Site Servicing and Stormwater Management Report - 3856, 3866, and 3876 Navan Road

Project # 160410200

Prepared for:
St. George and St. Anthony
Coptic Orthodox Church

Prepared by:
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Sign-off Sheet

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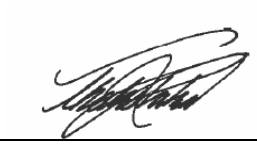
Prepared by  _____
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1.0 INTRODUCTION

Stantec Consulting Ltd. has been commissioned by St. George and St. Anthony Coptic Orthodox Church to prepare a Site Servicing and Stormwater Management Report and design for the proposed development located at 3856, 3866, and 3876 Navan Road within the Village of Notre Dame des Champs. The site is situated southeast of the intersection of Diamond Way and Navan Road. The proposed development would replace a vacant property with a Church, service building and a paved parking area. The property is located in the City of Ottawa and is indicated in **Figure 1** below. The 1.42 ha (3.48 acre) site is presently zoned Rural Institutional which permits the proposed use. The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with design guidelines, and meets the requirements outlined in consultation with City of Ottawa staff.

Figure 1: Location Plan

2.0 BACKGROUND

Documents referenced in preparation of the design for the 3856, 3866, and 3876 Navan Road development include:

- Geotechnical Investigation Report, New Church 3856, 3866 and 3876 Navan Road, Stantec Consulting Ltd., July 10, 2019
- 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 WATER SUPPLY SERVICING

3.1 BACKGROUND

The proposed development will be comprised of a church and service building, complete with surface parking. The two buildings are one-storey in height and are joined architecturally with a fire rated separation. The development site is located on the south side of Navan Road immediately east of the intersection with Diamond Way. The site will be serviced via a 150mm service connection to the existing 150mm dia. watermain within the Navan Road ROW at the northern boundary of the site. The property is located within the City's Pressure Zone 2E and average ground elevations of the site are approximately 86.26m. Under normal operating conditions, hydraulic gradelines within the mains at the intersection of Diamond Way and Navan Road vary from approximately 131m to 127m as confirmed through boundary conditions provided by the City of Ottawa (see **Appendix A.3**).

3.2 WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008). Although it is our understanding that both the church building and the service building will not be fully occupied during the same periods, the full gross floor area of both buildings has been used to provide conservative values for water demand. Institutional design demands are determined based on 28,000L/ha/day of gross floor area. See **Appendix A.1** for detailed domestic water demand estimates.

The average day demand (AVDY) for the entire site was determined to be 0.08 L/s. The maximum daily demand (MXDY) is 1.5 times the AVDY (institutional property), which equals 0.13 L/s. The peak hour demand (PKHR) is 1.8 times the MXDY, totaling 0.23 L/s.

Through consultation with the City of Ottawa, it was determined that available fire flow for the site must meet Ontario Building Code requirements. The building is intended to be constructed with non-combustible material and has been assessed based on non-combustible construction without fire resistance ratings. Ontario Building Code(OBC) Fire Flow Calculations are included in **Appendix A.2**. The minimum required fire flow for this development has been determined to be 75 L/s (4,500 L/min).

3.3 HYDRAULIC MODEL RESULTS

A hydraulic model of the water supply system was created by Stantec based on current boundary conditions to assess the proposed watermain layout under the above domestic demands and during fire flow scenarios. Results of the hydraulic modeling demonstrate that adequate domestic flow is available for the subject site, with on-site pressures ranging from **68psi** to **59 psi** under normal

operating conditions. These values are within the normal operating pressure range as defined by Ontario Ministry of Environment Conservation and Parks (MECP) and City of Ottawa design guidelines (desired 50 to 70 psi and not less than 40 psi). Results of the hydraulic model analysis can be found in **Appendix A.4**.

The OBC Fire Flow calculations for both the church building and service building are included in **Appendix A.2** . A two-hour firewall is proposed between the two buildings, with the higher rate used as the minimum required fire flow (Both buildings require 75 L/s).

A fire flow analysis was carried out using the hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and fire flow requirements based on Ontario Building Code requirements. Results of the modeling analysis indicate that available fire flow at the hydrant is 53.5 L/s, while the maximum required flow rate is 75L/s for 30 minutes. Given that the City distribution system can provide 96.3m3 (53.5 L/s x 60 s/min x 30min) of the full fire flow requirement of 135m3 (75L/s x 60s/min x 30 min), an additional volume of 38.7 m3 will have to be stored on site and accessible to the Ottawa Fire Department in the event of a fire.

It is proposed to provide the additional fire flow volume in an onsite water storage tank having a volume of 40 m3. The tank will be buried under the parking area. The tank hatch cover, draft pipe and vent pipe will extend above the ground surface within the landscaped area and will be used for access, filling and drawing from the tank. Results of the hydraulic modeling are included for reference in **Appendix A.4**. Details of a fire cistern that would meet the volume requirements are included in **Appendix A.5**.

3.4 SUMMARY OF FINDINGS

The proposed development is located in an area of the City's water distribution system that has sufficient capacity to provide the required domestic demands within target operating pressures. Emergency fire flow demands are provided through a combination of the City's water distribution system and an onsite water storage tank.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

The subject site is located outside of the City's sanitary collection area. There are no special constraints for the proposed development to be serviced by a private sewage system other than those related to the Ontario Building Code (OBC) requirements.

Paterson Group has prepared the detailed design of the on-site wastewater treatment system. The private wastewater treatment system design will be submitted to the Ottawa Septic System Office (OSSO) for approval and permit.

4.2 PROPOSED SERVICING

The proposed development will require installation of a septic tank and bed located south of the proposed Church and east of the service building.

Proposed grading will maintain positive drainage away from the raised septic bed. The septic system is to be designed to maintain a minimum 1.5m separation from proposed structures, a minimum 3m separation from the property line, and a minimum 15m separation from surface waters.

The location of the proposed septic bed has been identified on the servicing and grading plans. Details of the proposed Sewage System Layout prepared by Paterson Group are included in **Appendix B**.

A septic permit will be required from the OSSO for a system that falls under Part 8 of the Ontario Building Code (<10,000 litres).

5.0 STORMWATER MANAGEMENT

5.1 BACKGROUND AND OBJECTIVES

The development site is located on the south side of Navan Road approximately 390m east of the intersection with the southern leg of Mer Bleue Road. The site is part of the municipal drain assessment areas for both the Edouard Cleroux Municipal Drain and the Antoine Cleroux Municipal Drain. The site is currently undeveloped with limited trees and has historically been used as farmland. It is generally flat with the majority of the site currently draining to an existing ditch at the southern limit of the site that contributes to the Antoine Cleroux Municipal Drain across neighbouring private properties. The remainder of the site drains to the roadside ditch and Edouard Cleroux Municipal Drain at the northern boundary of the development. Both municipal drains outlet downstream at the Mer Bleue Bog. The site in relation to the municipal drains is shown in **Figure 2** below.

Figure 2: 3856, 3866, and 3876 Navan Road in and Neighbouring Municipal Drains

Through consultation with the City of Ottawa, it was determined that the preferred outlet for the developed portion of the site would be to the existing municipal outlet at the northern limit of the site.

The objective of the stormwater management plan is to determine the measures necessary to control the quantity and quality of stormwater released from the proposed development to criteria established during the pre-consultation and zoning process, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

Criteria were established by combining current design practices outlined by the City of Ottawa Sewer Design Guidelines (2012), and through consultation with City of Ottawa staff. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (City of Ottawa)
- Stormwater management for the site to follow MECP guidelines. (South Nation Conservation Authority)
- Post-development runoff to equal pre-development runoff for the 2 or 5 year event and the 100 year event. (South Nation Conservation Authority)
- Post development water treatment to achieve 80% TSS removal. (South Nation Conservation Authority)

Inlet Controls

- Site discharge rates for each storm event to be restricted to pre-development rates for the 5-100-year design storm events.
- Stormwater to be controlled and stored for up to the 100-year event and discharged to the approved outlet (Edouard Cleroux Municipal Drain) at the northern boundary of the site.
- Use of standard self-cleansing inlet control device (ICD) where possible.
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30m above the 100-year water level (City of Ottawa)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35 m in the 100-year event (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa)

5.3 WATER QUANTITY CONTROL

5.3.1 Allowable Release Rate

The entire development site is 1.42 ha in area. The portion of the site being developed will be directed to the Edouard Cleroux Municipal Drain that runs along the northwest corner of the property. The remainder of the site will remain pervious area and will continue to drain as per existing conditions to the shallow ditch at the southern limit of the site that contributes to the Antoine Cleroux Municipal Drain.

Engineer's Reports for the Edouard Cleroux Municipal Drain and Antoine Cleroux Municipal Drain provided by the Drainage Superintendent have been included in **Appendix C**. The development site is included in the watershed boundaries for both reports. As noted in section 5.1 above, only the Edouard Cleroux Municipal Drain provides an outlet to the site along the property boundary. As such, post-development flows are proposed to be directed to the Edouard Cleroux Municipal Drain for the developed portion of the site.

The predevelopment release rate for the area has been determined using the modified rational method. The existing site is entirely grassed area, therefore a runoff coefficient of 0.2 was considered for the predevelopment condition. For stormwater management design purposes, the site has been divided into two overall drainage areas; The area tributary to the Edouard Cleroux Municipal Drain which comprises all the site area being developed and the non-tributary area which consists of the pervious area that will continue to drain to the southern limit of the site per existing conditions.

Given that the non-tributary area flowing uncontrolled to the south of the site (area UNC-3) will remain unchanged, no stormwater management controls are proposed for this drainage area of 0.32 ha. Discharge criteria for the developed portion of the site, the tributary area of 1.1 ha are summarized below.

The longest overland flow route for the contributing area was measured at approximately 140m in length with a difference in elevation of 0.79m, producing an estimated subcatchment slope of 0.6%. A time of concentration for the predevelopment area (19.7 minutes) was assigned based on Airport Method calculations for proposed site predevelopment conditions (see **Appendix C**). Peak flow rates have been calculated using the rational method as follows:

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

The target release rate for the area of the site tributary to the Edouard Cleroux Municipal Drain is summarized in **Table 1** below:

Table 1: Edouard Cleroux Tributary Area Target Release Rates

Design Storm	Target Flow Rate (L/s)
5-year	43.2
100-year	73.8

5.3.2 Storage Requirements

The proposed development requires quantity control measures to meet the stormwater release criteria. Onsite storage will be necessary to retain stormwater flow in excess of the allowable release rate. A shallow dry pond in combination with an underground storage tank, parking lot storage and roof storage were selected for use in this design. The site has been graded to direct all overland flow from impervious surfaces to the proposed dry pond adjacent to Navan Road.

The Modified Rational Method was employed to assess the rate and volume of runoff generated during post-development conditions. As noted in the City of Ottawa Sewer Design Guidelines, the Rational Method is appropriate for use for drainage areas of less than 2ha for the determination of storage volume requirements for rooftops, roadways, parking lots, underground storage and ponds. The site was subdivided into subcatchments (subareas) tributary to stormwater controls. Runoff coefficient values have been increased by 25% for the post-development 100-year storm event based on MTO Drainage Manual recommendations. A summary of subareas and runoff coefficients is provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management subcatchments.

5.3.2.1 Uncontrolled Areas

Due to grading constraints, two catchments of the Edourd Cleroux tributary area were designed without a storage component (UNC-1 and UNC-2). The associated area flows offsite uncontrolled and discharges to the existing collection systems north east of the site without entering the proposed stormwater management system and must be compensated for in areas with controls. **Table 2** summarizes the peak uncontrolled 5 and 100 year catchment release rates for catchments that are non-tributary to the retention basin.

Table 2: 5 and 100 Year Discharge for Tributary Uncontrolled Catchment

Catchment ID's	5-Year Peak Uncontrolled Discharge (L/s)	100-Year Peak Uncontrolled Discharge (L/s)
UNC-1 & UNC-2	4.0	8.5

Peak 5 and 100 year discharge values in the above table are based on minimum time of concentration values (10 minutes).

The controlled release rate for the developed portion of the site will be reduced by the uncontrolled flows detailed above. As such the controlled outlet from the Edouard Cleroux tributary area of the site must be restricted to a maximum of 65.3 L/s during a 100 year event.

As noted above, the non-tributary catchment, UNC-3 will remain undeveloped and will continue to drain the southern boundary of the site as per existing conditions. Separate pre-development release rate calculations were completed for this drainage area and a time of concentration of 12.6 min was calculated based on the Airport Method. The uncontrolled flow rates based on a time of concentration of 12.6 min during the 5 and 100 year events for area UNC-3 are summarized in **Table 3**.

Table 3: 5 and 100 Year Discharge for Non-Contributing Area UNC-3

Catchment ID's	5-Year Peak Uncontrolled Discharge (L/s)	100-Year Peak Uncontrolled Discharge (L/s)
UNC-3	16.5	36.3

Peak 5 and 100 year discharge values in the above table are based on minimum time of concentration values (12.6 minutes).

5.3.2.2 Surface and Subsurface Storage

A portion of the overall storage volume requirement will be provided on the flat roof of the service building as detailed in section 5.3.2.3 below. The remainder of the storage will be provided within a dry pond, a subsurface storage tank and within the paved parking lot. The volume of storage proposed is sufficient to retain the stormwater generated by the 100-year event while not exceeding the 5 year pre-development release rate from the site.

Stormwater falling on the flat roof will be temporarily retained and will flow at a controlled release rate to the paved parking lot. Stormwater falling on the parking lot and discharged from the roof will flow overland to the dry pond and then into the underground storage tank. The stormwater will be released at a controlled release rate to the municipal drain that runs along the northwest property line of the site. Flow in excess of the controlled release rate will back up into the tank, into the dry pond and onto the paved parking area. An overflow into the roadside ditch has been provided at an elevation of 85.65m for any event that exceeds the 100 year storm.

Based on the available rooftop storage, the balance of required storage has been determined given the outlet controls for the site. MRM design sheets are provided in **Appendix C** and demonstrate that a total of 365.1 m3 of storage is required for the developed portion of the site.

This storage is achieved on the rooftop, in the pond and parking lot and within the underground storage tank as detailed below.

The dry pond has been sized to retain the maximum possible volume considering grading restrictions. Additional storage volume will be provided within a subsurface storage tank to be located under the parking lot with a controlled outlet to the Edouard Cleroux Municipal Drain. The outlet from the subsurface tank is controlled by two inlet control devices with diameters of 145 mm, sized to control runoff from the site to a flow rate less than or equal to the target flow rates for the 5 and 100 year predevelopment flow, taking into account uncontrolled flow from UNC-1 and UNC-2 as detailed in **Table 2**. Both ICDs are located within the outlet manhole (STM 101), with the invert elevation of the second orifice set above the maximum elevation of the 5 year storm event.

The dry pond, parking lot and underground tank form part of the POND drainage area. Details of the design discharge rate and required storage for the drainage area are included in **Table 3** below. The available surface storage volume in the dry pond and on the surface of the parking lot is 229.5m^3. The subsurface storage tank is designed with a volume of 68m^3.

Table 4: Controlled Tributary Area (POND)

Design Storm	Design Head (m)	Discharge (L/s)	Static Ponding Depth (m)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
5-Year	0.63	35.3	0.40	141.5	297.5
100-Year	0.78	64.4	0.55	295.2	297.5

5.3.2.3 Rooftop Storage

Roof controls have been specified for the flat portions of the service building (area BLDG on SD-1) to retain stormwater on the roof prior to discharge to the parking lot surface.

It is proposed to retain stormwater on the building rooftops by installing restricted flow roof drains. The following calculations assume the roof will be equipped with standard Watts Model R1100 Accuflow Roof Drains.

Watts Drainage "Accutrol" roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Accutrol" weir has been used as an example only, and that other products may be specified for use, provided that the total roof drain release rate is restricted to match the maximum rate of release indicated in **Table 4**, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater. Proposed drain release rates have been calculated based on the Accutrol weir setting at 50% open and 7 roof notches. Rooftop storage

calculations assume that 80% of the flat rooftop can be used for storage and that the storage depth at each drain will not exceed 15mm.

Based on the allowable release rate, required storage volumes were determined for each of the design storms. **Table 4** summarizes the controlled release rate, storage volume required and volume of storage provided as part of the site servicing design during the 5 and 100 year storm event. Note that discharge from controlled flow roof drains is proposed to outlet to the surface and is tributary to the proposed downstream dry pond. Discharge rates have been considered in the overall runoff from area POND as noted in Table 3 above.

Table 5: 5 and 100 Year Design Discharge Rate and Storage Volume Requirements

Storm Event	Controlled Design Discharge to Parking Lot (L/s)	Depth (mm)	Volume Stored (m3)
5-Year	7.1	111.0	29.0
100-Year	8.7	147.2	65.7

5.3.3 Results

Table 5 summarizes the controlled and uncontrolled discharge from the site based on the proposed stormwater management plan and demonstrates adherence to target peak outflow rates for the site.

Table 6: Summary of Total 5 and 100 Year Event Release Rates

	Area	5-Year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
Roof (BLDG)	0.17	7.1	8.7
Uncontrolled Tributary (UNC-1, UNC-2)	0.07	4.0	8.5
Uncontrolled Non-tributary (UNC-3)	0.32	16.5	36.3
Controlled (POND)	0.86	35.3	64.4
Total (Tributary to Edouard Cleroux)	**1.10**	**39.3**	**72.9**
Target (Tributary to Edouard Cleroux)	**1.10**	**43.2**	**73.8**
Total (Tributary to Antoine Cleroux)	**0.32**	**16.5**	**36.3**

Target (Tributary to Antoine Cleroux)	**0.32**	**16.5**	**36.3**

*Note: Roof and uncontrolled release rates from UNC-3 are not included to the target rate.

Similarly, the required storage volume is achieved as detailed in the table below.

Table 7: Summary of Maximum Storage Volume Available

	Volume Required (m3)	Volume Available (m3)
Roof	65.7	68.9
Surface & Underground	295.2	297.5
Total	360.9	366.4

5.4 WATER QUALITY CONTROL

The South Nation Conservation Authority has provided water quality control requirements that adhere to criteria outlined in the Ministry of Environment Conservation and Parks Stormwater Management Planning and Design Manual (2003). The water quality control for this site requires an enhanced level of protection which is equivalent to removal of 80% total suspended solids (TSS) before discharge to the municipal drain. Additionally, the development should employ lot level Best Management Practices (BMPs) for quality control wherever possible.

Table 3.2 of the MECP Stormwater Management Planning and Design Manual outlines the Water Quality Storage Requirements based on Receiving Waters. The table was used to determine the dead storage volume required in the dry pond to provide 80% TSS removal through infiltration. Only the impervious portions of the site require quality control treatment. The area of the site contributing to the dry pond was used to determine the dead storage volume requirement. Based on an imperviousness of 91.7% for the 1.03ha drainage area (POND & BLDG), 43.4m3 of storage is required to provide quality control through infiltration. This result in included in **Table 6.**

The invert of the outlet from the dry pond has been designed to be perched above the bottom of the basin such that a minimum of 43.4m^3 of quality control storage will be provided.

Table 8: Required Quality Control Volume

Area ID	Pond Drainage Area (ha)	Imperviousness (%)	Required Storage (m^3)
POND, BLDG	1.03	91.7	43.4

Based on the geotechnical report for the site plan development, existing soils will permit the infiltration of stormwater through the sand layer immediately below the dry pond. In situ soil

percolation rate tests were performed on July 2, 2019 which measured percolation times of 2 – 2.5 min/cm and a rate of 2 – 8 min/cm is associated with the laboratory grain size distribution analysis. A conservative rate of 8 min/cm was used to for the infiltration design.
The conservative rate was used with in the MECP's SWM Planning & Design Manual equation 4.3 to ensure appropriate sizing of the pond bottom area. The quality storage volume within the pond is estimated to drawdown within a period of 24 hours or less (see **Appendix C** for detailed calculations).

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 1.42ha in area. The topography across the site is relatively flat. The majority of the site currently drains from northeast to southwest, with overland flow generally being directed to the ditch located at the south of the property. A portion of the site drains to the municipal drain that runs along the northwest property line of the site. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements for the property. 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 maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the existing ditch as depicted in **Drawing SD-1.**

Grade raise restrictions on the site are limited to 0.6m under structures. As such, proposed grade raise was minimized to that feasible to achieve the required site grading. Where the grade raise exceeds 0.6m at the buildings, lightweight fill will be required as recommended in the geotechnical report.

7.0 UTILITIES

Hydro overhead lines exist along Navan Road. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location, and routing of hydro utilities, as well as required transformer locations, will be finalized after design circulation.

Similarl to Hydro, existing Bell/cable lines and gas plant exist within the adjacent Navan Road right-of-way, and are expected to be able to service the proposed site. Easement requirements and location of telecommunication infrastructure and on-site gas services will be determined as part of the site utility design.

8.0 APPROVALS

Based on pre-consultation with Ontario Ministry of Environment Conservation and Parks (MECP), Environmental Compliance Approval (ECA) under the Ontario Water Resources Act is not required given that the stormwater management outlet for the site is the existing Edouard Cleroux municipal drain.

Approval for septic tank, line and bed will be required from the Ottawa Septic System Office by way of OSSO permit.

A South Nation Conservation Authority permit approval is expected to be required for any alteration to the watercourse and drainage ditch along the northern limit of the site.

A MECP Permit to Take Water (PTTW) or posting on the Environmental Activity Sector Registry (EASR) may be required for the proposed site should groundwater reasonably be expected to be encountered during installation of on-site services. The geotechnical consultant shall confirm at the time of application if a PTTW or EASR is required.

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. Plan construction at proper time to avoid flooding.
8. Installation of a mud matt to prevent mud and debris from being transported off site.
9. Installation of silt fence to prevent sediment runoff.

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

10. Verification that water is not flowing under silt barriers.

10.0 GEOTECHNICAL INVESTIGATION

A Geotechnical Investigation Report was prepared by Stantec in July 2019. The report summarizes the existing soil conditions within the subject area and construction recommendations.

Some key finding in the report that have an impact on the site servicing are detailed below. The full report should be referenced for the complete site details.

The site is overlain by 100 to 190mm of topsoil over a 3 to 4m layer of silty sand, underlain by approximately 25m of a thick compressible deposit of Champlain Sea Clay that is highly sensitive to strength loss when disturbed. Bedrock was encountered at a depth of approximately 28m.

Groundwater elevation was measured at 84.0m. The first groundwater elevation observed of 85.6m via piezometer was likely influenced by pore pressure within the clay layer 3-4m below ground surface, and has not been considered as representative of site conditions based on site visual observations of the free draining silty sand layer.

In situ soil percolation rate tests were performed which measured percolation times of 2 – 2.5 min/cm and a rate of 2 – 8 min/cm is associated with the laboratory grain size distribution analysis.

Grade raises of more that 0.6m in depth shall be achieved using lightweight fill within the building footprints and extend at least 6m away from the building footprints.

With the subgrade preparation recommendations detailed in the report, the following pavement structure is recommended for the parking areas.

Location	Asphalt Thickness	Base Thickness OPSS Granular A (mm)	Subbase Thickness Granular B Type II (mm)
Standard Duty Parking Areas	60 mm SP12.5 mm	150	300
Heavy Duty Parking	40 mm SP12.5 mm 50 mm SP SP19.0 mm	150	400

11.0 CONCLUSIONS

11.1 WATER SERVICING

Based on the supplied boundary conditions for existing watermains and estimated domestic and fire flow demands for the subject site, it is anticipated that the proposed servicing in this development will provide sufficient capacity to provide the required domestic demands and a portion of the required emergency fire flow demands. Additional fire suppression will be provided through additional onsite water storage.

11.2 STORMWATER SERVICING

Surface ponding in a dry pond and parking area, roof storage and a storage tank under the parking lot will provide quantity control for all runoff in excess of predevelopment peak discharge rates. Quality control storage volumes will be provided in the dry pond for infiltration into the native soils based on MECP design criteria. Stormwater discharge is to ultimately outlet to the Edouard Cleroux Municipal Drain at the northern boundary of the site.

11.3 GRADING

Grading for the site has been designed to meet the stormwater management requirements and provide an emergency overland flow route as per City requirements. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing downstream watercourses.

11.4 UTILITIES

Utility infrastructure exists within overhead lines within Navan Road at the northern boundary of the proposed site. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed development. Exact size, location and routing of utilities will be finalized after design circulation.

11.5 APPROVALS/PERMITS

An MECP Environmental Compliance Approval is not expected to be required. An alteration to watercourse permit is expected to be required from the South Nation Conservation Authority. An EASR or PTTW may be required to manage water during construction. No other approval requirements from other regulatory agencies are anticipated.