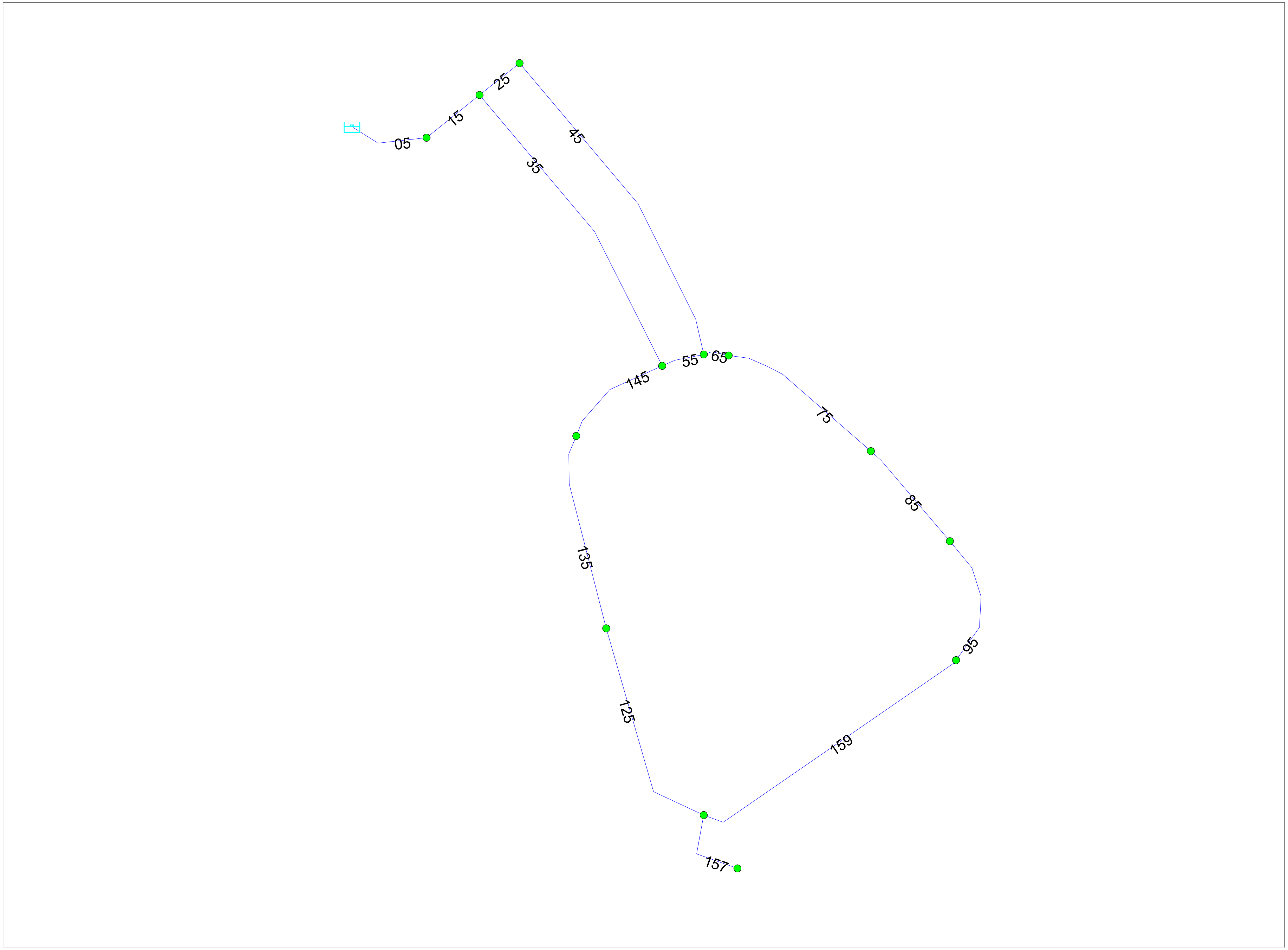
Petrie's Landing II - Node ID's



Prepared By: IBI Group

Date: Thursday, November 28, 2013

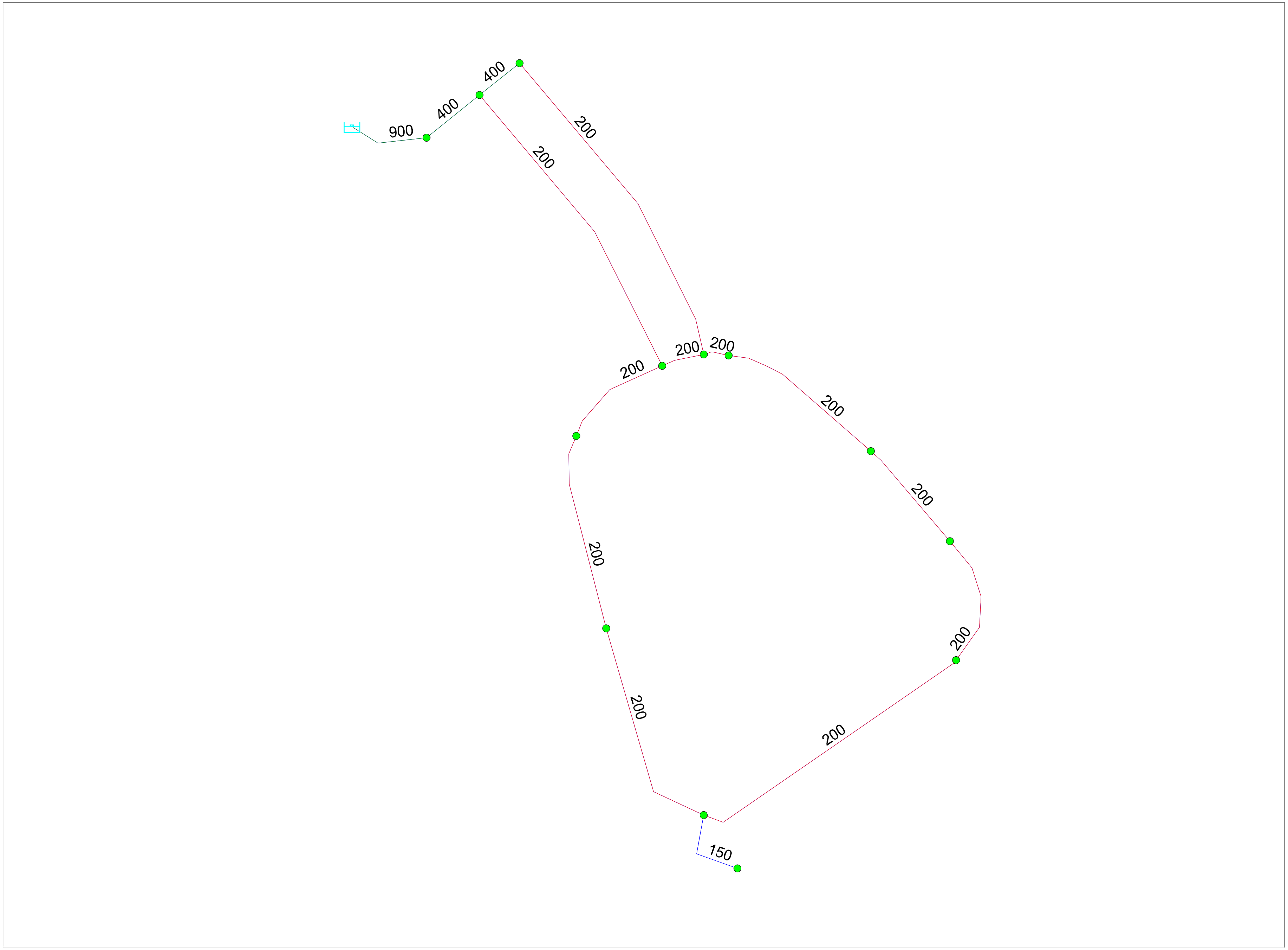
Petrie's Landing II - Pipe ID's



Prepared By: IBI Group

Date: Thursday, November 28, 2013

Petrie's Landing II - Pipe Sizes



Prepared By: IBI Group

Date: Thursday, November 28, 2013

Average Day (High Presure Check) - Junction Report (HGL = 115.00m)

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		10	0.00	51.75	115.00	619.78
2		20	0.00	52.00	115.00	617.35
3		30	0.00	51.60	115.00	621.25
4		40	0.00	55.05	115.00	587.42
5		50	0.00	55.05	115.00	587.42
6		BLK1	0.29	55.20	114.99	585.94
7		BLK2	0.29	56.70	114.99	571.24
8		BLK3A	0.67	57.00	114.99	568.30
9		BLK5	0.55	57.10	114.99	567.32
10		BLK6	0.55	56.60	114.99	572.22
11		BLK7	0.00	55.65	114.99	581.53
12		BLK8	0.64	55.00	115.00	587.91
13		HYD-1	0.00	57.10	114.99	567.32

Average Day (High Presure Check) - Pipe Report (HGL = 115.00m)

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)
1		05	R-1	20	0.10	900.00	130.00	2.99	0.00	0.00
2		125	BLK3A	BLK2	57.74	200.00	110.00	-0.67	0.02	0.000
3		135	BLK2	BLK1	50.89	200.00	110.00	-0.96	0.03	0.000
4		145	BLK1	40	29.62	200.00	110.00	-1.25	0.04	0.000
5		15	20	10	800.00	400.00	120.00	2.99	0.02	0.00
6		157	BLK3A	HYD-1	21.20	150.00	100.00	0.00	0.00	0.00
7		159	BLK3A	BLK5	81.61	200.00	110.00	0.00	0.000	0.00
8		25	10	30	13.11	400.00	120.00	1.47	0.01	0.00000
9		35	10	40	84.27	200.00	110.00	1.52	0.05	0.00
10		45	30	50	89.46	200.00	110.00	1.47	0.05	0.00
11		55	40	50	11.11	200.00	110.00	0.27	0.01	0.0000
12		65	50	BLK8	6.59	200.00	110.00	1.74	0.06	0.000
13		75	BLK8	BLK7	44.78	200.00	110.00	1.10	0.03	0.000
14		85	BLK7	BLK6	30.74	200.00	110.00	1.10	0.03	0.000
15		95	BLK6	BLK5	34.82	200.00	110.00	0.55	0.02	0.000

Average Day (High Presure Check) - Pipe Report (HGL = 115.00m)

		ID	HL/1000 (m/km)
1		05	0.00
2		125	0.01
3		135	0.01
4		145	0.02
5		15	0.00
6		157	0.00
7		159	0.00
8		25	0.000
9		35	0.03
10		45	0.03
11		55	0.00
12		65	0.03
13		75	0.01
14		85	0.01
15		95	0.00

Max Day + Fire - Fireflow Report (HGL = 110.00m)

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
1		BLK1	134.06	HYD-1	448.81	101.00	345.12	335.18	BLK1	139.96	69.48	335.18	335.18
2		BLK2	134.06	BLK2	426.82	100.26	289.16	289.18	BLK2	139.96	70.98	289.18	289.16
3		BLK5	134.72	BLK5	415.09	99.46	276.06	276.08	BLK5	139.96	71.38	276.08	276.06
4		BLK6	134.72	BLK6	427.07	100.18	289.25	289.27	BLK6	139.96	70.88	289.27	289.25
5		BLK7	133.33	BLK5	438.59	100.41	318.44	310.34	BLK7	139.96	69.93	310.34	310.34
6		BLK8	251.60	BLK5	335.27	89.21	375.48	378.29	BLK6	134.64	68.74	375.44	375.44
7		HYD-1	133.33	HYD-1	304.50	88.17	182.43	182.43	HYD-1	139.96	71.38	182.43	182.43

Peak Hour - Junction Report (HGL = 108.00m)

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		10	0.00	51.75	107.95	550.69
2		20	0.00	52.00	108.00	548.76
3		30	0.00	51.60	107.95	552.16
4		40	0.00	55.05	107.89	517.83
5		50	0.00	55.05	107.89	517.82
6		BLK1	1.60	55.20	107.88	516.23
7		BLK2	1.60	56.70	107.87	501.39
8		BLK3A	3.69	57.00	107.86	498.37
9		BLK5	3.05	57.10	107.86	497.39
10		BLK6	3.05	56.60	107.86	502.32
11		BLK7	0.00	55.65	107.87	511.74
12		BLK8	3.53	55.00	107.89	518.26
13		HYD-1	0.00	57.10	107.86	497.39

APPENDIX D

IBI Group
400 - 333 Preston Street
Ottawa, ON
K1S 5N4

SANITARY SEWER DESIGN SHEET
PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

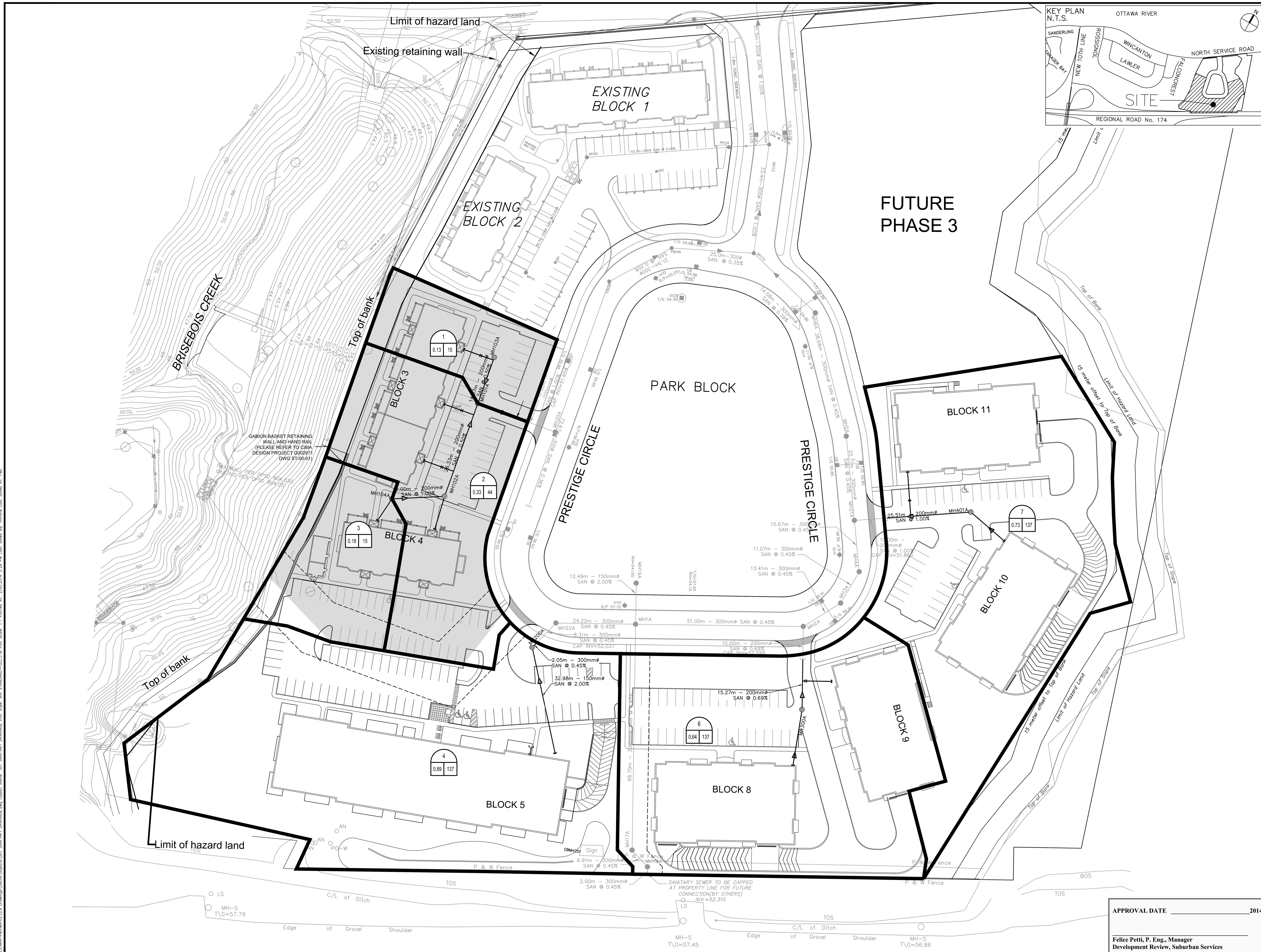
LOCATION				INDIVIDUAL		CUMULATIVE		DESIGN FLOW					SEWER DATA					
FROM MH	TO MH	TH (#)	APT (#)	POP.	AREA (Ha)	POP.	AREA (Ha)	PEAK FACTOR	POP. FLOW (L/s)	INFILT. FLOW (L/s)	OFFSITE FLOW (L/s)	PEAK FLOW (L/s)	CAP. (L/s)	VELOCITY (FULL) (m/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	AVAIL. CAP. (%)
19A	*1A*			*0.0*	*0.27*	*0*	*0.27*	*4.00*	*0.00*	*0.08*		***0.08***	***22.47***	*1.23*	*12.49*	*150*	*2.00*	*99.64%*
STUB	*18A*			***17.10 L/s from off-site lands south of Regional Road No. 174***							*17.10*	***17.10***	***67.64***	*0.93*	*2.00*	*300*	*0.45*	*74.72%*
18A	*17A*			*0.0*	*0.00*	*0*	*0.00*	*4.00*	*0.00*	*0.00*	*17.10*	***17.10***	***67.64***	*0.93*	*6.91*	*300*	*0.45*	*74.72%*
17A	*1A*			*0.0*	*0.00*	*0*	*0.00*	*4.00*	*0.00*	*0.00*	*17.10*	***17.10***	***67.64***	*0.93*	*68.70*	*300*	*0.45*	*74.72%*
BLK 5	200A		76	136.8	0.25	137	0.25	4.00	2.22	0.07		**2.29**	**22.47**	1.23	32.98	150	2.00	89.81%
200A	CAP			0.0	0.00	137	0.25	4.00	2.22	0.07		**2.29**	**67.64**	0.93	2.05	300	0.45	96.61%
CAP	22A			0.0	0.00	137	0.25	4.00	2.22	0.07		**2.29**	**67.64**	0.93	8.31	300	0.45	96.61%
22A	*1A*			0.0	0.00	137	0.25	4.00	2.22	0.07		**2.29**	**67.64**	0.93	24.22	300	0.45	96.61%
1A	*2A*			*0.0*	*0.07*	*137*	*0.59*	*4.00*	*2.22*	*0.17*	*17.10*	***19.49***	***67.64***	*0.93*	*51.00*	*300*	*0.45*	*71.19%*
300A	CAP		76	136.8	0.64	137	0.64	4.00	2.22	0.18		**2.40**	**28.41**	0.88	15.27	200	0.69	91.55%
CAP	*2A*			0.0	0.00	137	0.64	4.00	2.22	0.18		**2.40**	**28.41**	0.88	10.00	200	0.69	91.55%
2A	*3A*			*0.0*	*0.02*	*274*	*1.25*	*4.00*	*4.43*	*0.35*	*17.10*	***21.88***	***67.64***	*0.93*	*13.41*	*300*	*0.45*	*67.65%*
3A	*4A*			*0.0*	*0.02*	*274*	*1.27*	*4.00*	*4.43*	*0.36*	*17.10*	***21.89***	***67.64***	*0.93*	*11.07*	*300*	*0.45*	*67.64%*
4A	*21A*			*0.0*	*0.07*	*274*	*1.34*	*4.00*	*4.43*	*0.38*	*17.10*	***21.91***	***67.64***	*0.93*	*15.67*	*300*	*0.45*	*67.61%*
401A	*CAP*		76	136.8	0.75	137	0.75	4.00	2.22	0.21		**2.43**	**34.21**	1.06	25.51	200	1.00	92.90%
CAP	*21A*			0.0	0.00	137	0.75	4.00	2.22	0.21		**2.43**	**34.21**	1.06	10.00	200	1.00	92.90%

Q = Average daily per capita flow 350 l/cap/d
I = Unit of peak extraneous flow 0.28 l/sec/Ha
M = Peaking factor = 1+(14/(4+P)^0.5)), P=pop. IN 1000'S, max. of 4
Q(p) = Peak population flow (l/s)
Q(i) = Peak extraneous flow (l/s)
Population = 2.7 per townhouse (TH) unit, 1.8 per apartment (APT) unit
Coeff. of friction (n) = 0.013

IBI GROUP	IBI Group 400 - 333 Preston Street Ottawa, ON K1S 5N4	SANITARY SEWER DESIGN SHEET PROJECT: PETRIE'S LANDING II - PHASE 2 LOCATION: CITY OF OTTAWA DEVELOPER: BRIGIL PLATINUM	PAGE: 2 OF 2 JOB: 31464.5.7 DATE: 2013-11-28 DESIGN: RPK

LOCATION				INDIVIDUAL		CUMULATIVE		DESIGN FLOW					SEWER DATA					
FROM MH	TO MH	TH (#)	APT (#)	POP.	AREA (Ha)	POP.	AREA (Ha)	PEAK FACTOR	POP. FLOW (L/s)	INFILT. FLOW (L/s)	OFFSITE FLOW (L/s)	PEAK FLOW (L/s)	CAP. (L/s)	VELOCITY (FULL) (m/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	AVAIL. CAP. (%)
21A	*5A*			*0.0*	*0.07*	*410*	*2.16*	*4.00*	*6.65*	*0.60*	*17.10*	***24.35***	***67.64***	*0.93*	*25.71*	*300*	*0.45*	*64.00%*
5A	*6A*			*0.0*	*0.00*	*410*	*2.16*	*4.00*	*6.65*	*0.60*	*17.10*	***24.35***	***67.64***	*0.93*	*38.68*	*300*	*0.45*	*64.00%*
	6A		*81*	*145.8*	*0.57*	*146*	*0.57*	*4.00*	*2.36*	*0.16*		***2.52***						
6A	*7A*			*0.0*	*0.04*	*556*	*2.77*	*3.95*	*8.90*	*0.78*	*17.10*	***26.78***	***62.97***	*0.86*	*26.08*	*300*	*0.39*	*57.47%*
10A	*20A*			*0.0*	*0.16*	*0*	*0.16*	*4.00*	*0.00*	*0.04*		***0.04***	***59.69***	*0.82*	*41.00*	*300*	*0.35*	*99.93%*
104A	102A		8	14.4	0.12	14	0.12	4.00	0.23	0.03		**0.26**	**34.21**	1.06	16.00	200	1.00	99.24%
102A	101A		24	43.2	0.27	58	0.39	4.00	0.93	0.11		**1.04**	**24.19**	0.75	26.33	200	0.50	95.70%
103A	101A		8	14.6	0.13	15	0.13	4.00	0.24	0.04		**0.28**	**24.19**	0.75	14.87	200	0.50	98.84%
101A	*CAP*			0.0	0.00	72	0.52	4.00	1.17	0.15		**1.32**	**34.21**	1.06	15.15	200	1.00	96.14%
CAP	*20A*			0.0	0.00	72	0.52	4.00	1.17	0.15		**1.32**	**34.21**	1.06	10.00	200	1.00	96.14%
20A	*9A*			*0.0*	*0.03*	*72*	*0.71*	*4.00*	*1.17*	*0.20*		***1.37***	***59.69***	*0.82*	*48.80*	*300*	*0.35*	*97.70%*
	9A		*40*	*72.0*	*0.61*	*72*	*0.61*	*4.00*	*1.17*	*0.17*		***1.34***						
9A	*8A*			*0.0*	*0.03*	*144*	*1.35*	*4.00*	*2.34*	*0.38*		***2.72***	***79.46***	*1.09*	*21.08*	*300*	*0.62*	*96.58%*
8A	*7A*			*0.0*	*0.03*	*144*	*1.38*	*4.00*	*2.34*	*0.39*		***2.73***	***68.44***	*0.94*	*25.19*	*300*	*0.46*	*96.01%*
7A	*13A*			*0.0*	*0.09*	*700*	*4.24*	*3.89*	*11.05*	*1.19*	*17.10*	***29.34***	***101.35***	*1.39*	*33.06*	*300*	*1.01*	*71.05%*
13A	*14A*			*0.0*	*0.11*	*700*	*4.35*	*3.89*	*11.05*	*1.22*	*17.10*	***29.37***	***104.85***	*1.44*	*51.59*	*300*	*1.08*	*71.99%*
14A	*15A*			*0.0*	*0.00*	*700*	*4.35*	*3.89*	*11.05*	*1.22*	*17.10*	***29.37***	***100.91***	*1.38*	*23.00*	*300*	*1.00*	*70.90%*
15A	*EX 10A*			*0.0*	*0.00*	*700*	*4.35*	*3.89*	*11.05*	*1.22*	*17.10*	***29.37***	***100.91***	*1.38*	*34.90*	*300*	*1.00*	*70.90%*

Q = Average daily per capita flow 350 l/cap/d
I = Unit of peak extraneous flow 0.28 l/sec/Ha
M = Peaking factor = 1+(14/(4+P)^0.5)), P=pop. IN 1000'S, max. of 4
Q(p) = Peak population flow (l/s)
Q(i) = Peak extraneous flow (l/s)
Population = 2.7 per townhouse (TH) unit, 1.8 per apartment (APT) unit
Coeff. of friction (n) = 0.013



LEGEND :

1 — AREA IDENTIFICATION
15 — POPULATION
0.13 — AREA IN HECTARES

POPULATION:
- APARTMENT = 1.8 PPU

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8	REVISED PER CITY COMMENTS	RPK	14:02:06
7	REVISED PER CITY COMMENTS	RPK	13:11:26
6	REVISED BLOCK 5	RPK	13:08:19
5	RE-ISSUED FOR SITE PLAN APPROVAL	TRB	12:11:19
4	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12:10:19
3	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12:08:27
2	ISSUED FOR SITE PLAN APPROVAL	RPK	12:04:12
1	ISSUED FOR REVIEW	RPK	12:03:07

LE GROUPE BRIGIL CONSTRUCTION

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
Fax (613)225-9868

Project Title
PETRIE'S LANDING II
PHASE 2

LICENSED PROFESSIONAL ENGINEER R.P. KENNEDY 100086734 2014/02/06 PROVINCE OF ONTARIO

Drawing Title
SANITARY DRAINAGE AREA PLAN

Scale
1:500

Design	Date
RPK	FEB. 2012
Drawn	Checked
DD	TRB
Project No.	Drawing No.
31464	501

APPROVAL DATE ________________ 2014

Felice Petti, P. Eng., Manager
Development Review, Suburban Services

J:\31464-PetrielPh2\5.9 Drawings\59civil\layouts\501 SANITARY DRAINAGE.dwg Layout Name: 501 SANITARY DRAINAGE Plot Style: AIA STANDARD-FULL.CTB Plot Scale: 1:1 Plotted At: 2/6/2014 3:28 PM Last Saved By: mmline Last Saved At: Feb.

APPENDIX E

IBI GROUP

IBI Group
400 - 333 Preston Street
Ottawa, ON
K1S 5N4

STORM SEWER DESIGN SHEET
PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

		AREA (Ha)									DESIGN FLOW							SEWER DATA						
FROM MH	TO MH	C= 0.10	C= 0.20	C= 0.30	C= 0.70	C= 0.75	C= 0.80	C= 0.90	INDIV. 2.78AC	CUM. 2.78AC	INLET (min)	TIME IN PIPE	TOTAL	$i_{5\text{-year}}$ (mm/hr)	$i_{100\text{-year}}$ (mm/hr)	PEAK FLOW (L/s) IND	PEAK FLOW (L/s) TOTAL	CAP. (L/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	n	VEL. (m/s)	AVAIL. CAP. (%)
CBMH 17	MH 1		0.270						0.15	0.15	10.00	0.11	10.11	104.20		15.63	15.63	142.65	12.49	300	2.00	0.013	1.96	89.04%
MH 1	MH 2								0.00	0.15	10.11	0.62	10.73	103.60		15.54	15.54	78.15	40.05	300	0.60	0.013	1.07	80.11%
GAR 8	MH 303								0.00	0.00	10.00			104.20		0.00	0.00							
							0.070		0.16	0.16	10.00	0.27	10.27		178.60	28.58	28.58	34.21	16.77	200	1.00	0.013	1.06	16.48%
MH 303	MH 301								0.00	0.00	10.27			102.80		0.00	0.00							
									0.00	0.16	10.27	0.17	10.43		176.20	28.19	28.19	34.21	10.50	200	1.00	0.013	1.06	17.60%
GAR 9	MH 301								0.00	0.00	10.00			104.20		0.00	0.00							
							0.050		0.11	0.11	10.00	0.26	10.26		178.60	19.65	19.65	34.21	16.69	200	1.00	0.013	1.06	42.58%
MH 301	MH 300				0.040			0.100	0.33	0.33	10.43			102.00		33.66	33.66							
									0.00	0.27	10.43	0.33	10.76		174.70	47.17	80.83	114.99	31.40	300	1.30	0.013	1.58	29.71%
CB 302	CBMH 32				0.120				0.23	0.23	10.00	0.24	10.24	104.20		23.97	23.97	65.83	28.85	200	3.70	0.013	2.03	63.59%
CBMH 32	MH 300				0.110				0.21	0.21	10.00	0.06	10.06	104.20		21.88	21.88	138.74	10.31	250	5.00	0.013	2.74	84.23%
MH 300	MH 2							0.100	0.25	0.79	10.76			100.30		79.24	79.24							
									0.00	0.27	10.76	0.32	11.08		171.90	46.41	125.65	151.97	25.18	375	0.69	0.013	1.33	17.32%
MH 2	MH 3				0.120				0.23	1.17	11.08			98.80		115.60	115.60							
									0.00	0.27	11.08	0.19	11.26		169.30	45.71	161.31	218.51	14.76	450	0.54	0.013	1.33	26.18%
MH 3	MH 4								0.00	1.17	11.26			98.00		114.66	114.66							
									0.00	0.27	11.26	0.10	11.36		167.80	45.31	159.97	361.78	9.29	525	0.65	0.013	1.62	55.78%
MH 4	MH 21								0.00	1.17	11.36			97.50		114.08	114.08							
									0.00	0.27	11.36	0.22	11.58		167.00	45.09	159.17	429.62	19.81	600	0.45	0.013	1.47	62.95%
RYCB 43	MH 404			0.050					0.04	0.04	15.00	0.21	15.21	83.60		3.34	3.34	87.71	21.28	250	2.00	0.013	1.73	96.19%
MH 404	MH 403							0.100	0.25	0.29	15.21	0.12	15.33	82.90		24.04	24.04	124.09	18.24	250	4.00	0.013	2.45	80.63%
MH 403	MH 401				0.140				0.27	0.56	15.33	0.21	15.54	82.50		46.20	46.20	87.71	21.57	250	2.00	0.013	1.73	47.33%
GAR 10	MH 405								0.00	0.00	10.00			104.20		0.00	0.00							
							0.070		0.16	0.16	10.00	0.23	10.23		178.60	28.58	28.58	34.21	14.23	200	1.00	0.013	1.06	16.48%
MH 405	MH 402								0.00	0.00	10.23			103.00		0.00	0.00							
									0.00	0.16	10.23	0.33	10.56		176.50	28.24	28.24	34.21	21.06	200	1.00	0.013	1.06	17.46%
GAR 11	MH 402								0.00	0.00	10.00			104.20		0.00	0.00							
							0.050		0.11	0.11	10.00	0.29	10.29		178.60	19.65	19.65	34.21	18.11	200	1.00	0.013	1.06	42.58%
MH 402	MH 401				0.060				0.12	0.12	10.56			101.30		12.16	12.16							
									0.00	0.27	10.56	0.34	10.90		173.60	46.87	59.03	114.99	32.30	300	1.30	0.013	1.58	48.67%
MH 401	MH 21							0.100	0.25	0.93	15.54			81.90		76.17	76.17							
									0.00	0.27	15.54	0.26	15.79		140.00	37.80	113.97	182.87	24.70	375	1.00	0.013	1.60	37.68%
MH 21	MH 5				0.080				0.16	2.26	15.79			81.10		183.29	183.29							
									0.00	0.54	15.79	0.26	16.05		138.60	74.84	258.13	410.07	21.89	600	0.41	0.013	1.41	37.05%

Q = 2.78AIC, where:
Q = Peak Flow in Litres per Second (l/s)
A = Area in Hectares (ha.)
I = Rainfall Intensity in Millimeters per Hour (mm/hr)

I=998.071/(TC+6.053)^0.814

IBI GROUP

IBI Group
400 - 333 Preston Street
Ottawa, ON
K1S 5N4

STORM SEWER DESIGN SHEET
PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

		AREA (Ha)									DESIGN FLOW							SEWER DATA						
FROM MH	TO MH	C= 0.10	C= 0.20	C= 0.30	C= 0.70	C= 0.75	C= 0.80	C= 0.90	INDIV. 2.78AC	CUM. 2.78AC	INLET (min)	TIME IN PIPE	TOTAL	$i_{5\text{-year}}$ (mm/hr)	$i_{100\text{-year}}$ (mm/hr)	PEAK FLOW (L/s) IND	PEAK FLOW (L/s) TOTAL	CAP. (L/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	n	VEL. (m/s)	AVAIL. CAP. (%)
	MH 5					0.330			0.69	0.69	11.00													
MH 5	MH 6								0.00	2.95	16.05			80.30		236.89	236.89							
									0.00	0.54	16.05	0.53	16.58		137.30	74.14	311.03	389.64	42.06	600	0.37	0.013	1.34	20.18%
	MH 6					0.570			1.19	1.19	11.50													
MH 6	MH 7				0.120				0.23	4.37	16.58			78.80		344.36	344.36							
									0.00	0.54	16.58	0.32	16.90	78.80	134.70	72.74	417.09	488.33	25.46	675	0.31	0.013	1.32	14.59%
MH 12	MH 7				0.090				0.18	0.18	10.00	0.31	10.31	104.20		18.76	18.76	172.61	27.98	375	0.89	0.013	1.51	89.13%
PARK	MH 7	0.360							0.10	0.10	10.00	0.21	10.21	104.20		10.42	10.42	62.02	15.60	250	1.00	0.013	1.22	83.20%
MH 7	MH 8				0.120				0.23	4.88	16.90			77.90		380.15	380.15							
									0.00	0.54	16.90	0.37	17.27		133.10	71.87	452.03	580.53	27.87	750	0.25	0.013	1.27	22.14%
	MH 8					0.610			1.27	1.27	11.50													
MH 8	MH 9								0.00	6.15	17.27			76.90		472.94	472.94							
									0.00	0.54	17.27	0.23	17.50		131.40	70.96	543.89	706.40	21.72	750	0.37	0.013	1.55	23.01%
MH 9	MH 20				0.060				0.12	6.27	17.50			76.30		478.40	478.40							
									0.00	0.54	17.50	0.58	18.08		130.30	70.36	548.76	819.98	51.50	825	0.30	0.013	1.49	33.08%
CB 10	MH 101				0.100				0.19	0.19	10.00	0.15	10.15	104.20		19.80	19.80	72.58	20.33	200	4.50	0.013	2.24	72.72%
CB 102	MH 101				0.130				0.25	0.25	10.00	0.10	10.10	104.20		26.05	26.05	83.80	16.02	200	6.00	0.013	2.58	68.91%
MH 101	MH 20								0.00	0.44	10.10	0.27	10.37	103.70		45.63	45.63	100.91	22.15	300	1.00	0.013	1.38	54.78%
MH 20	MH 10				0.130				0.25	6.96	18.08			74.80		520.61	520.61							
									0.00	0.54	18.08	0.45	18.53		127.70	68.96	589.57	819.98	40.50	825	0.30	0.013	1.49	28.10%
MH 10	MH 11								0.00	6.96	18.53			73.60		512.26	512.26							
									0.00	0.54	18.53	0.08	18.61		125.80	67.93	580.19	1,527.39	12.48	825	1.04	0.013	2.77	62.01%
MH 11	MH 13								0.00	6.96	18.61			73.50		511.56	511.56	0.00						
									0.00	0.54	18.61	0.28	18.89		125.50	67.77	579.33	1,037.39	32.06	825	0.48	0.013	1.88	44.16%
MH 13	MH 14								0.00	6.96	18.89			72.80		506.69	506.69							
									0.00	0.54	18.89	0.43	19.32		124.30	67.12	573.81	886.20	41.69	825	0.35	0.013	1.61	35.25%
CB 21	MH 200				0.140				0.27	0.27	10.00	0.34	10.34	104.20		28.13	28.13	34.21	21.47	200	1.00	0.013	1.06	17.77%
ECB 1	MH 200			0.020					0.02	0.02	10.00	0.10	10.10	104.20		2.08	2.08	62.02	7.29	250	1.00	0.013	1.22	96.64%
RYCB 22	MH 200			0.070					0.06	0.06	15.00	0.24	15.24	83.60		5.02	5.02	34.21	14.99	200	1.00	0.013	1.06	85.34%
GAR 5	MH 200								0.00	0.00	10.00			104.20		0.00	0.00							
							0.030		0.07	0.07	10.00	0.03	10.03		178.60	12.50	12.50	34.21	2.10	200	1.00	0.013	1.06	63.46%

Q = 2.78AIC, where:
Q = Peak Flow in Litres per Second (l/s)
A = Area in Hectares (ha.)
I = Rainfall Intensity in Millimeters per Hour (mm/hr)

I=998.071/(TC+6.053)^0.814

IBI GROUP

IBI Group
400 - 333 Preston Street
Ottawa, ON
K1S 5N4

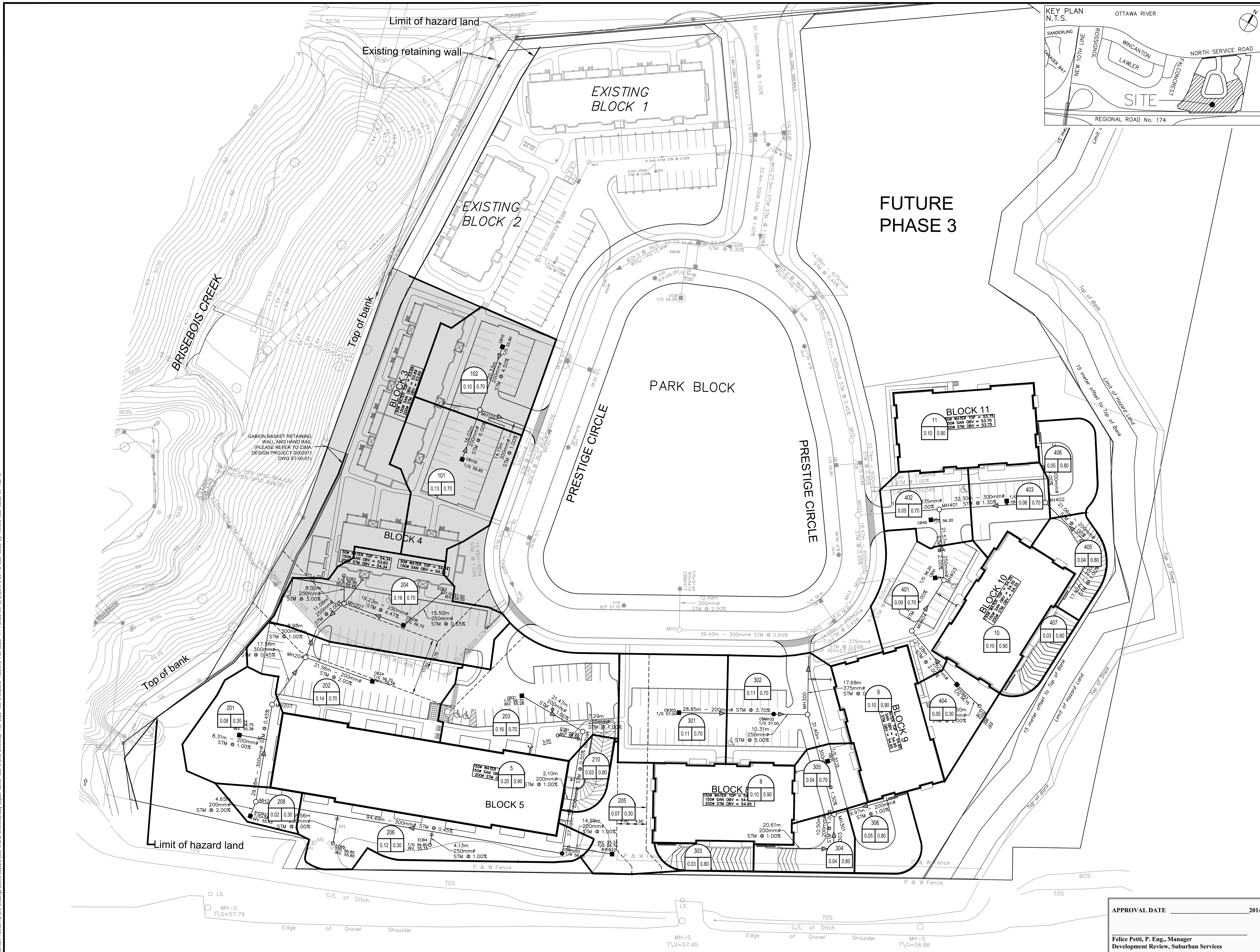
STORM SEWER DESIGN SHEET
PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

		AREA (Ha)									DESIGN FLOW							SEWER DATA						
FROM MH	TO MH	C= 0.10	C= 0.20	C= 0.30	C= 0.70	C= 0.75	C= 0.80	C= 0.90	INDIV. 2.78AC	CUM. 2.78AC	INLET (min)	TIME IN PIPE	TOTAL	$i_{5\text{-year}}$ (mm/hr)	$i_{100\text{-year}}$ (mm/hr)	PEAK FLOW (L/s) IND	PEAK FLOW (L/s) TOTAL	CAP. (L/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	n	VEL. (m/s)	AVAIL. CAP. (%)
MH 200	CBMH 201								0.00	0.35	15.24			82.80		28.98	28.98							
									0.00	0.07	15.24	0.72	15.96		141.60	9.91	38.89	43.88	37.59	250	0.50	0.013	0.87	11.37%
CBMH 201	MH 202								0.00	0.35	15.96			80.60		28.21	28.21							
				0.120					0.10	0.17	15.96	1.70	17.66		137.80	23.43	51.64	67.64	94.49	300	0.45	0.013	0.93	23.66%
RYCB 23	MH 202			0.020					0.02	0.02	15.00	0.05	15.05	83.60		1.67	1.67	48.38	4.65	200	2.00	0.013	1.49	96.54%
RYCB 24	MH 202			0.080					0.07	0.07	15.00	0.13	15.13	83.60		5.85	5.85	34.21	8.31	200	1.00	0.013	1.06	82.90%
MH 202	MH 203								0.00	0.44	17.66			75.80		33.35	33.35							
									0.00	0.17	17.66	0.54	18.20		129.60	22.03	55.38	67.64	29.98	300	0.45	0.013	0.93	18.12%
MH 203	MH 204								0.00	0.44	18.20			74.50		32.78	32.78							
									0.00	0.17	18.20	0.32	18.51		127.20	21.62	54.40	67.64	17.58	300	0.45	0.013	0.93	19.57%
CB 24	MH 204				0.140				0.27	0.27	10.00	0.24	10.24	104.20		28.13	28.13	48.38	21.56	200	2.00	0.013	1.49	41.85%
MH 204	MH 14								0.00	0.71	18.51			73.70		52.33	52.33							
									0.00	0.17	18.51	0.11	18.62		125.90	21.40	73.73	100.91	8.98	300	1.00	0.013	1.38	26.94%
CB 206	MH 207				0.210				0.41	0.41	10.00	0.14	10.14	104.20		42.72	42.72	72.35	19.23	200	4.47	0.013	2.23	40.95%
MH 207	MH 14								0.00	0.41	10.14	0.11	10.25	103.40		42.39	42.39	87.71	11.08	250	2.00	0.013	1.73	51.67%
MH 14	MH 15								0.00	8.08	19.32			71.80		580.14	580.14							
									0.00	0.71	19.32	0.18	19.50		122.60	87.05	667.19	1,519.67	29.14	825	1.03	0.013	2.75	56.10%
MH 15	HW								0.00	8.08	19.50			71.40		576.91	576.91							
									0.00	0.71	19.50	0.18	19.68		121.90	86.55	663.46	1,519.67	29.14	825	1.03	0.013	2.75	56.34%
		0.360	0.270	0.360	1.910	1.510	0.270	0.400		9.02														

Q = 2.78AIC, where:
Q = Peak Flow in Litres per Second (l/s)
A = Area in Hectares (ha.)
I = Rainfall Intensity in Millimeters per Hour (mm/hr)

I=998.071/(TC+6.053)^0.814



LEGEND :

- 406 — AREA IDENTIFICATION
- 0.80 — RUNOFF COEFFICIENT
- 0.03 — AREA IN HECTARES
- ⇨ MAJOR FLOW ROUTE
- → MINOR FLOW ROUTE

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8	REVISED PER CITY COMMENTS	RPK	14:02:06
7	REVISED PER CITY COMMENTS	RPK	13:11:26
6	REVISED BLOCK 5	RPK	13:08:19
5	RE-ISSUED FOR SITE PLAN APPROVAL	TRB	12:11:19
4	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12:10:19
3	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12:08:27
2	ISSUED FOR SITE PLAN APPROVAL	RPK	12:04:12
1	ISSUED FOR REVIEW	RPK	12:03:07

LE GROUPE BRIGIL CONSTRUCTION

IBI GROUP
333 Preston Street
Tower 1, Suite 400
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Project Title
PETRIE'S LANDING II
PHASE 2

LICENSED PROFESSIONAL ENGINEER
R.P. KENNEDY
100086734
2014/02/06
PROVINCE OF ONTARIO

Drawing Title
STORM DRAINAGE
AREA PLAN

Scale
1:500

Design	Date
RPK	FEB. 2012
Drawn	**Checked**
DD	TRB
Project No.	**Drawing No.**
31464	500

APPROVAL DATE ______________ 2014

Felice Petti, P. Eng., Manager
Development Review, Suburban Services

11.1 Brisbois Creek

11.1.1 Quantity Control

On-site detention storages consisting of parking lot and rooftop storage for all future commercial/business park developments are required to ensure that capacities of culverts at Hwy. 17 and the North Service Road are not exceeded. The release rate for the on-site storage is the 5 year post-development peak flow which is 150 l/s/ha. The required storage volume for quantity control is 160 m^3/ha.

For mitigation of possible reductions in baseflows, roof drains should be discharged on grassed areas or into a drainage pit. Recharge of approximately two-thirds of the yearly average rainfall from roof areas would be sufficient to balance hard surface recharge loss. During the detailed design, however, the natural groundwater baseflow from the surficial sands should be verified to assess what ultimate mitigation measures, if any, are required.

11.1.2 Quality Control

The storage volume for quality control required in the valley upstream of the NSR is 5,300 m^3. Figure 11.2 gives the stage-storage characteristics of the existing valley.

The proposed pond will have a permanent pool about 1.2 m deep near the outlet. The active storage volume for quality control of 5,300 m^3 is available at elevation 47.3 m. The outlet of the quality control storage is to be sized to give a detention time of 72 hours in accordance with MNR's guidelines.

To avoid excessive velocities through the pond, a 1.8 m x 3.5 m bypass sewer as shown in Figures 11.3 and 11.4 or an increase in the cross-sectional area of the pond (Figures D3.3 and D3.4) is proposed. The preferred option will be determined at the detailed design stage.

IBI GROUP 333 PRESTON STREET OTTAWA, ON K1S 5N4	**PROJECT:** Petrie's Landing II - 2 **DATE:** 2013-11-28 **FILE:** 31464.5.7 **REV #:** 4 **DESIGNED BY:** RPK **CHECKED BY:** TRB

STORMWATER MANAGEMENT

Formulas and Descriptions

i_{5yr} = 1:5 year Intensity = 998.071 / $(T_c+6.053)^{0.814}$
i_{10yr} = 1:10 year Intensity = 1174.184 / $(T_c+6.014)^{0.816}$
i_{100yr} = 1:100 year Intensity = 1735.688 / $(T_c+6.014)^{0.820}$
T_c = Time of Concentration (min)
C = Average Runoff Coefficient
A = Area (Ha)
Q = Flow = 2.78CiA (L/s)

Maximum Allowable Release Rate

Site Area

Area =	2.91	Ha

Restricted Flowrate (based on "Servicing Design Brief - Petrie's Landing II" 2010-03-15)

$Q_{restricted}$ =	361.87	L/s

Uncontrolled Release (Q = 2.78CiA)
C = 0.30
100-year design flow
T_c = 20 min
$A_{uncontrolled}$ = 0.55 Ha

$Q_{uncontrolled}$ =	55.02	L/s

Garage Ramps (Q = 2.78CiA)
C = 0.80
100-year design flow
T_c = 10 min
A_{garage} = 0.27 Ha

Q_{garage} =	107.22	L/s

Maximum Allowable Release Rate
$Q_{max\ allowable} = Q_{restricted} - Q_{uncontrolled} - Q_{garage}$

$Q_{max\ allowable}$ =	199.62	L/s

Total Proposed Release Rate
(not including $Q_{uncontrolled} + Q_{garage}$)

$Q_{proposed}$ =	155.00	L/s

MODIFIED RATIONAL METHOD (100-Year & 5-Year Ponding)

Drainage Area	***101***
Area (Ha)	0.130
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
10	178.56	45.17	12.00	33.17	19.90	2.5	173.95	44.01	12.00	32.01	4.80	
15	142.89	36.15	12.00	24.15	21.73	5	141.18	35.72	12.00	23.72	7.11	
20	119.95	30.35	12.00	18.35	22.01	7.5	119.59	30.25	12.00	18.25	8.21	
25	103.85	26.27	12.00	14.27	**21.41**	10	104.19	26.36	12.00	14.36	**8.62**	**Required Storage**
30	91.87	23.24	12.00	11.24	20.23	12.5	92.61	23.43	12.00	11.43	8.57	
35	82.58	20.89	12.00	8.89	18.67	15	83.56	21.14	12.00	9.14	8.22	
40	75.15	19.01	12.00	7.01	16.82	17.5	76.26	19.29	12.00	7.29	7.66	
45	69.05	17.47	12.00	5.47	14.76	20	70.25	17.77	12.00	5.77	6.93	

Storage (m^3)

Overflow	**Required**	**Available**	**Balance**	
0.00	21.41	31.74	0.00	overflows to Area 102

Drainage Area	***102***
Area (ha)	0.100
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
0	398.62	77.57	12.00	65.57	0.00	0	230.48	44.85	12.00	32.85	0.00	
5	242.70	47.23	12.00	35.23	10.57	2.5	173.95	33.85	12.00	21.85	3.28	
10	178.56	34.75	12.00	22.75	13.65	5	141.18	27.47	12.00	15.47	4.64	
15	142.89	27.81	12.00	15.81	**14.23**	7.5	119.59	23.27	12.00	11.27	**5.07**	**Required Storage**
20	119.95	23.34	12.00	11.34	13.61	10	104.19	20.28	12.00	8.28	4.97	
25	103.85	20.21	12.00	8.21	12.31	12.5	92.61	18.02	12.00	6.02	4.52	
30	91.87	17.88	12.00	5.88	10.58	15	83.56	16.26	12.00	4.26	3.83	
35	82.58	16.07	12.00	4.07	8.55	17.5	76.26	14.84	12.00	2.84	2.98	

Storage (m^3)

Overflow	**Required**	**Available**	**Balance**	
0.00	14.23	38.79	0.00	overflows to Prestige Circle

Drainage Area	***201***
Area (Ha)	0.080
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
7	211.67	14.12	6.00	8.12	3.41	2	182.69	12.19	6.00	6.19	0.74	
8	199.20	13.29	6.00	7.29	3.50	3	166.09	11.08	6.00	5.08	0.91	
9	188.25	12.56	6.00	6.56	3.54	4	152.51	10.18	6.00	4.18	1.00	
10	178.56	11.91	6.00	5.91	**3.55**	5	141.18	9.42	6.00	3.42	**1.03**	**Required Storage**
11	169.91	11.34	6.00	5.34	3.52	6	131.57	8.78	6.00	2.78	1.00	
12	162.13	10.82	6.00	4.82	3.47	7	123.30	8.23	6.00	2.23	0.94	
13	155.11	10.35	6.00	4.35	3.39	8	116.11	7.75	6.00	1.75	0.84	
14	148.72	9.92	6.00	3.92	3.30	9	109.79	7.33	6.00	1.33	0.72	

Storage (m^3)

Overflow	**Required**	**Available**	**Balance**	
0.00	3.55	27.91	0.00	overflows to Brisebois Creek

Drainage Area	202		
Area (ha)	0.140		
C =	0.70	Restricted Flow Q_r (L/s)=	15.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
0	398.62	108.60	15.00	93.60	0.00	6	131.57	35.84	15.00	20.84	7.50	
5	242.70	66.12	15.00	51.12	15.34	7	123.30	33.59	15.00	18.59	7.81	
10	178.56	48.65	15.00	33.65	20.19	8	116.11	31.63	15.00	16.63	7.98	
15	142.89	38.93	15.00	23.93	**21.54**	9	109.79	29.91	15.00	14.91	**8.05**	**Required Storage**
20	119.95	32.68	15.00	17.68	21.22	10	104.19	28.39	15.00	13.39	8.03	
25	103.85	28.29	15.00	13.29	19.94	11	99.19	27.02	15.00	12.02	7.94	
30	91.87	25.03	15.00	10.03	18.05	12	94.70	25.80	15.00	10.80	7.78	
35	82.58	22.50	15.00	7.50	15.75	13	90.63	24.69	15.00	9.69	7.56	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	21.54	82.61	0.00	overflows to Area 203

Drainage Area	203		
Area (ha)	0.160		
C =	0.70	Restricted Flow Q_r (L/s)=	15.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	75.57	15.00	60.57	18.17	2.5	173.95	54.16	15.00	39.16	5.87	
10	178.56	55.60	15.00	40.60	24.36	5	141.18	43.96	15.00	28.96	8.69	
15	142.89	44.49	15.00	29.49	26.54	7.5	119.59	37.23	15.00	22.23	10.01	
20	119.95	37.35	15.00	22.35	**26.82**	10	104.19	32.44	15.00	17.44	**10.46**	**Required Storage**
25	103.85	32.33	15.00	17.33	26.00	12.5	92.61	28.84	15.00	13.84	10.38	
30	91.87	28.60	15.00	13.60	24.49	15	83.56	26.02	15.00	11.02	9.91	
35	82.58	25.71	15.00	10.71	22.49	17.5	76.26	23.75	15.00	8.75	9.18	
40	75.15	23.40	15.00	8.40	20.15	20	70.25	21.87	15.00	6.87	8.25	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	26.82	67.07	0.00	overflows to Prestige Circle

Drainage Area	204		
Area (ha)	0.160		
C =	0.70	Restricted Flow Q_r (L/s)=	15.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	75.57	15.00	60.57	18.17	8	116.11	36.15	15.00	21.15	10.15	
10	178.56	55.60	15.00	40.60	24.36	9	109.79	34.19	15.00	19.19	10.36	
15	142.89	44.49	15.00	29.49	26.54	10	104.19	32.44	15.00	17.44	10.46	
20	119.95	37.35	15.00	22.35	**26.82**	11	99.19	30.88	15.00	15.88	**10.48**	**Required Storage**
25	103.85	32.33	15.00	17.33	26.00	12	94.70	29.48	15.00	14.48	10.43	
30	91.87	28.60	15.00	13.60	24.49	13	90.63	28.22	15.00	13.22	10.31	
35	82.58	25.71	15.00	10.71	22.49	14	86.93	27.07	15.00	12.07	10.14	
40	75.15	23.40	15.00	8.40	20.15	15	83.56	26.02	15.00	11.02	9.91	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	26.82	102.49	0.00	overflows to Prestige Circle

Drainage Area	205
Area (ha)	0.070
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	14.17	6.00	8.17	2.45	1	203.51	11.88	6.00	5.88	0.35	
6	226.01	13.19	6.00	7.19	2.59	2	182.69	10.67	6.00	4.67	0.56	
7	211.67	12.36	6.00	6.36	2.67	3	166.09	9.70	6.00	3.70	0.67	
8	199.20	11.63	6.00	5.63	**2.70**	4	152.51	8.90	6.00	2.90	**0.70**	Required Storage
9	188.25	10.99	6.00	4.99	2.69	5	141.18	8.24	6.00	2.24	0.67	
10	178.56	10.42	6.00	4.42	2.65	6	131.57	7.68	6.00	1.68	0.61	
11	169.91	9.92	6.00	3.92	2.59	7	123.30	7.20	6.00	1.20	0.50	
12	162.13	9.47	6.00	3.47	2.50	8	116.11	6.78	6.00	0.78	0.37	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	2.70	4.26	0.00	overflows to ditch

Drainage Area	206
Area (ha)	0.120
C =	0.30

Restricted Flow Q_r (L/s)= 17.87*

**** 100-year unrestricted flow collected rear yard perforated pipe network***

Drainage Area	208
Area (ha)	0.020
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
0	398.62	6.65	6.00	0.65	**0.00**	0	230.48	3.84	6.00	-2.16	**0.00**	Required Storage
1	351.38	5.86	6.00	-0.14	-0.01	1	203.51	3.39	6.00	-2.61	-0.16	
2	315.00	5.25	6.00	-0.75	-0.09	2	182.69	3.05	6.00	-2.95	-0.35	
3	286.05	4.77	6.00	-1.23	-0.22	3	166.09	2.77	6.00	-3.23	-0.58	
4	262.41	4.38	6.00	-1.62	-0.39	4	152.51	2.54	6.00	-3.46	-0.83	
5	242.70	4.05	6.00	-1.95	-0.59	5	141.18	2.35	6.00	-3.65	-1.09	
6	226.01	3.77	6.00	-2.23	-0.80	6	131.57	2.19	6.00	-3.81	-1.37	
7	211.67	3.53	6.00	-2.47	-1.04	7	123.30	2.06	6.00	-3.94	-1.66	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	0.00	4.41	0.00	overflows to ditch

Drainage Area	305										
Area (ha)	0.040										
C =	0.70	Restricted Flow Q_r (L/s)=		6.00							
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***	***T_c Variable (min)***	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
5	242.70	18.89	6.00	12.89	3.87	3	166.09	12.93	6.00	6.93	1.25
7.5	205.22	15.97	6.00	9.97	4.49	4	152.51	11.87	6.00	5.87	1.41
10	178.56	13.90	6.00	7.90	4.74	5	141.18	10.99	6.00	4.99	1.50
12.5	158.53	12.34	6.00	6.34	**4.76**	6	131.57	10.24	6.00	4.24	**1.53**
15	142.89	11.12	6.00	5.12	4.61	7	123.30	9.60	6.00	3.60	1.51
17.5	130.31	10.14	6.00	4.14	4.35	8	116.11	9.04	6.00	3.04	1.46
20	119.95	9.34	6.00	3.34	4.00	9	109.79	8.55	6.00	2.55	1.38
22.5	111.26	8.66	6.00	2.66	3.59	10	104.19	8.11	6.00	2.11	1.27

Required Storage

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	4.76	24.70	0.00	overflows to Area 302

Drainage Area	302										
Area (ha)	0.220										
C =	0.70	Restricted Flow Q_r (L/s)=		20.00							
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***	***T_c Variable (min)***	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
5	242.70	103.91	20.00	83.91	25.17	8	116.11	49.71	20.00	29.71	14.26
10	178.56	76.44	20.00	56.44	33.87	9	109.79	47.00	20.00	27.00	14.58
15	142.89	61.18	20.00	41.18	37.06	10	104.19	44.61	20.00	24.61	14.76
20	119.95	51.35	20.00	31.35	**37.62**	11	99.19	42.47	20.00	22.47	**14.83**
25	103.85	44.46	20.00	24.46	36.69	12	94.70	40.54	20.00	20.54	14.79
30	91.87	39.33	20.00	19.33	34.80	13	90.63	38.80	20.00	18.80	14.66
35	82.58	35.35	20.00	15.35	32.24	14	86.93	37.22	20.00	17.22	14.46
40	75.15	32.17	20.00	12.17	29.21	15	83.56	35.77	20.00	15.77	14.20

Required Storage

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	37.62	148.18	0.00	overflows to Prestige Circle

Drainage Area	401										
Area (ha)	0.090										
C =	0.70	Restricted Flow Q_r (L/s)=		12.00							
T_c Variable (min)	***i_{100yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{100yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 100yr (m^3)***	***T_c Variable (min)***	***i_{5yr} (mm/hour)***	***Peak Flow Q_p=2.78xCi$_{5yr}$A (L/s)***	***Q_r (L/s)***	***Q_p-Q_r (L/s)***	***Volume 5yr (m^3)***
0	398.62	69.81	12.00	57.81	0.00	0	230.48	40.37	12.00	28.37	0.00
5	242.70	42.51	12.00	30.51	9.15	2.5	173.95	30.47	12.00	18.47	2.77
10	178.56	31.27	12.00	19.27	11.56	5	141.18	24.73	12.00	12.73	3.82
15	142.89	25.03	12.00	13.03	**11.72**	7.5	119.59	20.94	12.00	8.94	**4.03**
20	119.95	21.01	12.00	9.01	10.81	10	104.19	18.25	12.00	6.25	3.75
25	103.85	18.19	12.00	6.19	9.28	12.5	92.61	16.22	12.00	4.22	3.17
30	91.87	16.09	12.00	4.09	7.36	15	83.56	14.63	12.00	2.63	2.37
35	82.58	14.46	12.00	2.46	5.17	17.5	76.26	13.36	12.00	1.36	1.42

Required Storage

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	11.72	24.95	0.00	overflows to Area 402

Drainage Area	403		
Area (ha)	0.060		
C =	0.70	Restricted Flow Q_r (L/s)=	12.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)	
0	398.62	46.54	12.00	34.54	0.00	1	203.51	23.76	12.00	11.76	0.71	
2.5	299.75	35.00	12.00	23.00	3.45	2	182.69	21.33	12.00	9.33	1.12	
5	242.70	28.34	12.00	16.34	4.90	3	166.09	19.39	12.00	7.39	1.33	
7.5	205.22	23.96	12.00	11.96	**5.38**	4	152.51	17.81	12.00	5.81	**1.39**	**Required Storage**
10	178.56	20.85	12.00	8.85	5.31	5	141.18	16.48	12.00	4.48	1.35	
12.5	158.53	18.51	12.00	6.51	4.88	6	131.57	15.36	12.00	3.36	1.21	
15	142.89	16.68	12.00	4.68	4.22	7	123.30	14.40	12.00	2.40	1.01	
17.5	130.31	15.22	12.00	3.22	3.38	8	116.11	13.56	12.00	1.56	0.75	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	5.38	24.95	0.00	overflows to Area 402

Drainage Area	402		
Area (ha)	0.050		
C =	0.70	Restricted Flow Q_r (L/s)=	12.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)	
0	398.62	38.79	12.00	26.79	0.00	0	230.48	22.43	12.00	10.43	0.00	
2.5	299.75	29.17	12.00	17.17	2.57	1	203.51	19.80	12.00	7.80	0.47	
5	242.70	23.62	12.00	11.62	3.48	2	182.69	17.78	12.00	5.78	0.69	
7.5	205.22	19.97	12.00	7.97	**3.59**	3	166.09	16.16	12.00	4.16	**0.75**	**Required Storage**
10	178.56	17.37	12.00	5.37	3.22	4	152.51	14.84	12.00	2.84	0.68	
12.5	158.53	15.43	12.00	3.43	2.57	5	141.18	13.74	12.00	1.74	0.52	
15	142.89	13.90	12.00	1.90	1.71	6	131.57	12.80	12.00	0.80	0.29	
17.5	130.31	12.68	12.00	0.68	0.71	7	123.30	12.00	12.00	0.00	0.00	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	3.59	24.96	0.00	overflows to Prestige Circle

Drainage Area	404		
Area (ha)	0.050		
C =	0.30	Restricted Flow Q_r (L/s)=	6.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)	
2	315.00	13.14	6.00	7.14	0.86	0	230.48	9.61	6.00	3.61	0.00	
3	286.05	11.93	6.00	5.93	1.07	1	203.51	8.49	6.00	2.49	0.15	
4	262.41	10.94	6.00	4.94	1.19	2	182.69	7.62	6.00	1.62	**0.19**	
5	242.70	10.12	6.00	4.12	**1.24**	3	166.09	6.93	6.00	0.93	0.17	**Required Storage**
6	226.01	9.42	6.00	3.42	1.23	4	152.51	6.36	6.00	0.36	0.09	
7	211.67	8.83	6.00	2.83	1.19	5	141.18	5.89	6.00	-0.11	-0.03	
8	199.20	8.31	6.00	2.31	1.11	6	131.57	5.49	6.00	-0.51	-0.18	
9	188.25	7.85	6.00	1.85	1.00	7	123.30	5.14	6.00	-0.86	-0.36	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	1.24	1.62	0.00	overflows to Creek

GARAGE RAMPS

Drainage Area	*210*		
Area (ha)	0.030		
C =	0.80	Restricted Flow Q_r (L/s)=	11.91 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	*303*		
Area (ha)	0.030		
C =	0.80	Restricted Flow Q_r (L/s)=	11.91 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	*304*		
Area (ha)	0.040		
C =	0.80	Restricted Flow Q_r (L/s)=	15.88 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	*306*		
Area (ha)	0.050		
C =	0.80	Restricted Flow Q_r (L/s)=	19.86 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	*405*		
Area (ha)	0.040		
C =	0.80	Restricted Flow Q_r (L/s)=	15.88 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	*406*		
Area (ha)	0.050		
C =	0.80	Restricted Flow Q_r (L/s)=	19.86 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	*407*		
Area (ha)	0.030		
C =	0.80	Restricted Flow Q_r (L/s)=	11.91 *

**** 100-year unrestricted flow collected by garage drain***

BUILDINGS

Building	5		
Area (ha)	0.200		
C =	0.90	Restricted Flow Q_r (L/s)=	20.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	121.45	20.00	101.45	30.43	5	141.18	70.65	20.00	50.65	15.19	
10	178.56	89.35	20.00	69.35	41.61	7.5	119.59	59.84	20.00	39.84	17.93	
15	142.89	71.50	20.00	51.50	46.35	10	104.19	52.14	20.00	32.14	19.28	
20	119.95	60.02	20.00	40.02	**48.03**	12.5	92.61	46.34	20.00	26.34	**19.76**	**Required Storage**
25	103.85	51.97	20.00	31.97	47.95	15	83.56	41.81	20.00	21.81	19.63	
30	91.87	45.97	20.00	25.97	46.75	17.5	76.26	38.16	20.00	18.16	19.07	
35	82.58	41.32	20.00	21.32	44.78	20	70.25	35.15	20.00	15.15	18.18	
40	75.15	37.60	20.00	17.60	42.25	22.5	65.20	32.63	20.00	12.63	17.05	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	48.03	375.00	0.00	controlled on roof

Building	8		
Area (ha)	0.100		
C =	0.90	Restricted Flow Q_r (L/s)=	10.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	24.01	168.75	0.00	controlled on roof

Building	9		
Area (ha)	0.100		
C =	0.90	Restricted Flow Q_r (L/s)=	10.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	24.01	168.75	0.00	controlled on roof

Building	**10**
Area (ha)	0.100
C =	0.90

Restricted Flow Q_r (L/s)= 10.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	**Required**	**Available**	**Balance**	
0.00	24.01	168.75	0.00	controlled on roof

Building	**11**
Area (ha)	0.100
C =	0.90

Restricted Flow Q_r (L/s)= 10.00

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)	T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	**Required**	**Available**	**Balance**	
0.00	24.01	168.75	0.00	controlled on roof

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Multi-Storey Buildings
Blocks 6, 7 and 8 - Petrie's Landing II
8466 Jeanne D'Arc Boulevard
Ottawa, Ontario

Prepared For

Construction Brigil

May 24, 2017

Report: PG4112-1

Paterson Group Inc.
Consulting Engineers
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Appendices

Appendix 1 Soil Profile and Test Data Sheets
Symbols and Terms
Analytical Testing Results

Appendix 2 Figure 1 - Key Plan
Drawing PG4112-1 - Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by Construction Brigil to conduct a geotechnical investigation for Blocks 6, 7 and 8 at Petrie's Landing II residential development located at 8466 Jeanne D'Arc Boulevard in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- determine the subsoil and groundwater conditions at this site by means of test holes and existing soils information.

- provide geotechnical recommendations for the 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. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

It is understood that the current phases of the residential development will consist of three (3) residential multi-storey buildings with slab-on-grade construction, pathways, landscaping and paved parking areas with local access roadways and will be serviced by municipal services.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on April 24 and 25, 2017 which consisted of extending a total of six (6) boreholes (BH 1-17 to BH 6-17) to a maximum depth of 30.4 m below existing ground surface. The borehole locations were distributed in a manner to provide general coverage of the subject site at the proposed buildings footprints area and taking into consideration site features. The locations of the boreholes are shown on Drawing PG4112-1 - Test Hole Location Plan included in Appendix 2.

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

Sampling and In Situ Testing

Soil samples were recovered from a 50 mm diameter split-spoon or the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our 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.

Standard Penetration Tests (SPT) were conducted and 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 sample 300 mm into the soil after the initial penetration of 150 mm using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

Dynamic Cone Penetration Tests (DCPT) were also carried out at BH 3-17 location. The DCPT is a continuous test which utilized a dropping weight to drive a 45 degree cone and rod into the ground. The number of blows for each 300 mm penetration was recorded. The rods consisted of the same 44.4 mm diameter rods used for the SPT, and the drive weight of fall and the hammer weight were the same as the SPT.

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 boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

3.2 Field Survey

The borehole locations and ground surface elevations at the borehole locations were provided by Annis, O'Sullivan Vollebekk Ltd. The borehole locations and the ground surface elevation at the borehole locations are presented on Drawing PG4112-1 - 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.

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 sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The results are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject property is bordered to the north by Jeanne D'Arc Boulevard North, to the east by a treed area and Taylor creek, to the south by Regional Road 174, and to the west by Prestige Circle and two (2) residential dwellings located within the southwest portion of the site.

The site is relatively flat and grass covered. Some existing fill piles containing organic and construction debris were observed near the central portion of the site adjacent to Prestige Circle. The site trailer was located near the south side of Prestige Circle.

4.2 Subsurface Profile

Generally, the soil conditions encountered at the test holes locations consist of topsoil or fill overlying silty clay deposit. The silty clay deposit was not fully penetrated at any of the current borehole locations, which extended to a maximum depth of 30.4 m below existing grade.

Based on available geological mapping and previous investigations conducted by Paterson in the area, interbedded limestone and dolomite bedrock of the Gull River formation is present in this area with a drift thickness of 40 to 50 m.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profiles encountered at each test hole location.

Silty Clay

A weathered silty clay crust varying in depths between 1.8 and 3.4 m was encountered at the boreholes. In situ shear vane field testing was carried out in the lower portion of the weathered crust yielded undrained shear strength values ranging from approximately 55 to 159 kPa. These values are indicative of a stiff to very stiff consistency.

Grey silty clay which was encountered below the weathered crust at all borehole locations, did not reach refusal at a maximum depth of 30.4 m. In situ shear vane field testing carried out in the grey silty clay yielded undrained shear strength values ranging between 41 and 104 kPa. These values are indicative of a firm to stiff consistency.

4.3 Groundwater

The measured groundwater levels in the boreholes are presented in Table 1 below.

Table 1
Summary of Groundwater Level Readings

Borehole Number	Ground Elevation (m)	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-17	56.90	3.09	53.81	May 1, 2017
BH 2-17	55.71	4.69	51.02	May 1, 2017
BH 3-17	53.88	1.55	52.33	May 1, 2017
BH 4-17	53.84	dry	-	May 1, 2017
BH 5-17	52.45	4.35	48.10	May 1, 2017
BH 6-17	52.59	5.48	47.11	May 1, 2017
BH 8-07	56.10	dry	-	July 16, 2007

Note: The groundwater level at each current borehole location is referenced to the borehole ground surface elevation, as provided by Annis, O'Sullivan Vollebekk Ltd.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered satisfactory for the proposed multi-storey buildings. Based on the results of the field program, it is expected that the proposed buildings will be founded on conventional shallow footings placed on the undisturbed stiff silty clay bearing surface.

A permissible grade raise restriction is required for the subject site due to the presence of a deep silty clay deposit. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

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 organics, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building footprints, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building area should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Site-excavated soils are not suitable for use as backfill against foundation walls due to the frost heave potential of the site excavated soils below settlement sensitive areas, such as concrete sidewalks and exterior concrete entrance areas.

5.3 Foundation Design

Spread Footing Foundations

Footings founded on an undisturbed, stiff silty clay bearing surface 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 **225 kPa**.

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 the concrete for the footings.

Settlement

Footings designed using the above-noted bearing resistance value at SLS 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 silty clay or engineered fill when a plane extending down and out from the bottom edges 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 Restriction

Due to the presence of the silty clay layer, the subject site will be subjected to a permissible grade restriction. A permissible grade raise restriction of **2.0 m** is recommended for the subject site.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E** as defined in the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4.A) for the foundations considered at this site. The soils underlying the proposed shallow foundations are not susceptible to liquefaction for the local seismicity.

5.5 Slab on Grade Construction

With the removal of all topsoil and deleterious materials, within the footprint of the proposed buildings, the native soil or engineered fill surface will be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 150 mm of sub-slab fill should consist of an OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

5.6 Pavement Design

Car only parking areas, access lanes and heavy truck parking areas are anticipated at this site. The proposed pavement structures are shown in Tables 2 and 3.

Table 2 - Recommended Pavement Structure - Car Only 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 situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill

Table 3 - Recommended Pavement Structure Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, 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 98% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping 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 its load carrying capacity.

Due to the impervious nature of the subgrade materials consideration should be given to installing subdrains during the pavement construction. These drains should be installed at each catch basin, be at least 3 m long and should extend in four orthogonal directions or longitudinally when placed along a curb. Along local streets, the drains should be placed along the edges of the pavement. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls. A drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system is recommended.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

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 structure proper and require additional protection, such as soil cover of 2.1 m or a 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 cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

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.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left 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.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and 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 at least 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 compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist, not wet, silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

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 minimize 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 material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

Permit to Take Water

A temporary Ministry of the Environment and Climate Change (MOECC) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MOECC.

For typical ground or surface water volumes, being pumped during the construction phase, 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 MOECC review of the PTTW application.

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.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the 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.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) 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 is indicative of a non aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed development is located in an area of medium sensitive silty clay deposits for tree planting. It is recommended that trees placed within 4.5 m of the foundation wall consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 4.5 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum 2 m depth.

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

Swimming Pools

The in-situ soils are considered to be acceptable for swimming pools. Above ground swimming pools must be placed at least 4 m away from the residence foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❏ Review of the grading plan once available
- ❏ Observation of all subgrades prior to backfilling.
- ❏ 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 slopes 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 the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available and our recommendations when the drawings and specifications are complete.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

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 Construction Brigil or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
May 24, 2017
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng. Carlos P. Da Silva, P.Eng.

Report Distribution:

- ❏ Construction Brigil (3 copies)
- ❏ Paterson Group (1 copy)

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4112-1 - TEST HOLE LOCATION PLAN

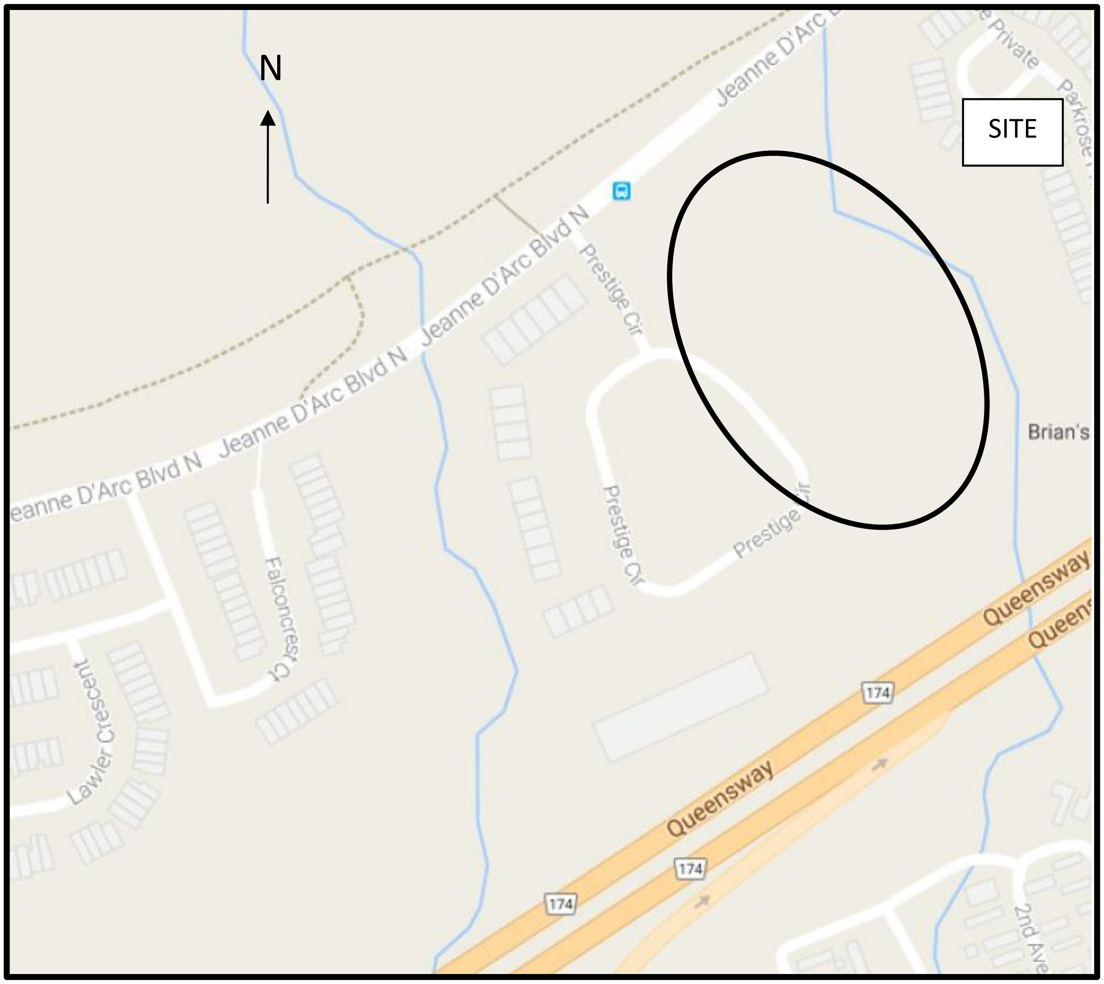
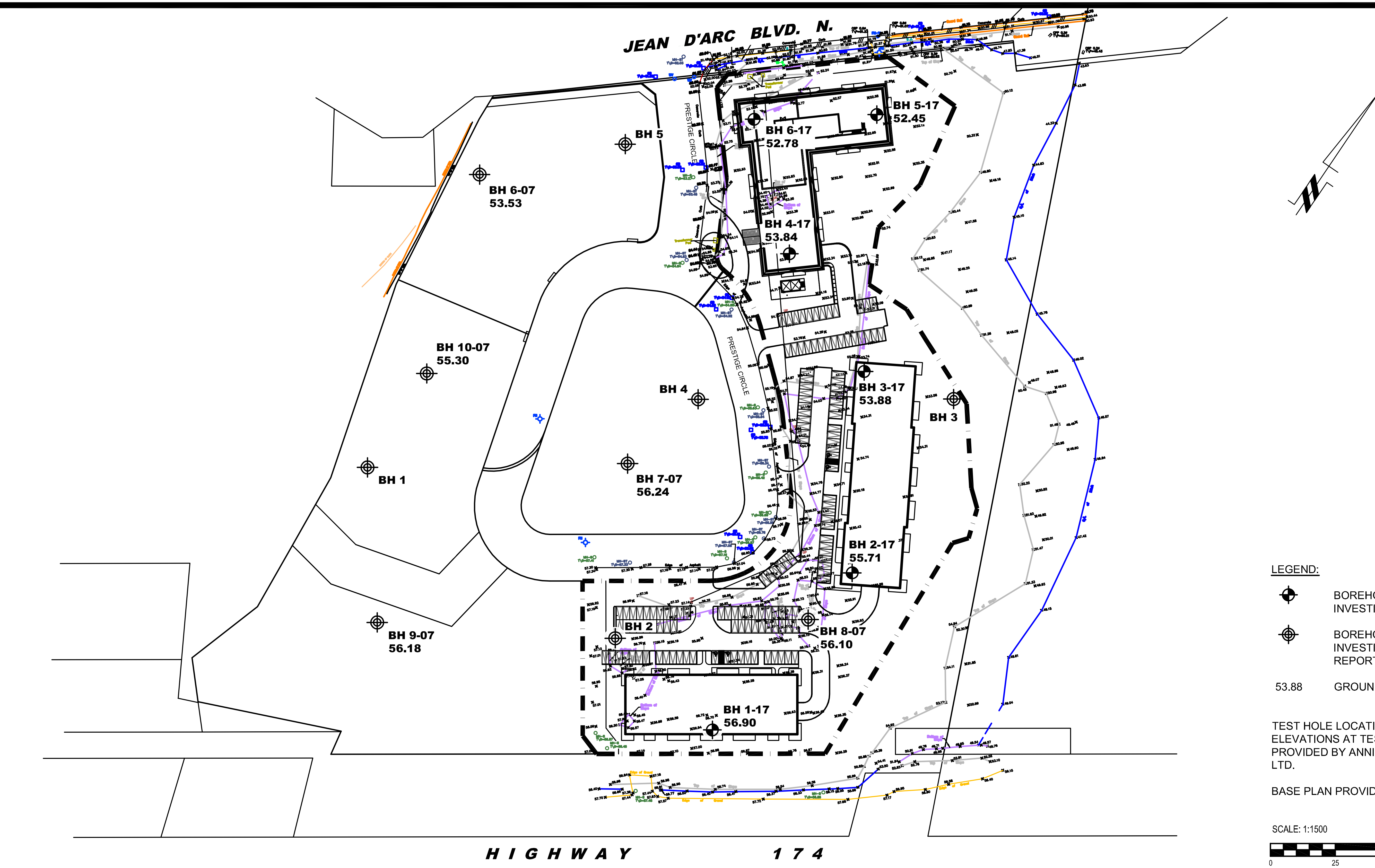


FIGURE 1

KEY PLAN



LEGEND:

BOREHOLE LOCATION, CURRENT INVESTIGATION

BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG0448

53.88 GROUND SURFACE ELEVATION (m)

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS AT TEST HOLE LOCATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

BASE PLAN PROVIDED BY NEUF ARCHITECTS.

SCALE: 1:1500

0 25 50 75 100m

patersongroup
consulting engineers

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NO.	REVISIONS	DATE	INITIAL
0			

CONTRUCTION BRIGIL

GEOTECHNICAL INVESTIGATION
PROP. MULTI-STOREY BUILDINGS - 8466 JEAN D'ARC BLVD.

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 05/2017
Drawn by: MPG	Report No.: PG4112-1
Checked by: SM	Dwg. No.: PG4112-1
Approved by: DJG	Revision No.: 0

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REVIEW COMMENTS AND RESPONSE

Appendix F

Stantec

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

January 23, 2018
File: 160401331

Attention: Mr. Jeff McEwen, P.Eng., Manager
City of Ottawa
Planning, Infrastructure and Economic Development Department
Development Review East
110 Laurier Avenue West
Ottawa ON K1P 1J1

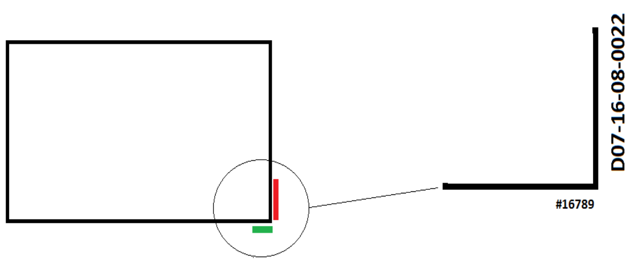
Dear Mr. McEwen

Reference: Site Plan Control Application City Comments, 8466 Jeanne-d'Arc Boulevard – File No. D07-12-17-0093

The following summarizes the Civil comments received from the City of Ottawa on the first Engineering Submission along with Stantec's responses.

A. List of Drawing(s):

General: Place on all plans; DWG #, D07 # and signature block as per sample



Use **Bold Black text**:

Your Numbers are as per the colours listed here.
DWG **15546** (place number on the bottom right)

D07 Number **D07-12-17-0093**

Signature Block – digital stamp

Reference: Site Plan Control Application City Comments, 8466 Jeanne-d'Arc Boulevard – File No. D07-12-17-0093

APPROVED ☐ REFUSED ☐

THIS______DAY OF_____________, 2017

____

JEFF MCEWEN, P.ENG, MANAGER
DEVELOPMENT REVIEW EAST,
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

R/ The drawings have been revised accordingly.

Notes and Legends, NL-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017.

6. Storm and Sanitary Sewer note # 9 should refer to S19 and not S19.1. Please revise.
R/ Note has been revised to include S19 for catch basin maintenance holes, typically S19.1 is specified for square catch basins.
7. Consider removing Note 8.
R/ Note 8 has been revised accordingly.

Existing Conditions Plan Removals Plan, EXRM-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

8. Limit of hazard land Line. Show and identify.
R/ The drawing has been revised accordingly.

Site Servicing Plan, S1SP-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

9. Minimum release rate acceptable is 6L/s. Revise the 2 CBs to be at least 6L/s each. They tend to block more frequently with anything less. The future owner

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has to call a provincially Licensed Wastewater Operator company and it is $1200.00 every time they show up to clean a CB. Please revise.
R/ The ICDs have been revised accordingly.

10. Limit of hazard Land line and 15 metre offset must be clearly identified.
R/ The drawing has been revised accordingly.

Grading Plan, GP-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

11. Limit of hazard Land line and 15 metre offset must be clearly identified.
R/ The drawing has been revised accordingly.
12. The Geotechnical Engineer is going to have to sign off on the Grading plan as it appears you are exceeding the 2.0 metre permissible grade raise in locations.
R/ A sign off letter from the Geotechnical Engineer will be provided under separate cover.
13. Check your slopes across the sidewalks at entrances to the sites. Review and revise.
R/ The drawing has been revised accordingly.
14. Private approach By-law requires that the slope from the ROW into the site be set at a maximum of 2% towards the ROW. Clearly show in the centre of the entrance the proposed % slope. Review and revise.
R/ The drawing has been revised accordingly.
15. The sanitary sewer easement located within Block 6 requires proposed grades to be set. You can't have block 6 drain to block 5. Are you prepared to have your client enter into a JUMA with CONDO Corp (Block 5) at their cost to accommodate water across 2 property owners, plus you will need an ECA as it services more than one property? Set grades so the easement surface water stays within Block 6 or slightly uncontrolled but not to the adjacent property. Revise.
R/ Storm drainage from the area adjacent to the building in Block 6 was included in the SWM calculations for Block 5. However, a subdrain system has been added on the east side of the proposed building to capture runoff from most of that area. The site storm sewer calculations have been revised to include the subject area.
16. Every HP set at the asphalt entrance to the ramp must be 300mm higher than the maximum ponding. The HP at the ramp entrance is deemed a building opening. A 300mm difference in the maximum ponding and the HP is required.

8.3.3.9 of the SDG. Please review and revise.
R/ The drawing has been revised accordingly.

17. Clearly show the slope of the ramps. Ramps steeper than 6% must be concrete and heat traced. If the intent is to have slopes greater than 6% then provide call out notes indicated ramp is concrete and Heat traced. Review and revise.
R/ The drawing has been revised accordingly.

18. Maximum grades should be 7%. Surface grades should not exceed **7%** at the rear of the buildings. Phase 3 parking; 30% will require a wall and or fence behind the parking area as it would be considered inaccessible. Provide less steep slopes and or terrace some areas. Block 7 will require a wall and a fence. Please review and revise.
R/ A toe wall has been provided behind the parking area. Surface slopes at the rear of the proposed buildings have been reduced as much as possible to match existing condition slopes while accommodating the required proposed grading in the back of the proposed buildings which requires a flat patio area.

19. The OPSD Toe Wall is going to require a detail and a Structural Stamp. Consider re-aligning the parking to conform better to existing conditions.
R/ A structural detailed signed and stamped will be provided by the Geotechnical Engineer under separate cover.

20. The proposed drainage to the Bellevue Creek was not part of the master Drainage Plan.
R/ Given the proposed site plan layout and grading restrictions to match existing grades at the right of way and at the creek, a grassed portion of the site will sheet drain towards the creek as per existing conditions. Every effort has been made to redirect some of that drainage towards the proposed site storm sewer. The areas behind the proposed buildings were assumed to sheet drain to the creek and were not included in the SWM plan for the overall site prepared by IBI in 2014 (see Drawing 500 in report excerpts in Appendix E of the Site Servicing and SWM Report).

21. The City objects to your proposal of directing major flows to the Bellevue Creek. We don't see a way whereby you could protect that discharge area from erosion along the bank portion owned by the City. Set grades so the major flow spills to the ROW. This is no different than the first phases of the development whereby they provided a retaining wall and fencing to minimize slopes to the rear.Areas uncontrolled should at least have a small swale and a large perforated pipe to minimize slope/ bank destruction.
R/ Please see response to comment 20.

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22. Block 8 has a terracing as per the legend but it is clearly too steep if you look at the proposed grades at the building and existing along the Jeanne d'Arc Blvd N. Revise accordingly.
    R/ The drawing has been revised to show the proposed slopes at various locations.
23. Proposed noise barriers or fences are to be shown on the Site Plan, Grading Plan and Landscape Plan. Review and Revise.
    R/ The grading plan has been revised to show a chain link fence along the creek as per the Site Plan and Landscape Plan.
24. The property line along the "Un-named Creek" requires a chain link fence the entire length of the property.
    R/ Please see response to comment 23.

Erosion Control Plan and Detail Sheet, EC/DS-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

25. Detail SC7.1 has a more current revision date. Revise.
    R/ The drawing has been revised accordingly.

Storm Drainage Plan, SD-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

26. No comments.

Sanitary Drainage Plan, SAN-1, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

27. No comments.

B. List of Report(s):

Site Servicing & Storm Water Management Brief, prepared by Stantec Consulting Ltd., Project # 160401331, revision 1, dated June 13, 2017

B1. Revise the report to reflect the requested changes in the previous drawing comments.
    R/ The report has been revised accordingly.

Reference: Site Plan Control Application City Comments, 8466 Jeanne-d'Arc Boulevard – File No. D07-12-17-0093

1. **SEDIMENT AND EROSION CONTROL**

The applicant has provided a sediment and erosion control plan. As part of the plan, a sediment fence is proposed at the eastern property boundary which coincides with the 15 metre setback from top of slope. While the location of the silt fencing is appropriate, Subdivision Agreement Clause #42 requires the installation of construction fencing at 15 metres from top of slope until such time that the permanent fencing is installed. Therefore, the sediment and erosion control plan needs to also incorporate the construction fencing.

R/ The drawing has been revised accordingly.

2. **STORMWATER MANAGEMENT**

The Stormwater Management plan indicates that stormwater from this site will be directed to existing storm sewers on Prestige Circle. This area is subject to a Master Drainage Plan, and water quality for this area is treated by the Brisebois Creek Stormwater Management Facility prior to outletting to the Ottawa River.

Given that the site is within an area subject to an MDP and that stormwater is being directed to existing infrastructure, the RVCA will rely on the City to ensure that the stormwater management plan is consistent with the design assumptions of the receiving storm sewers.

R/ Noted.

Regards,

STANTEC CONSULTING LTD.

Ana Paerez, P. Eng.
Water Resources Engineer
Phone: (506) 204-5856
Ana.Paerez@stantec.com

Attachment: Attachment

Reference: Site Plan Control Application City Comments, 8466 Jeanne-d'Arc Boulevard – File No. D07-12-17-0093

c. C.C.

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DRAWINGS

Appendix G