Site Servicing and Stormwater Management Brief: Home2 Hotel, 135 Lusk Street, Nepean, ON

Stantec Project No. 160401620

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1.0 INTRODUCTION

Stantec Consulting Ltd. has been retained by 2441736 Ontario Inc. to prepare the following site servicing and stormwater management (SWM) brief to satisfy the City of Ottawa Site Plan Control Application process and to address City of Ottawa reviewers' comments from 1st submission. The subject site is located in the area of West Barrhaven on 135 Lusk Street, and is bounded by Fallowfield Road to the south and east, Highway 416 to the west, and O'Keefe Court to the north (see **Figure 1** below). The subject site is within the future O'Keefe Court commercial business park and is identified as Block 7 in the *Design Brief O'Keefe Court – 416 Lands* prepared by IBI Group in 2018 (excerpts are included in **Appendix D**).

The 0.62 ha proposed developed will consist of a six-storey hotel building with 99 rooms, 89 surface parking stalls, associated access, and servicing infrastructure. The site will be serviced by existing municipal infrastructure on Lusk Street, formerly identified as Street No.1. The design is based on Mataj Architects Inc. overall site plan dated April 2022 as shown in **Appendix E**.

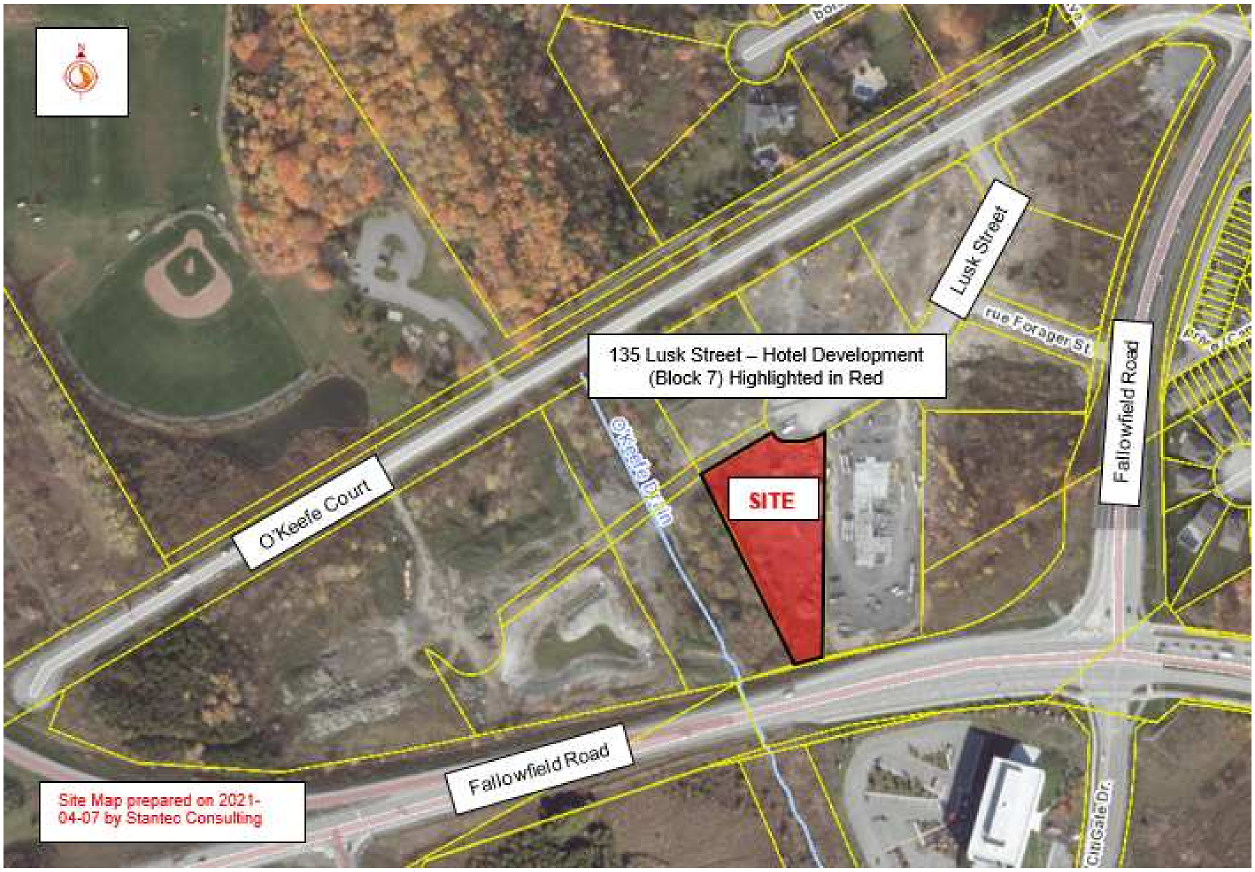


Figure 1: Site Location

1.1 OBJECTIVE

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

Criteria and constraints provided in the background reports 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 and future street design grades.
- **Water Servicing**
    - Estimate water demands to characterize the proposed feed for the proposed development which will be serviced from the existing 200 mm diameter watermain stub on the north-west end of the site.
    - 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 allowable range of 40 to 80 psi (276 to 552 kPa).
    - Under fire flow (emergency) conditions, the water distribution system is to maintain a minimum pressure greater than 20 psi (140 kPa).
- **Wastewater Servicing**
    - Define and size the sanitary sewer network which will be connected to the existing 250 mm diameter stub on the north-west end of the site.
- **Storm Sewer Servicing**
    - Define major and minor conveyance systems in conjunction with the grade control plan.
    - Maximize surface grading to meet stormwater management (SWM) storage requirements.
    - Define and size the proposed storm sewer network which will be connected to the future MH07 and the 450mm diameter storm sewer fronting the site on Lusk Street.
    - Size inlet control devices to meet the SWM allowable release rate for the site.

The accompanying drawings included in **Appendix F** at the back of this report illustrate the proposed internal servicing scheme for the site.

2.0 REFERENCES

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

- *Design Brief O'Keefe Court – 416 Lands*, IBI Group, January 2018
- *Additional Subsurface Investigation Proposed Residential and Commercial Development O'Keefe Court and Fallowfield Road, Ottawa, ON,* Kollaard Associates., March 5, 2008
- *Technical Bulletin PIEDTB -2016-01,* City of Ottawa, September 6, 2016
- *Technical Bulletin ISDTB-2014-01,* City of Ottawa, February 2014
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010

3.0 POTABLE WATER SERVICING

3.1 BACKGROUND

The proposed development is located within the City of Ottawa Barrhaven 3SW Water Pressure Zone. The proposed development will be serviced from the existing 200 mm diameter watermain stub on the north-east end of the site, which will be connected to a 305 mm diameter watermain on Lusk Street. A proposed on-site fire hydrant will provide additional fire protection to the site, augmenting the existing fire hydrant on Lusk street as shown on **Drawing SSP-1**.

The proposed six-storey hotel consists of 99 rooms and amenity areas. The building is to have a total floor area of approximately 5,895.5 m^2.

3.2 WATER DEMANDS

3.2.1 Domestic Water Demands

Water demands were calculated using the City of Ottawa Water Distribution Guidelines (July 2010) to determine the typical operating pressures expected at the building (see detailed calculations in **Appendix A**). Based on *Table 4.2* of the *Ottawa Water Distribution Design Guidelines*, a daily rate of 225 L/ bed-space/day was applied for the population of the proposed site. The average daily (AVDY) residential demand was estimated for an occupancy of 2 persons per room. Maximum day (MXDY) residential demand was determined by multiplying the AVDY demand by a factor of 2.5 and peak hourly (PKHR) residential demand was determined by multiplying the MXDY demand by a factor of 2.2. An estimated demand of 28,000 L/ha/day was applied to the proposed Indoor Amenity Space covering an estimated area of 504 m^2. The estimated demands are summarized in **Table 1** and the detailed water demand calculations provided in **Appendix A.**

Table 1: Estimated Water Demands

Demand Type	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Hotel & Amenity Area	198	0.53	0.80	1.44

1. Hotel population based on 99 rooms and 2 persons per room occupancy.

3.2.2 Fire Flow Demands

Fire flow requirements were estimated using the Fire Underwriters Survey (FUS). The proposed building is expected to be composed of non-combustible construction materials, will be fully equipped with an automatic sprinkler system conforming to NFPA 13, and will have 2-hour-rated fire separation between each floor. The fire flow requirement was calculated in accordance with FUS methodology and determined to be approximately 3,000 L/min (50.0 L/s). The FUS calculations for the proposed site are included in

Appendix A. The boundary conditions request to the City was based on both the proposed demand of 3,000 L/min (50.0 L/s) and 7,000 L/min (116.7 L/s) for the worst-case scenario for the development.

3.2.3 Boundary Conditions

The hydraulic boundary conditions provided by the City of Ottawa on February 3, 2021, illustrated in **Table 2** &

Table 3, are based on the anticipated domestic water demands and a fire flow demand of 3,000 L/min (Fire 1 - 50 L/s) and 7000 L/min (Fire 2 – 116.7 L/s), respectively for existing and zone reconfiguration conditions. The boundary conditions are also included in **Appendix A**.

Table 2: Boundary Conditions based on Existing Conditions.

Connection 1 – Lusk St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	153.9	71.2
Peak Hour	147.3	61.9
Max Day plus Fire 1	152.0	68.5
Max Day plus Fire 2	149.5	64.9

Ground Elevation = 103.8 m

Table 3: Boundary Conditions based on SUC Zone Reconfiguration.

Connection 1 – Lusk St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	151.0	67.0
Peak Hour	148.0	62.8
Max Day plus Fire 1	148.7	63.8
Max Day plus Fire 2	141.8	54.0

Ground Elevation = 103.8 m

The desired normal operating objective pressure range as per the *City of Ottawa Water Distribution Design Guidelines* is 345 kPa (50 psi) to 552kPa (80 psi) and no *less than 276kPa (40 psi)* at ground elevation. 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.

The proposed building connection grade is 104.12m. Assuming the worst-case peak hour boundary condition of 147.3m during the existing conditions scenario, the resulting peak hour pressure is 61 psi (43.2m). As the proposed building is 6-storeys, additional head loss of 5psi is accounted for the change in elevation head for every additional storey over two storeys. The minimum pressure calculated on the 6th floor was 23 psi, therefore, there is insufficient pressure to adequately service the top floors. As a result, a booster pump inside the building will be required to maintain an acceptable level of service to the higher floors. The booster pump is to be sized and designed by the building's mechanical engineer.

The maximum pressure was analysed using the basic day demands, the boundary conditions HGL of 153.9m resulted in a pressure of 71 psi (49.8m). The pressure range is within the guidelines of 50-80 psi specified in the City of Ottawa Design Guidelines for Water Distribution.

The boundary conditions provided by the City of Ottawa confirms that a fire flow rate of 7,000 L/min (116.7 L/s) can be accommodated by the proposed development and is above the required minimum residual pressure of at least 138kPa (20psi). This demonstrates that sufficient fire flow is available for the proposed development.

Based on the hydraulic analysis for the O'Keefe Court commercial business park conducted by IBI and the hydraulic boundary conditions received from the City of Ottawa, the 300 mm diameter watermain on Lusk Street can provide the anticipated fire flow requirement for the proposed building while maintaining a residual pressure of at least 138kPa (20 psi). A 200mm diameter service lateral connected to the 305 mm diameter watermain on Lusk Street will be capable of providing the anticipated domestic water demands to the lower storeys, but a booster pump will be required to maintain minimum pressures of 350 kPa (50 psi) for the upper storeys.

4.0 WASTEWATER SERVICING

The site will be serviced via an existing 250 mm diameter sanitary stub situated on the north-east end of the site (see **Drawing SSP-1**). Wastewater flows from the proposed development, referred to as Block 7, were included in the sanitary sewer design of the O'Keefe court Commercial Business Park sanitary sewer network prepared by IBI in January 2018 (see report excerpts in **Appendix D**).

The proposed 0.62 ha development will consist of a six-storey hotel building with 99 rooms, 89 surface parking stalls, and associated access infrastructure.

As illustrated on **Drawing SSP-1**, sanitary servicing for the proposed development will be provided through a 200 mm diameter sanitary service from the proposed building to the SAN 101 maintenance hole and ultimately conveyed to the existing 250 mm diameter sanitary sewer on Lusk Street.

The anticipated wastewater peak flow generated from the proposed development is summarized in **Table 4** below while the sanitary sewer design sheet is included in **Appendix B.**

Table 4: Estimated Wastewater Peak Flow

Residential/Commercial Units				Infiltration Flow (L/s)	Total Peak Flow (L/s)
# of Rooms	Population	Peak Factor	Peak Flow (L/s)		
99	198	4.0	3.21	0.17	3.38

1. Average hotel flow based on 225 L/p/day for the residential portion with full housekeeping facilities, plus 125 L/p/day for the dining room)
2. Peaking factor for residential units calculated using Harmon's formula
3. Hotel population estimated based on 2 persons/room
4. Infiltration flow based on 0.33 L/s/ha.

The sanitary sewer design for the O'Keefe court Commercial Business Park assumed an average flow of 50,000 L/ha/day, a peaking factor of 1.5 and infiltration flow of 0.28 L/s/ha, which results in a total peak flow of 0.71 L/s for the proposed site. The total estimated peak flow from the proposed site is 3.38 L/s which is higher than the value initially assumed for Block 7. However, as per the sanitary sewer design sheet prepared by IBI for the O'Keefe court Commercial Business Park included in **Appendix D**, the residual capacity of the downstream sewers is at least 21.9 L/s and is only 29% full and as such, the residual capacity in the existing sewer should be able to accommodate the proposed development. Consultation with the City has been initiated to confirm that there is sufficient capacity in the downstream sanitary sewer to accommodate the site (**See Appendix B.2**). Detailed sanitary sewage calculations are also included in **Appendix B.1**.

4.1 SANITARY SEWER DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the MECP's Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewer service:

- 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
- Minimum size – 200mm dia. for residential areas, 250mm for commercial areas
- 2.0 persons/room occupancy
- Harmon's Formula for Peak Factor – Max = 4.0
- Extraneous Flow Allowance – 0.33 L/s/ha
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m

5.0 STORMWATER MANAGEMENT AND SERVICING

5.1 OBJECTIVES

The objective of this stormwater management 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 the *Design Brief O'Keefe Court – 416 Lands* prepared by IBI Group in January 2018, and the *City of Ottawa Sewer Design Guidelines (2012).* The following summarizes the criteria used in the preparation of this stormwater management plan:

- All minor system release rate up to the 100-year storm event from the proposed development to be restricted to 90 L/s.
- Provide sufficient on-site storage to contain major system overflows from all storms up to and including the 100-year storm.
- Maximum 100-year water depth of 0.35 m in parking and access areas.
- Provide adequate emergency overflow conveyance (overland flow route) off-site.
- Size the storm lateral to convey the 2-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.
- 100-year HGL to be at least 30 cm below the proposed under side of footings (USF). However, this is not a concern for this site since no basements are proposed.
- Water quality control will be provided in the downstream stormwater management facility within the O'Keefe Court Commercial Business Park.

5.3 STORMWATER MANAGEMENT DESIGN

The proposed 0.62 ha development consists of a six-storey hotel building, parking, access and landscaped areas, and associated servicing infrastructure. The overall imperviousness of the site is 83% (C = 0.78).

It is proposed to direct stormwater runoff from the proposed development to the existing 450mm diameter storm stub located at the northwestern boundary of the site, and ultimately connecting to the 975 mm diameter storm sewer that will be provided to service the site through the O'Keefe Commercial Business

Park. A combination of roof storage, surface storage in parking sags, and subsurface storage is proposed to contain major system flows up to and including the 100-year storm. A combination of inlet control devices (ICDs) in the proposed catch basins will be installed to restrict post development peak flows from the proposed development area to the allowable 90 L/s release rate which is equivalent to the 2-year runoff from a 0.57 ha area with a runoff coefficient of 0.80 as outlined in IBI's report for the O'keefe Commercial Business Park (report excerpts provided in **Appendix D**). The site plan, proposed storm sewers, and future connecting storm sewer infrastructure are shown on **Drawing SSP-1**.

5.3.1 Design Methodology

The intent of the stormwater management plan presented herein is to meet the criteria outlined in the background documents. The proposed stormwater management plan is designed to retain runoff on the rooftop, within subsurface storage infrastructure, and within parking areas to ensure that post-development peak flows do not exceed the target release rate for the site.

The small portion of grassed area at the back of the site along Fallowfield Road cannot be graded to enter the site's storm sewer system and as such this area will sheet drain uncontrolled. Runoff from the uncontrolled area along the back of the site (UNC-2) has not been included in the SWM calculations, given that this area was not included in IBI's SWM calculations and was initially assumed to sheet drain uncontrolled.

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 tributary to storm sewer inlets, as defined by the location of catch basins/inlet grates and used in the storm sewer design (see **Appendix C**). A summary of subcatchment areas and runoff coefficients is provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management subcatchments, 100-year ponding limits, and the proposed ICD schedule.

5.3.3 Storage Requirements

The stormwater management plan for the O'Keefe Commercial Business Park outlined on-site storage requirements for the individual commercial blocks as 120 m^3/ha which resulted in 68 m^3 of on-site storage required for the proposed development. **Drawing SD-1** indicates the design release rate from the rooftop and the proposed inlet control devices. Additional underground storage has been provided to contain and control the release of flows from the site, up to and including the 100-year storm event. Stormwater management calculations are provided in **Appendix C**.

5.3.3.1 Rooftop Storage

It is proposed that stormwater be retained on the rooftop by installing restricted flow roof drains. The following calculations assume that the proposed roofs, R1007A and R1007B, will be equipped with three

(3) and one (1) standard Watts Adjustable Accuflow Roof Drains at 75% open (R1007A) and closed (R1007B), respectively.

Watts Adjustable “Accuflow” roof drain data has been used to calculate a practical roof release rate and detention storage volume for the rooftop. It should be noted that the Adjustable “Accuflow” 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 5** and **Table 6** and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater.

Table 5 and **Table 6** provide details regarding the detention of stormwater on the proposed rooftop during the 2 and 100-year storm events. Refer to **Appendix C** for details.

Table 5: Peak Controlled (Rooftop) 2-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)	$V_{available}$ (m^3)
R1007A	0.10	0.10	3.31	11.35	38.40
R1007B	0.01	0.09	0.63	4.40	4.40

Table 6: Peak Controlled (Rooftop) 100-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)	$V_{available}$ (m^3)
R1007A	0.10	0.15	4.68	37.17	38.40
R1007B	0.01	0.14	0.63	4.00	4.40

5.3.3.2 Underground and Surface Storage

In addition to rooftop storage, it is proposed to detain stormwater within parking lot sags through ICDs located in the proposed catch basins. Approximately 123.1 m^3 of storage is available on parking lot surfaces. **Table 7** and **Table 8** summarize the ICD characteristics for the 2-year and 100-year events, respectively.

Table 7: Peak Controlled (Tributary) 2-Year Release Rate

Area ID	Catchbasin ID	Type of ICD	Head (m)	$Q_{release}$ (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
L1002A	CB1002A	LMF105	1.38	11.5	0.0	0.00
L1003A	CBMH1003	LMF75	1.80	6.72	1.20	8.92
L1003B	CB1003B	LMF95	1.38	9.38	0.0	0.00
L1004A & L1005A	CBMH1004	94mm DIA.ORIFICE	2.40	29.05	10.11	19.34
L1006A	CB1006	LMF105	1.38	11.50	0.18	0.50

Table 8: Peak Controlled (Tributary) 100-Year Release Rate

Area ID	Catchbasin ID	Type of ICD	Head (m)	$Q_{release}$ (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
L1002A	CB1002A	LMF105	1.53	12.11	6.73	6.80
L1003A	CBMH1003	LMF75	1.90	6.90	10.93	15.02
L1003B	CB1003B	LMF95	1.51	9.87	9.27	13.10
L1004A & 1005A	CBMH1004	94mm DIA. ORIFICE	2.65	30.52	84.42	85.44
L1006A	CB1006	LMF105	1.68	12.69	11.74	29.00

As outlined in the above tables, a total of 123.1 m^3 of storage is used in the parking lot areas by surface and subsurface storage and 41.2 m^3 on the roofs during the 100-year storm event, thus meeting the 68 m^3 on-site storage required.

5.3.4 Uncontrolled Area

A small portion of the site fronting Lusk Street (see area UNC-1 and UNC-3 on **Drawing SD-1**) could not be graded to enter the building's storm sewer system and as such it will sheet drain uncontrolled.

Table 9 and

Table 10 summarize the 2-year and 100-year uncontrolled release rates from the proposed development.

Table 9: Peak Uncontrolled (Tributary) 2-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.0057	0.63	10	7.67
UNC-3	0.003	0.20	10	0.13

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

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.057	0.79	10	22.28
UNC-3	0.003	0.25	10	0.37

5.3.5 Results

Table 11 and **Table 12** demonstrate that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow for the site.

Table 11: Estimated Discharge from Site (2-Year)

Area Type	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
Controlled – Parking	11.38	68.14	**90**
Controlled – Roof	12.32	3.94	
Uncontrolled – (UNC-1, UNC-3)	-	7.80	
Total	**23.70**	**79.88**	

Table 12: Estimated Discharge from Site (100-Year)

Area Type	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
Controlled – Parking	123.09	59.41	**90**
Controlled – Roof	41.17	5.31	
Uncontrolled – (UNC-1, UNC-3)	-	22.65	
Total	**164.26**	**87.37**	

As can be seen above, the proposed ICD combination meets the minor system target release rate for the site.

5.3.6 Water Quality Control

Water quality control will be provided in the downstream stormwater management facility within the O’Keefe Court Commercial Business Park. The O’keefe is identified as a cold-cool system. The RCVA noted that sites outleting to the O’Keefe system are required to integrate best management practices to provide thermal protection on-site. Thermal protection will be provided in pipe storage for the smaller storm events up to the 2-year storm. It is proposed to the Architect to provide a high albedo roof covering for the proposed building to provide thermal control for rooftop storm detention.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.62 ha in area. The topography across the site is relatively steep, and currently drains from both the northeast and southwestern boundary, with overland flow generally being directed to the adjacent O'Keefe's Drain. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, adhere to any geotechnical restrictions (see **Section 10.0**) for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management in accordance with City of Ottawa requirements.

The subject site is graded to provide an emergency overland flow route to Lusk Street for storm flows exceeding those generated by the 100-year design storm.

7.0 UTILITIES

Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available within subsurface plant and adjacent overhead utility lines within the Lusk Street ROW. Exact size, location and routing of utilities, along with determination of any off-site works required for redevelopment, will be finalized after design circulation by the electrical consultant.

8.0 APPROVALS/PERMITS

Pre-consultation with Ontario Ministry of Environment, Conservation and Parks (MECP) staff concerning Environmental Compliance Approvals (ECAs, formerly Certificates of Approval (CofA)) under the Ontario Water Resources Act is not expected to be a requirement for the development.

Requirement for a MECP Permit to Take Water (PTTW) for sewer construction dewatering and building footing excavation 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-1** for the proposed location of silt fences, and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was completed for the subject site by Yuri Mendez Engineering dated August 17, 2020. The report summarizes the existing soil conditions within the subject area and provides construction recommendations. For details which are not summarized below, please see the original geotechnical report included in **Appendix D.**

Subsurface soil conditions within the subject site were determined from five test pits which were completed in August 2021. Generally, the materials within 3.3 to 3.8 m depth beneath the surface consist of fill underlain by various soil types including dark gray clay, brown clay and gray clayey sand with gravel. Bedrock is inferred at a 6.1 m depth at BH5 while DCPT tests suggest bedrock depths of 9.45, 7.92 and 6.15 at BH1, BH3 and BH5.

The water level was measured on August 27, 2021 in monitoring wells installed in BH1, BH3 and BH4 at 5.08, 3.82 and 3.75 m depths respectively and shown in the boreholes logs. Ground water measurements in stand pipe installations often require numerous assessments in combination with boreholes data. Given the findings in the boreholes it suggests an average groundwater depth and elevation of 4.2 and 95.33 m respectively. Moisture contents vary above the ground water table.

11.0 CONCLUSIONS

11.1 POTABLE WATER SERVICING

The 300 mm diameter watermain on Lusk Street will provide adequate fire flow capacity as per the Fire Underwriters Survey. The service connection will be capable of providing anticipated demands to the lower storeys but will require a booster pump to maintain pressures of 276 kPa (40 psi) for the upper floors.

11.2 WASTEWATER SERVICING

The proposed sanitary sewer lateral is sufficiently sized to provide gravity drainage for the site. The proposed site will be serviced by a 250 mm diameter service lateral directing wastewater flows to the existing 250 mm dia. Lusk Street sanitary sewer.

11.3 STORMWATER MANAGEMENT AND SERVICING

The proposed stormwater management plan is in compliance with the goals specified in the background documents, as well as local standards. Surface and rooftop storage is proposed to meet the on-site storage requirements, while inlet control devices are proposed to limit inflow from the site area into the minor system to the required target release rate. The proposed site will be serviced through the future 975 mm diameter storm sewer on Lusk Street which will direct storm runoff from the overall O'Keefe Commercial Business Park to receive further quantity and quality control. The site will be serviced by an existing 450mm storm stub.

11.4 SITE GRADING AND DRAINAGE

Grading for the site has been designed to provide an emergency overland flow route towards Lusk Street as per the background documents. Erosion and sediment control measures will be implemented during construction to reduce the impact on future infrastructure and the receiving watercourses.

11.5 UTILITIES

As part of works related to the O'Keefe Commercial Business Park, it is anticipated that sufficient Hydro Ottawa, communications, and gas will be available for the proposed development. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVALS/PERMITS

Ministry of the Environment, Conservation and Parks (MECP) 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. A Permit to Take Water may be required for pumping requirements for construction. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A POTABLE WATER SERVICING

A.1 WATER DEMAND CALCULATIONS

135 Lusk Street - Hotel Water Demand Estimates

Based on enlarged site plan provided by Mataj Architects Inc. dated April 5, 2022

Estimated Population Densities

Rooms (Bed-spaces)	2.0	ppu

Building ID	**Commercial Area (m^2)**	**Number of Rooms**	**Population (2p/rooms)**	**Daily Demand Rate (L/cap/day or L/ha/d)[1]**	**Avg. Day Demand [2]**		**Max. Day Demand [2]**		**Peak Hour Demand [2]**	
					(L/min)	**(L/s)**	**(L/min)**	**(L/s)**	**(L/min)**	**(L/s)**
Hotel		99	198	225	30.9	0.52	46.4	0.77	83.5	1.39
Amenity Areas	504			28000	1.0	0.02	1.5	0.02	2.6	0.04
Total Site :	**504**	**99**	**198**	**-**	**31.9**	**0.53**	**47.9**	**0.80**	**86.2**	**1.44**

[1] Water demand for all hotel rooms (bed-spaces) based on an Average Day Demand from Table 4.2 of the City of Ottawa Water Distribution Design Guidelines (2010).

[2] City of Ottawa water demand criteria was used to estimate peak demand rates for residential areas are as follows:
maximum daily demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

A.2 FIRE FLOW REQUIREMENTS PER FUS GUIDELINES

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401620
Project Name: 135 Lusk Street
Date: 2022-06-02
Fire Flow Calculation #: 2

Description: Hotel building - 6 storey consisting of 99 rooms

2hr fire seperation between each floor

<table>
<tr><th>Step</th><th>Task</th><th colspan="6">Notes</th><th>Value Used</th><th>Req'd Fire Flow (L/min)</th></tr>
<tr><td>1</td><td>Determine Type of Construction</td><td colspan="6">Non-Combustible Construction</td><td>0.8</td><td>-</td></tr>
<tr><td rowspan="2">2</td><td>Determine Ground Floor Area of One Unit</td><td colspan="6">-</td><td>1071</td><td>-</td></tr>
<tr><td>Determine Number of Adjoining Units</td><td colspan="6">-</td><td>1</td><td>-</td></tr>
<tr><td>3</td><td>Determine Height in Storeys</td><td colspan="6">Does not include floors >50% below grade or open attic space</td><td>1</td><td>-</td></tr>
<tr><td>4</td><td>Determine Required Fire Flow</td><td colspan="6">(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min</td><td>-</td><td>6000</td></tr>
<tr><td>5</td><td>Determine Occupancy Charge</td><td colspan="6">Non-Combustible</td><td>-25%</td><td>4500</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Determine Sprinkler Reduction</td><td colspan="6">Conforms to NFPA 13</td><td>-30%</td><td rowspan="4">-1800</td></tr>
<tr><td colspan="6">Standard Water Supply</td><td>-10%</td></tr>
<tr><td colspan="6">Not Fully Supervised or N/A</td><td>0%</td></tr>
<tr><td colspan="6">% Coverage of Sprinkler System</td><td>100%</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Determine Increase for Exposures (Max. 75%)</td><td>Direction</td><td>Exposure Distance (m)</td><td>Exposed Length (m)</td><td>Exposed Height (Stories)</td><td>Length-Height Factor (m x stories)</td><td>Construction of Adjacent Wall</td><td>-</td><td>-</td></tr>
<tr><td>North</td><td>> 45</td><td>22.3</td><td>6</td><td>> 120</td><td>Wood Frame or Non-Combustible</td><td>0%</td><td rowspan="4">225</td></tr>
<tr><td>East</td><td>30.1 to 45</td><td>57.5</td><td>6</td><td>> 120</td><td>Wood Frame or Non-Combustible</td><td>5%</td></tr>
<tr><td>South</td><td>> 45</td><td>22.4</td><td>6</td><td>> 120</td><td>Wood Frame or Non-Combustible</td><td>0%</td></tr>
<tr><td>West</td><td>> 45</td><td>57.5</td><td>6</td><td>> 120</td><td>Wood Frame or Non-Combustible</td><td>0%</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Determine Final Required Fire Flow</td><td colspan="7">Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min</td><td>3000</td></tr>
<tr><td colspan="7">Total Required Fire Flow in L/s</td><td>50.0</td></tr>
<tr><td colspan="7">Required Duration of Fire Flow (hrs)</td><td>1.50</td></tr>
<tr><td colspan="7">Required Volume of Fire Flow (m^3)</td><td>270</td></tr>
</table>

A.3 BOUNDARY CONDITIONS

Boundary Conditions
135 Lusk Street

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	31	0.52
Maximum Daily Demand	47	0.78
Peak Hour	84	1.40
Fire Flow Demand #1	3,000	50.00
Fire Flow Demand #2	7,000	116.67

Location

Results – Existing Conditions

Connection 1 – Lusk St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	153.9	71.2
Peak Hour	147.3	61.9
Max Day plus Fire 1	152.0	68.5
Max Day plus Fire 2	149.5	64.9

Ground Elevation = 103.8 m

Results – SUC Zone Reconfiguration

Connection 1 – Lusk St.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	151.0	67.0
Peak Hour	148.0	62.8
Max Day plus Fire 1	148.7	63.8
Max Day plus Fire 2	141.8	54.0

Ground Elevation = 103.8 m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix BSANITARY SEWER

B.1 SANITARY SEWER DESIGN SHEET

SITE:
135 Lusk Street

DATE: 2022-06-02
REVISION: 2
DESIGNED BY: WJ
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

FILE NUMBER: 160401620

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	50,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
AVERAGE PERSONS / HOTEL ROOM	2.0	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
		INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	APARTMENT	KING SIZE BEDROOM	QUEEN SIZE BEDROOM	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)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	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)
C100A, G100A	Building	SAN101	0.00	0	49	50	198	0.00	198	4.00	3.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.51	0.00	0.510	0.51	0.17	3.38	3.70	200	PVC	SDR 35	1.00	33.4	**10.10%**	1.05	0.56
	SAN101	SAN100	0.00	0	0	0	0	0.00	198	4.00	3.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.000	0.51	0.17	3.38	9.00	250	PVC	SDR 35	0.40	38.3	**8.81%**	0.77	0.39
	SAN100	SAN MH 7A	0.00	0	0	0	0	0.00	198	4.00	3.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.000	0.51	0.17	3.38	7.60	250	PVC	SDR 35	0.40	38.3	**8.81%**	0.77	0.39

250

B.2 CORRESPONDENCE WITH CITY OF OTTAWA CONFIRMING SANITARY SEWER CAPACITY

Nwanise, Nwanise

From:	Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Sent:	Monday, June 6, 2022 3:31 PM
To:	Nwanise, Nwanise
Subject:	RE: 135 Lusk Str - Confirmation of sanitary sewer capacity

Good afternoon Nwanise

There are no issues with the proposed 3.35 L/s to the sanitary system.

Regards
Eric

Eric Tousignant, P.Eng.
Senior Water Resources Engineer/ Ingénieur principal en resources hydriques
Infrastructure and Water Services / *services d'infrastructure et d'eau*
613-580-2424 ext 25129

From: Nwanise, Nwanise <Nwanise.Nwanise@stantec.com>
Sent: June 01, 2022 5:18 PM
To: Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Johnson, Warren <Warren.Johnson@stantec.com>
Subject: 135 Lusk Str - Confirmation of sanitary sewer capacity

I hope you are doing well.

We are working on a site plan control application for a proposed commercial development on 135 Lusk Street located in West Barrhaven and we would like to confirm if there is sufficient capacity in the downstream sanitary sewer to accommodate a 3.35L/s wastewater flow from the site.

The wastewater contributions from the site were previously estimated to be 0.71 L/s as contained in the O'keefe Court – 416 Lands subdivision design brief. This design brief indicates that there is at least 21.9 L/s residual capacity in the existing downstream sewer.

The proposed development area (0.62 ha) consists of a six-storey hotel building with 99 rooms and an amenity area of about 175 sq. m.

Kindly find our sanitary sewer design sheet and sanitary drainage plan attached for your information.

Thank you for your help with this.

Regards,
Nwanise Nwanise,EIT
Engineering intern, Community Development

Mobile: (647) 400-1759
nwanise.nwanise@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Better Together, Even If We're Apart. Read more about Stantec's COVID-19 response, including remote working and business continuity measures.

'

'

Nwanise, Nwanise

From:	Nwanise, Nwanise
Sent:	Wednesday, June 1, 2022 5:18 PM
To:	Eric.Tousignant@ottawa.ca
Cc:	Kilborn, Kris; Johnson, Warren
Subject:	135 Lusk Str - Confirmation of sanitary sewer capacity
Attachments:	2022-05-25_SAN.pdf; 160401620 DB-SA-1.pdf

Hi Eric,

I hope you are doing well.

We are working on a site plan control application for a proposed commercial development on 135 Lusk Street located in West Barrhaven and we would like to confirm if there is sufficient capacity in the downstream sanitary sewer to accommodate a 3.35L/s wastewater flow from the site.

The wastewater contributions from the site were previously estimated to be 0.71 L/s as contained in the O'keefe Court – 416 Lands subdivision design brief. This design brief indicates that there is at least 21.9 L/s residual capacity in the existing downstream sewer.

The proposed development area (0.62 ha) consists of a six-storey hotel building with 99 rooms and an amenity area of about 175 sq. m.

Kindly find our sanitary sewer design sheet and sanitary drainage plan attached for your information.

Thank you for your help with this.

Regards,

Nwanise Nwanise,EIT
Engineering intern, Community Development

Mobile: (647) 400-1759
nwanise.nwanise@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Stantec

Appendix C STORMWATER SERVICING AND MANAGEMENT

135 LUSK STREET

DATE: 2022-06-02
REVISION: 2
DESIGNED BY: WAJ
CHECKED BY: DCT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160401620**

DESIGN PARAMETERS

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

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

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

LOCATION			DRAINAGE AREA																									PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L1003A	1003A	1003	0.048	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.041	0.041	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	8.8	12.0	600	600	CIRCULAR	CONCRETE	-	0.10	202.6	**4.32%**	0.69	0.29	0.70
L1003B	1003	1002	0.051	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.043	0.085	0.000	0.000	0.000	0.000	0.000	0.000	10.70	74.21	100.63	117.95	172.40	0.0	0.0	17.4	46.8	250	250	CIRCULAR	PVC	-	0.50	42.7	**40.79%**	0.86	0.69	1.13
L1002A	1002	1001	0.047	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.042	0.126	0.000	0.000	0.000	0.000	0.000	0.000	11.83	70.43	95.43	111.83	163.41	0.0	0.0	24.7	25.1	250	250	CIRCULAR	PVC	-	0.50	42.7	**57.80%**	0.86	0.77	0.54
																				12.37																			
R1007A, R1007B	1007	1001	0.000	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	5.3	5.3	5.3	2.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**15.94%**	1.05	0.63	0.06
																				10.06																			
	1001	1000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.126	0.000	0.000	0.000	0.000	0.000	0.000	12.37	68.75	93.13	109.11	159.43	0.0	5.3	29.4	9.7	300	300	CIRCULAR	PVC	-	0.40	60.8	**48.36%**	0.86	0.73	0.22
																				12.60																			
L1006A	1006	1005	0.065	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.055	0.055	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	11.7	20.5	200	200	CIRCULAR	PVC	-	1.00	33.3	**35.20%**	1.05	0.81	0.42
L1005A	1005	1004	0.101	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.085	0.140	0.000	0.000	0.000	0.000	0.000	0.000	10.42	75.21	102.00	119.56	174.77	0.0	0.0	29.2	48.2	600	600	CIRCULAR	CONCRETE	-	0.50	452.9	**6.45%**	1.55	0.73	1.10
L1004A	1004	1000	0.092	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.075	0.215	0.000	0.000	0.000	0.000	0.000	0.000	11.53	71.39	96.75	113.38	165.69	0.0	0.0	42.7	30.7	300	300	CIRCULAR	PVC	-	0.40	60.8	**70.22%**	0.86	0.82	0.62
																				12.15																			
	1000	EX STM STUB	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.341	0.000	0.000	0.000	0.000	0.000	0.000	12.60	68.09	92.23	108.05	157.87	0.0	5.3	69.9	3.3	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**52.55%**	0.81	0.71	0.08
																				12.67									450	450									

Stormwater Management Calculations

File No: **160401620**
Project: **135 Lusk Street**
Date: **02-Jun-22**

SWM Approach:
Minor system release rate restricted to 90 L/s with 68.4 m3 of on-site storage and major system overflows directed to Street 1

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Sub-catchment Area			**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Catchment Type	**ID / Description**							
Controlled - Tributary	L1002A	Hard	0.046		0.9	0.041		
		Soft	0.001		0.2	0.000		
		Subtotal		0.047			0.04136	0.880
Controlled - Tributary	L1003B	Hard	0.048		0.9	0.043		
		Soft	0.003		0.2	0.001		
		Subtotal		0.051			0.04386	0.860
Controlled - Tributary	L1003A	Hard	0.045		0.9	0.040		
		Soft	0.003		0.2	0.001		
		Subtotal		0.048			0.0408	0.850
Controlled - Tributary	L1004A	Hard	0.081		0.9	0.073		
		Soft	0.011		0.2	0.002		
		Subtotal		0.092			0.07544	0.820
Controlled - Tributary	L1005A	Hard	0.092		0.9	0.083		
		Soft	0.009		0.2	0.002		
		Subtotal		0.101			0.08484	0.840
Controlled - Tributary	L1006A	Hard	0.060		0.9	0.054		
		Soft	0.005		0.2	0.001		
		Subtotal		0.065			0.05525	0.850
Uncontrolled - Tributary	UNC-1	Hard	0.035		0.9	0.032		
		Soft	0.022		0.2	0.004		
		Subtotal		0.057			0.03591	0.630
Uncontrolled - Non-Tributary	UNC-2	Hard	0.000		0.9	0.000		
		Soft	0.049		0.2	0.010		
		Subtotal		0.049			0.0098	0.200
Uncontrolled - Tributary	UNC-3	Hard	0.000		0.9	0.000		
		Soft	0.003		0.2	0.001		
		Subtotal		0.003			0.0006	0.200
Roof	R1007A	Hard	0.096		0.9	0.086		
		Soft	0.000		0.2	0.000		
		Subtotal		0.096			0.0864	0.900
Roof	R1007B	Hard	0.011		0.9	0.010		
		Soft	0.000		0.2	0.000		
		Subtotal		0.011			0.0099	0.900
Total				**0.620**			**0.484**	
Overall Runoff Coefficient= C:								**0.78**

Total Roof Areas	**0.107 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.464 ha**
Total Tributary Area to Outlet	**0.571 ha**
Total Uncontrolled Areas (Non-Tributary) (not included in SWM calcs)	**0.049 ha**
Total Site	**0.620 ha**

Stormwater Management Calculations

Project #160401620, 135 Lusk Street
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

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

a =	732.951
b =	6.199
c =	0.81

t (min)	I (mm/hr)
10	76.81
20	52.03
30	40.04
40	32.86
50	28.04
60	24.56
70	21.91
80	19.83
90	18.14
100	16.75
110	15.57
120	14.56

Target Release from Site

SWM Approach: Minor system release rate restricted to 90 L/s as per IBI report.
Area (ha): 0.570 ha (IBI's January 2018 Design Brief O'Keefe Court - 416 Lands
C: 0.80

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L1002A
Area (ha): 0.05
C: 0.88

Controlled - Tributary

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	8.83	8.83	0.00	**0.00**
20	52.03	5.98	5.98	0.00	**0.00**
30	40.04	4.60	4.60	0.00	**0.00**
40	32.86	3.78	3.78	0.00	**0.00**
50	28.04	3.22	3.22	0.00	**0.00**
60	24.56	2.82	2.82	0.00	**0.00**
70	21.91	2.52	2.52	0.00	**0.00**
80	19.83	2.28	2.28	0.00	**0.00**
90	18.14	2.09	2.09	0.00	**0.00**
100	16.75	1.93	1.93	0.00	**0.00**
110	15.57	1.79	1.79	0.00	**0.00**
120	14.56	1.67	1.67	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: LMF105

Invert Elevation	102.14	m
T/G Elevation	103.52	m
Max Ponding Depth	0.00	m
Downstream W/L	100.83	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	103.52	1.38	11.50	0.00	0.00	Adjust ICD

Subdrainage Area: L1003B
Area (ha): 0.05
C: 0.86

Controlled - Tributary

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	9.36	9.36	0.00	**0.00**
20	52.03	6.34	6.34	0.00	**0.00**
30	40.04	4.88	4.88	0.00	**0.00**
40	32.86	4.01	4.01	0.00	**0.00**
50	28.04	3.42	3.42	0.00	**0.00**
60	24.56	2.99	2.99	0.00	**0.00**
70	21.91	2.67	2.67	0.00	**0.00**
80	19.83	2.42	2.42	0.00	**0.00**
90	18.14	2.21	2.21	0.00	**0.00**
100	16.75	2.04	2.04	0.00	**0.00**
110	15.57	1.90	1.90	0.00	**0.00**
120	14.56	1.78	1.78	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: LMF95

Invert Elevation	102.17	m
T/G Elevation	103.55	m
Max Ponding Depth	0.00	m
Downstream W/L	100.83	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	103.55	1.38	9.38	0.00	0.00	Adjust ICD

Subdrainage Area: L1003A
Area (ha): 0.05
C: 0.85

Controlled - Tributary

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	8.71	6.72	2.00	**1.20**
20	52.03	5.90	5.90	0.00	0.00
30	40.04	4.54	4.54	0.00	0.00
40	32.86	3.73	3.73	0.00	0.00
50	28.04	3.18	3.18	0.00	0.00
60	24.56	2.79	2.79	0.00	0.00
70	21.91	2.49	2.49	0.00	0.00
80	19.83	2.25	2.25	0.00	0.00
90	18.14	2.06	2.06	0.00	0.00
100	16.75	1.90	1.90	0.00	0.00
110	15.57	1.77	1.77	0.00	0.00
120	14.56	1.65	1.65	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation:	LMF75	
Orifice Diameter:		mm
Invert Elevation	101.83	m
T/G Elevation	103.63	m
Max Ponding Depth	0.00	m
Downstream W/L	100.83	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	103.63	1.80	6.72	1.20	8.92	OK

Subdrainage Area: L1004A
Area (ha): 0.09
C: 0.82

Controlled - Tributary

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	16.11	16.11	0.00	**0.00**
20	52.03	10.91	10.91	0.00	**0.00**
30	40.04	8.40	8.40	0.00	**0.00**
40	32.86	6.89	6.89	0.00	**0.00**
50	28.04	5.88	5.88	0.00	**0.00**
60	24.56	5.15	5.15	0.00	**0.00**
70	21.91	4.60	4.60	0.00	**0.00**

Project #160401620, 135 Lusk Street
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)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

Qtarget (L/s)	Vtarget ($120m^3/ha$)
90	**68**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L1002A
Area (ha): 0.05
C: 1.00

Controlled - Tributary

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	23.33	12.11	11.22	**6.73**
20	119.95	15.67	12.11	3.56	4.27
30	91.87	12.00	12.00	0.00	0.00
40	75.15	9.82	9.82	0.00	0.00
50	63.95	8.36	8.36	0.00	0.00
60	55.89	7.30	7.30	0.00	0.00
70	49.79	6.51	6.51	0.00	0.00
80	44.99	5.88	5.88	0.00	0.00
90	41.11	5.37	5.37	0.00	0.00
100	37.90	4.95	4.95	0.00	0.00
110	35.20	4.60	4.60	0.00	0.00
120	32.89	4.30	4.30	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: LMF105

Invert Elevation	102.14 m
T/G Elevation	103.52 m
Max Ponding Depth	0.15 m
Downstream W/L	100.83 m

Ponding Volume Calculations

Stage (m)	Depth (m)	Volume (m^3)
103.52	0.00	0.0
103.67	0.15	6.8

100yr Depth (m): 0.148 103.668

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.67	1.53	12.11	6.73	6.80	OK
					0.07	

Subdrainage Area: L1003B
Area (ha): 0.05
C: 1.00

Controlled - Tributary

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	25.32	9.87	15.44	**9.27**
20	119.95	17.01	9.87	7.13	8.56
30	91.87	13.03	9.87	3.15	5.67
40	75.15	10.65	9.87	0.78	1.87
50	63.95	9.07	9.07	0.00	0.00
60	55.89	7.92	7.92	0.00	0.00
70	49.79	7.06	7.06	0.00	0.00
80	44.99	6.38	6.38	0.00	0.00
90	41.11	5.83	5.83	0.00	0.00
100	37.90	5.37	5.37	0.00	0.00
110	35.20	4.99	4.99	0.00	0.00
120	32.89	4.66	4.66	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: LMF95

Invert Elevation	102.17 m
T/G Elevation	103.55 m
Max Ponding Depth	0.15 m
Downstream W/L	100.83 m

Ponding Volume Calculations

Stage (m)	Depth (m)	Volume (m^3)
103.55	0.00	0.0
103.70	0.15	13.1

100yr Depth (m): 0.106 103.656

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.70	1.53	9.87	9.27	13.10	OK
					3.83	

Subdrainage Area: L1003A
Area (ha): 0.05
C: 1.00

Controlled - Tributary

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	23.83	6.90	16.93	10.16
20	119.95	16.01	6.90	9.11	**10.93**
30	91.87	12.26	6.90	5.36	9.65
40	75.15	10.03	6.90	3.13	7.50
50	63.95	8.53	6.90	1.63	4.90
60	55.89	7.46	6.90	0.56	2.01
70	49.79	6.64	6.90	0.00	0.00
80	44.99	6.00	6.90	0.00	0.00
90	41.11	5.49	6.90	0.00	0.00
100	37.90	5.06	6.90	0.00	0.00
110	35.20	4.70	6.90	0.00	0.00
120	32.89	4.39	6.90	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation:	LMF75	
		mm
Invert Elevation	101.83	m
T/G Elevation	103.63	m
Max Ponding Depth	0.10	m
Downstream W/L	100.83	m

Pipe Storage

Diameter (mm)	Length (m)	Volume(m3)
600	12.0	3.4
MH		5.53
Total		8.92

Ponding Volume Calculations

Stage (m)	Depth (m)	Volume (m^3)
103.63	0.00	0.0
103.73	0.10	15.0

100yr Depth (m): 0.073 103.703

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.73	1.90	6.90	10.93	15.02	OK
					4.09	

Subdrainage Area: L1004A
Area (ha): 0.09
C: 1.00

Controlled - Tributary

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	45.67	45.67	0.00	**0.00**
20	119.95	30.68	30.68	0.00	**0.00**
30	91.87	23.50	23.50	0.00	**0.00**
40	75.15	19.22	19.22	0.00	**0.00**
50	63.95	16.36	16.36	0.00	**0.00**
60	55.89	14.30	14.30	0.00	**0.00**
70	49.79	12.73	12.73	0.00	**0.00**

Stormwater Management Calculations

80	19.83	4.16	4.16	0.00	**0.00**
90	18.14	3.80	3.80	0.00	**0.00**
100	16.75	3.51	3.51	0.00	**0.00**
110	15.57	3.27	3.27	0.00	**0.00**
120	14.56	3.05	3.05	0.00	**0.00**

Subdrainage Area: L1005A Controlled - Tributary
Area (ha): 0.10
C: 0.84

tc (min)	**I (2 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	76.81	18.11	18.11	0.00	**0.00**
20	52.03	12.27	12.27	0.00	**0.00**
30	40.04	9.44	9.44	0.00	**0.00**
40	32.86	7.75	7.75	0.00	**0.00**
50	28.04	6.61	6.61	0.00	**0.00**
60	24.56	5.79	5.79	0.00	**0.00**
70	21.91	5.17	5.17	0.00	**0.00**
80	19.83	4.68	4.68	0.00	**0.00**
90	18.14	4.28	4.28	0.00	**0.00**
100	16.75	3.95	3.95	0.00	**0.00**
110	15.57	3.67	3.67	0.00	**0.00**
120	14.56	3.43	3.43	0.00	**0.00**

ICD for subdrainage areas L1004A, L1005A and L1006A

tc (min)	**I (2 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	76.81	45.72	29.05	16.68	10.01
20	52.03	31.18	29.05	2.13	2.55
30	40.04	23.99	23.99	0.00	**0.00**
40	32.86	19.69	19.69	0.00	**0.00**
50	28.04	16.80	16.80	0.00	**0.00**
60	24.56	14.71	14.71	0.00	**0.00**
70	21.91	13.13	13.13	0.00	**0.00**
80	19.83	11.88	11.88	0.00	**0.00**
90	18.14	10.87	10.87	0.00	**0.00**
100	16.75	10.03	10.03	0.00	**0.00**
110	15.57	9.33	9.33	0.00	**0.00**
120	14.56	8.73	8.73	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 94.00 mm
Invert Elevation 101.14 m
T/G Elevation 103.54 m
Max Ponding Depth 0.00 m
Downstream W/L 100.83 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	103.54	2.40	29.05	10.01	19.34	OK

Subdrainage Area: L1006A Controlled - Tributary
Area (ha): 0.07
C: 0.85

tc (min)	**I (2 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	76.81	11.80	11.50	0.30	**0.18**
20	52.03	7.99	7.99	0.00	0.00
30	40.04	6.15	6.15	0.00	0.00
40	32.86	5.05	5.05	0.00	0.00
50	28.04	4.31	4.31	0.00	0.00
60	24.56	3.77	3.77	0.00	0.00
70	21.91	3.37	3.37	0.00	0.00
80	19.83	3.05	3.05	0.00	0.00
90	18.14	2.79	2.79	0.00	0.00
100	16.75	2.57	2.57	0.00	0.00
110	15.57	2.39	2.39	0.00	0.00
120	14.56	2.24	2.24	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: LMF105

Invert Elevation 102.08 m
T/G Elevation 103.46 m
Max Ponding Depth 0.00 m
Downstream W/L 100.83 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	103.46	1.38	11.50	0.18	0.50	OK

Subdrainage Area: UNC-1 Uncontrolled - Tributary
Area (ha): 0.06
C: 0.63

tc (min)	**I (2 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	76.81	7.67	7.67		
20	52.03	5.19	5.19		
30	40.04	4.00	4.00		
40	32.86	3.28	3.28		
50	28.04	2.80	2.80		
60	24.56	2.45	2.45		
70	21.91	2.19	2.19		
80	19.83	1.98	1.98		
90	18.14	1.81	1.81		
100	16.75	1.67	1.67		
110	15.57	1.55	1.55		
120	14.56	1.45	1.45		

Subdrainage Area: UNC-2 Uncontrolled - Non-Tributary
Area (ha): 0.05
C: 0.20

tc (min)	**I (2 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	76.81	2.09	2.09		
20	52.03	1.42	1.42		
30	40.04	1.09	1.09		
40	32.86	0.90	0.90		
50	28.04	0.76	0.76		
60	24.56	0.67	0.67		
70	21.91	0.60	0.60		
80	19.83	0.54	0.54		

80	44.99	11.51	11.51	0.00	**0.00**
90	41.11	10.51	10.51	0.00	**0.00**
100	37.90	9.69	9.69	0.00	**0.00**
110	35.20	9.00	9.00	0.00	**0.00**
120	32.89	8.41	8.41	0.00	**0.00**

Subdrainage Area: L1005A Controlled - Tributary
Area (ha): 0.10
C: 1.00

tc (min)	**I (100 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	178.56	62.83	62.83	0.00	**0.00**
20	119.95	46.37	46.37	0.00	**0.00**
30	91.87	38.49	38.49	0.00	**0.00**
40	75.15	33.79	33.79	0.00	**0.00**
50	63.95	29.51	29.51	0.00	**0.00**
60	55.89	25.79	25.79	0.00	**0.00**
70	49.79	22.98	22.98	0.00	**0.00**
80	44.99	20.76	20.76	0.00	**0.00**
90	41.11	18.97	18.97	0.00	**0.00**
100	37.90	17.49	17.49	0.00	**0.00**
110	35.20	16.25	16.25	0.00	**0.00**
120	32.89	15.18	15.18	0.00	**0.00**

Warning, max. volume may not have been reached.

ICD for subdrainage areas L1004A, L1005A and L1006A

tc (min)	**I (100 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	178.56	121.19	30.52	90.66	54.40
20	119.95	89.74	30.52	59.22	71.06
30	91.87	74.67	30.52	44.15	79.47
40	75.15	65.70	30.52	35.18	84.42
50	63.95	57.43	30.52	26.90	80.71
60	55.89	50.19	30.52	19.67	70.80
70	49.79	44.71	30.52	14.18	59.57
80	44.99	40.40	30.52	9.87	47.40
90	41.11	36.92	30.52	6.39	34.51
100	37.90	34.03	30.52	3.51	21.06
110	35.20	31.61	30.52	1.09	7.16
120	32.89	29.54	29.54	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 94.00 mm
Invert Elevation 101.14 m
T/G Elevation 103.54 m
Max Ponding Depth 0.25 m
Downstream W/L 100.83 m

Subsurface and Ponding Volume Calculations

Diameter (mm)	Length (m)	Volume(m3)
600	48.2	13.6
200	20.5	0.6
MH x 2		5.1
SURFACE STORAGE		66.1

Ponding Volume Calculations

Stage (m)	Depth (m)	Volume (m^3)
103.54	0.00	0.0
103.79	0.25	85.4

100yr Depth (m): 0.247 103.787

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.79	2.65	30.52	84.42	85.44	OK
					1.02	

Subdrainage Area: L1006A Controlled - Tributary
Area (ha): 0.07
C: 1.00

tc (min)	**I (100 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	178.56	32.27	12.69	19.57	**11.74**
20	119.95	21.68	12.69	8.98	10.78
30	91.87	16.60	12.69	3.91	7.04
40	75.15	13.58	12.69	0.89	2.13
50	63.95	11.56	11.56	0.00	0.00
60	55.89	10.10	10.10	0.00	0.00
70	49.79	9.00	9.00	0.00	0.00
80	44.99	8.13	8.13	0.00	0.00
90	41.11	7.43	7.43	0.00	0.00
100	37.90	6.85	6.85	0.00	0.00
110	35.20	6.36	6.36	0.00	0.00
120	32.89	5.94	5.94	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: LMF105

Invert Elevation 102.08 m
T/G Elevation 103.46 m
Max Ponding Depth 0.30 m
Downstream W/L 100.83 m

Storage Volume Calculations
Catchbasin Storage = 0.50
Ponding Storage = 28.50

Ponding Volume Calculations

Stage (m)	Depth (m)	Volume (m^3)
103.46	0.00	0.0
103.76	0.30	29.0

100yr Depth (m): 0.122 103.582

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.76	1.68	12.69	11.74	29.00	OK
					17.25	

Subdrainage Area: UNC-1 Uncontrolled - Tributary
Area (ha): 0.06
C: 0.79

tc (min)	**I (100 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	178.56	22.28	22.28		
20	119.95	14.97	14.97		
30	91.87	11.46	11.46		
40	75.15	9.38	9.38		
50	63.95	7.98	7.98		
60	55.89	6.97	6.97		
70	49.79	6.21	6.21		
80	44.99	5.61	5.61		
90	41.11	5.13	5.13		
100	37.90	4.73	4.73		
110	35.20	4.39	4.39		
120	32.89	4.10	4.10		

Subdrainage Area: UNC-2 Uncontrolled - Non-Tributary
Area (ha): 0.05
C: 0.25

tc (min)	**I (100 yr) (mm/hr)**	**Qactual (L/s)**	**Qrelease (L/s)**	**Qstored (L/s)**	**Vstored (m^3)**
10	178.56	6.08	6.08		
20	119.95	4.08	4.08		
30	91.87	3.13	3.13		
40	75.15	2.56	2.56		
50	63.95	2.18	2.18		
60	55.89	1.90	1.90		
70	49.79	1.70	1.70		
80	44.99	1.53	1.53		

Stormwater Management Calculations

Project #160401620, 135 Lusk Street
Modified Rational Method Calculatons for Storage

90	18.14	0.49	0.49		
100	16.75	0.46	0.46		
110	15.57	0.42	0.42		
120	14.56	0.40	0.40		

Subdrainage Area: UNC-3
Area (ha): 0.003
C: 0.20

Uncontrolled - Tributary

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	0.13	0.13		
20	52.03	0.09	0.09		
30	40.04	0.07	0.07		
40	32.86	0.05	0.05		
50	28.04	0.05	0.05		
60	24.56	0.04	0.04		
70	21.91	0.04	0.04		
80	19.83	0.03	0.03		
90	18.14	0.03	0.03		
100	16.75	0.03	0.03		
110	15.57	0.03	0.03		
120	14.56	0.02	0.02		

Subdrainage Area: R1007A
Area (ha): 0.10
C: 0.90

Roof
Maximum Storage Depth: 150 mm

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	18.45	3.08	15.37	9.22	91.80	0.00
20	52.03	12.50	3.28	9.22	11.06	98.80	0.00
30	40.04	9.62	3.31	6.31	**11.35**	99.91	0.00
40	32.86	7.89	3.28	4.61	11.07	98.85	0.00
50	28.04	6.74	3.22	3.51	10.54	96.82	0.00
60	24.56	5.90	3.15	2.75	9.89	94.34	0.00
70	21.91	5.26	3.08	2.19	9.19	91.67	0.00
80	19.83	4.76	3.00	1.76	8.47	88.95	0.00
90	18.14	4.36	2.92	1.44	7.76	86.24	0.00
100	16.75	4.02	2.85	1.18	7.06	83.58	0.00
110	15.57	3.74	2.77	0.97	6.38	81.00	0.00
120	14.56	3.50	2.70	0.80	5.73	78.52	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	99.91	0.10	3.31	11.35	38.40	0.23

Subdrainage Area: R1007B
Area (ha): 0.01
C: 0.90

Roof
Maximum Storage Depth: 150 mm

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	2.11	0.63	1.48	**0.89**	86.27	0.00
20	52.03	1.43	0.63	0.80	0.96	88.64	0.00
30	40.04	1.10	0.63	0.47	0.85	84.89	0.00
40	32.86	0.90	0.63	0.27	0.66	78.54	0.00
50	28.04	0.77	0.63	0.14	0.42	66.77	0.00
60	24.56	0.68	0.63	0.05	0.16	49.98	0.00
70	21.91	0.60	0.57	0.03	0.14	45.23	0.00
80	19.83	0.55	0.52	0.02	0.11	41.37	0.00
90	18.14	0.50	0.48	0.02	0.10	38.17	0.00
100	16.75	0.46	0.45	0.01	0.08	35.47	0.00
110	15.57	0.43	0.42	0.01	0.07	33.16	0.00
120	14.56	0.40	0.39	0.01	0.06	31.15	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	88.64	0.09	0.63	0.96	4.40	0.00

2-Year Site Peak Flow Summary

Total Area =	0.57 **ha**	**Parking Volume Used =**	11.38 **m^3**
Q Target =	90 **L/s**	**Roof Volume Used =**	12.32 **m^3**
			23.70 **m^3**
Q unc =	7.80 **L/s**		
Q roof =	3.94 **L/s**	**Parking Volume Available =**	28.76 **m^3**
Q parking =	68.14 **L/s**	**Roof Volume Available =**	42.80 **m^3**
			71.56 **m^3**
Q total =	79.88 **L/s**		

Project #160401620, 135 Lusk Street
Modified Rational Method Calculatons for Storage

90	41.11	1.40	1.40		
100	37.90	1.29	1.29		
110	35.20	1.20	1.20		
120	32.89	1.12	1.12		

Subdrainage Area: UNC-3
Area (ha): 0.003
C: 0.25

Uncontrolled - Tributary

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	0.37	0.37		
20	119.95	0.25	0.25		
30	91.87	0.19	0.19		
40	75.15	0.16	0.16		
50	63.95	0.13	0.13		
60	55.89	0.12	0.12		
70	49.79	0.10	0.10		
80	44.99	0.09	0.09		
90	41.11	0.09	0.09		
100	37.90	0.08	0.08		
110	35.20	0.07	0.07		
120	32.89	0.07	0.07		

Subdrainage Area: R1007A
Area (ha): 0.10
C: 1.00

Roof
Maximum Storage Depth: 150 mm

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	47.65	4.19	43.46	26.08	130.96	0.00
20	119.95	32.01	4.50	27.52	33.02	141.69	0.00
30	91.87	24.52	4.62	19.90	35.82	146.01	0.00
40	75.15	20.05	4.67	15.39	36.93	147.73	0.00
50	63.95	17.07	4.68	12.39	**37.17**	148.10	0.00
60	55.89	14.92	4.67	10.25	36.90	147.69	0.00
70	49.79	13.29	4.64	8.65	36.32	146.78	0.00
80	44.99	12.01	4.61	7.40	35.53	145.56	0.00
90	41.11	10.97	4.56	6.41	34.60	144.12	0.00
100	37.90	10.12	4.52	5.60	33.57	142.54	0.00
110	35.20	9.39	4.47	4.92	32.49	140.86	0.00
120	32.89	8.78	4.42	4.36	31.36	139.13	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	148.10	0.15	4.68	37.17	38.40	0.49

Subdrainage Area: R1007B
Area (ha): 0.01
C: 1.00

Roof
Maximum Storage Depth: 150 mm

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	5.46	0.63	4.83	2.90	129.74	0.00
20	119.95	3.67	0.63	3.04	**3.64**	139.81	0.00
30	91.87	2.81	0.63	2.18	3.92	143.54	0.00
40	75.15	2.30	0.63	1.67	4.00	144.62	0.00
50	63.95	1.96	0.63	1.32	3.97	144.26	0.00
60	55.89	1.71	0.63	1.08	3.88	143.02	0.00
70	49.79	1.52	0.63	0.89	3.74	141.17	0.00
80	44.99	1.38	0.63	0.74	3.58	138.88	0.00
90	41.11	1.26	0.63	0.63	3.38	136.27	0.00
100	37.90	1.16	0.63	0.53	3.17	133.40	0.00
110	35.20	1.08	0.63	0.45	2.94	130.32	0.00
120	32.89	1.01	0.63	0.38	2.70	127.08	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	144.62	0.14	0.63	4.00	4.40	0.00

100-Year Site Peak Flow Summary

Total Area =	0.57 **ha**	**Parking Volume Used =**	123.09 **m^3**
Q Target =	90 **L/s**	**Roof Volume Used =**	41.17 **m^3**
			164.26 **m^3**
Q unc =	22.65 **L/s**		
Q roof =	5.31 **L/s**	**Parking Volume Available =**	149.36 **m^3**
Q parking =	59.41 **L/s**	**Roof Volume Available =**	42.80 **m^3**
			192.16 **m^3**
Q total =	87.37 **L/s**		

Project #160401620, 135 Lusk Street
Roof Drain Design Sheet, Area R1007A
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	0.0009	0	0.025	21	0	0	0.025
0.050	0.0006	0.0019	1	0.050	85	1	1	0.050
0.075	0.0009	0.0026	5	0.075	192	3	5	0.075
0.100	0.0011	0.0033	11	0.100	341	7	11	0.100
0.125	0.0013	0.0040	22	0.125	533	11	22	0.125
0.150	0.0016	0.0047	38	0.150	768	16	38	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.2	657.5	1.2	0.182637458
4.6	1297.9	3.4	0.543168564
11.2	1985.9	6.6	1.094808483
22.0	2696.3	10.8	1.843775397
38.2	3419.0	16.2	2.793490178

Rooftop Storage Summary

Total Building Area (sq.m)		960
Assume Available Roof Area (sq.m)	80%	768
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		3
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		38
Estimated 100 Year Drawdown Time (h)		2.7

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

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

From Watts Drain Catalogue

Head (m) L/s

	Open	**75%**	50%	25%	Closed
0.025	0.31545	**0.31545**	0.31545	0.31545	0.315
0.050	0.6309	**0.6309**	0.6309	0.6309	0.631
0.075	0.94635	**0.86749**	0.78863	0.70976	0.631
0.100	1.2618	**1.10408**	0.94635	0.78863	0.631
0.125	1.57726	**1.34067**	1.10408	0.86749	0.631
0.150	1.89271	**1.57726**	1.2618	0.94635	0.631

Calculation Results

	2yr	100yr	Available
Qresult (cu.m/s)	0.003	0.005	-
Depth (m)	0.100	0.148	0.150
Volume (cu.m)	11.4	37.2	38.4
Draintime (hrs)	1.1	2.7	

Project #160401620, 135 Lusk Street
Roof Drain Design Sheet, Area R1007B
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	0.0003	0	0.025	2	0	0	0.025
0.050	0.0006	0.0006	0	0.050	10	0	0	0.050
0.075	0.0006	0.0006	1	0.075	22	0	1	0.075
0.100	0.0006	0.0006	1	0.100	39	1	1	0.100
0.125	0.0006	0.0006	3	0.125	61	1	3	0.125
0.150	0.0006	0.0006	4	0.150	88	2	4	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.1	226.0	0.1	0.06278163
0.5	613.5	0.4	0.2331889
1.3	1194.6	0.8	0.56503464
2.5	1969.5	1.2	1.11213166
4.4	2938.2	1.9	1.9282928

Rooftop Storage Summary

Total Building Area (sq.m)		110	
Assume Available Roof Area (sq.m)	80%	88	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		1	
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)		4	
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	0.315	0.315	0.315	0.31545	**0.315**
0.050	0.631	0.631	0.631	0.6309	**0.631**
0.075	0.946	0.867	0.789	0.70976	**0.631**
0.100	1.262	1.104	0.946	0.78863	**0.631**
0.125	1.577	1.341	1.104	0.86749	**0.631**
0.150	1.893	1.577	1.262	0.94635	**0.631**

Calculation Results

	2yr	**100yr**	**Available**
Qresult (cu.m/s)	0.001	0.001	-
Depth (m)	0.089	0.145	0.150
Volume (cu.m)	1.0	4.0	4.4
Draintime (hrs)	0.4	1.8	

4 STORMWATER MANAGEMENT

4.1 Background

The subject site is tributary to the O'Keefe Drain, a tributary of the Jock River. The 'Jock River Reach One Subwatershed Study,' (Stantec 2007) established a preferred stormwater management plan for the tributary lands. Subsequently, the City of Ottawa initiated an Environmental Management Plan for the lands within the subwatershed tributary to the O'Keefe Drain. CH2MHill has prepared the 'O'Keefe Drain Environmental and Stormwater Management Plan Final Report' (June 2013), which aims to "build upon conclusions and recommendations included in the Jock River Reach One Subwatershed Study and will detail a plan that will be implemented largely through development approval conditions and stormwater site management plans."

Although the subject lands are external to the EMP study area, it is included in the larger area representing the O'Keefe Drain subwatershed. Under existing conditions, the subject site is comprised of uncultivated grass lands and wooded areas. The site topography is generally between elevations 106 m and 101 m with most of the site draining towards the O'Keefe Drain, which bisects the subject site. As identified in the EMP, the northeast portion of the site drains east to a tributary of the O'Keefe Drain. The existing topography and existing conditions drainage areas are presented on **Figure 4.1**, as well as on EMP Figure 4.6 (enclosed in **Appendix E**).

The proposed development also includes design of a SWM Facility to service the site, and a culvert crossing at Block 18 to accommodate both municipal services over the O'Keefe Drain upstream of the pond outlet. The design of the SWM facility and the proposed culvert crossing is being completed concurrently with this report and it is outlined in the Draft "O'Keefe Court 416 Lands Stormwater Management Report and Design Brief" (IBI, May 2017).

This report builds upon the recommendations and findings of the above reports, and is intended to aid in the review and approval of the servicing for the proposed development.

4.2 Objective

The purpose of this evaluation is to prepare the dual drainage design, including the minor and major system, of the O'Keefe Court development. The evaluation includes assessment of the on-site detention versus cascading major flow, maximum depth and velocity of flow on the street segments, sizing of inlet control devices and hydraulic grade line analysis.

4.3 Dual Drainage Design

The evaluation takes into consideration the City of Ottawa Sewer Design Guidelines (OSDG) (October 2012), the OSDG guidelines of September 2016 Technical Bulletin PIEDTB-2016-01, and the February 2014 Technical Bulletin ISDTP-2014-1.

The site was designed with dual drainage features, accommodating minor and major system flow. During frequent storm events, the effective runoff of a catchment area is directly released via catchbasin inlets to the network of storm sewers, called the minor system. During less frequent storm events, the balance of the flow (in excess of the minor flow) is accommodated by a system of street segments, called the major system.

The streets within O'Keefe Court feature a mix of sawtooth and continuous grade profiles. The sawtooth profile facilitates surface storage on subdivision streets. Inlet control devices (ICDs) are proposed across the site to maximize the use of available on-site storage and control surcharge of the minor system during infrequent storm events. The dual drainage system has been evaluated using the SWMHYMO hydrological model, which offers single storm event flow generation and routing. The minor system hydraulic grade line analysis has been evaluated using the XPSWMM dynamic model.

Further details on the minor and major system design are outlined below.

4.3.1 Minor System

The storm sewer system in the subject site is designed to convey runoff (up to the ICD restriction) from approximately 8.86 ha of development to the SWMF. The SWM Facility is located north of Fallowfield Road and west of O'Keefe Drain (see **Drawing 750** enclosed in **Appendix C**). Inlet control devices (ICDs) are proposed to limit the flow into the minor system during the 100 year event and are described in detailed in **Section 4.4.1.11**.

As shown on **Drawing 750**, minor system trunks servicing the east and west sides of the subject site will be tied into MH301. Flow from there will be conveyed to MH300 and ultimately to the inlet headwall of the SWMF via a 1200 mm diameter storm sewer.

Detailed design and the performance of the proposed SWMF are discussed in the Draft "O'Keefe Court 416 Lands Stormwater Management Report and Design Brief" (IBI, May 2017).

The minor system analysis was evaluated with XPSWMM and is discussed in **Section 4.5.**

4.3.2 Major System

The major system was evaluated using SWMHYMO as discussed in **Section 4.4.1.12.** Surface runoff in excess of the minor system capture will cascade via street segments, eventually reaching the O'Keefe Drain via one of the three (3) outlets noted below (as shown on **Drawing 750**).

1. The area north of Street No. 3 (Area S305) outlets to the side ditch on O'Keefe Court which drains to the O'Keefe Drain.
2. The area south of Street No. 2 (Area S200A) outlets to the side ditch on Flewellyn Road which drains the O'Keefe Drain.
3. Outflow from the SWF will discharge to the O'keefe Drain via a combination of an outlet pipe and an open channel outlet, as described in the Draft "O'Keefe Court 416 Lands Stormwater Management Report and Design Brief" (IBI, May 2017).

   Major flow to the proposed SWM facility is conveyed via two (2) overland flow routes:

   - The Eastern Major Flow Route: flows conveyed via the sewer easement located immediately west of the O'Keefe Drain (as shown on **Drawing 750**).
     Major system flow from the east of the O'Keefe Drain will flow over the culvert and along the pathway prior to entering the eastern flow inlet.
   - The Western Major Flow Route: flows conveyed via the 3 m wide drainage easement, along the MTO easement.
     A ditch is proposed to be constructed within the drainage easement and to be extended into the SWM block to convey the surface runoff from Block 3 and drainage easements (areas B400, B401 on **Drawing 750**) to the western flow inlet.

As shown on **Drawing 750**, major system flow from the west of Street No.3, except Block 3, will cascade along the easement and eventually reach to Area S302. A sawtooth design on Street No. 3 will provide sufficient storage to capture major flow runoff during the 100 year Chicago storm event, with no overflow to the SWM facility.

Major flow routing and outlet locations are shown on **Drawing 750** enclosed in **Appendix C**.

4.4 Hydrological Evaluation

Existing conditions hydrological analysis of the lands tributary to O'Keefe Drain was completed in the EMP. The study area was evaluated using the SWMHYMO computer model. As mentioned in **Section 4.3**, hydrological analysis of the proposed dual drainage system was conducted using SWMHYMO, which is consistent with the overall modelling completed to support the EMP. This technique offers a single storm event flow generation and routing. Land use, selected modeling routines, and input parameters are discussed in the following sections. The SWMHYMO drainage area plan (**Drawing 750)** and model files are included in **Appendix C**.

The primary focus of the hydrological analysis was to evaluate surface flow and ponding conditions during the 100 year storm event in order to satisfy City of Ottawa Sewer Design Guidelines (October 2012) and the September 2016 Technical Bulletin PIEDTB-2016-01 in terms of velocity by depth. The parameters used to model the subject site are presented in **Section 4.4.1**.

4.4.1 Design Parameters

Parameters of existing areas tributary to the O'Keefe Drain were developed based on the 2013 EMP study as described below. The following design parameters were used in the evaluation of the stormwater management system for the subject site. The main hydrology parameters are summarized in **Table 4-1**.

4.4.1.1 Land Use

The site will be developed as a mixture of commercial land uses. The site was divided into drainage areas reflective of the minor system design. The post-development drainage scheme is indicated in **Drawing 750**.

4.4.1.2 Design storms:

The site was evaluated using the following storms:

- 100 year 12 hour SCS Type II design storm events, 10 minute time step (identified as the most critical design storm in the existing conditions simulation);
- 100 year 12 hour SCS Type II design storm events + 20% increase in intensity, 10 minute time step (stress test per City of Ottawa guidelines);
- 2, 5 and 100 year 3 hour Chicago storm event with a 10 minute time step (for dual drainage evaluation, specifically major flow conveyance); and,
- 100 year 3 hour Chicago storm event + 20% increase in intensity, 10 minute time step (stress test per City of Ottawa guidelines);
- July 1, 1979, August 4, 1988, and August 8, 1996 storms (historical storms per City of Ottawa guidelines).

4.4.1.3 Area

Drainage areas are based on the proposed development blocks and minor system network of storm sewers. There are also two blocks representing the Drain corridor (Blocks 15 and 6). The total drainage area contributing minor and major flow to the SWM facility measures 8.86 ha. The Drain corridor measures 1.33 ha.

The O'Keefe Court development is located within EMP existing conditions drainage areas O-6 and O-7 (refer to EMP Figure 4.6, enclosed in **Appendix E**). Under existing conditions, the east portion of the O'Keefe Court site drains to the east and south, towards the O'Keefe Drain Tributary, which connects to the O'Keefe Drain south of Strandherd Drive. The portion of development corresponds to the area within Area ID O-7 on **Figure 4.1**. As part of the proposed development, this area will be diverted to the proposed SWM facility and outlet directly to the O'Keefe Drain.

4.4.1.4 Imperviousness

Typical total and directly connected impervious ratios for the site are based on the typical runoff coefficients that have been applied across the site. A runoff coefficient of 0.86 was applied to development blocks and 0.99 was applied to streets. This corresponds to an overall weighted average of 81% imperviousness for the drainage area to the SWM facility.

4.4.1.5 Infiltration

Infiltration losses were selected to be consistent with the City of Ottawa Sewer Design Guidelines. The Horton values are as follows: f_o = 76 mm/h, f_c = 13.5 mm/h, k = 0.00115 s^{-1}. Blocks 6 and 15, the two blocks representing the O'Keefe Drain corridor, were simulated using the CALIB NASHYD command and therefore the SCS CN method was used for infiltration losses. A CN value of 43 was applied, consistent with the EMP. Similarly, CALIB NASHYD command with a CN value of 43 was used to simulate flow for areas OKFCRT and FLFDCH, consistent with the EMP. These areas are tributary to O'Keefe Drain. The pond block was also simulated using the SCS CN method, and a value of 95 was applied.

4.4.1.6 Length

The impervious length is based on an average of the measured length of the trunk through the catchment and the calculated length based on the SWMHYMO user's manual.

The calculated length based on area, is outlined below:

L_M = measured length of trunk sewer within the subwatershed area

$L_C = \sqrt{\frac{A}{1.5}}$ where: A = area in m^2

$L_{AVG} = L_M + L_C / 2$

The pervious length parameter is based on an average lot depth from the back of a typical lot to the centre line of the road, approximately 40 m. This approach is consistent with City of Ottawa Sewer Design Guidelines (Appendix 8).

4.4.1.7 Initial Abstraction (Depression Storage)

Depression storage depths of 1.57 mm and 4.67 mm were used for impervious and pervious areas, respectively. These values are consistent with those in the City of Ottawa Sewer Design Guidelines.

4.4.1.8 Manning's roughness

Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.

4.4.1.9 Slope

A slope of 0.15% was used for impervious surfaces and a slope of 2% was used for pervious areas (lot grading).

4.4.1.10 Baseflow

No baseflow components were assumed for any of the areas contributing runoff to the minor system within the SWMHYMO model.

4.4.1.11 Minor System capture

Inlet control devices (ICDs) are proposed to control the surcharge in the minor system during infrequent storm events and maximize the use of available on site storage. The ICD sizes were selected from the standard orifice sizes summarized in the City of Ottawa Standard tender Documents MS-18.4 (March, 2017).

The minimum minor system capture of ICDs for the subject site is based on SWMHYMO generated flows for individual areas for the 2 year 3 hour Chicago storm event, as per the September 2016 Technical Bulletin PIEDTB-2016-01City guideline.

Where required, the minor system inflow rate was optimized to protect lots from surface flooding during the 100 year storm event. This was accomplished by increasing the ICD release rates for street segments at critical locations above the 2 year storm event. The level of service for future development blocks east and west of the O'Keefe Drain remains at 2 year modeled flow.

SWMHYMO input parameters, including ICD restrictions, are summarized in **Table 4-1.** Further information on the ICDs can be found in the catchbasin table on **Drawing 010**.

4.4.1.12 Major System Storage and Routing

- **Street Segments**

All the street segments within the subject site, except areas S200A and S305, have a saw-tooth design grade pattern with catchbasins installed with inlet control devices (ICDs) at the low points. Flow is attenuated within these low points with potential overflow cascading to the next segment downstream. The total volume at each low point, up to the overflow depth, is the maximum static storage.

Available surface storage was accounted for in the SWMHYMO model, and is summarized in **Table 4-1** and shown on **Drawing 400**. The surface storage was considered in two parts: a "static" storage and a "dynamic" storage. Each storage location was examined individually, at a static depth (for this particular design, varies between 0.11 to 0.31m), designed as "static" storage with the outflow-storage curve based on the minor system capture and the "static" ponding volume. If the SWMHYMO simulation did not produce overflow, then the design of the low point was completed. If the SWMHYMO simulation indicated an overflow, the "dynamic" routing was performed to utilize the available storage (i.e. the difference between the static depth and the allowable 0.35m ponding depth). Dynamic routing was performed with a second route reservoir command.

The second outflow-storage curve was based on the normal depth of flow for the downstream street segment and available storage between the static ponding elevation and max depth of 0.35 m.

The outflow from this command represents the major system flow cascading to the downstream segment. Any overflow from this second route reservoir would indicate that the max depth would be exceeded. In the event that overflow occurred during the "dynamic" storage routing, an additional iteration was performed in which the minor system capture was increased to ensure no overflow, and therefore the depth limited to below the max depth.

The above approach ensures that the City guideline of 0.35 m ponding depth is maintained at all locations. It should also be noted that if the approximate 0.35 m of ponding was designed as the "static" storage, then "dynamic" storage was not available and therefore not used.

- **Future Development Blocks**

To protect the lots from surface flooding, it is required to provide on-site quantity control storages for all the future development blocks, with the exception of Blocks 16, 17, and 3 which directly discharge to the SWMF. The required unit storage rate for each block is 120 m^3/ha. The provided surface storage for commercial blocks was accounted for in the SWMHYMO model, and is summarized in **Table 4-1.**

4.4.2 Summary of Design Parameters

Table 4-1 summarizes the main hydrological parameters used in the SWMHYMO model. The SWMHYMO drainage area plan is presented in **Drawing 750**. Model output files are included on the CD enclosed in **Appendix C**.

Table 4-1: Hydrological parameters – O'Keefe Court development
(Storm files noted in table)

Drainage Area		Downstream Segment ID‡	MH	IMP Ratio (%)	Segment Length (m)			Time to Peak (hr)	CN	Static Storage (m^3)		Extended Storage (m3)	2 Year Modeled Flow (l/s)*	Total Flow to Minor System (l/s)†
Segment ID	Area (ha)				Average	Measured	Calculated			Available	Assumed**			
Street Segments														
B11	0.71	S202A	MH11	0.86	101.00	133.50	68.80				85.20		110	110
B12	0.41	S202B	MH12	0.86	60.00	67.00	52.28				49.20		69	69
B10	0.36	S202A	MH10	0.86	59.00	68.50	48.99				43.20		61	61
S202B	0.10	S202A	MH202	0.99	46.00	66.00	25.82			8.83		72.70	20	24
S202A	0.10	S200C	MH202	0.99	46.00	66.00	25.82			2.24		130.10	20	24
S200C	0.03	S200D	MH200	0.99	22.00	30.00	14.14			5.57		42.78	6	6
S200D	0.03	S206	MH200	0.99	22.00	30.00	14.14			3.78		48.96	6	6
S200A	0.04	FLFRD	MH200	0.99	18.00	20.00	16.33						8	5
B9	0.37	S206	MH09	0.86	71.00	92.20	49.67				44.40		61	61
B8	0.75	S206	MH08	0.86	105.00	140.00	70.71				90.00		115	115
B13	0.66	S206	MH13	0.86	73.00	79.50	66.33				79.20		108	108
S206	0.27	S208	MH206	0.99	82.00	121.00	42.43			47.89		120.89	50	57
S208	0.06	B209	MH208	0.99	22.00	24.00	20.00			6.91		21.11	13	44
B7	0.57	B209	MH07	0.86	91.00	120.00	61.64				68.40		90	90
B14	0.44	B209	MH14	0.86	64.00	74.00	54.16				52.80		74	74
B209	0.04	B18	MH209	0.99	33.00	49.00	16.33			19.70		16.50	8	63
B16	0.36	B18	MH16	0.86	65.00	82.00	48.99						60	60
B17	0.58	B18	MH17	0.86	76.00	90.00	62.18						95	95
B18	0.13	SWM	0.00	0.99	89.00	148.00	29.44						23	0
B1	0.55	S304A	MH01	0.86	81.00	102.00	60.55				66.00		89	89
B2	0.43	S304A	MH02	0.86	73.00	93.00	53.54				51.60		71	71
S304A	0.20	S302	MH304	0.99	48.00	60.00	36.51			54.67		25.71	40	44

Drainage Area		Downstream Segment ID‡	MH	IMP Ratio (%)	Segment Length (m)			Time to Peak (hr)	CN	Static Storage (m^3)		Extended Storage (m3)	2 Year Modeled Flow (l/s)*	Total Flow to Minor System (l/s)†
Segment ID	**Area (ha)**				**Average**	**Measured**	**Calculated**			**Available**	**Assumed****			
S304B	0.08	S302	MH304	0.99	42.00	60.00	23.09			33.93		16.32	16	23
S302	0.07	SWM	MH302	0.99	21.00	21.30	21.60				33.61	15	23	16
B3	0.51	SWM	MH03	0.86	83.00	107.00	58.31						82	82
B400	0.23	B401	0.00	0.99	84.00	128.00	39.16						42	0
B401	0.03	SWM	0.00	0.99	63.00	111.00	14.14						6	0
S305	0.08	OKFCRT	MH305	0.99	33.00	42.00	23.09						16	0
SWM	0.67	DRAIN	SWM					0.25	95.00				46	0
Total (ha)	**8.86**	**Total Flow from Street and Block Areas to Minor System (cms)**												**1404**
Area Tributary to O'keef Drain (in addition to SWMF outflow)														
OKFCRT	1.08	B15	0.00		0.00			0.11	43.00				11	0
B15	0.54	B6	0.00		0.00			0.17	43.00				5	0
B6	0.79	FLCLV	0.00		0.00			0.17	43.00				7	0
FLFDCH	7.36	FLCLV	0.00		0.00			1.82	43.00				14	0
Total (ha)	**18.63**													

Notes:

** Areas modeled using NASHYD to generate hydrographs use Time to Peak & CN value rather than IMP ratio & Segment Length. These values are noted in the table.*

‡ Downstream segment presented is the segment which that area ultimately drains to.

*** On-site storages should be provided for future development blocks.*

 # 2 year generated flow values are from the SWMHYMO file (39744-HWY416.dat/out) presented on the CD in Appendix C.

† Minor flow restriction is from the SWMHYMO file (39744-HWY416.dat/out) presented on the CD in Appendix C during the 100 year 3 hour 10 min Chicago storm event.

The drainage area tributary to SWM facility is about 8.86 ha. Total drainage area of the subject site, including the areas tributary to O'Keefe Drain (FLFDCH, OKFCRT, B15, and B6) is approximately 18.63 ha.

As mentioned before, the O'Keefe Court development is located within EMP existing conditions drainage areas O-6 and O-7 (refer to EMP Figure 4.6, enclosed in **Appendix E**). The EMP Scenario 1 drainage areas that approximately correspond to the O'Keefe Court development is about 21.74 ha (refer to EMP Figure 5.2, enclosed in **Appendix E**).

The decrease in area is due to the revised drainage area boundaries as part of the detailed design. Specifically, a gas station is proposed at the North West corner of the intersection of Fallowfield Road and Strandherd Drive. This portion of the land is not included as part of the subject site. The minor and major stormwater management will be provided by others and outlet to the existing roadside ditches towards the O'Keefe Drain Tributary. On-site stormwater management will be required for the gas station block.

4.4.3 Simulation Results

The results of the SWMHYMO major system evaluation are summarized in the following sections.

4.4.3.1 On-Site Storage

The storage available on-site, and the results of the SWMHYMO evaluation for the subject site are presented in **Table 4-2**. Also included in **Table 4-2** is the amount of ponding utilized for the 2 year, 5 year, 100 year Chicago, and the stress test storm events. The ponding plan for the subject site is presented in **Drawing 400**. The SWMHYMO output files are included on the CD in **Appendix C**.

Table 4-2: Summary of On-Site Storage on Street Segments
(Storm files noted in table)

MAJOR SYSTEM SEGMENT ID	MAXIMUM AVAILABLE STORAGE (M^3)	TOTAL STORAGE UTILIZED (M^3)	MAJOR SYSTEM CASCADING OVERFLOW (L/S)	TOTAL STORAGE UTILIZED (M^3)	MAJOR SYSTEM CASCADING OVERFLOW (L/S)	TOTAL STORAGE UTILIZED (M^3)	MAJOR SYSTEM CASCADING OVERFLOW (L/S)	TOTAL STORAGE UTILIZED (M^3)	MAJOR SYSTEM CASCADING OVERFLOW (L/S)
		2 YEAR 3HR CHICAGO		5 YEAR 3HR CHICAGO		100 YEAR 3HR CHICAGO		100 YEAR 3HR CHICAGO + 20% increase in intensity	
		Storm file: S12H002y.stm		Storm file: S12H005y.stm		Storm file: C3H10010.stm		Storm file: C3H12010.stm	
S202B	8.83	0	0.0	1	0.0	8.53	67	8.65	168
S202A	2.24	0	0.0	1	0.0	1.87	133	1.93	397
S200C	5.57	0	0.0	1	0.0	5.44	127	5.51	381
S200D	3.78	0	0.0	1	0.0	3.80	118	3.54	357
S200A	0.00	0	0.0	0	0.0	0.00	0	0.00	0
S206	47.89	0	0.0	5	0.0	47.85	154	47.83	402
S208	6.91	0	0.0	0	0.0	6.85	141	6.77	381
B209	19.70	0	0.0	0	0.0	19.53	10	18.85	13
S304A	54.67	0	0.0	4	0.0	54.42	2	54.50	26
S304B	33.93	0	0.0	0	0.0	7.17	0	11.91	0
S302	17.00	0	0.0	0	0.0	5.36	0	17.01	1
S305	0.00	0	0.0	0	0.0	0.00	0	0.00	0

The analysis indicates that all streets provide full capture during the 2 year storm event. Ponding during the 5 year storm event is negligible.

It should be noted that storage volumes of 0.01 m^3 indicated in the computer output are not considered in the calculation of ponding duration since the volume are considered to be below of the threshold recognition.

4.4.4 Velocity X Depth

The cascading flow across the site was evaluated to confirm that depth and velocity were in accordance with City guidelines. As per the newest update to OSDG guidelines (refer to September 2016 Technical bulletin PIEDTB-2016-01), the maximum depth of flow should not exceed 350 mm and the product of velocity x depth on all the street segments should not exceed 0.6 m2/s during the 100 year storm event.

To determine velocity of cascading overflow at street segments, a separate SWMHYMO model was used (39744VXD.dat/out). The evaluation is based on street cross-sections and proposed grades. Using the channel routing routine in SWMHYMO, maximum normal depth and velocity of flow have been quantified and results are presented below for the 100 year 3 hour Chicago storm, and the 100 year 3 hour Chicago + 20 % storm.

To determine depth of the cascading overflow for street segments with ponding, the calculation sheet from the February 2014 City of Ottawa Technical Bulletin ISDTB-2014-01 was employed.

Table 4-3 and **Table 4-4** summarize the cascading flows on the subject site for the 100 year 3 hour Chicago storm event and the 100 year Chicago storm increased by 20%, respectively. The cascading overflow is the flow exiting a drainage area when maximum minor system inflow and maximum available ponding has been utilized. The overflow is obtained from the respective detailed model SWMHYMO output file and is noted in the tables below. The corresponding total ponding elevation, including the static and dynamic ponding, is also summarized on **Table 4-3** and **Table 4-4**.

The output files are provided on the CD enclosed in **Appendix C**. The typical road cross sections, and the ponding plan for the subject site are also presented in **Appendix C**.

Table 4-3: Summary of Cascading Flow during the 100 Year 3 Hour Chicago Storm

MAJOR SYSTEM SEGMENT ID	ROAD ROW SECTION	LONGITUDINAL SLOPE (%)	TOP OF GRATE ELEVATION (M)	OVERFLOW (L/S)	VELOCITY (M/S)	DYNAMIC DEPTH (WHERE APPLICABLE) (M)	MAXIMUM STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	MAXIMUM DEPTH (STATIC + DYANMIC, WHERE APPLICABLE) (M)	CORRESPONDING ELEVATION (M)	VELOCITY X DEPTH (M^2/S)
Cascading Flow – O'KEEFE COURT DEVELOPMENT										
(SWMHYMO Output "39744-HWY416.dat/out")										
S202B	20	3	103.66	134*	1.21	0.08	0.17	0.25	103.91	0.09
S202A	20	0.53	103.66	266*	0.76	0.10	0.11	0.21	103.87	0.08
S200C	20	3	103.62	254*	1.43	0.10	0.16	0.26	103.88	0.14
S200D	20	0.53	103.61	236*	0.73	0.10	0.14	0.24	103.85	0.07
S200A	20	5	102.98	14	0.85	0.02	N/A	0.02	103.00	0.02
S206	20	0.84	103.38	154	0.78	0.10	0.24	0.34	103.72	0.08
S208	20	0.84	103.50	141	0.77	0.10	0.15	0.25	103.75	0.08
B209	9	0.5	103.30	10	0.48	0.04	0.29	0.33	103.63	0.02
S304A	20	3	104.16	4*	0.49	0.02	0.31	0.33	104.49	0.01
S304B	20	3	104.16	0*	0.00	0.00	0.31	0.31	104.47	0.00
S305	20	3.79	103.36	33	0.84	0.03	N/A	0.03	103.39	0.03
B18	9	0.55	N/A	313	1.01	0.08	N/A	0.08	N/A	0.08
S302	20	27	104.20	0	0.00	0.00	0.24	0.24	104.44	0.00
EASTERN MAJOR FLOW INLET TO POND	6.5	0.26	N/A	313	0.68	0.07	N/A	0.07	N/A	0.05
WESTERN MAJOR FLOW INLET TO POND	3	3.6	N/A	258	1.51	0.18	N/A	0.18	N/A	0.27

*Note: * flow multiplied by 2 for half streets and then used City sheets*

Table 4-4: Summary of Cascading Flow during the 100 Year 3 Hour Chicago Storm Increased by 20%

MAJOR SYSTEM SEGMENT ID	ROAD ROW SECTION	LONGITUDINAL SLOPE (%)	TOP OF GRATE ELEVATION (M)	OVERFLOW (L/S)*	VELOCITY (M/S)	DYNAMIC DEPTH (WHERE APPLICABLE) (M)	MAXIMUM STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	MAXIMUM DEPTH (STATIC + DYANMIC, WHERE APPLICABLE) (M)	CORRESPONDING ELEVATION (M)	VELOCITY X DEPTH (M^2/S)
CASCADING FLOW – O'KEEFE COURT DEVELOPMENT										
(SWMHYMO OUTPUT "39744-HWY416.DAT/OUT")										
S202B	20	3	103.66	336*	1.53	0.11	0.17	0.28	103.94	0.164
S202A	20	0.53	103.66	794*	0.99	0.15	0.11	0.26	103.92	0.150
S200C	20	3	103.62	762*	1.89	0.15	0.15	0.30	103.92	0.274
S200D	20	0.53	103.61	714*	0.97	0.15	0.14	0.29	103.90	0.141
S200A	20	5	102.98	18	0.93	0.02	N/A	0.02	103.00	0.022
S206	20	0.84	103.38	402	1.00	0.15	0.24	0.39	103.77	0.150
S208	20	0.84	103.50	381	0.98	0.15	0.15	0.30	103.80	0.145
B209	9	0.5	103.30	13	0.52	0.04	0.29	0.33	103.63	0.022
S304A	20	3	104.16	52*	0.95	0.05	0.31	0.36	104.52	0.051
S304B	20	3	104.16	0*	0.00	0.00	0.31	0.31	104.47	0.000
S305	20	3.79	103.36	41	0.91	0.04	N/A	0.04	103.40	0.034
B18	9	0.55	N/A	418	1.11	0.10	N/A	0.10	N/A	0.108
S302	20	27	104.20	1	0.18	0.09	0.24	0.33	104.53	0.016
EASTERN MAJOR FLOW INLET TO POND	6.5	0.26	N/A	418	0.77	0.09	N/A	0.09	N/A	0.066
WESTERN MAJOR FLOW INLET TO POND	3	3.6	N/A	333	1.61	0.20	N/A	0.20	N/A	0.314

*Note: * flow multiplied by 2 for half streets and then used City sheets*

In all locations within the subject site and under all storm events, the VxD product is less than the maximum allowable product of 0.6 per City of OSDG.

Within the subject site under the 100 year Chicago storm event, for all the street segments the summation of depth of ponding and depth of cascading flow is less than allowable depth of 0.35m per September 2016 City of Ottawa Technical Bulletin.

During the 100 year storm event increased by 20%, the summation of depth of ponding and depth of cascading flow is less than 0.35 m in the majority of the locations throughout the subject site. However, there are two locations (S206 and S304A) where the total depth exceeds 0.35 m. These areas are noted in **Table 4-4** in red and bold.

The following table summarizes the elevation of the low points and high points, depth of the sags, and property line elevation for the street segments where summation of depth of ponding and depth of cascading flow is exceeds 0.35 m during the 100 year storm event increased by 20%.

Table 4-5: Summary of Extent of Cascading Flow in Relation to Property Lines and Garage Elevations

MAJOR SYSTEM SEGMENT ID	SPILL POINT ELEVATION (M)	TOP OF GRATE ELEVATION (M)	DEPTH OF SAG (M)	MAXIMUM PONDING DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	CORRESPONDING ELEVATION(M)*	LOWEST PROPERTY LINE ELEVATION (M)
S206	103.62	103.38	0.24	0.24	103.62	103.62
S304A	104.47	104.16	0.31	0.31	104.47	104.39

During the 100 year storm event increased by 20%, the major system cascading flow will encroach the lowest property line. However, proposed grading within each of the blocks will be entirely dependent tenant and building use within each block. Detail design of each block will need to verify that the lowest building openings are above the corresponding elevation within the street segment.

4.4.5 Major System Outlets to the SWM Facility

As noted in **Section 4.3.2**, except for areas S305 and S200A, surface runoff in excess of the minor system capture will cascade via street segments, eventually reaching to the proposed SWM facility. Flows will enter the SWM facility from the east via the sewer easement alignment (Area B18); and from the west, via the proposed swale within the 3m wide drainage easement block (Area B401), as shown on **Drawing 750**.

Major system flow from the east of the O'Keefe Drain will flow over the culvert and along the easement (Block 18 & Block 5) prior to entering the eastern flow inlet. The easement/major flow pathway consists of two cross sections, Block 18 & Block 5. Their corresponding cross sections are presented on **Drawing 011,** and their capacities have been confirmed as presented in **Table 4-6**. During the 100 year 3 hour Chicago storm event, the total estimated flow to be conveyed to the eastern inlet is 313 L/s.

The proposed swale will be constructed inside the drainage easement along the northern edge of the 14 m wide MTO easement to convey runoff to the western inlet of the facility. The swale will consist of a triangular cross-section with a height of 0.30 m that ties into the SWF to the east and to the proposed development to the west, as shown on **Drawing 39744-400**. The proposed longitudinal slope of the swale ranges between 0.5% and 3.6%. At its downstream end, the total estimated flow to be conveyed to the channel is 258 L/s, during the 100 year Chicago storm event.

It should be noted that a sawtooth design on Street No. 3 will provide sufficient storage to capture major flow runoff during the 100 year Chicago storm event, with no overflow to the SWM facility.

The capacity of the proposed swale and the overland flow pathway (Block 18 & Block 5) was confirmed by modeling the swale cross section using the SWMHYMO channel route command. The results are summarized in the table below. The supporting SWMHYMO output files (39744VXD.dat/out) are provided on the CD enclosed in **Appendix C**.

Table 4-6: Contributing flows to major system inlets during the 100 Year Chicago design event

OUTLET	CONTRIBUTING DRAINAGE AREA (AREA ID) / BLOCK NO.	FLOW (CMS)	MAXIMUM DEPTH OF FLOW (M)	FREREBOARD (M)	VELOCITY (M/S)
WESTERN MAJOR FLOW INLET	B401 / Drainage easement	0.122	0.18	0.12	1.51
	B3 / Block 3	0.136			
EASTERN MAJOR FLOW INLET	B18 / Block 18	0.313	0.07	0.23	0.68
	B18 / Block 5	0.313	0.08	0.22	0.70

4.5 Hydraulic Evaluation

4.5.1 Post-Development Conditions Evaluation

The hydraulic grade line (HGL) was evaluated using the XPSWMM hydraulic model. A model was created for the detail design of the laterals and storm sewers within the subject site. The XPSWMM analysis was also used to evaluate the hydraulic function of the SWM Facility. The hydraulic function of the SWM Facility is discussed in the Draft "O'Keefe Court 416 Lands Stormwater Management Report and Design Brief" (IBI, May 2017).

The minor system hydrographs for each area were downloaded from SWMHYMO model. The stage-area curve for the SWM facility has been downloaded into the model. Minor system losses were accounted for in accordance with Appendix 6-B of the City of Ottawa Sewer Design Guidelines (October 2012). The XPSWMM schematic and the model files are enclosed in **Appendix C**.

XPSWMM simulations were conducted for the 100 year 3 hour Chicago storm and 100 year 12 hour SCS Type II with 10 minute time step to evaluate HGL in the sewers. A sensitivity analysis was also performed using the 100 year Chicago storm with a 20% increase in intensity, 100 year SCS storm with a 20% increase in intensity, and the July 1 1979 historical storm to ensure that there would be no severe flooding to lots. Hydraulic grade line values for the various storms are presented in **Table 4-7** below.

Table 4-7: Summary of Hydraulic Grade Line Evaluation

XP-SWMM NODE ID	MH NO.	GROUND ELEVATION (M)	OBVERT ELEVATION (M)	100 YEAR 12 HOUR SCS TYPE II ‡		100 YEAR 3 HOUR CHICAGO†		100 YEAR 12 HOUR SCS TYPE II INCREASED BY 20%%		JULY 1, 1979¥		100 YEAR 3 HOUR CHICAGO INCREASED BY 20%£	
				HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*
O'Keefe Court Development													
MH304	304	104.43	102.16	101.87	2.56	101.87	2.56	102.09	2.34	102.10	2.33	101.89	2.54
MH303	303	104.27	102.14	101.75	2.52	101.67	2.60	102.08	2.19	102.09	2.18	101.84	2.43
MH302	302	104.49	101.31	101.75	2.74	101.66	2.83	102.06	2.43	102.08	2.41	101.83	2.66
MH301	301	103.29	101.18	101.74	1.55	101.62	1.67	102.03	1.26	102.05	1.24	101.79	1.50
MH300	300	102.81	101.11	101.73	1.08	101.62	1.19	102.01	0.80	102.02	0.79	101.79	1.02

XP-SWMM NODE ID	MH NO.	GROUND ELEVATION (M)	OBVERT ELEVATION (M)	100 YEAR 12 HOUR SCS TYPE II ‡		100 YEAR 3 HOUR CHICAGO†		100 YEAR 12 HOUR SCS TYPE II INCREASED BY 20%%		JULY 1, 1979¥		100 YEAR 3 HOUR CHICAGO INCREASED BY 20%£	
				HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*	HGL (M)	FREE BOARD (M)*
SWM	N/A	102.3	N/A	101.73	0.57	101.61	0.69	102.01	0.29	102.02	0.28	101.78	0.52
MH17	17	104.77	102.21	102.04	2.73	102.04	2.73	102.11	2.66	102.12	2.65	102.04	2.73
MH305	305	104.65	102.19	101.94	2.71	101.95	2.70	102.10	2.55	102.12	2.54	101.95	2.70
MH02	2	104.77	102.21	101.99	2.78	102.00	2.77	102.11	2.66	102.13	2.64	102.00	2.77
CB305B	305B	103.36	102.05	101.94	1.42	101.95	1.41	102.11	1.25	102.12	1.24	101.95	1.41
CB305A	305A	103.36	102.05	101.94	1.42	101.95	1.41	102.11	1.25	102.12	1.24	101.95	1.41
CB200B	200B	102.98	101.81	101.94	1.04	101.89	1.09	102.31	0.67	102.28	0.70	102.07	0.91
MH200	200	103.82	101.71	101.93	1.89	101.89	1.93	102.30	1.52	102.27	1.55	102.06	1.76
MH201	201	103.93	101.52	101.92	2.02	101.87	2.06	102.28	1.65	102.27	1.66	102.04	1.89
MH205	205	103.87	101.50	101.91	1.96	101.86	2.01	102.27	1.60	102.26	1.61	102.03	1.84
MH206	206	103.64	101.45	101.89	1.75	101.85	1.79	102.25	1.39	102.24	1.40	102.01	1.63
MH207	207	103.63	101.38	101.85	1.78	101.80	1.83	102.20	1.43	102.20	1.43	101.96	1.67
MH208	208	103.57	101.34	101.82	1.75	101.77	1.80	102.17	1.40	102.18	1.39	101.94	1.63
MH209	209	103.57	101.30	101.81	1.76	101.76	1.81	102.16	1.41	102.17	1.40	101.93	1.64
MH210	210	103.63	101.23	101.77	1.86	101.71	1.92	102.12	1.51	102.13	1.50	101.88	1.75
CB200A	200A	102.98	101.81	101.94	1.04	101.89	1.09	102.31	0.67	102.27	0.71	102.07	0.91
MH11	11	104.11	101.66	102.01	2.10	101.96	2.15	102.37	1.74	102.36	1.75	102.14	1.97
MH203	203	103.88	101.64	101.99	1.89	101.94	1.94	102.35	1.53	102.34	1.54	102.11	1.77
MH202	202	103.91	101.60	101.96	1.95	101.91	2.00	102.32	1.59	102.31	1.60	102.08	1.83
MH10	10	104.04	101.62	101.98	2.06	101.93	2.11	102.34	1.70	102.33	1.71	102.10	1.94
MH12	12	104.06	101.55	101.94	2.12	101.90	2.16	102.31	1.75	102.30	1.76	102.07	1.99
MH09	9	103.83	101.46	101.91	1.92	101.86	1.97	102.27	1.56	102.26	1.57	102.03	1.80
MH13	13	103.74	101.41	101.87	1.87	101.81	1.93	102.22	1.52	102.22	1.52	101.98	1.76
MH08	8	103.73	101.40	101.86	1.87	101.81	1.92	102.21	1.52	102.22	1.51	101.98	1.75
MH03	3	104.44	101.35	101.75	2.69	101.67	2.77	102.08	2.36	102.09	2.35	101.84	2.60
MH14	14	103.89	101.29	101.83	2.06	101.77	2.12	102.18	1.71	102.18	1.71	101.94	1.95
MH07	7	103.89	101.28	101.83	2.06	101.77	2.12	102.18	1.71	102.19	1.70	101.94	1.95
MH16	16	103.51	101.20	101.74	1.77	101.62	1.89	102.03	1.48	102.05	1.46	101.79	1.72
XS3180	N/A	99.99	N/A	99.96	0.03	99.70	0.29	99.97	0.02	99.97	0.02	99.97	0.02
FLCLV	N/A	100.5	N/A	99.97	0.53	99.71	0.79	99.98	0.52	99.98	0.52	99.97	0.53
Node41	N/A	100.5	N/A	99.97	0.53	99.70	0.80	99.97	0.53	99.97	0.53	99.97	0.53

Notes:

* The free board is the Ground Elevation minus the HGL.

‡ HGL results for the 100 year 12 hour SCS Type II storm event were taken from the results of the XPSWMM model entitled "39744-SCS100yr.xp/out" and presented on the CD in **Appendix C**.

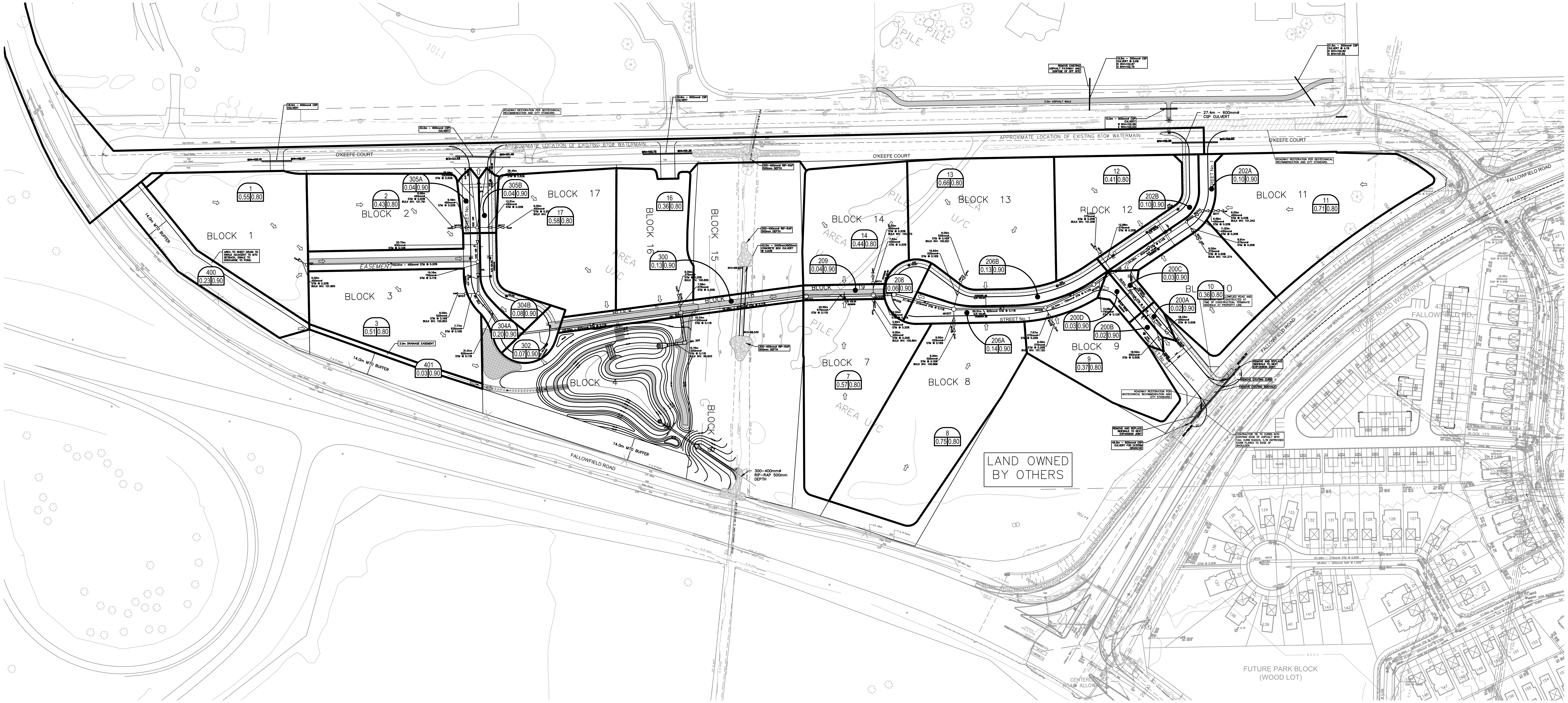
† HGL results for the 100 year 3 hour Chicago storm event were taken from the results of the XPSWMM model entitled "39744-100ch.xp/out" and presented on the CD in **Appendix C**.

£ HGL results for the 100 year 12 hour SCS storm event increased by 20% were taken from the results of the XPSWMM model entitled "39744-SCS120yr.xp/out" and presented on the CD in **Appendix C**.

¥ HGL results for the July 1, 1979 historical storm were taken from the results of the XPSWMM model entitled "39744-JUL79.xp/out" and presented on the CD in **Appendix C**.
£ HGL results for the 100 year 3 hour Chicago storm event increased by 20% were taken from the results of the XPSWMM model entitled "39744-120CH.xp/out" and presented on the CD in **Appendix C**.

The results indicate that the pond water level is a dominant factor in evaluating HGL in the storm sewers. The 100 year 12 hours SCS Type II with 10 minute time step has been determined to be the most critical event in HGL analysis of the storm sewers.

HGL results of the sensitivity analysis along with a comparison of ground elevations are also summarized in the above table.



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ____________________

Date ____________________2017

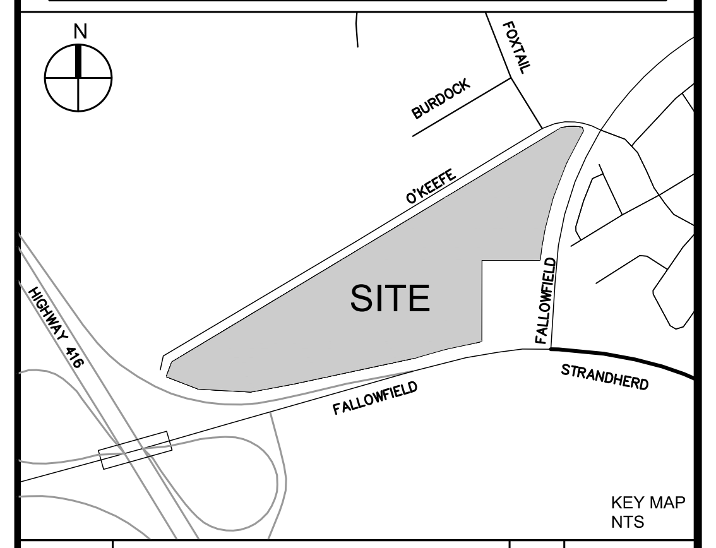
Plan Number ____________________

LEGEND :

S168 / 2.01 | 0.80 ← AREA NUMBER; ← RUNOFF COEFFICIENT; ← AREA IN HECTARES

⇨ EMERGENCY FLOW ROUTE

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY MAP
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED PER CITY COMMENTS	DGY	18:01:10
2	REVISED PER CITY COMMENTS	DGY	17:09:26
1	ISSUED FOR CITY REVIEW	DGY	17:05:04

DCR/PHOENIX GROUP OF COMPANIES
18A BENTLEY AVE,
OTTAWA ONT
K2E 6T8

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

416 LANDS
4401 FALLOWFIELD ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
10/01/2018
PROVINCE OF ONTARIO

Drawing Title

STORM DRAINAGE AREA PLAN

Scale 1:1250	
Design MB/RM	Date MARCH 2016
Drawn EH	Checked DGY
Project No. 39744	Drawing No. 500

CITY PLAN No. 17492

CITY FILE No. D07-16-13-0013

J:\39744-Hwy416\5.9 Drawings\59civil\layouts\500STM TRIB.dwg Layout Name: 500STM TRIB Plot Style: AIA STANDARD-FULL.CTB Plot Scale: 1:25.4 Plotted At: 1/10/2018 2:39 PM Last Saved By: ehenrie Last Saved At: Jan. 10, 18

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

STORM SEWER DESIGN SHEET

416 Lands
City of Ottawa
DCR Phoenix

LOCATION				AREA (Ha)							RATIONAL DESIGN FLOW															SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.40	C= 0.50	C= 0.57	C= 0.80	C= 0.90	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm)			SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr)	
																												DIA	W	H			(L/s)	(%)
STREET NO. 3	S305A	CB305A	MH 305							0.04	0.10	0.10	10.00	0.57	10.57	76.81	104.19	122.14	178.56	7.69	10.43	12.22	17.87		7.69	34.22	35.99	200			1.00	1.055	26.53	77.54%
STREET NO. 3	S305B	CB305B	MH 305							0.04	0.10	0.10	10.00	0.58	10.58	76.81	104.19	122.14	178.56	7.69	10.43	12.22	17.87		7.69	34.22	36.45	200			1.00	1.055	26.53	77.54%
BLOCK 2	2	STUB W	MH02						0.43		0.96	0.96	10.00	0.12	10.12	76.81	104.19	122.14	178.56	73.45	99.64	116.81	170.76		73.45	133.02	6.00	450			0.20	0.810	59.57	44.78%
STREET NO. 3		MH02	MH 305								0.00	0.96	10.12	0.20	10.32	76.33	103.55	121.38	177.44	73.00	99.02	116.08	169.69		73.00	133.02	9.49	450			0.20	0.810	60.02	45.12%
BLOCK 17	17	STUB E	MH17						0.58		1.29	1.29	10.00	0.12	10.12	76.81	104.19	122.14	178.56	99.07	134.40	157.55	230.33		99.07	133.02	6.00	450			0.20	0.810	33.94	25.52%
STREET NO. 3		MH17	MH 305								0.00	1.29	10.12	0.26	10.38	76.33	103.55	121.38	177.44	98.46	133.56	156.57	228.88		98.46	133.02	12.51	450			0.20	0.810	34.55	25.98%
STREET NO. 3		MH 305	MH 304								0.00	2.45	10.58	0.42	11.00	74.66	101.25	118.67	173.46	182.65	247.69	290.32	424.36		182.65	239.68	20.70	600			0.14	0.821	57.02	23.79%
BLOCK 1	1	STUB NW	MH01						0.55		1.22	1.22	10.00	0.12	10.12	76.81	104.19	122.14	178.56	93.95	127.45	149.40	218.41		93.95	133.02	6.00	450			0.20	0.810	39.07	29.37%
EASEMENT		MH01	MH 304								0.00	1.22	10.12	2.13	12.25	76.33	103.55	121.38	177.44	93.37	126.66	148.47	217.04		93.37	133.02	103.51	450			0.20	0.810	39.64	29.80%
STREET NO. 3	S304A, S304B	MH 304	MH 303							0.28	0.70	4.37	12.25	0.38	12.63	69.12	93.63	109.70	160.29	302.05	409.18	479.42	700.50		302.05	385.20	19.16	750			0.11	0.845	83.14	21.58%
BLOCK 3	3	STUB W	MH03						0.51		1.13	1.13	10.00	0.12	10.12	76.81	104.19	122.14	178.56	87.12	118.18	138.54	202.53		87.12	179.46	6.00	525			0.16	0.803	92.35	51.46%
STREET NO. 3		MH03	MH 303								0.00	1.13	10.12	0.16	10.29	76.33	103.54	121.37	177.43	86.58	117.44	137.67	201.25		86.58	179.46	7.77	525			0.16	0.803	92.89	51.76%
STREET NO. 3		MH 303	MH 302								0.00	5.50	12.63	0.57	13.20	67.99	92.09	107.89	157.62	374.25	506.87	593.84	867.61		374.25	496.66	31.01	825			0.11	0.900	122.42	24.65%
STREET NO. 3	302	MH 302	MH 301							0.07	0.18	5.68	13.20	1.96	15.16	66.36	89.84	105.25	153.75	376.87	510.27	597.76	873.23		376.87	496.66	105.60	825			0.11	0.900	119.79	24.12%
BLOCK 16	16	STUB N	MH16						0.36		0.80	0.80	10.00	0.12	10.12	76.81	104.19	122.14	178.56	61.49	83.42	97.79	142.96		61.49	91.46	6.00	375			0.25	0.802	29.96	32.76%
BLOCK 5		MH16	MH 301								0.00	0.80	10.12	0.16	10.28	76.33	103.54	121.37	177.43	61.11	82.90	97.17	142.06		61.11	91.46	7.59	375			0.25	0.802	30.34	33.18%
BLOCK 11	11	STUB E	MH11						0.71		1.58	1.58	10.00	0.14	10.14	76.81	104.19	122.14	178.56	121.28	164.52	192.87	281.95		121.28	133.02	6.98	450			0.20	0.810	11.74	8.82%
STREET NO. 1		MH11	MH203								0.00	1.58	10.14	0.13	10.28	76.26	103.44	121.25	177.26	120.41	163.34	191.47	279.89		120.41	133.02	6.56	450			0.20	0.810	12.60	9.47%
STREET NO. 1		MH203	MH202								0.00	1.58	10.28	0.24	10.52	75.75	102.74	120.43	176.05	119.61	162.24	190.17	277.99		119.61	133.02	11.83	450			0.20	0.810	13.40	10.08%
BLOCK 10	10	STUB SE	MH10						0.36		0.80	0.80	10.00	0.12	10.12	76.81	104.19	122.14	178.56	61.49	83.42	97.79	142.96		61.49	91.46	6.00	375			0.25	0.802	29.96	32.76%
STREET NO. 1		MH10	MH202								0.00	0.80	10.12	0.19	10.31	76.33	103.54	121.37	177.43	61.11	82.90	97.17	142.06		61.11	91.46	8.91	375			0.25	0.802	30.34	33.18%
STREET NO. 1	S202A, S202B	MH202	MH201							0.20	0.50	2.88	10.52	1.10	11.62	74.86	101.51	118.99	173.92	215.59	292.37	342.69	500.92		215.59	239.68	54.06	600			0.14	0.821	24.08	10.05%
BLOCK 12	12	STUB NW	MH12						0.41		0.91	0.91	10.00	0.12	10.12	76.81	104.19	122.14	178.56	70.03	95.01	111.37	162.82		70.03	91.46	6.00	375			0.25	0.802	21.42	23.42%
STREET NO. 1		MH12	MH201								0.00	0.91	10.12	0.27	10.39	76.33	103.54	121.37	177.43	69.60	94.41	110.67	161.79		69.60	91.46	12.98	375			0.25	0.802	21.86	23.90%
STREET NO. 1	S200A	CB200A	MH200							0.02	0.05	0.05	10.00	0.20	10.20	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	50.75	18.33	200			2.20	1.565	46.91	92.43%
STREET NO. 1	S200B	CB200B	MH200							0.02	0.05	0.05	10.00	0.21	10.21	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	49.23	19.52	200			2.07	1.518	45.39	92.19%
STREET NO. 1	S200C, S200D	MH200	MH201							0.06	0.15	0.25	10.21	0.79	11.00	75.99	103.07	120.82	176.62	19.01	25.79	30.23	44.19		19.01	41.15	38.51	250			0.44	0.812	22.14	53.80%
STREET NO. 1		MH201	MH205								0.00	4.04	11.62	0.26	11.88	71.10	96.35	112.91	165.00	287.40	389.47	456.39	666.95		287.40	402.33	13.58	750			0.12	0.882	114.93	28.57%
STREET NO. 1		MH205	MH206								0.00	4.04	11.88	0.61	12.49	70.28	95.23	111.59	163.06	284.09	384.93	451.05	659.09		284.09	402.33	32.34	750			0.12	0.882	118.24	29.39%
BLOCK 9	9	STUB SE	MH09						0.37		0.82	0.82	10.00	0.12	10.12	76.81	104.19	122.14	178.56	63.20	85.74	100.51	146.93		63.20	91.46	6.00	375			0.25	0.802	28.25	30.89%
STREET NO. 1		MH09	MH206								0.00	0.82	10.12	0.16	10.28	76.33	103.54	121.37	177.43	62.81	85.20	99.87	146.00		62.81	91.46	7.67	375			0.25	0.802	28.65	31.32%
STREET NO. 1	S206A, S206B	MH206	MH207							0.27	0.68	5.54	12.49	1.03	13.51	68.41	92.67	108.57	158.63	379.06	513.42	601.54	878.88		379.06	496.66	55.51	825			0.11	0.900	117.61	23.68%
BLOCK 8	8	STUB S	MH08						0.75		1.67	1.67	10.00	0.12	10.12	76.81	104.19	122.14	178.56	128.11	173.79	203.73	297.84		128.11	179.46	6.00	525			0.16	0.803	51.35	28.61%
STREET NO. 1		MH08	MH207								0.00	1.67	10.12	0.20	10.32	76.33	103.54	121.37	177.43	127.32	172.70	202.45	295.95		127.32	179.46	9.50	525			0.16	0.803	52.14	29.06%
BLOCK 13	13	STUB NE	MH13						0.66		1.47	1.47	10.00	0.12	10.12	76.81	104.19	122.14	178.56	112.74	152.94	179.28	262.10		112.74	179.46	6.00	525			0.16	0.803	66.73	37.18%
STREET NO. 1		MH13	MH207								0.00	1.47	10.12	0.34	10.47	76.33	103.54	121.37	177.43	112.04	151.98	178.16	260.44		112.04	179.46	16.62	525			0.16	0.803	67.42	37.57%
STREET NO. 1		MH207	MH208								0.00	8.68	13.51	0.62	14.13	65.51	88.68	103.88	151.75	568.40	769.46	901.33	1,316.62		568.40	775.41	37.18	975			0.11	1.006	207.01	26.70%
BLOCK 19	S208	MH208	MH209							0.06	0.15	8.83	14.13	0.21	14.34	63.90	86.48	101.28	147.93	564.00	763.28	893.99	1,305.72		564.00	775.41	12.54	975			0.11	1.006	211.41	27.26%
BLOCK 14	14	STUB N	MH14						0.44		0.98	0.98	10.00	0.12	10.12	76.81	104.19	122.14	178.56	75.16	101.96	119.52	174.73		75.16	133.02	6.00	450			0.20	0.810	57.86	43.50%
BLOCK 19		MH14	MH209								0.00	0.98	10.12	0.15	10.28	76.33	103.55	121.38	177.44	74.70	101.33	118.78	173.63		74.70	133.02	7.50	450			0.20	0.810	58.32	43.84%
BLOCK 7	7	STUB S	MH07						0.57		1.27	1.27	10.00	0.12	10.12	76.81	104.19	122.14	178.56	97.36	132.08	154.84	226.36		97.36	133.02	6.00	450			0.20	0.810	35.65	26.80%
BLOCK 19		MH07	MH209								0.00	1.27	10.12	0.07	10.20	76.33	103.55	121.38	177.44	96.77	131.26	153.87	224.94		96.77	133.02	3.50	450			0.20	0.810	36.25	27.25%
BLOCK 19	S209	MH209	MH210							0.04	0.10	11.17	14.34	0.67	15.01	63.37	85.76	100.44	146.69	708.07	958.16	1,122.20	1,638.97		708.07	775.41	40.55	975			0.11	1.006	67.34	8.68%
BLOCK 18		MH210	MH 301								0.00	11.17	15.01	1.27	16.28	61.74	83.52	97.81	142.84	689.85	933.21	1,092.86	1,595.91		689.85	775.41	76.48	975			0.11	1.006	85.56	11.03%
BLOCK 4		MH 301	MH 300								0.00	17.65	16.28	0.26	16.54	58.91	79.65	93.25	136.15	1,039.93	1,406.00	1,646.20	2,403.40		1,039.93	1,348.97	18.34	1200			0.11	1.155	309.04	22.91%
BLOCK 4		MH 300	HW1								0.00	17.65	16.54	0.16	16.70	58.35	78.89	92.36	134.84	1,030.12	1,392.59	1,630.43	2,380.26		1,030.12	1,348.97	10.75	1200			0.11	1.155	318.85	23.64%
										Total:	17.65																							

Definitions:
Q = 2.78CiA, 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 = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.01

Designed: KH

Checked: RM

Dwg. Reference: 39744-500

No.	Revision	Date
1.	Servicing Brief - Submission No. 1	2017-05-05
2.	Revised per City Comments - Submission No. 2	2017-09-27

File Reference: 39744.5.7.1
Date: 2017-05-05
Sheet No: 1 of 1

Appendix D EXTERNAL REPORTS

DCR/PHOENIX GROUP OF COMPANIES

REPORT
PROJECT: 39744-5.2.2

DESIGN BRIEF
O'KEEFE COURT - 416 LANDS
C/O DCR/PHOENIX GROUP OF COMPANIES
WEST BARRHAVEN - CITY OF OTTAWA

IBI

Prepared for DCR/PHOENIX GROUP OF COMPANIES
by IBI GROUP

JANUARY 2018

2 WATER DISTRIBUTION

2.1 Existing Conditions

The subject property is located in the City of Ottawa Barrhaven Water Pressure Zone. An existing large diameter (610 mm) watermain runs along O'Keefe Court north of the site and an existing 400 mm diameter watermain is located along Fallowfield Road east of the site.

2.2 Design Criteria

2.2.1 Water Demands

Water demands have been calculated based on Table 4.2 – Consumption Rates for Subdvisions of 501 to 3,000 persons of the Ottawa Design Guidelines – Water Distribution. For the commercial lands in the subject site, a consumption rate of 50,000 l/hectare/day is used.

A watermain demand calculation sheet is included in **Appendix A** and the total water demands are summarized as follows:

Average Daily	4.44 l/s
Maximum Daily	6.66 l/s
Peak Hourly	11.98 l/s

2.2.2 System Pressure

The 2010 City of Ottawa Water Distribution Guidelines states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Maximum Pressure	Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls may be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.2.3 Fire Flow Rate

As per the Ottawa Design Guidelines, fire flow requirements are to be calculated using the Fire Underwriters Survey (FUS) method. The FUS method requires the building area, type of construction, type of occupancy, use of sprinklers and exposures to adjacent buildings. At this time there are no details available for the future buildings therefore, we are proposing a fire flow rate of 15,000 l/min (250 l/s) which represents a conservative fire flow for commercial buildings..

2.2.4 Boundary Conditions

Three boundary conditions for the analysis were obtained from the City:

1. O'Keefe Court (near Highway 416)
2. O'Keefe Court (near Fallowfield Road)
3. Fallowfield Road.

A copy is also included in **Appendix A**, and they are summarized as follows:

BOUNDARY CONDITIONS			
SCENARIO	**HGL (m)** **O'Keefe Court (Near Highway 416)**	**HGL (m)** **O'Keefe Court (Near Fallowfield Road)**	**HGL (m)** **Fallowfield Road**
Maximum HGL (Basic Day)	154.0	154.4	154.5
Minimum HGL (Peak Hour)	150.2	149.9	149.8
Max Day + Fire Flow	148.5	146.5	146.0

2.2.5 Hydraulic Model

A computer model for the 416 Lands has been developed using the $H_2$0 map version 6.0 program produced by MWH Soft. The three boundary conditions have been incorporated into the model which represent the three connections to existing watermains.

2.3 Proposed Water Plan

2.3.1 Modeling Results

The hydraulic model was run under basic day, maximum day with fire flows and under peak hour conditions. Water pipes are sized to provide sufficient pressure under peak hour conditions and provide the required fire flows under maximum day conditions. Results of the hydraulic model are included in **Appendix A** and summarized as follows:

Results of the hydraulic analysis are summarized as follows:

SCENARIO	
Basic Day (Max HGL) Pressure (kPa)	480.0 – 523.3
Peak Hour Pressure (kPa)	441.3 – 462.0
Minimum Design Fire Flow @140 kPa Residual Pressure (l/s)	367.5

A comparison of the results and the design criteria is summarized as follows:

Maximum Pressure:	All nodes in the basic day, maximum hydraulic gradeline analysis have pressure less than 552 kPa therefore, pressure reducing control is not required for this development.
Minimum Pressure:	All nodes in the peak hour analysis are greater than the required 276 kPa pressure.
Fire Flow:	Under the fire flow analysis all nodes exceed the required 250 l/s (15,000 l/min) flow.

2.3.2 Watermain Layout

The proposed watermain layout for this development is shown on Drawing No. 100. A connection to the existing 600 mm watermain is proposed at Street No. 1 and O'Keefe Court with a 300 mm watermain. The 300 mm watermain will extend through the site to connect to an existing 200 mm watermain at O'Keefe Court and Foxtail Avenue. A 200 mm watermain will connect to the existing 400 mm watermain on Fallowfield Road and will be extended to connect to the internal 300 mm main. In order to service Block 1 at the west end of the site, a 250 mm will be extended from the 300 mm internal main through an easement at Blocks 2 and 3.

WATERMAIN DEMAND CALCULATION SHEET

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

PROJECT : 416 Lands
LOCATION : City of Ottawa
DEVELOPER : DCR/Phoenix

FILE: 39744-5.7.3
DATE PRINTED: 2017-09-28

PAGE : 1 OF 1

Note: *Demand calculated for all blocks as one total area (excluding roads)*
(Blocks 1-3, 7-14, 16 - 17)

NODE	RESIDENTIAL				NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND
	UNITS			POP'N	INDTRL	COMM.	RETAIL										
	SF	APT	ST		(ha.)	(ha.)	(m^2)	Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total	(l/min)
J-15						1.88			1.09	1.09		1.63	1.63		2.94	2.94	15,000
J-20						0.80			0.46	0.46		0.69	0.69		1.25	1.25	15,000
J-25						0.40			0.23	0.23		0.35	0.35		0.63	0.63	15,000
J-30						1.09			0.63	0.63		0.95	0.95		1.70	1.70	15,000
J-35						1.50			0.87	0.87		1.30	1.30		2.34	2.34	15,000
J-40						0.81			0.47	0.47		0.70	0.70		1.27	1.27	15,000
J-50						1.19			0.69	0.69		1.03	1.03		1.86	1.86	15,000
						7.67			**4.44**	**4.44**		**6.66**	**6.66**		**11.98**	**11.98**	**15,000**

ASSUMPTIONS

RESIDENTIAL DENSITIES

Single Family (SF):	3.4	p / p / u
Apartment (APT):	1.8	p / p / u
Stacked Townhouse (ST):	2.7	p / p / u

AVG. DAILY DEMAND

Residential:		l / cap / day
Industrial:		l / ha / day
Commercial:	50,000	l / ha / day
Retail:		l / ha / day

MAX. DAILY DEMAND

Residential:		l / cap / day
Industrial:		l / ha / day
Commercial:	75,000	l / ha / day
Retail:		l / ha / day

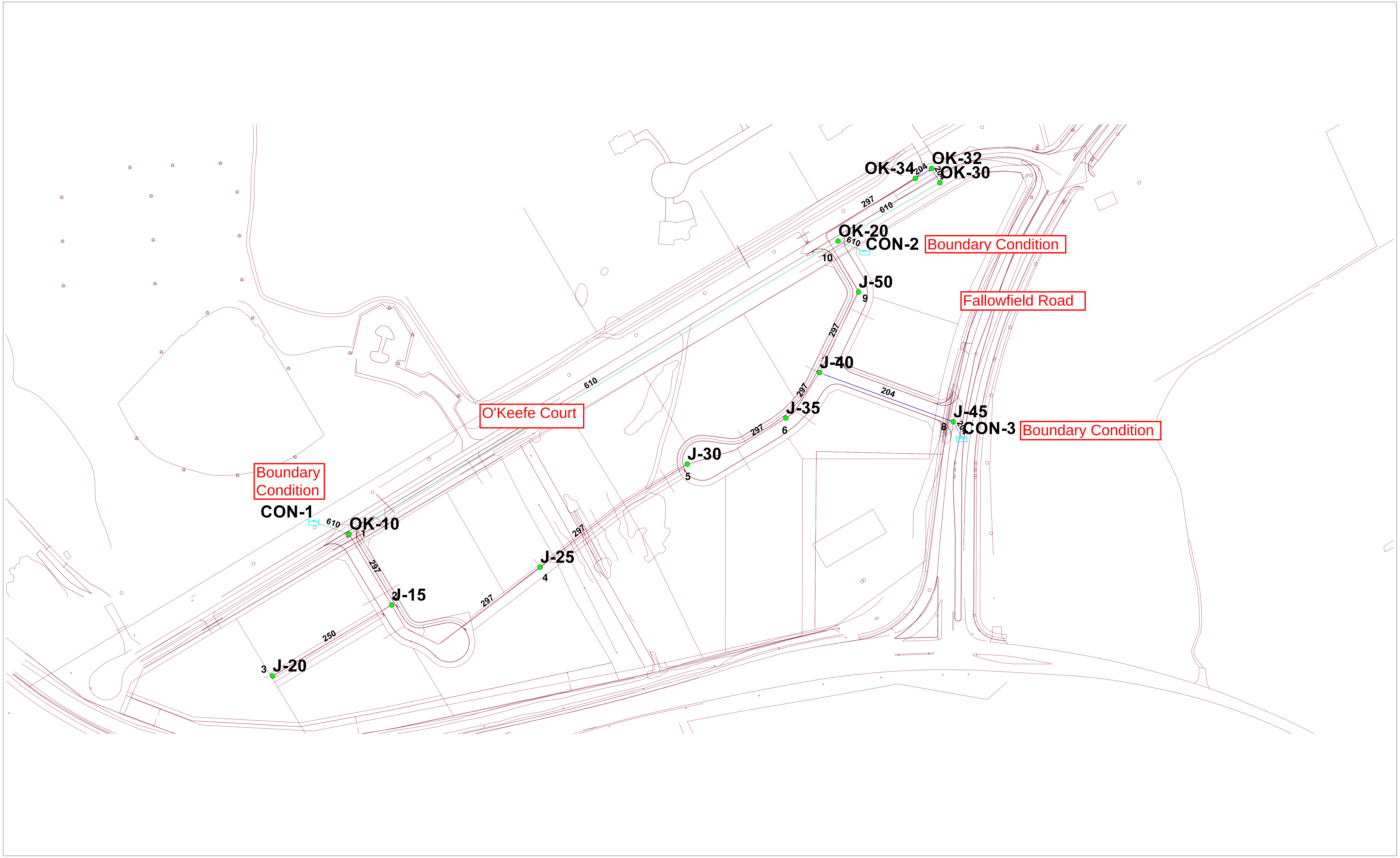
MAX. HOURLY DEMAND

Residential:		l / cap / day
Industrial:		l / ha / day
Commercial:	135,000	l / ha / day
Retail:		l / ha / day

FIRE FLOW

Commercial Demand:	15,000	l / min

O'Keefe Court - 416 Lands - Pipe Sizes and Node ID's



Date: Thursday, September 28, 2017

Basic Day (Max HGL) - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	☐	J-15	1.09	104.71	154.04	483.37
2	☐	J-20	0.46	105.05	154.04	480.04
3	☐	J-25	0.23	103.50	154.13	496.15
4	☐	J-30	0.63	103.60	154.22	496.05
5	☐	J-35	0.87	103.72	154.28	495.44
6	☐	J-40	0.47	104.00	154.31	493.00
7	☐	J-45	0.00	101.08	154.48	523.25
8	☐	J-50	0.69	104.03	154.32	492.85
9	☐	OK-10	0.00	103.05	154.00	499.28
10	☐	OK-20	0.00	104.03	154.40	493.58
11	☐	OK-30	0.00	103.80	154.40	495.82
12	☐	OK-32	0.00	103.80	154.38	495.62
13	☐	OK-34	0.00	103.80	154.35	495.39

Peak Hour - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	▢	J-15	2.94	104.71	150.08	444.61
2	▢	J-20	1.25	105.05	150.08	441.27
3	▢	J-25	0.63	103.50	149.86	454.25
4	▢	J-30	1.70	103.60	149.65	451.24
5	▢	J-35	2.34	103.72	149.53	448.92
6	▢	J-40	1.27	104.00	149.48	445.64
7	▢	J-45	0.00	101.08	146.41	444.21
8	▢	J-50	1.86	104.03	149.54	445.99
9	▢	OK-10	0.00	103.05	150.20	462.02
10	▢	OK-20	0.00	104.03	149.90	449.49
11	▢	OK-30	0.00	103.80	149.90	451.72
12	▢	OK-32	0.00	103.80	149.80	450.75
13	▢	OK-34	0.00	103.80	149.68	449.63

Max Day + Fire - Fireflow Design Report

		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	▤	J-15	251.63	J-20	401.63	145.70	1,164.24	1,171.67	J-20	136.64	118.65	1,164.24	1,164.24
2	▤	J-20	250.69	J-20	280.31	133.66	367.49	367.49	J-20	139.96	119.33	367.49	367.49
3	▤	J-25	250.35	J-25	397.16	144.03	803.24	803.17	J-25	139.97	117.78	803.18	803.18
4	▤	J-30	250.95	J-30	390.48	143.45	761.00	760.98	J-30	139.97	117.88	760.99	760.99
5	▤	J-35	251.30	J-35	391.16	143.64	799.07	799.08	J-35	139.97	118.00	799.09	799.07
6	▤	J-40	250.70	J-40	391.12	143.91	843.48	843.49	J-40	139.97	118.28	843.51	843.48
7	▤	J-50	251.03	J-50	386.81	143.50	794.67	794.69	J-50	139.97	118.31	794.70	794.67

3 WASTEWATER

3.1 Existing Conditions and Studies

The subject lands are located in the Tributary of the future South Nepean Collector (SNC). A high level master report prepared for the City by Dillon provided a functional design for the SNC. The report "South Nepean Collector (SNC) Wastewater Servicing Study and Functional Design" dated October 2003, identifies the preliminary size, slope and elevation of the SNC up to the intersection of Strandherd Drive and the former Temporary Road. The report also notes the requirement for a sub trunk "G" to be located within the West Barrhaven Community to support the growth node and provide a gravity outlet for the Havencrest lands up to Fallowfield Road.

In addition, IBI prepared a Servicing Report in 2006 and subsequently updated in 2013 titled 'Sanitary Servicing Brief, Tartan-Claridge (Jockvale Heights) DCR Phoenix (Maravista Heights)'. Future Residential lands West Barrhaven, identifying how this growth node and the adjacent lands can be serviced in advance of the SNC and provided details on the location, size and elevation of sub trunk "G". This servicing strategy has been followed to date allowing all of the following downstream developments to be constructed: DCR Phoenix West Barrhaven Phases 1 to 4, Claridge Homes West Pointe Village Phases 1 to 3, Tartan Homes Havencrest and DCR Phoenix Maravista Heights. The subject lands were not originally included in sub trunk "G"; however, the 2013 servicing report identified sufficient residual capacity within the sub-trunk sewer to accommodate the subject lands.

3.2 Design Criteria

The sanitary flows for the O'Keefe Court – 416 Lands were determined based on the City of Ottawa design criteria which includes but is not limited to the following:

Institutional/Commercial:	50,000 l/d/Ha
Institutional/Commercial 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

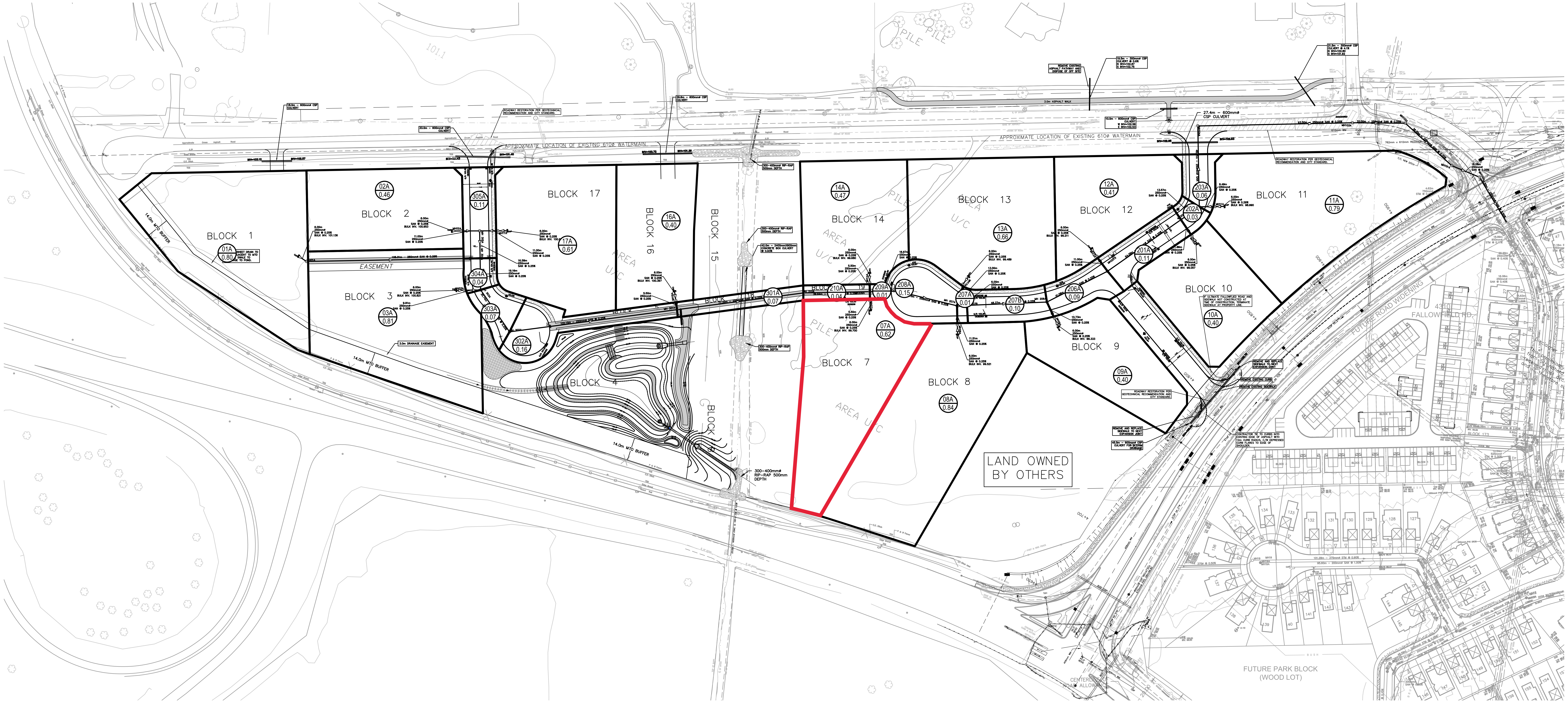
3.3 Proposed Wastewater Plan

The previously noted sub trunk "G" has been constructed and a 250 mmØ stub for these lands has been constructed at the northern limits of Cobble Hill Drive. On an interim basis flow from the Cobble Hill Drive trunk sewer is directed to the Tartan Pump Station. This interim solution for sanitary sewage has been detailed in the previous noted reports to support current development of the West Barrhaven area in advance of the SNC, see Sanitary Briefs of January 2013.

The O'Keefe Court -416 Lands will consist of commercial business park (employment) lands. The City of Ottawa's level of service for these commercial lands is 50,000 L/Ha/day with a Peaking factor of 1.5.

Drawing 501 in Appendix C illustrates the conceptual sanitary sewer layout and tributary areas for the O'Keefe Court – 416 lands. A copy of the sanitary sewer design sheet is provided in the Appendix C.

J:\39744-Hwy416\5.9 Drawings\59civil\layouts\501SAN TRIB.dwg Layout Name: 501SAN TRIB Plot Style: AIA STANDARD-FULL.CTB Plot Scale: 1:25.4 Plotted At: 1/10/2018 2:40 PM Last Saved By: ehenrie Last Saved At: Jan. 10, 18



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ____________________

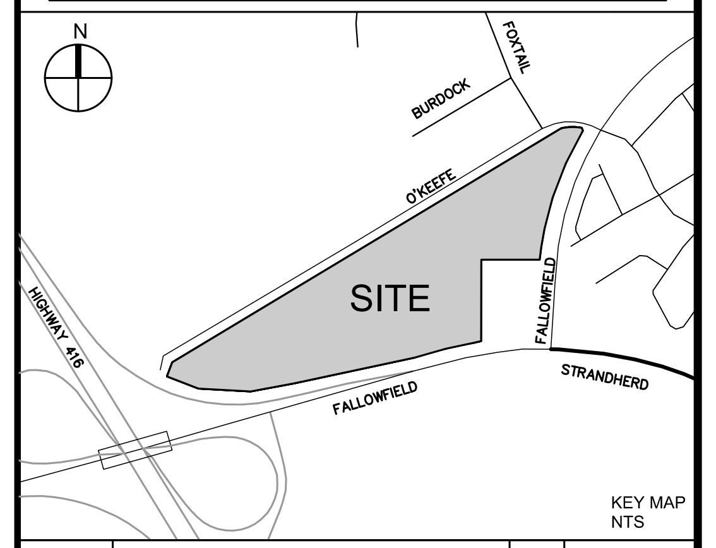
Date ____________________ 2017

Plan Number ____________________

LEGEND :

204 / 0.07 ← AREA NUMBER
← AREA IN HECTARES

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY MAP
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED PER CITY COMMENTS	DGY	18:01:10
2	REVISED PER CITY COMMENTS	DGY	17:09:26
1	ISSUED FOR CITY REVIEW	DGY	17:05:04

DCR/PHOENIX GROUP OF COMPANIES
18A BENTLEY AVE,
OTTAWA ONT
K2E 6T8

IBI GROUP
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Ottawa ON K1S 5N4 Canada
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ibigroup.com

Project Title

416 LANDS

4401 FALLOWFIELD ROAD

D. G. Yannoulopoulos
10/01/2018

Drawing Title

SANITARY DRAINAGE

AREA PLAN

Scale
1:1250

Design
MB/RM

Date
MARCH 2016

Drawn
EH

Checked
DGY

Project No.
39744

Drawing No.
501

CITY PLAN No. 17492

CITY FILE No. D07-16-13-0013

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ibigroup.com

SANITARY SEWER DESIGN SHEET

416 Lands
CITY OF OTTAWA
DCR Phoenix

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
STREET	AREA ID	FROM MH	TO MH	AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						PEAK FLOW (L/s)	AREA (Ha)		FLOW (L/s)			(L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL															
					SF	SD	TH	APT		IND	CUM			IND	CUM	IND	CUM	IND	CUM		IND	CUM		IND	CUM							L/s	(%)
BLOCK 2	02A	STUB W	MH02A							0.0	0.0	4.00	0.00			0.46	0.46			0.40	0.46	0.46	0.13			0.53	31.02	6.00	250	0.25	0.612	30.49	98.30%
STREET NO. 3		MH02A	MH 305A							0.0	0.0	4.00	0.00			0	0.46			0.40	0.00	0.46	0.13			0.53	31.02	11.00	250	0.25	0.612	30.49	98.30%
BLOCK 17	17A	STUB E	MH17A							0.0	0.0	4.00	0.00			0.61	0.61			0.53	0.61	0.61	0.17			0.70	31.02	6.00	250	0.25	0.612	30.32	97.74%
STREET NO. 3		MH17A	MH 305A							0.0	0.0	4.00	0.00			0	0.61			0.53	0.00	0.61	0.17			0.70	31.02	11.00	250	0.25	0.612	30.32	97.74%
STREET NO. 3	305A	MH 305A	MH 304A	0.11						0.0	0.0	4.00	0.00			0	1.07			0.93	0.11	1.18	0.33			1.26	31.02	16.58	250	0.25	0.612	29.76	95.94%
BLOCK 1	01A	STUB NW	MH01A							0.0	0.0	4.00	0.00			0.8	0.8			0.69	0.80	0.80	0.22			0.92	31.02	6.00	250	0.25	0.612	30.10	97.04%
EASEMENT		MH01A	MH 304A							0.0	0.0	4.00	0.00			0	0.8			0.69	0.00	0.80	0.22			0.92	31.02	105.01	250	0.25	0.612	30.10	97.04%
STREET NO. 3	304A	MH 304A	MH 303A	0.04						0.0	0.0	4.00	0.00			0	1.87			1.62	0.04	2.02	0.57			2.19	31.02	19.16	250	0.25	0.612	28.83	92.94%
BLOCK 3	03A	STUB W	MH03A							0.0	0.0	4.00	0.00			0.81	0.81			0.70	0.81	0.81	0.23			0.93	31.02	6.00	250	0.25	0.612	30.09	97.00%
STREET NO. 3		MH03A	MH 303A							0.0	0.0	4.00	0.00			0	0.81			0.70	0.00	0.81	0.23			0.93	31.02	9.91	250	0.25	0.612	30.09	97.00%
STREET NO. 3	303A	MH 303A	MH 302A	0.07						0.0	0.0	4.00	0.00			0	2.68			2.33	0.07	2.90	0.81			3.14	31.02	30.74	250	0.25	0.612	27.88	89.88%
STREET NO. 3 / BLOCK 5	302A	MH 302A	MH 301A	0.16						0.0	0.0	4.00	0.00			0	2.68			2.33	0.16	3.06	0.86			3.18	31.02	102.15	250	0.25	0.612	27.84	89.74%
BLOCK 16	16A	STUB N	MH16A							0.0	0.0	4.00	0.00			0.4	0.4			0.35	0.40	0.40	0.11			0.46	31.02	6.00	250	0.25	0.612	30.56	98.52%
BLOCK 5		MH16A	MH 301A							0.0	0.0	4.00	0.00			0	0.4			0.35	0.00	0.40	0.11			0.46	31.02	5.50	250	0.25	0.612	30.56	98.52%
BLOCK 18	301A	MH 301A	MH 210A	0.07						0.0	0.0	4.00	0.00			0	3.08			2.67	0.07	3.53	0.99			3.66	31.02	77.32	250	0.25	0.612	27.36	88.19%
BLOCK 19	210A	MH 210A	MH209A	0.04						0.0	0.0	4.00	0.00			0	3.08			2.67	0.04	3.57	1.00			3.67	31.02	39.94	250	0.25	0.612	27.35	88.16%
BLOCK 14	14A	STUB N	MH14A							0.0	0.0	4.00	0.00			0.47	0.47			0.41	0.47	0.47	0.13			0.54	31.02	6.00	250	0.25	0.612	30.48	98.26%
BLOCK 19		MH14A	MH209A							0.0	0.0	4.00	0.00			0	0.47			0.41	0.00	0.47	0.13			0.54	31.02	5.50	250	0.25	0.612	30.48	98.26%
BLOCK 7	07A	STUB S	MH07A							0.0	0.0	4.00	0.00			0.62	0.62			0.54	0.62	0.62	0.17			0.71	31.02	6.00	250	0.25	0.612	30.31	97.71%
BLOCK 19		MH07A	MH209A							0.0	0.0	4.00	0.00			0	0.62			0.54	0.00	0.62	0.17			0.71	31.02	5.50	250	0.25	0.612	30.31	97.71%
BLOCK 19	209A	MH209A	MH208A	0.01						0.0	0.0	4.00	0.00			0	4.17			3.62	0.01	4.67	1.31			4.93	31.02	16.67	250	0.25	0.612	26.09	84.12%
STREET NO. 1	208A	MH208A	MH 207A	0.15						0.0	0.0	4.00	0.00			0	4.17			3.62	0.15	4.82	1.35			4.97	31.02	37.15	250	0.25	0.612	26.05	83.98%
BLOCK 8	08A	STUB S	MH08A							0.0	0.0	4.00	0.00			0.84	0.84			0.73	0.84	0.84	0.24			0.96	31.02	6.00	250	0.25	0.612	30.06	96.89%
STREET NO. 1		MH08A	MH 207A							0.0	0.0	4.00	0.00			0	0.84			0.73	0.00	0.84	0.24			0.96	31.02	11.51	250	0.25	0.612	30.06	96.89%
STREET NO. 1	207A	MH 207A	MH207B	0.01						0.0	0.0	4.00	0.00			0	5.01			4.35	0.01	5.67	1.59			5.94	31.02	6.00	250	0.25	0.612	25.08	80.86%
BLOCK 13	13A	STUB NE	MH13A							0.0	0.0	4.00	0.00			0.66	0.66			0.57	0.66	0.66	0.18			0.76	31.02	6.00	250	0.25	0.612	30.26	97.56%
STREET NO. 1		MH13A	MH207B							0.0	0.0	4.00	0.00			0	0.66			0.57	0.00	0.66	0.18			0.76	31.02	13.00	250	0.25	0.612	30.26	97.56%
STREET NO. 1	207B	MH207B	MH 206A	0.10						0.0	0.0	4.00	0.00			0	5.67			4.92	0.10	6.43	1.80			6.72	31.02	48.37	250	0.25	0.612	24.30	78.33%
BLOCK 9	09A	STUB SE	MH09A							0.0	0.0	4.00	0.00			0.4	0.4			0.35	0.40	0.40	0.11			0.46	31.02	6.00	250	0.25	0.612	30.56	98.52%
STREET NO. 9		MH09A	MH 206A							0.0	0.0	4.00	0.00			0	0.4			0.35	0.00	0.40	0.11			0.46	31.02	10.73	250	0.25	0.612	30.56	98.52%
STREET NO. 1	206A	MH 206A	MH201A	0.09						0.0	0.0	4.00	0.00			0	6.07			5.27	0.09	6.92	1.94			7.21	31.02	41.06	250	0.25	0.612	23.81	76.77%
BLOCK 12	12A	STUB NW	MH12A							0.0	0.0	4.00	0.00			0.41	0.41			0.36	0.41	0.41	0.11			0.47	31.02	6.00	250	0.25	0.612	30.55	98.48%
STREET NO. 1		MH12A	MH201A							0.0	0.0	4.00	0.00			0	0.41			0.36	0.00	0.41	0.11			0.47	31.02	11.00	250	0.25	0.612	30.55	98.48%
STREET NO. 1	201A	MH201A	MH202A	0.11						0.0	0.0	4.00	0.00			0	6.48			5.63	0.11	7.44	2.08			7.71	31.02	54.28	250	0.25	0.612	23.31	75.15%
BLOCK 10	10A	STUB SE	MH10A							0.0	0.0	4.00	0.00			0.4	0.4			0.35	0.40	0.40	0.11			0.46	31.02	6.00	250	0.25	0.612	30.56	98.52%
STREET NO. 1		MH10A	MH202A							0.0	0.0	4.00	0.00			0	0.4			0.35	0.00	0.40	0.11			0.46	31.02	11.86	250	0.25	0.612	30.56	98.52%
STREET NO. 1	202A	MH202A	MH203A	0.03						0.0	0.0	4.00	0.00			0	6.88			5.97	0.03	7.87	2.20			8.18	31.02	13.57	250	0.25	0.612	22.84	73.64%
BLOCK 11	11A	STUB E	MH11A							0.0	0.0	4.00	0.00			0.79	0.79			0.69	0.79	0.79	0.22			0.91	31.02	6.98	250	0.25	0.612	30.11	97.08%
STREET NO. 1		MH11A	MH203A							0.0	0.0	4.00	0.00			0	0.79			0.69	0.00	0.79	0.22			0.91	31.02	9.49	250	0.25	0.612	30.11	97.08%
STREET NO. 1	203A	MH203A	MH104A	0.06						0.0	0.0	4.00	0.00			0	7.67			6.66	0.06	8.72	2.44			9.10	31.02	48.91	250	0.25	0.612	21.92	70.66%
O'KEEFE COURT		MH104A	MH103A							0.0	0.0	4.00	0.00			0	7.67			6.66	0.00	8.72	2.44			9.10	31.02	93.50	250	0.25	0.612	21.92	70.66%
O'KEEFE COURT		MH103A	MH102A							0.0	0.0	4.00	0.00			0	7.67			6.66	0.00	8.72	2.44			9.10	31.02	32.00	250	0.25	0.612	21.92	70.66%
O'KEEFE COURT		MH102A	MH101A							0.0	0.0	4.00	0.00			0	7.67			6.66	0.00	8.72	2.44			9.10	31.02	38.00	250	0.25	0.612	21.92	70.66%
O'KEEFE COURT		MH101A	MH100A							0.0	0.0	4.00	0.00			0	7.67			6.66	0.00	8.72	2.44			9.10	31.02	18.08	250	0.25	0.612	21.92	70.66%
FALLOWFIELD ROAD		MH100A	EXMH1A							0.0	0.0	4.00	0.00			0	7.67			6.66	0.00	8.72	2.44			9.10	116.06	31.50	250	3.50	2.291	106.96	92.16%
		EXMH1A								0.0	0.0	4.00	0.00			0	7.67			6.66	0.00	8.72	2.44			9.10	124.08	29.99	250	4.00	2.449	114.98	92.67%

Design Parameters:

Residential				ICI Areas			Peak Factor
SF	3.4	p/p/u	INST	50,000	L/Ha/day		1.5
TH/SD	2.7	p/p/u	COM	50,000	L/Ha/day		1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day		MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day		

Notes:

1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day 300 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: KH

Checked: RM

Dwg. Reference: 39744-501

No.	Revision	Date
1.	Servicing Brief - Submission No. 1	2017-05-05
2.	Revised per City Comments - Submission No. 2	2017-09-27

File Reference:	Date:	Sheet No:
39744.5.7.1	2017-05-05	1 of 1

The above approach ensures that the City guideline of 0.35 m ponding depth is maintained at all locations. It should also be noted that if the approximate 0.35 m of ponding was designed as the "static" storage, then "dynamic" storage was not available and therefore not used.

- **Future Development Blocks**

To protect the lots from surface flooding, it is required to provide on-site quantity control storages for all the future development blocks, with the exception of Blocks 16, 17, and 3 which directly discharge to the SWMF. The required unit storage rate for each block is 120 m^3/ha. The provided surface storage for commercial blocks was accounted for in the SWMHYMO model, and is summarized in **Table 4-1.**

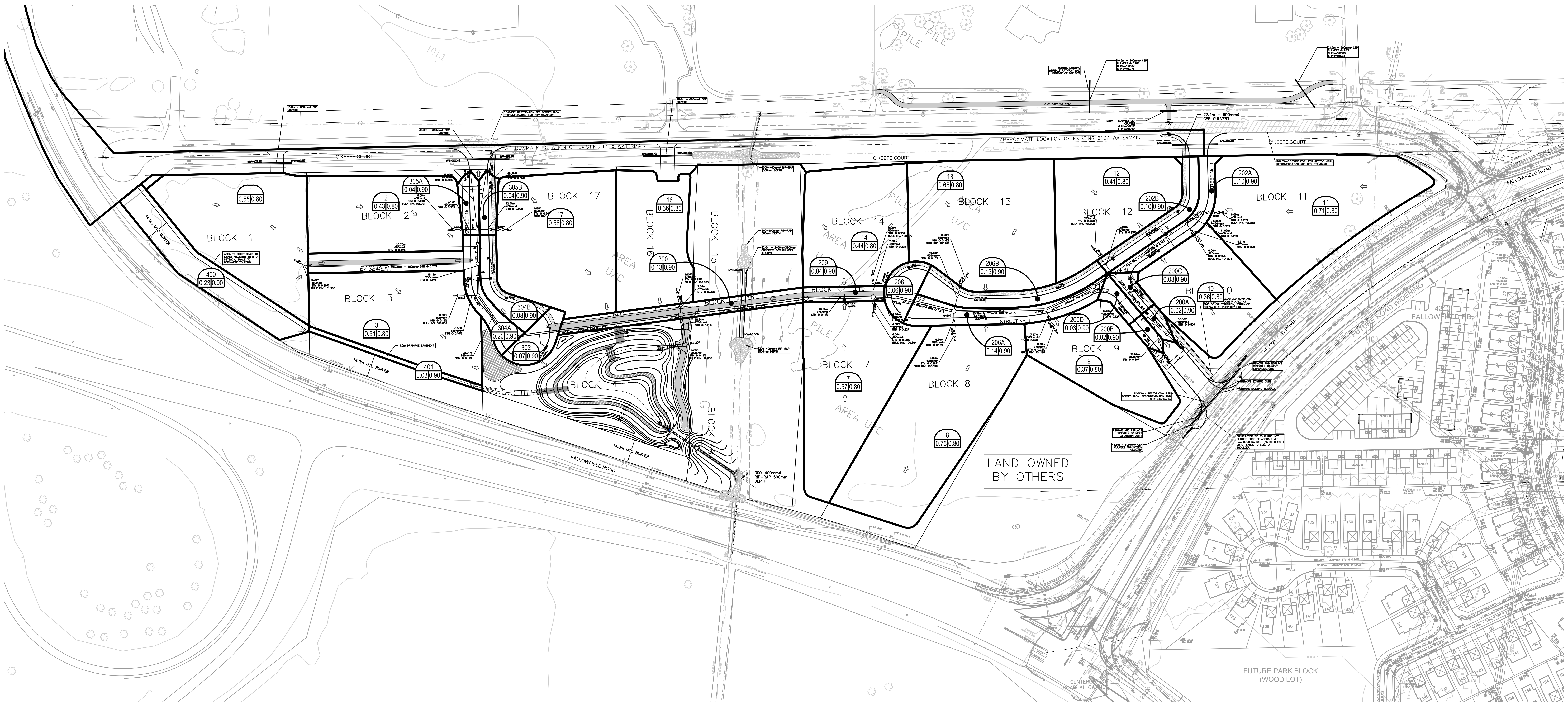
4.4.2 Summary of Design Parameters

Table 4-1 summarizes the main hydrological parameters used in the SWMHYMO model. The SWMHYMO drainage area plan is presented in **Drawing 750**. Model output files are included on the CD enclosed in **Appendix C**.

Table 4-1: Hydrological parameters – O'Keefe Court development
(*Storm files noted in table)*

Drainage Area		Downstream Segment ID‡	MH	IMP Ratio (%)	Segment Length (m)			Time to Peak (hr)	CN	Static Storage (m^3)		Extended Storage (m3)	2 Year Modeled Flow (l/s)*	Total Flow to Minor System (l/s)†
Segment ID	Area (ha)				Average	Measured	Calculated			Available	Assumed**			
Street Segments														
B11	0.71	S202A	MH11	0.86	101.00	133.50	68.80				85.20		110	110
B12	0.41	S202B	MH12	0.86	60.00	67.00	52.28				49.20		69	69
B10	0.36	S202A	MH10	0.86	59.00	68.50	48.99				43.20		61	61
S202B	0.10	S202A	MH202	0.99	46.00	66.00	25.82			8.83		72.70	20	24
S202A	0.10	S200C	MH202	0.99	46.00	66.00	25.82			2.24		130.10	20	24
S200C	0.03	S200D	MH200	0.99	22.00	30.00	14.14			5.57		42.78	6	6
S200D	0.03	S206	MH200	0.99	22.00	30.00	14.14			3.78		48.96	6	6
S200A	0.04	FLFRD	MH200	0.99	18.00	20.00	16.33						8	5
B9	0.37	S206	MH09	0.86	71.00	92.20	49.67				44.40		61	61
B8	0.75	S206	MH08	0.86	105.00	140.00	70.71				90.00		115	115
B13	0.66	S206	MH13	0.86	73.00	79.50	66.33				79.20		108	108
S206	0.27	S208	MH206	0.99	82.00	121.00	42.43			47.89		120.89	50	57
S208	0.06	B209	MH208	0.99	22.00	24.00	20.00			6.91		21.11	13	44
B7	0.57	B209	MH07	0.86	91.00	120.00	61.64				68.40		90	90
B14	0.44	B209	MH14	0.86	64.00	74.00	54.16				52.80		74	74
B209	0.04	B18	MH209	0.99	33.00	49.00	16.33			19.70		16.50	8	63
B16	0.36	B18	MH16	0.86	65.00	82.00	48.99						60	60
B17	0.58	B18	MH17	0.86	76.00	90.00	62.18						95	95
B18	0.13	SWM	0.00	0.99	89.00	148.00	29.44						23	0
B1	0.55	S304A	MH01	0.86	81.00	102.00	60.55				66.00		89	89
B2	0.43	S304A	MH02	0.86	73.00	93.00	53.54				51.60		71	71
S304A	0.20	S302	MH304	0.99	48.00	60.00	36.51			54.67		25.71	40	44

J:\39744–Hwy416\5.9 Drawings\59civil\layouts\500STM TRIB.dwg Layout Name: 500STM TRIB Plot Style: AIA STANDARD–FULL.CTB Plot Scale: 1:25.4 Plotted At: 1/10/2018 2:39 PM Last Saved By: ehenrie Last Saved At: Jan. 10, 18



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ______________________________

Date ______________________________2017

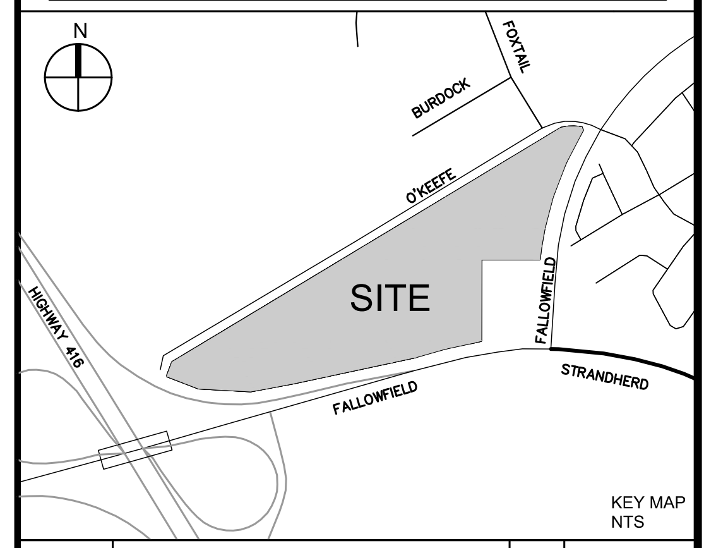
Plan Number ______________________________

LEGEND :

S168 — AREA NUMBER
2.01 | 0.80 — RUNOFF COEFFICIENT
— AREA IN HECTARES

⇨ EMERGENCY FLOW ROUTE

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY MAP
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED PER CITY COMMENTS	DGY	18:01:10
2	REVISED PER CITY COMMENTS	DGY	17:09:26
1	ISSUED FOR CITY REVIEW	DGY	17:05:04

DCR/PHOENIX GROUP OF COMPANIES
18A BENTLEY AVE,
OTTAWA ONT
K2E 6T8

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

416 LANDS

4401 FALLOWFIELD ROAD

D. G. Yannoulopoulos
10/01/2018

N

Drawing Title

STORM DRAINAGE AREA PLAN

Scale
1:1250

Design	Date
MB/RM	MARCH 2016
Drawn	**Checked**
EH	DGY
Project No.	**Drawing No.**
39744	500

CITY PLAN No. 17492

CITY FILE No. D07-16-13-0013

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Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

STORM SEWER DESIGN SHEET

416 Lands
City of Ottawa
DCR Phoenix

LOCATION				AREA (Ha)							RATIONAL DESIGN FLOW															SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.40	C= 0.50	C= 0.57	C= 0.80	C= 0.90	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm)			SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr)	
																												DIA	W	H			(L/s)	(%)
STREET NO. 3	S305A	CB305A	MH 305							0.04	0.10	0.10	10.00	0.57	10.57	76.81	104.19	122.14	178.56	7.69	10.43	12.22	17.87		7.69	34.22	35.99	200			1.00	1.055	26.53	77.54%
STREET NO. 3	S305B	CB305B	MH 305							0.04	0.10	0.10	10.00	0.58	10.58	76.81	104.19	122.14	178.56	7.69	10.43	12.22	17.87		7.69	34.22	36.45	200			1.00	1.055	26.53	77.54%
BLOCK 2	2	STUB W	MH02						0.43		0.96	0.96	10.00	0.12	10.12	76.81	104.19	122.14	178.56	73.45	99.64	116.81	170.76		73.45	133.02	6.00	450			0.20	0.810	59.57	44.78%
STREET NO. 3		MH02	MH 305								0.00	0.96	10.12	0.20	10.32	76.33	103.55	121.38	177.44	73.00	99.02	116.08	169.69		73.00	133.02	9.49	450			0.20	0.810	60.02	45.12%
BLOCK 17	17	STUB E	MH17						0.58		1.29	1.29	10.00	0.12	10.12	76.81	104.19	122.14	178.56	99.07	134.40	157.55	230.33		99.07	133.02	6.00	450			0.20	0.810	33.94	25.52%
STREET NO. 3		MH17	MH 305								0.00	1.29	10.12	0.26	10.38	76.33	103.55	121.38	177.44	98.46	133.56	156.57	228.88		98.46	133.02	12.51	450			0.20	0.810	34.55	25.98%
STREET NO. 3		MH 305	MH 304								0.00	2.45	10.58	0.42	11.00	74.66	101.25	118.67	173.46	182.65	247.69	290.32	424.36		182.65	239.68	20.70	600			0.14	0.821	57.02	23.79%
BLOCK 1	1	STUB NW	MH01						0.55		1.22	1.22	10.00	0.12	10.12	76.81	104.19	122.14	178.56	93.95	127.45	149.40	218.41		93.95	133.02	6.00	450			0.20	0.810	39.07	29.37%
EASEMENT		MH01	MH 304								0.00	1.22	10.12	2.13	12.25	76.33	103.55	121.38	177.44	93.37	126.66	148.47	217.04		93.37	133.02	103.51	450			0.20	0.810	39.64	29.80%
STREET NO. 3	S304A, S304B	MH 304	MH 303							0.28	0.70	4.37	12.25	0.38	12.63	69.12	93.63	109.70	160.29	302.05	409.18	479.42	700.50		302.05	385.20	19.16	750			0.11	0.845	83.14	21.58%
BLOCK 3	3	STUB W	MH03						0.51		1.13	1.13	10.00	0.12	10.12	76.81	104.19	122.14	178.56	87.12	118.18	138.54	202.53		87.12	179.46	6.00	525			0.16	0.803	92.35	51.46%
STREET NO. 3		MH03	MH 303								0.00	1.13	10.12	0.16	10.29	76.33	103.54	121.37	177.43	86.58	117.44	137.67	201.25		86.58	179.46	7.77	525			0.16	0.803	92.89	51.76%
STREET NO. 3		MH 303	MH 302								0.00	5.50	12.63	0.57	13.20	67.99	92.09	107.89	157.62	374.25	506.87	593.84	867.61		374.25	496.66	31.01	825			0.11	0.900	122.42	24.65%
STREET NO. 3	302	MH 302	MH 301							0.07	0.18	5.68	13.20	1.96	15.16	66.36	89.84	105.25	153.75	376.87	510.27	597.76	873.23		376.87	496.66	105.60	825			0.11	0.900	119.79	24.12%
BLOCK 16	16	STUB N	MH16						0.36		0.80	0.80	10.00	0.12	10.12	76.81	104.19	122.14	178.56	61.49	83.42	97.79	142.96		61.49	91.46	6.00	375			0.25	0.802	29.96	32.76%
BLOCK 5		MH16	MH 301								0.00	0.80	10.12	0.16	10.28	76.33	103.54	121.37	177.43	61.11	82.90	97.17	142.06		61.11	91.46	7.59	375			0.25	0.802	30.34	33.18%
BLOCK 11	11	STUB E	MH11						0.71		1.58	1.58	10.00	0.14	10.14	76.81	104.19	122.14	178.56	121.28	164.52	192.87	281.95		121.28	133.02	6.98	450			0.20	0.810	11.74	8.82%
STREET NO. 1		MH11	MH203								0.00	1.58	10.14	0.13	10.28	76.26	103.44	121.25	177.26	120.41	163.34	191.47	279.89		120.41	133.02	6.56	450			0.20	0.810	12.60	9.47%
STREET NO. 1		MH203	MH202								0.00	1.58	10.28	0.24	10.52	75.75	102.74	120.43	176.05	119.61	162.24	190.17	277.99		119.61	133.02	11.83	450			0.20	0.810	13.40	10.08%
BLOCK 10	10	STUB SE	MH10						0.36		0.80	0.80	10.00	0.12	10.12	76.81	104.19	122.14	178.56	61.49	83.42	97.79	142.96		61.49	91.46	6.00	375			0.25	0.802	29.96	32.76%
STREET NO. 1		MH10	MH202								0.00	0.80	10.12	0.19	10.31	76.33	103.54	121.37	177.43	61.11	82.90	97.17	142.06		61.11	91.46	8.91	375			0.25	0.802	30.34	33.18%
STREET NO. 1	S202A, S202B	MH202	MH201							0.20	0.50	2.88	10.52	1.10	11.62	74.86	101.51	118.99	173.92	215.59	292.37	342.69	500.92		215.59	239.68	54.06	600			0.14	0.821	24.08	10.05%
BLOCK 12	12	STUB NW	MH12						0.41		0.91	0.91	10.00	0.12	10.12	76.81	104.19	122.14	178.56	70.03	95.01	111.37	162.82		70.03	91.46	6.00	375			0.25	0.802	21.42	23.42%
STREET NO. 1		MH12	MH201								0.00	0.91	10.12	0.27	10.39	76.33	103.54	121.37	177.43	69.60	94.41	110.67	161.79		69.60	91.46	12.98	375			0.25	0.802	21.86	23.90%
STREET NO. 1	S200A	CB200A	MH200							0.02	0.05	0.05	10.00	0.20	10.20	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	50.75	18.33	200			2.20	1.565	46.91	92.43%
STREET NO. 1	S200B	CB200B	MH200							0.02	0.05	0.05	10.00	0.21	10.21	76.81	104.19	122.14	178.56	3.84	5.21	6.11	8.94		3.84	49.23	19.52	200			2.07	1.518	45.39	92.19%
STREET NO. 1	S200C, S200D	MH200	MH201							0.06	0.15	0.25	10.21	0.79	11.00	75.99	103.07	120.82	176.62	19.01	25.79	30.23	44.19		19.01	41.15	38.51	250			0.44	0.812	22.14	53.80%
STREET NO. 1		MH201	MH205								0.00	4.04	11.62	0.26	11.88	71.10	96.35	112.91	165.00	287.40	389.47	456.39	666.95		287.40	402.33	13.58	750			0.12	0.882	114.93	28.57%
STREET NO. 1		MH205	MH206								0.00	4.04	11.88	0.61	12.49	70.28	95.23	111.59	163.06	284.09	384.93	451.05	659.09		284.09	402.33	32.34	750			0.12	0.882	118.24	29.39%
BLOCK 9	9	STUB SE	MH09						0.37		0.82	0.82	10.00	0.12	10.12	76.81	104.19	122.14	178.56	63.20	85.74	100.51	146.93		63.20	91.46	6.00	375			0.25	0.802	28.25	30.89%
STREET NO. 1		MH09	MH206								0.00	0.82	10.12	0.16	10.28	76.33	103.54	121.37	177.43	62.81	85.20	99.87	146.00		62.81	91.46	7.67	375			0.25	0.802	28.65	31.32%
STREET NO. 1	S206A, S206B	MH206	MH207							0.27	0.68	5.54	12.49	1.03	13.51	68.41	92.67	108.57	158.63	379.06	513.42	601.54	878.88		379.06	496.66	55.51	825			0.11	0.900	117.61	23.68%
BLOCK 8	8	STUB S	MH08						0.75		1.67	1.67	10.00	0.12	10.12	76.81	104.19	122.14	178.56	128.11	173.79	203.73	297.84		128.11	179.46	6.00	525			0.16	0.803	51.35	28.61%
STREET NO. 1		MH08	MH207								0.00	1.67	10.12	0.20	10.32	76.33	103.54	121.37	177.43	127.32	172.70	202.45	295.95		127.32	179.46	9.50	525			0.16	0.803	52.14	29.06%
BLOCK 13	13	STUB NE	MH13						0.66		1.47	1.47	10.00	0.12	10.12	76.81	104.19	122.14	178.56	112.74	152.94	179.28	262.10		112.74	179.46	6.00	525			0.16	0.803	66.73	37.18%
STREET NO. 1		MH13	MH207								0.00	1.47	10.12	0.34	10.47	76.33	103.54	121.37	177.43	112.04	151.98	178.16	260.44		112.04	179.46	16.62	525			0.16	0.803	67.42	37.57%
STREET NO. 1		MH207	MH208								0.00	8.68	13.51	0.62	14.13	65.51	88.68	103.88	151.75	568.40	769.46	901.33	1,316.62		568.40	775.41	37.18	975			0.11	1.006	207.01	26.70%
BLOCK 19	S208	MH208	MH209							0.06	0.15	8.83	14.13	0.21	14.34	63.90	86.48	101.28	147.93	564.00	763.28	893.99	1,305.72		564.00	775.41	12.54	975			0.11	1.006	211.41	27.26%
BLOCK 14	14	STUB N	MH14						0.44		0.98	0.98	10.00	0.12	10.12	76.81	104.19	122.14	178.56	75.16	101.96	119.52	174.73		75.16	133.02	6.00	450			0.20	0.810	57.86	43.50%
BLOCK 19		MH14	MH209								0.00	0.98	10.12	0.15	10.28	76.33	103.55	121.38	177.44	74.70	101.33	118.78	173.63		74.70	133.02	7.50	450			0.20	0.810	58.32	43.84%
BLOCK 7	7	STUB S	MH07						0.57		1.27	1.27	10.00	0.12	10.12	76.81	104.19	122.14	178.56	97.36	132.08	154.84	226.36		97.36	133.02	6.00	450			0.20	0.810	35.65	26.80%
BLOCK 19		MH07	MH209								0.00	1.27	10.12	0.07	10.20	76.33	103.55	121.38	177.44	96.77	131.26	153.87	224.94		96.77	133.02	3.50	450			0.20	0.810	36.25	27.25%
BLOCK 19	S209	MH209	MH210							0.04	0.10	11.17	14.34	0.67	15.01	63.37	85.76	100.44	146.69	708.07	958.16	1,122.20	1,638.97		708.07	775.41	40.55	975			0.11	1.006	67.34	8.68%
BLOCK 18		MH210	MH 301								0.00	11.17	15.01	1.27	16.28	61.74	83.52	97.81	142.84	689.85	933.21	1,092.86	1,595.91		689.85	775.41	76.48	975			0.11	1.006	85.56	11.03%
BLOCK 4		MH 301	MH 300								0.00	17.65	16.28	0.26	16.54	58.91	79.65	93.25	136.15	1,039.93	1,406.00	1,646.20	2,403.40		1,039.93	1,348.97	18.34	1200			0.11	1.155	309.04	22.91%
BLOCK 4		MH 300	HW1								0.00	17.65	16.54	0.16	16.70	58.35	78.89	92.36	134.84	1,030.12	1,392.59	1,630.43	2,380.26		1,030.12	1,348.97	10.75	1200			0.11	1.155	318.85	23.64%
										Total:	17.65																							

Definitions:
Q = 2.78CiA, 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 = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.01

Designed: KH

Checked: RM

Dwg. Reference: 39744-500

No.	Revision	Date
1.	Servicing Brief - Submission No. 1	2017-05-05
2.	Revised per City Comments - Submission No. 2	2017-09-27

File Reference:	Date:	Sheet No:
39744.5.7.1	2017-05-05	1 of 1

SUBSURFACE INVESTIGATION REPORT

135 LUSK ST., OTTAWA, ON, K2J 4S2

Abstract

This report presents the findings of a Subsurface Investigation completed at the 135 Lusk St. parcel, in the City of Ottawa, ON, K2J 4S2, and issue recommendations for a proposed Commercial 6 Storey Building development. It provides technical information about the subsurface conditions at 5 boreholes locations compiled from field sampling and testing and a subsequent laboratory testing program of soils. The boreholes locations and rough details of the subsurface conditions are shown in figure 1 in page 9. The information reviewed also includes readily available geologic information from the Geological Survey of Canada (GSC) and local climate data from Environment Canada.

YURI MENDEZ M. ENG., P. ENG.

LICENSED PROFESSIONAL ENGINEER
SEPT. 02, 2021
Y. MENDEZ ZARATE
100148573
PROVINCE OF ONTARIO

Report number: 52-OI36-R0[1]
August 17, 2020

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[1] For the account of 2441736 Ontario Inc. (OI36).

Report 52-OI36-R0
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1 Introduction

This document reports the findings of a subsurface investigation completed at 135 Lusk St., in the City of Ottawa, ON, K2J 4S2, having extents and geometry shown in figure 1 in page 9. The geotechnical materials in Ottawa and the surrounding areas are largely influenced by a history of glaciation, glacio-fluvial activity and the Champlain Sea. Common overburden materials include clay, very sensitive silty clay, till, boulder till, clean sand and silty sand overlying sedimentary rocks. Igneous and metamorphic rocks are also present. Organic materials have also influenced numerous soil deposits.

The investigation was carried out by advancing 5 boreholess through overburden soils and by proving bedrock depth by available exploration techniques for engineering purposes. The information compiled from the exploration and sampling and testing completed in the boreholess and a subsequent laboratory testing program of soils and rock is to assist in the design and construction of a proposed Commercial 6 Storey Building development. The information reviewed also includes readily available geologic information from the Geological Survey of Canada (GSC), and local climate data from Environment Canada.

2 Report Organization

The body of this report and its appendices constitute the entire report. The discussion presented under sections in the body may refer to further information and/or background and/or details in the appendices. The reader is responsible of reviewing the information in the appendices. Other references may be presented as footnotes.

Future revisions to this report will be referred to as “47-CEI-R#”, where # is the consecutive number of the revision. Additions and/or alterations and/or inclusions to the information provided in this report at the request of any institution and/or body with authority to request the additions and/or alterations and/or inclusion will be provided in a separate “Response to ” (RT) section at the end of the report, before the appendices. The RT section shall state the section that is added and/or altered, the name of the person making the request and the reason. The section altered and or portions added will be provided in full as a subsection of the RT section. Any subsection added under the RT section will be considered a replacement to the original section.

Part I

Investigation

3 Sampling and Testing

The field and laboratory program set out in our proposal is guided by the following standards:

- ASTM D 420-98 Standard Guide to Site Characterization for Engineering Design and Construction Purposes,
- ASTM D5434 - 12 Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock,
- ASTM D1586 - 11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils,
- ASTM D1586 - 11 based Dynamic Cone Penetration Test (DCPT),
- ASTM D2573 - 08 Standard Test Method for Field Vane Shear Test in Cohesive Soil.

The ASTM D1586 tests were completed using an “auto safety” hammer rated at 60% energy.

The field program consisted in sampling the subsurface profile using boreholess located as shown in fig. 1 in page 9 along with field review, assessments and classification of samples.

The program also included an elevation survey referenced to an elevation of 100 m assigned arbitrarily to the top of the storm sewer manhole (TBM) shown in the Test Hole Locations Plan in fig. 1 in page 9. The program included in addition a laboratory review of samples recovered from the field and one sample submitted to a local laboratory to investigate soluble ions concentration, PH and resistivity.

The laboratory testing, soil sampling and field testing at each location are shown in the soil profile testing and sampling logs (BH) in the appendices.

Note that all references to elevations in this report are with respect to an elevation of 100 m assigned arbitrarily to the top of the storm sewer manhole (TBM) shown in the Test Hole Locations Plan in fig. 1 in page 9.

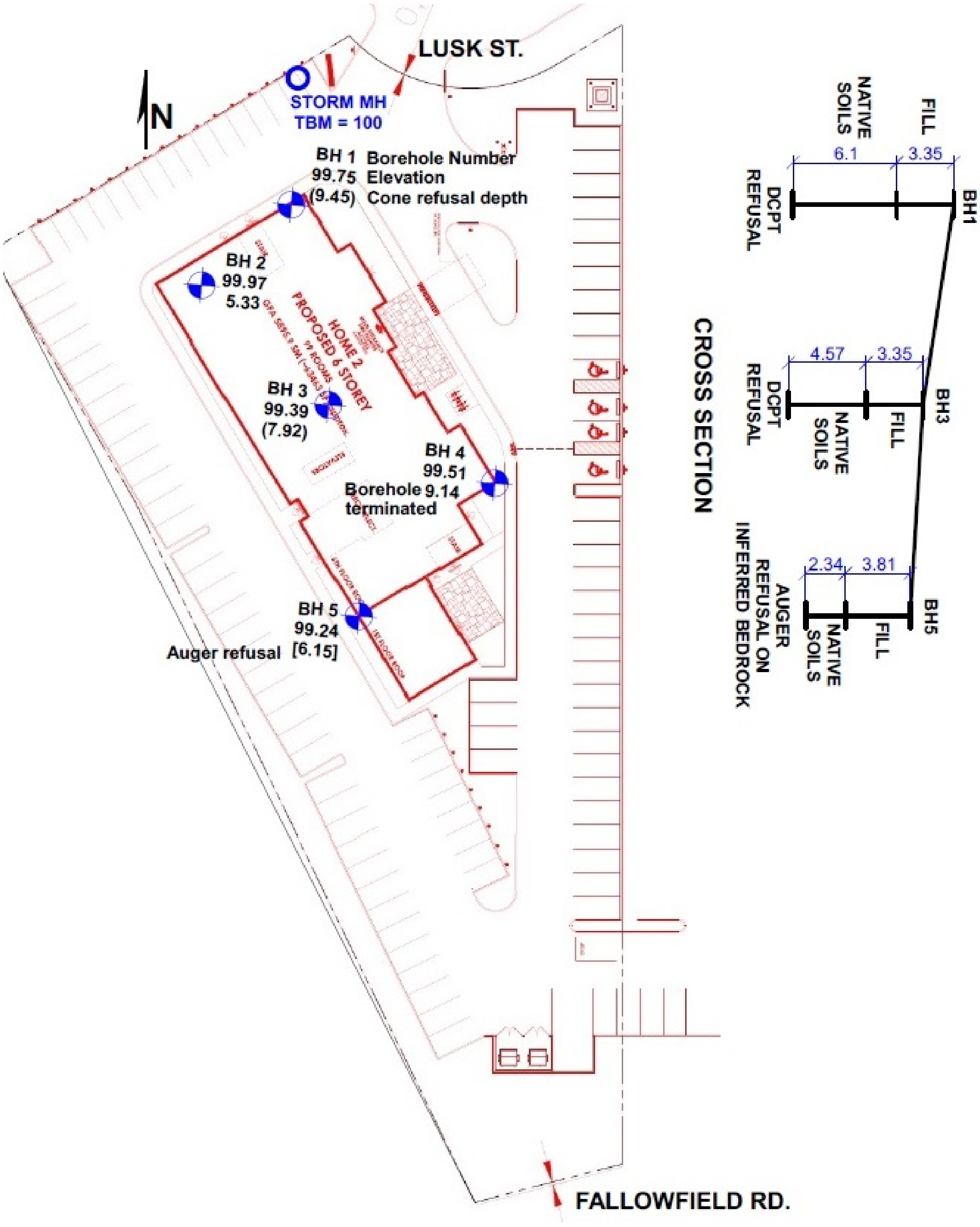

Figure 1: Test hole Locations Plan and cross section

Part II

Findings

4 Physical Settings, Strata and Topography

The site slopes slightly southwest and is bordered along the west property line by a creek. At the time of the field program the site was sparsely covered by grass and shrubs with some areas near its northeast side covered by pavement granular pads and some soil piles along its west side. It consists on the 135 Lusk St. parcel in the City of Ottawa, ON. Figure 1 in page 9 shows a plan view of the site displaying the approximate test hole locations, elevations and depth. Figure 1 in page 9 also presents a schematic site cross section including some boreholes data.

It can be seen in fig. 1 and in the testhole logs in appendix A that the site is covered by fill underlain by various materials including dark gray clay, brown clay and gray clayey sand with gravel at greater depths. Inferred bedrock was encountered at a 6.15 m depth in BH5 (Borehole 5) while DCPT tests suggest the depth of bedrock at 9.45 and 7.92 m at BHS 1 and 3 respectively as seen in fig. 9.

The geology data base by Belanger J. R. 1998 suggests 3 to 10 m of overburden soils underlain by interbedded sandstone and dolomite bedrock at this site.

5 Surface and Subsurface Materials

The site is sparsely covered by grass and shrubs with some areas near its northwest side covered by pavement granular pads and some soil piles along its west side. The arrangement of strata found in our investigation is shown in the borehole logs in appendix A and presented graphically in the schematic cross section in figure 1 in page 9. Generally, the materials within 3.3 to 3.8 m depth beneath the surface consist of fill underlain by various soil types including dark gray clay, brown clay and gray clayey sand with gravel. Bedrock is inferred at a 6.1 m depth at BH5 while DCPT tests suggest bedrock depths of 9.45, 7.92 and 6.15 at BH1, BH3 and BH5. Refer to the borehole logs in appendix A for specific details.

5.1 Gray to Dark Gray Clay

The gray to dark gray clay is stiff to very stiff (50 to more than 100 kPa of shear strength). Excavated clay cannot be used for purposes other than landscaping.

5.2 Brownish Gray and Brownish Clay

The brownish clay was found to be of 57 kPa of shear strength of 57 kPa at BH1 at 7.1 m depth.

5.3 Gray Sandy and Silty Clay with gravel

This materials are generally found at greater depths approaching inferred bedrock and refusals. Because of its high clay content and the N(60) recorded in BH5, it is estimated to be stiff to very stiff.

5.4 DCPT Tested Strata

The mechanical properties to the 9.45, 7.92 and 6.15 m depth of the DCPT tests completed in BH1, BH3 and BH5 can be estimated based on its results shown in the borehole logs in appendix A which have been used in combination with other field tests to determined the site class assigned in this report.

5.5 Groundwater and Moisture

The water level was measured on August 27, 2021 in monitoring wells installed in BH1, BH3 and BH4 at 5.08, 3.82 and 3.75 m depths respectively and shown in the boreholes logs. Ground water measurements in stand pipe installations often require numerous assessments in combination with boreholes data.

Given the findings in the BHs YME's understanding of the water table depth and elevation at this site relies entirely on the water level measurements which suggest an average depth and elevation of 4.2 and 95.33 m respectively. Moisture contents vary above the ground water table.

5.6 Freezing Index, Frost Depth and Frost Susceptibility

It is generally assumed that the frost depth for the 1,000 degree Celsius-days freezing index applicable to Ottawa will reach no deeper than 1.8 m on bare ground (snow free) or pavement. It is also assumed that frost depth will reach no deeper than 1.5 m on snow covered ground.

The soil materials encountered at this site are frost susceptible and thus will heave upon exposure to freezing temperatures. Heaving destroys the mechanical properties of soils so that any soil which has been frozen is considered disturbed.

Part III

Recommendations

The following set of the recommendations result from sampling and testing outlined in section 3 and from geotechnical engineering evaluation and assessments.

It is understood that the proposed development will consist of a Commercial 6 Storey Building with an at grade slab and no basement.

6 Foundations General

Generally speaking, code compliant OBC Part 9 and Part 4 buildings founded on deep foundations can be considered for the proposed Commercial 6 Storey Building.

6.1 Load and Resistance Factors

For the purpose of computations related to the service (SLS) and strength limits (ULS) note:

- A resistance factor is applied to the computed or estimated (nominal) bearing resistance from field or lab tests to obtain the strength limit for factored loads (ULS). The value of the resistance factor is stated for each option.
- An average load factor of 1.5 is assumed to compute the service limit (SLS).

6.2 Bearing Capacity of Strip and/or Pad Footings

Based on the findings of this investigation and geotechnical assessments, the following bearing capacity can be used *for strip footings up to 1.0 m wide and pad footings up to 2 m wide placed on undisturbed native undisturbed soils or engineered fill placed on native soils encountered in the testholes*:

- 150 kPa at service limit (SLS).
- 225 kPa for factored loads (ULS).

6.3 Settlements

For the footing loads provided in section 6.2 building settlements for foundations on undisturbed very stiff silty clay are not to exceed service limit values (SLS) of 25 mm and 20 mm total and differential settlements respectively at this site.

6.4 Deep Foundation Alternatives

Where building loads can not be accommodated with the bearing capacity described in section 6.2 deep foundations, such as driven or bored piles need to be considered.

Piles are generally driven to refusal and/or drilled to bedrock and proof tested.

Where the friction angle of the bedrock is required for design 30 degrees can be used.

Specific geotechnical resistance for specific pile systems will be provided if requested as part of this report.

6.5 Frost Protection for Foundations

Shallow foundations on frost susceptible which may be required on the perimeter of the building for canopies or other structures are considered to be frost protected when placed at sufficient depth to prevent supporting soils from freezing. Foundations in the perimeter of heated buildings where snow is not cleared are considered frost protected at 1.5 m depth (as having a soil cover of 1.5 m). Foundations away from heated buildings or in areas where snow is cleared, need to be at about 1.8 m depth to be frost protected. On the alternative frost protection can be provided by using foundation insulation for shallower foundations.

6.6 Foundation Insulation

To meet the required frost protection in section 6.5 for foundations for canopies or other structures in the perimeter of the building and in unheated areas in otherwise heated buildings 50 mm of extruded polystyrene insulation (XPS) type V, VI or VII meet foundation insulation requirements for the freezing index in the Ottawa area.

6.7 Foundation Wall Dampproofing and Drainage

Foundation walls dampproofing and foundation drainage are not required for foundations serving buildings of slab on grade construction not having floor levels lower than the finished grade on the perimeter.

Elevatior shafts often require drainage along their exterior perimeter. Appendix D.1 presents page 2 of NRC Construction Evaluation Reports CCMC 12658-R showing dampproofing and foundation wall drainage system details satisfying the provisions under OBC 2012 and suitable for drainage along the perimeter of elevator shafts. Other available similar systems having the components shown in CCMC 12658-R may be used. Foundation drainage must be provided to daylight or a positive outlet, or sump.

7 Site Class for Seismic Design

At this site, the geotechnical testing completed along with the estimated 9.45, 7.92 and 6.15 m depth of bedrock (or hard strata) via Dynamic Cone Penetration (DCPT) conducted in BH1, BH3 and BH5 are indicative of a Vs(30) exceeding 360 m/s. As such, site class C is assigned under the provisions in section 4.1.8.4 of the Ontario Building Code 2012 (OBC 2012) for seismic design.

It is hence recommended to refer to the following information in appendix B.1:

1. The 2010 National Building Code Seismic Hazard Calculation for the *reference site* in page 28.
2. Figure 2 in page 27 showing the design spectral accelerations.

8 Roadbed Soils and Pavement Structure

The flexible pavement structures supplied in this report follow the guidelines set out in AASHTO 1993 Guide for Design of Pavement Structures (AASHTO) for climatic Region III. Under AASHTO pavements are designed to withstand 20 year accumulated design Equivalent Single Axle 80 kN (18,000 pounds) load applications (ESALs). ESALs are a measure of mix traffic loads including vehicle loads and truck loads. The number of ESALs applications depend on traffic class and use.

Roadbed denotes the materials beneath pavement structures. The term pavement is used to denote the layered structure that forms a road carriageway or vehicle parking. *The general quality of the near surface undisturbed soil to serve as foundation for pavement structure (Roadbed soil) are assumed to be very poor* as defined in the AASHTO guide. It is hence recommended to refer to the following information in appendix C:

- *Yuri Mendez Engineering's pavement catalog in appendix C.1 to select pavement structures* for traffic classes on the very poor roadbed soils encountered at this site.
- Appendix C.2 for guidelines regarding frost heave.
- Appendix C.3 for frost protection recommendations for manholes and catch basin construction.

9 Excavations, Open Cuts, Trenches and Safety

Typically, the main concern when excavating soils or rock is the stability of the sides of excavations. The stability of the sides is achieved by either cutting the sides to safe slopes or by providing shoring. It is also an issue of safety because of imminent hazards to the safety of workers and to property. As such, excavations are governed by the provisions in the Occupational Health and Safety Act of Ontario (O. Reg. 213/91). The application of O. Reg. 213/91 requires a classification of soils in one or several of four types (type I to type IV).

At this site for soils can be considered type II under O. Reg. 213/91. As such, the following key aspects of O. Reg. 213/91 are applicable to excavations:

- Safe open cut is 1 vertical to 1 horizontal.
- Within 1.2 m of the bottom of open cut areas or trenches, the soil can be cut vertical.

Where the safe open cut is not provided, either the shoring systems described in O. Reg. 213/91 or engineered shoring systems need be used. Information regarding physical and mechanical properties of subsurface materials which will be required for shoring design are provided in this report.

9.1 Conditions Requiring Engineered Shoring

O. Reg. 213/91 describe the conditions in which engineered shoring systems are required. Some key aspects of O.Reg. 213/91 regarding the conditions in which an engineered shoring system is required are:

- Where soils are type I to III and the prescribed safe open cuts are not provided and
    - The excavation is not a trench or
    - The excavation is a trench either deeper than 6 m or wider than 3.6 m or both
- For trench excavations or open cut, where soils are type IV and the safe open cuts are not provided.

Note that along with the descriptions in O. Reg. 213/91 for soils type IV, any difficult soil having significant seepage and/or strength loss upon excavation such as caving soils can be rendered as type IV.

Note also that since excavation and safety are usually in control of the contractor, *shoring design and construction is done by the contractor.*

10 Reinstatement of Excavated Soils

As stated in appendix E the suitability of material for specific purposes is determined by the geotechnical engineer. To the extent they are needed, suitable material from the excavations can be used in the construction of required permanent earthfill or rockfill.

11 Stripping, Excavation to Undisturbed Soils and rock, Earth and Rock Fill Placement. Asphalt Placement and Compaction

Appendix E presents recommended geotechnical specifications and guidelines for stripping, earth and rock excavation to undisturbed surfaces, earth and rock fill placement, asphalt placement, compacted lifts thicknesses for equipment type and compaction for different placements.

11.1 Winter Construction

Winter construction is not recommended. Many construction practices are inadequate to provide protection for all the details and geometries which could allow exposure of frost susceptible soils to freezing temperatures rendering them disturbed.

In situations where YME is required for guidance and inspections during winter, YME will provide its best approach with the resources available for protections during construction in real time and its expected that the contractors will act in real time to provide the protections. YME has insufficient control of the contractor operations and and/or the construction tasks and/or the method of protection to provide any warranties in those situations. Irresponsive contractors add great potential to induce damage.

Disclaimer

2441736 Ontario Inc. OI36 and other professionals understand that soils and groundwater information in this report has been collected in boreholess guided by standards and practice guidelines generally accepted for engineering characterization of ground conditions in Ontario and in no case boreholes data and their interpretation warrant understanding of conditions away from the boreholes locations. OI36 accepts that as development will have spread away from the boreholess other designers will need the best opinion from the geotechnical consultant based on the findings of the investigation so that any statements which could be implicitly or explicitly depart from the conditions at boreholes may be given to fulfill this need in good faith as best available opinion with the information available at the time without any warranties.

User Agreement

Acknowledgment of Duties

In this 52-OI36-R0 report, Yuri Mendez Engineering (YME) has pursued to fulfill every aspect of the obligations of professional engineers. As a part of those duties, from field work, operations, testing, analyses, application of knowledge and report, YME has ensured that it meats a high standard of Geotechnical engineering practice and care in the province of Ontario. Obligations under R.R.O. 1990, Reg. 941: Professional Engineers Act, R.S.O. 1990, c. P.28, further referred to as Reg. 941 which are of immediate interest to this service are:

"77. 7. A practitioner shall,

i. act towards other practitioners with courtesy and good faith,

ii. not accept an engagement to review the work of another practitioner for the same employer except with the knowledge of the other practitioner or except where the connection of the other practitioner with the work has been terminated,

iii. not maliciously injure the reputation or business of another practitioner,

8. A practitioner shall maintain the honour and integrity of the practitioners profession and without fear or favour expose before the proper tribunals unprofessional, dishonest or unethical conduct by any other practitioner."

Communications

52-OI36-R0 is to be used solely in connection with the Commercial 6 Storey Building by 2441736 Ontario Inc. (OI36) and thus subject of communications amongst other professionals (OP), government bodies and authorities, and OI36 for that purpose. YME demands great care in precluding damage to the integrity of this professional work which may arise from careless communications from engineers of Canada. OP and OI36 acknowledge understanding that where any such communication occur in connection with this report, they are bound by this agreement as an extension to the standard of care embodied in R.R.O. 1990, Reg. 941 and thus accept that any correspondence from OP or the public seen to add any bad connotations to the breadth, depth, typesetting, typography, formal semantics and scope of this report or otherwise diminish the breadth of services and knowledge delivered in this report which in any way raise concerns or insecurities to the qualities and/or the *reasonable completeness* delivered to OI36 in this report will be forwarded to YME.

Reasonable Completeness

OP and 2441736 Ontario Inc. acknowledge understanding that said care and said standard has been applied equality to the reasonable completeness of this report relative to the information available from the field program and acknowledge understanding that is neither feasible nor possible to convey geotechnical information in this report that would cover for every possible consideration by OP and/or OI36 and that upon issuance it will be subject to reviews which may trigger the need to add information which at the discretion of YME will be added when considered within the practice obligations under Reg. 941. The geotechnical information here provided is thus envisioned as to cover for the scope and breadth of design figures and assessments generally foreseeable as needed by other designers at the time of issuance and which could be amended as needed within the context of services provided by other designers. YME agrees to issue revised versions of this 52-OI36-R0 report by adding R# to each revision where # is the number of the revision. OP covenant to conduct all communications in connection with these reviews following great care to preclude the suggestion of a breach to the reasonable completeness acknowledged herein. Written communications which may trigger reviews under this agreement will be acknowledged as requests for "review under the 52-OI36-R0 report user agreement". This reasonable completeness is also relative to the scope of services generally accepted in geotechnical engineering work in Ontario

Errors

Where errors are found during reviews under the 52-OI36-R0 report user agreement, OP covenant great care in communications to preclude the suggestion of a breach to the duties acknowledge herein which could induce damages to YME. Communications triggered by errors or any such communication which would render the person doing the request in a position of technical authority above the author implies an unauthorized review and constitute a serious breach of the code of ethics under Reg. 941 and damages to YME and so subject to disciplinary measures and/or liability for damages to YME. OI36 is thus acquainted that correction of errors will be made and acknowledged by YME as they may arise in any professional work but in no way OP will purport or render such corrections as omissions departing away from the correction of errors set forth in this agreement. Where communications in connection with the correction of errors process set forth in this agreement raise concerns or insecurities to the qualities and/or the reasonable completeness delivered to OI36 in this report occur, OI36 covenants to inform YME. OI36 is acquainted that such corrections are part of the natural processes associated with the applied sciences nature of this report and so typified explicitly in this agreement to protect YME from inappropriate manipulation of those processes by OP and others.

Disclaimer

OI36 and OP understand that soils and groundwater information in this report has been collected in boreholess guided by standards and practice guidelines generally accepted for engineering characterization of ground conditions in Ontario and in no case boreholes data and their interpretation warrant understanding of conditions away from the boreholes locations. OI36 accepts that as development will have spread away from the boreholess other designers will need the best opinion from the geotechnical consultant based on the findings of the investigation so that any statements which could be implicitly or explicitly depart from the conditions at boreholes may be given to fulfill this need in good faith as best available opinion with the information available at the time without any warranties.

Part IV

Appendices

A Borehole Logs

Report 52-OI36-R0
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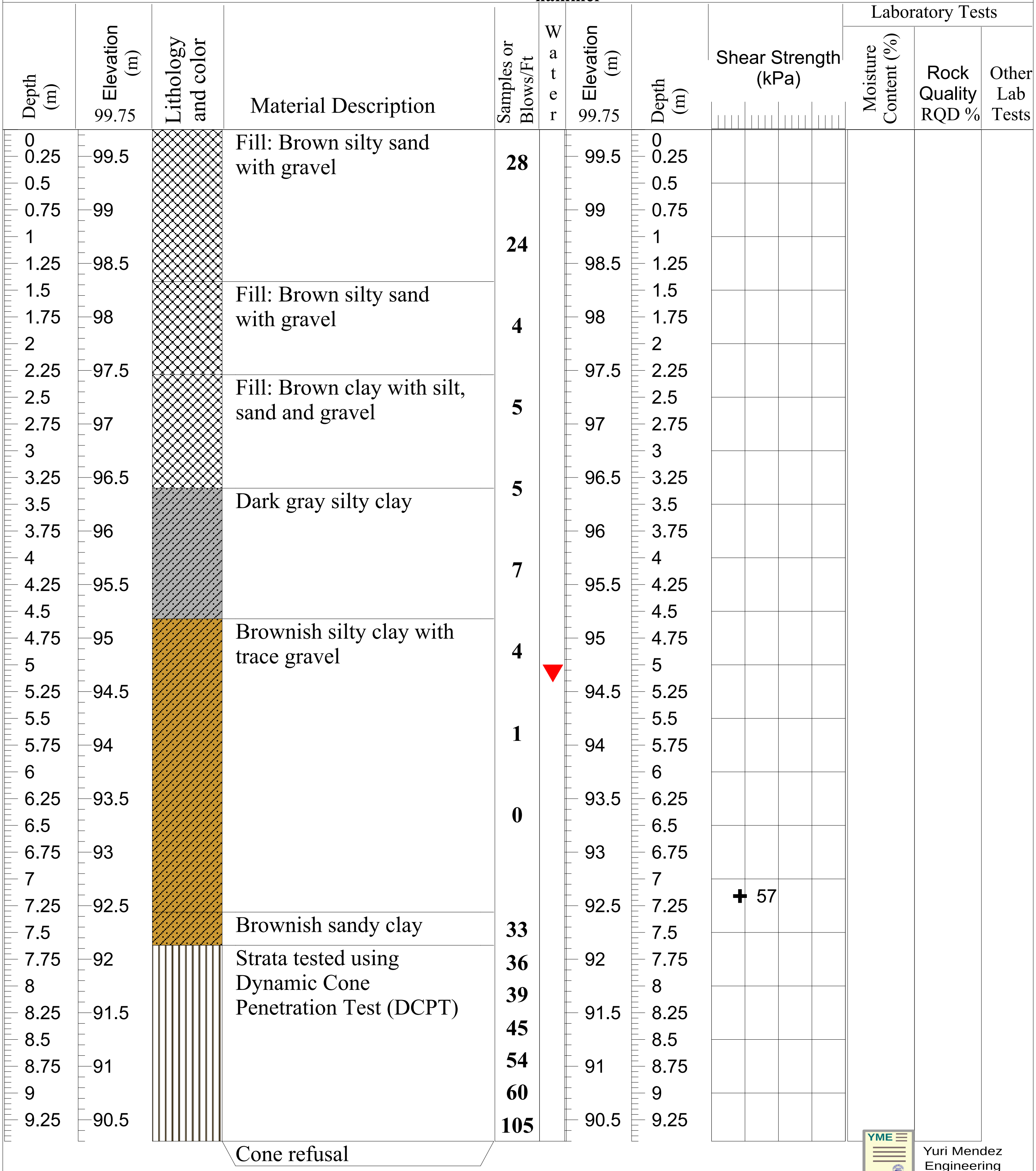
Project: **Proposed 6 Storey Building**		YME Yuri Mendez Engineering.
Location: **135 Lusk St.**	Client: **2441736 Ontario Inc.**	**Test Hole No.: BH1 of 5**
Job No.: **52-OI36**	Test Hole Type: **8" OD Auger.**	Date: **August 16, 2021**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**



Fill: Brown silty sand with gravel

Fill: Brown silty sand with gravel

Fill: Brown clay with silt, sand and gravel

Dark gray silty clay

Brownish silty clay with trace gravel

Brownish sandy clay

Strata tested using Dynamic Cone Penetration Test (DCPT)

Cone refusal

Yuri Mendez Engineering

S = Sample for lab review and moisture content

▼ Interpreted water level

Project: **Proposed 6 Storey Building**

YME Yuri Mendez Engineering.

Location: **135 Lusk St.**

Client: **2441736 Ontario Inc.**

Test Hole No.: BH2 of 5

Job No.: **52-OI36**

Test Hole Type: **8" OD Auger.**

Date: **August 16, 2021**

"7" OD Auger."

SPT Hammer Type: **Safety auto hammer**

Logged By: **Yuri Mendez**

Depth (m)	Elevation (m) 99.97	Lithology and color	Material Description	Samples or Blows/Ft	Water	Elevation (m) 99.97	Depth (m)	Shear Strength (kPa)	Laboratory Tests Moisture Content (%)	Laboratory Tests Rock Quality RQD %	Laboratory Tests Other Lab Tests
0	99.9	▩	Fill: Brown silty sand with gravel			99.9	0				
0.25		▩					0.25				
0.5	99.4	▩				99.4	0.5				
0.75		▩					0.75				
1	98.9	▩	Fill: dark gray to black silty clay with organic soils	**27**		98.9	1				
1.25		▩					1.25				
1.5	98.4	▩				98.4	1.5				
1.75		▩		**7**			1.75				
2	97.9	▩				97.9	2				
2.25		▩					2.25				
2.5	97.4	▩		**2**		97.4	2.5				
2.75		▩					2.75				
3	96.9	▩				96.9	3				
3.25		▩		**6**			3.25				
3.5	96.4	▩				96.4	3.5				
3.75		▨	Dark gray to brownish silty clay				3.75				
4	95.9	▨		**9**		95.9	4				
4.25		▨					4.25				
4.5	95.4	▨				95.4	4.5				
4.75		▨		**6**			4.75				
5	94.9	▨				94.9	5				
5.25		▨					5.25				

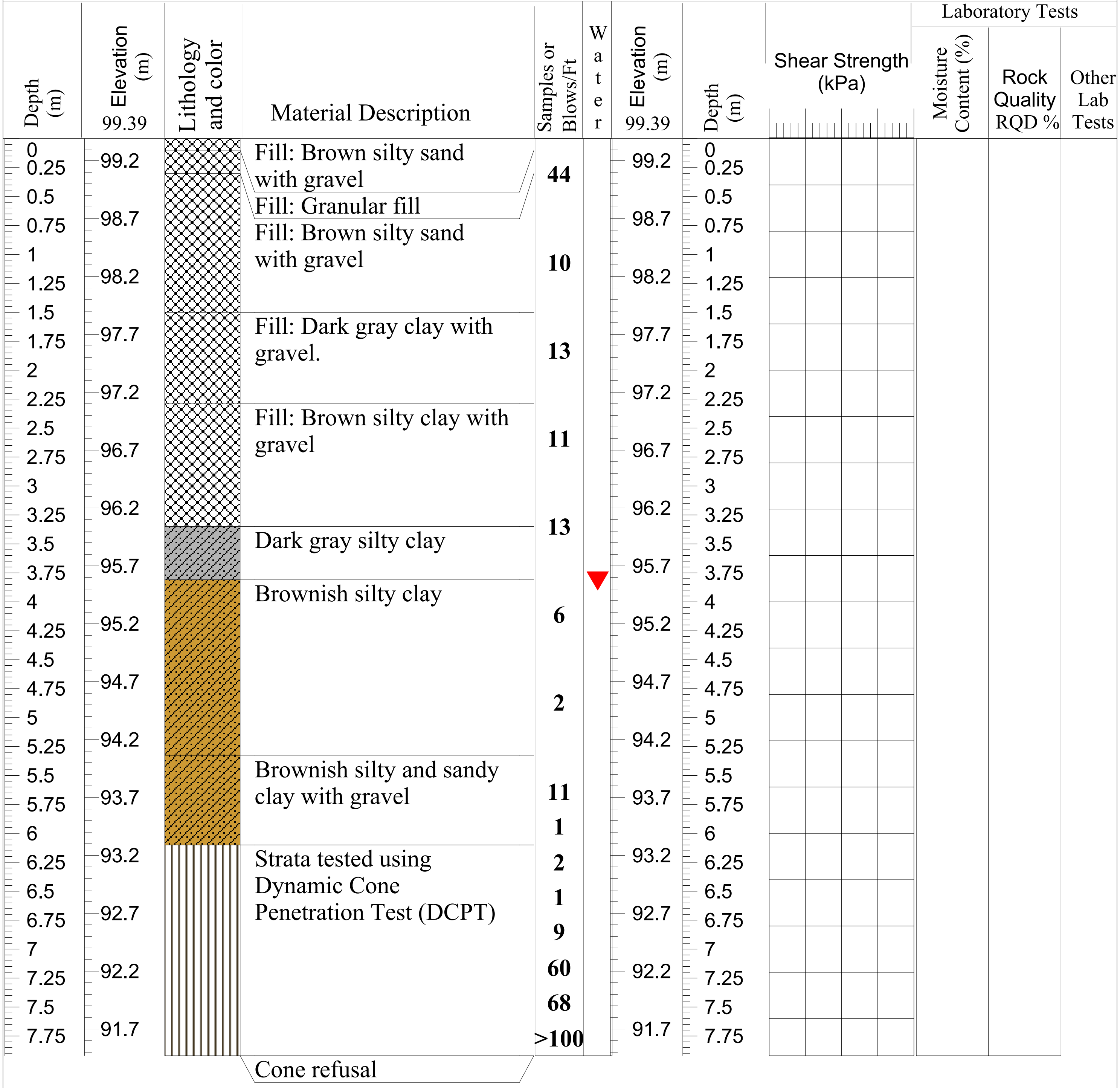
Borehole terminaged

Yuri Mendez Engineering

S = Sample for lab review and moisture content

▼ Interpreted water level

Project: **Proposed 6 Storey Building**		YME Yuri Mendez Engineering.
Location: **135 Lusk St.**	Client: **2441736 Ontario Inc.**	**Test Hole No.: BH3 of 5**
Job No.: **52-OI36**	Test Hole Type: **8" OD Auger.**	Date: **August 16, 2021**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**



Material Description	Samples or Blows/Ft
Fill: Brown silty sand with gravel	44
Fill: Granular fill	
Fill: Brown silty sand with gravel	10
Fill: Dark gray clay with gravel.	13
Fill: Brown silty clay with gravel	11 13
Dark gray silty clay	
Brownish silty clay	6 2
Brownish silty and sandy clay with gravel	11 1
Strata tested using Dynamic Cone Penetration Test (DCPT)	2 1 9 60 68 >100
Cone refusal	

Yuri Mendez Engineering

S = Sample for lab review and moisture content

▼ Interpreted water level

Project: **Proposed 6 Storey Building**		YME Yuri Mendez Engineering.
Location: **135 Lusk St.**	Client: **2441736 Ontario Inc.**	**Test Hole No.: BH4 of 5**
Job No.: **52-OI36**	Test Hole Type: **8" OD Auger.**	Date: **August 16, 2021**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**

Depth (m)	Elevation (m) 99.51	Lithology and color	Material Description	Samples or Blows/Ft	Water	Elevation (m) 99.51	Depth (m)	Shear Strength (kPa)	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Rock Quality RQD %	Laboratory Tests: Other Lab Tests
0	99.5	▨	Granular fill			99.5	0				
0.25		▨	Fill: dark gray silty sand with gravel				0.25				
0.5	99					99	0.5				
0.75							0.75				
1	98.5			34		98.5	1				
1.25							1.25				
1.5	98					98	1.5				
1.75				8			1.75				
2	97.5					97.5	2				
2.25							2.25				
2.5	97			14		97	2.5				
2.75		▨	Fill: dark gray to silty clay				2.75				
3	96.5					96.5	3				
3.25				11			3.25				
3.5	96					96	3.5				
3.75					▼		3.75				
4	95.5	▨	Brownish gray silty clay	6		95.5	4				
4.25							4.25				
4.5	95					95	4.5				
4.75				3			4.75				
5	94.5					94.5	5				
5.25		▨	Gray sandy and silty clay with gravel				5.25				
5.5	94					94	5.5				
5.75				38			5.75				
6	93.5					93.5	6				
6.25							6.25				
6.5	93					93	6.5				
6.75							6.75				
7	92.5					92.5	7				
7.25				59			7.25				
7.5	92					92	7.5				
7.75							7.75				
8	91.5					91.5	8				
8.25							8.25				
8.5	91					91	8.5				
8.75							8.75				
9	90.5					90.5	9				

Borehole terminaged

Yuri Mendez Engineering

S = Sample for lab review and moisture content

▼ Interpreted water level

Project: **Proposed 6 Storey Building**		YME Yuri Mendez Engineering.
Location: **135 Lusk St.**	Client: **2441736 Ontario Inc.**	**Test Hole No.: BH5 of 5**
Job No.: **52-OI36**	Test Hole Type: **8" OD Auger.**	Date: **August 16, 2021**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**

Depth (m)	Elevation (m) 99.24	Lithology and color	Material Description	Samples or Blows/Ft	Water	Elevation (m) 99.24	Depth (m)	Shear Strength (kPa)	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Rock Quality RQD %	Laboratory Tests: Other Lab Tests
0			Granular fill				0				
0.25				**26**			0.25				
0.5	98.8		Fill: Brown silty sand with gravel and boulders			98.8	0.5				
0.75							0.75				
1	98.3			**66**		98.3	1				
1.25							1.25				
1.5	97.8		Fill: dark gray clay with sand gravel and organic matter			97.8	1.5				
1.75				**17**			1.75				
2	97.3					97.3	2				
2.25							2.25				
2.5	96.8			**48**		96.8	2.5				
2.75							2.75				
3	96.3					96.3	3				
3.25				**14**			3.25				
3.5	95.8					95.8	3.5				
3.75							3.75				
4	95.3		Dark gray clay	**7**		95.3	4				
4.25							4.25				
4.5	94.8					94.8	4.5				
4.75			Gray silty clay with sand and gravel	**2**			4.75				
5	94.3					94.3	5				
5.25							5.25				
5.5	93.8			**2**		93.8	5.5				
5.75							5.75				
6	93.3					93.3	6				

Auger refusal

Yuri Mendez Engineering

S = Sample for lab review and moisture content

▼ Interpreted water level

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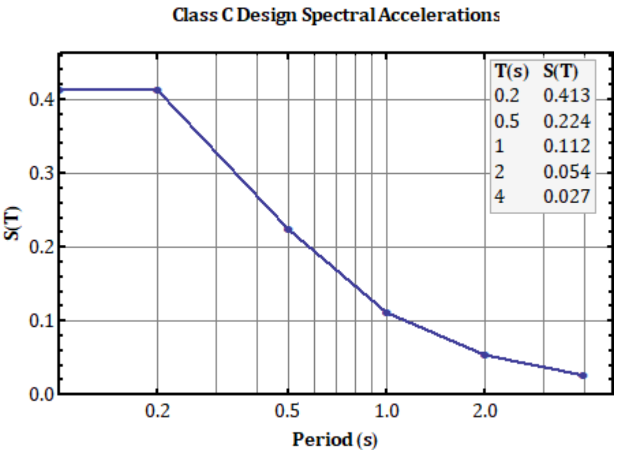

Figure 2:

Appendix

B Geotechnical Site Class Assignment

The ground motion transfered from earthquakes to buildings depend largely on ground conditions. Current seismic provisions in building codes recognize seismic waves as oscillations and buildings as oscillators having natural periods and damping. The role of soils engineering is to assign a site class which defines the interpolations prescribed under the code to obtain a spectrum of period versus damped accelerations using a base *reference site* for design of buildings at a given site. The soils information required to do this site class assignment is the velocity at which a seismic shear wave travels upward 30 meters (or downward) in a given site (Vs(30)). The Vs(30) is estimated based on standard geotechnical testing along with experience and available local data bases. Seismic tests can also be completed to determine the Vs(30) with greater accuracy.

B.1 Reference Site and Design Spectral Accelerations

Details of the *reference site* spectral and peak seismic hazard values applicable to this site are presented in the 2010 National Building Code Seismic Hazard Calculation in page 28 of this appendix. Figure 2 in page 27 presents the design spectral accelerations computed under section 4.1.8.4 of the Ontario Building Code 2012 (OBC 2012) for the site class C assigned to this site.

2015 National Building Code Seismic Hazard Calculation

INFORMATION: **Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836**
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 45.273N 75.790W

2021-08-28 17:57 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.419	0.227	0.135	0.040
Sa (0.1)	0.492	0.277	0.171	0.056
Sa (0.2)	0.413	0.238	0.149	0.051
Sa (0.3)	0.314	0.183	0.116	0.041
Sa (0.5)	0.224	0.131	0.083	0.029
Sa (1.0)	0.112	0.066	0.043	0.015
Sa (2.0)	0.054	0.031	0.020	0.006
Sa (5.0)	0.014	0.008	0.005	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.264	0.151	0.093	0.030
PGV (m/s)	0.186	0.105	0.064	0.020

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

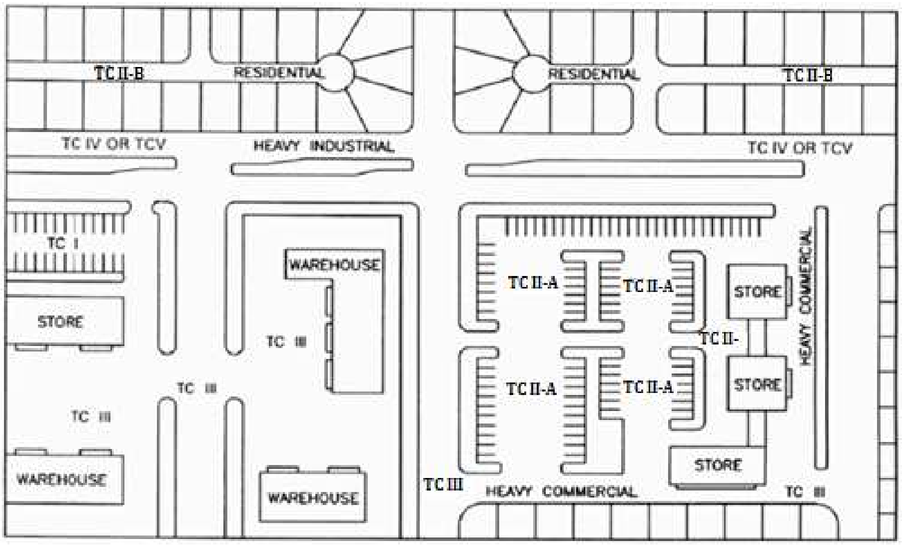

Figure 3: Traffic Classes

Appendix

C Pavement

C.1 Traffic Classes and Pavement Catalog

Figure 3 in page 29 presents a schematic site plan differentiating example uses for five traffic classes developed by the Wisconsin Asphalt Pavement Association and presented in their Design Guide May, 2001.

1. Refer to figure 3 in page 29 to differentiate pavement classes for the proposed Commercial 6 Storey Building.

2. Refer to table 1 in page 30 for additional information and design ESALs.

3. Refer to Tables 2, 3 and 4 in page 30 to select pavement structures for each traffic class on very poor soils encountered at this site.

Consult Yuri Mendez Engineering for pavement structures on roadbed consisting of newly placed engineered fill, underground parking or as required, where the roadbed is not the near surface very poor soil encountered at this site.

Ontario Category	Classes	ESALs	Uses
A	I	50,000	Residential dead end and parking lots 50 stalls or less.
A	II-A	100,000	Parking lots 51 to 500 stalls.
A	II-B	200,000	Residential streets, parking lots more than 500 stalls.
B	III	600,000	Minor colectors, local streets and light industrial lots.
B	IV	900,000	Collector Streets and heavy industrial parking lots.
B	V	2,200,000	Minor Arterial.

Table 1: Design ESALs (20 years) and uses for traffic classes

		Thicknesses			
Material	Specification	Class I		Class II-A	
Class		mm	in	mm	in
Surface course	OPSS 1151 Superpave 9.5	50.8	2	50.8	2
Surface course	OPSS 1151 Superpave 12.5				
Binder course	OPSS 1151 Superpave 19.0				
Base	OPSS 1010 Granular A	152.4	6	152.4	6
Subbase	OPSS 1010 Granular B Type II	228.6	9	279.4	11
Subgrade	Undisturbed In situ Soil				

Table 2: Flexible Pavement Structure Classes I and II-A

		Thicknesses			
Material	Specification	Class II-B		Class III	
Class		mm	in	mm	in
Surface course	OPSS 1151 Superpave 9.5				
Surface course	OPSS 1151 Superpave 12.5	63.5	2.5	76.2	3
Binder course	OPSS 1151 Superpave 19.0				
Base	OPSS 1010 Granular A	152.4	6	152.4	6
Subbase	OPSS 1010 Granular B Type II	330.2	13	406.4	16
Subgrade	Undisturbed In situ Soil				

Table 3: Flexible Pavement Structure Classes II-B and III

Material	Specification	Thicknesses			
		Class IV		Class V	
Class		mm	in	mm	in
Surface course	OPSS 1151 Superpave 9.5	31.8	1.25		
Surface course	OPSS 1151 Superpave 12.5				
Binder course	OPSS 1151 Superpave 19.0	57.2	2.25		
Base	OPSS 1010 Granular A	152.4	6		
Subbase	OPSS 1010 Granular B Type II	457.2	18		
Subgrade	Undisturbed In situ Soil				

Table 4: Flexible Pavement Structure Classes IV and V

C.2 Frost Heave in Pavements

Frost heave of founding materials for pavement induces reduction (serviceability losses) of the performance period (along with traffic ESALs) for which the structure was designed. Generally speaking, AASHTO 1993 does not provide for an increase in thicknesses (structural number) for reduction of losses, as such increase has very small influence in the detrimental effects of frost heave. Frost heave affects pavements by roughness induced by differential frost heave, i.e., if the longitudinal vertical alignment is all equally frost susceptible, there is negligible detrimental effect. This is difficult to achieve in urban developments in which services trenches are backfilled with non frost susceptible materials. For long lasting pavements on frost susceptible soils, the general guideline is, where possible; ensure that all soils serving as pavement foundation are equally frost susceptible. This could be achieved by providing frost susceptible backfill within 1.4 m of the pavement foundation in service trenches. Where measures to mitigate the effect of frost heave are not undertaken, decrease of the performance period is accepted to occur.

C.3 Frost Protection for Manholes, Catch Basins and Others

Manholes and catch basin type structures provide a cold bridge to a deeper portion of the soil profile and create localized areas prompt to pavement failure by excessive frost heave roughness in frost susceptible soils. This can be prevented by providing insulation extending downward around the structure and horizontally outward to create a transition from the varying pavement elevation to the more stable catch basin elevation. On the alternative, non frost susceptible backfill can be provided tapered outward from the structure to the surrounding pavement.

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Appendix

D Foundation Drainage

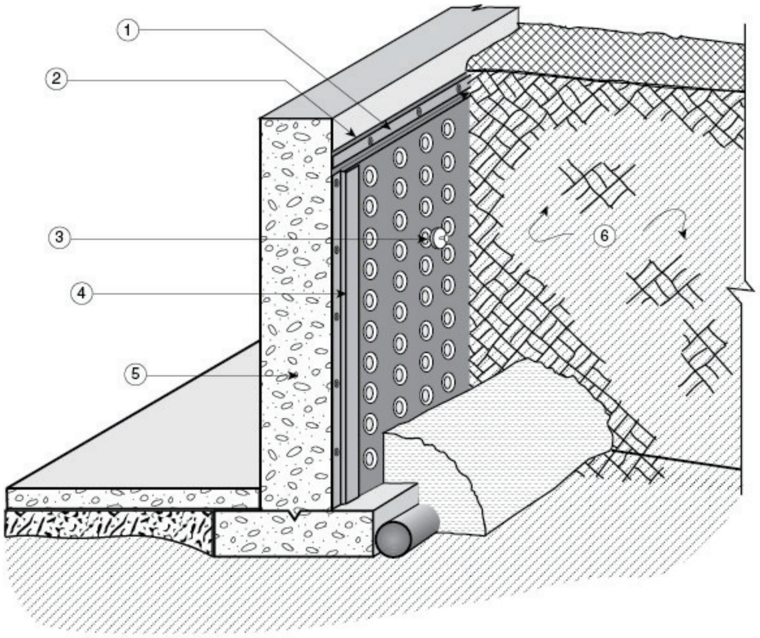


Figure 1. "Cosella-Dörken DELTA®-MS and DELTA®-MS CLEAR Dampproofing Membranes" – face in contact with the soil

1. **termination bar**
2. **caulking (behind membrane)**
3. **fastener**
4. **mould strip**
5. **concrete foundation**
6. **backfill**

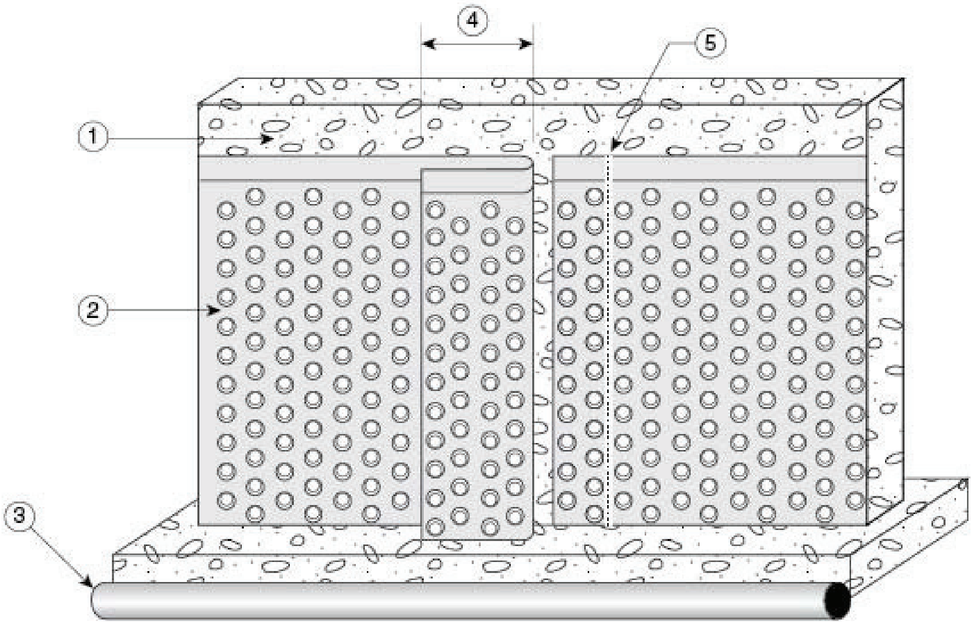


Figure 2. "Cosella-Dörken DELTA®-MS and DELTA®-MS CLEAR Dampproofing Membranes" – face in contact with the wall

1. **concrete foundation**
2. **membrane**
3. **drainage tile**
4. **minimum 6" overlap**
5. **caulking**

Appendix

E Construction Recommendations for Stripping, Earth and Rock Excavation to Undisturbed Soils, Earth and Rock Fill Placement, Asphalt Placement and Compaction

In the event that any of the following recommendations conflict with municipal and or provincial specifications, the most restrictive applies. For the case when products involving ground conditions are used, the manufacturer's specifications take precedence.

The contractor shall be prepared to proceed as directed by the geotechnical consultant within the framework of these recommendations. Construction methods will abide to these recommendations and/or be discussed and agreed upon with the consultant on site in real time or as expressed in writing.

E.1 Field Briefings

At any time in which the geotechnical consultant is required in the field for inspections, the contractor shall brief the consultant in real time about any work in progress or work to proceed at the time requiring excavation, rock excavation, placement, hauling in or out, re-working, compaction equipment weight and nature, equipment passes, moisture, stock piling, sorting of materials, stock piling, etc. of geotechnical materials. The briefing will sick approval of the methods and materials and will involve discussions regarding the source, nature and/or specifications of any source of materials brought or removed, and/or placed and/or stock piled and/or excavated from the site and discussions to meet geotechnical requirements. The consultant may choose to instate a log book in the field which may include the persons having authority to log as representative of the contractor.

E.2 Removal of Water

Removal and diversion of surface water and ground water will be planed prior to all earthwork within the scope of these recommendations. All surfaces in which to commence construction will be maintained dry and free of muddy conditions.

E.3 Earth Excavation

Earth excavations are subject to the provisions in O. Reg. 213/91: Construction Projects under Occupational Health and Safety Act. Refer to section 9 for key aspect of O. Reg. 213/91 applicable to the findings in testholes at this site.

For the purpose of these recommendations earth materials will be refer to as one or more of the general material classes: topsoil and organic soils, non engineered fill, granular fill, native soils and rock. Topsoil and organic soils and non engineered fill are the subject of striping in subsection E.3.3.

E.3.1 Suitability of Earth Materials

The suitability of material for specific purposes is determined by the geotechnical engineer. To the extent they are needed, suitable material from the excavations can be used in the construction of required permanent earthfill or rockfill.

E.3.2 Stockpiling and Sorting

Stockpiling is not an acceptable mean to build up the subgrade beneath the perimeter of structures of any kind. For stock piling, with the exception of native soils, material will be sorted in piles belonging exclusively to each material class. For native soils, sorting will be as determined by the geotechnical engineer. Mixed materials will be rendered unusable for uses other than the buildup of the subgrade in landscaped areas.

E.3.3 Striping

Topsoil and/or organic soils and/or existing fill must be removed from the perimeter of all proposed structures, including retaining wall, buildings, pavement, parking areas and earth or fill banks for grading.

E.3.4 Excavation to Undisturbed Soil Surface

All soil surfaces in which to commence construction for all structures are to be preserved in undisturbed condition (Undisturbed Soil Surface (USS)). Native soil surfaces exposed to the weather for a period exceeding 72 hours are considered disturbed. Where rainy weather and/or equipment operation and/or labor make impractical or difficult the preservation of USS a working-leveling granular pad may be used. Use the compaction requirements and materials in Table 5.

Except as otherwise indicated for select earthfill materials (subsection E.8) at this site, reinstatement of excavated soil is not allowed. When excavation exceeds the depth of the proposed USS, a granular pad using the compaction requirements and materials in Table 5.

It can be assumed that it is impractical to conduct excavations to an even USS. In such case a granular pad not less than 150mm thick must be used to remedy for irregularities caused by the operation of equipment.

E.4 Foundations Placement

Native soil surfaces exposed to the weather for a period exceeding 72 hours are considered disturbed. Place foundations on a OPSS.MUNI 1010 granular B type 2 granular pad that is at least 150 mm thick placed on undisturbed soils.

E.5 Retaining Wall Foundations

Retaining wall foundations are to be placed on a OPSS.MUNI 1010 granular B type 2 granular pad that is at least 150 mm thick.

E.6 Imported Materials

Materials to be imported are subject to prior approval by the geotechnical engineer. The exceptions are granular materials having 12 % or less fines including clean sands. Fines are materials passing the # 200 sieve (70 μm).

E.7 Overexcavation

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete which will be cured by spraying water twice a day for 7 days. Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill.

E.8 Earthfill

The type of Earthfill materials will be as indicated in plans and specifications. Suitability of earth materials will be determined by the geotechnical engineer.

Earthfill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than 2/3 of the maximum approved lift thickness shall be removed prior to compaction of the fill.

For the purpose of this subsection all suitable materials will belong to one of the following two classes: *granular earthfill* and *select earthfill*. Granular eathfill will be any natural or crushed earth materials containing 12% or less passing the #200 sieve (70 μm). Select earthfill will be materials for which more than 12% passes the #200 sieve *and* have water content close to the optimum *and* have been rendered as suitable by the geotechnical engineer.

E.8.1 Granular Earthfill Placement

E.8.1.1 Moisture for Granular Earthfill

For granular earthfill it is to be assumed that moisture will be added for placement. Compaction in wet of optimum condition is preferred for granulars.

E.8.1.2 Compacted Lifts Thicknesses Equipment and Passes for Granular Eathfill

Compacted lifts will not exceed 250 mm. Subject to test trials a maximum compacted lift of 300 mm may be accepted provided vibratory compaction equipment rated at 60,000 lb-f (27,300 kg-f) of dynamic force is used.

For road construction passes are to overlap by 300 mm for full coverage.

Where non vibratory pneumatic compactors with ballast an tire pressure of 100 psi (7 kg/cm2) are used (9 or 13 ply) the compacted lift thicknesses will not exceed 150 mm for granular.

For services and culvert trenches, when using rammers and light vibratory plates weighing less than 115 kg (250 lbs) the compacted lift thicknesses will not exceed 100 and 125 mm respectively. For heavier trench equipment the compacted lifts will not exceed 250 mm.

No heavy equipment will be operated above the crown of pipes or culverts unless 1.2 m of fill has been placed or the subgrade elevation has been reached.

For all trenches below the water table, trench foundation not less than 200 mm will be provided as per materials and specification in Table 5 in page 40.

Materials lift placement beneath foundations, slabs or any placement not specified above must abide to the above specifications as they relate to the equipment being used.

E.8.2 Select Earthfill Placement

It is to be assumed that suitable select fill will be materials that will be excavated from the bank to be put directly on hauling equipment transported and dumped directly for spreading in lifts by push tractors, be added water and compacted. Stockpiling at the source or on site is not acceptable.

E.8.2.1 Moisture for Select Earthfill

It is to be assumed that moisture will be added for placement.

E.8.2.2 Compacted Lifts Thicknesses Equipment and Passes for Select Earthfill

Compacted lifts will not exceed 200 mm for heavy sheep foot rollers. Suitability of smooth vibratory rollers for the materials will be determined by the geotechnical engineer.

For road construction passes are to overlap by 300 mm for full coverage.

Where non vibratory pneumatic compactors with ballast an tire pressure of 100 psi (7 kg/cm2) are used (9 or 13 ply) the compacted lift thicknesses will not exceed 150 mm.

For services and culvert trenches, when using rammers and light vibratory plates weighing less than 115 kg (250 lbs) the compacted lift thicknesses will not exceed 100 and 125 mm respectively. For heavier trench equipment the compacted lifts will not exceed 200 mm.

No heavy equipment will be operated above the crown of pipes or culverts unless 1.2 m of fill has been placed or the subgrade elevation has been reached.

For all trenches below the water table, trench foundation not less than 200 mm will be provided as per materials and specification in Table 5 in page 40.

Materials lift placement beneath foundations, slabs or any placement not specified above must abide to the above specifications as they relate to the equipment being used.

E.8.2.3 Re-working and/or Re-stripping for Select Earthfill

Re-stripping of 75 mm for select fill surfaces expose to rain or the environment for more than 24 hours is required. Areas of water ponding shall be stripped-off and backfilled.

E.8.3 Compaction Guide for Passes and Level of Compaction

The contents of this section are provided as guidelines for construction. The resulting compaction densities and compacted lift thicknesses can only be verified by actual testing and field trials respectively.

For equipment passes the contractor may consider not less than 4, 5 or 6 passes for 95, 98 or 100 % Proctor Standard compaction.

For granular materials loose lifts may be approximately 150, 175 and 235 mm for compacted lift thicknesses 125, 150 and 200 mm respectively.

For select earthfill materials loose lifts may be approximately 125 and 190 mm for compacted lift thicknesses 100 and 150 mm respectively.

E.8.3.1 Compacted Lifts Thicknesses Equipment and Passes for Rockfill

Compacted lifts will not exceed 400 mm. Subject to test trials a maximum compacted lift of 550 mm may be accepted provided vibratory compaction equipment rated at 60,000 lb-f (27,300 kg-f) of dynamic force is used.

For road construction passes are to overlap by 300 mm for full coverage.

E.9 Compaction General

It is to be assumed that water will be added for compaction and that the required maximum grain size shall be 3/4 of the compacted lift thickness.

Obtain the approximate loose lift thickness by dividing the compacted lift by 0.88. Compacted lifts are approximately 12% less than the loose lift thickness.

Each lift shall be compacted by the specified number of passes of the approved type and weight of roller or other equipment.

Table 5 in page 40 presents Proctor Standard (PS) compaction requirements for specified placement and materials.

E.10 Compaction Specific

E.10.1 Compaction Along Basement Walls, Retaining Walls and Structures

No heavy compaction equipment is to be operated within 0.9 m of any structure. The consolidation zone is defined as the zone within 0.9 m of the exterior edge

Material Placement	Material Description	% PS
Base	OPSS.MUNI 1010 Granular A	100
Subbase	OPSS.MUNI 1010 Granular B Type II	100
Subgrade	Granular earthfill (with 12 % or less fines) and 100% passing 106 mm sieve	95
	Select earthfill	95
Backfill for trenches under pavement	Granular earthfill (with 12 % or less fines) and 100% passing 106 mm sieve.	95
	Select earthfill	95
Under sidewalks top 200 mm	Any OPSS.MUNI 1010 Granular specification for which 100% passes the 26.5 mm sieve	95
Under foundations	OPSS.MUNI 1010 Granular B type 2 with 12% or less fines and for which 100% passes the 106 mm sieve	98
Backfill under slabs on grade	Cohesionless (with 12 % or less fines) and 100% passing 106 mm sieve.	100
	Select earthfill	100
Top 100 mm under slabs	Crushed stone 9.5 to 19 mm (use one or several sizes).	90
Pipe bedding and cover (150 mm for bedding to 150 mm above the crown)	Any OPSS.MUNI 1010 Granular specification for which 100% passes the 26.5 mm sieve	95
Trench foundation (stabilization minimum 200 mm)	Any OPSS 1010.MUNI Granular specification for which 100% passes the 106 mm sieve except Granular B Type I	95
Backfill for non building, non traffic and/or non parking areas	Granular (with 12 % or less fines) and 100% passing 106 mm sieve	90
	Select earthfill	90
Placement not specified above	Granular (with 12% or less fines) and 100% passing 106 mm sieve	95
	Select earthfill	95

Table 5: Proctor Standard (PS) compaction requirements for specified placement and materials.

of basements or the interior edge of retaining walls or any structure. Only light to very light compaction is to be applied along the consolidation zone with no more than 2 passes of light vibratory equipment.

E.10.2 Self Compacting Materials

There are no self compacting materials. Total fill thickness of 200 mm of granular materials consisting of more than 90% of one nominal size referred to as crushed stone are acceptable without compaction under concrete slabs.

E.10.3 Settlement Allowance and Overfill

The settlement (consolidation) of lightly compacted earthfill can be excessive. Overfill to compensate for settlement allowance will be discussed with the geotechnical engineer.

E.10.4 Compaction Quality Control

Provide moisture density relationships for Standard Proctor compaction for the proposed materials and source. Conduct one in situ test at randomly selected locations per 60 m3 of fill. This is approximately one test, each 300 m2 of lift in place. Nuclear or non-nuclear density probes testing can be used. Density probes will only measure the density within 0.12 m depth at the point of the measurement.

E.11 Asphalt Pavement

Place asphalt mix only when base course, or previous course is dry and air temperature is 7 degrees C and increasing.

Asphalt pavement mix temperatures at the time of placement will be within the range of 120 to 160 degrees C.

Do not place asphalt on a surface which is wet or covered by snow or ice or if the ground is frozen.

E.11.1 Surface Preparation for Asphalt Pavement

It is to be assumed that rough grading and fine grading shall take place before asphalt placement. Rough grading will be completed to within ± 25 mm of the underside of asphalt and tested to meet the specified density. Fine grading and rolling will completed by the paving contractor. The granular material for fine grading will meet OPSS.MUNI 1010 Granular M.

E.11.2 Proof Rolling Prior to Asphalt Pavement

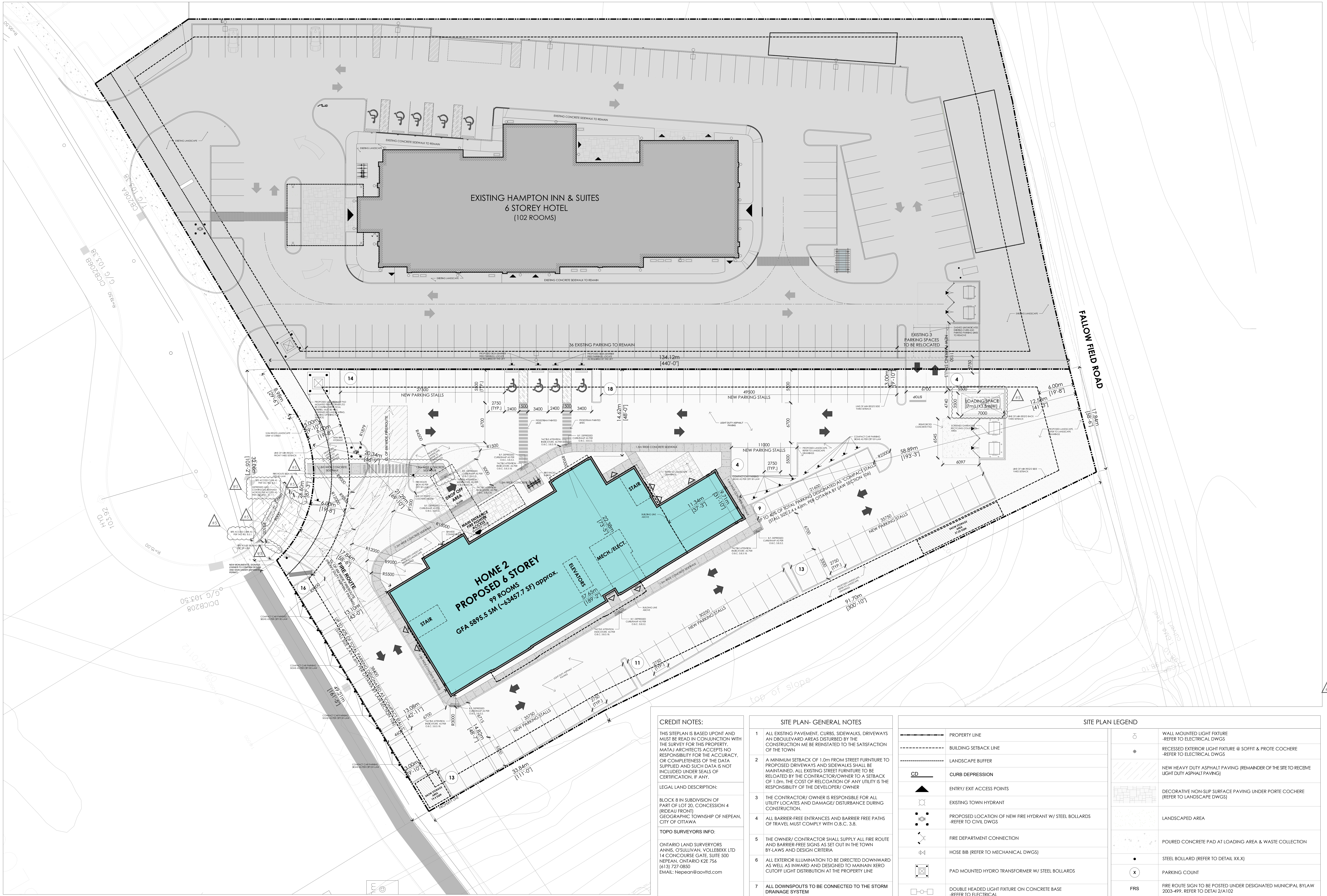
Conduct proof rolling using a single pass of a tandem-axle dump truck or a tri-axle dump truck with the third axle raised loaded to a minimum gross vehicle weight of 26 metric tons at walking speed. Rutting in excess of 25 mm is considered failure. Where proof rolling reveals areas of defective subgrade, Remove base, Sub-base and subgrade material to depth and extent and width that will allow reconstruction using the available equipment or as directed by the Consultant.

E.11.3 Asphalt compaction

The compacted lifts are accepted to be 80% of the loose lift thickness (the loose lift reduces thickness by 20% when compacted). Divide the compacted lift thickness by 0.8 to obtain the thickness of the loose lift.

Compaction will consist on at least three passes at approximately walking speed (5.4 km/hr) as follows: *break down rolling* using a vibratory steel drum roller, *intermediate rolling* with a static (non-vibrating) roller or a pneumatic roller and *finish rolling* with a smooth static roller.

Appendix E PROPOSED SITE PLAN



1 ASP-1 OVERALL SITE PLAN

1:300

CREDIT NOTES:
THIS SITEPLAN IS BASED UPONT AND MUST BE READ IN CONJUNCTION WITH THE SURVEY FOR THIS PROPERTY. MATAJ ARCHITECTS ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY, OR COMPLETENESS OF THE DATA SUPPLIED AND SUCH DATA IS NOT INCLUDED UNDER SEALS OF CERTIFICATION, IF ANY.
LEGAL LAND DESCRIPTION:
BLOCK 8 IN SUBDIVISION OF PART OF LOT 20, CONCESSION 4 (RIDEAU FRONT) GEOGRAPHIC TOWNSHIP OF NEPEAN, CITY OF OTTAWA
TOPO SURVEYORS INFO:
ONTARIO LAND SURVERYORS ANNIS, O'SULLIVAN, VOLLEBEKK LTD 14 CONCOURSE GATE, SUITE 500 NEPEAN, ONTARIO K2E 7S6 (613) 727-0850 EMAIL: Nepean@aovltd.com

SITE PLAN- GENERAL NOTES

1	ALL EXISTING PAVEMENT, CURBS, SIDEWALKS, DRIVEWAYS AN DBOULEVARD AREAS DISTURBED BY THE CONSTRUCTION ME BE REINSTATED TO THE SATISFACTION OF THE TOWN
2	A MINIMUM SETBACK OF 1.0m FROM STREET FURNTIURE TO PROPOSED DRIVEWAYS AND SIDEWALKS SHALL BE MAINTAINED. ALL EXISTING STREET FURNITURE TO BE RELOATED BY THE CONTRACTOR/OWNER TO A SETBACK OF 1.0m. THE COST OF RELCOATION OF ANY UTILITY IS THE RESPONSIBILITY OF THE DEVELOPER/ OWNER
3	THE CONTRACTOR/ OWNER IS RESPONSIBLE FOR ALL UTILITY LOCATES AND DAMAGE/ DISTURBANCE DURING CONSTRUCTION.
4	ALL BARRIER-FREE ENTRANCES AND BARRIER FREE PATHS OF TRAVEL MUST COMPLY WITH O.B.C. 3.8.
5	THE OWNER/ CONTRACTOR SHALL SUPPLY ALL FIRE ROUTE AND BARRIER-FREE SIGNS AS SET OUT IN THE TOWN BY-LAWS AND DESIGN CRITERIA
6	ALL EXTERIOR ILLUMINATION TO BE DIRECTED DOWNWARD AS WELL AS INWARD AND DESIGNED TO MAINAIN XERO CUTOFF LIGHT DISTRIBUTION AT THE PROPERTY LINE
7	ALL DOWNSPOUTS TO BE CONNECTED TO THE STORM DRAINAGE SYSTEM
8	ALL CONDENSING UNITS TO BE SCREENED ON THE GROUND FLOOR
9	SEPARATE PERMITS ARE REQUIRED FOR ANY SIGNAGE ON THE PROPERY
10	WHERE POSSIBLE TREES ARE TO BE PROTECTED FROM CONSTRUCTION

SITE PLAN LEGEND

—··—··—	PROPERTY LINE	○	WALL MOUNTED LIGHT FIXTURE -REFER TO ELECTRICAL DWGS
- - - - -	BUILDING SETBACK LINE	⌖	RECESSED EXTERIOR LIGHT FIXTURE @ SOFFIT & PROTE COCHERE -REFER TO ELECTRICAL DWGS
----------	LANDSCAPE BUFFER	▨	NEW HEAVY DUTY ASPHALT PAVING (REMAINDER OF THE SITE TO RECEIVE LIGHT DUTY ASPHALT PAVING)
CD	CURB DEPRESSION	▦	DECORATIVE NON-SLIP SURFACE PAVING UNDER PORTE COCHERE (REFER TO LANDSCAPE DWGS)
▲	ENTRY/ EXIT ACCESS POINTS	░	LANDSCAPED AREA
⊗	EXISTING TOWN HYDRANT	░	POURED CONCRETE PAD AT LOADING AREA & WASTE COLLECTION
◎	PROPOSED LOCATION OF NEW FIRE HYDRANT W/ STEEL BOLLARDS -REFER TO CIVIL DWGS	●	STEEL BOLLARD (REFER TO DETAIL XX.X)
⋋	FIRE DEPARTMENT CONNECTION	(X)	PARKING COUNT
⋈	HOSE BIB (REFER TO MECHANICAL DWGS)	FRS	FIRE ROUTE SIGN TO BE POSTED UNDER DESIGNATED MUNICIPAL BYLAW 2003-499. REFER TO DETAI 2/A102
⊠	PAD MOUNTED HYDRO TRANSFORMER W/ STEEL BOLLARDS	104.04 ×	PROPOSED GRADING (REFER TO CIVIL DWGS)
□-○-□	DOUBLE HEADED LIGHT FIXTURE ON CONCRETE BASE -REFER TO ELECTRICAL	▭	CONDENSING UNIT ON 4" CONCRETE PAD (REFER TO MECH DWGS)
□-○	SINGLE HEADED LIGHT FIXTURE ON CONCRETE BASE -REFER TO ELECTRICAL DWGS	⊞	SNOW STORAGE AREA (OWNER TO TAKE NECESSARY PRECAUTIONS W/ SNOW REMOVAL COMPANY TO ADDRESS SLOPED CONDITION AT SOUTH END OF SITE)
□-○ E	SINGLE HEADED LIGHT FIXTURE ON CONCRETE BASE W/ ELECTRICAL OUTLET -REFER TO ELECTRICAL DWGS		

Project North:

True North:

Key Plan:

HOME2 SUITES BY HILTON

No.	Date:	Issue/Revision	By:
5	22/04/05	Issued for SPA Re-Submission	AB
4	21/11/16	Issued for Brand 25% Re-Submission	AB
3	21/10/08	Issued for Brand 25% Re-Submission	AB
2	21/07/23	Issued for Brand 25% Submission	AB
1	20/09/24	Issued for brand review	MO

Drawing Issues/Revisions:

Note:

ALL DIMENSIONS AND INFORMATION SHOWN ON THESE DRAWINGS MUST BE CHECKED AND VERIFIED ON SITE AND ANY DISCREPANCIES REPORTED TO THE ARCHITECT PRIOR TO CONSTRUCTION AND FABRICATION OF ITS COMPONENTS. SHOULD EXISTING CONDITIONS OR SERVICES BE FOUND TO VARY FROM THAT INDICATED ON THE DRAWINGS, THE ARCHITECT MUST BE NOTIFIED IMMEDIATELY.

FEATURES OF CONSTRUCTION NOT FULLY SHOWN ARE ASSUMED TO BE THE SAME CHARACTER AS THOSE NOTED FOR SIMILAR CONDITIONS.

UNLESS SPECIFICALLY NOTED OTHERWISE ON THE DRAWINGS, NO PROVISION HAS BEEN MADE IN THE DESIGN FOR CONDITIONS OCCURRING DURING CONSTRUCTION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE ALL NECESSARY BRACING, SHORINGS, SHEET PILING OR OTHER TEMPORARY SUPPORTS, TO SAFEGUARD ALL EXISTING OR ADJACENT STRUCTURES AFFECTED BY THIS WORK.

USE LATEST REVISED DRAWINGS. DO NOT SCALE DRAWINGS.

ONTARIO ASSOCIATION OF ARCHITECTS
2022-04-06
ETLEVA GURAKUQI MATAJ
LICENCE
7609

MATAJ ARCHITECTS INC

Architect's Stamp

MATAJ ARCHITECTS INCORPORATED
206-418 Iroquois Shore Rd
Oakville Ontario
L6H 0X7
T.905.281.4444

Project:

OTTAWA HOME2 DEVELOPMENT
135 LUSK STREET, NEPEAN, ON

Owner

2441736 Ontario Inc.
125 Lusk Street Ottawa, ON K2J 6S5
Phone: 613-307-0412

Sheet Title:

OVERALL SITE PLAN

Design By:	Drawn By:	Approved By:
AM	AB	EM
Scale:	Date:	Project No.:
1:300	DEC 2020	20-022

Drawing No:

ASP-01 Of:

City's Application Number D07-12-21-0201
City's Plan Number: 18665

Appendix FDRAWINGS