138 Forward Avenue – Stormwater Management and Servicing Report

Stantec Project No.
160401680

December 22, 2021

Prepared for:

VIKA Land Development Group Inc.

Prepared by:

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. has been commissioned by VIKA Land Development group Inc. to prepare the following servicing and stormwater management report in support of a site plan control application for the proposed development located at 138 Forward Avenue in the city of Ottawa.

The current site measures 0.05 ha and currently zoned R4UD. It contains a two-storey building, driveway and surface parking. The site is bounded by Forward Avenue to the east, and existing developments on the north, south, and west (see **Figure 1** below).

Figure 1: Key plan of site

The proposed development consists of a four-storey apartment building with a basement level, consisting of 18 residential units. The proposed building will include 4 one-bedroom, 4 bachelor, and 10 two-bedroom apartment units with a mechanical room located in the basement. Susan D. Smith Architect has prepared a draft site plan dated January 2021 to support the proposed development (see **Appendix B**).

1.1 OBJECTIVE

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

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

- Prepare a grading plan in accordance with the proposed site plan and existing grades.
- Storm Sewer Servicing
    - Define major and minor conveyance systems in conjunction with the proposed grading plan
    - Determine the stormwater management storage requirements to meet the allowable release rate for the site
    - Define and size the proposed storm service lateral that will be connected to the existing 300 mm diameter storm sewer on Forward Avenue.
- Wastewater Servicing
    - Define and size the sanitary service lateral which will be connected to the existing 250 mm diameter sanitary on Forward Avenue.
- Water Servicing
    - Estimate water demands to characterize the proposed feed for the proposed development which will be serviced from the existing 203 mm diameter watermain on Forward Avenue.
    - Watermain servicing for the development is to be able to provide average day and maximum day (including peak hour) demands (i.e., non-emergency conditions) at pressures within the acceptable range of 50 to 80 psi (345 to 552 kPa).
    - Under fire flow (emergency) conditions, the water distribution system is to maintain a minimum pressure greater than 20 psi (140 kPa).

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

2.0 BACKGROUND

Documents referenced in preparation of this stormwater and servicing report for 138 Forward Avenue development include:

- *City of Ottawa Sewer Design Guidelines (SDG),* City of Ottawa, October 2012, including all subsequent technical bulletins.
- *City of Ottawa Design Guidelines – Water Distribution,* City of Ottawa, July 2010, including all subsequent technical bulletins.
- *Water Supply for Public Fire Protection,* Fire Underwriters Survey (FUS), CGI Group Inc, 1999.
- *Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code*, Office of the Fire Marshal (OFM), October 1999.
- *Geotechnical Investigation – Report PG6026-1*, Paterson Group Inc., November 2021.

3.0 WATER SERVICING

3.1 BACKGROUND

The proposed building is located in Pressure Zone 1W of the City of Ottawa's Water Distribution System. It will be serviced via a 150mm building service connection to the existing 203 mm diameter watermain on Forward Avenue as shown on the Site Servicing Plan (see **Drawing SSP-1** in **Appendix F**).

3.2 WATER DEMANDS

The proposed four-storey with basement building consists of one-bedroom (4 units), bachelor apartment (4 units) and two-bedroom apartments (10 units).

The City of Ottawa Water Distribution Guidelines (July 2010) and ISTB 2021-03 technical bulletin were used to determine water demands based on population densities for residential areas. A daily rate of 280 L/cap/day has been applied for residential units. The average daily (AVDY) residential demand was estimated using an occupancy of 1.4 persons per unit for a one-bedroom and bachelor apartment and 2.1 persons per unit for a two-bedroom apartment. Maximum day (MXDY) demands were determined by multiplying the AVDY demands by a factor of 2.5 for residential areas. Peak hourly (PKHR) demands were determined by multiplying the MXDY demands by a factor of 2.2 for residential areas (see **Appendix A.1)**. The estimated demands are summarized in **Table 3.1**

Table 3.1: Estimated Water Demands

	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Residential	32 persons	0.1	0.26	0.57
Total Site		**0.1**	**0.26**	**0.57**

As no on-site watermains or fire hydrants are proposed for the current development, the fire flow demand was calculated in accordance with the Office of the Fire Marshal (OFM) fire protection water supply guidelines for the Ontario Building Code (OBC) methodology. The OFM estimate is based on a wood-frame construction building with unprotected building openings. The floor area was estimated as the area of the ground floor and taking into consideration the storeys above ground level. Additionally, it is anticipated that the building will be sprinklered, with final sprinkler design to conform to NFPA 13 (See calculations in **Appendix A.2**). Required fire flows were determined to be approximately 5400 L/min (90.0 L/s).

Table 3.2 outlines the boundary conditions provided by the City of Ottawa on December 8, 2021.

Table 3.2: Boundary Conditions

	Connection @ Forward Avenue
Min. HGL (m)	107.7
Max. HGL (m)	115.2
Max. Day + Fire Flow (60 L/s)	108.8
Max. Day + Fire Flow (150 L/s)	102.4

3.3 LEVEL OF SERVICING

3.3.1 Allowable Pressures

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

The proposed finished floor elevation at the ground floor of 63.57m will serve as ground elevation for the calculation of residual pressures at ground level. On-site pressures are expected to range from 434kPa (63 psi) to 503 kPa (73 psi) under normal operating conditions. These values are within the normal operating pressure range as defined by City of Ottawa design guidelines which desires 40 to 80 psi.

3.3.2 Fire Flow Demands

Based on anticipated maximum daily demand and fire flow requirements as per the OFM methodology of 90L/s, the boundary conditions provided by the City of Ottawa indicate that the 203 mm dia. watermain within Forward Avenue is expected to maintain a residual pressure of 43.1m equivalent to 423kPa (61.3 psi) under the specified fire flow conditions. This demonstrates that the existing watermain and nearby hydrants can provide the required fire flows while maintaining a residual pressure of 20psi.

In summary, the existing 203 mm diameter watermain on Forward Avenue can provide adequate fire and domestic flows for the subject site based on City of Ottawa Design Guidelines. An existing hydrant, located approximately 31 m south of the subject site, can be used for fire suppression. The proposed water servicing is shown on **Drawing SSP-1** contained in **Appendix F**.

4.0 WASTEWATER SERVICING

The site will be serviced from the existing 250 mm diameter PVC sanitary sewer on Forward Avenue. A 150 mm diameter sanitary service lateral connected directly to the 250 mm diameter main will service the building from its east side. See Drawing SSP-1 (in **Appendix F**) for the proposed location of the service lateral.

4.1 DESIGN CRITERIA

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

- Minimum velocity = 0.6 m/s (0.8 m/s for upstream sections)
- Maximum velocity = 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes = 0.013
- Minimum size of sanitary sewer service = 135 mm
- Minimum grade of sanitary sewer service = 1.0% (2.0% preferred)
- Average wastewater generation = 280 L/person/day
- Peak Factor = based on Harmon Equation; maximum of 4.0 (residential)
- Harmon correction factor = 0.8
- Infiltration allowance = 0.33 L/s/ha (per City Design Guidelines)
- Minimum cover for sewer service connections – 2.0 m
- Population density for one-bedroom/bachelor apartments – 1.4 persons/apartment
- Population density for two-bedroom apartments – 2.1 persons/apartment

4.2 PROPOSED SERVICING

The proposed 0.05 ha development area will consist of a 4-storey plus basement residential apartment building consisting of bachelor (4 units), one-bed (4 units), two-bed (10 units) for a total of 18 units. The anticipated wastewater peak flow generated from the proposed development is summarized in **Table 4.1** below

Wastewater Servicing

Table 4.1: Estimated Wastewater Peak Flow

Residential Peak Flows					Infiltration Flow (L/s)	Total Peak Flow (L/s)
	No. of Units	**Population**	**Peak Factor**	**Peak Flow (L/s)**		
Residential	18 units	32	3.68	0.4	0.02	0.4

Detailed sanitary sewage calculations are included in **Appendix C.1**. A backflow preventer will be required for the proposed building in accordance with the Sewer Design Guidelines and will be coordinated with building mechanical engineers.

The proposed sewage peak flows were provided to City of Ottawa staff to conduct a capacity analysis of the sanitary sewer system in the vicinity of the site and confirmation was received that there are no concerns with respect to adding the proposed sanitary peak flows to the existing sewer on Forward Avenue. Also, it was confirmed that there is sufficient downstream residual capacity in the City System to accommodate this minor additional peak flow (see correspondence in **Appendix C.2**).

5.0 STORMWATER MANAGEMENT AND SERVICING

5.1 OBJECTIVES

The goal of this stormwater servicing and stormwater management (SWM) plan is to determine the measures necessary to control the quantity and quality of stormwater released from the proposed development to meet the criteria established during the consultation process with City of Ottawa staff, and to provide sufficient details required for approval and construction.

5.2 EXISTING CONDITIONS AND SWM CRITERIA

The existing development area (0.05ha) currently consists of two-storey building, paved parking lot and some landscaping. Existing structures will be removed to allow for the proposed development.

The Stormwater Management (SWM) 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

- Use of the dual drainage principle (City of Ottawa).
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (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)
- The proposed site is not subject to quality control criteria due to the small site size and land usage of the development (City of Ottawa).

Storm Sewer & Inlet Controls

- Size storm sewers to convey 5-year storm event under free-flow conditions using City of Ottawa I-D-F parameters (City of Ottawa)
- Site discharge rates for each storm event to be restricted to a 5-year storm event pre-development rates with a maximum pre-development C coefficient of 0.5 (City of Ottawa)
- Proposed site to discharge into the existing 300mm dia. storm sewer within Forward Avenue ROW (City of Ottawa).
- The foundation drainage system is to be independently connected to the storm sewer main unless being pumped with appropriate back up power, sufficient sized pump and back flow prevention. (City of Ottawa)
- Tc should be not less than 10 minutes since IDF curves become unrealistic at less than 10 min (City of Ottawa).

Surface Storage & Overland Flow

- Any additional peak flows generated by events greater than the 5-year storm event up to and including the 100-year storm event must be detained on site. Alternatively, City of Ottawa staff noted during pre-consultation that it would be acceptable to control the roof portion of the development only so long as the remainder of the site is directed towards the Right-of-way uncontrolled.
- Building openings to be a minimum of 0.30m above the 100-year water level (City of Ottawa)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.30m (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site with a minimum vertical clearance of 15cm between the spill elevation and the ground elevation at the building envelope in the proximity of the flow route or ponding area. (City of Ottawa)

The outlet for the storm system for this site is a stormwater sewer within the Forward Avenue ROW. Separate connections have been proposed for the foundation drain and the on-site storm sewer system (roof drain and rear yard drainage). The storm sewer connection to the existing building will be removed in accordance with the City of Ottawa's infrastructure requirements. Full port backwater valves will be installed on the building's storm service to provide protection from the uncontrolled sewer system.

5.3 STORMWATER MANAGEMENT DESIGN

The Modified Rational Method was employed to assess the rate and volume of runoff generated during post-development conditions. The site was subdivided into sub catchments (subareas) tributary to stormwater controls as defined by the location of inlet control devices. A summary of subareas and runoff coefficients is provided in **Appendix D.1** and **Drawing SD-1** indicates the stormwater management sub catchments.

5.3.1 Allowable Release Rate

Based on consultation with City of Ottawa staff, the peak post-development discharge from the subject site would traditionally be limited to the discharge resulting from the 5-year event using a maximum site runoff coefficient of C = 0.5. As the site under predevelopment conditions is nearly paved in its entirety, the maximum runoff coefficient of 0.5 was selected. 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 small site size and its proximity to the existing drainage outlet. C coefficient values have been increased by 25% for the post-development 100-year storm event based on MTO Drainage Manual recommendations. Peak flow rates have been calculated using the rational method as follows:

$$Q = 2.78\,(C)(I)(A)$$

Where:

$Q = peak\ flow\ rate, L/s$

$C = site\ runoff\ coefficient$

$I = rainfall\ intensity, mm/hr\ (per\ City\ of\ Ottawa\ IDF\ curves)$
$A = drainage\ area, ha$

Table 5.1: Target Release Rate

Design Storm	Target Flow Rate (L/s)
All Events	6.81

5.3.2 Storage Requirements

The site requires quantity control measures to meet the restrictive stormwater release criteria. It is proposed that rooftop storage via restricted roof release be used to reduce site peak outflow. A spreadsheet using the Modified Rational Method (MRM) was used to size the subsurface storage.

5.3.2.1 Rooftop Storage

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

Watts Drainage *Accutrol* roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the *Accutrol* weir has been used as an example only, and that other products may be specified for use, provided that the peak roof drain release rate is restricted to match the maximum rate of release indicated in **Table 5.1**, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater. Proposed drain release rates have been calculated based on the *Accutrol* weir setting at 25% open. Storage volume and controlled release rate are summarized in **Table 5.2**:

Table 5.2: Roof Control Areas

Design Storm	Storage Depth (mm)	Discharge (L/s)	Volume Stored (m^3)
5-Year (Roof A)	102	1.59	2.94
100-Year (Roof A)	138	1.82	7.31
5-Year (Roof B)	58	0.65	0.08
100-Year (Roof B)	104	0.80	0.41

5.3.2.2 Uncontrolled Areas

Due to grading restrictions, one subcatchment area has been designed without a storage component. The catchment area discharges off-site uncontrolled to the Forward Avenue ROW. Peak discharges from uncontrolled areas have been considered in the overall SWM plan.

Table 5.3: Uncontrolled Non-Tributary Area (UNC-1)

Design Storm	Discharge (L/s)
5-year	0.56
100-Year	1.21

5.3.2.3 Storm Sewer Tributary Areas

Per the modified rational method calculations included in **Appendix D.2**, the remainder of the site is to be directed towards three proposed catch basins. The proposed catch basins will also receive discharge from the controlled flow roof drains as detailed in sections above.

Table 5.4 summarizes the controlled release rate for the site during the 100-year storm based on the Modified Rational Method (MRM). Design sheets are included in **Appendix D.1**

Table 5.4: Tributary Area (CB1-CB3)

Design Storm	Discharge (L/s)
5-Year	4.94
100-Year	8.36

5.3.3 Results

Table 5.5 provides a summary of the peak design discharge rates from the MRM analysis based on the proposed stormwater management plan. As the table demonstrates, there is a minor exceedance in 100-year peak discharge when considering control to the 5-year storm predevelopment criteria. The SWM plan meets requirements identified during pre-consultation that it would be acceptable to control the roof portion of the development only so long as the remainder of the site is directed towards the Right-of-way uncontrolled.

Table 5.5: Summary of Total 5-Year and 100-Year Event Release Rates

Drainage areas	5-year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
Uncontrolled to ROW	0.56	1.21
Flows to Sewer	4.94	8.36
Total (L/s)	**5.50**	**9.57**
Target (L/s)	**6.81**	**6.81**

6.0 SITE GRADING

The proposed re-development site measures approximately 0.05 ha in area. A detailed grading plan (see **Drawing GP-1**) has been prepared to satisfy the stormwater management requirements described in **Section 5.0** and to allow for positive drainage away from the face of the building.

The site grading is designed to effectively direct stormwater runoff into proposed catch basins within the subject site, and which are sized to adequately capture all runoff from the proposed development area. The subject site maintains emergency overland flow routes across the existing rear yards along Forward Avenue, with eventual discharge to City-owned ROWs as per existing split lot drainage patterns.

7.0 UTILITIES

Overhead wires run north-south on the east side of Forward Avenue and along the eastern perimeter of the site. These wires will restrict the movement of heavy machinery during the construction works but otherwise, should not cause any conflicts with the proposed services and site works. The existing utility poles are to be protected during construction.

Hydro Ottawa, Bell, Rogers, and Enbridge all have existing utility plants in the area, which will be used to service the site. The exact size, location, and routing of utilities will be finalized after design circulation. Existing overhead wires and utility plants may need to be moved/reconfigured to allow sufficient clearance to the proposed building. The relocation of existing utilities will be coordinated with the individual utility providers upon design circulation.

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8.0 APPROVALS

The proposed development lies on a private site under singular ownership draining to an approved sewer outlet, does not drain to a combined sewer, and is not intended to service industrial land or land uses. Therefore, the site is exempt from the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Application (ECA) process under O.Reg. 525/98.

As is mentioned in the geotechnical report for the site, for typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the preparation of the Water Taking and Discharge Plan by a Qualified Person as stipulated under O.Reg. 63/16. A Permit to Take Water (PTTW) through the MECP would be required for dewatering in excess of 400,000 L/day, which is unlikely for this site. However, if a PTTW is required, at least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

9.0 EROSION CONTROL DURING CONSTRUCTION

In order to protect downstream water quality and prevent sediment build up in catch basins and storm sewers, erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the contract documents and communicated to the Contractor.

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/DS-1** for the proposed location of silt fences, sediment traps, and other erosion control measures.

10.0 GEOTECHNICAL INVESTIGATION AND ENVIRONMENTAL SITE ASSESSMENTS

A geotechnical investigation report for 138 Forward Avenue was completed by Paterson Group on November 24, 2021. Field testing consisting of the advancement of three (3) boreholes to a maximum depth of 0.9 m below existing grade was carried out throughout the subject site on November 2, 2021, while taking into consideration underground utilities and site features. The borehole locations are presented in geotechnical investigation report is included in **Appendix D**.

Currently, the subject site is occupied by two storey residential building which is surrounded by asphalt-paved parking areas with an existing ground surface at approximate geodetic elevation of 62m. The subsurface profile encountered at the test hole locations consists of fill, extending to depths of 0.6 to 0.9m below the existing ground surface, where there was a refusal of augers at the bedrock surface. underlain by fill material followed by a glacial till deposit. The fill material generally consists of crushed stone with some sand and occasional traces of clay. Considering the available geological mapping, the bedrock in the subject area is reported to consist of limestone of the Bobcaygeon formation.

Groundwater levels was not observed in the boreholes before backfilling but based on previous experience at an adjacent site, it is speculated that the groundwater level is expected at approximate depths of 2 to 3 m below the existing ground surface; however, these levels are subject to seasonal fluctuations.

According to the geotechnical investigation, the site is considered satisfactory for the proposed development from a geotechnical perspective. It is recommended that the foundation be conventional spread footings placed on clean, surface sounded bedrock. However, anticipated excavation depth and the proximity of the proposed development to the site boundaries, a temporary excavation support system will be required to support the overburden during the construction period.

In order to construct the basement level, bedrock removal will be required. Paterson also recommends Line drilling, controlled blasting for the removal of large quantities of bedrock while for small quantities of bedrock or weathered bedrock, hoe-ramming will be sufficient. For the blasting operation, it is advised that it should be planned and completed under the guidance of a professional engineer with experience in blasting operations.

11.0 CONCLUSIONS

11.1 WATER SERVICING

Based on the supplied boundary conditions for existing watermains and calculated domestic and fire flow demands for the subject site, the adjacent watermain on Forward Avenue has sufficient capacity to sustain both the required domestic demands and emergency fire flow demands for the development. The proposed development requires a 150 mm diameter water service which will be connected to the existing 203mm main on Forward Avenue.

11.2 SANITARY SERVICING

The proposed sanitary sewer service is sufficiently sized to provide gravity drainage of the site. The proposed development will be serviced by a 150 mm dia. sanitary service lateral directing wastewater by gravity to the existing 250 mm diameter sanitary sewer on Forward Avenue. Existing connections are to be removed and full port backwater valves installed on the proposed sanitary service within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property. The proposed sanitary lateral for the property will be installed through the foundation wall below the basement floor slab to provide a gravity outlet for the basement level and all floors above grade.

11.3 STORMWATER SERVICING AND MANAGEMENT

A 150 mm diameter storm service is proposed for the building's foundation drain with full-port backwater valve on the stormwater service which will prevent flooding if the storm sewer on Forward Avenue surcharges.

The remainder of the site will drain to the main on Forward Avenue using a separate 200 mm diameter catch basin lead and be bound by a stormwater management plan in compliance with the goals specified through pre-consultation with the City of Ottawa. Roof storage has been proposed to limit the peak 100-year stormwater discharge rate for the development area to 9.57 L/s. SWM controls have been developed to meet criteria as determined by the City of Ottawa at the pre-development stage.

11.4 GRADING

Site grading has been designed to provide an emergency overland flow route as per City requirements and to follow the recommendations made in the geotechnical investigation report prepared by Paterson Group. Erosion and sediment control measures, outlined in this report and included in the drawing set, will be implemented during construction to reduce the impact on existing facilities.

11.5 UTIILITIES

Utility infrastructure exists within overhead lines and subsurface plant within the Forward Avenue ROW at the western boundary of the proposed site. It is anticipated that existing infrastructure will be sufficient to

provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVALS/RESTRICTIONS

An MECP Environmental Compliance Approval (ECA) is not required for the site, as the development lies on a private site under singular ownership draining to an approved sewer outlet, does not drain to a combined sewer, and is not intended to service industrial land or land uses. Therefore, the site is exempt from the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Application (ECA) process under O.Reg. 525/98.

For the expected dewatering needs of 50,000 to 400,000 L/day, the proponent will need to register on the MECP's Environmental Activity and Sector Registry (EASR). A Permit to Take Water will only be required for dewatering needs in excess of 400,000 L/day which is not expected for this site. The Phase II ESA recommends the removal and disposal of some soils in the northeast corner of the site which are contaminated with petroleum hydrocarbons. No permitting is expected for this activity, which is recommended to be conducted under the supervision of a geotechnical consultant. An environmental noise study and stationary noise study per City NCG and NPC 300 Guidelines will be required as the site is within 100 m of St Laurent Boulevard. These studies are to be undertaken by other consultants and to be submitted as part of the site plan application.

APPENDICES

Appendix A POTABLE WATER SERVICING

A.1 DOMESTIC WATER DEMAND CALCULATIONS

138 Forward Avenue - Domestic Water Demand Estimates

Site Plan provided by Susan D. Smith Architect (Dated 2021-12-02)

Project No. 160401680

Densities as per City Guidelines:		
Apartment Units		
1 Bedroom	1.4	ppu
2 Bedroom	2.1	ppu

Building ID	Amenity Areas (m^2)	No. of Units	Population	Daily Rate of Demand [1] (L/cap/day)	Avg Day Demand		Max Day Demand [2]		Peak Hour Demand [2]	
					(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Bachelor unit		4	6	280	1.1	0.02	2.7	0.05	6.0	0.10
1 Bedroom		4	6	280	1.1	0.02	2.7	0.05	6.0	0.10
2 Bedroom		10	21	280	4.1	0.07	10.2	0.17	22.5	0.37
Total Site :		**18**	**32**		**6**	**0.10**	**16**	**0.26**	**34**	**0.57**

1 Average day water demand for residential areas: 280L/cap/day per ISTB 2021-03

2 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 for residential

peak hour demand rate = 2.2 x maximum day demand rate for residential

A.2 FIRE FLOW REQUIREMENTS PER OFM GUIDELINES

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A) & OFM 1999 Guideline

Project	138 Forward Avenue	**Designed by:**	AG
Project #	160401680	**Checked by:**	DT
Date	23-Dec-21	**Description:**	4- storey +basement residential building with 18 dwelling units

$Q = KVS_{tot}$

Q = Volume of water required (L)
V = Total building volume (m3)
K = Water supply coefficient from Table 1
S_{tot} = Total of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	**Type of construction**	**Building Classification**		**Water Supply Coefficient**
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	**Area of one floor (m^2)**	**Number of floors**	**Height of ceiling (m)**	**Total Building Volume (m^3)**
	257.2	5	2.74	3,524
3	**Side**	**Exposure Distance (m)**	**Spatial Coefficient**	**Total Spatial Coeffiecient**
	North	2.18	0.5	2
	East	15.00	0.0	
	South	1.90	0.5	
	West	21.79	0.0	
4	**Established Fire Safety Plan?**	**Reduction in Volume (%)**		**Total Volume Reduction**
	no	0%		0%
5				**Total Volume 'Q' (L)**
				162,104
				Minimum Required Fire Flow (L/min)
				5,400

NOTES:

1. Calculation is based on information provided by Susan D. Smith Architects in Site Plan provided December 2, 2021
2. Major occupancy classification based on Table 3.1.2.1 of OBC 2020

A.3 BOUNDARY CONDITIONS

Shobowale, Aminat

From: Bakhit, Reza <reza.bakhit@ottawa.ca>
Sent: Wednesday, December 8, 2021 8:26 AM
To: Shobowale, Aminat
Cc: Gladish, Alyssa
Subject: RE: Hydraulic Boundary Conditions Request - 138 Forward Avenue
Attachments: 138 Forward Avenue REVISED December 2021.pdf

Hi Aminat,

The following are boundary conditions, HGL, for hydraulic analysis at 138 Forward Avenue (zone 1W) assumed to be connected to the 203 mm watermain on Forward Avenue (see attached PDF for location).

Minimum HGL: 107.7 m

Maximum HGL: 115.2 m

Max Day + FF (60 L/s): 108.8 m

Max Day + FF (150 L/s): 102.4 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.

Regards,

Reza Bakhit, P.Eng, C.E.T
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Centeral Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca
Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Shobowale, Aminat <Aminat.Shobowale@stantec.com>
Sent: Wednesday, December 01, 2021 11:48 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: RE: Hydraulic Boundary Conditions Request - 138 Forward Avenue

Good morning Reza,

We received a revised site plan for the proposed residential redevelopment at 138 Forward Avenue and would like to make a new request for hydraulic boundary conditions based on the revised site plan. The proposed development is a 4-storey plus basement apartment building comprising of ten 2-bedroom units and six 1-bedroom units.

We intend to connect to existing 203mm diameter watermain on Forward Avenue.

Estimated domestic demands and fire flow requirements for the site are as follows:

- Domestic demand:
  - Average day: 5.7 L/min (0.10 L/s)
  - Maximum day: 14.3 L/min (0.24 L/s)
  - Peak hour: 31.4 L/min (0.52 L/s)
- Estimated fire flow demand per OBC methodology : 3600 L/min (60 L/s)
- Estimated fire flow demand per FUS methodology : 9000 L/min (150.0 L/s)

Kindly find attached the following:

1) Location map
2) Water demand calculation sheets.

Thank you for your help. Kindly contact me if you need any additional information.

Regards,

Aminat.

Aminat Shobowale
Civil Designer, Community Development

Mobile: (437) 833-4988
Aminat.Shobowale@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Bakhit, Reza <reza.bakhit@ottawa.ca>
Sent: Friday, November 19, 2021 1:42 PM
To: Shobowale, Aminat <Aminat.Shobowale@stantec.com>
Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: RE: Hydraulic Boundary Conditions Request - 138 Forward Avenue

Hi Aminat,

The following are boundary conditions, HGL, for hydraulic analysis at 138 Forward Avenue (zone 1W) assumed to be connected to the 203 mm watermain on Forward Avenue (see attached PDF for location).

Minimum HGL: 107.9 m

Maximum HGL: 115.2 m

Max Day + FF (45 L/s): 109.4 m

Max Day + FF (133.3 L/s): 103.9 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.

Regards,

Reza Bakhit, P.Eng, C.E.T
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Centeral Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca
Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Shobowale, Aminat <Aminat.Shobowale@stantec.com>
Sent: Wednesday, November 10, 2021 10:19 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: Hydraulic Boundary Conditions Request - 138 Forward Avenue

Good morning Reza,

We would like to request for hydraulic boundary conditions for a proposed residential development at 138 Forward Avenue. The proposed development is a 3-storey plus basement apartment building (15 units) comprising eight 2-bedroom units, five 1-bedroom units and two bachelor units.

We intend to connect to existing 203mm diameter watermain on Forward Avenue.

Estimated domestic demands and fire flow requirements for the site are as follows:

- Domestic demand:
  - Average day: 5.2 L/min (0.09 L/s)
  - Maximum day: 12.9 L/min (0.22 L/s)
  - Peak hour: 28.4 L/min (0.47 L/s)
- Estimated fire flow demand per OBC methodology : 2700 L/min (45 L/s)
- Estimated fire flow demand per FUS methodology : 8000 L/min (133.3 L/s)

Kindly find attached the following:

1) Location map
2) Water demand calculation sheets.

Thank you for your help. Kindly contact me if you need any additional information.

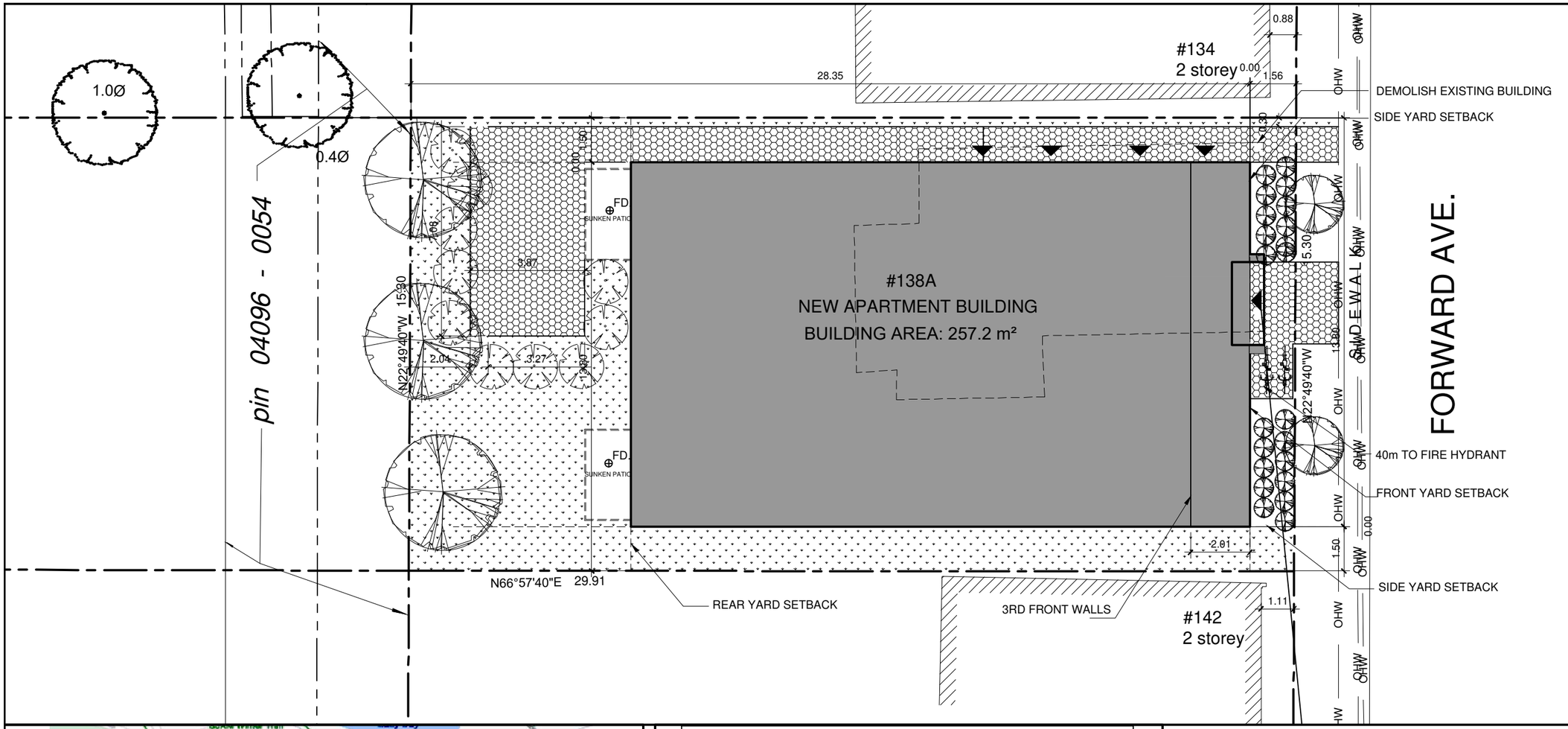
Regards,

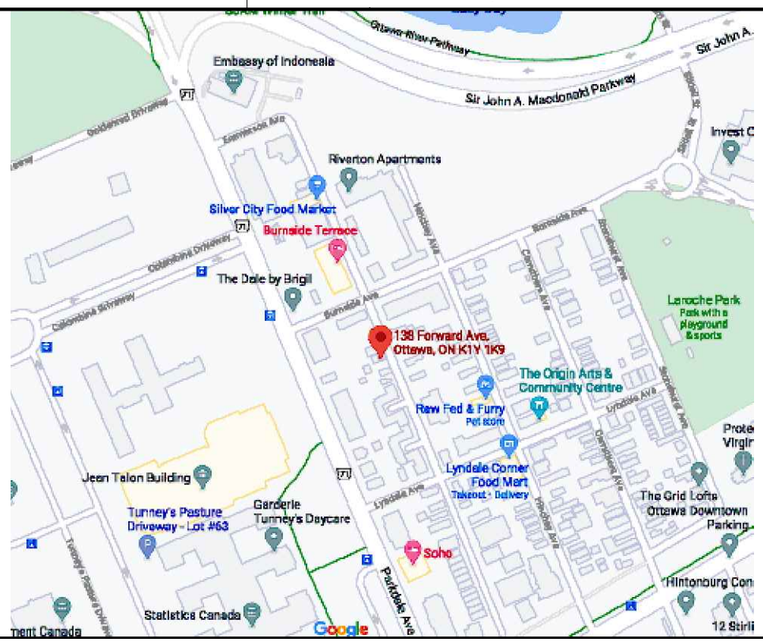
Aminat Shobowale
Civil Designer, Community Development

Mobile: (437) 833-4988
Aminat.Shobowale@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

Appendix B DRAFT SITE PLAN





City of Ottawa Zoning By-law No. 2008-250 and Revised By-law No. 2015-228		
R4UD		
LOW RISE APARTMENT 4 STOREY, 8 UNIT	REQUIRED	PROPOSED
MINIMUM LOT WIDTH	15m	15.32m
MINIMUM LOT AREA	450m²	457.8m²
MAXIMUM BUILDING HEIGHT	14.5m	12m
MINIMUM FRONT YARD SETBACK	1.5m	1.5m
MINIMUM CORNER SIDE YARD SETBACK	3m	N/A
MINIMUM REAR YARD SETBACK	7.44m (25% of lot depth)	7.44m
MINIMUM INTERIOR SIDE YARD SETBACK	1.5m	1.5m
LANDSCAPE AREA	30%	42%
SOFT LANDSCAPE AT FRONT YARD	20% OF REAR YARD	50% OF REAR YARD
SOFT LANDSCAPE AT REAR YARD	50% OF REAR YARD	100% OF REAR YARD
FENESTRATION ON FRONT WALL	25%	30%
RECESSED FRONT WALL	20%	25%
Bicycle Parking (0.5/unit)	15 UNIT @0.5=7.5	15

SURVEYOR'S REAL PROPERTY REPORT
PART 1 Plan of LOT 4
WEST FORWARD AVENUE LOTS
REGISTERED PLAN 35
CITY OF OTTAWA
Surveyed by Annis, O'Sullivan, Vollebekk Ltd.

LEGEND:

- ENTRANCE
- PROPERTY LINE
- SETBACK LINE
- REMOVE EXISTING WALL
- NEW BUILDING
- LANDSCAPE AREA
- INTERLOCKING WALKWAY
- RIVER ROCK

0 1 2 3 4 5 6 7 8 9 10 12
0.5

NEW APARTMENT BUILDING
138 FORWARD AVE.

OTTAWA, ONT.
K1Y 1E7

CLIENT:
VIKA
LAND DEVELOPMENT GROUP INC.

PROJECT NORTH
TRUE NORTH

gba
1339 Wellington St. W #204
Ottawa, ON K1Y 3B8
(613) 680-9450

SUSAN D. SMITH ARCHITECT
941 MERIVALE RD
Ottawa, Ontario
613-722-5327
S.SMITH@SDSARCH.CA

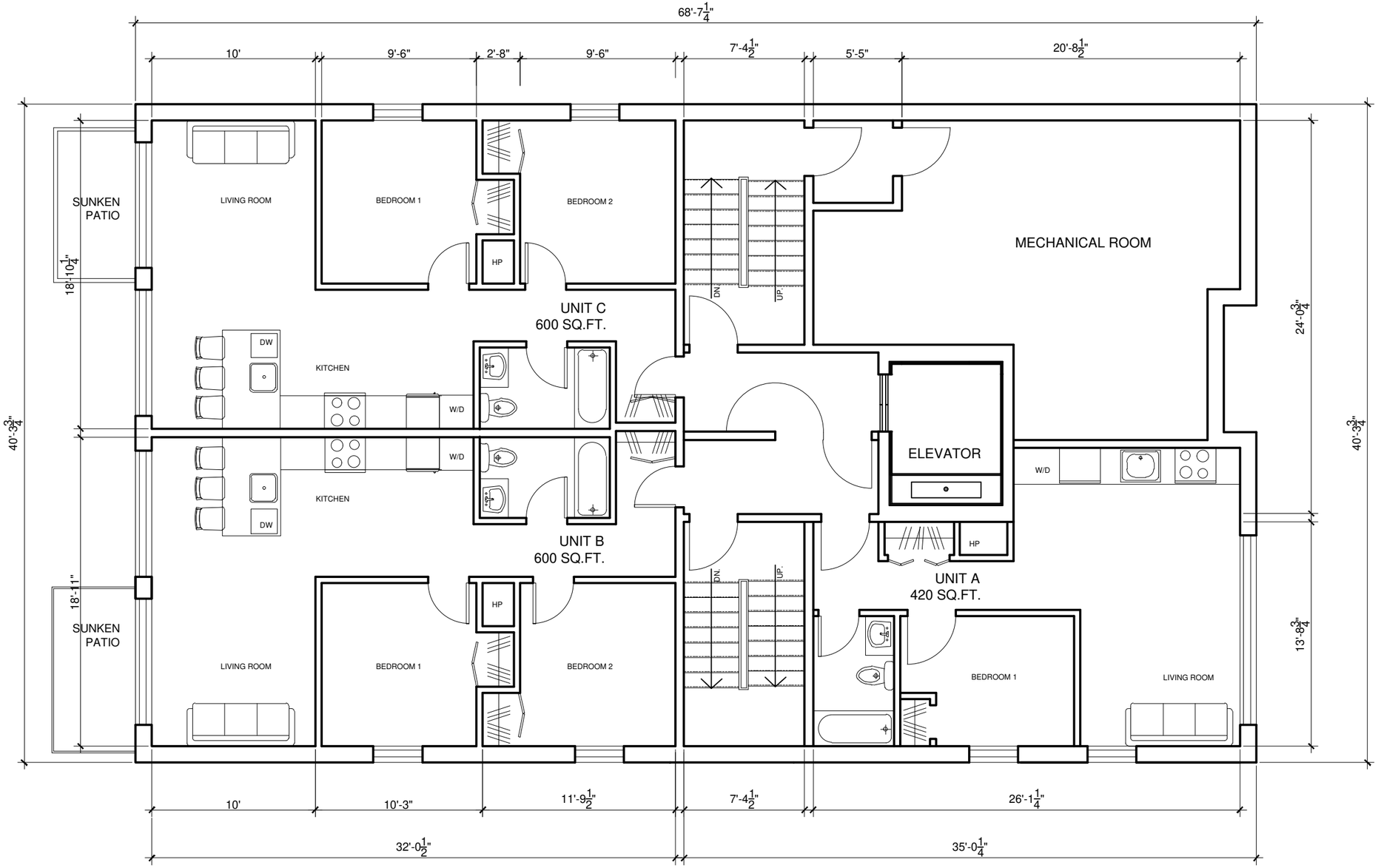
No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

NOTES:
1. All dimensions are to be checked on site. Discrepancies or ambiguities should be reported prior to work on site or ordering of materials.
2. All work to be in accordance with the Ontario Building Code, latest edition.

SITE PLAN

Scale	1:150
Drawn	TD
Checked	SDS
Date	JAN/2021
Job #	2108

SP



BUILDING HEIGHT: 4 STOREY + BASEMENT
EQUIPPED w/ ELEVATOR AND SPRINKLER SYSTEM
BUILDING FOOTPRINT: 2749 SQ.FT.
BUILDING AREA: 13148 SQ.FT.

UNIT TYPE	QTT	AREA	3pc BATHROOM
TWO BEDROOM UNIT	10	600 sq.ft.	1
ONE BEDROOM UNIT	4	ave. 440 sq.ft.	1
BACHELOR UNIT	4	280 sq.ft.	1
TOTAL	18	8809 sq.ft.	18

NEW APARTMENT BUILDING
138 FORWARD AVE.
OTTAWA, ONT.
K1Y 1E7

CLIENT:
VIKA
LAND DEVELOPMENT GROUP INC.

SUSAN D. SMITH ARCHITECT
941 MERIVALE RD
Ottawa, Ontario
613-722-5327
S.SMITH@SDSARCH.CA

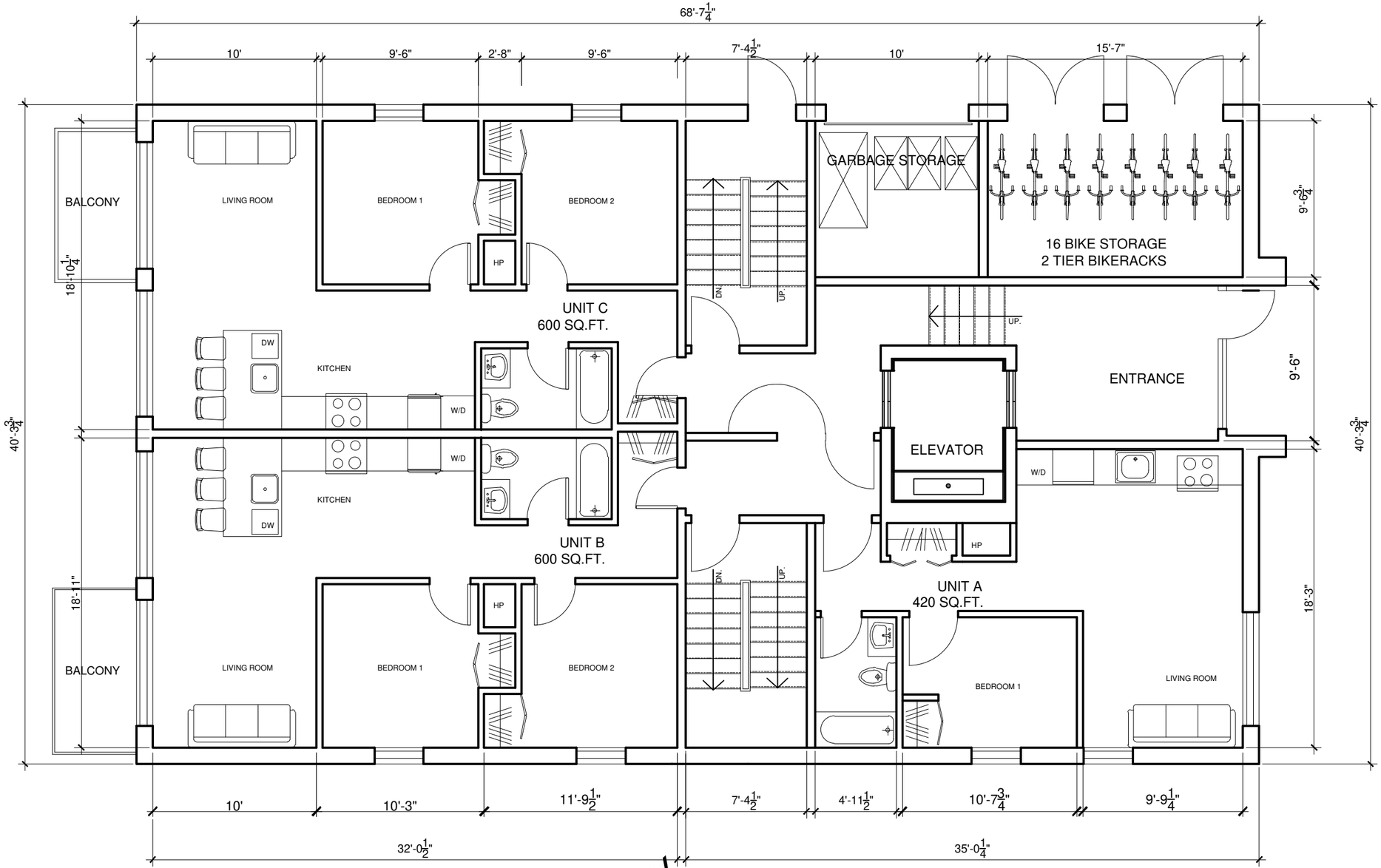
PRELIMINARY

BASEMENT PLAN

No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

1/8"=1'-0"
DRAWN BY: T.D.
JOB # 2017
DATE JUL/20

SK1



PRELIMINARY

NEW APARTMENT BUILDING 138 FORWARD AVE. OTTAWA, ONT. K1Y 1E7	CLIENT: VIKA LAND DEVELOPMENT GROUP INC.	SUSAN D. SMITH ARCHITECT 941 MERIVALE RD Ottawa, Ontario 613-722-5327 S.SMITH@SDSARCH.CA

GROUND FLR PLAN

No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

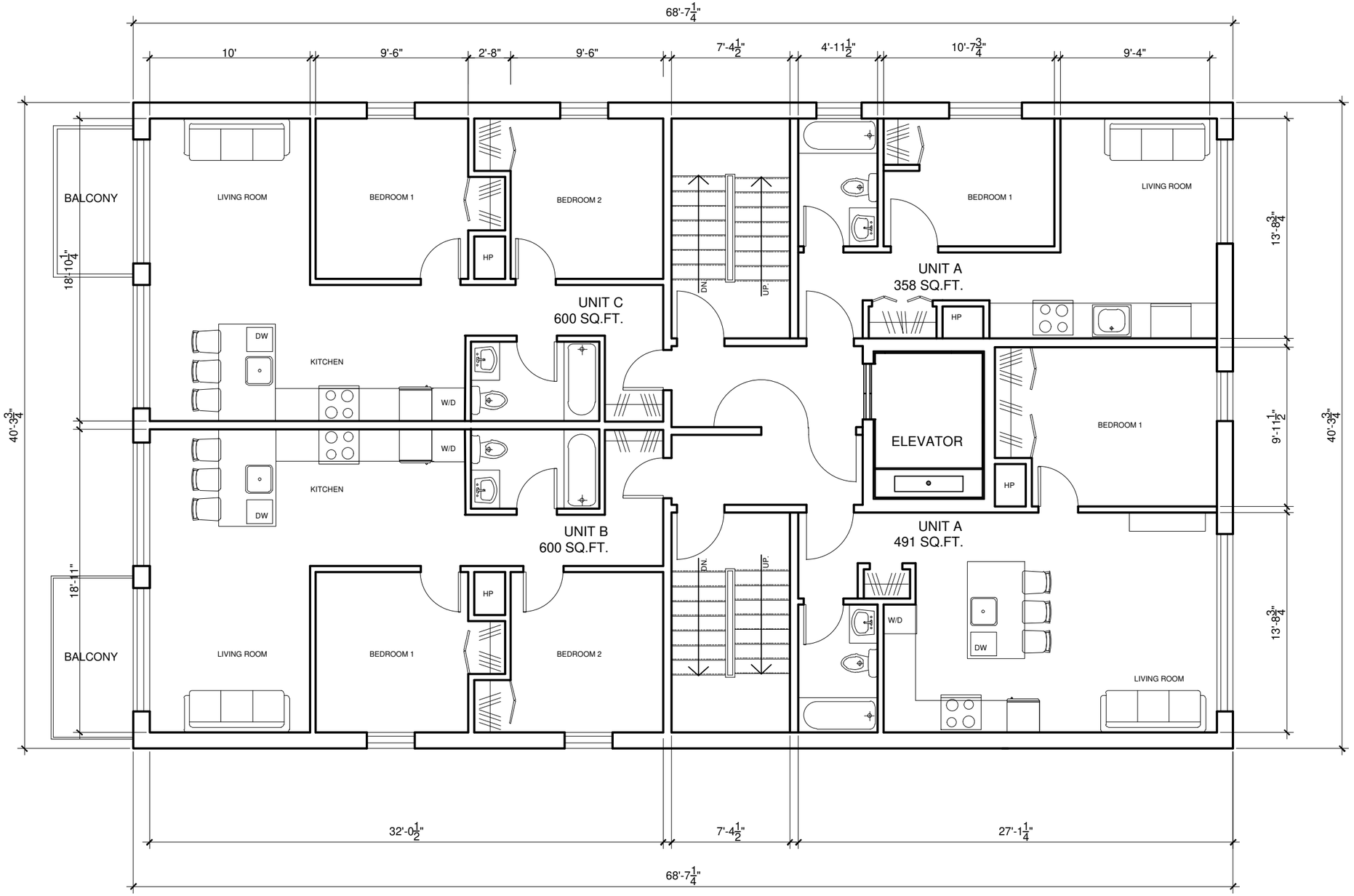
1/8"=1'-0"

DRAWN BY: T.D.

JOB # 2017

DATE JUL/20

SK2



NEW APARTMENT BUILDING 138 FORWARD AVE. OTTAWA, ONT. K1Y 1E7	CLIENT: VIKA LAND DEVELOPMENT GROUP INC.	SUSAN D. SMITH ARCHITECT 941 MERIVALE RD Ottawa, Ontario 613-725-5327 S.SMITH@SDSARCH.CA

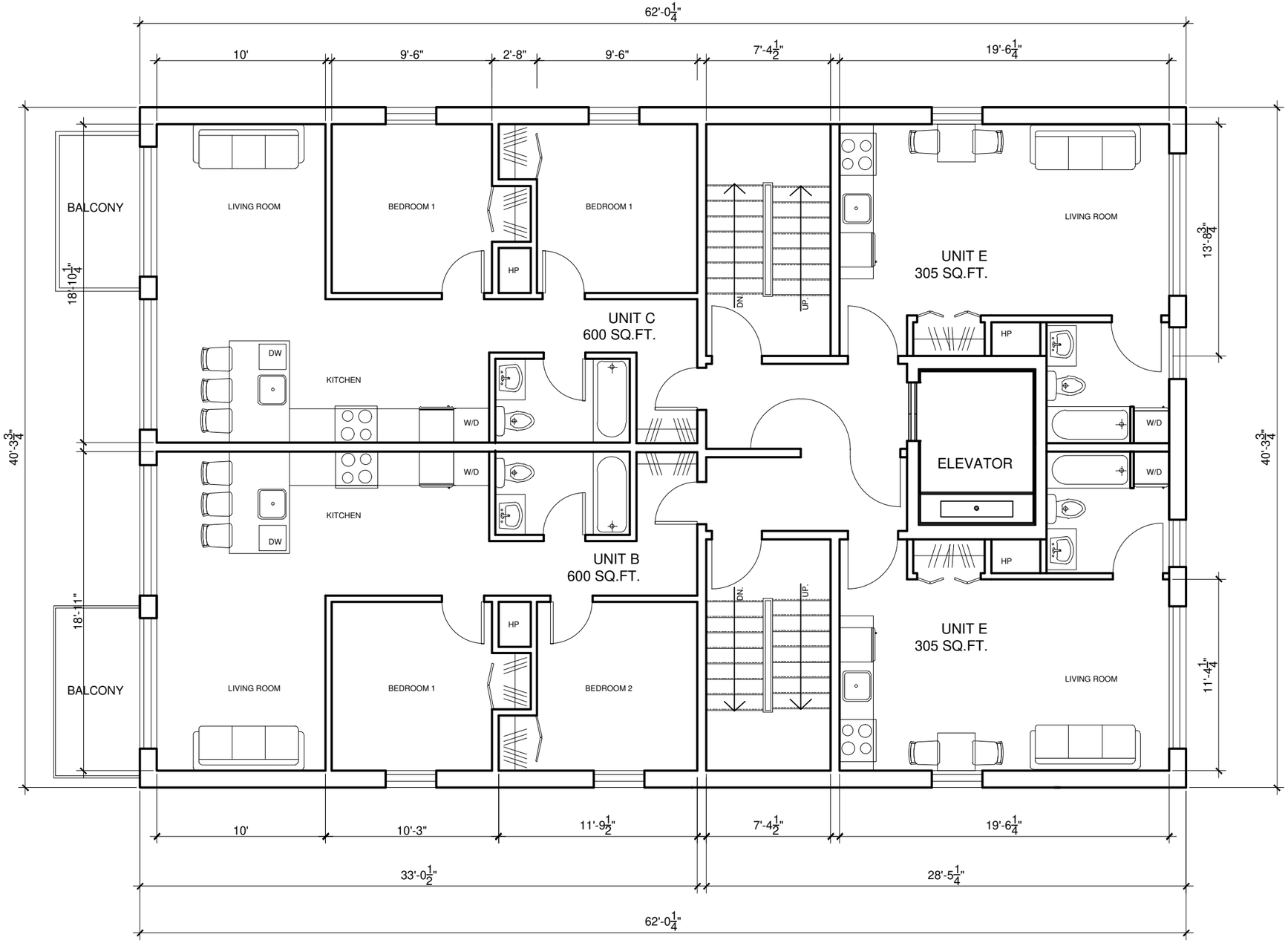
PRELIMINARY

2ND FLOOR PLAN

No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

1/8"=1'-0"	
DRAWN BY: T.D.	
JOB #	2017
DATE	JUL/20

SK3



PRELIMINARY

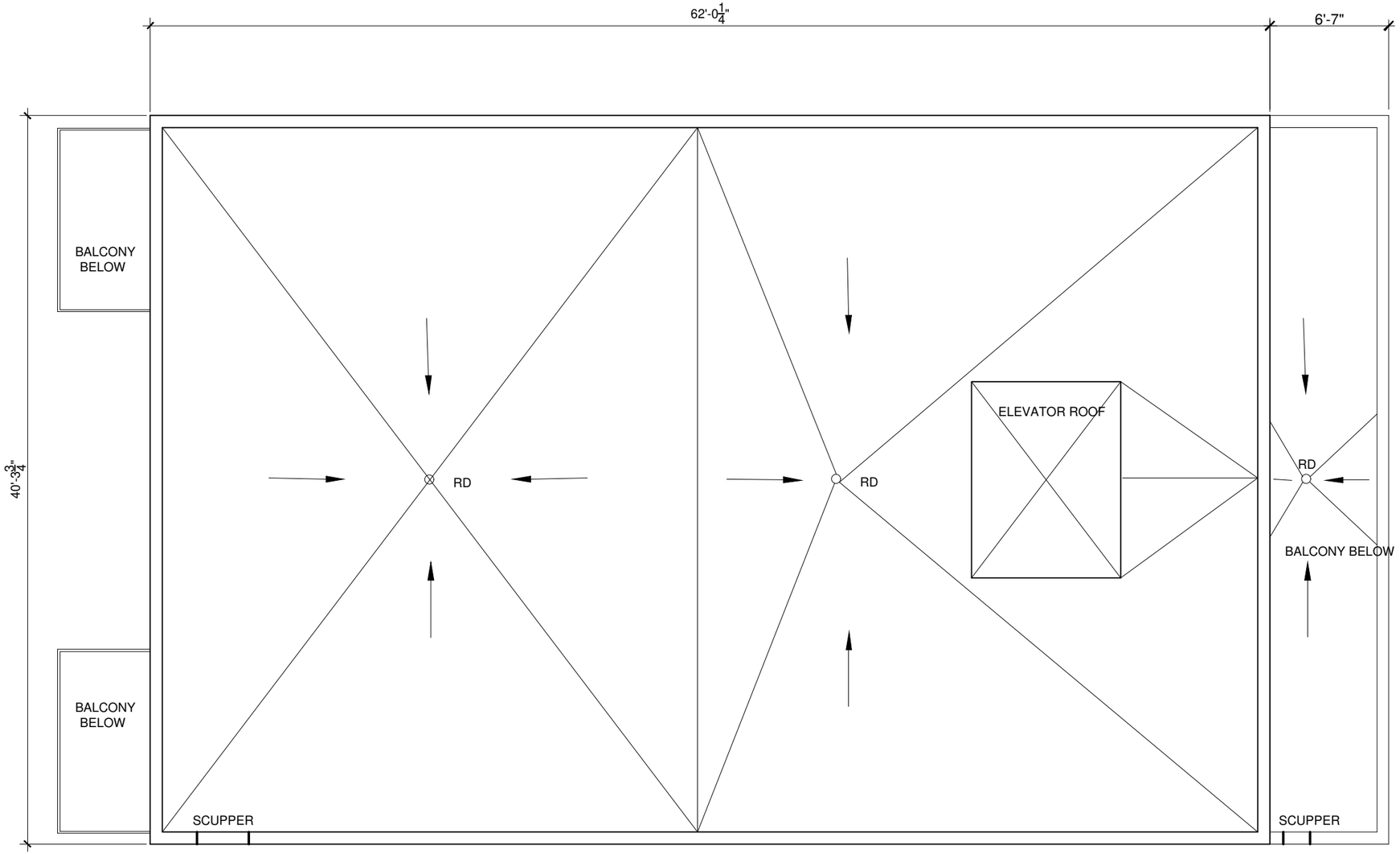
NEW APARTMENT BUILDING 138 FORWARD AVE. OTTAWA, ONT. K1Y 1E7	CLIENT: VIKA LAND DEVELOPMENT GROUP INC.	SUSANNE SMITH ARCHITECT 941 MERIVALE RD Ottawa, Ontario 613-722-5327 S.SMITH@SDSARCH.CA

3rd, 4th FLR. PLAN

No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

1/8"=1'-0"
DRAWN BY: T.D.
JOB # 2017
DATE JUL/20

SK4



PRELIMINARY

NEW APARTMENT BUILDING
138 FORWARD AVE.
OTTAWA, ONT.
K1Y 1E7

CLIENT:
VIKA
LAND DEVELOPMENT GROUP INC.

SUSAN D. SMITH ARCHITECT
941 MERIVALE RD
Ottawa, Ontario
613-722-5327
S.SMITH@SDSARCH.CA

ROOF PLAN

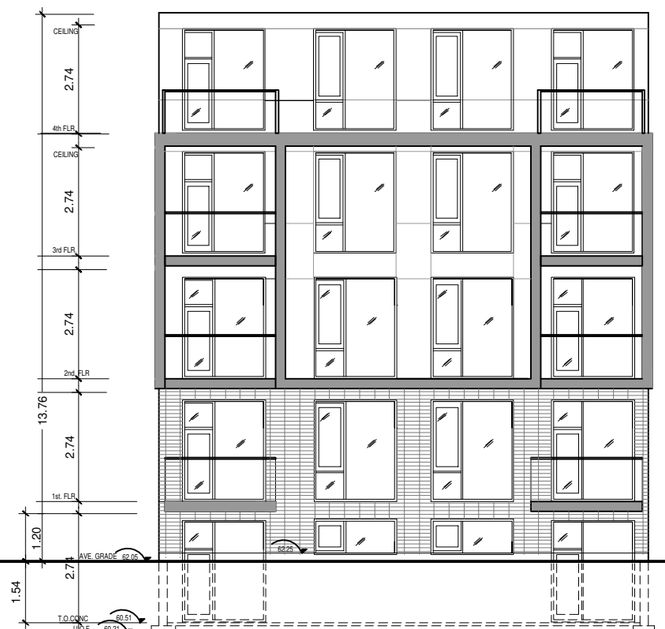
No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

1/8"=1'-0"
DRAWN BY: T.D.
JOB # 2017
DATE JUL/20

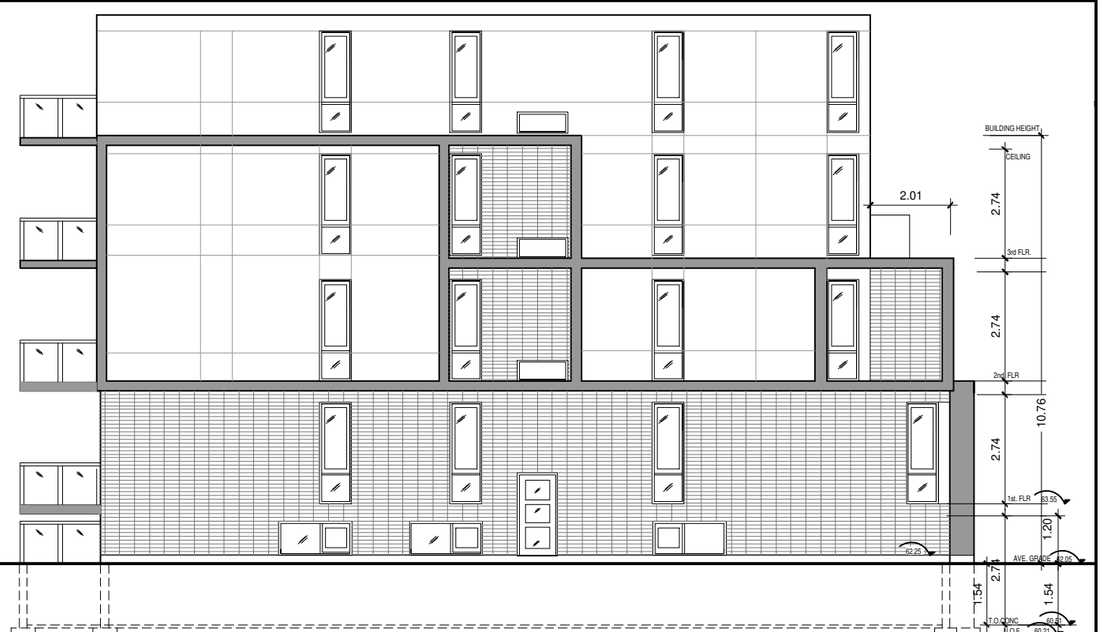
SK4

1 EL — EAST ELEVATION
SCALE: 1/150

2 EL — NORTH ELEVATION
SCALE: 1/150



3 EL — WEST ELEVATION
SCALE: 1/150



4 EL — SOUTH ELEVATION
SCALE: 1/150

NEW APARTMENT BUILDING
138 FORWARD AVE.
OTTAWA, ONT.
K1Y 1E7

CLIENT:
VIKA
LAND DEVELOPMENT GROUP INC.

PROJECT NORTH
TRUE NORTH

gba
1339 Wellington St. W #204
Ottawa, ON K1Y 3B8
(613) 680-9450

SUSAN D. SMITH ARCHITECT
941 MERIVALE RD
Ottawa, Ontario
613-722-5327
S.SMITH@SDSARCH.CA

No.	REVISION	DATE
3		
2		
1		
0	ISSUED FOR REVIEW	NOV. 30/21

NOTES:
1. All dimensions are to be checked on site. Discrepancies or ambiguities should be reported prior to work on site or ordering of materials.
2. All work to be in accordance with the Ontario Building Code, latest edition.

ELEVATIONS

Scale	1:150
Drawn	TD
Checked	SDS
Date	JAN/2021
Job #	2108

EL

Appendix C WASTEWATER SERVICING

C.1 SANITARY SEWER CALCULATION SHEET

Stantec

SUBDIVISION:

138 Forward Avenue

DATE: 12/21/2021
REVISION: 1
DESIGNED BY: AS
CHECKED BY: NN

160401680

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
1 BEDROOM	1.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
2 BEDROOM	2.1	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
BACHELOR APARTMENT	1.4				

LOCATION				RESIDENTIAL AREA AND POPULATION							COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID	FROM	TO	AREA				POP.	CUMULATIVE		PEAK	PEAK	AREA	ACCU.	AREA	ACCU.	AREA	ACCU.	AREA	ACCU.	AREA	ACCU.	PEAK	TOTAL	ACCU.	INFILT.	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP.	CAP. V	VEL.	VEL.
NUMBER	M.H.	M.H.		1 BEDROOM UNIT	BACHELOR UNIT	2 BEDROOM UNIT		AREA	POP.	FACT.	FLOW		AREA		AREA		AREA		AREA		FLOW	AREA	AREA	FLOW							(FULL)	PEAK FLOW	(FULL)	(ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
TOTAL SITE	BLDG	EXT	0.03	4	4	10	32	0.03	32	3.68	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.0	0.05	0.05	0.02	0.40	8.3	150	PVC	SDR 35	1.00	15.3	**2.60%**	0.86	0.31

C.2 CONFIMATION OF SANITARY SEWER CAPACITY

From: Bakhit, Reza
To: Shobowale, Aminat
Cc: Gladish, Alyssa
Subject: RE: Sanitary Capacity on Forward Avenue
Date: Friday, December 17, 2021 12:30:50 PM

Hi Aminat,

I can confirm there is no concern with the proposed flow.

Regards

Reza Bakhit, P.Eng, C.E.T
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Centeral Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca
Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Shobowale, Aminat <Aminat.Shobowale@stantec.com>
Sent: Wednesday, December 15, 2021 10:41 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: Sanitary Capacity on Forward Avenue

Good morning Reza,

We are currently working on servicing a proposed residential development at 138 Forward Avenue . The proposed redevelopment of 4-storey with basement apartment building comprises of 4 one-bedroom units, 4 bachelor units and 10 two bedrooms units.

We intend to connect to the existing 250mm sanitary sewer on Forward Avenue. Can you please confirm if there is adequate capacity to capture 0.4L/s into the receiving and downstream wastewater system from the proposed 4-storey+ basement building?

Thank you.

Regards,
Aminat.

Aminat Shobowale
Civil Designer, Community Development

Mobile: (437) 833-4988
Aminat.Shobowale@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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

'

'

Appendix D STORMWATER SERVICING

D.1 MODIFIED RATIONAL METHOD SHEET

Stormwater Management Calculations

File No: **160401680**
Project: **138 Forward Avenue**
Date: **17-Dec-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

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Tributary	UNC1	Hard	0.002		0.9	0.002		
		Soft	0.001		0.2	0.000		
		Subtotal		0.003			0.00195	0.650
Uncontrolled - Tributary	CB1, CB2, CB3	Hard	0.008		0.9	0.007		
		Soft	0.010		0.2	0.002		
		Subtotal		0.018			0.00936	0.520
Roof	ROOFB	Hard	0.003		0.9	0.003		
		Soft	0.000		0.2	0.000		
		Subtotal		0.003			0.0027	0.900
Roof	ROOFA	Hard	0.023		0.9	0.021		
		Soft	0.000		0.2	0.000		
		Subtotal		0.023			0.0207	0.900
Total				**0.047**			**0.035**	
Overall Runoff Coefficient= C:								**0.74**

Total Roof Areas	**0.026 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.021 ha**
Total Tributary Area to Outlet	**0.047 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**0.047 ha**

Stormwater Management Calculations

Project #160401680, 138 Forward Avenue
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

$I = a/(t + b)$

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): 0.0470
C: 0.50

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**6.81**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC1 — Uncontrolled - Tributary
Area (ha): 0.00
C: 0.65

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	0.56	0.56		
20	70.25	0.38	0.38		
30	53.93	0.29	0.29		
40	44.18	0.24	0.24		
50	37.65	0.20	0.20		
60	32.94	0.18	0.18		
70	29.37	0.16	0.16		
80	26.56	0.14	0.14		
90	24.29	0.13	0.13		
100	22.41	0.12	0.12		
110	20.82	0.11	0.11		
120	19.47	0.11	0.11		

Subdrainage Area: CB1, CB2, CB3 — Uncontrolled - Tributary
Area (ha): 0.02 — Includes roof drain discharge
C: 0.52

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	4.94	4.94	0.00	**0.00**
20	70.25	3.92	3.92	0.00	**0.00**
30	53.93	3.38	3.38	0.00	**0.00**
40	44.18	3.02	3.02	0.00	**0.00**
50	37.65	2.76	2.76	0.00	**0.00**
60	32.94	2.56	2.56	0.00	**0.00**
70	29.37	2.40	2.40	0.00	**0.00**
80	26.56	2.25	2.25	0.00	**0.00**
90	24.29	2.11	2.11	0.00	**0.00**
100	22.41	1.99	1.99	0.00	**0.00**
110	20.82	1.85	1.85	0.00	**0.00**
120	19.47	1.74	1.74	0.00	**0.00**

Subdrainage Area: ROOFB — Roof
Area (ha): 0.00 — 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	0.78	0.65	0.13	**0.08**	57.6	0.00
20	70.25	0.53	0.50	0.02	0.03	39.9	0.00
30	53.93	0.40	0.40	0.01	0.02	31.4	0.00
40	44.18	0.33	0.33	0.00	0.01	26.0	0.00
50	37.65	0.28	0.28	0.00	0.00	22.2	0.00
60	32.94	0.25	0.25	0.00	0.00	19.5	0.00
70	29.37	0.22	0.22	0.00	0.00	17.3	0.00
80	26.56	0.20	0.20	0.00	0.00	15.7	0.00
90	24.29	0.18	0.18	0.00	0.00	14.5	0.00
100	22.41	0.17	0.17	0.00	0.00	13.3	0.00
110	20.82	0.16	0.16	0.00	0.00	12.4	0.00
120	19.47	0.15	0.15	0.00	0.00	11.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	57.56	0.06	0.65	0.08	1.20	0.00

Subdrainage Area: ROOFA — Roof
Area (ha): 0.02 — 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	6.00	1.57	4.43	2.66	98.9	0.00
20	70.25	4.04	1.59	2.45	**2.94**	102.1	0.00
30	53.93	3.10	1.58	1.52	2.74	100.2	0.00
40	44.18	2.54	1.54	1.00	2.40	94.8	0.00
50	37.65	2.17	1.50	0.66	1.99	88.3	0.00
60	32.94	1.90	1.46	0.43	1.56	81.6	0.00
70	29.37	1.69	1.42	0.27	1.14	74.8	0.00
80	26.56	1.53	1.36	0.17	0.83	65.0	0.00
90	24.29	1.40	1.30	0.10	0.53	55.9	0.00
100	22.41	1.29	1.23	0.05	0.33	48.9	0.00
110	20.82	1.20	1.15	0.04	0.29	45.7	0.00
120	19.47	1.12	1.08	0.04	0.26	43.0	0.00

Storage: Roof Storage

Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check

Project #160401680, 138 Forward Avenue
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)$

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): 0.0470
C: 0.50

100 Year Post Development Target release rate= 6.81 L/s

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC1 — Uncontrolled - Tributary
Area (ha): 0.00
C: 0.81

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	1.21	1.21		
20	119.95	0.81	0.81		
30	91.87	0.62	0.62		
40	75.15	0.51	0.51		
50	63.95	0.43	0.43		
60	55.89	0.38	0.38		
70	49.79	0.34	0.34		
80	44.99	0.30	0.30		
90	41.11	0.28	0.28		
100	37.90	0.26	0.26		
110	35.20	0.24	0.24		
120	32.89	0.22	0.22		

Subdrainage Area: CB1, CB2, CB3 — Uncontrolled - Tributary
Area (ha): 0.02 — Includes roof drain discharge
C: 0.65

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	8.36	8.36	0.00	**0.00**
20	119.95	6.47	6.47	0.00	**0.00**
30	91.87	5.50	5.50	0.00	**0.00**
40	75.15	4.86	4.86	0.00	**0.00**
50	63.95	4.40	4.40	0.00	**0.00**
60	55.89	4.06	4.06	0.00	**0.00**
70	49.79	3.79	3.79	0.00	**0.00**
80	44.99	3.58	3.58	0.00	**0.00**
90	41.11	3.39	3.39	0.00	**0.00**
100	37.90	3.23	3.23	0.00	**0.00**
110	35.20	3.09	3.09	0.00	**0.00**
120	32.89	2.97	2.97	0.00	**0.00**

Subdrainage Area: ROOFB — Roof
Area (ha): 0.00 — 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	1.49	0.80	0.69	**0.41**	104.2	0.00
20	119.95	1.00	0.76	0.24	0.29	91.6	0.00
30	91.87	0.77	0.69	0.07	0.13	70.1	0.00
40	75.15	0.63	0.61	0.02	0.04	48.3	0.00
50	63.95	0.53	0.52	0.01	0.03	41.4	0.00
60	55.89	0.47	0.46	0.01	0.02	36.4	0.00
70	49.79	0.42	0.41	0.00	0.02	32.6	0.00
80	44.99	0.38	0.37	0.00	0.01	29.5	0.00
90	41.11	0.34	0.34	0.00	0.01	27.0	0.00
100	37.90	0.32	0.32	0.00	0.01	25.0	0.00
110	35.20	0.29	0.29	0.00	0.01	23.2	0.00
120	32.89	0.27	0.27	0.00	0.00	21.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	104.19	0.10	0.80	0.41	1.20	0.00

Subdrainage Area: ROOFA — Roof
Area (ha): 0.02 — 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	11.42	1.75	9.66	5.80	128.1	0.00
20	119.95	7.67	1.80	5.86	7.04	136.1	0.00
30	91.87	5.87	1.82	4.06	**7.31**	137.8	0.00
40	75.15	4.80	1.81	2.99	7.19	137.0	0.00
50	63.95	4.09	1.80	2.29	6.87	135.0	0.00
60	55.89	3.57	1.78	1.79	6.45	132.3	0.00
70	49.79	3.18	1.76	1.42	5.97	129.2	0.00
80	44.99	2.88	1.74	1.14	5.45	125.8	0.00
90	41.11	2.63	1.71	0.92	4.95	121.4	0.00
100	37.90	2.42	1.68	0.74	4.45	116.6	0.00
110	35.20	2.25	1.65	0.60	3.95	111.8	0.00
120	32.89	2.10	1.62	0.48	3.46	107.1	0.00

Storage: Roof Storage

Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check

Stormwater Management Calculations

Project #160401680, 138 Forward Avenue
Modified Rational Method Calculatons for Storage

5-year Water Level	102.09	0.10	1.59	2.94	9.20	0.00

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	0.044 ha			
Total 5yr Flow to Sewer	4.94 L/s	0	0 m^3	Ok
Non-Tributary Area	0.003 ha			
Total 5yr Flow Uncontrolled	0.56 L/s			
Total Area	0.047 ha			
Total 5yr Flow	5.50 L/s			
Target	6.81 L/s			

Project #160401680, 138 Forward Avenue
Modified Rational Method Calculatons for Storage

100-year Water Level	137.78	0.14	1.82	7.31	9.20	0.00

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	0.044 ha			
Total 100yr Flow to Sewer	8.36 L/s	0	0 m^3	Ok
Non-Tributary Area	0.003 ha			
Total 100yr Flow Uncontrolled	1.21 L/s			
Total Area	0.047 ha			
Total 100yr Flow	9.57 L/s			
Target	6.81 L/s			

Project #160401680, 138 Forward Avenue
Roof Drain Design Sheet, Area ROOFA
Standard Watts Model R1100 Accuflow Roof Drainin

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	0.0006	0	0.025	5	0	0	0.025
0.050	0.0006	0.0013	0	0.050	20	0	0	0.050
0.075	0.0007	0.0014	1	0.075	46	1	1	0.075
0.100	0.0008	0.0016	3	0.100	82	2	3	0.100
0.125	0.0009	0.0017	5	0.125	128	3	5	0.125
0.150	0.0009	0.0019	9	0.150	184	4	9	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.3	236.3	0.3	0.06564
1.1	570.1	0.8	0.22399
2.7	999.2	1.6	0.50154
5.3	1497.5	2.6	0.91751
9.2	2047.8	3.9	1.48635

Rooftop Storage Summary

Total Building Area (sq.m)		230
Assume Available Roof Area (sq.	80%	184
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		9
Estimated 100 Year Drawdown Time (h)		1.2

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

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

From Watts Drain Catalogue

Head (m)	L/s				
	Open	0.75	0.5	**0.25**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.05	0.6309	0.6309	0.6309	**0.6309**	0.6309
0.075	0.9464	0.8675	0.7886	**0.7098**	0.6309
0.1	1.2618	1.1041	0.9464	**0.7886**	0.6309
0.125	1.5773	1.3407	1.1041	**0.8675**	0.6309
0.15	1.8927	1.5773	1.2618	**0.9464**	0.6309

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.002	0.002	-
Depth (m)	0.102	0.138	0.150
Volume (cu.m)	2.9	7.3	9.2
Draintime (hrs)	0.5	1.2	

Project #160401680, 138 Forward Avenue
Roof Drain Design Sheet, Area ROOFB
Standard Watts Model R1100 Accutrol 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	0.000
0.025	0.0003	0.0003	0.01	0.025	1	0.01	0.01	0.025
0.050	0.0006	0.0006	0.0	0.050	3	0.04	0.04	0.050
0.075	0.0007	0.0007	0.2	0.075	6	0.11	0.15	0.075
0.100	0.0008	0.0008	0.4	0.100	11	0.21	0.36	0.100
0.125	0.0009	0.0009	0.7	0.125	17	0.34	0.694	0.125
0.150	0.0009	0.0009	1.2	0.150	24	0.506	1.20	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.0	61.6	0.0	0.01712
0.1	148.7	0.1	0.05843
0.4	260.6	0.2	0.13084
0.7	390.7	0.3	0.23935
1.2	534.2	0.5	0.38774

Rooftop Storage Summary

Total Building Area (sq.m)		30
Assume Available Roof Area (sq.	80%	24
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		1
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		1
Estimated 100 Year Drawdown Time (h)		0.2

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

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

From Watts Drain Catalogue

Head (m)	L/s				
	Open	0.75	0.5	**0.25**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.05	0.6309	0.6309	0.6309	**0.6309**	0.6309
0.075	0.9464	0.8675	0.7886	**0.7098**	0.6309
0.1	1.2618	1.1041	0.9464	**0.7886**	0.6309
0.125	1.5773	1.3407	1.1041	**0.8675**	0.6309
0.15	1.8927	1.5773	1.2618	**0.9464**	0.6309

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.001	0.001	-
Depth (m)	0.058	0.104	0.150
Volume (cu.m)	0.1	0.4	1.2
Draintime (hrs)	0.0	0.2	

D.2 STORM SEWER DESIGN SHEET

Stantec

138 FORWARD AVENUE

DATE: 2021-12-23
REVISION: 1
DESIGNED BY: AS
CHECKED BY: DT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401680

DESIGN PARAMETERS

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

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

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

LOCATION			DRAINAGE AREA																						PIPE SELECTION										
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
SITE	CB-1	EXIST.	0.00	0.00	0.00	0.044	0.03	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	**10.00**	76.81	104.19	122.14	178.56	0.0	0	16.1	10.5	200	200	CIRCULAR	PVC	-	1.00	33.3	**48.49%**	1.05	0.89	0.20
																				10.20															

D.3 PRECONSULTATION NOTES

Pre-Application Consultation Meeting Notes

138 Forward Avenue
File Number: PC2021-0323
Wednesday September 22, 2021, Microsoft Teams

Attendees:

City of Ottawa:
Jean-Charles Renaud, Planner, File Lead
Margot Linker, Student Planner
Reza Bakhit, Project Manager
Adrian Van Wyk, Urban Design
Jessica Button, Planner

Applicant Team:
Anthony Devonish, Owner
John Moser, GPA Group
Susan D. Smith, SDS Architect
Thanh Do, SDS Architecture

Community Association Representatives:
Lorrie Marlow

Subject: 138 Forward Avenue

Meeting Notes:

Opening & attendee introduction

- Introduction of meeting attendees

Proposal Overview

- Last year, proposal was to combine lot with 139 Parkdale into one property.
- Now proposing two separate buildings on two separate lots.
- Proposal: 3-storeys plus 1 basement, 15 units: eight two-bedroom units, five one-bedroom units, 2 bachelor units
- Proposal complies with all zoning requirements
- Front entrance facing Froward Avenue. Next to entryway is a lift and a set of stairs that lead to the main lobby where bike storage and garbage can be accessed.
- 3rd floor – stepback five metres due to overhead wires
- Proposed 3D models – modern look, large setback in rear yard between the two buildings

Questions:

- JC: Fully compliant?
    - Thanh: Yes.
    - JC: Edit site plan zoning table to remove "(MINOR VARIANCE)" from minimum front yard setback.
- JC: Is the door on the north and south side a main entrance or emergency exit?
    - Thanh: These are emergency exits
    - JC: A concrete landing is required and needs to be kept clear (snow, etc.). Need to show this as a hard surface on the plans.
- JC: Is there vehicular access to the laneway at back
    - Thanh: This is a public laneway. No access for traffic
    - Lorrie: this is an unmaintained laneway. Must be kept as open greenspace.
    - Thanh: Property doesn't include the laneway. No encroachments on laneway. Setbacks are from property line not the laneway.
    - John: when we do apartment on Parkdale side, lane will be used as rear yard setback and will not be part of the building.

Preliminary Comments from Related Discipline:

<u>Planning (JC)</u>

- 10 spaces of bike parking next to a lift, site plan shows 16 spaces.
    - Thanh: Will revise to show stacked bike storage that will maintain 10 bike parking spaces.
    - JC: Encourage you to strive to increase bike storage to one space per unit
- Parking prohibitors, incorporate landscaping to ensure that front lawn doesn't become front yard parking.
- Encourage you to look at opportunities for additional landscaping (front and rear yard)
- Conforming with s.143 waste management access, s.144 alternative setbacks, new r4 provisions in s.161(15)
- Study what happens if the immediate neighbours do what you're doing or taller. You are respecting zoning by-law. Does the proposal remain adequate if neighbours decide to do the exact same thing? There would be 3 m between buildings – access to light through those side windows? Opportunities to remediate pressures on site in this scenario.
    - Discuss this in planning rationale
- Consider how residents are to access the rear yard. Current plans do not make this clear.

<u>Urban Design (Adrian)</u>

- What is the relationship between the two parcels?
    - Thanh: Two separate parcels of land. Previously planned to merge them together but there were issues in zoning compliance. Now they will develop separately through two distinct applications.

    - John: lane closure application and pre-consultation for 139 Parkdale coming soon. Two distinct developments.
- 139 Parkdale is within Tunney's Pasture mixed use priority area and is subject to UDRP
- 138 Forward is on the border, no requirement for UDRP
- A Design Brief will be required as part of a complete application. Please see the attached terms of reference for requirements. Can combine design brief with planning rationale
- Clarification: Front yard setback and needing to provide additional setback to accommodate hydro line by 5 meters.
    - Setback shown is 1.56 on plan, is currently 3.2 and on the third floor it steps back 2 more metres
- More details are requested on proposed landscaping. It is strongly recommended that trees be planted in the rear yard, and that street trees be planted in the front yard if conditions allow.
    - Consider on front façade trellises, shrubbery to soften the façade
- Bicycle parking – appreciate ratio of 1-1. Visitor bike parking in the front would be appreciated
- It is strongly recommended that sustainable design elements be incorporated into the proposal (e.g. green roofs, passive design interventions, etc.).
- Please review and consider the Low-Rise Infill Design Guidelines and the Transit Oriented Development Guidelines.
- In terms of materiality and architectural expression, it is felt that the front façade of the building is very busy and could benefit from a quieter expression (limiting the amount of dark brick on the ground floor as a suggestion)
- It is strongly recommended that the applicant consider potential future development on adjacent properties and demonstrate how the proposal responds to these future conditions.

<u>Transportation (Wally)</u>

- The development site proposes 16 units and no parking spaces. This development would not generate sufficient traffic to warrant a TIA report.
- Forward Avenue is classified as a Local road. There are no additional protected ROW limits identified in the OP.
- The closure of an existing private approach shall reinstate the sidewalk, shoulder, curb and boulevard to City standards.
- The purchaser, tenant or sub-lessee acknowledges the unit being rented/sold is not provided with any on-site parking and should a tenant/purchaser have a vehicle for which they wish to have parking that alternative and lawful arrangements will need to be made to accommodate their parking need at an alternative location. The Purchaser/Tenant also acknowledges that the availability and regulations governing on-street parking vary; that access to on-street parking, including through residential on-street parking permits issued by the City cannot be guaranteed now or in the future; and that a purchaser, tenant or sub-lessee intending to rely on on-street parking for their vehicle or vehicles does so at their own risk.
- Please keep in mind that on street parking is not a viable option for tenants. Ensure that potential tenants are aware that there is no provision for parking.
- The Owner shall be required to enter into maintenance and liability agreement for all pavers, plant and landscaping material placed in the City right-of-way and the Owner shall assume all maintenance and replacement responsibilities in perpetuity.

- Bicycle parking spaces are required as per Section 111 of the Ottawa Comprehensive Zoning By-law. Bicycle parking spaces should be located in safe, secure places near main entrances and preferably protected from the weather.

Civil Engineer (Reza)

- Standard SPC
- Services – all are present, pretty much new
- Attain an engineering consultant
- Glad to see you consider rear yard for landscape
- Services you have in ROW are storm and sanitary

General:

- It is the sole responsibility of the consultant to investigate the location of existing underground utilities in the proposed servicing area and submit a request for locates to avoid conflict(s). The location of existing utilities and services shall be documented on an **Existing Conditions Plan**.
- Any easements on the subject site shall be identified and respected by any development proposal and shall adhere to the conditions identified in the easement agreement. A **legal survey plan** shall be provided and all easements shall be shown on the engineering plans.
- Existing buildings require a CCTV inspection and report to ensure existing services to be re-used are in good working order and meet current minimum size requirements. Located services to be placed on site servicing plans.

- Reference documents for information purposes :
  - Ottawa Sewer Design Guidelines (October 2012)
  - Technical Bulletin PIEDTB-2016-01
  - Technical Bulletins ISTB-2018-01, ISTB-2018-02 , ISTB-2021-03, and ISTB-2018-03.
  - Ottawa Design Guidelines - Water Distribution (2010)
  - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
  - City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
  - City of Ottawa Environmental Noise Control Guidelines (January 2016)
  - City of Ottawa Accessibility Design Standards (2012) (City recommends development be in accordance with these standards on private property)
  - Ottawa Standard Tender Documents (latest version)
  - Ontario Provincial Standards for Roads & Public Works (2013)
  - Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-424 x.44455).

Please note that this is the applicant responsibility to refer to the latest applicable guidelines while preparing reports and studies.

Disclaimer:

The City of Ottawa does not guarantee the accuracy or completeness of the data and information contained on the above image(s) and does not assume any responsibility or liability with respect to any damage or loss arising from the use or interpretation of the image(s) provided. This image is for schematic purposes only.

Stormwater Management Criteria and Information:

- **Water Quantity Control:** In the absence of area specific SWM criteria please control post-development runoff from the subject site, up to and including the **100-year storm event**, to **a 5-year pre-development level.** The pre-development runoff coefficient will need to be determined **as per existing conditions** but in no case more than 0.5. [**If 0.5 applies it needs to be clearly demonstrated in the report that the pre-development runoff coefficient is greater than 0.5**]. The time of concentration (T_c) used to determine the pre-development condition should be calculated. *Tc should not be less than 10 min. since IDF curves become unrealistic at less than 10 min; T_c of 10 minutes shall be used for all post-development calculations*].
- Any storm events greater than the established **5-year allowable** release rate, up to and including the **100-year storm event**, shall be detained on-site. The SWM measures required to avoid impact on downstream sewer system will be subject to review.
- Please note that foundation drainage is to be independently connected to sewer main unless being pumped with appropriate back up power, sufficient sized pump and back flow prevention. **It is recommended that the foundation drainage system be drained by a sump pump connection to the storm sewer to minimize risk of basement flooding as it will provide the best protection from the uncontrolled sewer system compared to relying on the backwater valve.**
- **Water Quality Control:** Please consult with the local conservation authority (RVCA) regarding water quality criteria prior to submission of a Site Plan Control Proposal application to establish any water quality control restrictions, criteria and measures for the site. Correspondence and clearance shall be provided in the Appendix of the report.
- **If Underground Storage proposed:** Please note that the Modified Rational Method for storage computation in the Sewer Design Guidelines was originally intended to be used for above ground storage (i.e. parking lot) where the change in head over the orifice varied from 1.5 m to 1.2 m (assuming a 1.2 m deep CB and a max ponding depth of 0.3 m). This change in head was

small and hence the release rate fluctuated little, therefore there was no need to use an average release rate.

When underground storage is used, the release rate fluctuates from a maximum peak flow based on maximum head down to a release rate of zero. This difference is large and has a significant impact on storage requirements. **We therefore require that an average release rate equal to 50% of the peak allowable rate shall be applied to estimate the required volume. Alternatively, the consultant may choose to use a submersible pump in the design to ensure a constant release rate.**

In the event that there is a disagreement from the designer regarding the required storage, The City will require that the designer demonstrate their rationale utilizing dynamic modelling, that will then be reviewed by City modellers in the Water Resources Group.

Please provide information on UG storage pipe. Provide required cover over pipe and details, chart of storage values, capacity etc. How will this pipe be cleaned of sediment and debris? Provide information on type of underground storage system including product name and model, number of chambers, chamber configuration, confirm invert of chamber system, top of chamber system, required cover over system and details, interior bottom slope (for self-cleansing), chart of storage values, length, width and height, capacity, entry ports (maintenance) etc.

Provide a cross section of underground chamber system showing invert and obvert/top, major and minor HWLs, top of ground, system volume provided during major and minor events. UG storage to provide actual 2- and 100-year event storage requirements.

In regard to all proposed UG storage, ground water levels (and in particular HGW levels) will need to be reviewed to ensure that the proposed system does not become surcharged and thereby ineffective.

Modeling can be provided to ensure capacity for both storm and sanitary sewers for the proposed development by City's Water Distribution Dept. – Modeling Group, through PM and upon request.

- Please note that the minimum orifice dia. for a plug style **ICD is 83mm and the minimum flow rate from a vortex ICD is 6 L/s** in order to reduce the likelihood of plugging.
- Post-development site grading shall match existing property line grades in order to minimize disruption to the adjacent residential properties. A **topographical plan of survey** shall be provided as part of the submission and a note provided on the plans.
- Please provide a **Pre-Development Drainage Area Plan** to define the pre-development drainage areas/patterns. **Existing drainage patterns shall be maintained and discussed as part of the proposed SWM solution**.
- **If rooftop control** proposed and storage is proposed as part of the SWM solutions sufficient details (Cl. 8.3.8.4) shall be discussed and document in the report and on the plans. Roof drains are to be connected downstream of any incorporated ICDs within the SWM system and not to the foundation drain system. Provide a **Roof Drain Plan** as part of the submission.
- Considering the size of the site, it would be acceptable to control the roof portion only and leave the remainder of the site uncontrol as long as the run off from uncontrolled portion is directed towards the right of way. This approach should be discussed in the SWM report. Also, the

grading plan should clearly demonstrate that the runoff from the uncontrolled portion of the site will be directed towards the ROW

- If **Window wells** are proposed, they are to be indirectly connected to the footing drains. A detail of window well with indirect connection is required, as is a note at window well location speaking to indirect connection.
- There must be at least **15cm of vertical clearance** between the spill elevation and the ground elevation at the building envelope that is in proximity of the flow route or ponding area. The exception in this case would be at reverse sloped loading dock locations. At these locations, a minimum of 15cm of vertical clearance must be provided below loading dock openings. Ensure to provide discussion in report and ensure grading plan matches if applicable.

Storm Sewer:

- A 300mm dia. PVC storm sewer (2000) is available within **Forward Avenue.**

Sanitary Sewer Maclaren St:

- A 250 mm dia. PVC Sanitary sewer (2000) is available within **Forward Avenue.**
- Please provide the new Sanitary sewer discharge and we confirm if sanitary sewer main has the capacity. An analysis and demonstration that there is sufficient/adequate residual capacity to accommodate any increase in wastewater flows in the receiving and downstream wastewater system is required to be provided. Needs to be demonstrated that there is adequate capacity to support any increase in wastewater flow.
- Please apply the wastewater design flow parameters *in Technical Bulletin PIEDTB-2018-01.*
- Sanitary sewer monitoring maintenance hole is required to be installed at the property line (on the private side of the property) as per City of Ottawa Sewer-Use By-Law 2003-514 (14) *Monitoring Devices*.
- A backwater valve is required on the sanitary service for protection.

Water :

- A 203 mm dia. PVC watermain (2002) is available within **Forward Avenue.**
- Existing residential service to be blanked at the main.
- **Water Supply Redundancy:** Residential buildings with a basic day demand greater than 50m^3/day (0.57 L/s) are required to be connected to a minimum of two water services separated by an isolation valve to avoid a vulnerable service area as per the *Ottawa Design Guidelines - Water Distribution, WDG001, July 2010 Clause 4.3.1 Configuration.* The basic day demand for this site not expected to exceed 50m^3/day.
- Please **review Technical Bulletin ISTB-2018-0**, maximum fire flow hydrant capacity is provided in Section 3 Table 1 of Appendix I. A **hydrant coverage figure** shall be provided and **demonstrate there is adequate fire protection for the proposal**. Two or more public hydrants are anticipated to be required to handle fire flow.
- Boundary conditions are required to confirm that the require fire flows can be achieved as well as availability of the domestic water pressure on the City street in front of the development. Use Table 3-3 of the MOE Design Guidelines for Drinking-Water System to determine Maximum Day and Maximum Hour peaking factors for 0 to 500 persons and use Table 4.2 of the Ottawa Design Guidelines, Water Distribution for 501 to 3,000 persons. Please provide the following information to the City of Ottawa via email to request water distribution network boundary conditions for the subject site. Please note that once this information has been provided to the City of Ottawa it takes approximately 5-10 business days to receive boundary conditions.
    - Type of Development and Units

- Site Address
- A plan showing the proposed water service connection location.
- **Average Daily Demand** (L/s)
- **Maximum Daily Demand** (L/s)
- **Peak Hour Demand** (L/s)
- **Fire Flow** (L/min)

[Fire flow demand requirements shall be based on ISTB-2021-03]

- **Hydrant capacity shall be assessed to demonstrate the RFF can be achieved**. Please identify which hydrants are being considered to meet the RFF on a fire hydrant coverage plan as part of the boundary conditions request.

Snow Storage:

- Any portion of the subject property which is intended to be used for permanent or temporary snow storage shall be as shown on the approved site plan and grading plan. Snow storage shall not interfere with approved grading and drainage patters or servicing. Snow storage areas shall be setback from the property lines, foundations, fencing or landscaping a minimum of 1.5m. Snow storage areas shall not occupy driveways, aisles, required parking spaces or any portion of a road allowance. If snow is to be removed from the site please indicate this on the plan(s).

Trees:

Please note that a new Tree By-law is now in effect.

General Bulletin_New Tree Protection Bylaw

Gas pressure regulating station

A gas pressure regulating station may be required depending on HVAC needs (typically for 12+ units). Be sure to include this on the Grading, Site Servicing, SWM and Landscape plans. This is to ensure that there are no barriers for overland flow routes (SWM) or conflicts with any proposed grading or landscape features with installed structures and has nothing to do with supply and demand of any product.

Gas Pressure Regulating Station.pd

Regarding Quantity Estimates:

Please note that external Garbage and/or bicycle storage structures are to be added to QE under Landscaping as it is subject to securities.In addition, sump pumps for Sanitary and Storm laterals and/or cisterns are to be added to QE under Hard items as it is subject to securities, even though it is internal and is spoken to under SWM and Site Servicing Report and Plan.

Required Engineering Plans and Studies:

PLANS:

- Existing Conditions and Removals Plan
- Site Servicing Plan
- Grade Control and Drainage Plan
- Erosion and Sediment Control Plan
- Roof Drainage Plan (If roof utilized as a SWM component)
- Topographical survey

REPORTS:

- Site Servicing and Stormwater Management Report
- Geotechnical Study/Investigation
- Noise Control Study
- Phase I ESA
- Phase II ESA (Depending on recommendations of Phase I ESA)
- Site lighting certificate

Please refer to the **City of Ottawa Guide to Preparing Studies and Plans [Engineering]:**

Specific information has been incorporated into both the Guide to Preparing Studies and Plans for a site plan. The guide outlines the requirement for a statement to be provided on the plan about where the property boundaries have been derived from.

Added to the general information for servicing and grading plans is a note that an **O.L.S**. should be engaged when reporting on or relating information to property boundaries or existing conditions. The importance of engaging an **O.L.S.** for development projects is emphasized.

Phase One Environmental Site Assessment:

- A Phase I ESA is required to be completed in accordance with Ontario Regulation 153/04 in support of this development proposal to determine the potential for site contamination. Depending on the Phase I recommendations a Phase II ESA may be required.
- The Phase I ESA shall provide all the required Environmental Source Information as required by O. Reg. 153/04. ERIS records are available to public at a reasonable cost and need to be included in the ESA report to comply with O.Reg. 153/04 and the Official Plan. The City will not be in a position to approve the Phase I ESA without the inclusion of the ERIS reports.
- Official Plan Section 4.8.4:

https://ottawa.ca/en/city-hall/planning-and-development/official-plan-and-master-plans/official-plan/volume-1-official-plan/section-4-review-development-applications#4-8-protection-health-and-safety

Geotechnical Investigation:

- A Geotechnical Study/Investigation shall be prepared in support of this development proposal.
- Reducing the groundwater level in this area can lead to potential damages to surrounding structures due to excessive differential settlements of the ground. The impact of groundwater lowering on adjacent properties needs to be discussed and investigated to ensure there will be no short term and long term damages associated with lowering the groundwater in this area.
- Geotechnical Study shall be consistent with the **Geotechnical Investigation and Reporting Guidelines for Development Applications**.

https://documents.ottawa.ca/sites/documents/files/geotech_report_en.pdf

Noise Study:

- A **Transportation Noise Assessment** is required as the subject development is located within 100m proximity of an Arterial Road
- A **Stationary Noise Assessment** is required in order to assess the noise impact of the proposed sources of stationary noise (mechanical HVAC system/equipment) of the development onto the surrounding residential area to ensure the noise levels do not exceed allowable limits specified in the City Environmental Noise Control Guidelines.

https://documents.ottawa.ca/sites/default/files/documents/enviro_noise_guide_en.pdf

Construction approach – Please contact the Right-of-Ways Permit Office TMconstruction@ottawa.ca early in the Site Plan process to determine the ability to construct site and copy File Lead Jean Charles Jean-Charles.Renaud@ottawa.ca on this request.

Please note that these comments are considered preliminary based on the information available to date and therefore maybe amended as additional details become available and presented to the City. It is the responsibility of the applicant to verify the above information. The applicant may contact me for follow-up questions related to engineering/infrastructure prior to submission of an application if necessary.

If you have any questions or require any clarification, please let me know.

Community Association Comments:

Lorrie Marlow

- Neighbours must be consulted on lane closure.
    - This will occur through separate application that will require public consultation
- Is the glass safe bird complaint? Yes
- HVAC on roof, correct? No ventilation plans exhausting into neighbours. Correct?
    - Thanh: Don't have exact layout. Setback is 1.5 m. Will be designed based on requirements
    - Ensure none of the neighbours are affected by fans
- Please be absolutely upfront with people renting in this building that there is no parking
    - John: Is there permit parking on streets? Lorrie: Hard to get.
- Recommendation: NCC in greenspace have been renting out that land for construction staging.
- Consider a carshare program
- 2 front/back semi approved on 134 and 138/140 Forward

Next Steps:

- Follow up email that will include meeting notes and the plans and studies list required for SPC submission
- Lorrie has signed an NDA. Book some time to approach community association to discuss proposal, as well as with the ward Councillor

D.4 RIDEAU VALLEY CONSERVATION AUTHORITY CONSULTATION

From: Eric Lalande
To: Shobowale, Aminat
Cc: Gladish, Alyssa
Subject: RE: 138 Forward Avenue Ottawa, Ontario
Date: Thursday, December 2, 2021 7:21:27 AM

Thank you Aminat,

The comments are maintained that no quality protection is required based on the site design. Best management practices are encouraged to be integrated where possible.

Thank you,

Eric Lalande, MCIP, RPP
Planner, RVCA
613-692-3571 x1137

From: Shobowale, Aminat <Aminat.Shobowale@stantec.com>
Sent: Tuesday, November 30, 2021 10:55 AM
To: Eric Lalande <eric.lalande@rvca.ca>
Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: RE: 138 Forward Avenue Ottawa, Ontario

Hi Eric,

Thank you for your response and attached is the site plan for the proposed development.

Regards,

Aminat.

Aminat Shobowale
Civil Designer, Community Development

Mobile: (437) 833-4988
Aminat.Shobowale@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Eric Lalande <eric.lalande@rvca.ca>
Sent: Tuesday, November 30, 2021 9:05 AM
To: Shobowale, Aminat <Aminat.Shobowale@stantec.com>

Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: RE: 138 Forward Avenue Ottawa, Ontario

Hi Aminat,

I typically look for a site plan, based on the description it would appear likely that no quality control is required, however I will reserve comment until I am able to review the plan.

Thank you,

Eric Lalande, MCIP, RPP
Planner, RVCA
613-692-3571 x1137

From: Shobowale, Aminat <Aminat.Shobowale@stantec.com>
Sent: Monday, November 29, 2021 4:56 PM
To: Eric Lalande <eric.lalande@rvca.ca>
Cc: Gladish, Alyssa <Alyssa.Gladish@stantec.com>
Subject: 138 Forward Avenue Ottawa, Ontario

Good afternoon Eric,

Stantec is preparing a civil engineering design submission in support of a site plan control application for a proposed re-development on 138 Forward Avenue in the City of Ottawa.

We have been directed to consult with you to confirm if stormwater quality control requirements are necessary for this site.

Below is a list of some key site information:

i. The existing building will be replaced by a 3-storeys plus 1 basement building to be serviced through the existing services on Forward Avenue.
ii. There is an existing 300mm diameter PVC storm sewer fronting the site on Forward Avenue.
iii. There is no onsite parking at the proposed development.
iv. Stormwater quantity control for the site is anticipated to be provided via rooftop storage and the remaining site uncontrolled towards the right of way.
v. The City of Ottawa has indicated that the allowable stormwater release rate is to be calculated using:
    - Allowable Runoff coefficient (C): 0.5.
    - Allowable flowrate: Control the 100-year storm events to the 5-year predevelopment storm event.

Thank you in advance for your help.

Please let me know if you require any additional information from our end.

Regards,

Aminat.

Aminat Shobowale
Civil Designer, Community Development

Mobile: (437) 833-4988
Aminat.Shobowale@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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

Appendix E GEOTECHNICAL INVESTIGATION

E.1 DRAFT GEOTECHNICAL INVESTIGATION BY PATERSON GROUP INC

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Noise and Vibration Studies

patersongroup

Geotechnical Investigation

Proposed Residential Building
138 Forward Avenue
Ottawa, Ontario

Prepared For

VIKA Land Development Group Inc.

November 24, 2021

Report: PG6026-1

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

Table of Contents

PAGE

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by VIKA Land Development Group Inc. to conduct a geotechnical investigation for the proposed residential building site to be located at 138 Forward Avenue in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the geotechnical investigation were to:

- Determine the subsoil and groundwater conditions at this site by means of test holes.
- Provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of a multi-storey residential building with one basement level, which will occupy most of the subject site.

Associated walkways and landscaped areas are anticipated surrounding the proposed building. It is also expected that the proposed building will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on November 2, 2021 and consisted of advancing a total of 3 boreholes to a maximum depth of 0.9 m below existing grade. The test hole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and site features. The borehole locations are shown on Drawing PG6026-1 - Test Hole Location Plan included in Appendix 2.

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

Sampling and In Situ Testing

The soil samples were recovered from the auger flights and using a 50 mm diameter split-spoon sampler. The samples were initially classified on site, placed in sealed plastic bags, and transported to our laboratory. The depths at which the auger and split-spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Sample Storage

All samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The borehole locations were selected by Paterson to provide general coverage of the proposed development, taking into consideration the existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a handheld GPS and referenced to a geodetic datum.

The location of the boreholes and ground surface elevation at each test hole location are presented on Drawing PG6026-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a two-storey residential building, which is surrounded by asphalt-paved parking areas. The site is bordered by Forward Avenue to the east, and residential properties to the north, south and west. The existing ground surface across the site is relatively level at approximate geodetic elevation 62 m.

4.2 Subsurface Profile

Overburden

Generally, the soil profile at the borehole locations consists of fill, extending to approximate depths of 0.6 to 0.9 m below the existing ground surface, where practical refusal of the augers was encountered on the inferred bedrock surface. The fill was generally observed to consist of a crushed stone with some sand and occasional traces of clay.

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

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of limestone of the Bobcaygeon formation.

4.3 Groundwater

Groundwater was not observed in the completed boreholes prior to backfilling. However, based on our experience at an adjacent site, the groundwater level is expected at approximate depths of 2 to 3 m below the existing ground surface.

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

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. The proposed building is recommended to be founded on conventional spread footings placed on clean, surface sounded bedrock.

Bedrock removal will be required to construct the basement level. Hoe ramming is an option where the bedrock is weathered and/or where only small quantities of bedrock need to be removed. Line drilling and controlled blasting may be required where large quantities of bedrock need to be removed. The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations.

The above and other considerations are discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Due to the depth of the bedrock at the subject site and the anticipated founding level for the proposed multi-storey building, it is anticipated that all existing overburden material will be excavated from within the footprint of the proposed multi-storey building.

Existing foundation walls and other construction debris should be entirely removed from within the proposed building perimeter. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

As noted above, bedrock removal can be accomplished by hoe ramming where the bedrock is weathered and/or where only small quantities of the bedrock need to be removed. Sound bedrock may be removed by line drilling in conjunction with controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings, and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in the proximity of the blasting operations should be carried out prior to commencing site activities.

The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries or claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing surrounding structures. The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be a source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz).

It should be noted that these guidelines are for today's construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading beneath the building area should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery to the site. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction

equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill and beneath exterior parking where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on clean, surface sounded bedrock can be designed using a bearing resistance value at ultimate limits states (ULS) of **1,000 kPa**. A geotechnical factor of 0.5 was applied to the above noted bearing resistance value. Minimum dimensions of 1 m and 0.5 m should be provided for all spread and strip footings, respectively.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures, or open joints which can be detected from surface sounding with a rock hammer.

Footings bearing on an acceptable bedrock bearing surface and designed for the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A weathered bedrock bearing medium will require a lateral support zone of 1H:1V (or flatter).

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations constructed at the subject site. A higher site class, such as Class A or B, may be provided for foundations placed on bedrock. However, the higher site class would need to be confirmed by a site-specific seismic shear wave velocity test.

The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Floor Slab

All overburden soil will be removed from the subject site leaving the bedrock as the founding medium for the basement floor slab. It is recommended that the upper 200 mm of sub-slab fill consists of 19 mm clear crushed stone.

In consideration of the groundwater conditions at the site, an underslab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the 19 mm clear crushed stone layer under the lower basement floor. This is discussed further in Subsection 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3.

Two distinct conditions, static and seismic, should be reviewed for design calculations. The corresponding parameters are presented below.

Lateral Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained material (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the "at-rest" case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32 g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.
The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Design

For design purposes, the pavement structures presented in the following tables are recommended for the design of car only parking areas and access lanes, should they be required as part of the proposed development.

Table 1 - Recommended Pavement Structure - Car Only Parking Areas	
Thickness (mm)	**Material Description**
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 2 - Recommended Pavement Structure Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course** – HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** – HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable vibratory equipment, noting that excessive compaction can result in subgrade softening.

If bedrock is encountered at the subgrade level, the total thickness of the pavement granular materials (base and subbase) could be reduced to 300 mm. The upper 300 mm of the bedrock surface should be reviewed and approved by Paterson prior to placing the base and subbase materials. Care should be exercised to ensure that the bedrock subgrade does not have depressions that will trap water.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

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

Where insufficient room is available for exterior backfill, it is suggested that the composite drainage system (such as Delta Drain 6000 or equivalent) be secured against the vertical bedrock face extending to a series of drainage sleeves inlets through the building foundation wall at the footing/foundation wall interface. The drainage sleeves should be at least 150 mm diameter and be spaced 3 m along the perimeter foundation walls. An interior perimeter drainage pipe should be placed along the building perimeter along with the underslab drainage system. The perimeter drainage pipe and sub-slab drainage system should direct water to sump pit(s) within the lower underground area.

Underslab Drainage

Sub-slab drainage is recommended to control water infiltration below the basement slab. For preliminary design purposes, we recommend that 100 to 150 mm diameter perforated PVC pipes be placed at 3 to 6 m centres underlying the basement slab. The spacing of the underslab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Where sufficient space is available for conventional backfilling, backfill against the exterior sides of the foundation wall should consist of free-draining, non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose. A waterproofing system should be provided for any elevator pits.

6.2 Protection of Footings Against Frost Action

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

Other exterior unheated footings, such as those for isolated exterior, are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

However, foundations which are founded directly on clean, surface-sounded bedrock with no cracks or fissures, and which is approved by Paterson at the time of construction, is not considered frost susceptible and does not require soil cover.

6.3 Excavation Side Slopes

The side slopes of shallow excavations anticipated at this site should either be cut back at acceptable slopes or be retained by temporary shoring systems from the start of the excavation until the structure is backfilled. Given the limited overburden encountered at this site, it is expected that there will be sufficient space to slope the overburden, followed by a vertical excavation in the underlying bedrock.

Unsupported Excavations

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

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

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

Rock stabilization

Excavation side slopes in sound bedrock can be carried out using almost vertical side walls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing or to provide a stable base for the overburden shoring system.

Horizontal rock anchors may be required at specific locations to prevent pop-outs of the bedrock, especially in areas where fractures in the bedrock are conducive to the failure of the bedrock surface.

The requirements for horizontal rock anchors and bedrock stabilization measures will be evaluated during the excavation program and determined by Paterson at the time of construction.

Underpinning

Considering the shallow depth to bedrock, it is expected that the adjacent buildings are founded on bedrock. Therefore, underpinning is not expected to be required at this site. However, an assessment should be completed by the geotechnical engineer at the time of excavation to confirm founding conditions of the existing buildings adjacent to the proposed building, in order to evaluate rock bolt locations and specific rock bolt details, should they be required.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 300 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's standard Proctor maximum dry density.

Well fractured bedrock should be acceptable as backfill for the lower portion of the trenches when the excavation is within bedrock provided the rock fill is placed only from at least 300 mm above the top of the service pipe and that all stones are 300 mm or smaller in their longest dimension.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Impacts on Neighbouring Properties

Based on the existing groundwater level and the depth of the proposed building, groundwater lowering is not expected to be required as part of construction. Further, due to the presence of shallow bedrock at, and in the vicinity of, the subject site, the neighbouring structures are expected to be founded on bedrock. Therefore, no issues are expected with respect to groundwater lowering that would cause long term adverse effects to adjacent structures surrounding the proposed building.

6.6 Winter Construction

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

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

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

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a low to slightly aggressive corrosive environment.

7.0 Recommendations

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

- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

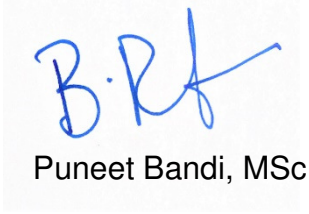
The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than the VIKA Land Development Group Inc., or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.



Puneet Bandi, MSc (Eng)

Scott S. Dennis, P.Eng.

Report Distribution:

- ❑ VIKA Land Development Group Inc. (email copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building - 138 Forward Ave.
Ottawa, Ontario

DATUM Geodetic

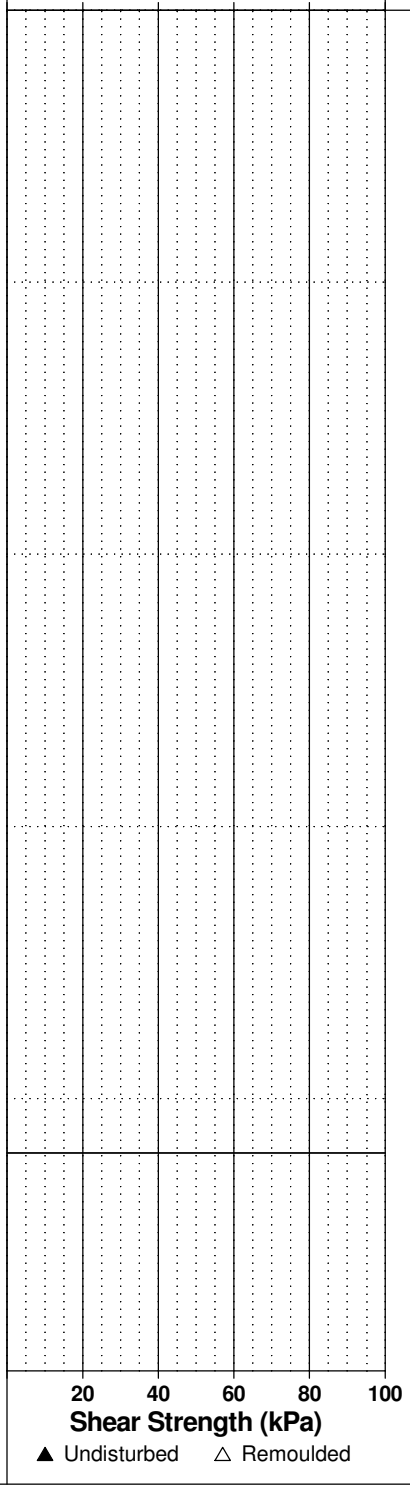
FILE NO. PG6026

REMARKS

HOLE NO. BH 1-21

BORINGS BY CME-55 Low Clearance Drill **DATE** November 2, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	61.89		
FILL: Crushed stone, some sand, trace clay		AU	1						
		SS	2	0	50+				
						0.84			
End of Borehole Practical refusal to augering at 0.84m depth (BH dry upon completion)									



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building - 138 Forward Ave.
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG6026

REMARKS

HOLE NO. BH 2-21

BORINGS BY CME-55 Low Clearance Drill **DATE** November 2, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	62.00		
FILL: Crushed stone, some sand		AU	1						
						0.69			
End of Borehole Practical refusal to augering at 0.69m depth (BH dry upon completion)									

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building - 138 Forward Ave.
Ottawa, Ontario

DATUM Geodetic

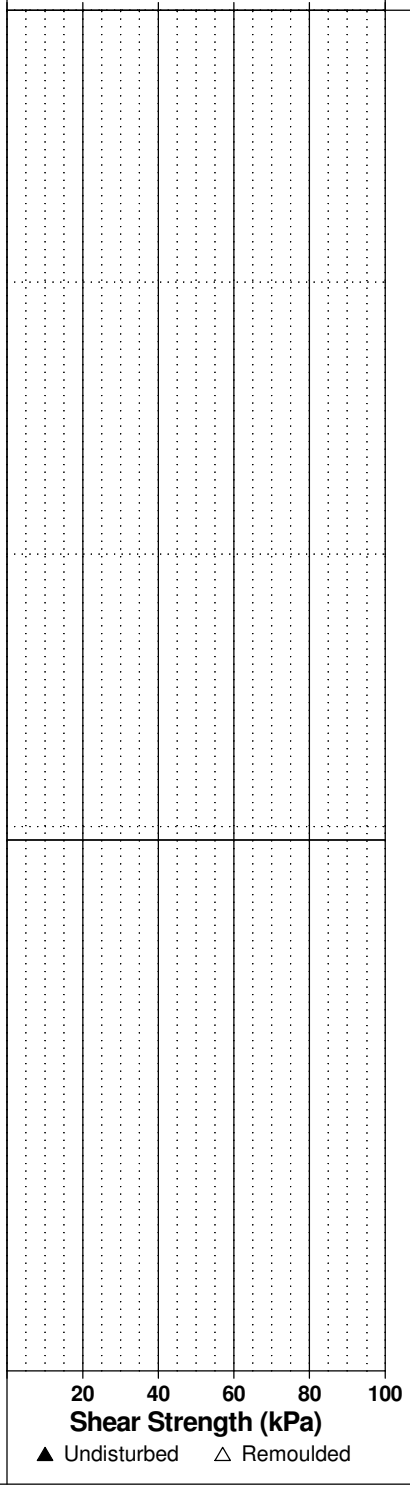
FILE NO. PG6026

REMARKS

HOLE NO. BH 3-21

BORINGS BY CME-55 Low Clearance Drill **DATE** November 2, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	61.99		
Asphaltic concrete 0.05									
FILL: Brown silty sand with crushed stone and gravel		AU	1						
0.61 End of Borehole									
Practical refusal to augering at 0.61m depth									
(BH dry upon completion)									



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

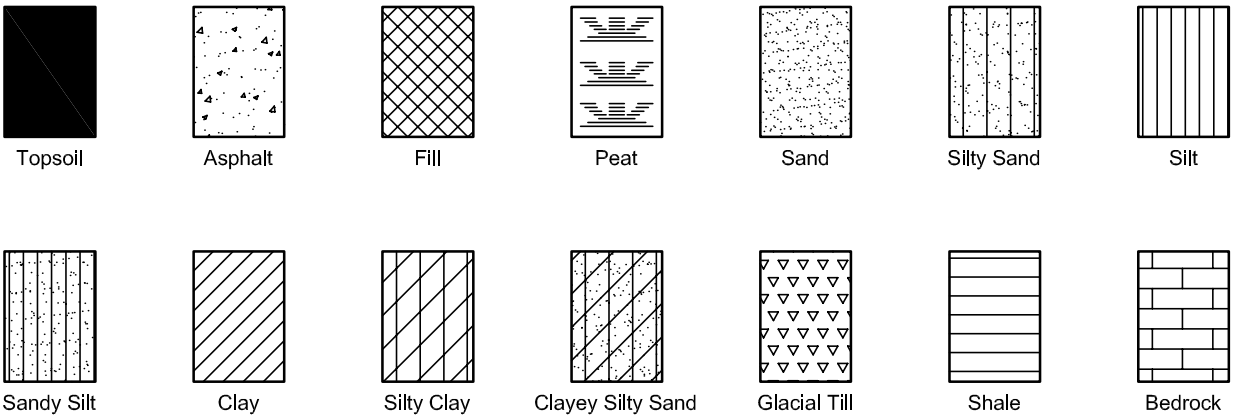
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

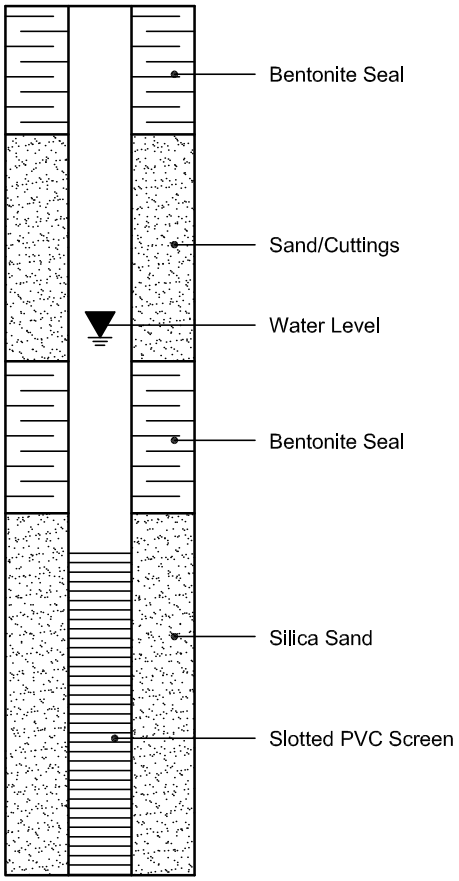
SYMBOLS AND TERMS (continued)

STRATA PLOT

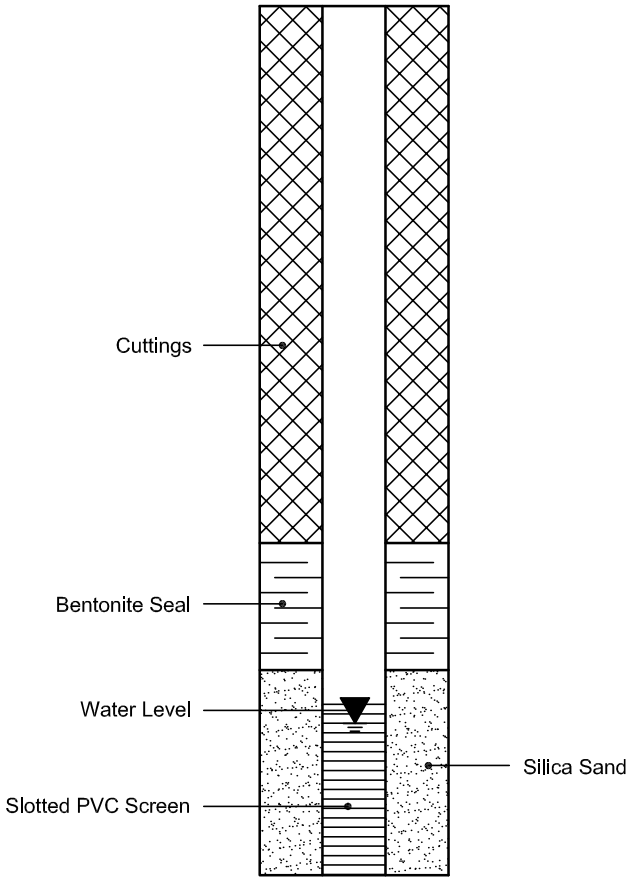


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Report Date: 09-Nov-2021

Client: Paterson Group Consulting Engineers

Order Date: 3-Nov-2021

Client PO: 33343

Project Description: PG6026

	Client ID:	BH3-21 AU1 1'-2'	-	-	-
	Sample Date:	02-Nov-21 09:00	-	-	-
	Sample ID:	2145331-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	92.8	-	-	-
General Inorganics					
pH	0.05 pH Units	7.46	-	-	-
Resistivity	0.10 Ohm.m	82.0	-	-	-
Anions					
Chloride	5 ug/g dry	11	-	-	-
Sulphate	5 ug/g dry	35	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG6026-1 – TEST HOLE LOCATION PLAN

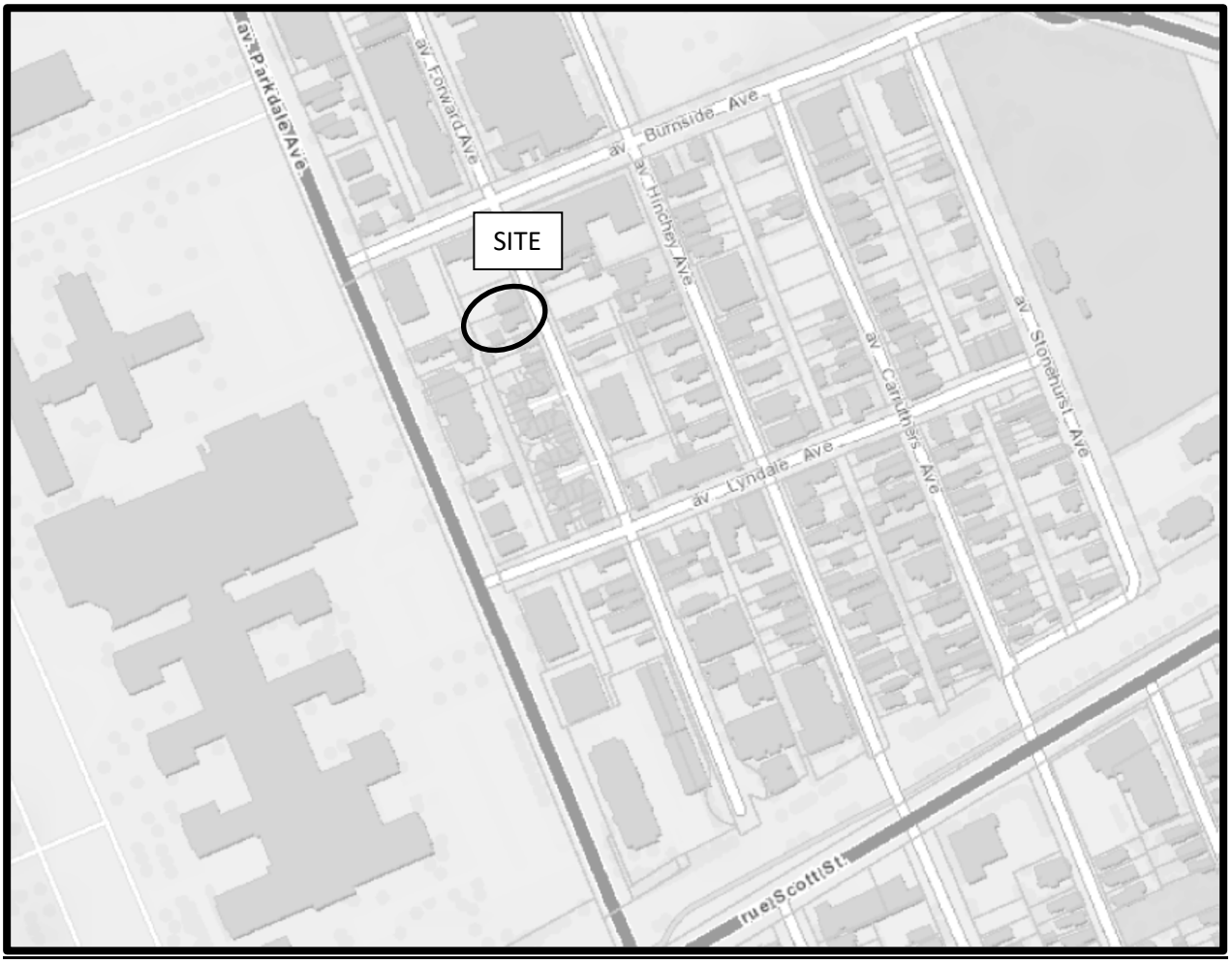
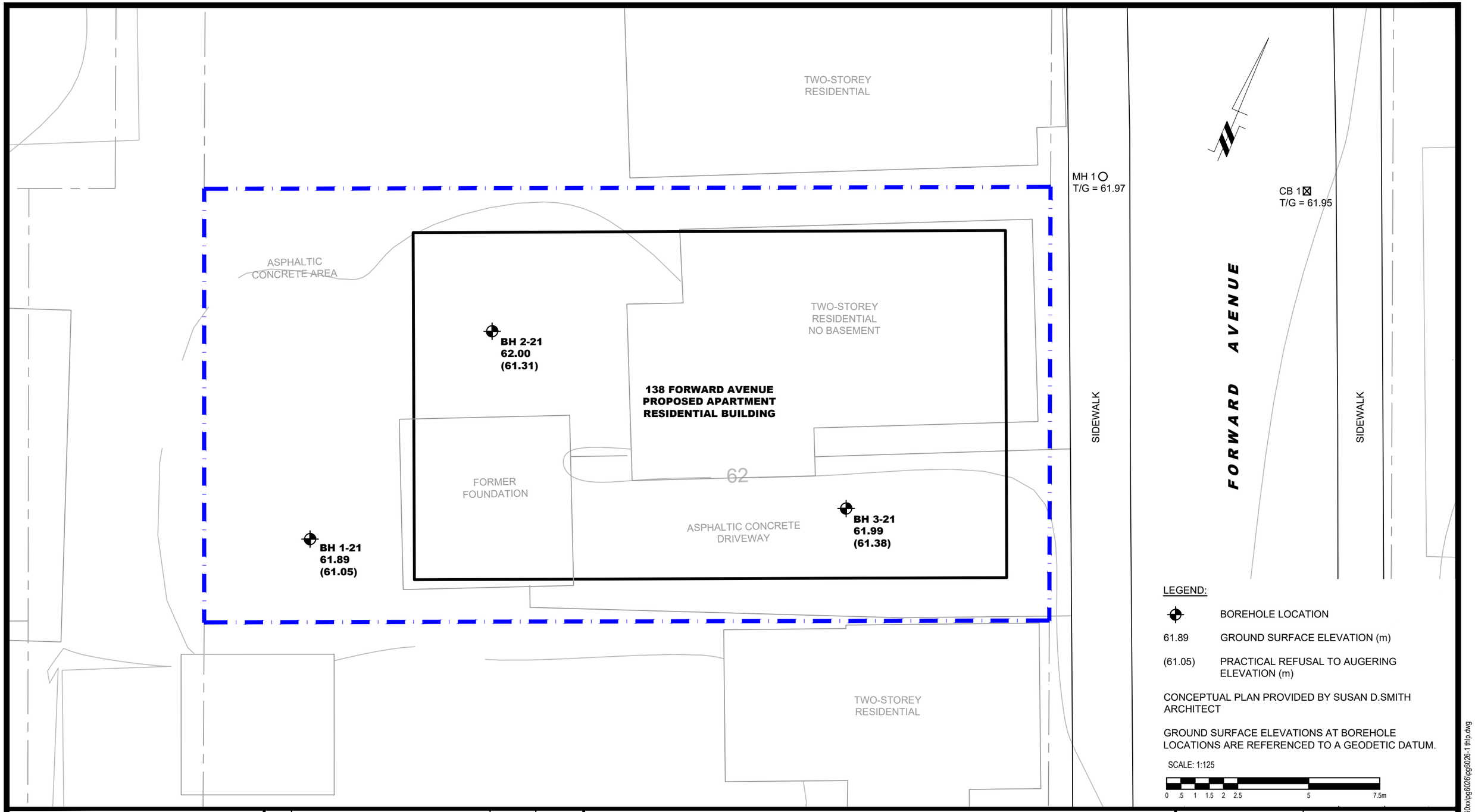


FIGURE 1

KEY PLAN



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consulting engineers

154 Colonnade Road South
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Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

VIKA LAND DEVELOPMENT GROUP INC.
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDING
138 FORWARD AVENUE
OTTAWA, ONTARIO

Title:
SITE PLAN

Scale: 1:125	**Date:** 11/2021
Drawn by: JM	**Report No.:** PG6026-1
Checked by: PB	**Dwg. No.:** PG6026-1
Approved by: SD	**Revision No.:**

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Appendix F DRAWINGS