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

Stantec Project No. 160401620

April 12, 2021

Prepared for:

2441736 Ontario Inc.

Prepared by:

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

Revision	Description	Author		Quality Check		Independent Review	
0	1st Submission SPA	PM	2021-03-15	TR	2021-04-01	KK	2021-04-02

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Prepared by _____

Peter Mott, EIT

Reviewed by _____

Kris Kilborn

Approved by _____

Rathnasooriya Thakshika, P.Eng.

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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. 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, surface parking, 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 November 2020 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 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 6,282 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 173 m^2. The estimated demands are summarized in **Table 1** and the detailed water demand calculations provided in **Appendix A.2**

Table 1: Estimated Water Demands

Demand Type	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Hotel & Amenity Area	198	0.52	0.78	1.41

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 7,000 L/min (116.7 L/s). The FUS calculations for the proposed site are included in

Appendix A.3. The boundary conditions request to the City was based on a fire flow demand of 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.1**.

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.

Potable Water Servicing

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 within the Lusk Street ROW at the westerner boundary of the site (see **Drawing SSP-1**). Wastewater flows from the proposed development, referred 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 E**).

The proposed 0.62 ha development will consist of a six-storey hotel building with 99 rooms, surface parking, 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	0.14	3.35

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 3.35 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 capacity in the existing sewer will be capable to accommodate the proposed development. Detailed sanitary sewage calculations are included in **Appendix B**.

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 north western 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 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 four (4) and two (2) standard Watts Model R1100 Accuflow Roof Drains at 50% open (R1007A) and closed (R1007B), respectively.

Watts “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 “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 D** 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)
R10007A	0.10	0.10	3.71	10.46
R10007B	0.01	0.07	1.26	0.51

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

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
R1007A	0.10	0.15	4.96	35.79
R10007B	0.01	0.13	1.26	2.89

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 121 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	1.14	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	12.1	6.73	6.80
L1003A	CBMH1003	LMF75	1.90	6.90	10.93	15.02
L1003B	CB1003B	LMF95	1.51	9.81	9.30	13.10

Area ID	Catchbasin ID	Type of ICD	Head (m)	$Q_{release}$ (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
L1004A & 1005A	CBMH1004	94mm DIA. ORIFICE	2.65	30.52	84.93	85.37
L1006A	CB1006	LMF105	1.68	12.69	11.74	29.00

As outlined in the above tables, a total of 121 m^3 of storage is used in the parking lot areas by surface and subsurface storage and 42 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	0.06	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	11.42	68.14	**90**
Controlled – Roof	10.97	4.97	
Uncontrolled – (UNC-1, UNC-3)	-	7.80	
Total	**22.39**	**80.91**	

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

Area Type	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
Controlled – Parking	123.63	59.35	**90**
Controlled – Roof	38.68	6.22	
Uncontrolled – (UNC-1, UNC-3)	-	22.65	
Total	**162.31**	**88.22**	

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

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 to 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.

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

At the time of completion of this site servicing and stormwater management brief, a site-specific geotechnical report has not been completed. As a result, the following information has been adopted from the preliminary subsurface investigation letter produced by Kollaard Associates in March 2008 with the intent of providing the general geotechnical conditions for the overall O'Keefe Court – 416 Lands.

As outlined in the subsurface investigation letter, the subsurface conditions within the O'Keefe Court – 416 Lands consists of stiff to very stiff, grey-brown to grey silty clay with depths varying from 2.4 to 5 meters below ground surface. The presence of glacial till deposits were encountered at depths below the silty clay consisting of gravel, cobbles, and boulders in a matrix of silty sand with traces of clay material. Boreholes were terminated at depths between 4.4 to 5.5 meters below ground surface upon refusal of auger advancement due to large boulders or upper bedrock surfaces.

At the time of the preliminary investigation, groundwater levels varied from 1 to 2.7 meters below the existing ground surface with water samples indicating the presence of low concentrations of sulphate. The results from the investigation indicate that there is no presence of soft or firm silty clay material and that laboratory consolidation testing was not required at the time. The final design of the proposed hotel development within Block 7 will require a site-specific geotechnical investigation with site specific details provided upon receipt of an updated geotechnical report.

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 Bussiness 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 Novemeber, 2020.

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	173			28000	0.3	0.01	0.5	0.01	0.9	0.02
Total Site :	**173**	**99**	**198**	**-**	**31.3**	**0.52**	**46.9**	**0.78**	**84.4**	**1.41**

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

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401620
Project Name: 135 Lusk Street
Date: 2021-03-04
Fire Flow Calculation #: 1
Description: Hotel building - 6 storey consisting of 99 rooms

Step	Task	Notes	Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Non-Combustible Construction	0.8	-
2	Determine Ground Floor Area of One Unit	-	1047	-
	Determine Number of Adjoining Units	-	1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space	6	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min	-	14000
5	Determine Occupancy Charge	Non-Combustible	-25%	10500
6	Determine Sprinkler Reduction	Conforms to NFPA 13	-30%	-4200
		Standard Water Supply	-10%	
		Not Fully Supervised or N/A	0%	
		% Coverage of Sprinkler System	100%	

7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	21.4	6	> 120	Wood Frame or Non-Combustible	0%	525
		East	30.1 to 45	57.5	6	> 120	Wood Frame or Non-Combustible	5%	
		South	> 45	21.4	6	> 120	Wood Frame or Non-Combustible	0%	
		West	> 45	57.5	6	> 120	Wood Frame or Non-Combustible	0%	

8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min	7000
		Total Required Fire Flow in L/s	116.7
		Required Duration of Fire Flow (hrs)	2.00
		Required Volume of Fire Flow (m^3)	840

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.

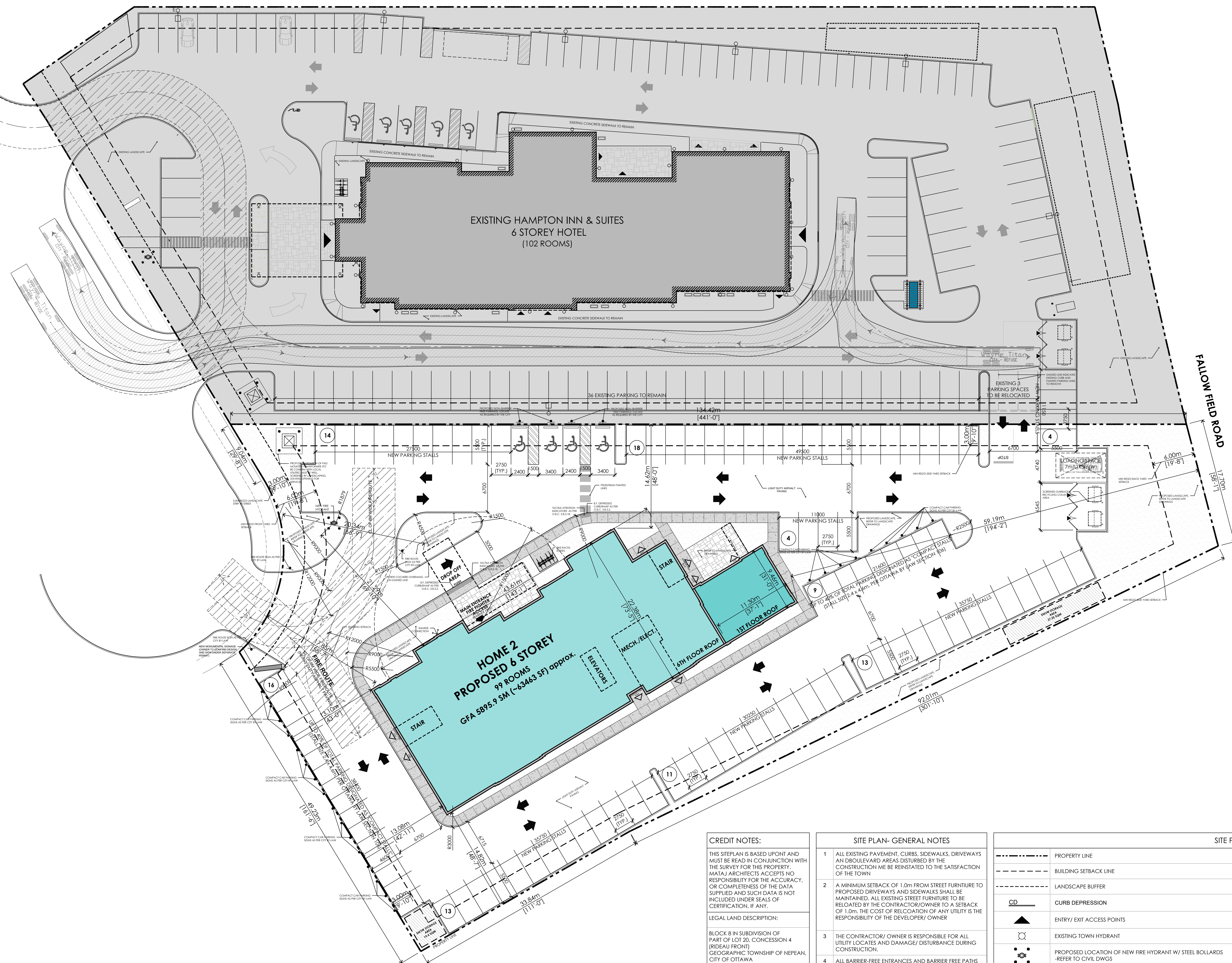
Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	151.0	67.0
Peak Hour	148.0	62.8
Max Day plus Fire 1	148.7	63.8
Max Day plus Fire 2	141.8	54.0

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 B 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

Symbol	Description	Symbol	Description
	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)
	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:
1	20/09/24	Issued for brand review	MA

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.

WORK IN PROGRESS

MATAJ ARCHITECTS INC

Architect's Stamp

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

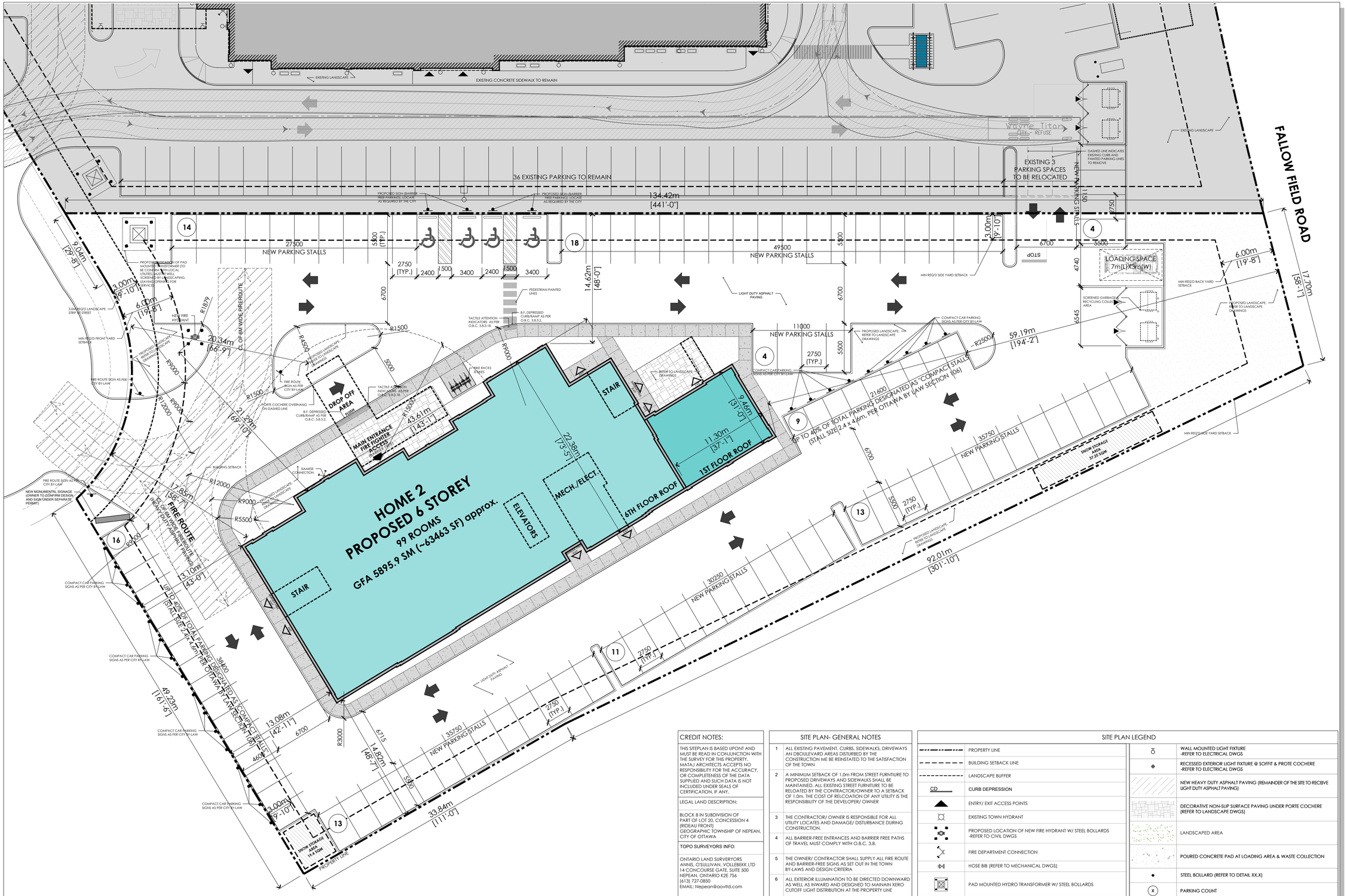
Project:
OTTAWA HOME2 DEVELOPMENT
4401 FALLOWFIELD RD, NEPEAN, ON

Sheet Title:
OVERALL SITE PLAN

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

Drawing No: **ASP-01** Of:

Drawing Series:



1
ASP-2

ENLARGED SITE PLAN

1:200

CREDIT NOTES:

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TOPO SURVEYORS INFO:

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ANNIS, O'SULLIVAN, VOLLEBEKK LTD
14 CONCOURSE GATE, SUITE 500
NEPEAN, ONTARIO K2E 7S6
(613) 727-0850
EMAIL: Nepean@aovltd.com

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Project North: | True North:

Key Plan:

HOME2 SUITES BY HILTON

No.	Date:	Issue/Revision	By:
1	20/09/24	Issued for brand review	MA

Drawing Issues/Revisions:

Note:
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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

4401 FALLOWFIELD RD, NEPEAN, ON

Sheet Title:

ENLARGED SITE PLAN

Design By:	Drawn By:	Approved By:
AM	AB	EM
Scale: 1:200	Date: NOV 2020	Project No.: 20-022

Drawing No:

ASP-02

Of:

Drawing Series:

Appendix C SANITARY SEWER CALCULATIONS

Stantec

SITE: 135 Lusk Street

DATE: 2021-04-07
REVISION: 1
DESIGNED BY: PM
CHECKED BY: RT

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	0.28 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	APARTMENT	KING SIZE BEDROOM	QUEEN SIZE BEDROOM	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
C100A, G100A	Building	SAN101	0.00	0	74	25	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	0.14	3.35	3.70	200	PVC	SDR 35	1.00	33.4	**10.02%**	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	0.14	3.35	9.00	250	PVC	SDR 35	0.40	38.3	**8.74%**	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	0.14	3.35	7.60	250	PVC	SDR 35	0.40	38.3	**8.74%**	0.77	0.39

250

Appendix D STORMWATER SERVICING AND MANAGEMENT

Stantec

135 LUSK STREET

DATE: 2021-04-12
REVISION: 1
DESIGNED BY: PM
CHECKED BY: TR

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	0.84	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	8.7	12.0	600	600	CIRCULAR	CONCRETE	-	0.10	202.6	**4.27%**	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	0.084	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	17.3	46.8	250	250	CIRCULAR	PVC	-	0.50	42.7	**40.56%**	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	24.6	25.1	250	250	CIRCULAR	PVC	-	0.50	42.7	**57.58%**	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	6.2	6.2	6.2	2.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**18.67%**	1.05	0.67	0.05
																				10.05																			
	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	6.2	30.2	9.7	300	300	CIRCULAR	PVC	-	0.40	60.8	**49.70%**	0.86	0.74	0.22
																				12.59																			
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	0.093	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.076	0.216	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	42.8	30.7	300	300	CIRCULAR	PVC	-	0.40	60.8	**70.45%**	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	0.342	0.000	0.000	0.000	0.000	0.000	0.000	12.59	68.10	92.23	108.06	157.88	0.0	6.2	70.9	3.3	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**53.28%**	0.81	0.71	0.08
																				12.67									450	450									

Stormwater Management Calculations

File No: **160401620**
Project: **135 Lusk Street**
Date: **07-Apr-21**

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

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
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	0.044		0.9	0.039		
		Soft	0.004		0.2	0.001		
		Subtotal		0.048			0.04032	0.840
Controlled - Tributary	L1004A	Hard	0.082		0.9	0.074		
		Soft	0.011		0.2	0.002		
		Subtotal		0.093			0.07626	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	0.095		0.9	0.086		
		Soft	0.000		0.2	0.000		
		Subtotal		0.095			0.0855	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	**0.106 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.465 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

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

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

Qtarget (L/s)	Vtarget (120m³/ha)
90	68

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L1002A — Controlled - Tributary
Area (ha): 0.05
C: 0.88

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

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L1002A — Controlled - Tributary
Area (ha): 0.05
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	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

	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 — Controlled - Tributary
Area (ha): 0.05
C: 0.86

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: L1003B — Controlled - Tributary
Area (ha): 0.05
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	25.32	9.81	15.50	**9.30**
20	119.95	17.01	9.81	7.20	8.63
30	91.87	13.03	9.81	3.21	5.78
40	75.15	10.65	9.81	0.84	2.02
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	0.13	m
Downstream W/L	100.83	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.68	1.51	9.81	9.30	13.10	OK
					3.80	

Subdrainage Area: L1003A — Controlled - Tributary
Area (ha): 0.05
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	8.61	6.72	1.89	**1.14**
20	52.03	5.83	5.83	0.00	0.00
30	40.04	4.49	4.49	0.00	0.00
40	32.86	3.68	3.68	0.00	0.00
50	28.04	3.14	3.14	0.00	0.00
60	24.56	2.75	2.75	0.00	0.00
70	21.91	2.46	2.46	0.00	0.00
80	19.83	2.22	2.22	0.00	0.00
90	18.14	2.03	2.03	0.00	0.00
100	16.75	1.88	1.88	0.00	0.00
110	15.57	1.75	1.75	0.00	0.00
120	14.56	1.63	1.63	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	1.14	8.92	OK

Subdrainage Area: L1003A — Controlled - Tributary
Area (ha): 0.05
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	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

	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 — Controlled - Tributary
Area (ha): 0.09
C: 0.82

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	16.28	16.28	0.00	**0.00**
20	52.03	11.03	11.03	0.00	**0.00**
30	40.04	8.49	8.49	0.00	**0.00**
40	32.86	6.97	6.97	0.00	**0.00**
50	28.04	5.94	5.94	0.00	**0.00**
60	24.56	5.21	5.21	0.00	**0.00**
70	21.91	4.65	4.65	0.00	**0.00**
80	19.83	4.20	4.20	0.00	**0.00**
90	18.14	3.85	3.85	0.00	**0.00**
100	16.75	3.55	3.55	0.00	**0.00**
110	15.57	3.30	3.30	0.00	**0.00**
120	14.56	3.09	3.09	0.00	**0.00**

Subdrainage Area: L1004A — Controlled - Tributary
Area (ha): 0.09
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	46.16	46.16	0.00	**0.00**
20	119.95	31.01	31.01	0.00	**0.00**
30	91.87	23.75	23.75	0.00	**0.00**
40	75.15	19.43	19.43	0.00	**0.00**
50	63.95	16.53	16.53	0.00	**0.00**
60	55.89	14.45	14.45	0.00	**0.00**
70	49.79	12.87	12.87	0.00	**0.00**
80	44.99	11.63	11.63	0.00	**0.00**
90	41.11	10.63	10.63	0.00	**0.00**
100	37.90	9.80	9.80	0.00	**0.00**
110	35.20	9.10	9.10	0.00	**0.00**
120	32.89	8.50	8.50	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**

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**

Stormwater Management Calculations

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

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	45.90	29.05	16.85	10.11
20	52.03	31.29	29.05	2.25	2.69
30	40.04	24.08	24.08	0.00	**0.00**
40	32.86	19.77	19.77	0.00	**0.00**
50	28.04	16.87	16.87	0.00	**0.00**
60	24.56	14.77	14.77	0.00	**0.00**
70	21.91	13.18	13.18	0.00	**0.00**
80	19.83	11.93	11.93	0.00	**0.00**
90	18.14	10.91	10.91	0.00	**0.00**
100	16.75	10.07	10.07	0.00	**0.00**
110	15.57	9.36	9.36	0.00	**0.00**
120	14.56	8.76	8.76	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	10.11	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		
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 Uncontrolled - Tributary
Area (ha): 0.003
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	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 Roof
Area (ha): 0.10 Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)

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

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	121.68	30.52	91.16	54.70
20	119.95	90.07	30.52	59.55	71.46
30	91.87	74.93	30.52	44.40	79.93
40	75.15	65.91	30.52	35.39	84.93
50	63.95	57.60	30.52	27.08	81.24
60	55.89	50.35	30.52	19.82	71.36
70	49.79	44.85	30.52	14.32	60.15
80	44.99	40.52	30.52	10.00	48.00
90	41.11	37.03	30.52	6.50	35.13
100	37.90	34.14	30.52	3.62	21.69
110	35.20	31.71	30.52	1.18	7.81
120	32.89	29.63	29.63	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		5.08
SURFACE STORAGE		66.03

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	103.79	2.65	30.52	84.93	85.37	OK
					0.44	

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

	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		
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 Uncontrolled - Tributary
Area (ha): 0.003
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	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 Roof
Area (ha): 0.10 Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)

Stormwater Management Calculations

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

10	76.81	18.26	3.55	14.71	8.82	90.65	0.00
20	52.03	12.37	3.70	8.67	10.40	96.69	0.00
30	40.04	9.52	3.71	5.81	**10.46**	96.92	0.00
40	32.86	7.81	3.66	4.15	9.96	95.02	0.00
50	28.04	6.67	3.59	3.08	9.23	92.20	0.00
60	24.56	5.84	3.51	2.33	8.39	88.97	0.00
70	21.91	5.21	3.42	1.79	7.50	85.58	0.00
80	19.83	4.71	3.34	1.38	6.61	82.16	0.00
90	18.14	4.31	3.25	1.06	5.74	78.79	0.00
100	16.75	3.98	3.17	0.81	4.88	75.50	0.00
110	15.57	3.70	3.06	0.64	4.24	71.18	0.00
120	14.56	3.46	2.95	0.51	3.67	66.94	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	96.92	0.10	3.71	10.46	38.00	0.16

Subdrainage Area: R1007B
Area (ha): 0.01
C: 0.90
Maximum Storage Depth: Roof 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	1.26	0.85	**0.51**	72.49	0.00
20	52.03	1.43	1.26	0.17	0.20	52.67	0.00
30	40.04	1.10	1.04	0.06	0.11	41.19	0.00
40	32.86	0.90	0.87	0.03	0.08	34.60	0.00
50	28.04	0.77	0.76	0.02	0.05	29.94	0.00
60	24.56	0.68	0.67	0.01	0.03	26.47	0.00
70	21.91	0.60	0.60	0.00	0.02	23.72	0.00
80	19.83	0.55	0.54	0.00	0.02	21.48	0.00
90	18.14	0.50	0.50	0.00	0.02	19.67	0.00
100	16.75	0.46	0.46	0.00	0.01	18.17	0.00
110	15.57	0.43	0.43	0.00	0.01	16.90	0.00
120	14.56	0.40	0.40	0.00	0.01	15.78	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	72.49	0.07	1.26	0.51	4.40	0.00

2-Year Site Peak Flow Summary

Total Area =	0.57 **ha**	**Parking Volume Used =**	11.42	**m³**
Q Target =	90 **L/s**	**Roof Volume Used =**	10.97	**m³**
			22.39	**m³**
Q unc =	7.80 **L/s**			
Q roof =	4.97 **L/s**	**Parking Volume Available =**	28.76	**m³**
Q parking =	68.14 **L/s**	**Roof Volume Available =**	42.40	**m³**
			71.16	**m³**
Q total =	80.91 **L/s**			

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

10	178.56	47.16	4.56	42.60	25.56	130.57	0.00
20	119.95	31.68	4.82	26.86	32.23	140.99	0.00
30	91.87	24.26	4.92	19.34	34.81	145.02	0.00
40	75.15	19.85	4.96	14.89	35.73	146.46	0.00
50	63.95	16.89	4.96	11.93	**35.79**	146.55	0.00
60	55.89	14.76	4.94	9.82	35.35	145.86	0.00
70	49.79	13.15	4.91	8.24	34.59	144.68	0.00
80	44.99	11.88	4.88	7.01	33.63	143.18	0.00
90	41.11	10.86	4.83	6.03	32.54	141.47	0.00
100	37.90	10.01	4.79	5.23	31.35	139.62	0.00
110	35.20	9.30	4.74	4.56	30.10	137.67	0.00
120	32.89	8.69	4.69	4.00	28.82	135.66	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	146.55	0.15	4.96	35.79	38.00	0.40

Subdrainage Area: R1007B
Area (ha): 0.01
C: 1.00
Maximum Storage Depth: Roof 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	1.26	4.20	2.52	124.45	0.00
20	119.95	3.67	1.26	2.41	**2.89**	129.60	0.00
30	91.87	2.81	1.26	1.55	2.79	128.23	0.00
40	75.15	2.30	1.26	1.04	2.49	123.80	0.00
50	63.95	1.96	1.26	0.69	2.08	115.65	0.00
60	55.89	1.71	1.26	0.45	1.61	106.18	0.00
70	49.79	1.52	1.26	0.26	1.10	93.08	0.00
80	44.99	1.38	1.26	0.11	0.55	74.82	0.00
90	41.11	1.26	1.23	0.03	0.16	48.68	0.00
100	37.90	1.16	1.14	0.02	0.13	45.04	0.00
110	35.20	1.08	1.06	0.02	0.12	41.95	0.00
120	32.89	1.01	0.99	0.01	0.10	39.30	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	129.60	0.13	1.26	2.89	4.40	0.00

100-Year Site Peak Flow Summary

Total Area =	0.57 **ha**	**Parking Volume Used =**	123.63	**m³**
Q Target =	90 **L/s**	**Roof Volume Used =**	38.68	**m³**
			162.31	**m³**
Q unc =	22.65 **L/s**			
Q roof =	6.22 **L/s**	**Parking Volume Available =**	149.29	**m³**
Q parking =	59.35 **L/s**	**Roof Volume Available =**	42.40	**m³**
			191.69	**m³**
Q total =	88.22 **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	0.0013	0	0.025	21	0	0	0.025
0.050	0.0006	0.0025	1	0.050	84	1	1	0.050
0.075	0.0008	0.0032	5	0.075	190	3	5	0.075
0.100	0.0009	0.0038	11	0.100	338	7	11	0.100
0.125	0.0011	0.0044	22	0.125	528	11	22	0.125
0.150	0.0013	0.0050	38	0.150	760	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	488.0	1.2	0.135551238
4.6	1059.6	3.3	0.42989107
11.1	1719.6	6.5	0.907547865
21.8	2430.0	10.7	1.58253801
37.8	3171.9	16.0	2.463621059

Rooftop Storage Summary

Total Building Area (sq.m)		950
Assume Available Roof Area (sq.m)	80%	760
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		4
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		38
Estimated 100 Year Drawdown Time (h)		2.4

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

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

From Watts Drain Catalogue

Head (m)	L/s Open	75%	**50%**	25%	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.315
0.050	0.6309	0.6309	**0.6309**	0.6309	0.631
0.075	0.9464	0.8675	**0.7886**	0.7098	0.631
0.100	1.2618	1.1041	**0.9464**	0.7886	0.631
0.125	1.5773	1.3407	**1.1041**	0.8675	0.631
0.150	1.8927	1.5773	**1.2618**	0.9464	0.631

Calculation Results	**2yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.004	0.005	-
Depth (m)	0.097	0.147	0.150
Volume (cu.m)	10.5	35.8	38.0
Draintime (hrs)	0.9	2.4	

Project #160401620, 135 Lusk Street
Roof Drain Design Sheet, Area R1007B
Standard Watts Drainage Model R1100 Accuflow Roof Drains

Rating Curve				Volume Estimation					Drawdown Estimate			
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)	Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000				
0.025	0.0003	0.0006	0	0.025	2	0	0	0.025	0.0	0.0	0.0	0
0.050	0.0006	0.0013	0	0.050	10	0	0	0.050	0.1	113.0	0.1	0.03139081
0.075	0.0006	0.0013	1	0.075	22	0	1	0.075	0.5	306.7	0.4	0.11659445
0.100	0.0006	0.0013	1	0.100	39	1	1	0.100	1.3	597.3	0.8	0.28251732
0.125	0.0006	0.0013	3	0.125	61	1	3	0.125	2.5	984.8	1.2	0.55606583
0.150	0.0006	0.0013	4	0.150	88	2	4	0.150	4.4	1469.1	1.9	0.9641464

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*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		4
Estimated 100 Year Drawdown Time (h)		0.6

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

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**

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

Calculation Results

	2yr	100yr	Available
Qresult (cu.m/s)	0.001	0.001	-
Depth (m)	0.072	0.130	0.150
Volume (cu.m)	0.5	2.9	4.4
Draintime (hrs)	0.1	0.6	

Appendix E 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

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_20 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

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

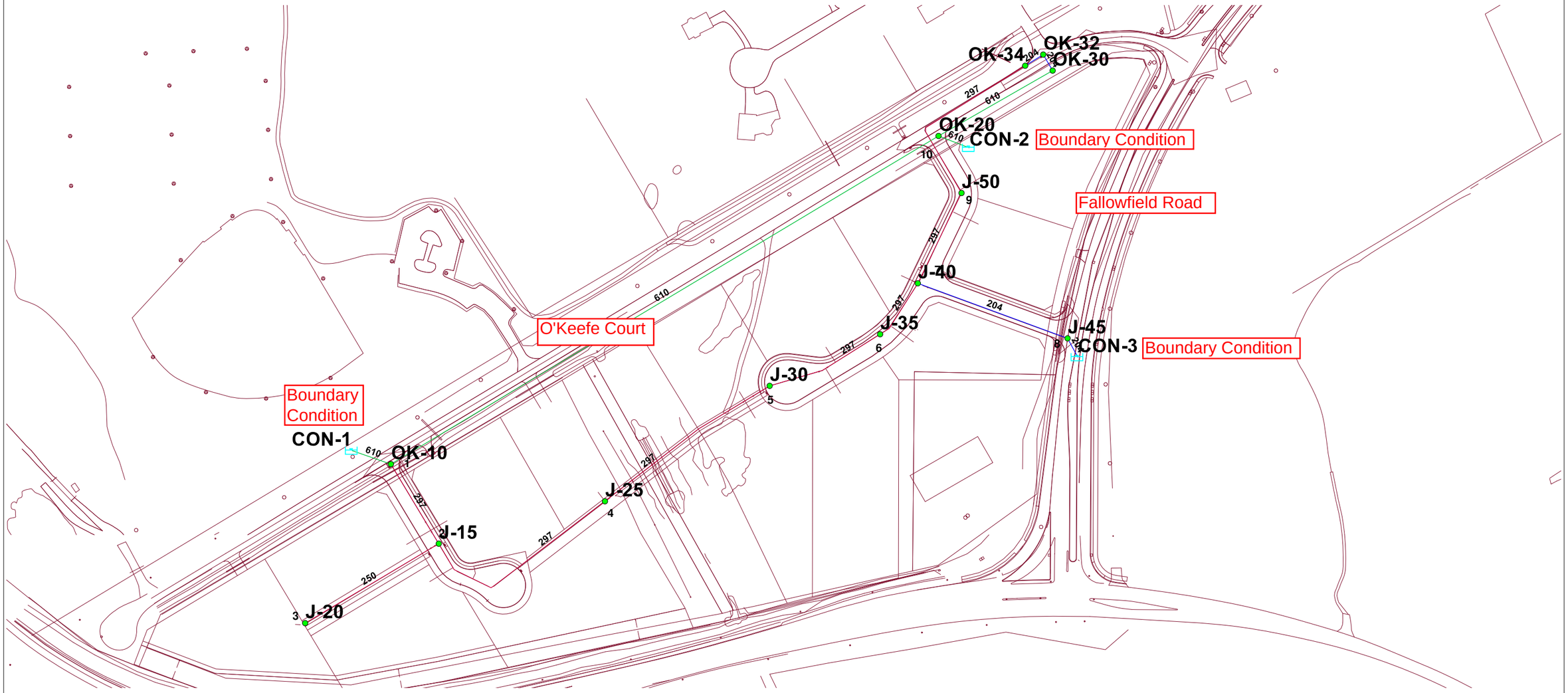
MAX. HOURLY DEMAND

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:

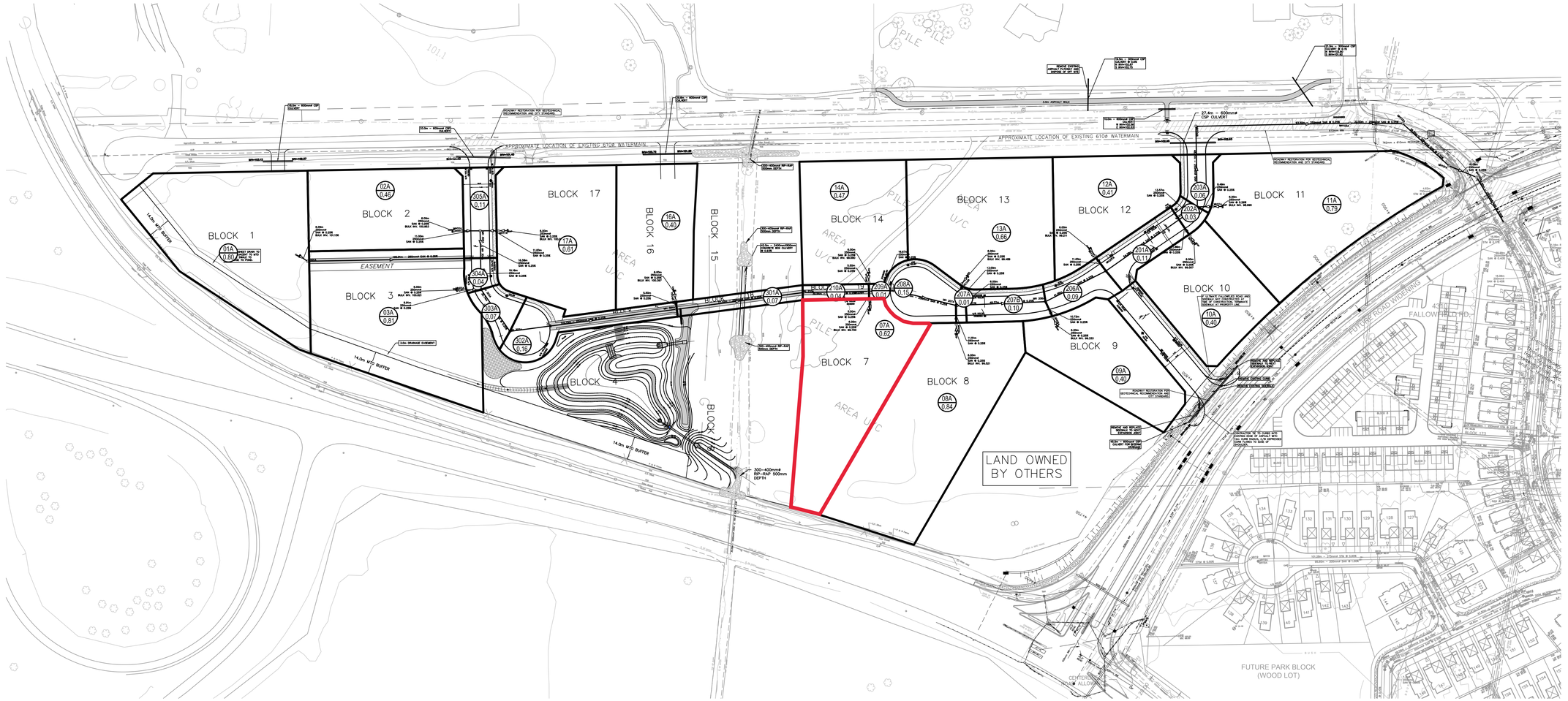
Institutional/Commercial:	50,000 l/d/Ha
Institutional/Commercial Peak Factor:	1.5
Extraneous Flow:	0.28 l/s/Ha
Minimum Pipe Size:	200 mm diameter
Maximum Velocity	3.0 m/s
Minimum Velocity	0.6 m/s

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.



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed _____

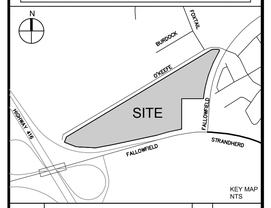
Date _____ 2017

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
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. S. Yannoulopoulos
10/01/2018
PROVINCE OF ONTARIO

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale: 1:1250

Design	Date
MB/RM	MARCH 2016
Drawn	Checked
EH	DGY
Project No.	Drawing No.
39744	501

CITY FILE No. D07-16-13-0013

CITY PLAN No. 17492

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
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						
				AREA	UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)					PEAK	AREA (Ha)		FLOW				CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	FACTOR	FLOW (L/s)	INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	FLOW (L/s)	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	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: 39744.5.7.1
Date: 2017-05-05
Sheet No: 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

REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed _____

Date _____ 2017

Plan Number _____

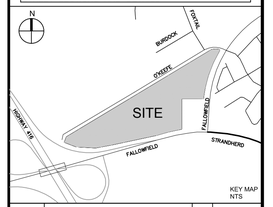
LEGEND :

S168 | 2.01 | 0.80

- AREA NUMBER
- RUNOFF COEFFICIENT
- AREA IN HECTARES

SEE 010, 011, 012 FOR MORE LEGEND OR TABLE, STREET SECTIONS AND DETAILS

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

CITY FILE No. D07-16-13-0013

CITY PLAN No. 17492

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) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (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

Kollaard Associates
Engineers
215 Sanders Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Industrial Health & Safety
(613) 860-0923
FAX: (613) 258-0475

March 5, 2008 080069

Phoenix Homes
18 Bentley Avenue
Nepean, Ontario
K2E 6T8

Attention: Mr. Bill Buchanan

RE: ADDITIONAL SUBSURFACE INVESTIGATION
PROPOSED RESIDENTIAL AND
COMMERCIAL DEVELOPMENT
O'KEEFE COURT AND FALLOWFIELD ROAD
OTTAWA, ONTARIO

Dear Sirs:

This letter presents the results of an additional subsurface investigation carried out at the site of the proposed residential and commercial development between O'Keefe Court and Fallowfield Road in the City of Ottawa, Ontario further to the preliminary subsurface investigation carried out at the site by Kollaard Associates Inc. in August 2006. The purpose of this present investigation was to check for the presence of any firm to soft silty clay in the area of the site identified during the preliminary subsurface investigation as underlain by a silty clay deposit.

BACKGROUND

The results of the above mentioned preliminary subsurface investigation are provided in the Kollaard Associates Inc. Report No. 060445, entitled "Preliminary Subsurface Investigation, Proposed Residential and Commercial Development, O'Keefe Court and Fallowfield Road, Ottawa, Ontario" dated August 2006. That report should be read in conjunction with this present letter.

A series of some 20 test pits were put down at the site for the previous subsurface investigation. Nine of those test pits, numbered 9 and 11 to 18, put down within the "central" portion of the site encountered silty clay material and were terminated in the silty clay at depths of some 3.2 to 3.8 metres below the existing ground surface. Although, the silty clay material is stiff in consistency to the depth encountered at the test pits, in view that the full depth of the silty clay was not penetrated and that silty clay deposits typically decrease in strength with depth, it was considered possible that firm to soft clay exits within the "central" area of the site.

PROCEDURE

To check for the presence of any firm to soft silty clay material within the "central portion" of the site, two boreholes were put down at the site on February 15, 2008, using a truck mounted drill rig supplied and operated by OGS Inc. of Almonte, Ontario. The boreholes, numbered 1 and 2, were advance to some 5.5 and 4.4 metres, respectively, below the existing ground surface. Borehole 1 was put down in close proximity of previous test pit 12 and borehole 2 was put down in close proximity of previous test pit 15, as shown on the attached site plan, Figure 1.

The boreholes were detailed sampled and tested below the level at which the adjacent previous test pits had been terminated, using a conventional 50 millimetre OD split spoon sampler in conjunction with standard penetration testing. A standpipe was installed in each of the boreholes for subsequent water level measuring and sampling.

Water levels were measured and water samples obtained at the standpipes on February 27, 2008. A water sample from each standpipe was delivered to Accutest Laboratories Ltd. in Ottawa, Ontario for sulphate testing.

A detailed account of the subsurface conditions encountered at the boreholes is provided in the attached Record of Borehole sheets.

SUBSURFACE CONDITIONS

General

As previously indicated, the soil and groundwater conditions encountered at the boreholes put down for this investigation are given on the attached Record of Borehole Sheets. The borehole logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted.

Silty Clay

As indicated above the boreholes were sampled and tested below about the level at which the adjacent previous test pits were terminated. Accordingly, borehole 1 was sampled and tested below about 4.0 metres depth and borehole 2 was sampled and tested below about 2.4 metres depth. Boreholes 1 and 2 encountered stiff to very stiff, grey brown to grey silty clay to depths of some 4.0 to 5.0 metres and 2.4 to 3.4 metres, respectively below the existing ground surface.

Glacial Till

Beneath the silty clay both of the boreholes encountered a deposit of glacial till. The glacial till consist of gravel, cobbles and boulders in a matrix of silty sand with a trace of clay. Standard penetration tests carried out in the glacial till material gave values of 8 and 37 blows for 0.3 metres, indicating a loose to compact state of packing.

Borehole 2 was terminated in the glacial till at depth of about 4.4 metres below the existing ground surface. Borehole 1 was terminated at a depth of about 5.5 metres below the existing ground surface on refusal to auger advancement on a large boulder or the upper surface of the bedrock.

Groundwater

The water level was measured at the borehole standpipes on February 19, 2008. At that time the water level at borehole 1 was measured at about 2.7 metres below the existing ground surface and at borehole 2 at about 1.0 metre below the existing ground surface.

The results of the laboratory testing of the water samples obtained from the standpipes gave values of 88 and 169 milligrams per litre for sulphate. Based on the above test results a negligible to mild attack of groundwater on concrete can be expected. Accordingly, normal Portland cement in a ratio of 0.5 water to cement may be used for buried concrete elements.

DISCUSSION

Based on the results of this additional investigation no presence of soft or firm silty clay material is indicated for the site, and no laboratory consolidation testing of the silty clay material is considered warranted. Accordingly, it is considered that the guidelines for foundation design for the "east and west areas" of the site outlined in our preliminary subsurface investigation report mentioned above can also be used for foundation design for rowhouses, single family dwellings and light commercial buildings within the "central area" of the site.

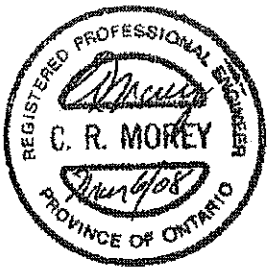
As suggested in the preliminary subsurface investigation report, for final design of any proposed commercial buildings, site/building specific subsurface investigation should be considered in view of the potential for substantial fill thicknesses within proposed building areas.

We trust this letter provides sufficient information for your present purposes. If you have any questions concerning this letter please do not hesitate to contact our office.

Yours truly,

Kollaard Associates Inc.

C. R. Morey, P. Eng.



Attachments: Record of Borehole Sheets
Figure 1

File 080069

Kollaard Associates
Engineers

PO. Box 189, 215 SANDERS ST
KEMPTVILLE, ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

(613) 860-0923
info@kollaard.ca

RECORD OF BOREHOLE BH1

CLIENT: PHOENIX HOMES

ADDITIONAL SUBSURFACE INVESTIGATION
PROPOSED DEVELOPMENT
FALLOWFIELD ROAD AND O'KEEFE COURT, OTTAWA, ON.

PROJECT No.: 080069
DATE OF DRILLING
FEBRUARY 15, 2008

LOCATION: SEE FIGURE 1

DEPTH (m) / WATER LEVEL	STRATA DESCRIPTION	STRATA PLOT	ELEV. / DEPTH	MOISTURE CONTENT (%) 20 40 60 80	SAMPLE & TEST DEPTH	N-VALUE BLOWS/0.3m	SHEAR VANE kPa	VANE REMOLD kPa	COMMENTS
	Probably topsoil, clay, gravel, asphaltic concrete (FILL)		0.00						Auger cuttings
	Probably TOPSOIL								
	Probably stiff grey brown SILTY CLAY								
	Stiff grey SILTY CLAY, trace sand and gravel		3.96		3.96-4.56	7			
	Compact, grey silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		5.02		5.20-5.50	16 / 0.15m 50 / 0.15m			
	End of Borehole -Refusal to advance in glacial till or bedrock at about 5.5 metres below existing ground surface, backfilled with auger cuttings.		5.50						

Water level in standpipe at about 2.7 metres depth, February 19, 2008.

DRILL RIG: TRACK MOUNTED CME 55 AUGER: 200 mm HOLLOW STEM.

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Engineers

PO. BOX 189, 215 SANDERS ST
KEMPTVILLE, ONTARIO
K0G 1J0 FAX (613) 258-0475
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RECORD OF BOREHOLE BH2

CLIENT: PHOENIX HOMES

ADDITIONAL SUBSURFACE INVESTIGATION
PROPOSED DEVELOPMENT
FALLOWFIELD ROAD AND O'KEEFE COURT, OTTAWA, ON.

PROJECT No.: 080069
DATE OF DRILLING
FEBRUARY 15, 2008

LOCATION: SEE FIGURE 1

DEPTH (m) / WATER LEVEL	STRATA DESCRIPTION	STRATA PLOT	ELEV. / DEPTH	MOISTURE CONTENT (%) 20 40 60 80	SAMPLE & TEST DEPTH	N-VALUE BLOWS/0.3m	SHEAR VANE kPa	VANE REMOLD kPa	COMMENTS
	Probably topsoil, clay, gravel, boulders and brick (FILL)		0.00						Auger cuttings
	Probably TOPSOIL		2.20						
	Probably very stiff grey brown SILTY CLAY		2.30						
	Very stiff grey brown SILTY CLAY (WEATHERED CRUST)		2.44		2.44 -3.05	13			
					3.05 -3.65	8			
	Compact, grey silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		3.35		3.81 -4.42	37			
	End of Borehole -backfilled with auger cuttings.		4.42						Water level in standpipe at about 1.8 metre depth, February 19, 2008

DRILL RIG: TRACK MOUNTED CME 55 AUGER: 200 mm HOLLOW STEM.

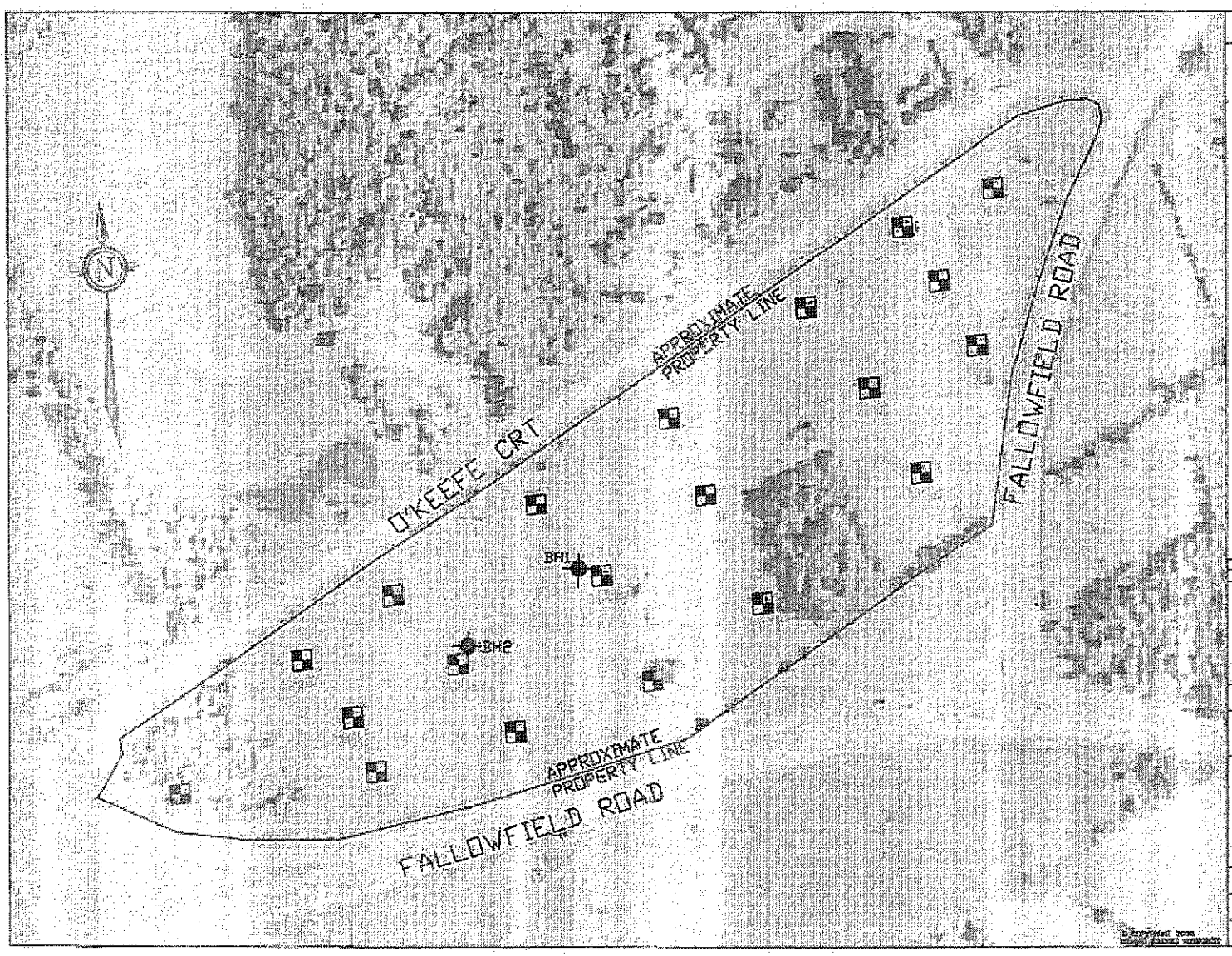

FIGURE 1

LEGEND

Approximate Borehole Location Present Investigation

Approximate Test Pit Location previous investigation by Kollaard Associates Inc., August 2006.

REFERENCE PLAN:
City of Ottawa mapping website.

SPECIAL NOTE:
This drawing to be read in conjuction with accompanying letter.

REV.	INIT.	DATE	DESCRIPTION

Kollaard Associates
Engineers
PO Box 189, 215 Sanders St
Kemptville Ontario
K0G 1J0 Tel (613) 258-0625 Fax (613) 258-0475
http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT: PHOENIX HOMES

PROJECT: ADDITIONAL SUBSURFACE INVESTIGATION

LOCATION: FALLOWFIELD ROAD AND O'KEEFE COURT CITY OF OTTAWA ONTARIO

DESIGNED BY:	DATE:
DT	FEBRUARY 21, 2008
DRAWN BY:	SCALE:
DT	1:2500

KOLLAARD FILE NUMBER: 080069

The typical Micro-Cell site, consisting of a concrete pad approximately 3.0 metres X 3.0 metres, may be permitted at a minimum setback of 3.0 metres from property line.

The typical cell site, consisting of a self-support tower, facilities shed, and compound area of approximately 12 metres X 20 metres, may be permitted at a minimum setback of 8.0 metres from property line to the limit of the compound area.

The same relocation requirements in the Telecommunications Industry Master Agreement must apply to any of these installations proposed to be placed at the reduced setbacks noted above.

All other types, including both guyed and self-supporting towers, shall be set back a minimum of 14.0 metres. This setback shall be to the nearest part of the installation, whether above or below ground (i.e. guy wire concrete anchors). Where there is any concern for the safety and operational integrity of the provincial highway due to the size or height of the installation proposed, the Ministry may request a report prepared by a Professional Engineer certified by the Province of Ontario.

All telecommunication towers must be designed to collapse within themselves so it will not fall onto the highway right-of-way.

4.28 Wrecking Yards

Under the authority of The Public Transportation and Highway Improvement Act and The Highway Traffic Act, the Ministry exercises control over wrecking yards located within the controlled area adjacent to Provincial Highways.

Building and land use, entrance and sign permits are required and the applicant must comply with all requirements of the Ministry's Vehicle Licensing Office.

Applicant Subject to Conditions

The Ministry will require the following:

1) the wrecking operations and equipment shall be screened from the highway by natural means or by a fence at least 2m in height and shall be maintained in a manner satisfactory to the Ministry. Wrecking yards must not be located in low spots, valleys or adjacent to a fill where they are not screened from view,

2) the location and operation of the wrecking yard shall be carried out in accordance with all municipal by-laws and restrictions,

3) no drains from the wrecking yard or buildings shall be directed to a highway drainage system.

5 ADMINISTRATION

5.1 Applications and Permits

The Public Transportation and Highway Improvement Act places the onus on the individual to secure a permit from the Minister. This must be done before any of the activities described in the "Permit Required" Section.

5.2 Applications Adjacent to Controlled Access Highways

The Field Services Engineer may refer all applications adjacent to controlled-access highways to the Regional Director. The Field Services Engineer may also refer complex/controversial applications to the Regional Director for consideration.

5.3 Applicant to be Advised of Restrictions

Applicants must be fully advised of the restrictions regarding buildings and land use at sites adjacent to a provincial highway. Work must not start before a permit is obtained.

5.4 Change of Ownership

When a permit is issued and the building or property to which it applies changes ownership before the works authorized by the permit commences, the permit shall be void. The new owner or other person concerned must apply for a new permit before work commences. If work has started, the permit remains in force.

The Field Services Engineer will consider each application as recommended by the Corridor Management Officer.

When an application for building and land permit has been recommended for approval, the Corridor Management Officer shall forward the application to the Field Services Engineer for signature.

5.5 Field Inspection

When the works under a permit commence, it is the responsibility of the Corridor Management Officer to ensure that the construction of any buildings/structures is in the location approved by the Ministry. It is essential that MTO Staff including Maintenance Co-ordinators and Superintendents report to the Corridor Management Officer any variation from the conditions of the permit. When a variation has been identified, the Field Services Engineer shall refer to Procedure Regarding Infractions, Chapter 1.

5.6 Application For Building And Land Use Permit

Number: PH-A-20 95-01

Name: Application for Building and Land Use Permit/Entrance Permit

Number of Copies: Three

5.7 Building and Land Use Permit

Number: PH-A-41 95-04

Number of Copies: Three

Destination of Copies:

1) Original – Applicant
2) Photo copy – Maintenance staff or Co-ordinator
3) Photo copy – Area Office copy

5.8 Permit Fee

Refer to Ministry Directive B-7.

APPENDICES

TABLE OF TYPE, CLASSIFICATION AND SETBACK DISTANCE

Note: - * to be referred to the Regional Director.

TYPE OF USE	CLASSIFICATION	SETBACK P/L	Class 1 and 2 P/L
*Amusement Park	Land Use - Commercial	14m	14m
Arena	Building - Commercial	14m	14m
Ball Park	Land Use - Commercial	14m	14m
Band Stand	Building - Commercial	14m	14m
Barn - Private	Building - Residential	14m	14m
Barn - Public Sale	Building - Commercial	14m	14m
Booster Station - telephone, gas, oil, etc	Structure - Commercial	14m	14m
Bleachers	Building - Commercial	14m	14m
Bowling Alley	Building - Commercial	14m	14m
Bowling Green	Land Use - Commercial	14m	14m
Bus Passenger Shelter	Structure - Commercial/ Residential	1m	1m
Bus Terminal	Building - Commercial	20m	14m
Car Sales	Building - Commercial	14m	14m
Cemetery (including pets)	Building - Commercial	14m	14m
(Graves)	Land Use - Commercial	27m	27m
Church	Building - Commercial	14m	14m
Chip Truck Stand	Building - Commercial	14m	14m
Community Building	Building - Commercial	14m	14m
Dog Kennel	Building - Commercial	14m	14m
*Drive-In Theatre	Structure - Commercial	14m	14m

TYPE OF USE	CLASSIFICATION	SETBACK P/L	Class 1 and 2 P/L
Driving Range Tee	Structure - Commercial	14m	14m
Earth Berm (toe of slope)	Land Use - Commercial/ Residential	0.3m	0.3m
Explosive, storage	Building – Commercial	As required by Legislation	
Factory	Building - Commercial	14m	14m
*Fair Ground	Land Use - Commercial	14m	14m
- Building, rides			
Fence	Structure	0.3m	0.3m
Fire Hall	Building - Commercial	14m	14m
Foundation	Building - Residential	8m	14m
	Building - Commercial	14m	14m
Fruit/Produce Stand	Building - Commercial	14m	14m
Funeral Home	Building - Commercial	14m	14m
Garage	Building - Residential	8m	14m
	Building- Commercial	14m	14m
Gasoline Pump Island and Attendant Booth	Structure - Commercial	6m	14m
Gasoline Canopy / Shelter	Structure - Commercial	3m	14m
Gates	Structure	0.3m	14m
Golf Course Green	Land Use - Commercial	20m	14m
Golf Course Tee	Land Use - Commercial	8m	14m
Grand Stand	Building - Commercial	14m	14m
Greenhouse	Building - Commercial	14m	14m
Hedge/Planting	Land Use	0.3m	0.3m
Heliport	Land Use - Commercial	14m	14m
Hospital	Building - Commercial	14m	14m
Hotel	Building - Commercial	14m	14m
Hydro Sub Station	Structure - Commercial	14m	14m

TYPE OF USE	CLASSIFICATION	SETBACK P/L	Class 1 and 2 P/L
Illumination-Light Standard	Structure - Commercial	0.3m	0.3m
Implement Sales / Service	Building - Commercial	14m	14m
Junk Yard	Land Use - Commercial	45m	45m
Landfill Site	Land Use - Commercial	45m	45m
Library	Building - Commercial	14m	14m
Lumber Yard	Building - Commercial	14m	14m
Mail Box (Super / Group)	Structure	0.3m	0.3m
Manure Pit	Land Use	14m	14m
Marquee	Structure - Commercial	14m	14m
Mausoleum	Structure - Commercial	14m	14m
Meter Station			
- pipe line, gas, oil	Structure - Commercial	14m	14m
Monument	Structure - Commercial/	14m	14m
Motel	Building - Commercial	14m	14m
Newspaper Dispenser	Structure - Commercial	0.3m	0.3m
Noise Attenuation Structure	Structure	0.3m	0.3m
Parking Lot	Land Use - Commercial	3m	3m
Pipe Line	Structure - Commercial	3m	14m
*Pit and Quarries	Land Use	30m	30m
Pond			
-Detention/Retention	Land Use	14m	14m
-Other	Land Use - Residential	8m	14m
	Land Use - Commercial	14m	14m
Power / Transmission Line	Structure - Commercial	0.3m	14m
Pumping Station	Building - Commercial	14m	14m
*Race Track	Land Use - Commercial	14m	14m
Radio/Television Station/ Tower	Structure - Commercial	14m	14m

TYPE OF USE	CLASSIFICATION	SETBACK	Class 1 and 2
		P/L	P/L
Residential Dwelling	Building - Residential	8m	14m
- more than 5 units	Building - Commercial	14m	14m
- Class 1 and 2 highways	Building - Commercial	14m	14m
Restaurant	Building - Commercial	14m	14m
Retaining wall	Structure – Residential/ Commercial	0.3m	14m
Roads	Private	8m	14m
- not essential to future viability of development			
Road	Private	8m	14m
- essential to future viability of development			
Road	Municipal	8m	8m
- ROW wide enough to permit relocation road outside 14 m setback in future			
Road	Municipal	8m	14m
- ROW not wide enough to permit relocation road outside 14m setback in future			
Satellite Dish	Structure - Residential/	8m	8m
	Commercial	14m	14m
School	Building - Commercial	14m	14m
Septic Tank	Structure - Residential/ Commercial	8m	14m
Septic Bed	Structure - Residential/ Commercial	3m	14m
Service Station	Building - Commercial	14m	14m
Sewage Plant	Structure - Commercial	14m	14m

Kollaard Associates
Engineers
215 Sanders Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Industrial Health & Safety
(613) 860-0923
FAX: (613) 258-0475

March 5, 2008 080069

Phoenix Homes
18 Bentley Avenue
Nepean, Ontario
K2E 6T8

Attention: Mr. Bill Buchanan

RE: ADDITIONAL SUBSURFACE INVESTIGATION
PROPOSED RESIDENTIAL AND
COMMERCIAL DEVELOPMENT
O'KEEFE COURT AND FALLOWFIELD ROAD
OTTAWA, ONTARIO

Dear Sirs:

This letter presents the results of an additional subsurface investigation carried out at the site of the proposed residential and commercial development between O'Keefe Court and Fallowfield Road in the City of Ottawa, Ontario further to the preliminary subsurface investigation carried out at the site by Kollaard Associates Inc. in August 2006. The purpose of this present investigation was to check for the presence of any firm to soft silty clay in the area of the site identified during the preliminary subsurface investigation as underlain by a silty clay deposit.

BACKGROUND

The results of the above mentioned preliminary subsurface investigation are provided in the Kollaard Associates Inc. Report No. 060445, entitled "Preliminary Subsurface Investigation, Proposed Residential and Commercial Development, O'Keefe Court and Fallowfield Road, Ottawa, Ontario" dated August 2006. That report should be read in conjunction with this present letter.

A series of some 20 test pits were put down at the site for the previous subsurface investigation. Nine of those test pits, numbered 9 and 11 to 18, put down within the "central" portion of the site encountered silty clay material and were terminated in the silty clay at depths of some 3.2 to 3.8 metres below the existing ground surface. Although, the silty clay material is stiff in consistency to the depth encountered at the test pits, in view that the full depth of the silty clay was not penetrated and that silty clay deposits typically decrease in strength with depth, it was considered possible that firm to soft clay exits within the "central" area of the site.

PROCEDURE

To check for the presence of any firm to soft silty clay material within the "central portion" of the site, two boreholes were put down at the site on February 15, 2008, using a truck mounted drill rig supplied and operated by OGS Inc. of Almonte, Ontario. The boreholes, numbered 1 and 2, were advance to some 5.5 and 4.4 metres, respectively, below the existing ground surface. Borehole 1 was put down in close proximity of previous test pit 12 and borehole 2 was put down in close proximity of previous test pit 15, as shown on the attached site plan, Figure 1.

The boreholes were detailed sampled and tested below the level at which the adjacent previous test pits had been terminated, using a conventional 50 millimetre OD split spoon sampler in conjunction with standard penetration testing. A standpipe was installed in each of the boreholes for subsequent water level measuring and sampling.

Water levels were measured and water samples obtained at the standpipes on February 27, 2008. A water sample from each standpipe was delivered to Accutest Laboratories Ltd. in Ottawa, Ontario for sulphate testing.

A detailed account of the subsurface conditions encountered at the boreholes is provided in the attached Record of Borehole sheets.

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As previously indicated, the soil and groundwater conditions encountered at the boreholes put down for this investigation are given on the attached Record of Borehole Sheets. The borehole logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted.

Silty Clay

As indicated above the boreholes were sampled and tested below about the level at which the adjacent previous test pits were terminated. Accordingly, borehole 1 was sampled and tested below about 4.0 metres depth and borehole 2 was sampled and tested below about 2.4 metres depth. Boreholes 1 and 2 encountered stiff to very stiff, grey brown to grey silty clay to depths of some 4.0 to 5.0 metres and 2.4 to 3.4 metres, respectively below the existing ground surface.

Glacial Till

Beneath the silty clay both of the boreholes encountered a deposit of glacial till. The glacial till consist of gravel, cobbles and boulders in a matrix of silty sand with a trace of clay. Standard penetration tests carried out in the glacial till material gave values of 8 and 37 blows for 0.3 metres, indicating a loose to compact state of packing.

Borehole 2 was terminated in the glacial till at depth of about 4.4 metres below the existing ground surface. Borehole 1 was terminated at a depth of about 5.5 metres below the existing ground surface on refusal to auger advancement on a large boulder or the upper surface of the bedrock.

Groundwater

The water level was measured at the borehole standpipes on February 19, 2008. At that time the water level at borehole 1 was measured at about 2.7 metres below the existing ground surface and at borehole 2 at about 1.0 metre below the existing ground surface.

The results of the laboratory testing of the water samples obtained from the standpipes gave values of 88 and 169 milligrams per litre for sulphate. Based on the above test results a negligible to mild attack of groundwater on concrete can be expected. Accordingly, normal Portland cement in a ratio of 0.5 water to cement may be used for buried concrete elements.

DISCUSSION

Based on the results of this additional investigation no presence of soft or firm silty clay material is indicated for the site, and no laboratory consolidation testing of the silty clay material is considered warranted. Accordingly, it is considered that the guidelines for foundation design for the "east and west areas" of the site outlined in our preliminary subsurface investigation report mentioned above can also be used for foundation design for rowhouses, single family dwellings and light commercial buildings within the "central area" of the site.

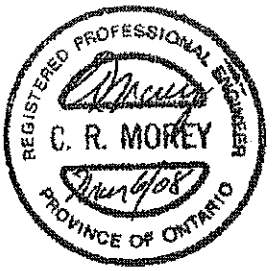
As suggested in the preliminary subsurface investigation report, for final design of any proposed commercial buildings, site/building specific subsurface investigation should be considered in view of the potential for substantial fill thicknesses within proposed building areas.

We trust this letter provides sufficient information for your present purposes. If you have any questions concerning this letter please do not hesitate to contact our office.

Yours truly,

Kollaard Associates Inc.

C. R. Morey, P. Eng.



Attachments: Record of Borehole Sheets
Figure 1

File 080069

Kollaard Associates
Engineers

PO. Box 189, 215 SANDERS ST
KEMPTVILLE, ONTARIO
K0G 1J0 FAX (613) 258-0475
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RECORD OF BOREHOLE BH1

CLIENT: PHOENIX HOMES

ADDITIONAL SUBSURFACE INVESTIGATION
PROPOSED DEVELOPMENT
FALLOWFIELD ROAD AND O'KEEFE COURT, OTTAWA, ON.

PROJECT No.: 080069
DATE OF DRILLING
FEBRUARY 15, 2008

LOCATION: SEE FIGURE 1

DEPTH (m) / WATER LEVEL	STRATA DESCRIPTION	STRATA PLOT	ELEV. / DEPTH	MOISTURE CONTENT (%) 20 40 60 80	SAMPLE & TEST DEPTH	N-VALUE BLOWS/0.3m	SHEAR VANE kPa	VANE REMOLD kPa	COMMENTS
	Probably topsoil, clay, gravel, asphaltic concrete (FILL)		0.00						Auger cuttings
	Probably TOPSOIL								
	Probably stiff grey brown SILTY CLAY								
	Stiff grey SILTY CLAY, trace sand and gravel		3.96		3.96-4.56	7			
	Compact, grey silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		5.02		5.20-5.50	16 / 0.15m 50 / 0.15m			
	End of Borehole -Refusal to advance in glacial till or bedrock at about 5.5 metres below existing ground surface, backfilled with auger cuttings.		5.50						

Water level in standpipe at about 2.7 metres depth, February 19, 2008.

DRILL RIG: TRACK MOUNTED CME 55 AUGER: 200 mm HOLLOW STEM.

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PO. BOX 189, 215 SANDERS ST
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K0G 1J0 FAX (613) 258-0475
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(613) 868-0923
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RECORD OF BOREHOLE BH2

CLIENT: PHOENIX HOMES

ADDITIONAL SUBSURFACE INVESTIGATION
PROPOSED DEVELOPMENT
FALLOWFIELD ROAD AND O'KEEFE COURT, OTTAWA, ON.

PROJECT No.: 080069
DATE OF DRILLING
FEBRUARY 15, 2008

LOCATION: SEE FIGURE 1

DEPTH (m) / WATER LEVEL	STRATA DESCRIPTION	STRATA PLOT	ELEV. / DEPTH	MOISTURE CONTENT (%) 20 40 60 80	SAMPLE & TEST DEPTH	N-VALUE BLOWS/0.3m	SHEAR VANE kPa	VANE REMOLD kPa	COMMENTS
	Probably topsoil, clay, gravel, boulders and brick (FILL)		0.00						Auger cuttings
	Probably TOPSOIL		2.20						
	Probably very stiff grey brown SILTY CLAY		2.30						
	Very stiff grey brown SILTY CLAY (WEATHERED CRUST)		2.44		2.44 -3.05	13			
					3.05 -3.65	8			
	Compact, grey silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		3.35		3.81 -4.42	37			
	End of Borehole -backfilled with auger cuttings.		4.42						Water level in standpipe at about 1.8 metre depth, February 19, 2008

DRILL RIG: TRACK MOUNTED CME 55 AUGER: 200 mm HOLLOW STEM.

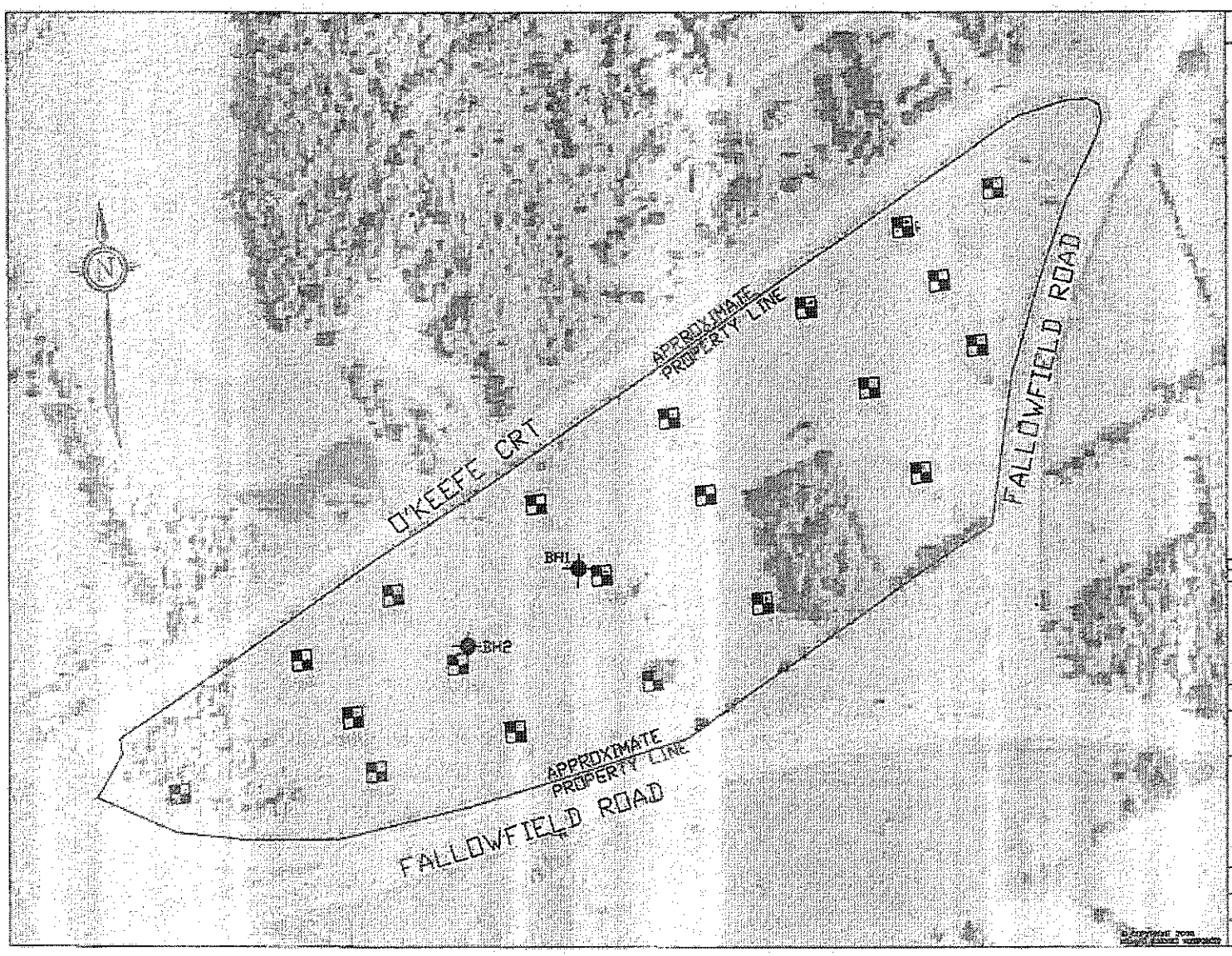

FIGURE 1

LEGEND

Approximate Borehole Location Present Investigation

Approximate Test Pit Location previous investigation by Kollaard Associates Inc., August 2006.

REFERENCE PLAN:
City of Ottawa mapping website.

SPECIAL NOTE:
This drawing to be read in conjuction with accompanying letter.

REV.	INIT.	DATE	DESCRIPTION

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K0G 1J0 Tel (613) 258-0625 Fax (613) 258-0475
http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT: PHOENIX HOMES

PROJECT: ADDITIONAL SUBSURFACE INVESTIGATION

LOCATION: FALLOWFIELD ROAD AND O'KEEFE COURT CITY OF OTTAWA ONTARIO

DESIGNED BY:	DATE:
DT	FEBRUARY 21, 2008
DRAWN BY:	SCALE:
DT	1:2500

KOLLAARD FILE NUMBER: 080069

The typical Micro-Cell site, consisting of a concrete pad approximately 3.0 metres X 3.0 metres, may be permitted at a minimum setback of 3.0 metres from property line.

The typical cell site, consisting of a self-support tower, facilities shed, and compound area of approximately 12 metres X 20 metres, may be permitted at a minimum setback of 8.0 metres from property line to the limit of the compound area.

The same relocation requirements in the Telecommunications Industry Master Agreement must apply to any of these installations proposed to be placed at the reduced setbacks noted above.

All other types, including both guyed and self-supporting towers, shall be set back a minimum of 14.0 metres. This setback shall be to the nearest part of the installation, whether above or below ground (i.e. guy wire concrete anchors). Where there is any concern for the safety and operational integrity of the provincial highway due to the size or height of the installation proposed, the Ministry may request a report prepared by a Professional Engineer certified by the Province of Ontario.

All telecommunication towers must be designed to collapse within themselves so it will not fall onto the highway right-of-way.

4.28 Wrecking Yards

Under the authority of The Public Transportation and Highway Improvement Act and The Highway Traffic Act, the Ministry exercises control over wrecking yards located within the controlled area adjacent to Provincial Highways.

Building and land use, entrance and sign permits are required and the applicant must comply with all requirements of the Ministry's Vehicle Licensing Office.

Applicant Subject to Conditions

The Ministry will require the following:

1) the wrecking operations and equipment shall be screened from the highway by natural means or by a fence at least 2m in height and shall be maintained in a manner satisfactory to the Ministry. Wrecking yards must not be located in low spots, valleys or adjacent to a fill where they are not screened from view,

2) the location and operation of the wrecking yard shall be carried out in accordance with all municipal by-laws and restrictions,

3) no drains from the wrecking yard or buildings shall be directed to a highway drainage system.

5 ADMINISTRATION

5.1 Applications and Permits

The Public Transportation and Highway Improvement Act places the onus on the individual to secure a permit from the Minister. This must be done before any of the activities described in the "Permit Required" Section.

5.2 Applications Adjacent to Controlled Access Highways

The Field Services Engineer may refer all applications adjacent to controlled-access highways to the Regional Director. The Field Services Engineer may also refer complex/controversial applications to the Regional Director for consideration.

5.3 Applicant to be Advised of Restrictions

Applicants must be fully advised of the restrictions regarding buildings and land use at sites adjacent to a provincial highway. Work must not start before a permit is obtained.

5.4 Change of Ownership

When a permit is issued and the building or property to which it applies changes ownership before the works authorized by the permit commences, the permit shall be void. The new owner or other person concerned must apply for a new permit before work commences. If work has started, the permit remains in force.

The Field Services Engineer will consider each application as recommended by the Corridor Management Officer.

When an application for building and land permit has been recommended for approval, the Corridor Management Officer shall forward the application to the Field Services Engineer for signature.

5.5 Field Inspection

When the works under a permit commence, it is the responsibility of the Corridor Management Officer to ensure that the construction of any buildings/structures is in the location approved by the Ministry. It is essential that MTO Staff including Maintenance Co-ordinators and Superintendents report to the Corridor Management Officer any variation from the conditions of the permit. When a variation has been identified, the Field Services Engineer shall refer to Procedure Regarding Infractions, Chapter 1.

5.6 Application For Building And Land Use Permit

Number: PH-A-20 95-01

Name: Application for Building and Land Use Permit/Entrance Permit

Number of Copies: Three

5.7 Building and Land Use Permit

Number: PH-A-41 95-04

Number of Copies: Three

Destination of Copies:

1) Original – Applicant
2) Photo copy – Maintenance staff or Co-ordinator
3) Photo copy – Area Office copy

5.8 Permit Fee

Refer to Ministry Directive B-7.

APPENDICES

TABLE OF TYPE, CLASSIFICATION AND SETBACK DISTANCE

Note: - * to be referred to the Regional Director.

TYPE OF USE	CLASSIFICATION	SETBACK P/L	Class 1 and 2 P/L
*Amusement Park	Land Use - Commercial	14m	14m
Arena	Building - Commercial	14m	14m
Ball Park	Land Use - Commercial	14m	14m
Band Stand	Building - Commercial	14m	14m
Barn - Private	Building - Residential	14m	14m
Barn - Public Sale	Building - Commercial	14m	14m
Booster Station - telephone, gas, oil, etc	Structure - Commercial	14m	14m
Bleachers	Building - Commercial	14m	14m
Bowling Alley	Building - Commercial	14m	14m
Bowling Green	Land Use - Commercial	14m	14m
Bus Passenger Shelter	Structure - Commercial/ Residential	1m	1m
Bus Terminal	Building - Commercial	20m	14m
Car Sales	Building - Commercial	14m	14m
Cemetery (including pets)	Building - Commercial	14m	14m
(Graves)	Land Use - Commercial	27m	27m
Church	Building - Commercial	14m	14m
Chip Truck Stand	Building - Commercial	14m	14m
Community Building	Building - Commercial	14m	14m
Dog Kennel	Building - Commercial	14m	14m
*Drive-In Theatre	Structure - Commercial	14m	14m

TYPE OF USE	CLASSIFICATION	SETBACK P/L	Class 1 and 2 P/L
Driving Range Tee	Structure - Commercial	14m	14m
Earth Berm (toe of slope)	Land Use - Commercial/ Residential	0.3m	0.3m
Explosive, storage	Building – Commercial	As required by Legislation	
Factory	Building - Commercial	14m	14m
*Fair Ground	Land Use - Commercial	14m	14m
- Building, rides			
Fence	Structure	0.3m	0.3m
Fire Hall	Building - Commercial	14m	14m
Foundation	Building - Residential	8m	14m
	Building - Commercial	14m	14m
Fruit/Produce Stand	Building - Commercial	14m	14m
Funeral Home	Building - Commercial	14m	14m
Garage	Building - Residential	8m	14m
	Building- Commercial	14m	14m
Gasoline Pump Island and Attendant Booth	Structure - Commercial	6m	14m
Gasoline Canopy / Shelter	Structure - Commercial	3m	14m
Gates	Structure	0.3m	14m
Golf Course Green	Land Use - Commercial	20m	14m
Golf Course Tee	Land Use - Commercial	8m	14m
Grand Stand	Building - Commercial	14m	14m
Greenhouse	Building - Commercial	14m	14m
Hedge/Planting	Land Use	0.3m	0.3m
Heliport	Land Use - Commercial	14m	14m
Hospital	Building - Commercial	14m	14m
Hotel	Building - Commercial	14m	14m
Hydro Sub Station	Structure - Commercial	14m	14m

TYPE OF USE	CLASSIFICATION	SETBACK P/L	Class 1 and 2 P/L
Illumination-Light Standard	Structure - Commercial	0.3m	0.3m
Implement Sales / Service	Building - Commercial	14m	14m
Junk Yard	Land Use - Commercial	45m	45m
Landfill Site	Land Use - Commercial	45m	45m
Library	Building - Commercial	14m	14m
Lumber Yard	Building - Commercial	14m	14m
Mail Box (Super / Group)	Structure	0.3m	0.3m
Manure Pit	Land Use	14m	14m
Marquee	Structure - Commercial	14m	14m
Mausoleum	Structure - Commercial	14m	14m
Meter Station			
- pipe line, gas, oil	Structure - Commercial	14m	14m
Monument	Structure - Commercial/	14m	14m
Motel	Building - Commercial	14m	14m
Newspaper Dispenser	Structure - Commercial	0.3m	0.3m
Noise Attenuation Structure	Structure	0.3m	0.3m
Parking Lot	Land Use - Commercial	3m	3m
Pipe Line	Structure - Commercial	3m	14m
*Pit and Quarries	Land Use	30m	30m
Pond			
-Detention/Retention	Land Use	14m	14m
-Other	Land Use - Residential	8m	14m
	Land Use - Commercial	14m	14m
Power / Transmission Line	Structure - Commercial	0.3m	14m
Pumping Station	Building - Commercial	14m	14m
*Race Track	Land Use - Commercial	14m	14m
Radio/Television Station/ Tower	Structure - Commercial	14m	14m

TYPE OF USE	CLASSIFICATION	SETBACK	Class 1 and 2
		P/L	P/L
Residential Dwelling	Building - Residential	8m	14m
- more than 5 units	Building - Commercial	14m	14m
- Class 1 and 2 highways	Building - Commercial	14m	14m
Restaurant	Building - Commercial	14m	14m
Retaining wall	Structure – Residential/ Commercial	0.3m	14m
Roads	Private	8m	14m
- not essential to future viability of development			
Road	Private	8m	14m
- essential to future viability of development			
Road	Municipal	8m	8m
- ROW wide enough to permit relocation road outside 14 m setback in future			
Road	Municipal	8m	14m
- ROW not wide enough to permit relocation road outside 14m setback in future			
Satellite Dish	Structure - Residential/	8m	8m
	Commercial	14m	14m
School	Building - Commercial	14m	14m
Septic Tank	Structure - Residential/ Commercial	8m	14m
Septic Bed	Structure - Residential/ Commercial	3m	14m
Service Station	Building - Commercial	14m	14m
Sewage Plant	Structure - Commercial	14m	14m

Appendix F DRAWINGS