971 Montreal Road – Servicing and Stormwater Management Report

Stantec Project No. 160401667

June 17, 2021

Prepared for:

12318407 Canada Inc.
3500 Atwater, Suite 6
Quebec QC H3H 1Y5

Prepared by:

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

Revision	Description	Author		Quality Check		Independent Review	
1	1st Submission	Peter Mott	PM	Thakshika Rathnasooriya	TR	Kris Kilborn	KK

Sign-off Sheet

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Prepared by ______________________
(signature)

Peter Mott, EIT.

LICENSED PROFESSIONAL ENGINEER
T.K. RATHNASOORIYA
100225159
2021-06-17
PROVINCE OF ONTARIO

Prepared by ______________________
(signature)

Thakshika Rathnasooriya, P.Eng.

Approved by ______________________
(signature)

Kris Kilborn

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1.0 BACKGROUND

Stantec Consulting Ltd. has been commissioned by 12318407 Canada Inc. to prepare the following Servicing and Stormwater Management Report for a proposed 9-storey residential building with 78 units to be located on the north side of Montreal Road (971 Montreal Road) between Burma Road and Foxview Place. The overall subject property comprises 0.18 ha with approximately 0.09 ha proposed for the proposed residential building and underground parking. The site is proposed to contain a new 9-storey residential building with both surface and underground ground parking, and an outdoor amenity area. An existing one-storey dine-in restaurant with surface parking is currently established on the subject property. The site limits are indicated in **Figure 1** below.

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

The location of the site is provided in **Figure 1** below.

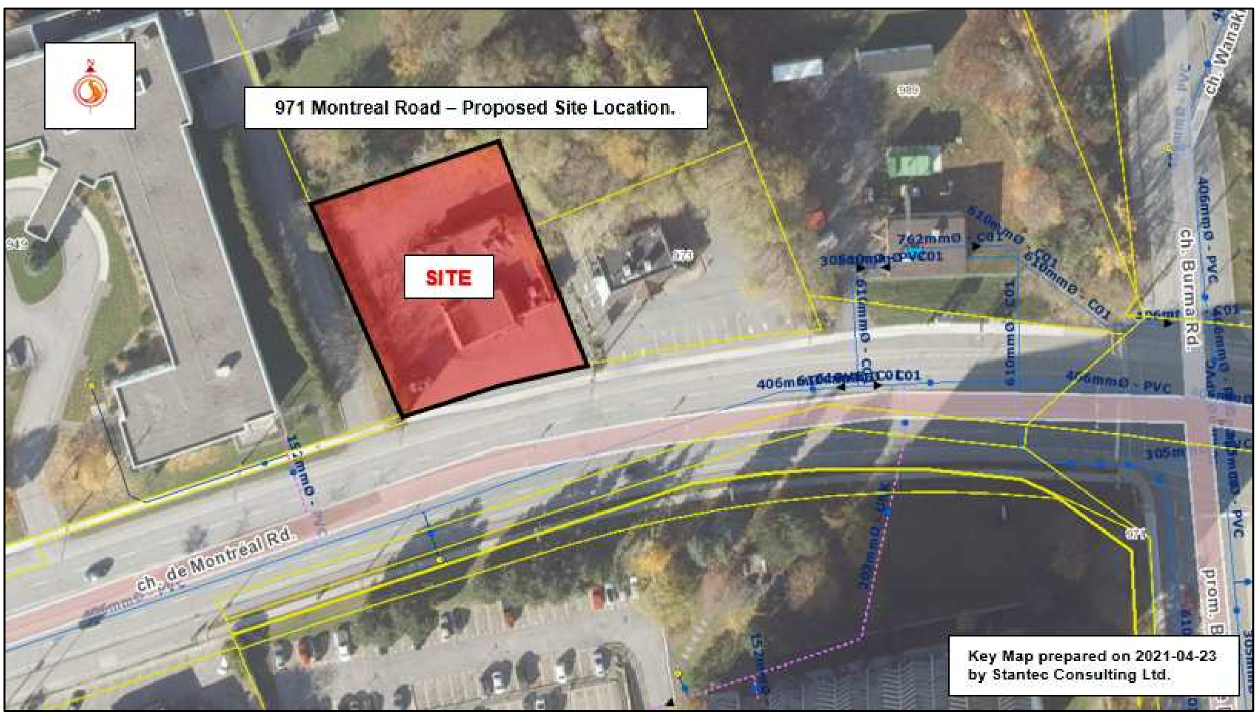

Figure 1: Key Map of Site

2.0 REFERENCES

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

- Geotechnical Investigation – Proposed Residential Development – 971 Montreal Road, Kollaard Associates July 31, 2020.
- City of Ottawa Design Guidelines – Water Distribution, Infrastructure Services Department, City of Ottawa, First Edition, July 2010
- City of Ottawa Sewer Design Guidelines, 2nd Ed., City of Ottawa, October 2012
- Technical Bulletin ISDTB-2014-01, City of Ottawa, February 2014
- Technical Bulletin ISTB-2018-01, City of Ottawa, March 21, 2018
- Technical Bulletin ISTB-2018-02, City of Ottawa, March 21, 2018
- Technical Bulletin ISTB-2018-03, City of Ottawa, March 21, 2018

3.0 POTABLE WATER SERVICING

The proposed development comprises one nine storey residential building, complete with associated infrastructure and parking. The proposed development is located within Zone MONT of the City of Ottawa's water distribution system. A 400 mm diameter PVC watermain exists south of the site within Montreal Road as shown on Drawing SSP-1 in Appendix E. The site will be serviced through two 50mm building service connections to the existing 400mm diameter watermain on Montreal Road ROW at the southern boundary of the site. Average ground elevations of the site are approximately 105.7m. Under normal operating conditions, the hydraulic gradeline is 146.9m as confirmed through boundary conditions as provided by the City of Ottawa (see Appendix A.1).

3.1 WATER DEMANDS

3.1.1 Domestic Water Demands

Water demands for the proposed development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008) and the City of Ottawa Design Guidelines – Water Distribution (2010). A daily demand rate of 350 L/cap/day was applied for the population of the proposed site. Population densities have been assumed as 1.4 pers./one bedroom and bachelor apartment units, 2.1 pers./two-bedroom units and 3.1 pers./three-bedroom units. See for detailed domestic water demand estimates. See **Appendix A.2** for detailed domestic water demand estimates.

The average day demand (AVDY) for the site was determined to be 0.60 L/s. The maximum day demand rate (MXDY) is 2.5 times the AVDY for residential areas, which results in 1.49 L/s. The peak hour demand rate (PKHR) is 2.2 times the MXDY which was determined to be 3.28 L/s.

Fire Underwriters Survey (FUS) methodology was used to determine the fire flow required for the proposed. The building was considered to be of non-combustible construction with a sprinkler system, and as a residential apartment, the building falls under occupancy class C. The FUS calculations assumed 2-hour fire separation between each floor and 1-hour fire separation for exterior vertical communications. Based on calculations per the FUS guidelines (see **Appendix A.3),** the minimum required fire flows for this development are 83 L/s (5,000L/min).

3.2 PROPOSED SERVICING

Domestic water supply pressures are required to range within the guidelines of 50-80 psi specified in the City of Ottawa Design Guidelines for Water Distribution. Maximum day demands rates must generate a residual pressure above the required minimum 140 kPa (20 psi).

Based on boundary conditions provided by the City of Ottawa and an approximate elevation of 105.7m, adequate domestic water supply is available for the subject site with pressures at 41.2m (58.6psi)). This pressure range is within the guidelines of 50-80 psi specified in the City of Ottawa Design Guidelines for Water Distribution.

Since the proposed buildings are 9-storeys in height, an additional 34 kPa (5 psi) for every additional storey (above 2 storeys) is required to account for the change in elevation head and additional head loss when determining available pressure at upper building floors. Given that the highest pressure is expected to be 404 kPa (58.6psi) at ground level, the resultant equivalent pressure at the 9th floor will be approximately 162 kPa (23.6 psi), below the City's objective pressures. As a result, building booster pump(s) will be required to maintain an acceptable level of service on the higher floors.

The boundary conditions provided for the proposed development under maximum day demands demonstrate that a maximum flowrate of 133 L/s is available in order to have a residual pressure above the required minimum 20 psi. Revised boundary conditions based on the decreased fire flow requirement of 83 L/s will be requested. The residual pressure in the system while providing maximum day demand plus a fire flow of 133 L/s is anticipated to be 41.0m (58.3 psi). This demonstrates that sufficient fire flow is available for the proposed development for a fire flow requirement of 83 L/s.

The closest hydrants are located on Montreal Road at the southern and eastern boundaries of the subject property and is within 90m of the proposed building as per City of Ottawa Water Distribution Design Guidelines

3.3 SUMMARY OF FINDINGS

The proposed development is in an area of the City's water distribution system that has sufficient capacity to provide both the required domestic and emergency fire flows. Based on boundary conditions provided by City of Ottawa staff, shown in **Appendix** Error! Bookmark not defined., it is anticipated that there is sufficient supply and pressure in the proposed water distribution system to meet the demands expected from the new development on lower floors, but will require the use of a booster pump to maintain minimum operating pressures on the higher floors.

4.0 WASTEWATER SERVICING

4.1 EXISTING CONDITIONS

An existing 225 mm diameter concrete sanitary sewer runs from east to west on Montreal Road, immediately south of the subject site. A proposed 150 mm diameter service lateral connection is to be made directly to the existing 225 mm diameter concrete sanitary sewer along Montreal Road to service the proposed site (see **Drawing SSP-1**). The location of the existing sanitary service lateral shall be confirmed prior to construction and is to be abandoned as part of the servicing works.

4.2 DESIGN CRITERIA

As outlined in the City's Sewer Design Guidelines and the MECP Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to preliminarily size on-site sanitary sewers:

- Minimum full flow velocity – 0.6 m/s
- Maximum full flow velocity – 3.0 m/s
- Manning's roughness coefficient for all smooth walled pipes – 0.013
- Minimum size – 200mm dia. for residential areas
- Max Peak Factor (Res.) – 4.0
- Min Peak Factor (Res.) – 2.0
- Extraneous flow allowance – 0.33 L/s/ha
- Harmon Correction Factor – 0.8
- Maintenance hole spacing – 120 m
- Minimum cover – 2.5 m

4.3 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows (approx. 1.7 L/s with allowance for infiltration) to the existing 225 mm diameter concrete sanitary sewer on Montreal Road. A sanitary sewer design sheet for the proposed service lateral is included in **Appendix B**. Full port backwater valves are to be installed on all sanitary services within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property.

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this 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 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 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).
- Use of the dual drainage principle (City of Ottawa).
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on major & minor drainage system (City of Ottawa)
- Quality control measures are not required for this site based on correspondence with the RVCA

Storm Sewer & Inlet Controls

- Proposed site to discharge the existing 225 mm diameter storm sewer on Montreal Road, south of the subject site.
- All stormwater runoff from the site up to and including the 100-year storm event to be stored on site and released into the minor system at a maximum discharge equivalent to the 5-year storm predevelopment release rate to Montreal Road at a maximum runoff coefficient of 0.5.
- Minor system inflow to be sized to convey 5-year storm event, under free-flow conditions using City of Ottawa I-D-F parameters (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30 m above the 100-year water level (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).

5.3 STORMWATER MANAGEMENT DESIGN

The proposed 0.19 ha development area is to contain a 9-storey high rise building with a total of 78 units. The site will be serviced by the existing 225 mm diameter concrete storm sewer running east to west on Montreal Road, as shown on **Drawing SD-1**.

The SWM strategy for the site is to provide roof storage and a stormwater cistern to attenuate peak flows in the downstream system to the allowable release rate. The proposed building will capture storm drainage through controlled roof drains and direct peak flows to a stormwater cistern located in the underground parking level for attenuation. Additionally, controlled drainage areas external of the building footprint will allocate all stormwater flows to the cistern. The cistern, to be located near the southwest corner of the building in parking level P1, will be pumped at a controlled rate into the existing 225 mm diameter storm sewer on Montreal Road via a 100 mm diameter storm service. The stormwater cistern location will be coordinated with the building's architect and structural engineer.

The intent of the stormwater management plan presented herein is to mitigate any negative impact that the proposed development will have on the existing storm sewer infrastructure, while providing adequate capacity to service the proposed buildings, parking and access areas. The proposed stormwater management plan is designed to detain runoff on site and within subsurface storage to ensure that peak flows after construction will not exceed the allowable site release rate detailed below.

The proposed site plan, drainage areas, runoff coefficients, and proposed storm sewer infrastructure are shown on **Drawing SD-1**.

5.3.1 Allowable Release Rate

The Modified Rational Method was employed to assess the rate of runoff generated during pre-development conditions. Based on consultation with City of Ottawa staff, the peak post-development discharge from the subject site to be controlled to the 5-year predevelopment release rate, to a maximum runoff coefficient C of 0.5. The predevelopment release rate for the area has been determined using the rational method based on the criteria above. A time of concentration for the predevelopment area (10 minutes) was assigned based on the relatively small site and its proximity to the existing drainage outlet for the site. Peak flow rates have been calculated using the rational method as follows:

$$\boldsymbol{Q} = \mathbf{2.78}\,(\boldsymbol{C})(\boldsymbol{I})(\boldsymbol{A})$$

Where:
$\boldsymbol{Q} = peak\ flow\ rate, L/s$
$\boldsymbol{C} = site\ runoff\ coefficient$
$\boldsymbol{I} = rainfall\ intensity, mm/hr\ (per\ City\ of\ Ottawa\ 5-year\ IDF\ curves)$
$\boldsymbol{A} = drainage\ area, ha$

The target release rate for the site is summarized in **Table 3** below:

Table 1: Target Release Rate to Montreal Road

Design Storm	Target Flow Rate (L/s)
5 and 100-year storm	26.1

5.3.2 Storage Requirements

The site requires quantity control measures to meet the restrictive stormwater release criteria. The use of controlled rooftop storage in addition to a cistern contained within the underground parking area are proposed to reduce site peak outflow to the allowable target release rates.

5.3.2.1 Rooftop Storage

It is proposed to detain stormwater within the rooftop area by installing restricted flow roof drains. Roof flows will be directed to the underground cistern unit proposed within the underground parking area. The following calculations assume that roofs will be equipped with Watts Model R1100 Accuflow Roof Drains open at 25%.

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. Storage volume and controlled release rate are summarized in **Table 4**:

Table 2: Summary of Rooftop Storage (5 & 100-Year Events)

Storm Return Period	Area ID	Ponding Depth (mm)	Discharge (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
5-year	BLDG	109.0	4.1	14.0	35.1
100-year	BLDG	146.1	4.7	32.9	35.1

*Drainage from the roof enters the cistern.

5.3.2.2 Subsurface Storage

It is proposed to detain stormwater within a 9 m^3 stormwater cistern below grade with a maximum controlled release rate of 16.4 L/s to the gravity storm service provided. The Modified Rational Method was used to determine the peak volume requirement for the cistern. The majority of the site was assumed to be captured and directed to the cistern where it will be temporarily stored then released at a controlled rate.

Table 5 summarizes the flow rates and volume of stormwater in the cistern in the 5-year and 100-year storm events.

Table 5: Peak Controlled (Tributary) 5- and 100-Year Release Rates

Storm Return Period	Area ID	Area (ha)	Runoff 'C'	$Q_{release}$ (L/s)	V_{stored} (m^3)
5-year	BLDG, RAMP, CB-1, CB-2	0.14	0.86	16.44	0.23
100-year	BLDG, RAMP, CB-1A, CB-1B	0.14	0.98	16.44	7.99

The design of the stormwater cistern will be coordinated with the building's mechanical engineer. Coordination with the architect and the mechanical engineer will be required to determine the ideal location for the cistern to ensure that no conflicts exist, and any constraints are adequately managed.

The outline of the stormwater cistern and its emergency overflow location is shown on **SD-1**, with additional details to be provided in the mechanical engineer's drawings.

5.3.3 Uncontrolled Areas

Due to grading restrictions, two subcatchment areas have been designed without a storage component. The UNC-1 catchment area discharges off-site uncontrolled to the adjacent Montreal Road ROW, while the UNC-2 catchment area discharges off-site uncontrolled to the adjacent properties to the northeast. Peak discharges from uncontrolled areas have been considered in the overall SWM plan and have been balanced through overcontrolling the proposed site discharge rates to meet target levels.

Table 6 summarizes the 5 and 100-year uncontrolled release rates from the proposed development.

Table 3: Peak Uncontrolled 5-year and 100-Year Release Rates

Storm Return Period	Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
5-year	UNC-1	0.03	0.39	10	3.77
	UNC-2	0.005	0.20	10	0.28
100-year	UNC-1	0.03	0.49	10	8.08
	UNC-2	0.005	0.25	10	0.59

5.3.4 Results

Table 7 demonstrates that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow for the site.

Table 5-4: Estimated Post-Development Discharge (5-Year, and 100-Year)

	5-Year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
Controlled Cistern Discharge	16.44	16.44
Uncontrolled Sheet Flow	4.05	8.67
Total	**20.49**	**25.11**
Target	**26.14**	

6.0 GRADING AND DRAINAGE

The proposed development measures approximately 0.18 ha in area and currently drains north. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements 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 maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the existing Montreal Road. Refer to grading plan **Drawings GP-1** for a detailed grading plan of the proposed site.

7.0 UTILITIES

Hydro, gas, and cable servicing are readily available for the development, as the site lies within a mature commercial area and the existing building on the site is presumed to be currently serviced by all utilities listed. The exact size, location, and routing of utilities, including determining whether off-site works are required to extend any additional utility services to the property, shall be finalized after design circulation and coordinated by the Electrical Consultant.

Several overhead hydro wires servicing the site may need to be removed, relocated, or buried as part of the site servicing works.

8.0 APPROVALS

An Environmental Compliance Approval (ECA) from the Ontario Ministry of Environment, Conservation, and Parks (MECP) is not anticipated for the proposed servicing works as all services are connecting into existing infrastructure.

Requirement for a MECP Permit to Take Water (PTTW) for pumping during construction of the underground parking area will be confirmed by the geotechnical consultant.

9.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the 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 the extent of the 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 geotextiles, geogrid, or synthetic mulches.
6. Provide sediment traps and basins during dewatering works.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Schedule the construction works at times which avoid flooding due to seasonal rains.

The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

- Verification that water is not flowing under silt barriers.
- Cleaning and changing the sediment traps placed on catch basins.

Refer to **Drawing EC-1** for details of the proposed erosion control measures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was completed for the subject site by Kollaard Associates on July 31, 2020. The report summarizes the existing soil conditions within the subject area and provides construction recommendations. For details which are not summarized below, please see the original geotechnical report included in **Appendix D**.

Subsurface soil conditions within the subject site were determined from 3 boreholes which were completed in July 2020. Fill material was encountered from the surface at all three boreholes and ranged in thickness from about 0.2 to 3.05 m. In general, the fill material consisted of asphaltic concrete underlain by grey crushed stone, then by grey-brown sand, some gravel, topsoil/organics and a trace of clay and brick. Grey limestone bedrock was encountered at between 1.37 m to 3.05 m. Based on the RQD index, the bedrock can be classified as fair to excellent.

Groundwater levels were found to range from 3.37 m to 4.32 m below the ground surface and are subject to seasonal fluctuations. No grade-raise restrictions adjacent to the proposed building foundation have been recommended for the subject site.

Pavement structure for car and light truck parking areas and access lane routes are provided in **Table 8** below.

Table 5: Recommended Pavement Structure – Car and Light Truck Parking Areas

Thickness (mm)	Material Description
50	Superpave 12.5 Asphaltic Concrete or hot mix asphalt concrete (HL3)
150	OPSS Granular A base
300	OPSS Granular B Type II Subbase

11.0 CONCLUSIONS

11.1 POTABLE WATER SERVICING

Based on the supplied boundary conditions from the City 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 sustain both the required domestic demands and emergency fire flow demands of the proposed site. Booster pumps will be required to achieve adequate pressures on higher levels.

11.2 WASTEWATER SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site. The proposed site will be serviced by a gravity sewer service lateral which will direct wastewater flows to the existing 225 mm diameter sanitary sewer within Montreal Road ROW, directly south of the property.

11.3 STORMWATER MANAGEMENT

The proposed stormwater management plan is in compliance with the goals specified through consultation with the City of Ottawa. Rooftop storage and controlled roof release, and subsurface storage via a stormwater cistern has been proposed to limit peak storm sewer inflows to downstream storm sewers to predevelopment levels as determined by City of Ottawa staff. No surface ponding is anticipated. The storm flows from the site will be controlled to the 5-year storm event.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the recommendations in the Geotechnical Review prepared by Kollaard Associates. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.5 APPROVALS/PERMITS

An MECP Environmental Compliance Approval is not expected to be required for the subject site. Requirements for a Permit to Take Water (PTTW) are not anticipated. Need for a PTTW for sewer construction dewatering and building footing excavation will be confirmed by the geotechnical consultant. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A POTABLE WATER SERVICING

A.1 BOUNDARY CONDITIONS

From:	Fawzi, Mohammed
To:	Mott, Peter
Cc:	Kilborn, Kris
Subject:	RE: 971 Montreal Road - Boundary Conditions Request
Date:	Tuesday, April 27, 2021 2:16:34 PM
Attachments:	971 Montreal April 2021.pdf

Hi Peter,

The following are boundary conditions, HGL, for hydraulic analysis at 971 Montreal Rd (zone MONT) assumed to be connected to the 406 mm on Montreal Road (see attached PDF for location).

Minimum HGL = 146.9 m

Maximum HGL = 146.9 m

Max Day + Fire Flow (133 L/s) = 146.7 m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Best Regards,

Mohammed Fawzi, E.I.T.
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l’infrastructure et du développement économique
Development Review - Central Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 20120, Mohammed.Fawzi@ottawa.ca

Please note that due to the current situation, I am working remotely. Email is currently the best way to contact me

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From: Fawzi, Mohammed

Sent: April 21, 2021 7:11 PM
To: Mott, Peter <Peter.Mott@stantec.com>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: RE: 971 Montreal Road - Boundary Conditions Request

Hi Peter,

This is to confirm that I have forwarded the request. I will forward you the results once received.

Thank you.

Best Regards,

Mohammed Fawzi, E.I.T.
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Central Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 20120, Mohammed.Fawzi@ottawa.ca

Please note that due to the current situation, I am working remotely. Email is currently the best way to contact me

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From: Mott, Peter <Peter.Mott@stantec.com>
Sent: April 19, 2021 10:02 AM
To: Fawzi, Mohammed <mohammed.fawzi@ottawa.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: 971 Montreal Road - Boundary Conditions Request

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ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

I would like to request the hydraulic boundary conditions for the proposed site located at 971 Montreal Road. Please find attached the site plan, the key map showing the location of the proposed development, domestic water demand calculations, and fire flow calculations.

A summary of the proposed site is provided below:

We anticipate a connection to the existing watermain infrastructure to service the site. The following connection is expected for servicing:

➢Connection to existing 406mm (PVC) watermain on Montreal Road.

*Existing fire hydrant adjacent to the property on the south side of Montreal Road.

For the purpose of the boundary conditions request, may you please provide us with the boundary conditions for the following servicing option:

i. Watermain connection to the existing 406 mm (PVC) watermain on Montreal Road; assuming a fire flow requirement of **8,000 L/min** for the site in addition to the domestic water demands provided below.

- The intended land use is residential, per the summary provided in the Domestic Demands spreadsheet. (See attached Site Plan with project stats)
- Estimated fire flow demand per the FUS methodology: 8000 L/min (133 L/s)
- Domestic water demands for the entire development:
    - **Average day: 35.1 L/min (0.59 L/s)**
    - **Maximum day: 87.8 L/min (1.46 L/s)**
    - **Peak hour: 193.2 L/min (3.22 L/s)**

Thank you for your time and please contact me at your earliest convenience if any additional information or clarification is required.

Best regards,

Peter Mott EIT
Engineering Intern, Community Development

Mobile: 613-897-0445
Peter.Mott@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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A.2 DOMESTIC WATER DEMAND CALCULATIONS

971 Montreal Road - Domestic Water Demand Estimates

Based on Figurr Architectes' Site Plan 19/03/2021
Project No. 160401667
Proposed Use: High-rise Apartment Dwelling (9-storeys)

Densities as per City Guidelines [1]		
Apartment Units		
1 Bedroom	1.4	ppu
2 Bedroom	2.1	ppu
3 Bedroom	3.1	ppu

Unit Type	No. of Units	Area (m^2)	Population	Daily Rate of Demand [2] (L/cap/day)	Avg Day Demand		Max Day Demand [3]		Peak Hour Demand [3]	
					(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Apartment Units										
1 Bedroom	38		54	350	13.1	0.22	32.8	0.55	72.2	1.20
2 Bedroom	32		68	350	16.5	0.28	41.3	0.69	90.9	1.52
3 Bedroom	8		25	350	6.1	0.10	15.2	0.25	33.4	0.56
Total Site :	**78.0**	**889.0**	**147**		**35.7**	**0.60**	**89.3**	**1.49**	**196.5**	**3.28**

1 Population counts based on a population densities provided in 'Table 4.1 Per Unit Populations' of the Ottawa Design Guidelines: Water Distribution (July 2010)
2 Average day water demand for residential areas equal to 350 L/cap/d
3 The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

A.3 FUS CALCULATION SHEETS

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401667
Project Name: 971 Montreal Road
Date: 6/15/2021
Fire Flow Calculation #: 1
Description: 9 Storey Residential Apartment Building

Notes: 9-storey residential high-rise. Building information from Site Plan by figurr Architects Collective (2021-03-08).
2-hour fire separation provided between each floor and 1-hour fire separation provided for exterior vertical communications.

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	Used the 'gross floor area' of the third floor (floor with the largest footprint, 889 m^2) + 25% of the gross construction area of the two immediately adjoining floors (the second floor and fourth floor). Methodology as per Page 17 of the Fire Underwriters Survey's *Water Supply for Public Fire Protection, 1999*.						1252.75	-
	Determine Number of Adjoining Units	-						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						1	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	6000
5	Determine Occupancy Charge	Limited Combustible						-15%	5100
6	Determine Sprinkler Reduction	Conforms to NFPA 13						-30%	-2040
		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	20.1 to 30	32.7	2	61-90	Wood Frame or Non-Combustible	9%	1887
		East	3.1 to 10	33.9	2	61-90	Wood Frame or Non-Combustible	19%	
		South	> 45	32.7	2	61-90	Wood Frame or Non-Combustible	0%	
		West	20.1 to 30	32.1	2	61-90	Wood Frame or Non-Combustible	9%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							5000
		Total Required Fire Flow in L/s							83.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							600

Appendix B   WASTEWATER SERVICING

B.1   SANITARY SEWER DESIGN SHEET

Stantec	SITE: 971 Montreal Road	SANITARY SEWER DESIGN SHEET (City of Ottawa)
	DATE: 6/15/2021	
	REVISION: 1	
	DESIGNED BY: PM	FILE NUMBER: 160401667
	CHECKED BY: TR	

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / 1 BEDROOM	1.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / 2 BEDROOM	2.1	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / 3 BEDROOM	3.1				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / STREET		C+I+I	INFILTRATION			TOTAL	PIPE									
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	1 BEDROOM	2 BEDROOM	3 BEDROOM	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
971 Montreal Road	BLDG	TEE	0.09	38	32	8	147	0.09	147	3.36	1.60	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.00	0.18	0.18	0.06	1.66	17.0	150	PVC	DR 28	1.00	15.3	**10.82%**	0.86	0.47

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec	971 Montreal Road	**STORM SEWER DESIGN SHEET (City of Ottawa)**	
	DATE:	2021-05-27	
	REVISION:	1	
	DESIGNED BY:	TR	**FILE NUMBER: 160401667**
	CHECKED BY:		

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	MANNING'S n =	0.013		BEDDING CLASS	B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m		
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min		

LOCATION			DRAINAGE AREA																								
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-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
BLDG, CB-1, CB-2, RAMP	BLDG	STM STUB.	0.000	0.05	0.00	0.00	0.09	0.00	0.98	0.00	0.00	0.000	0.000	0.053	0.053	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	15.4
																				10.33							

AREA ID NUMBER	PIPE SELECTION												
	LENGTH (m)	PIPE WIDTH OR DIAMETE (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)
BLDG, CB-1, CB-2, RAMP	17.6	200	200	CIRCULAR	PVC	SDR 35	1.00	33.3	**46.4%**	1.05	0.88	0.33
		225	225									

C.2 MODIFIED RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401667**
Project: **971 Montreal Road**
Date: **28-Apr-21**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Sub-catchment Area **Catchment Type**	**ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Roof	BLDG	Hard	0.088		0.9	0.079		
		Soft	0.000		0.2	0.000		
		Subtotal		0.0879			0.079074	0.900
Controlled - Tributary	RAMP	Hard	0.017		0.9	0.016		
		Soft	0.000		0.2	0.000		
		Subtotal		0.0174			0.01566	0.900
Controlled - Tributary	CB-1	Hard	0.017		0.9	0.016		
		Soft	0.000		0.2	0.000		
		Subtotal		0.0174			0.01566	0.900
Controlled - Tributary	CB-2	Hard	0.013		0.9	0.012		
		Soft	0.007		0.2	0.001		
		Subtotal		0.0197			0.013002	0.660
Uncontrolled - Non-Tributary	UNC-1	Hard	0.009		0.9	0.008		
		Soft	0.024		0.2	0.005		
		Subtotal		0.0334			0.013026	0.390
Uncontrolled - Non-Tributary	UNC-2	Hard	0.000		0.9	0.000		
		Soft	0.005		0.2	0.001		
		Subtotal		0.00475			0.00095	0.200
Total				**0.181**			**0.137**	
Overall Runoff Coefficient= C:								**0.76**

Total Roof Areas	**0.088 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.055 ha**
Total Tributary Area to Outlet	**0.142 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.038 ha**
Total Site	**0.181 ha**

Stormwater Management Calculations

Project #160401667, 971 Montreal Road
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

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

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
10	104.19
20	70.25
30	53.93
40	44.18
50	37.65
60	32.94
70	29.37
80	26.56
90	24.29
100	22.41
110	20.82
120	19.47

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1805
C: 0.50 (Per requirements from City of Ottawa staff)

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**26.14**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG — Roof
Area (ha): 0.09 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	22.90	3.98	18.92	11.35	102.37	0.00
20	70.25	15.44	4.07	11.37	13.65	108.14	0.00
30	53.93	11.85	4.09	7.77	13.99	109.00	0.00
40	44.18	9.71	4.07	5.65	**13.55**	107.90	0.00
50	37.65	8.28	4.04	4.24	12.73	105.83	0.00
60	32.94	7.24	3.99	3.25	11.69	103.22	0.00
70	29.37	6.46	3.95	2.51	10.54	100.31	0.00
80	26.56	5.84	3.88	1.96	9.41	95.85	0.00
90	24.29	5.34	3.80	1.54	8.29	91.18	0.00
100	22.41	4.93	3.73	1.19	7.17	86.53	0.00
110	20.82	4.58	3.66	0.92	6.07	81.94	0.00
120	19.47	4.28	3.59	0.69	4.98	77.45	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	109.00	0.11	4.09	13.99	35.14	0.00

Subdrainage Area: RAMP — Controlled - Tributary
Area (ha): 0.02 — Tributary to Trench Drain & Cistern
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.54	4.54	0.00	**0.00**
20	70.25	3.06	3.06	0.00	**0.00**
30	53.93	2.35	2.35	0.00	**0.00**
40	44.18	1.92	1.92	0.00	**0.00**
50	37.65	1.64	1.64	0.00	**0.00**
60	32.94	1.43	1.43	0.00	**0.00**
70	29.37	1.28	1.28	0.00	**0.00**
80	26.56	1.16	1.16	0.00	**0.00**
90	24.29	1.06	1.06	0.00	**0.00**
100	22.41	0.98	0.98	0.00	**0.00**
110	20.82	0.91	0.91	0.00	**0.00**
120	19.47	0.85	0.85	0.00	**0.00**

Subdrainage Area: CB-2 — Controlled - Tributary
Area (ha): 0.02 — Tributary to Cistern
C: 0.66

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	3.77	3.77	0.00	**0.00**
20	70.25	2.54	2.54	0.00	**0.00**
30	53.93	1.95	1.95	0.00	**0.00**
40	44.18	1.60	1.60	0.00	**0.00**
50	37.65	1.36	1.36	0.00	**0.00**
60	32.94	1.19	1.19	0.00	**0.00**
70	29.37	1.06	1.06	0.00	**0.00**
80	26.56	0.96	0.96	0.00	**0.00**
90	24.29	0.88	0.88	0.00	**0.00**
100	22.41	0.81	0.81	0.00	**0.00**
110	20.82	0.75	0.75	0.00	**0.00**
120	19.47	0.70	0.70	0.00	**0.00**

Subdrainage Area: CB-1 — Controlled - Tributary
Area (ha): 0.02 — Tributary to Cistern
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.54	4.54	0.00	**0.00**
20	70.25	3.06	3.06	0.00	**0.00**
30	53.93	2.35	2.35	0.00	**0.00**
40	44.18	1.92	1.92	0.00	**0.00**
50	37.65	1.64	1.64	0.00	**0.00**
60	32.94	1.43	1.43	0.00	**0.00**
70	29.37	1.28	1.28	0.00	**0.00**
80	26.56	1.16	1.16	0.00	**0.00**
90	24.29	1.06	1.06	0.00	**0.00**
100	22.41	0.98	0.98	0.00	**0.00**

Project #160401667, 971 Montreal Road
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

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1805
C: 0.50

100-Year Target Release Rate 26.14 L/s

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG — Roof
Area (ha): 0.09 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	43.61	4.42	39.19	23.51	130.36	0.00
20	119.95	29.30	4.59	24.71	29.65	140.73	0.00
30	91.87	22.44	4.65	17.79	32.02	144.73	0.00
40	75.15	18.35	4.67	13.68	32.84	146.11	0.00
50	63.95	15.62	4.67	10.95	32.85	146.13	0.00
60	55.89	13.65	4.66	8.99	**32.38**	145.33	0.00
70	49.79	12.16	4.64	7.52	31.60	144.02	0.00
80	44.99	10.99	4.61	6.38	30.61	142.35	0.00
90	41.11	10.04	4.58	5.46	29.49	140.45	0.00
100	37.90	9.26	4.55	4.71	28.26	138.37	0.00
110	35.20	8.60	4.51	4.08	26.96	136.18	0.00
120	32.89	8.03	4.48	3.56	25.61	133.90	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	146.13	0.15	4.67	32.85	35.14	0.00

Subdrainage Area: RAMP — Controlled - Tributary
Area (ha): 0.02 — Tributary to Trench Drain & Cistern
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	8.64	8.64	0.00	**0.00**
20	119.95	5.80	5.80	0.00	**0.00**
30	91.87	4.44	4.44	0.00	**0.00**
40	75.15	3.63	3.63	0.00	**0.00**
50	63.95	3.09	3.09	0.00	**0.00**
60	55.89	2.70	2.70	0.00	**0.00**
70	49.79	2.41	2.41	0.00	**0.00**
80	44.99	2.18	2.18	0.00	**0.00**
90	41.11	1.99	1.99	0.00	**0.00**
100	37.90	1.83	1.83	0.00	**0.00**
110	35.20	1.70	1.70	0.00	**0.00**
120	32.89	1.59	1.59	0.00	**0.00**

Subdrainage Area: CB-2 — Controlled - Tributary
Area (ha): 0.02 — Tributary to Cistern
C: 0.83

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	8.07	8.07	0.00	**0.00**
20	119.95	5.42	5.42	0.00	**0.00**
30	91.87	4.15	4.15	0.00	**0.00**
40	75.15	3.40	3.40	0.00	**0.00**
50	63.95	2.89	2.89	0.00	**0.00**
60	55.89	2.53	2.53	0.00	**0.00**
70	49.79	2.25	2.25	0.00	**0.00**
80	44.99	2.03	2.03	0.00	**0.00**
90	41.11	1.86	1.86	0.00	**0.00**
100	37.90	1.71	1.71	0.00	**0.00**
110	35.20	1.59	1.59	0.00	**0.00**
120	32.89	1.49	1.49	0.00	**0.00**

Subdrainage Area: CB-1 — Controlled - Tributary
Area (ha): 0.02 — Tributary to Cistern
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	8.64	8.64	0.00	**0.00**
20	119.95	5.80	5.80	0.00	**0.00**
30	91.87	4.44	4.44	0.00	**0.00**
40	75.15	3.63	3.63	0.00	**0.00**
50	63.95	3.09	3.09	0.00	**0.00**
60	55.89	2.70	2.70	0.00	**0.00**
70	49.79	2.41	2.41	0.00	**0.00**
80	44.99	2.18	2.18	0.00	**0.00**
90	41.11	1.99	1.99	0.00	**0.00**
100	37.90	1.83	1.83	0.00	**0.00**

Stormwater Management Calculations

Project #160401667, 971 Montreal Road
Modified Rational Method Calculatons for Storage

110	20.82	0.91	0.91	0.00	**0.00**
120	19.47	0.85	0.85	0.00	**0.00**

Cistern
Contributing Subcatchment Areas: BLDG, RAMP, CB-1, CB-2

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	16.82	16.44	0.38	0.23
20	70.25	12.73	12.73	0.00	**0.00**
30	53.93	10.73	10.73	0.00	**0.00**
40	44.18	9.51	9.51	0.00	**0.00**
50	37.65	8.67	8.67	0.00	**0.00**
60	32.94	8.05	8.05	0.00	**0.00**
70	29.37	7.57	7.57	0.00	**0.00**
80	26.56	7.15	7.15	0.00	**0.00**
90	24.29	6.80	6.80	0.00	**0.00**
100	22.41	6.49	6.49	0.00	**0.00**
110	20.82	6.22	6.22	0.00	**0.00**
120	19.47	5.99	5.99	0.00	**0.00**

Storage: e Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 85.00 mm
Invert Elevation 104.18 m
Top of Cistern Elevation 105.33 m
Max Ponding Depth 0.00 m
Downstream W/L 104.00 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	105.33	1.15	16.44	0.23	9.00	OK

Subdrainage Area: UNC-1 Uncontrolled - Non-Tributary
Area (ha): 0.03
C: 0.39

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	3.77	3.77		
20	70.25	2.54	2.54		
30	53.93	1.95	1.95		
40	44.18	1.60	1.60		
50	37.65	1.36	1.36		
60	32.94	1.19	1.19		
70	29.37	1.06	1.06		
80	26.56	0.96	0.96		
90	24.29	0.88	0.88		
100	22.41	0.81	0.81		
110	20.82	0.75	0.75		
120	19.47	0.70	0.70		

Subdrainage Area: UNC-2 Uncontrolled - Non-Tributary
Area (ha): 0.00
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	0.28	0.28		
20	70.25	0.19	0.19		
30	53.93	0.14	0.14		

Project #160401667, 971 Montreal Road
Modified Rational Method Calculatons for Storage

110	35.20	1.70	1.70	0.00	**0.00**
120	32.89	1.59	1.59	0.00	**0.00**

Cistern
Contributing Subcatchment Areas: BLDG, RAMP, CB-1, CB-2

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	29.76	16.44	13.32	7.99
20	119.95	21.61	16.44	5.17	6.20
30	91.87	17.69	16.44	1.25	2.24
40	75.15	15.34	15.34	0.00	**0.00**
50	63.95	13.75	13.75	0.00	**0.00**
60	55.89	12.59	12.59	0.00	**0.00**
70	49.79	11.70	11.70	0.00	**0.00**
80	44.99	11.00	11.00	0.00	**0.00**
90	41.11	10.42	10.42	0.00	**0.00**
100	37.90	9.93	9.93	0.00	**0.00**
110	35.20	9.51	9.51	0.00	**0.00**
120	32.89	9.15	9.15	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 85.00 mm
Invert Elevation 104.18 m
Top of Cistern Elevation 105.33 m
Max Ponding Depth 0.00 m
Downstream W/L 104.00 m

	Stage (m)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	105.33	1.15	16.44	7.99	9.00	OK
					1.01	

Subdrainage Area: UNC-1 Uncontrolled - Non-Tributary
Area (ha): 0.03
C: 0.49

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	8.08	8.08		
20	119.95	5.43	5.43		
30	91.87	4.16	4.16		
40	75.15	3.40	3.40		
50	63.95	2.89	2.89		
60	55.89	2.53	2.53		
70	49.79	2.25	2.25		
80	44.99	2.04	2.04		
90	41.11	1.86	1.86		
100	37.90	1.72	1.72		
110	35.20	1.59	1.59		
120	32.89	1.49	1.49		

Subdrainage Area: UNC-2 Uncontrolled - Non-Tributary Ok
Area (ha): 0.00
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	0.59	0.59		
20	119.95	0.40	0.40		
30	91.87	0.30	0.30		

Project #160401667, 971 Montreal Road
Roof Drain Design Sheet, Area BLDG
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0016	0	0.025	20	0	0	0.025
0.050	0.0006	0.0032	1	0.050	78	1	1	0.050
0.075	0.0007	0.0035	4	0.075	176	3	4	0.075
0.100	0.0008	0.0039	10	0.100	312	6	10	0.100
0.125	0.0009	0.0043	20	0.125	488	10	20	0.125
0.150	0.0009	0.0047	35	0.150	703	15	35	0.150

Rooftop Storage Summary

Total Building Area (sq.m)		878.6
Assume Available Roof Area (sq.m)	80%	702.88
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		5
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		35
Estimated 100 Year Drawdown Time (h)		2.1

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

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.004	0.005	-
Depth (m)	0.109	0.146	0.150
Volume (cu.m)	14.0	32.9	35.1
Draintime (hrs)	1.0	2.1	

C.3 RVCA CORRESPONDENCE

From:	Jamie Batchelor
To:	Rathnasooriya, Thakshika
Subject:	RE: Quality Control Requirements - 971 Montreal Road, Ottawa
Date:	Tuesday, June 15, 2021 10:00:12 PM

Good Evening Shika,

I have reviewed the storm sewer layer, and it would appear that the downstream outlet to the river is over 2 km. If my interpretation is correct, then we would not require any additional on-site water quality treatment as the distance to the downstream outlet would be significant enough that additional on-site water quality measures would have a negligible impact. We would however, encourage the incorporation of LID measures on-site.

Jamie Batchelor, MCIP, RPP
Planner, ext. 1191
Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority

3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 **F** 613-692-0831 | www.rvca.ca

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From: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Sent: Tuesday, June 15, 2021 1:12 PM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Subject: Quality Control Requirements - 971 Montreal Road, Ottawa

Hi Jamie,

We've been retained to help develop a 78 unit apartment building at 971 Montreal Road in Ottawa. The site currently used as a commercial site. The proposed development will include an apartment building covering majority of the property, and a proposed driveway for 10 parking spaces on the ground floor fully covered by the eight floors cantilevered above.

We are looking to confirm if quality control measures are required on-site. The proposed building includes a flat roof which will store and discharge stormwater into a cistern and ultimately into the 225mm diameter storm sewer within Montreal Road. We understand that rooftop runoff is considered clean water and does not require further water quality treatment. Please review the site servicing plan attached and confirm if quality treatment is required for the site. If you need any other information feel free to call.

Thank you,

Shika Rathnasooriya , P.Eng.

Direct: 613-668-9635
Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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Appendix D GEOTECHNICAL INVESTIGATION

Kollaard Associates
Engineers

210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923

FAX: (613) 258-0475

REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
971 MONTREAL ROAD
CITY OF OTTAWA, ONTARIO

Project # 200543

Submitted to:

Développements Proximi-T Inc.
3500 Atwater, Suite 6
Montreal, Quebec
H3H 1Y5

DISTRIBUTION

2 copy - Développements Proximi-T Inc.
1 copy - Kollaard Associates Inc.

July 31, 2020

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Engineers
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P.O. Box 189
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July 31, 2020 200543

Développements Proximi-T Inc.
3500 Atwater, Suite 6
Montreal, Quebec
H3H 1Y5

RE: GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
971 MONTREAL ROAD
CITY OF OTTAWA, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for a proposed residential development to be located at 971 Montreal Road, in the City of Ottawa, Ontario. The proposed development will consist of a nine storey residential apartment building having some 82 units. The proposed building will be provided with one storey of underground parking.

The purpose of the investigation was to:

- Identify the subsurface conditions at the site by means of a limited number of boreholes;
- Based on the factual information obtained, provide recommendations and guidelines on the geotechnical engineering aspects of the project design; including bearing capacity and other construction considerations, which could influence design decisions.

2.0 BACKGROUND INFORMATION AND SITE GEOLOGY

2.1 Existing Conditions and Site Geology

The subject site for this assessment consists of about a 0.18 hectare (0.44 acres) rectangular shaped property located on the north side of Montreal Road, about 932 metres west of the intersection of Montreal Road and Blair Road, in the City of Ottawa, Ontario (see Key Plan, Figure 1).

Professional Engineers Ontario
Authorized by the Association of Professional Engineers of Ontario to offer professional engineering services.

For the purposes of this assessment, project north lies in a direction perpendicular to Montreal Road which is located immediately south of the subject site.

The subject site is bordered on the east and west by commercial development, on the south by Montreal Road followed by high density residential development and on the north by light industrial development. The site is currently occupied by a commercial development consisting of a Chinese Restaurant – (Dragon Restaurant) with a second floor apartment.

The ground surface at the site is graded such that surface water drains from the front of the building towards Montreal Road and then to the west and from the west and north side of the building toward the northwest corner of the subject site.

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by a thin veneer of glacial till followed by bedrock. Bedrock geology maps indicated that the bedrock underlying the site consists of limestone with some shaly partings of the Ottawa Formation.

The ground surface elevations at the borehole locations were determined and provided by CM3 Environmental as the geotechnical investigation was completed in conjunction with a Phase II Environmental Site Assessment at the site.

2.2 Proposed Development

It is understood that plans are being prepared for the construction of an 82 unit, nine storey residential apartment building with a proposed building footprint of approximately 720 square metres and one storey of underground parking with approximately 42 parking spaces. The apartment building will be serviced by municipal water and sanitary site services. It is understood that the apartment building will be of concrete construction with conventional concrete spread footing foundations and concrete floor slab.

The proposed apartment building will be provided with an asphaltic concrete surfaced access roadway and a ramp to the underground parking.

Surface drainage for the proposed building will be by means of swales, catch basins and storm sewers.

3.0 PROCEDURE

The field work for this investigation was carried out on July 10, 2020, at which time three boreholes/coreholes, numbered BH1, BH2 and BH3 were put down at the site. The three boreholes were put down within the building footprint. The boreholes were put down using a truck mounted drill rig equipped with a hollow stem auger owned and operated by George Downing Estate Drilling of Hawkesbury, Ontario.

The subsurface soil conditions encountered at the boreholes were classified based on visual and tactile examination of the samples recovered (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and the results of the standard penetration tests. The soils were classified using the Unified Soil Classification System. Groundwater conditions at the test holes were noted at the time of the field work. A standpipe was installed at each of the borehole locations for subsequent ground water level monitoring and for the Phase II Environmental Site Assessment being carried out by CM3 Environmental.

No samples were submitted for physical or chemical laboratory testing as only small amounts of fill samples were recovered from each of the boreholes overlying shallow bedrock.

Based on known shallow bedrock conditions at the site, it was expected that some bedrock hoe-ramming will be required in order to achieve the proposed underside of footing elevation for the underground parking for the proposed apartment building and for the installation of the site services. Accordingly, the bedrock was cored at all three boreholes using diamond drilling procedures.

Any soil samples from the boreholes, where possible, were recovered from cuttings of the boreholes. The soil samples were classified on site, placed in a sealed plastic bag and transported to our laboratory. Rock samples from all three boreholes BH1, BH2 and BH3 were recovered using a core barrel. The rock samples were classified on site, placed in wooden and hard cardboard core boxes and transported to our laboratory. The rock cores are shown as RC on the Record of Borehole sheets.

Diamond drilling was carried out in all of the boreholes to determine the nature and quality of the bedrock. The recovery value and the rock quality designation value (RQD) were calculated for the drilled section (core run) of bedrock. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section (core run). The RQD value is the ratio, in percentage, of the total length of sound rock pieces longer than 100 millimetre in one core run over the length of the core run. Both values are indicative of the quality of the bedrock.

The field work was supervised throughout by a member of our engineering staff who located the boreholes in the field, logged the subsurface conditions encountered and cared for the samples obtained. A description of the subsurface conditions encountered at the boreholes is given in the attached Record of Borehole sheets following this report. The approximate locations of the boreholes are shown on the attached Site Plan, Figure 2.

The location of the boreholes were identified in the field by paint marks and the ground surface elevations were provided by CM3 Environmental.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, a description of the subsurface conditions encountered at the test holes are provided in the attached Record of Borehole Sheets. The test hole logs indicate the subsurface conditions at the specific test hole locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than test hole locations may vary from the conditions encountered at the test holes.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification was in general completed by visual-manual procedures in accordance with ASTM 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). No soil samples were submitted to a laboratory as only limited amounts of fill materials and/or a thin veneer of glacial till (BH3) were recovered from the boreholes followed by shallow bedrock at all of the test hole locations. The soils were classified in the field based on visual and tactile inspection (ASTM D2488).

Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and on the date the observations were noted in the report and on the test hole logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The following is a brief overview of the subsurface conditions encountered at the site during the site visit.

4.2 Fill

Fill materials were encountered from the surface at all three boreholes and ranged in thickness from about 0.2 to 3.05 metres. The fill materials were observed to consist of asphaltic concrete followed by grey crushed stone, then by grey brown sand, some gravel, topsoil/organics and a trace of clay and brick. The fill material was fully penetrated at all three borehole locations.

4.3 Topsoil

At borehole BH3, about a 0.5 metre thickness of black topsoil with a trace of sand and gravel was encountered below the fill materials. The material was classified as topsoil based on colour and the presence of organic materials and is intended as identification for geotechnical purposes only and does not constitute a statement as to the suitability of this layer for cultivation and sustaining plant growth.

4.4 Glacial Till

A thin deposit of glacial till was encountered beneath the fill materials and topsoil at borehole BH3. The glacial till consisted of gravel, cobbles and boulders, in a matrix of grey silty sand/sandy silt with a trace of silty clay. The results of standard penetration testing carried out in the glacial till material, which range from 37 to 50 blows per 0.3 metres, indicating a dense to very dense state of packing. Practical refusal on the surface of a large boulder was encountered at about 0.7 metres below the existing ground surface. Recovery within the spoon was poor and most of the sample was lost due to the boulders encountered within the borehole. Practical refusal for advancement on the surface of bedrock was encountered at about 2.72, 3.05, and 1.37 metres, respectively, below the existing ground surface for boreholes BH1, BH2 and BH3.

4.5 Bedrock

As indicated above, bedrock was encountered at all three of the boreholes at about 2.72, 3.05, and 1.37 metres, respectively. All of the boreholes were extended by coring to verify the quality of the upper bedrock.

The boreholes were continued into the bedrock using diamond coring to depths of about 7.16, 7.19 and 6.13 metres below the existing ground surface. A visual assessment of the bedrock indicated that the bedrock is grey limestone. The total core run length in each borehole was 4.44, 4.14 and 4.76 metres, respectively for boreholes, BH1, BH2 and BH3. Fracturing of the core samples is mostly along near horizontal bedding planes.

A measure of the condition of the bedrock core obtained from the boreholes can be represented as a percentage of Total Core Recovery (T.C.R.), Solid Core Recovery (S.C.R.) and Rock Quality Designation (R.Q.D.). There was no measurable amount of core lost during recovery of the bedrock giving a T.C.R. value of 100 percent.

The S.C.R. average value for the cores is about 96.9 percent.
From the bedrock surface to about 1.5 metres below the bedrock surface the S.C.R. = 95 percent.
Between 1.5 and 3.0 metres below the bedrock surface the S.C.R. = 95.9 percent.
Between 3.0 and 4.5 metres below the bedrock surface the S.C.R. = 100 percent

The R.Q.D. values for the cores vary as follows:

From the bedrock surface to 1.5 metres below the bedrock surface the R.Q.D = 90 to 92.5 percent.

Between 1.5 and 3.0 metres below the bedrock surface the R.Q.D = 73 to 90 percent.

Between 3.0 and 6.1 metres below the bedrock surface the R.Q.D = 93 to 100 percent.

Using the classification table, the R.Q.D. index for the rock mass can be classified as fair to excellent (R.Q.D. = 73 to 100%).

4.6 Groundwater

On July 16, 2020, groundwater was measured in standpipes installed in all three boreholes below the existing ground surface as follows (elevations are referenced to a local datum):

Borehole	Ground Surface Elevation (m)	Ground Water Elevation (m)	Depth to Groundwater (m)
BH1	100.89	96.57	4.32
BH2	100.07	96.70	3.37
BH3	100.00	95.95	4.05

It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the information from the test holes and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from offsite sources are outside the terms of reference for this report.

5.2 Foundations for Proposed Residential Apartment Building

With the exception of the topsoil and fill materials**,** the subsurface conditions encountered within the test holes are suitable for the support of the proposed apartment building with underground parking on conventional spread footing foundations. Excavations for the proposed foundations should be taken through the topsoil, fill materials and glacial till to expose the bedrock subgrade.

5.2.1 Proposed Apartment Building

It is suggested that the building be founded either directly on the underlying bedrock or on engineered fill placed on the underlying bedrock. The underside of footing can be stepped as necessary to facilitate placement on the bedrock.

The foundation of the proposed apartment building with a parking structure foundation may be placed on conventional pad and strip footings. A maximum allowable bearing pressure of 2000 kilopascals using serviceability limit states design and a factored ultimate bearing resistance of 4000 kilopascals using ultimate limit states design may be used for the design of conventional strip or pad footings, a minimum of 0.6 metres in width, founded on sound bedrock. Sound bedrock consists of a hard relatively level bedrock surface free of loose material, rock shatter and fractured rock.

No maximum allowable landscape grade raise adjacent to the proposed building foundation is required. Total and differential settlement of the footings for the apartment building designed and founded based on the above guidelines should be less than 15 millimetres and 10 millimetres, respectively.

The subgrade surfaces should be inspected and approved by geotechnical personnel prior to placement of any engineered fill.

5.3 Engineered Fill below Building Foundation

It is not recommended that the footings be placed on both bedrock and engineered fill or native glacial till at different locations in the building. As such engineered fill below the footing is not recommended. Should the bedrock surface be below the proposed underside of footing elevation, it is recommended that the bedrock subgrade be raised to the proposed underside of footing using a concrete sub-footing or that the foundation walls be extended.

5.4 Frost Protection Requirements for Spread Footing Foundations

Part 4 of the Ontario Building code indicates that the depth of foundation shall be below the level of potential damage including damage from frost action with that provision that the bearing surface need not be below the level of potential frost (Part 4.2.4.4 (2)) where the foundation overlies material not susceptible to frost action.

Where the proposed building foundations are placed on sound bedrock or on engineered fill over bedrock, the subgrade materials would be considered to be non susceptible to frost action and no frost protection for the foundations is required.

5.5 Foundation Wall Backfill and Drainage

To prevent possible foundation frost jacking, the backfill against unheated walls or isolated walls or piers should consist of the free draining, non-frost susceptible material such as sand or sand and gravel meeting OPSS Granular B Type I grading requirements. Alternatively, foundations could be backfilled with native material in conjunction with the use of an approved proprietary drainage layer system against the foundation wall. It is pointed out that there is potential for possible frost jacking of the upper portion of some types of these drainage layer systems if frost susceptible material is used as backfill. This could be mitigated by backfilling the upper approximately 0.6 metres with non-frost susceptible granular material.

A conventional, perforated perimeter drain, with a 150 millimetre surround of 20 millimetre minus crushed stone, should be provided at the founding level for the basement floor parking area and should lead by gravity flow to a sump to reduce the potential for buildup of hydrostatic pressure below the parking garage floor. The sump should be equipped with a backup pump and generator. The under floor drains should be placed beginning at the inside edge of the foundation wall and should be spaced a maximum of 5 metres apart. The under floor drain should also be directed to the sump. The sump discharge should be equipped with a backup flow protector.

It is considered that in view of the groundwater conditions observed at the boreholes, the above perimeter drainage system should adequately handle any groundwater seepage to the basement or elevator pit.

The basement foundation walls should be designed to resist the earth pressure, P, acting against the walls at any depth, h, calculated using the following equation.

$$P = k_0 (\gamma h + q)$$

Where:

P	=	the pressure, at any depth, h, below the finished ground surface
k_0	=	earth pressure at-rest coefficient, 0.5
γ	=	unit weight of soil to be retained, estimated at 22 kN/m^3
q	=	surcharge load (kPa) above backfill material
h	=	the depth, in metres, below the finished ground surface at which the pressure, P, is being computed

This expression assumes that the water table would be maintained at the founding level by the above mentioned foundation perimeter drainage and backfill requirements.

Where the backfill material will ultimately support a pavement structure or walkway, it is suggested that the foundation wall backfill material be compacted in 250 millimetre thick lifts to 95 percent of the standard Proctor dry density value. In that case any native material proposed for foundation backfill should be inspected and approved by the geotechnical engineer.

5.6 Building Structure Floor Slab

For predictable performance of the proposed concrete floor slab any existing topsoil, fill materials, soft or loose and any deleterious material should be removed from below the proposed floor slab area. The exposed native sub-grade surface should then be inspected and approved by geotechnical personnel. Should complete removal of all deleterious material result in a subgrade below the concrete floor structure, the subgrade can be built up using engineered fill.

The engineered fill materials beneath the proposed concrete floor slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting OPSS Granular A immediately beneath the concrete floor slab followed by sand, or sand and gravel meeting the OPSS for Granular B Type I, or crushed stone meeting OPSS grading requirements for Granular B Type II, or other material approved by the Geotechnical Engineer. The fill materials should be compacted in maximum 300 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density. Alternatively clear crushed 20 mm minus stone could be used immediately below the concrete floor slab provided the clear stone is well compacted prior to concrete placement.

The concrete floor slab should be saw cut at regular intervals to minimize random cracking of the slab due to shrinkage of the concrete. The saw cut depth should be about one quarter of the thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding the lesser of 25 times the slab thickness or 4.5 metres. The slab should be cut as soon as it is possible to work on the slab without damaging the surface of the slab.

5.7 Seismic Design for the Proposed Apartment Building

For seismic design purposes, in accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class B Rock. The subsurface conditions below the proposed footing design level consists of a thin veneer of glacial till over bedrock at a depth of about 1.4 to 2.7 metres. As indicated above, the bedrock is sound at a depth of 1.5 metres below the bedrock surface with an RQD of 73 to 90 percent. The bedrock consists of limestone.

5.8 National Building Code Seismic Hazard Calculation

The design Peak Ground Acceleration (PGA) for the site was calculated as 0.287 with a 2% probability of exceedance in 50 years based on the interpolation of the 2015 National Building Code Seismic Hazard calculation. The results of the test are attached following the text of this report.

5.9 Potential for Soil Liquefaction

As indicated above, the results of the boreholes indicate that the site is underlain by a thin veneer of glacial till overlying shallow bedrock and/or fill materials overlying shallow bedrock. As such, it is considered that no damage to the proposed residential building should occur due to liquefaction of the bedrock under seismic conditions.

5.9.1 Dewatering of Foundation Excavation

Bedrock was encountered at about 1.4 to 2.7 metres below the existing ground surface. On July 16, 2020, groundwater was measured in the standpipes placed within the boreholes by CM3 Environmental professional staff at about 4.3, 3.4 and 4.1 metres in boreholes BH1, BH2 and BH3, respectively, below the existing ground surface on July 16, 2020. The ground water level encountered corresponds to about 1.6, 0.3 and 2.7 metres, respectively, below the surface of the bedrock.

The excavation for the proposed building will be extended one storey below the existing ground surface and into the bedrock subgrade. Adjacent buildings will be either founded either on bedrock or on a relatively thin overburden layer above the bedrock above the ground water level.

Since the groundwater level is below the surface of the bedrock, lowering the groundwater level will not result in settlement as bedrock is not susceptible to shrinking and settling due to groundwater lowering.

Any groundwater inflow from the overburden deposits into the excavations should be controlled by pumping from filtered sumps within the excavations. There are no settlement concerns to the adjacent dwellings and other buildings due to groundwater removal from the foundation excavation at this site.

Based on the results of the boreholes, we do not expect significant groundwater inflow into the excavation for the proposed development. However, if groundwater is encountered during excavation for the proposed services or building foundation, a Permit to Take Water (PTTW) may be required for pumping rates exceeding 400,000 Litres/day. If groundwater is encountered, at minimum, registration on the Environmental Activity Sector Registry (EASR) as per O.Reg. 63/16 is expected to be required.

6.0 SITE SERVICES

6.1 Excavation

The excavations for the site services will be carried out through fill materials, topsoil, a thin layer of glacial till and/or bedrock. The sides of the excavations in overburden materials should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Ontario Occupational Health and Safety Act.

For the purposes of Ontario Regulation 213/91, the subsurface conditions at the site can be considered to be Soil Type 1. Work within an excavation in the bedrock should follow the requirements of Ontario Regulation 213/91 in particular O.Reg 213/91 S230 – S233. Excavation walls within bedrock may be made near vertical.

It is expected that bedrock will be encountered during excavating for site services. Small amounts of bedrock removal, can most likely be carried out by hoe ramming and heavy excavating equipment. Where larger amounts of bedrock removal are required it may be more economically feasible to use drill and blasting techniques which should be carried out under the supervision of a blasting specialist engineer. Monitoring of the blasting should be carried out throughout the blasting period to ensure that the blasting meets the limiting vibration criteria established by the specialist engineer. Pre-blast condition surveys of nearby structures and existing utilities are essential. It is also considered that were large amounts of bedrock are removed by hoe ramming, the hoe ramming could also introduce significant vibrations through the bedrock. A such it is considered that pre-excavation surveys of nearby structures and existing utilities should also be completed before extensive hoe ramming.

6.2 Pipe Bedding and Cover Materials

It is suggested that the service pipe bedding material consist of at least 150 millimetres of granular material meeting OPSS requirements for Granular A. A provisional allowance should, however, be made for sub-excavation of any existing fill or disturbed material encountered at sub-grade level. Granular material meeting OPSS specifications for Granular B Type II could be used as a sub-bedding material. The use of clear crushed stone as bedding or sub-bedding material should not be permitted.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A or Granular B Type I (with a maximum particle size of 25 millimetres).

The sub-bedding, bedding and cover materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

6.3 Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future roadway areas, acceptable native materials should be used as backfill between the roadway sub-grade level and the depth of seasonal frost penetrations (i.e. 1.8 metres below finished grade) in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent section of roadway. Where native material consists of bedrock, Granular A or Granular B Type 2 may be used for backfill.

Any wet materials that cannot be compacted to the required density should either be wasted from the site or should be used outside of existing or future roadway areas. Any boulders larger than 300 millimetres in size should not be used as service trench backfill. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. If the native material is not suitable for backfill, imported granular material may have to be used. If imported granular materials are used, suitable frost tapers should be used OPSD 802.013.

To minimize future settlement of the backfill and achieve an acceptable sub-grade for the roadways, sidewalks, etc., the trench should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The specified density may be reduced where the trench backfill is not located or in close proximity to existing or future roadways, driveways, sidewalks, or any other type of permanent structure.

7.0 ACCESS ROADWAY AND PARKING LOT PAVEMENTS

7.1 Subgrade Preparation

In preparation for pavement construction at this site any fill and topsoil and any soft, wet or deleterious materials should be removed from the proposed access roadway and parking lot area. The exposed subgrade surface should then be proof inspected and approved by geotechnical personnel. Any soft or unacceptable areas evident should be subexcavated and replaced with suitable earth borrow material. The subgrade should be shaped and crowned to promote drainage of the roadway and parking area granulars. Following approval of the preparation of the subgrade, the pavement granulars may be placed.

For any areas of the site that require the subgrade to be raised to proposed roadway and parking area subgrade level, the material used should consist of OPSS select subgrade material or OPSS Granular B Type I or Type II. Materials used for raising the subgrade to proposed roadway and parking area subgrade level should be placed in maximum 300 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

7.2 Access Roadway Pavements

In preparation for pavement construction at this site the topsoil and any soft, wet or deleterious materials should be removed from the proposed access roadway area. The exposed sub-grade should be inspected and approved by geotechnical personnel and any soft areas evident should be sub-excavated and replaced with suitable earth borrow approved by the geotechnical engineer. The sub-grade should be shaped and crowned to promote drainage of the roadway area granular. Following approval of the preparation of the sub-grade, the pavement granular may be placed.

For any areas of the site that require the sub-grade to be raised to proposed roadway area sub-grade level, the material used should consist of OPSS select sub-grade material or OPSS Granular B Type I or Type II. Materials used for raising the sub-grade to proposed roadway area sub-grade level should be placed in maximum 300 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

For pavement areas subject to cars and light trucks the pavement should consist of:

50 millimetres of Superpave 12.5 asphaltic concrete or hot mix asphalt concrete (HL3) over
150 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase
(50 or 100 millimetre minus crushed stone)

Performance grade PG 58-34 asphaltic concrete should be specified.

Compaction of the granular pavement materials should be carried out in maximum 300 millimetre thick loose lifts to 100 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

The above pavement structures will be adequate on an acceptable sub-grade, that is, one where any roadway fill and service trench backfill has been adequately compacted. If the roadway sub-grade is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or incorporate a non-woven geotextile separator between the roadway sub-grade surface and the granular subbase material.

8.0 CONSTRUCTION CONSIDERATIONS

It is suggested that the final design drawings for the project, including the proposed site grading plan, be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended and to re-evaluate the guidelines provided in the report with respect to the actual project plans. Items such as actual foundation wall/column loads, whether or not the basement or below grade parking structure is heated, etc could have significant impacts on foundation type, frost protection requirements, etc.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed development do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

All foundation areas and any engineered fill areas for the proposed apartment building should be inspected by Kollaard Associates Inc. to ensure that a suitable sub-grade has been reached and properly prepared.

The placing and compaction of any granular materials to support the concrete floor slab and within the access roadway pavement structure should be inspected to ensure that the materials used conform to the grading and compaction specifications.

The sub-grade for the site services should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the service pipe bedding and backfill, and the access roadway granular materials to ensure the materials meet the specifications from a compaction point of view.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Regards,
Kollaard Associates Inc.

LICENSED PROFESSIONAL ENGINEER
5.Aug.2020
S.E. deWit
100079612
PROVINCE OF ONTARIO

Dean Tataryn, B.E.S., EP.

Steve DeWit, P.Eng.

RECORD OF BOREHOLE BH1

PROJECT: Proposed Residential Development
CLIENT: Developpments Proximi-T Inc.
LOCATION: 971 Montreal Road, Ottawa, ON
PENETRATION TEST HAMMER: N/A

PROJECT NUMBER: 200543
DATE OF BORING: July 10, 2020
SHEET 1 of 1
DATUM: Geodetic

DEPTH SCALE (meters)	DESCRIPTION	ELEV. DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m
	Ground Surface	100.89			
0	ASPHALTIC CONCRETE	0.00			
	Grey crushed stone (FILL)		1	SS	8
	Sand, gravel, organics, trace clay (FILL)				
1			2	SS	6
			3	SS	3
2			4	SS	3
		98.17	5	SS	50
	Advanced corehole through Limestone BEDROCK	2.72			
3			1	RC	
4					
5			2	RC	
6			3	RC	
7		93.73			
	End of corehole in Limestone BEDROCK	7.16			
8					

UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80

REM. SHEAR STRENGTH ○ Cu, kPa ○ 20 40 60 80

DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90

ADDITIONAL LAB TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Water measured in borehole by CM3 Environmental at approximately 4.3 metres below existing ground surface on July16, 2020.

DEPTH SCALE: 1 to 50
BORING METHOD: Coring
AUGER TYPE: NQ Core Barrel
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH2

PROJECT: Proposed Residential Development
CLIENT: Developpments Proximi-T Inc.
LOCATION: 971 Montreal Road, Ottawa, ON
PENETRATION TEST HAMMER: N/A

PROJECT NUMBER: 200543
DATE OF BORING: July 10, 2020
SHEET 1 of 1
DATUM: Local

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (M)
	Ground Surface	100.07
0	ASPHALTIC CONCRETE	0.00
	Grey crushed stone (FILL)	
	Sand, gravel, topsoil, organics, trace brick, clay (FILL)	
3	Advanced corehole through Limestone BEDROCK	97.02 3.05
7	End of corehole in Limestone BEDROCK	92.88 7.19

SAMPLES: NUMBER	TYPE	BLOWS/0.3m
1	SS	26
2	SS	11
3	SS	9
4	SS	9
5	SS	50
1	RC	
2	RC	
3	RC	

UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80

REM. SHEAR STRENGTH ○ Cu, kPa ○ 20 40 60 80

DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90

ADDITIONAL LAB TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Water measuredin borehole by CM3 Environmental at approximately 3.4 metres below existing ground surface on July16, 2020.

DEPTH SCALE: 1 to 50
BORING METHOD: Coring
AUGER TYPE: NQ Core Barrel
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH3

PROJECT: Proposed Residential Development
CLIENT: Developpments Proximi-T Inc.
LOCATION: 971 Montreal Road, Ottawa, ON
PENETRATION TEST HAMMER: N/A

PROJECT NUMBER: 200543
DATE OF BORING: July 10, 2020
SHEET 1 of 1
DATUM: Local

DEPTH SCALE (meters)	DESCRIPTION	ELEV. DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa 20 40 60 80 / REM. SHEAR STRENGTH ○ Cu, kPa 20 40 60 80	DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	100.00							
0	ASPHALTIC CONCRETE	0.00							
	Grey crushed stone (FILL)		1	SS	10				
	TOPSOIL, trace sand and gravel, practical refusal on large boulder	99.34							
	Grey brown silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)	0.66	2	SS	37				
1		98.63	3	SS	50				
	Advanced corehole through Limestone BEDROCK	1.37	1	RC					
2			2	RC					
3			3	RC					
6		93.87							
	End of corehole in Limestone BEDROCK	6.13							Water measured in borehole by CM3 Environmental at approximately 4.1 metres below existing ground surface on July16, 2020.

DEPTH SCALE: 1 to 50
BORING METHOD: Coring
AUGER TYPE: NQ Core Barrel
LOGGED: DT
CHECKED: SD

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
MS manual sample
RC rock core
ST slotted tube .
TO thin-walled open Shelby tube
TP thin-walled piston Shelby tube
WS wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance, N

The number of blows by a 63.5 kg hammer dropped 760 millimeter required to drive a 50 mm drive open sampler for a distance of 300 mm. For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

Dynamic Penetration Resistance

The number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

WH

Sampler advanced by static weight of hammer and drill rods.

WR

Sampler advanced by static weight of drill rods.

PH

Sampler advanced by hydraulic pressure from drih rig.

PM

Sampler advanced by manual pressure.

SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH sieve and hydrometer analysis
U unconfined compression test
Q undrained triaxial test
V field vane, undisturbed and remolded shear strength

SOIL DESCRIPTIONS

Relative Density	'N' Value
Very Loose	0 to 4
Loose	4 to10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

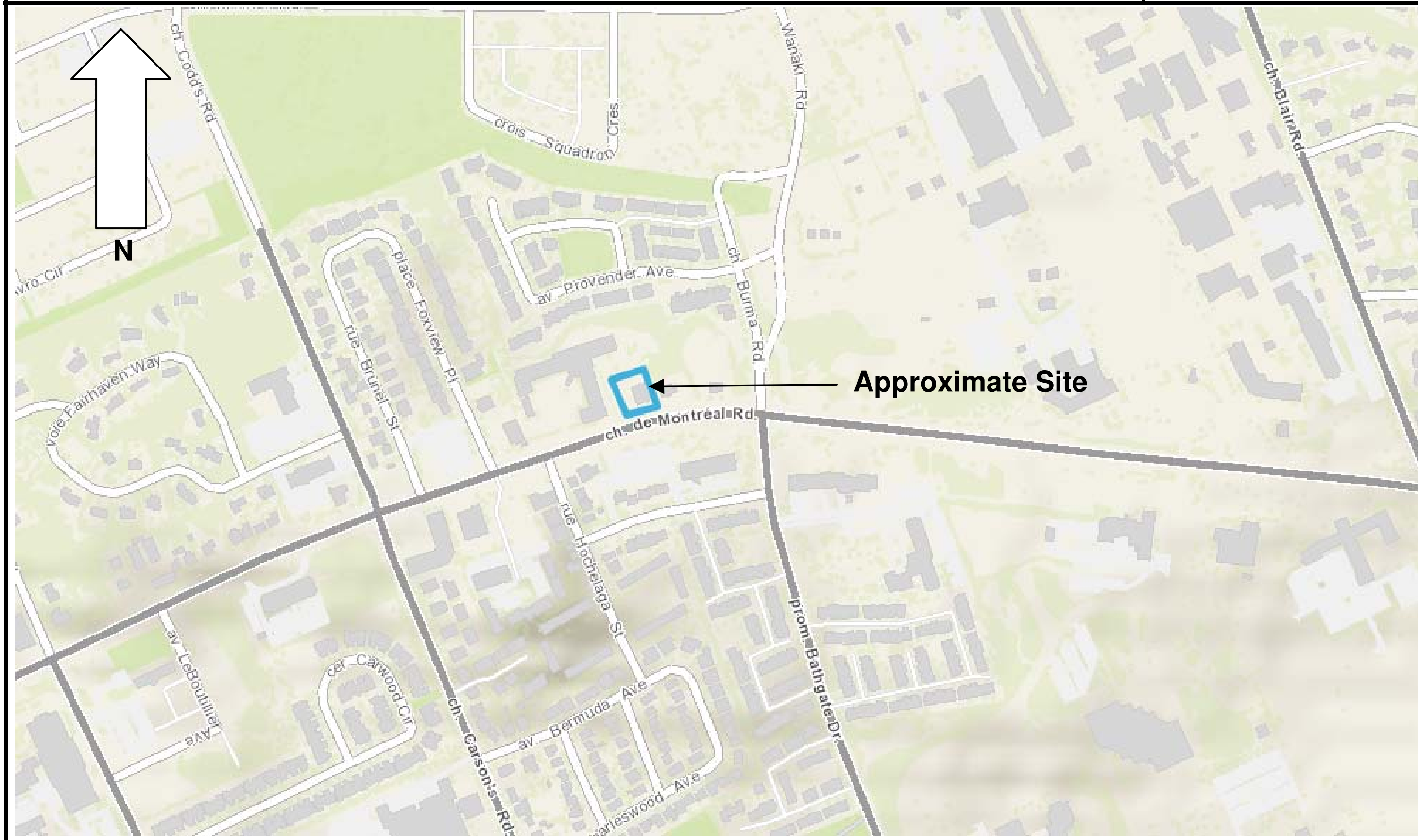
Consistency	Undrained Shear Strength (kPa)
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to100
Very Stiff	over100

LIST OF COMMON SYMBOLS

c_u undrained shear strength
e void ratio
C_c compression index
C_v coefficient of consolidation
k coefficient of permeability
I_p plasticity index
n porosity
u pore pressure
w moisture content
w_L liquid limit
w_p plastic limit
ϕ' effective angle of friction
γ unit weight of soil
γ' unit weight of submerged soil
σ normal stress

KEY PLAN

FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 200543

Date July 2020

DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY CITY OF OTTAWA EMAPS.

SPECIAL NOTE: THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

REV.	NAME	DATE	DESCRIPTION

Kollaard Associates
Engineers
PO, BOX 189, 210 PRESCOTT ST
KEMPTVILLE ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT:
DEVELOPMENTS PROXIMI-T INC.

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

LOCATION:
971 MONTREAL ROAD
CITY OF OTTAWA, ONTARIO

DESIGNED BY: --	*DATE:* JULY 10, 2020
DRAWN BY: DT	*SCALE:* N.T.S

KOLLAARD FILE NUMBER:
200543

ATTACHMENT A

National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

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

Site: 45.448N 75.627W **User File Reference:** 971 Montreal Road, Ottawa 2020-07-21 18:22 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.459	0.254	0.153	0.045
Sa (0.1)	0.535	0.307	0.191	0.062
Sa (0.2)	0.448	0.260	0.164	0.056
Sa (0.3)	0.340	0.199	0.126	0.044
Sa (0.5)	0.241	0.141	0.089	0.031
Sa (1.0)	0.119	0.070	0.045	0.015
Sa (2.0)	0.057	0.033	0.021	0.006
Sa (5.0)	0.015	0.008	0.005	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.287	0.167	0.104	0.033
PGV (m/s)	0.200	0.112	0.069	0.022

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

References

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

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

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

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

Appendix E DRAWINGS