WARE MALCOMB
ARCHITECTURE | PLANNING | INTERIORS
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Functional Servicing and Stormwater Management Report

Proposed Industrial Building
2760-2770 Sheffield Road
City of Ottawa, Ontario
K1B 3V9
City File: TBD

City of Ottawa
Planning Design and Development Department

May 15, 2023

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1. Introduction

1.0 Background

Ware Malcomb has been retained by Richcraft Properties to prepare a Functional Servicing Report in support of a Site Plan and Building Permit Application for the proposed development. The development is located at 2760-2770 Sheffield Road in the City of Ottawa. The purpose of this report is to:

- Calculate existing and proposed sanitary sewer capacity based on proposed industrial use
- Assess and confirm adequate supply and onsite distribution of municipal water to meet domestic and fire flow requirements
- Assess the requirement for stormwater management on-site including:
    - Evaluation of pre-development site conditions to determine allowable release rates
    - Evaluation of post-development site conditions based on land use
    - Development of stormwater management control measures to ensure the quantity and quality of stormwater is acceptable based on municipal and provincial regulations
    - Development of erosion and sediment control measures and practices to ensure the mitigation of sediment within surface runoff

The following documents and manuals were used to confirm conformance with municipal and provincial regulations:

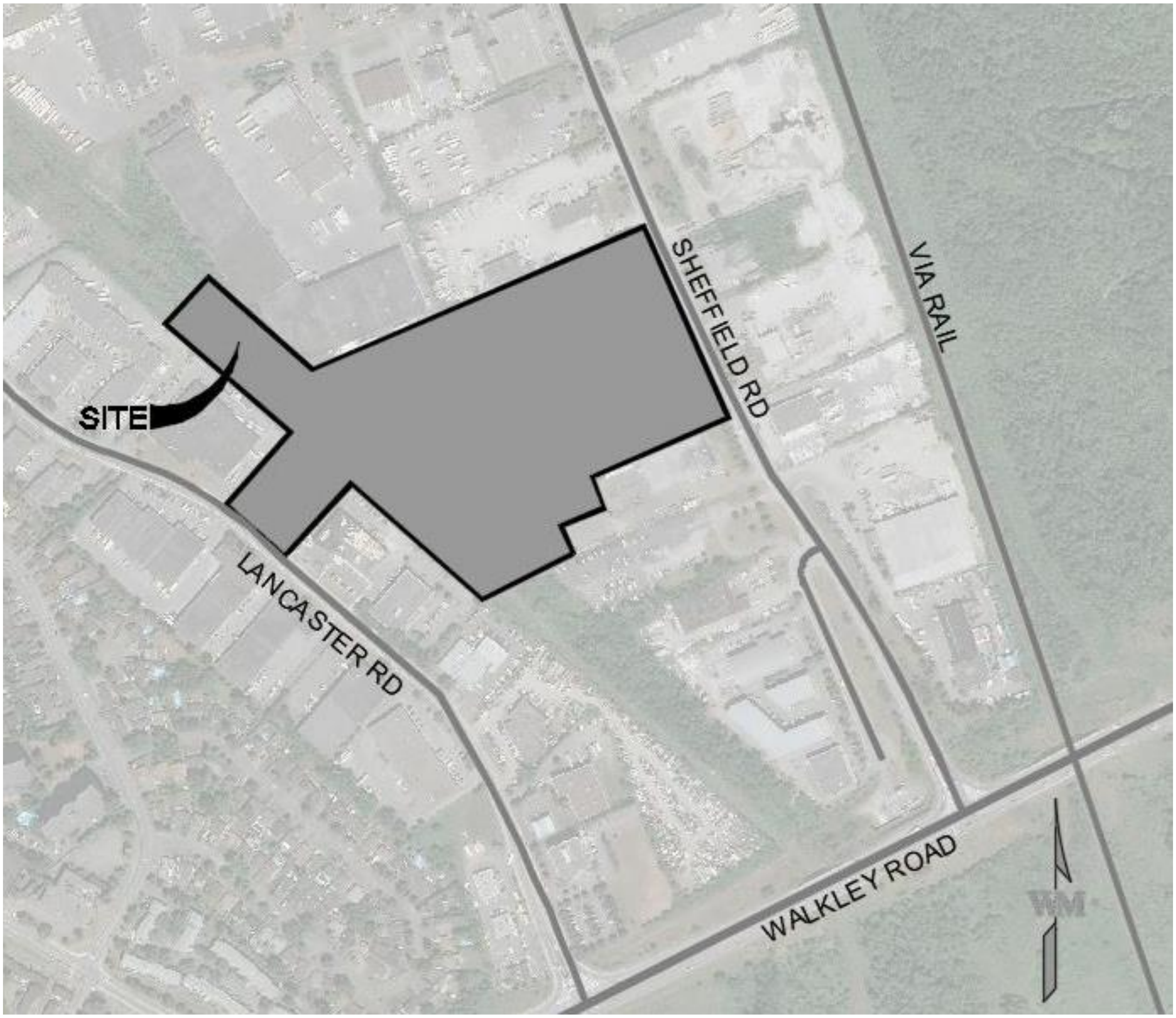
- *Sewer Design Guidelines – Second Edition*, City of Ottawa, October, 2012
- *Ottawa Design Guidelines – Water Distribution – First Edition,* City of Ottawa, July, 2010
- *Stormwater Management Planning and Design Manual*, Ontario Ministry of Environment and Climate Control, 2003
- *Guidelines for the Design of Sanitary Sewage Works and Water Works,* Ontario Ministry of Environment and Climate Control, 2008
- *Design Guidelines for Drinking Water Systems*, Ontario Ministry of Environment and Climate Control, 2008
- *Ontario Building Code* – (O.B.C), 2012
- *Drainage Management Manual* – Ontario Ministry of Transportation, 1997
- *Water Supply for Public Fire Protection in Canada* – Fire Underwriters Survey, 2020

1.1 Site Description

The subject site is bounded by Sheffield Road to the east and Lancaster Road to the west and is approximately 500m north of Walkley Road within the City of Ottawa. Refer to

Figure **1** for the site location plan. The site has a total area of 8.45 ha and is currently developed with 5 warehouse buildings and a CNR (Canadian National Railway) corridor splitting the 4 warehouse buildings fronting Sheffield Road and 1 warehouse building fronting Lancaster. The site is currently occupied. The site is divided into two drainage areas. The 4 warehouse buildings fronting Sheffield Road drain onto Sheffield Road, which outlets to the Bantree trunk sewer. The 1 warehouse building fronting Lancaster Road drains onto Lancaster Road, which outlets to the Walkley trunk sewer. The CNR corridor also drains southeast towards the Walkley trunk sewer. It is legally described as Part of Block A, Registered Plan 4M-121 and Part of Lots 24 and 25, Concession 3 (Ottawa Front) in the Geographic Township of Gloucester, City of Ottawa. The topographical information is based on a survey completed by Annis, O'Sullivan, Vollebekk Ltd., dated November 18th, 2022, as well as, an aerial map from Google Imagery.

Figure 1: Site Location Plan



1.2 Proposed Development

The proposed development includes the construction of one industrial building (GFA = 10,477m^2) with associated parking and loading areas. The proposed building will have car access off of Lancaster Road. Trucks will enter off of Sheffield to access the Loading Bays. There will also be a 1,881m^2 reduction for one of the existing industrial buildings (Building 4). The development will be designed to maintain the existing drainage patterns and match existing grades at property boundaries. Refer to Servicing and Grading Plans (C4.0 to C5.0) for the proposed servicing and grading designs.

2. Sanitary Servicing

2.0 Existing Sanitary Servicing

Existing plan and profile drawings were obtained from the City of Ottawa which indicate the existing municipal sanitary sewer infrastructure for both Sheffield Road and Lancaster Road. As the site is currently developed, it is generating sanitary sewerage flows in it's existing condition. Both properties have an internal 200mm diameter PVC sanitary service that connect to an existing 250mm diameter sanitary sewer located on Sheffield Road and an existing 375mm diameter sanitary sewer located on Lancaster Road which conveys sewage flows downstream to a 375mm diameter sanitary trunk sewer located on Leeds Avenue and a 450mm diameter sanitary trunk sewer located on Walkley Road, respectively. Refer to Appendix E for City of Ottawa As-Built drawing sheets. The City design criteria specifies an average wastewater flow of 35.0 m^3/ha/day for light industrial development with a peaking factor of 1.5 and a peak extraneous flow of 0.28 L/s/ha. Based on a total developable area of 0.48 ha for the property fronting Lancaster Road and 5.72 ha for the property fronting Sheffield Road, the projected daily average and peak sewage flows in its existing condition are summarized in the table below:

	Lancaster Road		Sheffield Road	
Average Daily Demand (Design)	16.8	m^3/d	200.2	m^3/d
	0.19	L/s	2.32	L/s
Peak Hour Flow (Design)	36.8	m^3/d	438.7	m^3/d
	0.43	L/s	5.08	L/s

2.1 Proposed Sanitary Servicing

The proposed development will be serviced with one (1) 200mm diameter PVC sanitary sewer that will connect to a proposed sanitary doghouse manhole (SAN DOGHOUSE MH01) installed along the existing 375mm diameter sanitary sewer located on Lancaster Road. The proposed sanitary connections have been designed based on the City of Ottawa's *Sewer Design Guidelines.*

The City design criteria specifies an average wastewater flow of 35.0 m^3/ha/day for light industrial development with a peaking factor of 1.5 and a peak extraneous flow of 0.28 L/s/ha. Based on a total developable area of 0.48 ha for the property fronting Lancaster Road and 5.72 ha for the property fronting Sheffield Road, the projected daily average and peak sewage flows in its proposed condition are summarized in the table below:

	Lancaster Road		Sheffield Road	
Average Daily Demand (Design)	95.6	m^3/d	200.2	m^3/d
	1.50	L/s	2.32	L/s
Peak Hour Flow (Design)	209.4	m^3/d	438.7	m^3/d
	2.42	L/s	5.08	L/s

A detailed review of the proposed sewers indicate that sufficient capacity is available for the addition of the proposed industrial building and existing development. Refer to Site Servicing Plan C5.0 for the proposed Sanitary Servicing layout and Appendix A for detailed Sanitary demand calculations.

3. Water Supply and Distribution

3.1 Existing Water Servicing

Existing plan and profile drawings were obtained from the City of Ottawa which indicate the existing municipal watermain infrastructure. As the site is currently developed, it generates water demands in its existing condition. There is an existing 300mm diameter watermain on both Lancaster Road and Sheffield Road. For the property fronting Sheffield Road, there are three separate water service connections from the 300mm diameter watermain to existing building 3B, 3C and 4. Refer to Appendix E for City of Ottawa As-Built drawing sheets and Appendix D for the Site Plan. The existing domestic demand was calculated using the City *Light Industrial* design criteria of 35.0 m^3/ha/day. The City also specifies a maximum day factor of 1.5 and maximum hourly factor of 2.7. Based on this criterion, the existing daily average, maximum day and maximum hourly daily demands from the subject properties are summarized in the table below:

	Lancaster Road		Sheffield Road	
Average Daily Demand (Design)	16.8	m^3/d	200.2	m^3/d
	0.19	L/s	2.32	L/s
Maximum Day Demand (Design)	25.2	m^3/d	300.3	m^3/d
	0.29	L/s	3.48	L/s
Maximum Hourly Flow (Design)	45.4	m^3/d	540.5	m^3/d
	0.53	L/s	6.26	L/s

3.2 Proposed Water Servicing

A *Water Systems* Analysis has yet to be completed by Ware Malcomb for the proposed development. We suggest that the City review the watermain design requirements for this development with respect to the City's water treatment and supply capacities and confirm that capacity allocation is available for this development. Given the size and location of this development, this is not expected to be a concern. The proposed domestic demand was calculated using the City *Light Industrial* design criteria of 35.0

m^3/ha/day. The City also specifies a maximum day factor of 1.5 and maximum hourly factor of 2.7. It is anticipated that the 300mm diameter watermain will provide adequate pressures and flow rates to service the site. Refer to Appendix B for detailed calculations.

Based on the above design criteria, the projected daily average, maximum day and maximum hourly daily demands from the subject properties are summarized in the table below:

	Lancaster Road		Sheffield Road	
Average Daily Demand (Design)	95.6	m^3/d	200.2	m^3/d
	1.11	L/s	2.32	L/s
Maximum Day Demand (Design)	143.3	m^3/d	300.3	m^3/d
	1.66	L/s	3.48	L/s
Maximum Hourly Flow (Design)	258.0	m^3/d	540.5	m^3/d
	2.99	L/s	6.26	L/s

The proposed development will front Lancaster Road and will be serviced with one (1) 150mm diameter fire connection stemming off the existing 300mm watermain located along Lancaster Road. A 50mm diameter domestic water service will tee off the fire connection with a 1.2m minimum separation at the property line. Watermains will be installed at the minimum 1.8m depth below finished grade. All systems will be constructed and tested in accordance with the City of Ottawa Engineering Standards and MOE Guidelines.

To determine water pressure under these demands, boundary conditions, based on the City of Ottawa computer simulation of the water distribution system at the subject property, are required. Based on the boundary conditions received from the City, the minimum HGL (Hydraulic Grade Line) is 109.8m and the maximum HGL is 118.0m. With these HGLs, the water pressure at the water meter is calculated to vary from 411 kPa to 492 kPa (60 psi to 71 psi). This is an acceptable range of water pressures for the proposed development. As for the Max Day + FF (150 L/s), the HGL is 102.7m, which corresponds to a water pressure of 341 kPa (50 psi). Minimum pressures during periods of Max Day + FF demand shall not be less than 140 kPa (20psi) for the residual pressure at any point in the distribution system.

In addition to providing water for industrial domestic use, a fire protection system must be designed based on the Fire Underwriters Survey (FUS) and National Fire Protection Association (NFPA) guidelines. The private fire main connections to the site have been designed to comply with NFPA 13 Guidelines. The proposed fire demand for the development was calculated based on the criteria outlined by the Fire Underwriters Survey – refer to detailed calculations in Appendix C. The fire demand for the total development will be 11,032 L/min or 183.9 L/sec. A hydrant flow test will need to be conducted and completed to ensure the minimum required fire flows for the proposed development can be achieved. As part of the fire protection design, fire hydrants will need a maximum of 90m spacing to building faces and 45m to building Siamese connection as per NFPA guidelines. Refer to Servicing Plan C5.0 for the proposed watermain layout.

4. Stormwater Management

A key component of the Development is the need to address environmental and related Stormwater Management (SWM) issues. These are examined in a framework aimed at meeting the City of Ottawa, Rideau Valley Conservation Authority (RVCA) and MOE requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems.

It is understood that the objectives of the SWM plan are to:

- Protect life and property from flooding and erosion;
- Maintain water quality for ecological integrity, recreational opportunities, etc..;
- Protect and maintain groundwater flow regime(s);
- Protect aquatic and fishery communities and habitats;
- Maintain and protect significant natural features;
- Protect and provide diverse recreational opportunities that are in harmony with the environment.

The stormwater management design criteria are specified as part of the City of Ottawa's *Sewer Design Guidelines Manual.* Based on an industrial development with a total developable area of 8.45 ha, the following design criteria were used:

- **Water Quantity:** Post-development flows must be controlled to the following standards:
    - Time of Concentration (Tc) to be 10 minutes;
    - Allowable Flow Rate for Walkley Trunk Sewer: Control the 5-year and 100-year post development storm events to the 5-year pre development storm event;
    - Allowable Flow Rate for Bantree Trunk Sewer: Control the 5-year and 100-year post development storm events to the 2-year pre development storm event;
- **Water Quality:** On-site water quality control to provide 80% enhance level of protection for Total Suspended Solids (TSS) based on Ontario's Ministry of the Environment Conservation and Parks (MECP) Enhanced Level I guidelines.
- **Erosion and Sediment Control:** Erosion and sediment controls must be designed in accordance with Erosion & Sediment Control Guidelines for Urban Construction.

4.1 Existing Drainage Conditions

The subject site (8.45 ha) is currently occupied and is currently being used as office space, cold storage and warehousing space. It is evaluated as having two drainage areas. Drainage Areas X-1 to X-4 and X-15 drain towards Lancaster Road, which outlets to the Walkley trunk sewer. Drainage Areas X-5 to X-14 drain towards Sheffield Road, which outlets to the Bantree trunk sewer. Based on our review of the mapping, topography across the development area is moderately flat. Drainage Areas X-1 to X-4 generally slopes from east to west towards Lancaster Road. Drainage Area X-15 generally slopes from north to south towards Walkley Road. Drainage Areas X-5 to X-14 generally slopes from west to east towards Sheffield Road. Both drainage areas ultimately discharge into the Ottawa River.

Using the Ministry of Transportation SWM Policies and Design Guidelines, the existing site statistics produce the following weighted runoff coefficients:

Drainage Areas X-1 to X-4 and X-15	Area (A)	Runoff Coefficient (R)	AR
Unimproved Lands	22,063 m^2	0.40	8,825.2
Building Roof	1,504 m^2	0.95	1,428.8
Gravel	1,055 m^2	0.60	633.0
Concrete	0 m^2	0.95	0.0
Asphalt	2,080 m^2	0.95	1,976.0
TOTAL	**26,702 m^2**	**0.48**	**12,862.0**

Based on the above site statistics, a weighted runoff coefficient of 0.48 was generated.

Drainage Areas X-5 to X-14	Area (A)	Runoff Coefficient (R)	AR
Unimproved Lands	15,568 m^2	0.40	6,227.2
Building Roof	20,219 m^2	0.95	19,208.1
Gravel	16,022 m^2	0.60	9,613.2
Concrete	0 m^2	0.95	0.0
Asphalt	5,943 m^2	0.95	5,655.4
TOTAL	**57,752 m^2**	**0.70**	**40,703.9**

Based on the above site statistics, a weighted runoff coefficient of 0.70 was generated.

Given the size and nature of the size, the Modified Rational Method will be used to determine the pre development release rates:

Catchment Area (X-1 to X-4 and X-15) = 2.67 ha
Catchment Area (X-5 to X-14) = 5.78 ha
Runoff Coefficient = 0.48
Runoff Coefficient = 0.70
Time of Concentration (t_c) = 10 minutes
Rainfall Intensity = City of Ottawa Curve Parameters
Peaking Factor (C_i) = 1.00 (2-10 year design periods)
= 1.10 (25 year design period)
= 1.20 (50 year design period)
= 1.25 (100 year design period)
Peak Runoff Rate (Q_r) = $C \times I \times A \times 360^{-1}$

Applying the above results produces the following allowable release rates:

	2 year (m^3/s)	5 year (m^3/s)	10 year (m^3/s)	25 year (m^3/s)	50 year (m^3/s)	100 year (m^3/s)
Lancaster - Pre-Development (X-1 to X-4 and X-15)	0.27	0.37	0.44	0.57	0.69	0.80
Sheffield - Pre-Development (X-5 to X-14)	0.87	1.18	1.38	1.80	2.19	2.53

4.2 Proposed Drainage Conditions

The proposed Development will increase the imperviousness of the site and it is important to quantify this increase in stormwater runoff rates for proper sizing of on-site controls with downstream facilities. Section 3.1 outlined that the site will be split into two major drainage areas. For Drainage Areas (P-1 to P-14 and P-24) discharging towards Lancaster Road, the storm servicing will outlet to a proposed storm doghouse manhole (STM DOGHOUSE MH01) along the existing 1350mm diameter storm sewer on Lancaster Road by means of one (1) 1050mm diameter storm sewer. For Drainage Areas (P-15 to P-23) discharging towards Sheffield Road, the storm servicing will continue to outlet to existing manholes located along the existing 750mm diameter storm sewer on Sheffield Road as no changes are anticipated.

Using the Ministry of Transportation SWM Policies and Design Guidelines, the proposed site statistics produce the following weighted runoff coefficients:

Drainage Areas P-1 to P-14 and P-24	Area (A)	Runoff Coefficient (R)	AR
Unimproved Lands	6,849 m^2	0.40	2,739.6
Building Roof	12,067 m^2	0.95	11,463.7
Gravel	0 m^2	0.60	0.0
Concrete	5,829 m^2	0.95	5,537.6
Asphalt	17,724 m^2	0.95	16,837.8
TOTAL	**42,469 m^2**	**0.86**	**36,578.7**

Based on the above site statistics, a weighted runoff coefficient of 0.86 was generated.

Drainage Areas P-15 to P-23	Area (A)	Runoff Coefficient (R)	AR
Unimproved Lands	4,094 m^2	0.40	1,637.6
Building Roof	18,388 m^2	0.95	17,468.6
Gravel	6,270 m^2	0.60	3,762.0
Concrete	0 m^2	0.95	0.0
Asphalt	13,233 m^2	0.95	12,571.4
TOTAL	**41,985 m^2**	**0.84**	**35,439.6**

Based on the above site statistics, a weighted runoff coefficient of 0.84 was generated.

Given the size and nature of the size, the Modified Rational Method will be used to determine the post development release rates:

Catchment Area (P-1 to P-14 and P-24) = 4.25 ha
Catchment Area (P-15 to P-23) = 4.20 ha
Runoff Coefficient = 0.86
Runoff Coefficient = 0.84
Time of Concentration (t_c) = 10 minutes
Rainfall Intensity = City of Ottawa Curve Parameters
Peaking Factor (C_i) = 1.00 (2-10 year design periods)
= 1.10 (25 year design period)
= 1.20 (50 year design period)
= 1.25 (100 year design period)
Peak Runoff Rate (Q_r) = C x I x A x 360^{-1}

Applying the above results produces the following allowable release rates:

	2 year (m^3/s)	5 year (m^3/s)	10 year (m^3/s)	25 year (m^3/s)	50 year (m^3/s)	100 year (m^3/s)
Lancaster - Post-Development w/o Attenuation (P-1 to P-14 and P-24)	0.78	1.06	1.24	1.61	1.97	2.27
Sheffield - Post-Development w/o Attenuation (P-15 to P-23)	0.76	1.03	1.20	1.57	1.91	2.20

Based on the above results, an increase in stormwater runoff rates towards Lancaster Road can be expected during the modelled storm events and as such, attenuation of runoff will be required. As for Sheffield Road, a decrease in stormwater runoff can be expected during the modelled storm events and as such, attenuation of runoff will not be required.

4.3 Quantity Controls

According to the City of Ottawa design criteria, allowable flow rates for both Walkley and Bantree Trunk Sewers are as follows:

- Allowable Flow Rate for Walkley Trunk Sewer: Control the 5-year and 100-year post development storm events to the 5-year pre development storm event;
- Allowable Flow Rate for Bantree Trunk Sewer: Control the 5-year and 100-year post development storm events to the 2-year pre development storm event.

Since Sheffield Road experiences a decrease in stormwater runoff, attenuation will not be required. As for Lancaster Road, the 5-year allowable pre-development flow rate is 372.28 L/s, based on the existing developable site. Therefore, stormwater management measures must be designed to control the 5-year and 100-year post-development storm events to below the allowable flow rate. Calculations have been included within Appendix C.

The development of this Site increases the existing stormwater runoff rate above that of the allowable release rate for Drainage Areas discharging towards Lancaster Road. Therefore, site quantity controls have been designed to closely approximate the allowable release rates. For quantity control, the site has been graded such that the stormwater will be captured by catch basins and catch basin manholes. The stormwater runoff will be controlled by rooftop storage, as well as, subsurface storage in the form of a Greenstorm system. Release from the rooftop surface will be controlled by roof drains while release from pavement/hardened surface areas will be controlled by an outlet plate sized using the following equation:

$$Q = cA\sqrt{2gh}$$

Q = allowable release rate
A = orifice area = 0.1352 m^2 (415mm dia)
c = orifice coefficient = 0.63
g = gravitational constant = 9.81m/s^2
h = high water level over center of orifice

Applying the above equation, we find that a 415mm orifice plate installed at STM MH03 will restrict the flows such that the controlled stormwater flows from the site are at a rate of less than the 5-year allowable release rate. The Pre and Post Development calculated release rates for the proposed development are detailed below. Calculations have been included within Appendix A.

	Design Storm Event Release Rate (m^3/s)					
	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
Allowable Release Rate	0.27	0.37	0.44	0.57	0.69	0.80
Post Development with Attenuations	0.16	0.20	0.23	0.28	0.32	0.36
Storage Volume Required (m^3)	345	477	563	747	919	1068

Quantity storage requirements within the subject site are calculated to be approximately 1068m^3. The total available quantity control volume on site is approximately 1245m^3, which exceeds storage requirements. This includes a proposed stormwater management facility (Greenstorm System) that has been sized to have a total available quantity control volume of about 729m^3, accompanied by rooftop storage, which will generate approximately 516m^3. Detailed calculations have been provided in Appendix C.

As mentioned above, it is proposed to discharge the controlled storm water runoff from the subject site to a proposed storm doghouse manhole (STM DOGHOUSE MH01) located on Lancaster Road, where stormwater is conveyed along the 1375mm diameter trunk sewer towards Walkley Road and ultimately into the Ottawa River.

4.4 Quality Control

The MOE issued a “Stormwater Management Planning and Design Manual” in 2003. This manual has been adopted by a variety of agencies including the City of Orillia. The objective of our SWM quality control will be to ensure MOE’s Enhanced Protection is met. To achieve Enhanced Protection, temporary and permanent controls of erosion and sediment transport are proposed and are discussed in the following sections.

Stormwater Quality Control During Construction

To ensure stormwater quality control during construction, it is imperative that effective environmental and sedimentation controls be in place throughout the entire area subject to construction activities. With the requirement of earth grading, there will be a potential of soil erosion. It is therefore recommended that the following be implemented to assist in achieving acceptable stormwater runoff quality:

- Restoration of exposed surfaces with vegetation and non-vegetative material as soon as construction schedules permit;
- Installation of temporary sediment ponds, filter strips, silt fences and rock check dams or other similar facilities throughout the site, and specifically during all construction activities;
- Reduce stormwater drainage velocities where possible;
- Ensure that disturbed areas that are left inactive for more than 30 days shall be vegetated and stabilized as instructed by the Engineer;
- Minimize the amount of existing vegetation removed.

Permanent Quality Control

The objective of the permanent SWM quality controls will be to ensure MOE’s Enhanced Protection. The proposed development will increase the imperviousness of the site. It is important to quantify this increase to evaluate the potential downstream impacts. As per the site’s assumed statistics for the developable area, the post development Total Imperviousness (TIMP) is:

Area of Building = 12,067m^2
Area of Asphalt = 17,724m^2
Area of Concrete = 5,829m^2
Area of Landscape = 6,849m^2
Total Area = 42,469m^2

$$\begin{aligned}\text{TIMP} &= (A_{BLD} + A_{ASP} + A_{CONC}) / A_{TOTAL} \\ &= (35,620) / 42,469 \\ &= 0.838 \text{ OR } (84\%)\end{aligned}$$

Given the nature of the site, and the unfavorable on-site soil conditions, it is proposed to utilize end of pipe facilities to provide quality control in a treatment train process. On-site controls in the form of an Oil-Grit Separator is an appropriate alternative to addressing quality controls for runoff from the pavement hardened surfaces.

Oil/Grit Separator (OGS)

To address stormwater quality, the City of Ottawa specifies a target water quality level of 80% TSS removal for the site based on MECP Enhanced Level I guidelines. The water quality target can be met through the use of on-site quality control measures approved by the MECP and the City of Ottawa.

The table below summarizes the total TSS removal for the site based on accepted rates for water quality. Rooftop coverage comprises 28.69% of the total site area and is considered to produce clean stormwater runoff. Rooftop drainage will bypass the Oil-Grit Separator. The remainder of the site, including paved and landscaped areas, accounts for 71.31% of the total site area. The table below shows that the total TSS removal for the site is 35.05%, which is below the 80% TSS removal target set by the MECP and City of Ottawa. Therefore, on-site quality control measures will be required to achieve a long-term average removal of 80% on an annual loading basis.

Type of Land Use/Surface	Stormwater Quality Breakdown – TSS Removal			
	Area (ha)	% of Developable Area	Effective TSS Removal	Total TSS Removal
Impervious Paved Areas	2.36	56.19%	0.0%	0.0%
Impervious Roof Areas	1.21	28.69%	80.0%	22.95%
Landscaped Areas	0.64	15.12%	80.0%	12.10%
Total	4.21	100%		35.05%

To achieve the MECP Enhanced Level I guidelines, an oil-grit separator (OGS) is being proposed. A Jellyfish or equivalent treatment unit is proposed in order to provide an added measure of protection a pre-treatment of stormwater before being discharged from the subject site. The Jellyfish JF10 model will treat the post development-controlled flows with a TSS removal rate of 85% as per the Canadian ETV sizing criteria. The design criteria and background information on how the Jellyfish unit is sized is provided within Appendix C. Refer to Servicing Plan C5.0 and Detail Plan C7.1 for stormwater quality control measures.

5. Erosion and Sediment Control

To ensure Stormwater runoff quality is controlled during construction, an erosion and sediment control strategy will be implemented to mitigate transportation of silt off-site to the existing roads and sewers. It is imperative that effective controls be put in place and maintained until all areas are stabilized with surface cover.

All erosion and sediment control Best Management Practices (BMP) shall be designed, constructed and maintained in accordance with the RVCA's erosion control requirements.

Items that will be addressed for both temporary and permanent erosion and sediment controls are based on the following:

- Site location description and area;
- Existing and proposed land use;
- Vegetative cover;
- Existing drainage routes;
- Proposed site works;
- Proposed outlets;
- Permits required;
- Sediment filters and barriers - silt fences;
- Construction entrance location;
- Protection to catch basins and ditch inlets;

To prevent construction generated sediments from entering the storm sewers or leaving the site by overland flow, the following measures should be implemented during the construction phase:

- Temporary sediment control fencing should be erected around the perimeter of the grading activities.
- Temporary sediment fabric and stone filters should be installed on existing and proposed catch basins until surface cover has been stabilized.
- A temporary construction access mud mat should be implemented to reduce the amount of materials that may be transported off site.
- Construction during drier months should be monitored for wind-borne transport of sediments. At the direction of the engineer, the contractor may be directed to water down exposed earth areas with an aqueous solution of calcium chloride.
- All disturbed areas not under immediate construction for 30 days, or not intended for building activities within a 3-month time period, should be stabilized with seeding.

Built up sediment should be removed and disposed off-site at least once a month, or more frequently as directed by the engineer. Details have been provided on drawing C6.0.

6. Conclusions and Recommendations

Municipal services for water and sanitary are available to service the proposed development. Stormwater management services will be facilitated through the use of on-site management facilities. In summary:

- The proposed development will be serviced for potable water and fire protection by connections to the existing Watermain along Lancaster Road.
- The proposed development will be serviced for sanitary sewerage by connection to the existing Sanitary Trunk Sewer along Lancaster Road.
- Storm drainage for all storms events (2-year to 100-year) will be controlled to the allowable pre-development 5-year storm event.
- Storm drainage for all storm events (2-year to 100-year) are controlled using underground storage systems (Greenstorm) in addition to rooftop storage.
- Stormwater quality control has been achieved on site to meet MECP Enhanced Level 1 protection.
- Erosion and sediment control practices have been designed to mitigate sediment in surface runoff.

In summary, the proposed development can be serviced by the existing municipal infrastructure along Lancaster Road with the addition of on-site stormwater management systems to be implemented in order to satisfy the City of Ottawa design criteria, improve on existing conditions and in keeping with good engineering practice. Accordingly, Ware Malcomb recommends the adoption of this report for the purposes of Site Plan Approval as it relates to the provision of servicing and stormwater management works.

Prepared by,

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Appendix A – Sanitary Calculations

Proposed Industrial Building

2760-2770 Sheffield Road
Ottawa, ON K1B 3V8

Existing Sanitary Demand Calculations

n = 0.013
M = 1 + (14 / (4 + (P / 1000) ^ 0.5))   2 <= "M" <= 4
Qp = P * Q * M / 86400   Q = 350 L/cap/day

Qtot = Qp + Qi

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE	PEAKING FACTOR
Single Family	3.40 people/unit	350 L/cap/d	M
Townhomes	2.70 people/unit	350 L/cap/d	M
Condominium Building	1.80 people/unit	350 L/cap/d	M
Commercial/Institutional		50000 L/ha/d	1.5
Light Industrial		35000 L/ha/d	1.5
Heavy Industrial		55000 L/ha/d	1.5

Peak Extraneous Flow 0.28 L/s/ha

	BUILDINGS	DEVELOPMENT AREA (Ha)	TOTAL UNITS	POPULATION (P)	POPULATION (ACC.)	EXTRANEOUS FLOW (L/s)	PEAKING FACTOR (M)	AVERAGE FLOW (L/s)	PEAK FLOW (L/s)
Light Industrial (Lancaster)	1	0.48	0	0	0	0.13	1.50	0.19	0.43
Light Industrial (Sheffield)	4	5.72	0	0	0	1.60	1.50	2.32	5.08
TOTAL	**5**	**6.2**	**0**	**0**	**0**	**1.74**	**1.50**	**2.51**	**5.50**

Proposed Sanitary Demand Calculations

n = 0.013
M = 1 + (14 / (4 + (P / 1000) ^ 0.5))   2 <= "M" <= 4
Qp = P * Q * M / 86400   Q = 350 L/cap/day

Qtot = Qp + Qi

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE	PEAKING FACTOR
Single Family	3.40 people/unit	350 L/cap/d	M
Townhomes	2.70 people/unit	350 L/cap/d	M
Condominium Building	1.80 people/unit	350 L/cap/d	M
Commercial/Institutional		50000 L/ha/d	1.5
Light Industrial		35000 L/ha/d	1.5
Heavy Industrial		55000 L/ha/d	1.5

Peak Extraneous Flow 0.28 L/s/ha

	BUILDINGS	DEVELOPMENT AREA (Ha)	TOTAL UNITS	POPULATION (P)	POPULATION (ACC.)	EXTRANEOUS FLOW (L/s)	PEAKING FACTOR (M)	AVERAGE FLOW (L/s)	PEAK FLOW (L/s)
Light Industrial (Lancaster)	2	2.73	0	0	0	0.76	1.50	1.11	2.42
Light Industrial (Sheffield)	4	5.72	0	0	0	1.60	1.50	2.32	5.08
TOTAL	**6**	**8.45**	**0**	**0**	**0**	**2.37**	**1.50**	3.42	**7.50**

Appendix B – Water Calculations

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Date: March 13, 2023
Revision No.:
Project No.: OTW21-0002
Designed By: N.I.
Checked By: D.N.

Proposed Industrial Building
2760-2770 Sheffield Road
Ottawa, ON K1B 3V8

Existing Water Demand Calculations

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE
Single Family	3.40 people/unit	350 L/cap/d
Townhomes	2.70 people/unit	350 L/cap/d
Condominium Building	1.80 people/unit	350 L/cap/d
Commercial/Institutional		50000 L/ha/d
Light Industrial		35000 L/ha/d
Heavy Industrial		55000 L/ha/d

PEAKING FACTORS*

MAX DAY FACTOR	1.50
PEAK RATE FACTOR	2.70

*From MOE Manual Table 3-3 - Population of Fewer than 500

PHASE	BUILDINGS	UNITS	TOTAL UNITS	POPULATION (P)	INDUSTRIAL AREA (ha)	INDUSTRIAL EQUIVALENT POPULATION	EQUIVALENT POPULATION	AVERAGE FLOW (L/s)	MAX DAY FLOW (L/s)	MAX HOUR (L/s)
Light Industrial (Lancaster)	1	0	0	0	0.48	0	0	0.19	0.29	0.53
Light Industrial (Sheffield)	4	0	0	0	5.72	0	0	2.32	3.48	6.26
TOTAL UNITS	**5**	**0**	**0**	**0**	**6.20**	**0**	**0**	**2.51**	**3.77**	**6.78**

Proposed Water Demand Calculations

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE
Single Family	3.40 people/unit	300 L/cap/d
Townhomes	2.70 people/unit	300 L/cap/d
Condominium Building	1.80 people/unit	300 L/cap/d
Commercial/Institutional		50000 L/ha/d
Light Industrial		35000 L/ha/d
Heavy Industrial		55000 L/ha/d

PEAKING FACTORS*

MAX DAY FACTOR	1.50
PEAK RATE FACTOR	2.70

*From MOE Manual Table 3-3 - Population of Fewer than 500

PHASE	BUILDINGS	UNITS	TOTAL UNITS	POPULATION (P)	INDUSTRIAL AREA (ha)	INDUSTRIAL EQUIVALENT POPULATION	EQUIVALENT POPULATION	AVERAGE FLOW (L/s)	MAX DAY FLOW (L/s)	MAX HOUR (L/s)
Light Industrial (Lancaster)	2	0	0	0	2.73	0	0	1.11	1.66	2.99
Light Industrial (Sheffield)	4	0	0	0	5.72	0	0	2.32	3.48	6.26
TOTAL UNITS	**6**	**0**	**0**	**0**	**8.45**	**0**	**0**	**3.42**	**5.13**	**9.24**

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Proposed Industrial Building

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Elevation of Water Meter: 67.9 m ASL

Finish Floor Elevation: 67 m ASL

		Static Pressure at Water Meter	
Minimum HGL:	109.8 m ASL	59.61616761 psi	411.039 kPa
Maximum HGL:	118 m ASL	71.28329349 psi	491.481 kPa
Max Day + FF (150 L/s):	102.7 m ASL	49.51414398 psi	341.388 kPa

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Proposed Industrial Building
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1 FUS Formula

$$F = 220\,C\,\sqrt{A}$$

where: F = required fire flow in litres per minute
C= the Coefficient related to the type of construction; and
A = the total flow area in square metres (including all storeys
but excluding basements at least 50% below grade)

Type of Construction: non-combustible construction
Building = Large Single Storey Space
Building is being used for high piled stock, or for rack storage

C = 0.8
A = 15716.1285

Building Height = 12m = 4 storeys (3m per Storey), therefore Total Effective Area shall be Single Largest Floor Area plus 25% of each of the two immediately adjoining floors.

F = 22064 L/min
368 L/s

2 Occupancy Adjustment

Type of Occupancy combustible
Hazard Allowance no change

Adjusted Fire Flow 22064 L/min

3 Sprinkler Adjustment

		CREDIT
NFPA 13 sprinkler standard	Yes	30%
Standard water supply	Yes	10%
Fully Supervised system	Yes	10%

Sprinkler Credit 11032 L/min

4 Exposure Adjustment

		Charge
North Side	>30m	0%
East Side	>30m	0%
South Side	>30m	0%
West Side	>30m	0%

Exposures Surcharge 0 L/min

Total Required Fire Flow 11032 L/min
183.9 L/sec

Appendix C – Storm Calculations

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Storm Sewer Capacity Calculations

Q= 0.0028*C*I*A (cms)
C=RUNOFF COEFFICIENT
I-RAINFALL INTENSITY= 998.1/(10+6.053)^0.814) - 1:5 year STM
A=AREA (ha)

A	B	C
998.1	0.814	6.053

Areas	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME		I	TOTAL	S	D	Available	Q	V	Percentage
								(min)			Q			Capacity	FULL	FULL	of Capacity
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(cms)	(m/s)	(%)
P-7	STM CBMH 4	STM MH 4	36.0	0.86	0.18	0.15	0.15	10.00	0.66	104.19	0.04	0.33	375	0.06	0.10	0.91	44%
P-5	STM CBMH 2	STM CBMH 3	45.7	0.77	0.30	0.23	0.23	10.00	0.96	104.19	0.07	0.25	375	0.02	0.09	0.79	76%
P-6	STM CBMH 3	STM MH 4	42.0	0.80	0.26	0.21	0.44	10.96	0.79	99.39	0.12	0.20	525	0.07	0.19	0.89	63%
\	STM MH 4	UNDERGROUND STORAGE	1.7	0.00	0.00	0.00	0.59	11.75	0.03	95.79	0.16	0.20	600	0.12	0.27	0.97	58%
\	UNDERGROUND STORAGE	STM MH 3	7.4	0.00	0.00	0.00	0.59	11.78	0.13	95.66	0.16	0.20	600	0.12	0.27	0.97	57%
P-24	STM CB 2	STM CBMH 8	36.5	0.77	0.18	0.13	0.13	10.00	0.77	104.19	0.04	0.25	375	0.05	0.09	0.79	44%
P-14	STM CBMH 8	STM CBMH 7	47.0	0.77	0.18	0.14	0.27	10.77	0.98	100.31	0.08	0.20	450	0.05	0.13	0.80	60%
P-11	STM CBMH 7	STM MH 7	31.9	0.71	0.16	0.12	0.39	11.74	0.60	95.81	0.10	0.20	525	0.09	0.19	0.89	54%
\	STM MH 7	STM CBMH 6	76.5	0.00	0.00	0.00	0.39	12.34	1.31	93.26	0.10	0.20	600	0.17	0.27	0.97	37%
P-10	STM CBMH 6	STM CBMH 5	82.8	0.78	0.26	0.20	0.59	13.65	1.42	88.18	0.14	0.20	600	0.13	0.27	0.97	52%
P-9	STM CBMH 5	UNDERGROUND STORAGE	1.9	0.84	0.24	0.20	0.79	15.07	0.03	83.32	0.18	0.20	600	0.09	0.27	0.97	67%
\	UNDERGROUND STORAGE	STM MH 3	4.8	0.00	0.00	0.00	0.79	15.11	0.08	83.22	0.18	0.20	600	0.09	0.27	0.97	66%
P-12				0.95	0.41	0.39											
P-13				0.95	0.50	0.48											
\	BUILDING	STM MH 3	12.4	0.00	0.00	0.86	0.86	10.00	0.17	104.19	0.25	0.33	600	0.10	0.35	1.25	71%
\	STM MH 3	OGS	6.2	0.00	0.00	0.00	2.25	15.19	0.09	82.95	0.52	0.20	825	0.12	0.64	1.20	81%
\	OGS	STM CBMH 1	15.3	0.00	0.00	0.00	2.25	15.27	0.21	82.68	0.52	0.20	825	0.13	0.64	1.20	80%
P-8	BUILDING	STM MH 2	33.8	0.95	1.06	1.01	1.01	10.00	0.45	104.19	0.29	0.33	600	0.06	0.35	1.25	83%
\	STM MH 2	STM CBMH 1	2.0	0.00	0.00	0.00	1.01	10.45	0.03	101.87	0.28	0.33	600	0.07	0.35	1.25	81%
P-3	STM CBMH 1	STM MH 1	64.6	0.80	0.21	0.17	3.25	15.49	0.88	82.02	0.74	0.15	1050	0.32	1.06	1.22	70%
\	STM MH 1	STM DOGHOUSE MH 1	14.7	0.00	0.00	0.00	3.25	16.37	0.20	79.38	0.72	0.15	1050	0.34	1.06	1.22	68%

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Weighted Runoff Coefficient Calculations

Area ID	Total Area	0.40	0.95	0.95	0.75	0.60	0.95	Weighted Rational Coefficient
		Undeveloped Lands	Asphalt Drive	Building Roof	Interlocking	Gravel	Concrete	
Pre-Development	84454	37631	8023	21723	0	17077	0	0.63
X-1	1504	0	0	1504	0	0	0	0.95
X-2	863	336	527	0	0	0	0	0.74
X-3	2115	562	1553	0	0	0	0	0.80
X-4	346	346	0	0	0	0	0	0.40
X-5	9263	2288	1410	0	0	5565	0	0.60
X-6	13200	8818	0	0	0	4382	0	0.47
X-7	4718	646	535	0	0	3537	0	0.61
X-8	3301	763	0	0	0	2538	0	0.55
X-9	3360	0	0	3360	0	0	0	0.95
X-10	4876	0	0	4876	0	0	0	0.95
X-11	9201	0	0	9201	0	0	0	0.95
X-12	2782	0	0	2782	0	0	0	0.95
X-13	2861	0	2861	0	0	0	0	0.95
X-14	4190	3053	1137	0	0	0	0	0.55
X-15	21874	20819	0	0	0	1055	0	0.41
Post-Development	84454	25207	25829	27663	0	0	5755	0.79
P-1	1504	0	0	1504	0	0	0	0.95
P-2	863	336	527	0	0	0	0	0.74
P-3	2115	562	1553	0	0	0	0	0.80
P-4	346	346	0	0	0	0	0	0.40
P-5	3039	992	2047	0	0	0	0	0.77
P-6	2588	699	1889	0	0	0	0	0.80
P-7	2151	501	1322	0	0	0	328	0.82
P-8	10563	0	0	10563	0	0	0	0.95
P-9	2135	429	1455	0	0	0	251	0.84
P-10	2385	790	1336	0	0	0	259	0.77
P-11	1605	692	748	0	0	0	165	0.71
P-12	4439	307	2129	0	0	0	2003	0.91
P-13	5217	0	2542	0	0	0	2675	0.95
P-14	1774	612	1088	0	0	0	74	0.76
P-15	4319	281	1420	0	0	2618	0	0.70
P-16	3379	0	0	3379	0	0	0	0.95
P-17	3305	767	0	0	0	2538	0	0.55
P-18	4886	0	0	4886	0	0	0	0.95
P-19	8887	0	7773	0	0	1114	0	0.91
P-20	7331	0	0	7331	0	0	0	0.95
P-21	2871	0	2871	0	0	0	0	0.95
P-22	2792	0	0	2792	0	0	0	0.95
P-23	4215	3046	1169	0	0	0	0	0.55
P-24	1745	583	1088	0	0	0	74	0.77
Lancaster Road (X-1 - X-4 and X-15)	26702	22063	2080	1504	0	1055	0	0.48
Sheffield Road (X-5 - X-14)	57752	15568	5943	20219	0	16022	0	0.70
Lancaster Road (P-1 to P-14 and P-24)	42469	6849	17724	12067	0	0	5829	0.86
Sheffield (P-15 to P-23)	41985	4094	13233	18388	0	6270	0	0.84
Lancaster Controlled (P-5 to P-7, P-9 to P-14 and P-24)	27078	5605	15644	0	0	0	5829	0.84
Lancaster Controlled (P-8)	10563	0	0	10563	0	0	0	0.95
Lancaster Uncontrolled (P-1 to P-4)	4828	1244	2080	1504	0	0	0	0.81

0

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Proposed Industrial Building

2760-2770 Sheffield Road
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Pre-Development Runoff Calculation

Lancaster - X-1 to X-4 and X-15

Area	2.67 ha	
Runoff Coefficient	0.48	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	76.8 mm/hr	
Allowable Release Rate	0.27 m^3/s	274.43 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	104.2 mm/hr	
Allowable Release Rate	0.37 m^3/s	372.28 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	122.1 mm/hr	
Allowable Release Rate	0.44 m^3/s	436.42 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	144.7 mm/hr	
Allowable Release Rate	0.57 m^3/s	568.69 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	161.5 mm/hr	
Allowable Release Rate	0.69 m^3/s	692.33 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	178.6 mm/hr	
Allowable Release Rate	0.80 m^3/s	797.49 L/s

Pre-Development Runoff Calculation

Sheffield - X-5 to X-14

Area	5.78 ha	
Runoff Coefficient	0.70	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	76.8 mm/hr	
Allowable Release Rate	0.87 m^3/s	868.20 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	104.2 mm/hr	
Allowable Release Rate	1.18 m^3/s	1177.80 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	122.1 mm/hr	
Allowable Release Rate	1.38 m^3/s	1380.69 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	144.7 mm/hr	
Allowable Release Rate	1.80 m^3/s	1799.17 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	161.5 mm/hr	
Allowable Release Rate	2.19 m^3/s	2190.31 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	178.6 mm/hr	
Allowable Release Rate	2.52 m^3/s	2523.03 L/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	733.0	0.81	6.199
5	998.1	0.814	6.053
10	1174.2	0.816	6.014
25	1402.9	0.819	6.018
50	1569.6	0.82	6.014
100	1735.7	0.82	6.014

Equation of Curve

$$I = A * (T) ^ {c}$$

Where:

I = Storm Intensity (mm/hr)
A = Coefficient (A)
C = Exponent (C)
T = Time of Concentration (Hours)

Modified Rational Method

$$Q = (C_i * C * I * A) / 360$$

Where:

Q = Flow Rate (m3/s)
Ci = Peaking Coefficient
C = Rational Method Runoff Coefficient
I = Storm Intensity (mm/hr)
A = Area (ha.)

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Post-Development Runoff Calculation

Lancaster - P-1 to P-14 and P-24

Area	4.25 ha	
Runoff Coefficient	0.86	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	76.8 mm/hr	
Allowable Release Rate	0.78 m^3/s	780.39 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	104.2 mm/hr	
Allowable Release Rate	1.06 m^3/s	1058.68 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	122.1 mm/hr	
Allowable Release Rate	1.24 m^3/s	1241.05 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	144.7 mm/hr	
Allowable Release Rate	1.62 m^3/s	1617.20 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	161.5 mm/hr	
Allowable Release Rate	1.97 m^3/s	1968.79 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	178.6 mm/hr	
Allowable Release Rate	2.27 m^3/s	2267.86 L/s

Post-Development Runoff Calculation

Sheffield - P-15 to P-23

Area	4.20 ha	
Runoff Coefficient	0.84	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	76.8 mm/hr	
Allowable Release Rate	0.76 m^3/s	756.09 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	104.2 mm/hr	
Allowable Release Rate	1.03 m^3/s	1025.71 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	122.1 mm/hr	
Allowable Release Rate	1.20 m^3/s	1202.41 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	144.7 mm/hr	
Allowable Release Rate	1.57 m^3/s	1566.85 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	161.5 mm/hr	
Allowable Release Rate	1.91 m^3/s	1907.49 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	178.6 mm/hr	
Allowable Release Rate	2.20 m^3/s	2197.24 L/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	733.0	0.81	6.199
5	998.1	0.814	6.053
10	1174.2	0.816	6.014
25	1402.9	0.819	6.018
50	1569.6	0.82	6.014
100	1735.7	0.82	6.014

Equation of Curve

$$I = A * (T)\ ^{c}$$

Where:

I = Storm Intensity (mm/hr)
A = Coefficient (A)
C = Exponent (C)
T = Time of Concentration (Hours)

Modified Rational Method

$$Q = (C_i * C * I * A) / 360$$

Where:

Q = Flow Rate (m3/s)
Ci = Peaking Coefficient
C = Rational Method Runoff Coefficient
I = Storm Intensity (mm/hr)
A = Area (ha.)

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Post-Development Runoff Calculation

Controlled Pavement (P-5 to P-7, P-9 to P-14 and P-24)

Area	2.71 ha		
Runoff Coefficient	0.84		
Time of Concentration	10 min		
	Interpolated		
Return Rate	2 year		
Coefficient	1		
Rainfall Intesity	76.8 mm/hr		
Allowable Release Rate	0.48 m^3/s	483.05 L/s	
Return Rate	5 year		
Coefficient	1		
Rainfall Intesity	104.2 mm/hr		
Allowable Release Rate	0.66 m^3/s	655.30 L/s	
Return Rate	10 year		
Coefficient	1		
Rainfall Intesity	122.1 mm/hr		
Allowable Release Rate	0.77 m^3/s	768.18 L/s	
Return Rate	25 year		
Coefficient	1.1		
Rainfall Intesity	144.7 mm/hr		
Allowable Release Rate	1.00 m^3/s	1001.01 L/s	
Return Rate	50 year		
Coefficient	1.2		
Rainfall Intesity	161.5 mm/hr		
Allowable Release Rate	1.22 m^3/s	1218.64 L/s	
Return Rate	100 year		
Coefficient	1.25		
Rainfall Intesity	178.6 mm/hr		
Allowable Release Rate	1.40 m^3/s	1403.76 L/s	

Controlled Rooptop (P-8)

Area	1.06 ha	
Runoff Coefficient	0.95	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	76.8 mm/hr	
Allowable Release Rate	0.21 m^3/s	214.09 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	104.2 mm/hr	
Allowable Release Rate	0.29 m^3/s	290.43 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	122.1 mm/hr	
Allowable Release Rate	0.34 m^3/s	340.47 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	144.7 mm/hr	
Allowable Release Rate	0.44 m^3/s	443.66 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	161.5 mm/hr	
Allowable Release Rate	0.54 m^3/s	540.11 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	178.6 mm/hr	
Allowable Release Rate	0.62 m^3/s	622.16 L/s

Uncontrolled (P-1 to P-4)

Area	0.48 ha	
Runoff Coefficient	0.81	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	76.8 mm/hr	
Allowable Release Rate	0.08 m^3/s	83.26 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	104.2 mm/hr	
Allowable Release Rate	0.11 m^3/s	112.95 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	122.1 mm/hr	
Allowable Release Rate	0.13 m^3/s	132.40 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	144.7 mm/hr	
Allowable Release Rate	0.17 m^3/s	172.53 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	161.5 mm/hr	
Allowable Release Rate	0.21 m^3/s	210.04 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	178.6 mm/hr	
Allowable Release Rate	0.24 m^3/s	241.95 L/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	733.0	0.81	6.199
5	998.1	0.814	6.053
10	1174.2	0.816	6.014
25	1402.9	0.819	6.018
50	1569.6	0.82	6.014
100	1735.7	0.82	6.014

Equation of Curve

$$I = A * (T) ^{c}$$

Where:

I = Storm Intensity (mm/hr)
A = Coefficient (A)
C = Exponent (C)
T = Time of Concentration (Hours)

Modified Rational Method

$$Q = (C_i * C * I * A) / 360$$

Where:

Q = Flow Rate (m3/s)
Ci = Peaking Coefficient
C = Rational Method Runoff Coefficient
I = Storm Intensity (mm/hr)
A = Area (ha.)

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Proposed Industrial Building
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Ottawa, ON K1B 3V8

Rooftop Storage Calculations

TOTAL COMBINED ROOFTOP STORAGE @ 10 mins(m^3)	299.2
TOTAL COMBINED ROOFTOP STORAGE MAXIMUM	515.9

SUMMARY

	Building A	
Rooftop Area (m^2)	10563	
Number of Drains	20	
Total Number of Weirs	20	
Discharge/Weir/Drain (L/m)	75.70823568	20 GPM
Total Roof Discharge (L/s)	25.24	
Maximum Design Depth (mm)	150	
Roof Storage at 10 minutes (m^3)	299.2	
Maximum Roof Storage (m^3)	515.9	
Maximum Storage Depth (mm)	149	

BUILDING A

Time	Intensity	Q_{total}	$Q_{discharge}$	$Q_{storage}$	Volume to Store
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3)
10	178.6	0.524	0.0252	0.499	299.2
50	64.0	0.188	0.0252	0.162	487.2
75	47.3	0.139	0.0252	0.113	510.4
100	37.9	0.111	0.0252	0.086	515.9
125	31.9	0.093	0.0252	0.068	511.9
150	27.6	0.081	0.0252	0.056	502.0

Area per Drain	528.15	m^2
Equivalent Radius	12.97	m
Original Slope	0.66	%
New Radius	12.86	m
Ponding Depth	149	mm

Elevation (m)	Outflow (m3/sec)	Storage (m3)	Storage (ha - m)
100.00	0	0	0.0000
100.03	0.006	20.63	0.0021
100.06	0.013	82.54	0.0083
100.09	0.019	185.71	0.0186
100.12	0.022	330.15	0.0330
100.15	0.025	515.87	0.0516

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Stage - Storage - Discharge - Subsurface/Surface Storage Calculations

Elevation (m)	Volume	Cum. Volume (m^3)	Storage Vol. (m^3)	Depth 1 (m)	Flow 1 (m^3/s)	Depth 2 (m)	Flow 2 (m^3/s)	Major Storm Control Weir Depth 3 (m)	Overflow (x)	Rectangular 'C'	Flow (m^3/s)	Total Flow (m^3/s)
64.90	0	0	0	0.12	0.0465	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0465
64.95	36.432	36	36	0.17	0.0556	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0556
65.00	36.432	73	73	0.22	0.0635	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0635
65.05	36.432	109	109	0.27	0.0705	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0705
65.10	36.432	146	146	0.31	0.0769	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0769
65.15	36.432	182	182	0.36	0.0828	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0828
65.20	36.432	219	219	0.41	0.0882	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0882
65.25	36.432	255	255	0.46	0.0934	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0934
65.30	36.432	291	291	0.51	0.0983	0.00	0.0000	0.00	0.00	0.00	0.0000	0.0983
65.35	36.432	328	328	0.56	0.1030	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1030
65.40	36.432	364	364	0.61	0.1074	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1074
65.45	36.432	401	401	0.66	0.1117	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1117
65.50	36.432	437	437	0.71	0.1158	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1158
65.55	36.432	474	474	0.76	0.1198	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1198
65.60	36.432	510	510	0.81	0.1237	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1237
65.65	36.432	546	546	0.86	0.1274	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1274
65.70	36.432	583	583	0.91	0.1310	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1310
65.75	36.432	619	619	0.96	0.1346	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1346
65.80	36.432	656	656	1.01	0.1380	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1380
65.85	36.432	692	692	1.06	0.1414	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1414
65.90	36.432	729	729	1.11	0.1446	0.00	0.0000	0.00	0.00	0.00	0.0000	0.1446

Orifice 1	
Diameter	250 mm
Elevation	64.66 m
Orifice Constant	0.63
Orifice Centroid	64.79 m

Rectangular C Equation
y=(a+bx)/(1+cx+dx^2)

a	**-1.04E+04**
b	**3.42E+06**
c	**2.13E+06**
d	**-2.35E+05**

Elevation (m)	Outflow (m3/sec)	Storage (m3)	Storage (ha - m)
64.90	0	0	0.0000
65.05	0.071	109.29600	0.0109
65.20	0.088	218.59200	0.0219
65.40	0.107	364.32000	0.0364
65.60	0.124	510.04800	0.0510
65.75	0.135	619.34400	0.0619
65.90	0.145	728.64000	0.0729

Year	Pre	Post	Storage
2	0.27	0.16	344.70
5	0.37	0.20	477.00
10	0.44	0.23	563.13
25	0.57	0.28	747.40
50	0.69	0.32	919.05
100	0.80	0.36	1067.81

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CHECKING STORAGE RELEASE CHARACTERISTICS

Controlled Release from Site - Pavement P-5 to P-7, P-9 to P-12 and P-20

2 Year Post Development Flow	0.483	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
64.90	0	0.000	0
65.05	0.071	0.011	109
65.20	0.088	0.022	219
65.40	0.107	0.036	364
65.60	0.124	0.051	510
65.75	0.135	0.062	619
65.90	0.145	0.073	729

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.05	0.000	3	3
2	0.10	0.001	6	0
3	0.14	0.000	9	9
4	0.19	0.002	11	20
5	0.24	0.005	14	35
6	0.29	0.008	17	52
7	0.34	0.011	20	71
8	0.39	0.016	22	93
9	0.43	0.021	25	118
10	0.48	0.072	25	143
11	0.43	0.076	22	164
12	0.39	0.079	18	183
13	0.34	0.082	15	198
14	0.29	0.085	12	211
15	0.24	0.087	9	220
16	0.19	0.088	6	226
17	0.14	0.089	3	229
18	0.10	0.090	0	230
19	0.05	0.090	-2	227
20	0.00	0.089	-5	222
22	0.00	0.089	-11	211
24	0.00	0.087	-10	201
26	0.00	0.085	-10	191
28	0.00	0.084	-10	181
30	0.00	0.082	-10	171
32	0.00	0.080	-10	161
34	0.00	0.079	-9	152
36	0.00	0.077	-9	142
38	0.00	0.076	-9	133
40	0.00	0.074	-9	124
42	0.00	0.073	-9	116
44	0.00	0.072	-9	107
46	0.00	0.024	-3	104
48	0.00	0.023	-3	101
50	0.00	0.022	-3	99
55	0.00	0.022	-7	92
60	0.00	0.020	-6	86
65	0.00	0.019	-6	80
70	0.00	0.018	-5	75
75	0.00	0.017	-5	70
80	0.00	0.015	-5	66
85	0.00	0.014	-4	61
90	0.00	0.013	-4	57
95	0.00	0.013	-4	53
100	0.00	0.012	-4	50

Controlled Release from Site - Rooftop (P-8)

2 Year Post Development Flow	0.214	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
100.00	0	0.000	0
100.03	0.006	0.002	21
100.06	0.013	0.008	83
100.09	0.019	0.019	186
100.12	0.022	0.033	330
100.15	0.025	0.052	516

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.02	0.000	1	1
2	0.04	0.000	3	0
3	0.06	0.000	4	4
4	0.09	0.001	5	9
5	0.11	0.003	6	15
6	0.13	0.005	7	23
7	0.15	0.007	9	31
8	0.17	0.007	10	41
9	0.19	0.008	11	52
10	0.21	0.010	12	65
11	0.19	0.011	11	76
12	0.17	0.012	10	85
13	0.15	0.013	8	93
14	0.13	0.013	7	100
15	0.11	0.014	6	106
16	0.09	0.014	4	110
17	0.06	0.014	3	113
18	0.04	0.014	2	115
19	0.02	0.015	0	115
20	0.00	0.015	-1	114
22	0.00	0.015	-2	113
24	0.00	0.014	-2	111
26	0.00	0.014	-2	109
28	0.00	0.014	-2	107
30	0.00	0.014	-2	106
32	0.00	0.014	-2	104
34	0.00	0.014	-2	102
36	0.00	0.014	-2	101
38	0.00	0.014	-2	99
40	0.00	0.014	-2	97
42	0.00	0.014	-2	96
44	0.00	0.013	-2	94
46	0.00	0.013	-2	93
48	0.00	0.013	-2	91
50	0.00	0.013	-2	89
55	0.00	0.013	-4	86
60	0.00	0.013	-4	82
65	0.00	0.013	-4	78
70	0.00	0.012	-4	74
75	0.00	0.012	-4	71
80	0.00	0.011	-3	67
85	0.00	0.011	-3	64
90	0.00	0.011	-3	61
95	0.00	0.010	-3	58
100	0.00	0.010	-3	55

Uncontrolled Release from Site - (P-1 to P-4)

2 Year Post Development Flow	0.083	m3/sec
Storm Duration	20	min

Hydrograph Data

Minute	In Flow	Out Flow
	(m3/sec)	(m3/sec)
(1)	(2)	(4)
0	0.000	0.000
1	0.008	0.008
2	0.017	0.017
3	0.025	0.025
4	0.033	0.033
5	0.042	0.042
6	0.050	0.050
7	0.058	0.058
8	0.067	0.067
9	0.075	0.075
10	0.083	0.083
11	0.075	0.075
12	0.067	0.067
13	0.058	0.058
14	0.050	0.050
15	0.042	0.042
16	0.033	0.033
17	0.025	0.025
18	0.017	0.017
19	0.008	0.008
20	0.000	0.000
22	0.000	0.000
24	0.000	0.000
26	0.000	0.000
28	0.000	0.000
30	0.000	0.000
32	0.000	0.000
34	0.000	0.000
36	0.000	0.000
38	0.000	0.000
40	0.000	0.000
42	0.000	0.000
44	0.000	0.000
46	0.000	0.000
48	0.000	0.000
50	0.000	0.000
55	0.000	0.000
60	0.000	0.000
65	0.000	0.000
70	0.000	0.000
75	0.000	0.000
80	0.000	0.000
85	0.000	0.000
90	0.000	0.000
95	0.000	0.000
100	0.000	0.000

Total Release From Site

Minute	Out Flow	Total Storage
	(m3/sec)	(m3/sec)
(1)	(2)	(2)
0	0.000	0.000
1	0.008	4.183
2	0.018	0.560
3	0.025	13.100
4	0.037	29.637
5	0.049	50.112
6	0.062	74.468
7	0.076	102.674
8	0.090	134.751
9	0.104	170.657
10	0.165	207.594
11	0.162	240.034
12	0.158	268.014
13	0.154	291.580
14	0.148	310.783
15	0.142	325.659
16	0.136	336.244
17	0.129	342.580
18	0.121	344.696
19	0.113	342.619
20	0.104	336.378
22	0.103	323.987
24	0.102	311.804
26	0.100	299.836
28	0.098	288.081
30	0.096	276.533
32	0.095	265.190
34	0.093	254.048
36	0.091	243.101
38	0.090	232.348
40	0.088	221.784
42	0.086	211.406
44	0.085	201.210
46	0.037	196.784
48	0.036	192.444
50	0.035	188.188
55	0.035	177.754
60	0.033	167.823
65	0.031	158.375
70	0.030	149.418
75	0.028	140.923
80	0.027	132.863
85	0.025	125.215
90	0.024	117.954
95	0.023	111.058
100	0.022	104.507

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CHECKING STORAGE RELEASE CHARACTERISTICS

Controlled Release from Site - Pavement P-5 to P-7, P-9 to P-12 and P-20

5 Year Post Development Flow	0.655	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
64.90	0	0.000	0
65.05	0.071	0.011	109
65.20	0.088	0.022	219
65.40	0.107	0.036	364
65.60	0.124	0.051	510
65.75	0.135	0.062	619
65.90	0.145	0.073	729

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.07	0.000	4	4
2	0.13	0.001	8	0
3	0.20	0.000	12	12
4	0.26	0.003	16	28
5	0.33	0.006	19	47
6	0.39	0.010	23	70
7	0.46	0.015	27	97
8	0.52	0.021	30	127
9	0.59	0.073	31	158
10	0.66	0.078	35	192
11	0.59	0.084	30	223
12	0.52	0.089	26	249
13	0.46	0.092	22	271
14	0.39	0.095	18	289
15	0.33	0.097	14	302
16	0.26	0.099	10	312
17	0.20	0.101	6	318
18	0.13	0.101	2	320
19	0.07	0.102	-2	318
20	0.00	0.101	-6	312
22	0.00	0.100	-12	299
24	0.00	0.099	-12	288
26	0.00	0.097	-12	276
28	0.00	0.096	-11	264
30	0.00	0.094	-11	253
32	0.00	0.093	-11	242
34	0.00	0.091	-11	231
36	0.00	0.090	-11	220
38	0.00	0.088	-11	210
40	0.00	0.087	-10	199
42	0.00	0.085	-10	189
44	0.00	0.083	-10	179
46	0.00	0.082	-10	169
48	0.00	0.080	-10	160
50	0.00	0.079	-9	150
55	0.00	0.077	-23	127
60	0.00	0.073	-22	105
65	0.00	0.023	-7	98
70	0.00	0.022	-6	92
75	0.00	0.020	-6	85
80	0.00	0.019	-6	80
85	0.00	0.018	-5	75
90	0.00	0.016	-5	70
95	0.00	0.015	-5	65
100	0.00	0.014	-4	61

Controlled Release from Site - Rooftop (P-8)

5 Year Post Development Flow	0.290	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
100.00	0	0.000	0
100.03	0.006	0.002	21
100.06	0.013	0.008	83
100.09	0.019	0.019	186
100.12	0.022	0.033	330
100.15	0.025	0.052	516

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.03	0.000	2	2
2	0.06	0.001	3	0
3	0.09	0.000	5	6
4	0.12	0.002	7	12
5	0.15	0.004	8	21
6	0.17	0.006	10	31
7	0.20	0.007	12	43
8	0.23	0.009	13	56
9	0.26	0.010	15	71
10	0.29	0.011	17	88
11	0.26	0.013	15	103
12	0.23	0.014	13	116
13	0.20	0.015	11	127
14	0.17	0.015	10	137
15	0.15	0.016	8	145
16	0.12	0.016	6	151
17	0.09	0.017	4	155
18	0.06	0.017	2	157
19	0.03	0.017	1	158
20	0.00	0.017	-1	157
22	0.00	0.017	-2	155
24	0.00	0.017	-2	153
26	0.00	0.017	-2	151
28	0.00	0.017	-2	149
30	0.00	0.017	-2	147
32	0.00	0.017	-2	145
34	0.00	0.016	-2	143
36	0.00	0.016	-2	141
38	0.00	0.016	-2	139
40	0.00	0.016	-2	137
42	0.00	0.016	-2	135
44	0.00	0.016	-2	133
46	0.00	0.016	-2	131
48	0.00	0.016	-2	129
50	0.00	0.015	-2	128
55	0.00	0.015	-5	123
60	0.00	0.015	-5	118
65	0.00	0.015	-4	114
70	0.00	0.015	-4	110
75	0.00	0.014	-4	105
80	0.00	0.014	-4	101
85	0.00	0.014	-4	97
90	0.00	0.014	-4	93
95	0.00	0.013	-4	89
100	0.00	0.013	-4	85

Uncontrolled Release from Site - (P-1 to P-4)

5 Year Post Development Flow	0.113	m3/sec
Storm Duration	20	min

Hydrograph Data

Minute	In Flow	Out Flow
	(m3/sec)	(m3/sec)
(1)	(2)	(4)
0	0.000	0.000
1	0.011	0.011
2	0.023	0.023
3	0.034	0.034
4	0.045	0.045
5	0.056	0.056
6	0.068	0.068
7	0.079	0.079
8	0.090	0.090
9	0.102	0.102
10	0.113	0.113
11	0.102	0.102
12	0.090	0.090
13	0.079	0.079
14	0.068	0.068
15	0.056	0.056
16	0.045	0.045
17	0.034	0.034
18	0.023	0.023
19	0.011	0.011
20	0.000	0.000
22	0.000	0.000
24	0.000	0.000
26	0.000	0.000
28	0.000	0.000
30	0.000	0.000
32	0.000	0.000
34	0.000	0.000
36	0.000	0.000
38	0.000	0.000
40	0.000	0.000
42	0.000	0.000
44	0.000	0.000
46	0.000	0.000
48	0.000	0.000
50	0.000	0.000
55	0.000	0.000
60	0.000	0.000
65	0.000	0.000
70	0.000	0.000
75	0.000	0.000
80	0.000	0.000
85	0.000	0.000
90	0.000	0.000
95	0.000	0.000
100	0.000	0.000

Total Release From Site

Minute	Out Flow	Total Storage
	(m3/sec)	(m3/sec)
(1)	(2)	(2)
0	0.000	0.000
1	0.011	5.674
2	0.024	0.560
3	0.034	17.574
4	0.050	40.011
5	0.066	67.791
6	0.084	100.838
7	0.102	139.194
8	0.120	182.800
9	0.185	228.874
10	0.203	280.229
11	0.199	325.483
12	0.193	364.720
13	0.186	398.028
14	0.178	425.446
15	0.170	447.014
16	0.161	462.771
17	0.151	472.753
18	0.141	477.000
19	0.130	475.550
20	0.119	468.440
22	0.118	454.323
24	0.116	440.412
26	0.114	426.703
28	0.113	413.193
30	0.111	399.880
32	0.109	386.760
34	0.108	373.830
36	0.106	361.088
38	0.105	348.531
40	0.103	336.189
42	0.101	324.063
44	0.099	312.150
46	0.098	300.447
48	0.096	288.948
50	0.094	277.650
55	0.093	249.899
60	0.088	223.358
65	0.038	211.983
70	0.036	201.148
75	0.034	190.820
80	0.033	180.970
85	0.031	171.570
90	0.030	162.594
95	0.029	154.018
100	0.027	145.818

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Date: May 15, 2023
Revision No.:
Project No.: OTW21-0002
Designed By: N.I.
Checked By: D.N.

Proposed Industrial Building
2760-2770 Sheffield Road
Ottawa, ON K1B 3V8

CHECKING STORAGE RELEASE CHARACTERISTICS

Controlled Release from Site - Pavement P-5 to P-7, P-9 to P-12 and P-20

10 Year Post Development Flow	0.768	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
64.90	0	0.000	0
65.05	0.071	0.011	109
65.20	0.088	0.022	219
65.40	0.107	0.036	364
65.60	0.124	0.051	510
65.75	0.135	0.062	619
65.90	0.145	0.073	729

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.08	0.000	5	5
2	0.15	0.001	9	0
3	0.23	0.000	14	14
4	0.31	0.003	18	32
5	0.38	0.007	23	55
6	0.46	0.012	27	82
7	0.54	0.018	31	113
8	0.61	0.071	33	146
9	0.69	0.076	37	183
10	0.77	0.082	41	224
11	0.69	0.089	36	260
12	0.61	0.094	31	291
13	0.54	0.098	26	318
14	0.46	0.101	22	339
15	0.38	0.104	17	356
16	0.31	0.106	12	368
17	0.23	0.108	7	375
18	0.15	0.109	3	378
19	0.08	0.109	-2	376
20	0.00	0.109	-7	370
22	0.00	0.108	-13	357
24	0.00	0.106	-13	344
26	0.00	0.105	-13	331
28	0.00	0.103	-12	319
30	0.00	0.101	-12	307
32	0.00	0.100	-12	295
34	0.00	0.098	-12	283
36	0.00	0.097	-12	271
38	0.00	0.095	-11	260
40	0.00	0.094	-11	249
42	0.00	0.092	-11	238
44	0.00	0.091	-11	227
46	0.00	0.089	-11	216
48	0.00	0.088	-11	205
50	0.00	0.086	-10	195
55	0.00	0.084	-25	170
60	0.00	0.080	-24	146
65	0.00	0.076	-23	123
70	0.00	0.073	-22	101
75	0.00	0.022	-7	94
80	0.00	0.021	-6	88
85	0.00	0.019	-6	82
90	0.00	0.018	-5	77
95	0.00	0.017	-5	72
100	0.00	0.016	-5	67

Controlled Release from Site - Rooftop (P-8)

10 Year Post Development Flow	0.340	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
100.00	0	0.000	0
100.03	0.006	0.002	21
100.06	0.013	0.008	83
100.09	0.019	0.019	186
100.12	0.022	0.033	330
100.15	0.025	0.052	516

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.03	0.000	2	2
2	0.07	0.001	4	0
3	0.10	0.000	6	6
4	0.14	0.002	8	14
5	0.17	0.004	10	24
6	0.20	0.007	12	36
7	0.24	0.008	14	50
8	0.27	0.009	16	66
9	0.31	0.011	18	84
10	0.34	0.013	20	103
11	0.31	0.014	18	121
12	0.27	0.015	15	136
13	0.24	0.016	13	150
14	0.20	0.017	11	161
15	0.17	0.017	9	170
16	0.14	0.018	7	177
17	0.10	0.018	5	182
18	0.07	0.019	3	185
19	0.03	0.019	1	186
20	0.00	0.019	-1	185
22	0.00	0.019	-2	183
24	0.00	0.019	-2	180
26	0.00	0.019	-2	178
28	0.00	0.018	-2	176
30	0.00	0.018	-2	174
32	0.00	0.018	-2	172
34	0.00	0.018	-2	169
36	0.00	0.018	-2	167
38	0.00	0.018	-2	165
40	0.00	0.018	-2	163
42	0.00	0.018	-2	161
44	0.00	0.017	-2	159
46	0.00	0.017	-2	157
48	0.00	0.017	-2	155
50	0.00	0.017	-2	153
55	0.00	0.017	-5	148
60	0.00	0.017	-5	143
65	0.00	0.016	-5	138
70	0.00	0.016	-5	133
75	0.00	0.016	-5	128
80	0.00	0.015	-5	124
85	0.00	0.015	-5	119
90	0.00	0.015	-4	115
95	0.00	0.015	-4	110
100	0.00	0.014	-4	106

Uncontrolled Release from Site - (P-1 to P-4)

10 Year Post Development Flow	0.132	m3/sec
Storm Duration	20	min

Hydrograph Data

Minute	In Flow	Out Flow
	(m3/sec)	(m3/sec)
(1)	(2)	(4)
0	0.000	0.000
1	0.013	0.013
2	0.026	0.026
3	0.040	0.040
4	0.053	0.053
5	0.066	0.066
6	0.079	0.079
7	0.093	0.093
8	0.106	0.106
9	0.119	0.119
10	0.132	0.132
11	0.119	0.119
12	0.106	0.106
13	0.093	0.093
14	0.079	0.079
15	0.066	0.066
16	0.053	0.053
17	0.040	0.040
18	0.026	0.026
19	0.013	0.013
20	0.000	0.000
22	0.000	0.000
24	0.000	0.000
26	0.000	0.000
28	0.000	0.000
30	0.000	0.000
32	0.000	0.000
34	0.000	0.000
36	0.000	0.000
38	0.000	0.000
40	0.000	0.000
42	0.000	0.000
44	0.000	0.000
46	0.000	0.000
48	0.000	0.000
50	0.000	0.000
55	0.000	0.000
60	0.000	0.000
65	0.000	0.000
70	0.000	0.000
75	0.000	0.000
80	0.000	0.000
85	0.000	0.000
90	0.000	0.000
95	0.000	0.000
100	0.000	0.000

Total Release From Site

Minute	Out Flow	Total Storage
	(m3/sec)	(m3/sec)
(1)	(2)	(2)
0	0.000	0.000
1	0.013	6.652
2	0.028	0.560
3	0.040	20.507
4	0.058	46.811
5	0.078	79.377
6	0.098	118.161
7	0.119	163.168
8	0.186	211.557
9	0.206	266.184
10	0.227	326.997
11	0.222	380.696
12	0.215	427.393
13	0.206	467.134
14	0.197	499.967
15	0.188	525.935
16	0.177	545.086
17	0.166	557.468
18	0.154	563.130
19	0.141	562.111
20	0.128	554.451
22	0.127	539.225
24	0.125	524.208
26	0.123	509.408
28	0.122	494.824
30	0.120	480.451
32	0.118	466.287
34	0.116	452.327
36	0.115	438.570
38	0.113	425.012
40	0.111	411.650
42	0.110	398.481
44	0.108	385.503
46	0.107	372.712
48	0.105	360.114
50	0.103	347.737
55	0.101	317.335
60	0.097	288.258
65	0.093	260.445
70	0.089	233.838
75	0.038	222.460
80	0.036	211.609
85	0.035	201.255
90	0.033	191.368
95	0.031	181.921
100	0.030	172.890

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Date: May 15, 2023
Revision No.:
Project No.: OTW21-0002
Designed By: N.I.
Checked By: D.N.

Proposed Industrial Building
2760-2770 Sheffield Road
Ottawa, ON K1B 3V8

CHECKING STORAGE RELEASE CHARACTERISTICS

Controlled Release from Site - Pavement P-5 to P-7, P-9 to P-12 and P-20

25 Year Post Development Flow	1.001	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
64.90	0	0.000	0
65.05	0.071	0.011	109
65.20	0.088	0.022	219
65.40	0.107	0.036	364
65.60	0.124	0.051	510
65.75	0.135	0.062	619
65.90	0.145	0.073	729

Hydrograph Data

Minute	In Flow (m3/sec)	Out Flow (m3/sec)	Del_Storage (m3)	Cumulative Storage (m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.10	0.000	6	6
2	0.20	0.001	12	0
3	0.30	0.000	18	18
4	0.40	0.004	24	42
5	0.50	0.009	29	72
6	0.60	0.016	35	107
7	0.70	0.023	41	147
8	0.80	0.077	43	191
9	0.90	0.084	49	240
10	1.00	0.091	55	294
11	0.90	0.098	48	343
12	0.80	0.105	42	384
13	0.70	0.110	35	420
14	0.60	0.114	29	449
15	0.50	0.117	23	472
16	0.40	0.119	17	489
17	0.30	0.121	11	500
18	0.20	0.122	5	504
19	0.10	0.123	-1	503
20	0.00	0.123	-7	496
22	0.00	0.122	-15	481
24	0.00	0.120	-14	466
26	0.00	0.119	-14	452
28	0.00	0.117	-14	438
30	0.00	0.116	-14	424
32	0.00	0.114	-14	411
34	0.00	0.113	-14	397
36	0.00	0.111	-13	384
38	0.00	0.110	-13	371
40	0.00	0.108	-13	358
42	0.00	0.107	-13	345
44	0.00	0.105	-13	332
46	0.00	0.103	-12	320
48	0.00	0.102	-12	308
50	0.00	0.100	-12	296
55	0.00	0.098	-30	266
60	0.00	0.094	-28	238
65	0.00	0.091	-27	211
70	0.00	0.087	-26	184
75	0.00	0.083	-25	160
80	0.00	0.079	-24	136
85	0.00	0.075	-22	114
90	0.00	0.071	-21	92
95	0.00	0.020	-6	86
100	0.00	0.019	-6	80

Controlled Release from Site - Rooftop (P-8)

25 Year Post Development Flow	0.444	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
100.00	0	0.000	0
100.03	0.006	0.002	21
100.06	0.013	0.008	83
100.09	0.019	0.019	186
100.12	0.022	0.033	330
100.15	0.025	0.052	516

Hydrograph Data

Minute	In Flow (m3/sec)	Out Flow (m3/sec)	Del_Storage (m3)	Cumulative Storage (m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.04	0.000	3	3
2	0.09	0.001	5	0
3	0.13	0.000	8	8
4	0.18	0.003	10	19
5	0.22	0.006	13	32
6	0.27	0.007	16	47
7	0.31	0.009	18	65
8	0.35	0.011	21	86
9	0.40	0.013	23	109
10	0.44	0.014	26	135
11	0.40	0.016	23	158
12	0.35	0.017	20	178
13	0.31	0.018	18	196
14	0.27	0.019	15	211
15	0.22	0.019	12	223
16	0.18	0.020	9	232
17	0.13	0.020	7	239
18	0.09	0.020	4	243
19	0.04	0.020	1	245
20	0.00	0.020	-1	243
22	0.00	0.020	-2	241
24	0.00	0.020	-2	238
26	0.00	0.020	-2	236
28	0.00	0.020	-2	234
30	0.00	0.020	-2	231
32	0.00	0.020	-2	229
34	0.00	0.020	-2	226
36	0.00	0.020	-2	224
38	0.00	0.020	-2	222
40	0.00	0.020	-2	219
42	0.00	0.020	-2	217
44	0.00	0.020	-2	215
46	0.00	0.020	-2	212
48	0.00	0.020	-2	210
50	0.00	0.019	-2	208
55	0.00	0.019	-6	202
60	0.00	0.019	-6	196
65	0.00	0.019	-6	190
70	0.00	0.019	-6	185
75	0.00	0.019	-6	179
80	0.00	0.019	-6	173
85	0.00	0.018	-5	168
90	0.00	0.018	-5	163
95	0.00	0.018	-5	157
100	0.00	0.017	-5	152

Uncontrolled Release from Site - (P-1 to P-4)

25 Year Post Development Flow	0.173	m3/sec
Storm Duration	20	min

Hydrograph Data

Minute	In Flow (m3/sec)	Out Flow (m3/sec)
(1)	(2)	(4)
0	0.000	0.000
1	0.017	0.017
2	0.035	0.035
3	0.052	0.052
4	0.069	0.069
5	0.086	0.086
6	0.104	0.104
7	0.121	0.121
8	0.138	0.138
9	0.155	0.155
10	0.173	0.173
11	0.155	0.155
12	0.138	0.138
13	0.121	0.121
14	0.104	0.104
15	0.086	0.086
16	0.069	0.069
17	0.052	0.052
18	0.035	0.035
19	0.017	0.017
20	0.000	0.000
22	0.000	0.000
24	0.000	0.000
26	0.000	0.000
28	0.000	0.000
30	0.000	0.000
32	0.000	0.000
34	0.000	0.000
36	0.000	0.000
38	0.000	0.000
40	0.000	0.000
42	0.000	0.000
44	0.000	0.000
46	0.000	0.000
48	0.000	0.000
50	0.000	0.000
55	0.000	0.000
60	0.000	0.000
65	0.000	0.000
70	0.000	0.000
75	0.000	0.000
80	0.000	0.000
85	0.000	0.000
90	0.000	0.000
95	0.000	0.000
100	0.000	0.000

Total Release From Site

Minute	Out Flow (m3/sec)	Total Storage (m3/sec)
(1)	(2)	(2)
0	0.000	0.000
1	0.017	8.668
2	0.037	0.560
3	0.052	26.555
4	0.076	60.834
5	0.101	103.274
6	0.127	153.891
7	0.153	212.617
8	0.226	276.709
9	0.252	348.928
10	0.278	429.292
11	0.269	500.462
12	0.260	562.499
13	0.249	615.489
14	0.236	659.532
15	0.223	694.693
16	0.208	721.015
17	0.193	738.545
18	0.177	747.326
19	0.160	747.402
20	0.143	738.817
22	0.142	721.750
24	0.141	704.885
26	0.139	688.219
28	0.137	671.751
30	0.136	655.477
32	0.134	639.394
34	0.132	623.501
36	0.131	607.795
38	0.129	592.273
40	0.128	576.934
42	0.126	561.790
44	0.124	546.855
46	0.123	532.124
48	0.121	517.595
50	0.119	503.265
55	0.118	467.929
60	0.114	433.795
65	0.110	400.819
70	0.106	369.030
75	0.102	338.561
80	0.097	309.403
85	0.093	281.495
90	0.089	254.781
95	0.038	243.436
100	0.036	232.590

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Revision No.:
Project No.: OTW21-0002
Designed By: N.I.
Checked By: D.N.

Proposed Industrial Building
2760-2770 Sheffield Road
Ottawa, ON K1B 3V8

CHECKING STORAGE RELEASE CHARACTERISTICS

Controlled Release from Site - Pavement P-5 to P-7, P-9 to P-12 and P-20

50 Year Post Development Flow	1.219	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
64.90	0	0.000	0
65.05	0.071	0.011	109
65.20	0.088	0.022	219
65.40	0.107	0.036	364
65.60	0.124	0.051	510
65.75	0.135	0.062	619
65.90	0.145	0.073	729

Hydrograph Data

Minute	In Flow (m3/sec)	Out Flow (m3/sec)	Del_Storage (m3)	Cumulative Storage (m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.12	0.000	7	7
2	0.24	0.002	15	0
3	0.37	0.000	22	22
4	0.49	0.005	29	51
5	0.61	0.011	36	87
6	0.73	0.019	43	130
7	0.85	0.074	47	177
8	0.97	0.081	54	230
9	1.10	0.090	60	291
10	1.22	0.098	67	358
11	1.10	0.107	59	417
12	0.97	0.113	52	469
13	0.85	0.119	44	513
14	0.73	0.124	36	549
15	0.61	0.128	29	578
16	0.49	0.130	21	600
17	0.37	0.133	14	614
18	0.24	0.134	7	620
19	0.12	0.135	-1	620
20	0.00	0.135	-8	611
22	0.00	0.134	-16	595
24	0.00	0.132	-16	580
26	0.00	0.131	-16	564
28	0.00	0.129	-15	548
30	0.00	0.127	-15	533
32	0.00	0.126	-15	518
34	0.00	0.124	-15	503
36	0.00	0.123	-15	488
38	0.00	0.121	-15	474
40	0.00	0.120	-14	459
42	0.00	0.118	-14	445
44	0.00	0.116	-14	431
46	0.00	0.115	-14	417
48	0.00	0.113	-14	404
50	0.00	0.112	-13	390
55	0.00	0.110	-33	357
60	0.00	0.107	-32	325
65	0.00	0.102	-31	295
70	0.00	0.098	-29	265
75	0.00	0.094	-28	237
80	0.00	0.091	-27	210
85	0.00	0.087	-26	184
90	0.00	0.083	-25	159
95	0.00	0.079	-24	135
100	0.00	0.075	-22	113

Controlled Release from Site - Rooftop (P-8)

50 Year Post Development Flow	0.540	m3/sec
Storm Duration	20	min

Pond Rating Curve

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
100.00	0	0.000	0
100.03	0.006	0.002	21
100.06	0.013	0.008	83
100.09	0.019	0.019	186
100.12	0.022	0.033	330
100.15	0.025	0.052	516

Hydrograph Data

Minute	In Flow (m3/sec)	Out Flow (m3/sec)	Del_Storage (m3)	Cumulative Storage (m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.05	0.000	3	3
2	0.11	0.001	6	0
3	0.16	0.000	10	10
4	0.22	0.003	13	23
5	0.27	0.007	16	39
6	0.32	0.008	19	58
7	0.38	0.010	22	80
8	0.43	0.012	25	105
9	0.49	0.014	28	133
10	0.54	0.016	31	165
11	0.49	0.018	28	193
12	0.43	0.019	25	217
13	0.38	0.020	22	239
14	0.32	0.020	18	257
15	0.27	0.020	15	272
16	0.22	0.021	12	284
17	0.16	0.021	8	292
18	0.11	0.021	5	298
19	0.05	0.021	2	300
20	0.00	0.021	-1	298
22	0.00	0.021	-3	296
24	0.00	0.021	-3	293
26	0.00	0.021	-3	291
28	0.00	0.021	-3	288
30	0.00	0.021	-3	285
32	0.00	0.021	-3	283
34	0.00	0.021	-3	280
36	0.00	0.021	-3	278
38	0.00	0.021	-3	275
40	0.00	0.021	-3	273
42	0.00	0.021	-2	270
44	0.00	0.021	-2	268
46	0.00	0.021	-2	265
48	0.00	0.021	-2	263
50	0.00	0.021	-2	260
55	0.00	0.021	-6	254
60	0.00	0.020	-6	248
65	0.00	0.020	-6	242
70	0.00	0.020	-6	236
75	0.00	0.020	-6	230
80	0.00	0.020	-6	224
85	0.00	0.020	-6	218
90	0.00	0.020	-6	212
95	0.00	0.020	-6	206
100	0.00	0.019	-6	201

Uncontrolled Release from Site - (P-1 to P-4)

50 Year Post Development Flow	0.210	m3/sec
Storm Duration	20	min

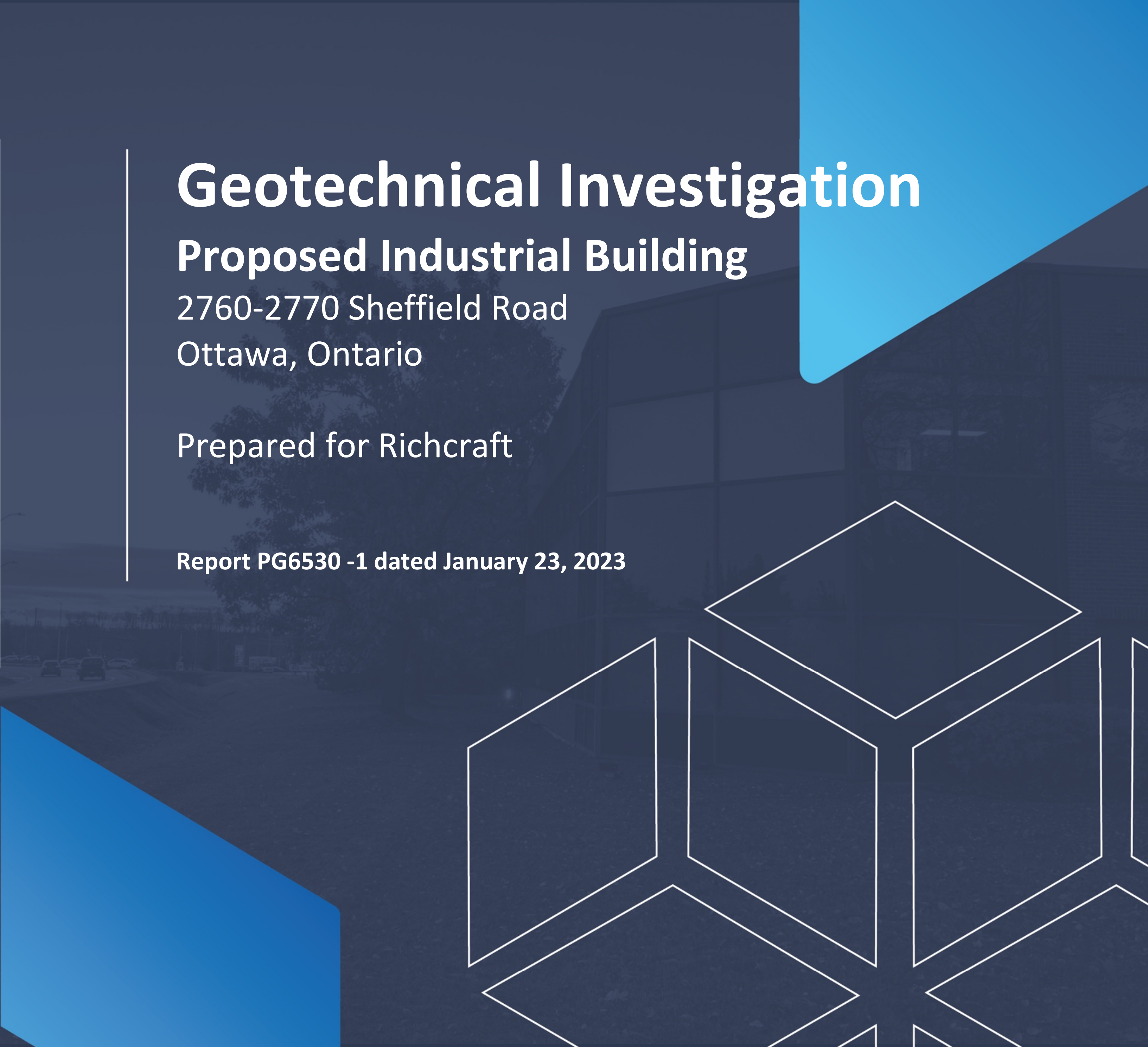
Hydrograph Data

Minute	In Flow (m3/sec)	Out Flow (m3/sec)
(1)	(2)	(4)
0	0.000	0.000
1	0.021	0.021
2	0.042	0.042
3	0.063	0.063
4	0.084	0.084
5	0.105	0.105
6	0.126	0.126
7	0.147	0.147
8	0.168	0.168
9	0.189	0.189
10	0.210	0.210
11	0.189	0.189
12	0.168	0.168
13	0.147	0.147
14	0.126	0.126
15	0.105	0.105
16	0.084	0.084
17	0.063	0.063
18	0.042	0.042
19	0.021	0.021
20	0.000	0.000
22	0.000	0.000
24	0.000	0.000
26	0.000	0.000
28	0.000	0.000
30	0.000	0.000
32	0.000	0.000
34	0.000	0.000
36	0.000	0.000
38	0.000	0.000
40	0.000	0.000
42	0.000	0.000
44	0.000	0.000
46	0.000	0.000
48	0.000	0.000
50	0.000	0.000
55	0.000	0.000
60	0.000	0.000
65	0.000	0.000
70	0.000	0.000
75	0.000	0.000
80	0.000	0.000
85	0.000	0.000
90	0.000	0.000
95	0.000	0.000
100	0.000	0.000

Total Release From Site

Minute	Out Flow (m3/sec)	Total Storage (m3/sec)
(1)	(2)	(2)
0	0.000	0.000
1	0.021	10.552
2	0.045	0.560
3	0.063	32.209
4	0.092	73.942
5	0.123	125.637
6	0.153	187.314
7	0.231	256.147
8	0.262	334.942
9	0.293	423.690
10	0.323	522.409
11	0.313	609.930
12	0.300	686.406
13	0.286	751.951
14	0.270	806.624
15	0.253	850.502
16	0.235	883.634
17	0.217	906.071
18	0.197	917.861
19	0.177	919.052
20	0.156	909.693
22	0.155	891.074
24	0.154	872.654
26	0.152	854.430
28	0.150	836.401
30	0.149	818.563
32	0.147	800.915
34	0.146	783.455
36	0.144	766.190
38	0.142	749.129
40	0.141	732.269
42	0.139	715.607
44	0.137	699.142
46	0.136	682.869
48	0.134	666.788
50	0.132	650.895
55	0.131	611.627
60	0.127	573.549
65	0.123	536.772
70	0.118	501.247
75	0.114	466.926
80	0.111	433.761
85	0.107	401.791
90	0.102	371.127
95	0.098	341.708
100	0.094	313.473

Appendix D – Geotechnical Report



Geotechnical Investigation

Proposed Industrial Building

2760-2770 Sheffield Road
Ottawa, Ontario

Prepared for Richcraft

Report PG6530 -1 dated January 23, 2023

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by the Richcraft to conduct a geotechnical investigation for the proposed industrial building to be located at 2760-2770 Sheffield Road in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 for the general site location).

The objectives of the geotechnical investigation were to:

❑ Determine the subsoil and groundwater conditions at this site by means of boreholes.

❑ Provide geotechnical recommendations for 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 an industrial building with a slab-on-grade and an approximate footprint of 10,000 to 11,000 m^2. It is further understood that associated asphalt-paved access lanes, loading areas, and parking areas will surround the proposed building.

It is also understood that the proposed building will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The current geotechnical investigation was carried out on January 10th and 11th, 2023, and consisted of a total of nine (9) boreholes (BH 1-23 through BH 9-23) advanced to a maximum depth of 7.3 m below the existing grade. The borehole locations were distributed in a manner to provide general coverage of the subject site, taking into consideration underground services and available access. The approximate locations of the boreholes are shown on Drawing PG6530-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a low-clearance track-mounted 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.

Sampling and In Situ Testing

The soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler or from the drill auger and hand auger flights. The samples were initially classified on site, placed in sealed plastic bags, and transported to our laboratory. The depths at which the drill 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.

A 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.

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at boreholes BH 1-23 and BH 4-23. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

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.

Groundwater

Three (3) monitoring well were installed at boreholes BH 4-23, BH 8-23 and BH 9-23. Flexible polyethylene standpipes were installed in the remaining boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. The groundwater observations are discussed in Section 4.3 and presented in the Soil Profile and Test Data Sheets in Appendix 1.

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 borehole locations, and the ground surface elevation at each borehole location, were surveyed by Paterson using a GPS unit with respect to a geodetic datum. The locations of the boreholes, and ground surface elevation at each borehole location, are presented on Drawing PG6530-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Review

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of three (3) Atterberg limits tests were completed on selected soil samples obtained from the current geotechnical investigation. All samples from the current investigation will be stored in the laboratory for 1 month after this report is completed. They will then be discarded unless we are otherwise directed.

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 a vacant grassed area, however, based on reviewing available aerial photos, the site formerly consisted of a right-of-way for several railroads which have since been demolished. The site is bordered by commercial buildings to the east and west, and the former railroad right-of-way to the north and south. The ground surface across the site is relatively level at approximate geodetic elevation 67 to 68.

4.2 Subsurface Profile

Generally, the subsurface profile at the subject site consists of topsoil and/or fill, extending to approximate depths of 0.2 to 1.8 m, overlying a silty clay deposit. The fill was generally observed to consist of silty sand to silty clay with varying amounts of gravel, cobbles, and organics.

The silty clay deposit, encountered underlying the topsoil and/or fill, was observed to have a very stiff to hard, brown silty clay crust, becoming a stiff, grey silty clay below approximate depths of 2.5 to 3.5 m.

A DCPT was conducted at boreholes BH 1-23 and BH 4-23, which encountered practical refusal at approximate depths of 11.9 and 9.6 m, respectively.

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, bedrock in the area of the subject site consists of shale of the Carlsbad Formation, with drift thicknesses ranging from 10 to 15 m.

Atterberg Limits Testing

Atterberg limits testing was completed on the recovered silty clay samples at selected locations throughout the subject site during the current and previous investigations. The results of the Atterberg Limits testing are presented in Table 1 on the next page, and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 – Atterberg Limits Results – Current Investigation

Borehole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
BH 1-23	SS4	2.3-2.9	63	21	42	CH
BH 3-23	SS4	2.3-2.9	62	22	40	CH
BH 4-23	SS4	2.3-2.9	65	21	44	CH

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plastic Index; CH: Inorganic Clay of High Plasticity. MH: Inorganic Silt of High Plasticity

4.3 Groundwater

Groundwater levels were measured in the monitoring wells and standpipe piezometers on January 17, 2023. The measured groundwater levels are presented on the Soil Profile and Test Data sheets in Appendix 1, and in Table 2 below.

Table 2 – Summary of Groundwater Level Readings

Test Hole Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Elevation (m)	Recording Date
BH 1-23	67.57	0.96	66.61	January 17, 2023
BH 2-23	67.11	1.08	66.03	
BH 3-23	67.28	1.32	65.96	
BH 4-23*	67.73	1.04	66.69	
BH 5-23	67.57	0.79	66.78	
BH 6-23	67.73	0.95	66.78	
BH 7-23	67.45	1.66	65.76	
BH 8-23*	66.80	1.20	65.60	
BH 9-23*	66.74	0.48	66.26	

Note:

-*Denotes borehole instrumented with a 51 mm diameter monitoring well.

- Ground surface elevations at borehole locations were surveyed by Paterson and are referenced to a geodetic datum.

It should be noted that surface water can become trapped within a backfilled borehole, which can lead to higher than typical groundwater level observations. Similarly, it is our experience that surface water generated by snowmelt and rainfall events may sheet drain into the borehole column given the relatively impermeable nature of the silty clay soil surface.

The long-term groundwater level can also be estimated based on the observed colour, moisture content, and consistency of the recovered samples. Based on these observations, the long-term groundwater level is expected at approximate depths of 2.5 to 3 m below the existing ground surface.

However, 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. It is recommended that the proposed industrial building be founded on conventional spread footings placed on an undisturbed, very to hard silty clay bearing surface.

Due to the presence of a silty clay deposit, a grade raise restriction will apply to the subject site. Permissible grade raise recommendations are discussed in Section 5.3.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill within the future building footprint, free of deleterious material and significant amounts of organics, can be left in place below the proposed building footprints outside of lateral support zones for the footings. However, it is recommended that the existing fill layer be proof-rolled several times under dry conditions and above freezing temperatures and approved by Paterson personnel at the time of construction. Any poor performing areas noted during the proof-rolling operation should be removed and replaced with an approved fill.

Fill Placement

Engineered fill placed for grading beneath the proposed buildings, where required, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings and paved areas should be compacted to at least 98% of the material’s standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

5.3 Foundation Design

Bearing Resistance Values – Conventional Spread Footings

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, very stiff to hard silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 is applied to the above noted bearing resistance value at ULS.

The above-noted bearing resistance values at SLS for soil bearing surfaces will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

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 silty clay bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as the bearing soil.

Permissible Grade Raise

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **2 m** is recommended. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise calculations.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D**. If a higher seismic site class is required (Class C), a site-specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed buildings, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

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

5.5 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the existing fill subgrade or native soil subgrade approved by the geotechnical consultant at the time of excavation will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction. Where the subgrade consists of the existing fill, a vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program. Any poor performing areas should be removed and reinstated with an engineered fill, such as OPSS Granular B Type II.

It is recommended that the upper 200 mm of sub-floor fill consists of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Design

Car only parking, heavy truck parking areas and access lanes are proposed at this site. The proposed pavement structures are presented in Tables 3 and 4 on the next page.

Table 3 – 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 fill or in-situ soil.	

Table 4 - Recommended Pavement Structure - Access Lanes/Local Roadways, Loading Areas and Heavy Truck Parking

Thickness (mm)	Material Description
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - 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 placedover fill or in situ soil.	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material. 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 compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity. For areas where silty clay is encountered at subgrade level, it is recommended that subdrains be installed during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free draining non frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material. 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.

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 an equivalent thickness of soil cover and foundation insulation, should be provided for adequate frost protection of heated structures.

Exterior unheated footings, such as those for isolated exterior piers, retaining walls or loading ramps, are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover, or an equivalent thickness of soil cover and foundation insulation

Consideration should be given to providing 2.1 m thick soil cover to interior footings within loading bays where significant exposure to freezing conditions during the winter months may occur. Further consideration may be given to installing heated slabs in these areas.

6.3 Excavation Side Slopes

The side slopes of the excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is expected that sufficient room will be available for the greater part of the excavation to be undertake by open-cut methods (i.e. unsupported excavations).

Unsupported Excavations

The excavation side slopes 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 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.

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.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on a soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe, should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 98% of the SPMDD.

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) and above the cover material should match the soils exposed at the trench walls to minimize 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. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. The contractor should be prepared to direct water away from all subgrades, regardless of the source, to prevent disturbance to the founding medium.

Groundwater Control for Building Construction

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application 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 Persons 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 to Neighboring Properties

As the proposed building will be a slab-on-grade structure, it is not anticipated that it will be founded below the long-term groundwater level. As a result, long-term groundwater lowering is not anticipated, and therefore no adverse effects are expected to neighboring properties.

Further, as the proposed slab-on-grade structures will be setback from the site limits, no impacts to the neighbouring properties are anticipated as a result of excavation at the subject site.

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 using 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 into 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 moderate to aggressive corrosive environment.

6.8 Landscaping Considerations

Paterson completed a soils review of the site to determine applicable tree planting setbacks, in accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines) for trees planted within a public right-of-way (ROW).

Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Grain size distribution and hydrometer testing was also completed on selected soil samples. The above-noted test results were completed on samples taken at depths between the anticipated underside of footing elevation and a 3.5 m depth below finished grade. The results of our testing are presented in Tables 1, 2, and 3 in Section 4.2, and in Appendix 1.

Based on these testing results, the plasticity index was found to be less than or equal to 40%. Therefore, the silty clay encountered throughout the subject site is considered to be a clay of low to medium potential for soil volume change.

The following tree planting setbacks are therefore recommended for the low to medium sensitivity silty clay deposit present throughout the subject site. Large trees (mature height over 14 m) can be planted provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g., in a park or other green space).

Tree planting setback limits may be reduced to **7.5 m** for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the condition noted below are met:

☐ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

☐ A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

☐ The The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

☐ The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

☐ Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

7.0 Recommendations

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

- Review of the grading plan, from a geotechnical perspective.
- 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.

All excess soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by Paterson

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 Richcraft, 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, M.Eng.

LICENSED PROFESSIONAL ENGINEER
Jan. 23, 2023
S. S. DENNIS
100519516
Scott Dennis
PROVINCE OF ONTARIO

Scott Dennis

Scott S. Dennis, P.Eng.

Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMIT TESTING RESULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Building - 2760-2770 Sheffield Drive
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE January 10, 2023

FILE NO. PG6530

HOLE NO. BH 1-23

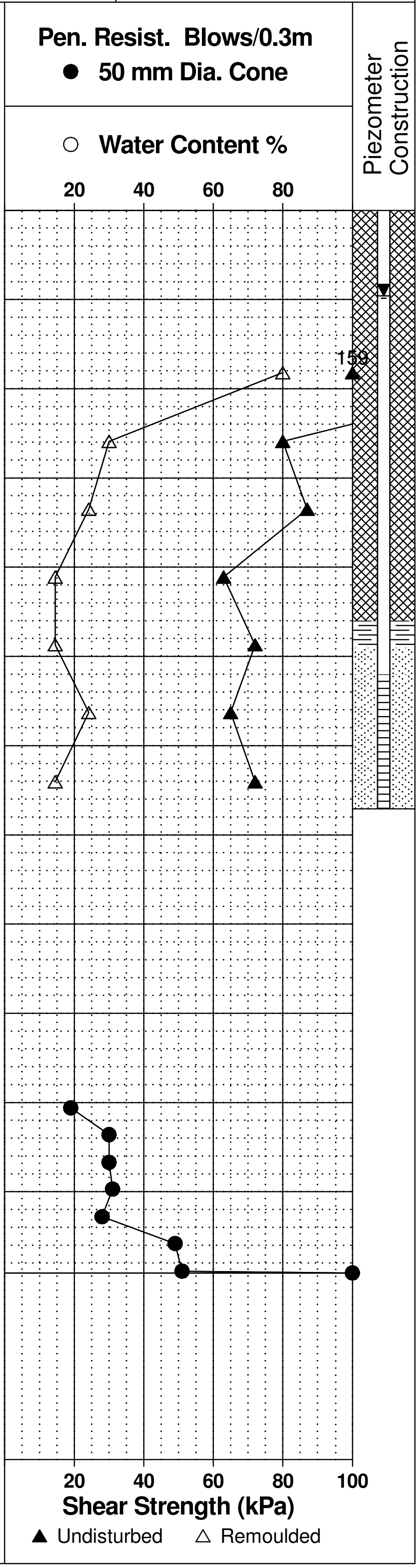
SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.15	AU	1		
FILL: Peat with brown silty sand, trace gravel	0.41				
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.7m depth	6.71	SS	2	75	6
		SS	3	83	P
		SS	4	100	P
		SS	5	100	P
		SS	6	100	P
		SS	7	100	P
		SS	8	100	P
		SS	9	100	P
Dyamic Cone Penetration Test commenced at 6.71m depth. Cone pushed to 9.75m depth.	11.91				

End of Borehole

Practical DCPT refusal at 11.91m depth.

(GWL @ 0.96m - Jan. 17, 2023)

DEPTH (m)	ELEV. (m)
0	67.57
1	66.57
2	65.57
3	64.57
4	63.57
5	62.57
6	61.57
7	60.57
8	59.57
9	58.57
10	57.57
11	56.57



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Building - 2760-2770 Sheffield Drive
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

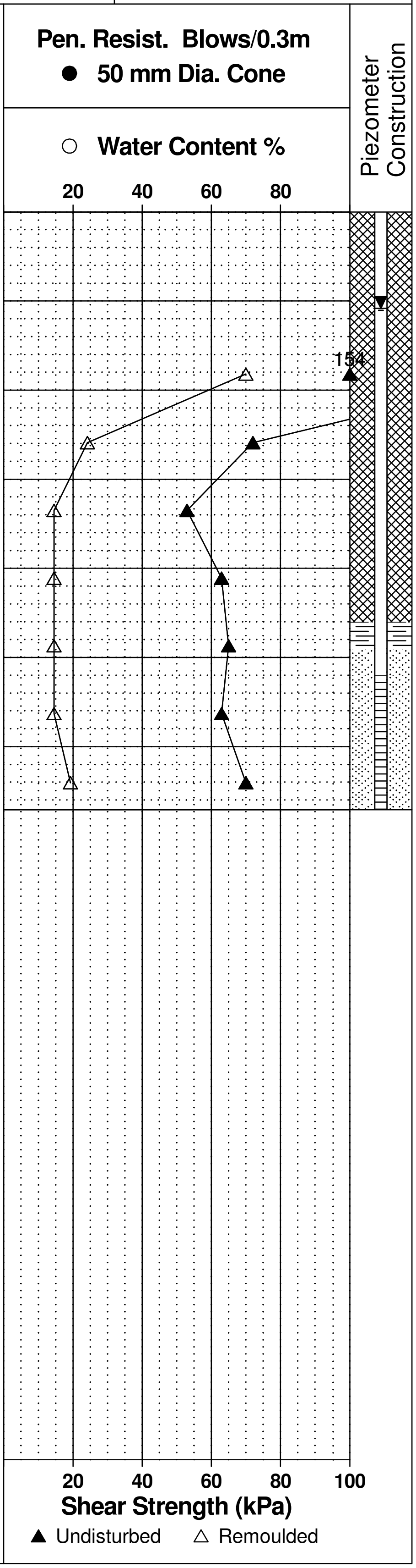
DATE January 10, 2023

FILE NO. PG6530

HOLE NO. BH 2-23

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.20				
FILL: Brown silty clay with topsoil, some peat and gravel	1.07	AU	1		
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.15m depth		SS	2	42	6
		SS	3	58	P
		SS	4	100	P
		SS	5	100	P
		SS	6	100	P
		SS	7	67	P
		SS	8	100	P
	6.71	SS	9	100	P
End of Borehole (GWL @ 1.08m - Jan. 17, 2023)					

DEPTH (m)	ELEV. (m)
0	67.11
1	66.11
2	65.11
3	64.11
4	63.11
5	62.11
6	61.11



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

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BORINGS BY CME-55 Low Clearance Drill

DATE January 10, 2023

FILE NO. PG6530

HOLE NO. BH 3-23

SOIL DESCRIPTION

GROUND SURFACE

SOIL DESCRIPTION	Depth (m)
FILL: Brown silty sand with gravel, occasional cobbles	0.15
FILL: Brown silty clay, some gravel, trace topsoil	0.48
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.7m depth	6.71

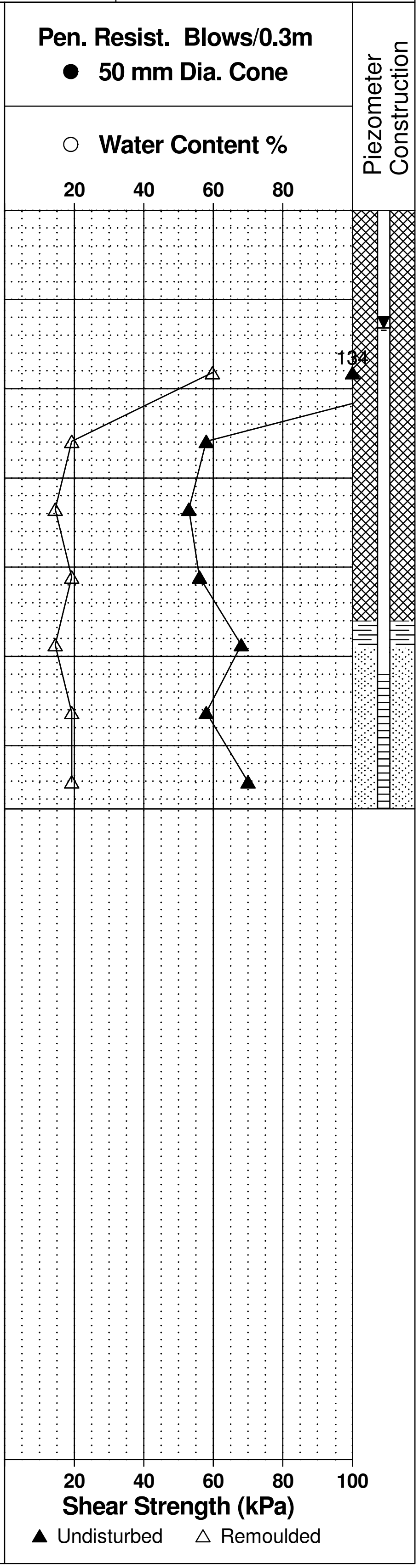
End of Borehole

(GWL @ 1.32m - Jan. 17, 2023)

SAMPLE

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	58	7
SS	3	67	
SS	4	100	
SS	5	100	
SS	6	100	
SS	7	100	
SS	8	67	
SS	9	4	P

DEPTH (m)	ELEV. (m)
0	67.28
1	66.28
2	65.28
3	64.28
4	63.28
5	62.28
6	61.28



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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

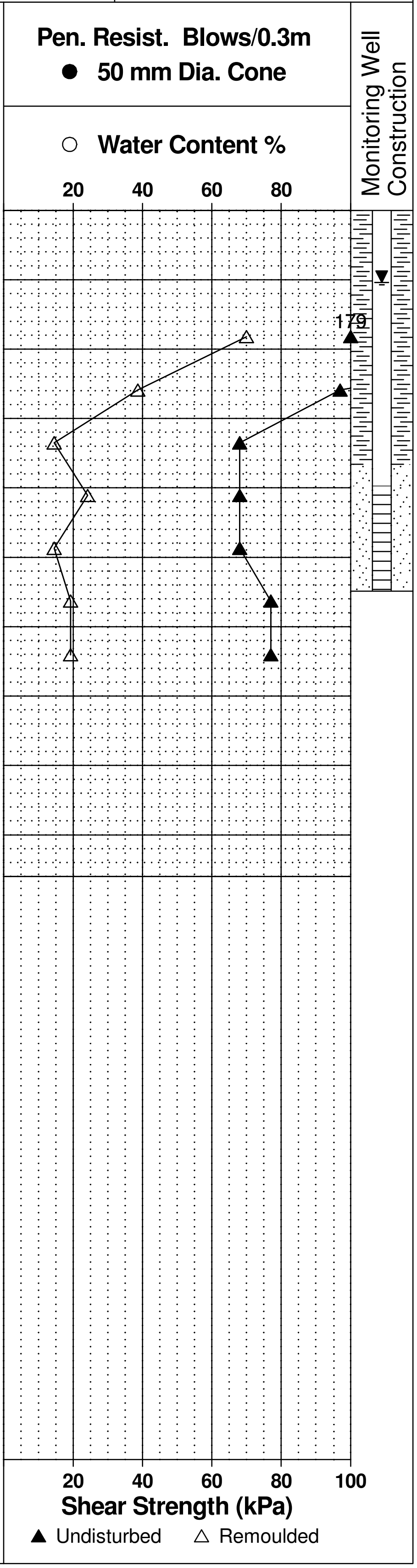
DATE January 10, 2023

FILE NO. PG6530

HOLE NO. BH 4-23

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
FILL: Dark brown silty sand with gravel, some clay, trace organics	AU	1		
0.94	SS	2	62	7
Very stiff to stiff, brown **SILTY CLAY**	SS	3	58	P
- grey by 3.7m depth	SS	4	83	P
	SS	5	83	P
	SS	6	100	P
	SS	7	100	P
	SS	8	100	P
6.71	SS	9		P
Dynamic Cone Penetration Test commenced at 6.71m depth. Cone pushed to 9.3m depth.				
9.60				
End of Borehole				
Practical DCPT refusal at 9.60m depth.				
(GWL @ 1.04m - Jan. 17, 2023)				

DEPTH (m)	ELEV. (m)
0	67.73
1	66.73
2	65.73
3	64.73
4	63.73
5	62.73
6	61.73
7	60.73
8	59.73
9	58.73



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SOIL PROFILE AND TEST DATA

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REMARKS

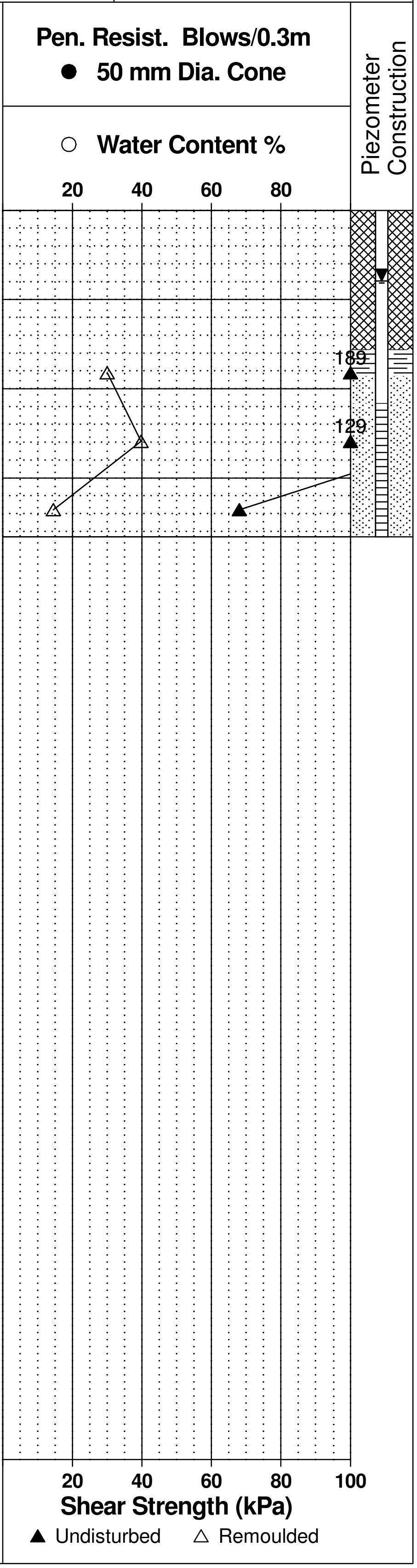
BORINGS BY CME-55 Low Clearance Drill

DATE January 10, 2023

FILE NO. PG6530

HOLE NO. BH 5-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	67.57
FILL: Dark brown silty sand with gravel, trace clay, occasional cobbles 0.69	▨	AU	1				
FILL: Dark brown silty clay, some sand and gravel, trace organics 1.22	▨	SS	2	75	3	1	66.57
Very stiff to stiff, brown **SILTY CLAY**	▨	SS	3	42	P	2	65.57
	▨	SS	4	75	P	3	64.57
3.66	▨	SS	5	83	P		
End of Borehole (GWL @ 0.79m - Jan. 17, 2023)							



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SOIL PROFILE AND TEST DATA

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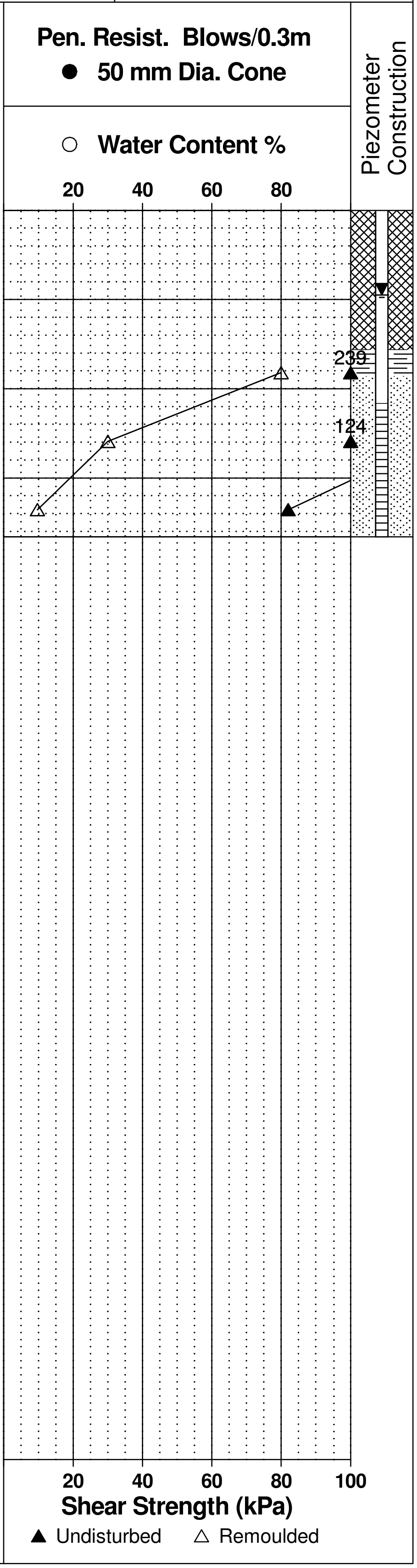
DATE January 11, 2023

FILE NO. PG6530

HOLE NO. BH 6-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	67.73
FILL: Dark brown silty clay, some gravel, topsoil and organics		AU	1				
0.91		SS	2	29	6	1	66.73
Hard to stiff, brown **SILTY CLAY**		SS	3	58	P	2	65.73
		SS	4	83	P	3	64.73
3.66		SS	5	100	P		
End of Borehole							
(GWL @ 0.95m - Jan. 17, 2023)							



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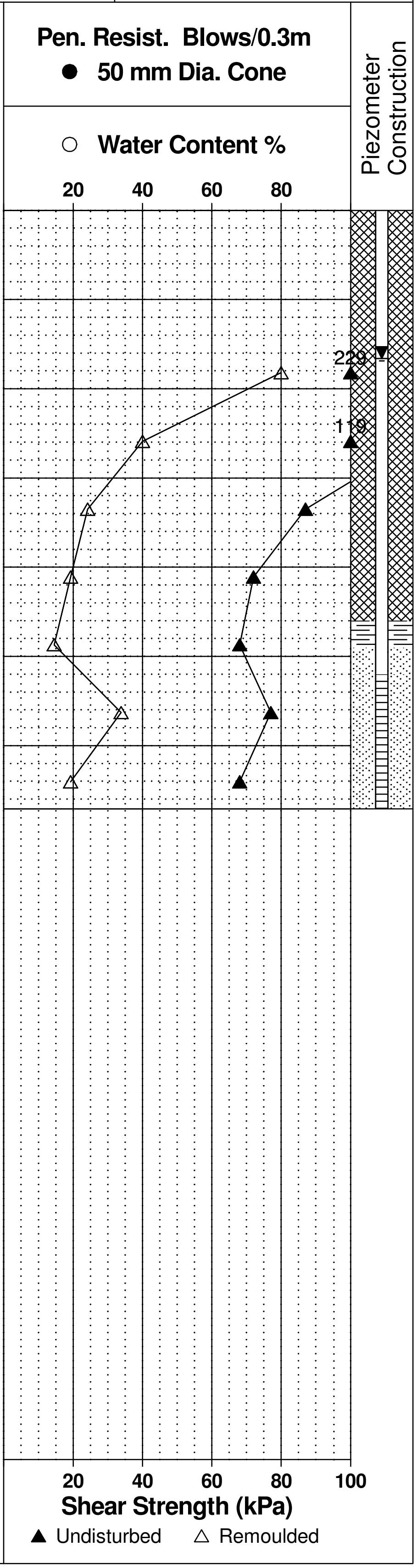
DATE January 11, 2023

FILE NO. PG6530

HOLE NO. BH 7-23

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Brown silty sand with gravel, occasional cobbles	0.28	AU	1		
FILL: Dark brown silty clay, some gravel, topsoil, organics	0.91	SS	2	67	6
Hard to stiff, brown **SILTY CLAY** - grey by 3.7m depth		SS	3	58	P
		SS	4	83	P
		SS	5	100	P
		SS	6	100	P
		SS	7	58	P
		SS	8	100	P
	6.71	SS	9	67	P
End of Borehole (GWL @ 1.66m - Jan. 17, 2023)					

DEPTH (m)	ELEV. (m)
0	67.45
1	66.45
2	65.45
3	64.45
4	63.45
5	62.45
6	61.45



SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY CME-55 Low Clearance Drill

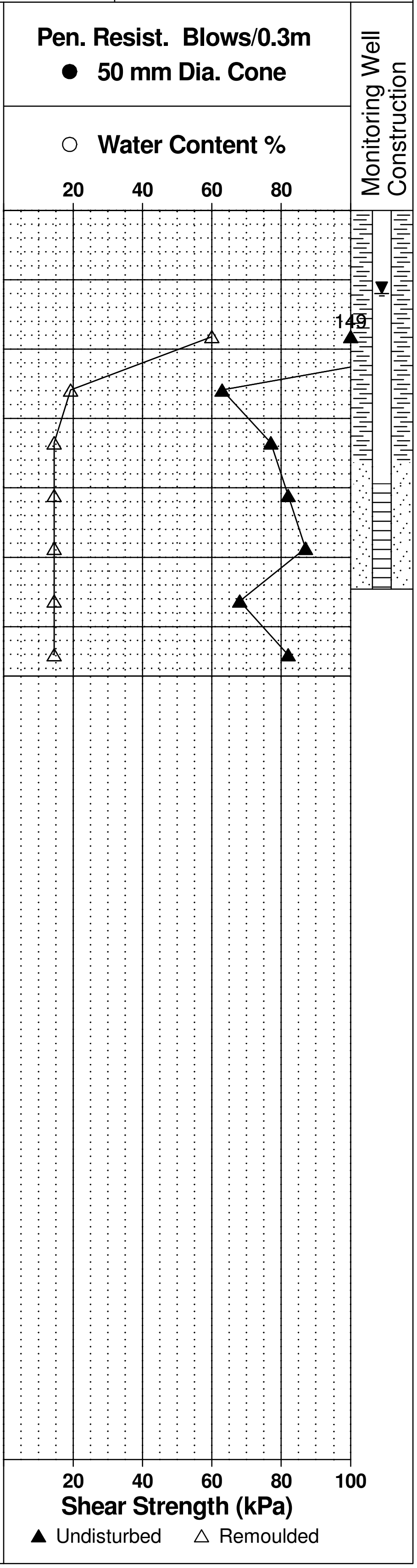
DATE January 11, 2023

FILE NO. PG6530

HOLE NO. BH 8-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
FILL: Crushed stone and gravel with sand 0.59		AU	1		
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.4m depth		SS	2	58	8
		SS	3	75	P
		SS	4	75	P
		SS	5	100	P
		SS	6	100	P
		SS	7	100	P
		SS	8	100	P
6.71		SS	9	67	P
End of Borehole (GWL @ 1.20m - Jan. 17, 2023)					

DEPTH (m)	ELEV. (m)
0	66.80
1	65.80
2	64.80
3	63.80
4	62.80
5	61.80
6	60.80



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE January 11, 2023

FILE NO. PG6530

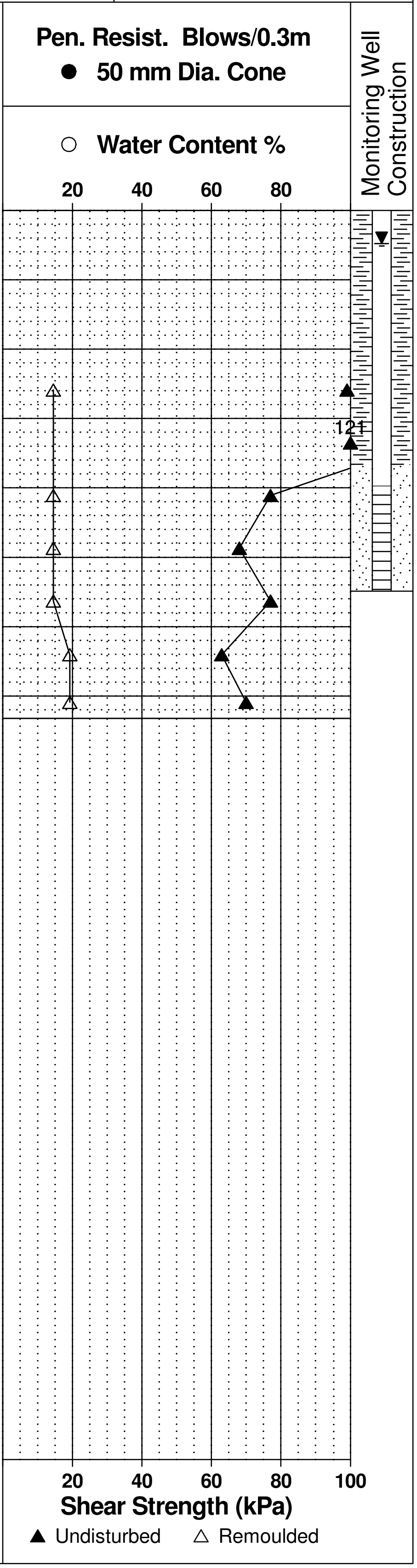
HOLE NO. BH 9-23

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Crushed stone and gravel with sand	0.56	AU	1		
FILL: Brown silty clay, some sand - trace gravel by 1.7m depth	1.83	SS	2	67	10
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.7m depth	7.32	SS	3	75	P
		SS	4	92	P
		SS	5	58	P
		SS	6	100	P
		SS	7	100	P
		SS	8	100	P
		SS	9	100	P

End of Borehole

(GWL @ 0.48m - Jan. 17, 2023)

DEPTH (m)	ELEV. (m)
0	66.74
1	65.74
2	64.74
3	63.74
4	62.74
5	61.74
6	60.74
7	59.74



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 relative strength of cohesionless soils is the compactness condition, 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. An SPT N value of “P” denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	‘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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC% - Natural water 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 at 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)

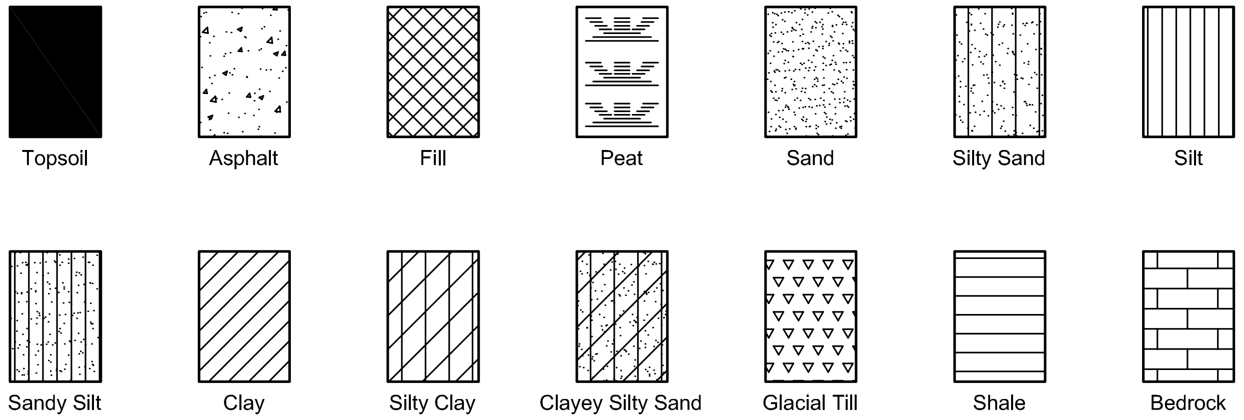
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

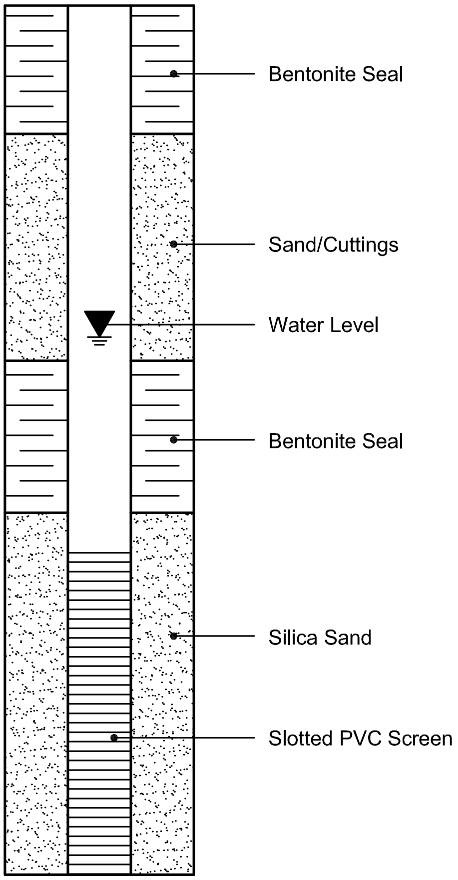
SYMBOLS AND TERMS (continued)

STRATA PLOT

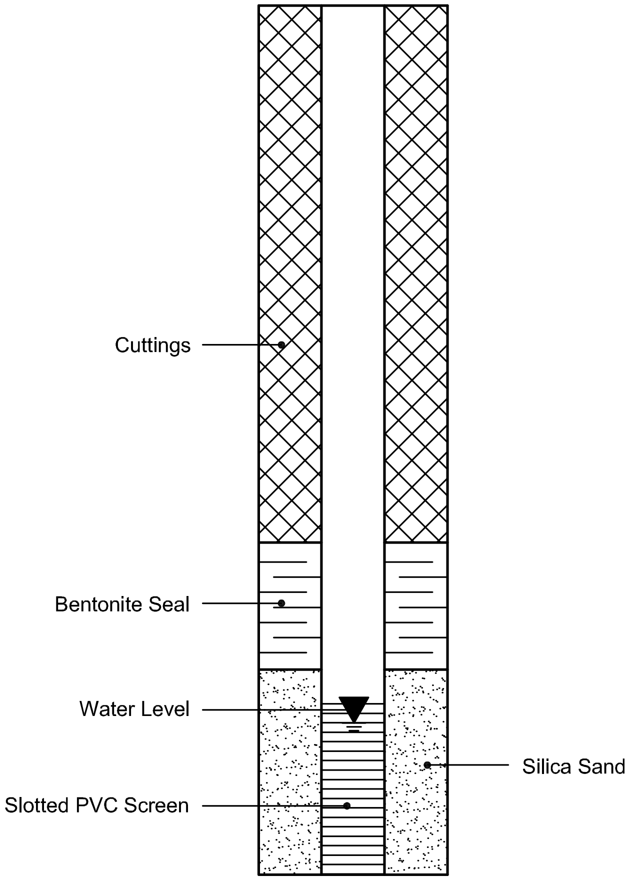


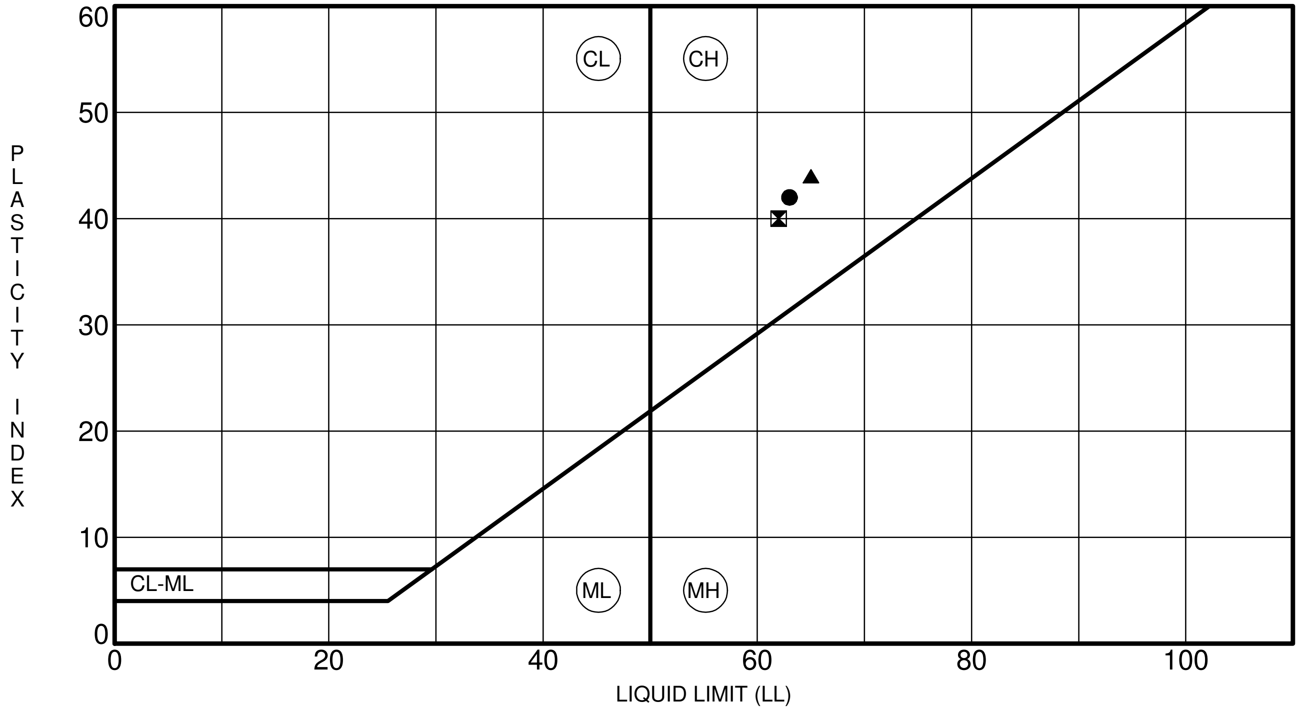
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-23**	**SS4**	**63**	**21**	**42**		**CH - Inorganic clay of high plasticity**
⧗	**BH 3-23**	**SS5**	**62**	**22**	**40**		**CH - Inorganic clay of high plasticity**
▲	**BH 4-23**	**SS4**	**65**	**21**	**44**		**CH - Inorganic clay of high plasticity**

CLIENT	**Richcraft Homes**	FILE NO.	**PG6530**
PROJECT	**Geotechnical Investigation - Prop. Industrial Building - 2760-2770 Sheffield Drive**	DATE	**10 Jan 23**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

ATTERBERG LIMITS' RESULTS

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**

Client PO: 56579

Report Date: 17-Jan-2023

Order Date: 12-Jan-2023

Project Description: PG6530

	Client ID:	BH3-23-SS3	-	-	-
	Sample Date:	10-Jan-23 09:00	-	-	-
	Sample ID:	2302473-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	74.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.37	-	-	-
Resistivity	0.10 Ohm.m	38.1	-	-	-
Anions					
Chloride	10 ug/g dry	73	-	-	-
Sulphate	10 ug/g dry	51	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG6530 - 1 - TEST HOLE LOCATION PLAN

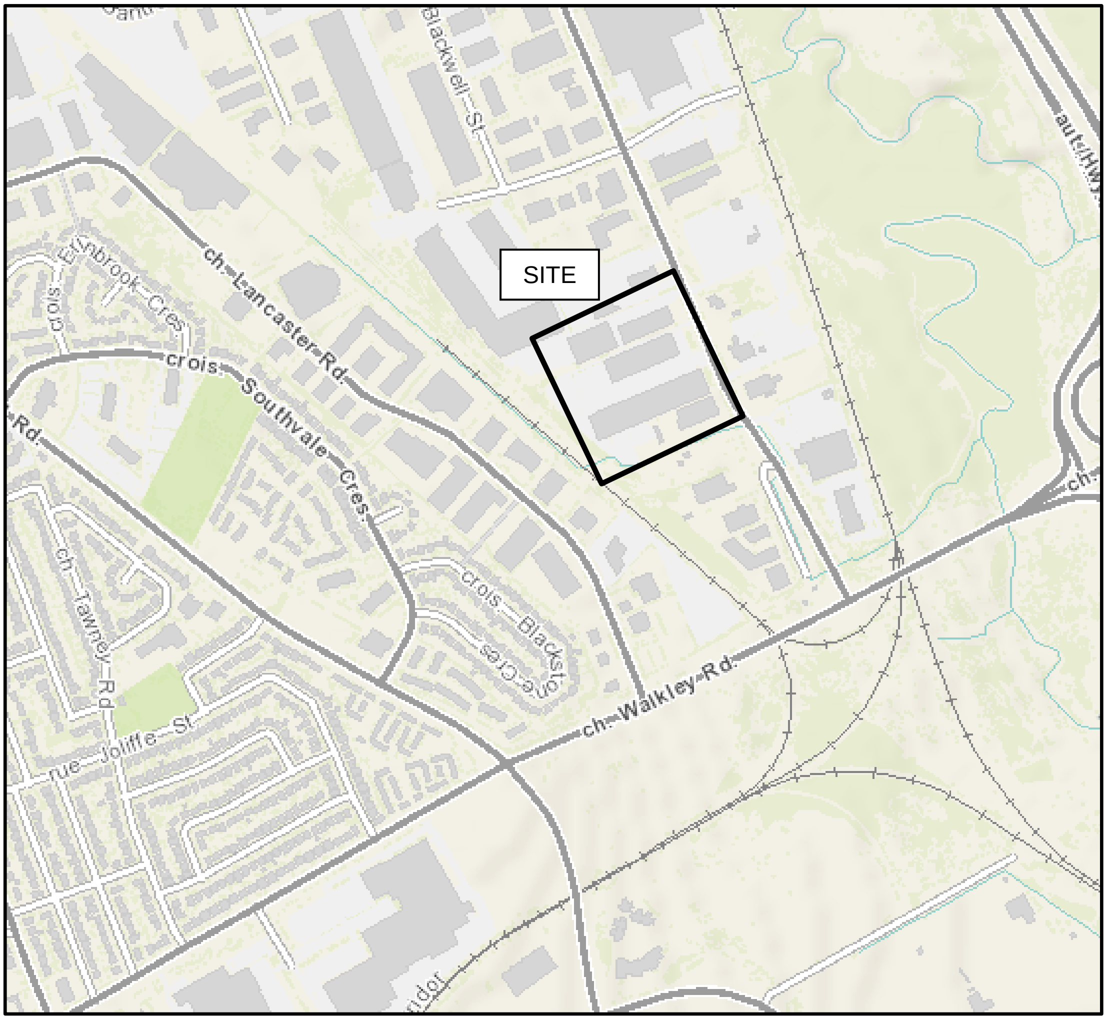
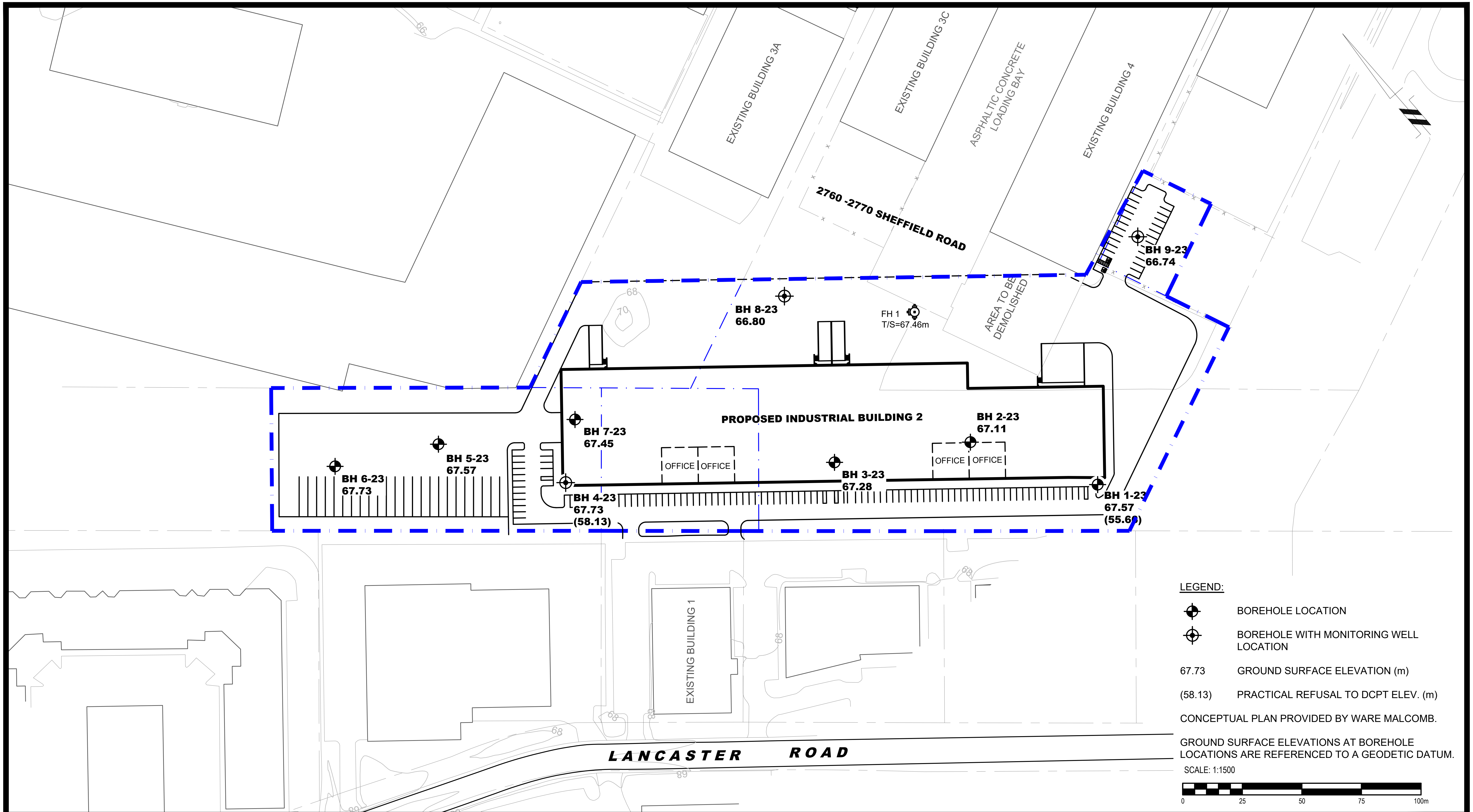


FIGURE 1

KEY PLAN

PATERSON
GROUP



LEGEND:

⌖	BOREHOLE LOCATION
⌖	BOREHOLE WITH MONITORING WELL LOCATION
67.73	GROUND SURFACE ELEVATION (m)
(58.13)	PRACTICAL REFUSAL TO DCPT ELEV. (m)

CONCEPTUAL PLAN PROVIDED BY WARE MALCOMB.

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1500

PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

RICHCRAFT HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL BUILDING
2760 - 2770 SHEFFIELD DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

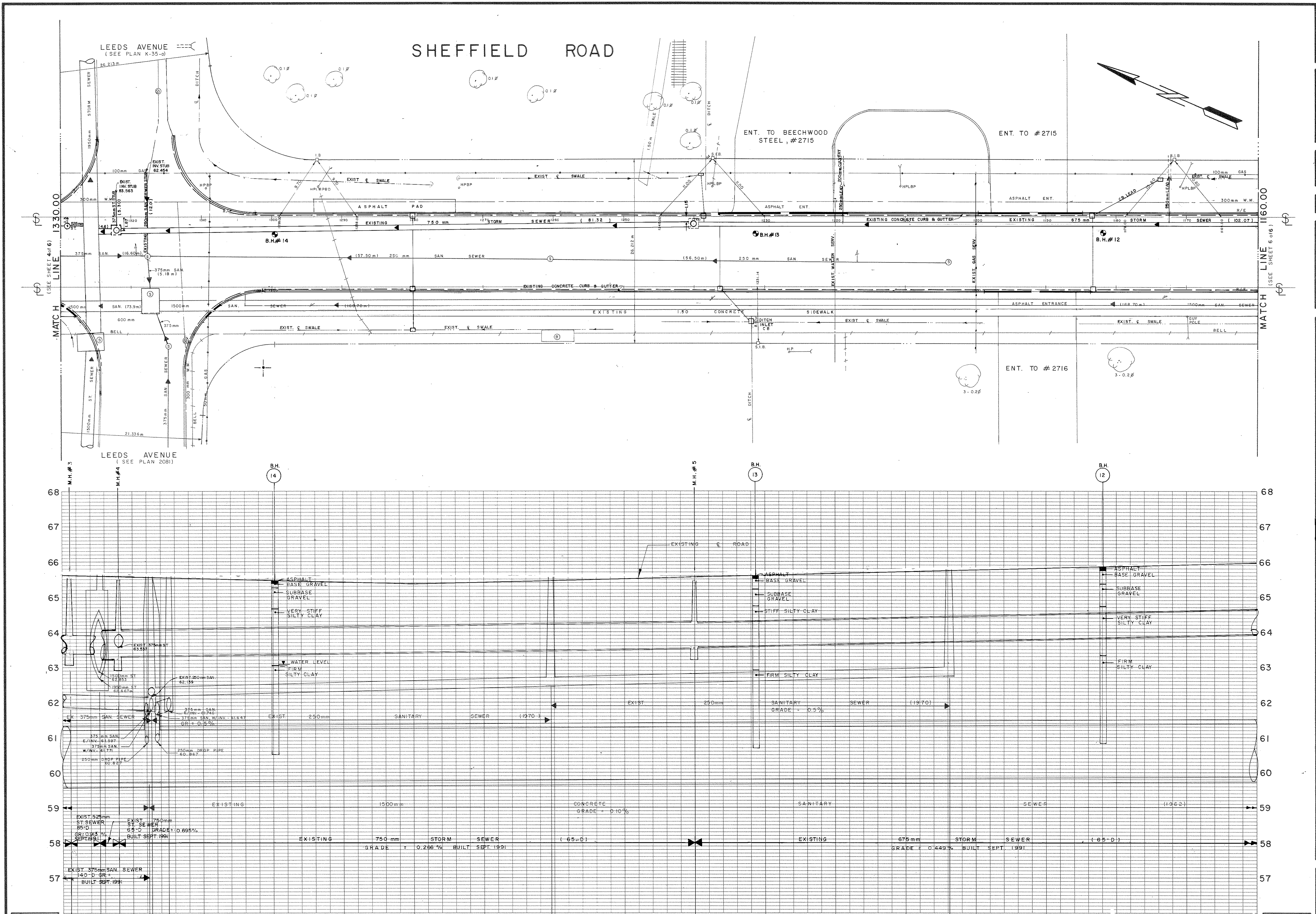
Scale: 1:1500	Date: 01/2023
Drawn by: YA	Report No.: PG6530-1
Checked by: PB	Dwg. No.: **PG6530-1**
Approved by: SD	Revision No.:

p:\autocad drawings\geotechnical\pg65xx\pg6530\pg6530-1-test hole location plan.dwg

11x17

Appendix E – Supporting Documentation

2459 SHEFFIELD ROAD Sheet # 5 of 6



Stations	Existing Surface ℄	Type & Diameter (sewer)	Inverts Exist. & Prop. (sewer)
1330.00	65.575		
1329.00	Fr. 65.514	525mmST 525mmST	63.399 63.391
1324.90		525mmST 750mmST	63.370 63.232
1322.00	Fr. 65.483	750mmST 750mmST	63.264 63.311
1320.00	65.541		
1317.60		1500mmSAN.	59.725
1317.90		375mm SAN.	61.762
1315.20		250mm SAN.	62.179
1310.00	65.487		
1300.00	65.413		
1290.00	65.392		
1280.00	65.403		
1270.00	65.425		
1260.40		250mm SAN.	62.465
1260.00	65.462		
1250.00	65.494		
1240.20	65.545 Fr. 65.438	750mmST 675mmST	63.528 63.578
1230.00	65.599		
1220.00	65.691		
1210.00	65.739		
1203.90		250mmSAN.	62.758
1200.00	65.769		
1190.00	65.828		
1180.00	65.889		
1170.00	65.949		
1160.00	65.991		

Elevations

Revisions:

No.	Date	Description	Drawn By	Appr'd By

Final Measurements:

Construction Type	Storm & San. Sewer Road Rec.	Inspector	Rick Lester Bill Cardo
Work Commenced	May 1991	Instrumentman	John France
Work Completed	Sept. 1991	Field Book #	5327 5328
Contractor	Brenning Const. C.A.C.E. Const.	Date	Sept. 30 1991
Drafting Revisions	Doug Mc Ewan Sept. 1991	Checked By	G.L. Oct/91

Designed By	Date 06-06-90	Structural Check By	Date
Survey Detail By John A Pinkey	Date 90/6/7	Checked By John A Pinkey	Date 91/03/12
Drafting By	Date 06-06-90	Checked By	Date Mar/91

Chief Design & Const. Eng.

Senior Const. Coord.

LICENSED PROFESSIONAL ENGINEER
PAUL E. SAUVE
PROVINCE OF ONTARIO

Notes:

- Utilities shown are taken from best available records. Contractor is requested to check with all utility companies before digging.
- Soil information shown is not guaranteed and contractors are advised to collect additional soils information as deemed necessary.
- Reference bench mark:
- Proposed storm and sanitary sewers may be constructed in a common trench provided that a minimum horizontal distance of 460mm is maintained between outside barrels of pipe.
- All pipes shall conform to the Canadian Standards Association (C.S.A.), A257.2 reinforced concrete sewer pipe with approved rubber gaskets.
- A minimum of 460 mm vertical clearance to be maintained between sewers and watermains where practical.
- Borehole soil descriptions are not based on sieve analysis but on visual inspection only, except where otherwise noted.
- Soil information taken from:
- Date of television inspection:
- This plan supercedes (in whole or in part) plan no:
- Actual rock line recorded during construction of existing sewer.
- Registered plan no.:
- Caution, while illustrations and utilities shown are taken from best available information, they cannot be guaranteed.
- See additional notes on sheet # 1

When reduced, the scale of this drawing is approximately 1:400 horizontaly and 1:81 verticaly. Do not scale this plan.

City of Ottawa
Ville d'Ottawa

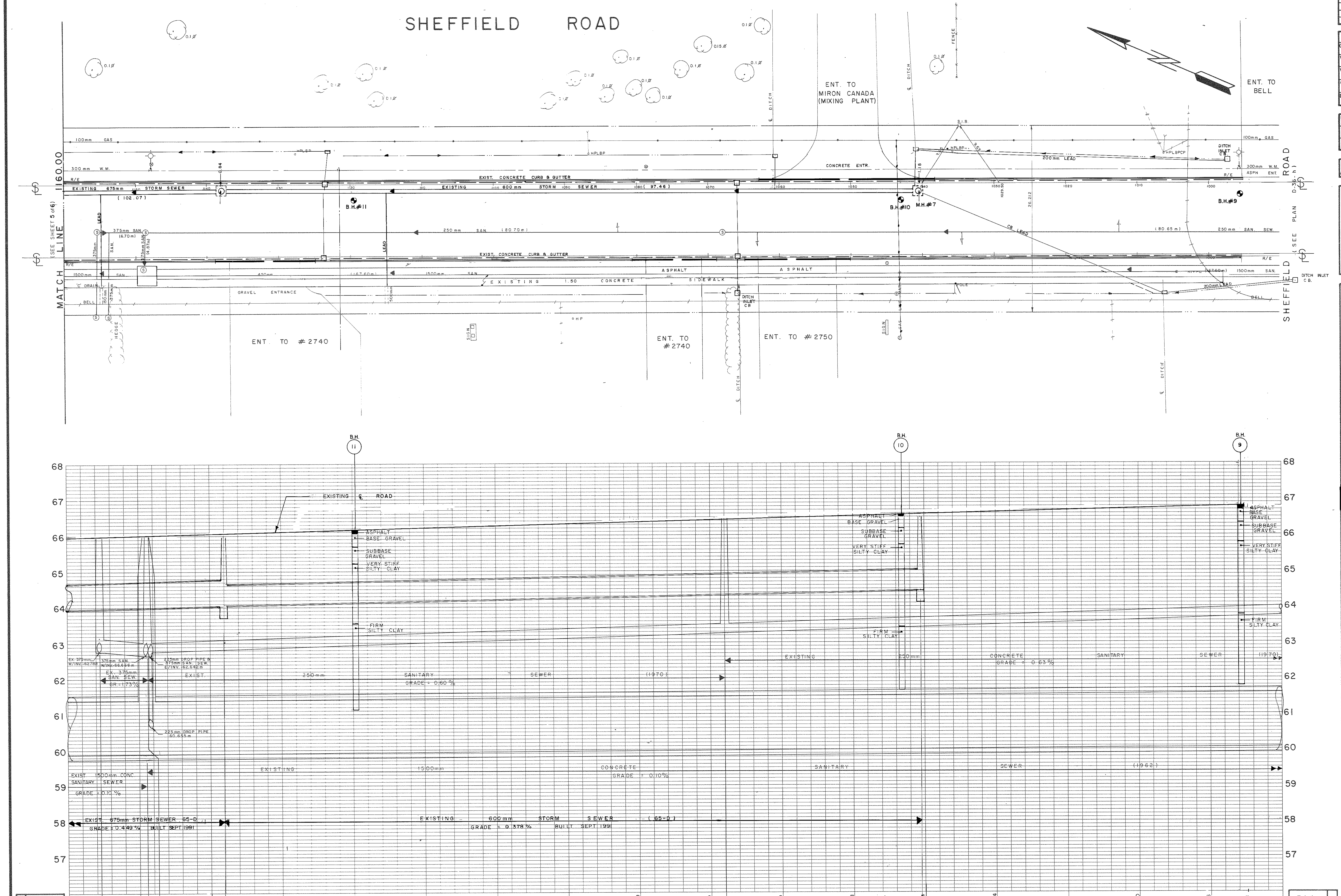
Department Of Engineering And Works
Engineering Branch
Design And Construction Division
1600 SCOTT STREET · OTTAWA ONTARIO · K1Y 4N7

D. Curry P. Eng. Commissioner	**W.R. Cole** P. Eng. Branch Director

SHEFFIELD ROAD

Contract No.:	Survey Books:	Scales:	Plan No:
91 · 38	4706, 4761, 4869, 4879, 4886	HOR. 1:250 VERT. 1:50	2459 Sheet 5 of 6

2459 SHEFFIELD ROAD Sheet #6 of 6



Stations	Existing Surface ℄	Type & Diameter (sewer)	Inverts Exist. & Prop. (sewer)
1160.00	65.991		
1155.40		375mm SAN.	62.758
1150.00	66.010		
1148.90		1500mm SAN.	59.899
1148.70		375mm SAN. 250 mm SAN.	62.672 62.764
1140.00	66.081		
1138.14	Fr.65.982	675mmST. 600mm ST.	64.037 64.072
1130.00	66.132		
1120.00	66.181		
1110.00	66.233		
1100.00	66.288		
1090.00	66.353		
1080.00	66.389		
1070.00	66.420		
1068.00		250mm SAN.	62.273
1060.00	66.469		
1050.00	66.538		
1040.67	Fr.66.491	600mmST.	64.441
1040.00	66.594		
1030.00	66.664		
1020.00	66.701		
1010.00	66.740		
1000.00	66.776		
	66.778		
990.00			

Revisions:

No.	Date	Description	Drawn By	Appr'd By

Final Measurements:

Construction Type	Storm & San. Sewer Road Rec.	Inspector	Rick Lester Bill Cardo
Work Commenced	May 1991	Instrumentman	John France
Work Completed	Sept. 1991	Field Book #	5327 5328
Contractor	Brenning Const. C.A.C.E. Const.	Date	Sept 30 1991
Drafting Revisions	Doug McEwan Sept. 1991	Checked By	Oct/91

Designed By	Paul Sauve Date 06.06.90	Structural Check By	Date
Survey Detail By	John A Pinkey 90/6/7 Date	Checked By	John A Pinkey 91/03/12 Date
Drafting By	Date 06.06.90	Checked By	Guy Quirouette Mars/91 Date
Chief Design & Const. Eng.		Senior Const. Coord.	

PAUL E. SAUVE
LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

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· Proposed storm and sanitary sewers may be constructed in a common trench provided that a minimum horizontal distance of 460mm is maintained between outside barrels of pipe.

· All pipes shall conform to the Canadian Standards Association(C.S.A.), A257.2 reinforced concrete sewer pipe with approved rubber gaskets.

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· Borehole soil descriptions are not based on sieve analysis but on visual inspection only, except where otherwise noted.

· Soil information taken from:

· Date of television inspection:

· This plan supercedes (in whole or in part) plan no:

· Actual rock line recorded during construction of existing sewer.

· Registered plan no.:

· Caution, while illustrations and utilities shown are taken from best available information, they cannot be guaranteed.

· See additional notes on sheet # 1

When reduced, the scale of this drawing is approximately 1:400 horizontaly and 1:81 verticaly. Do not scale this plan.

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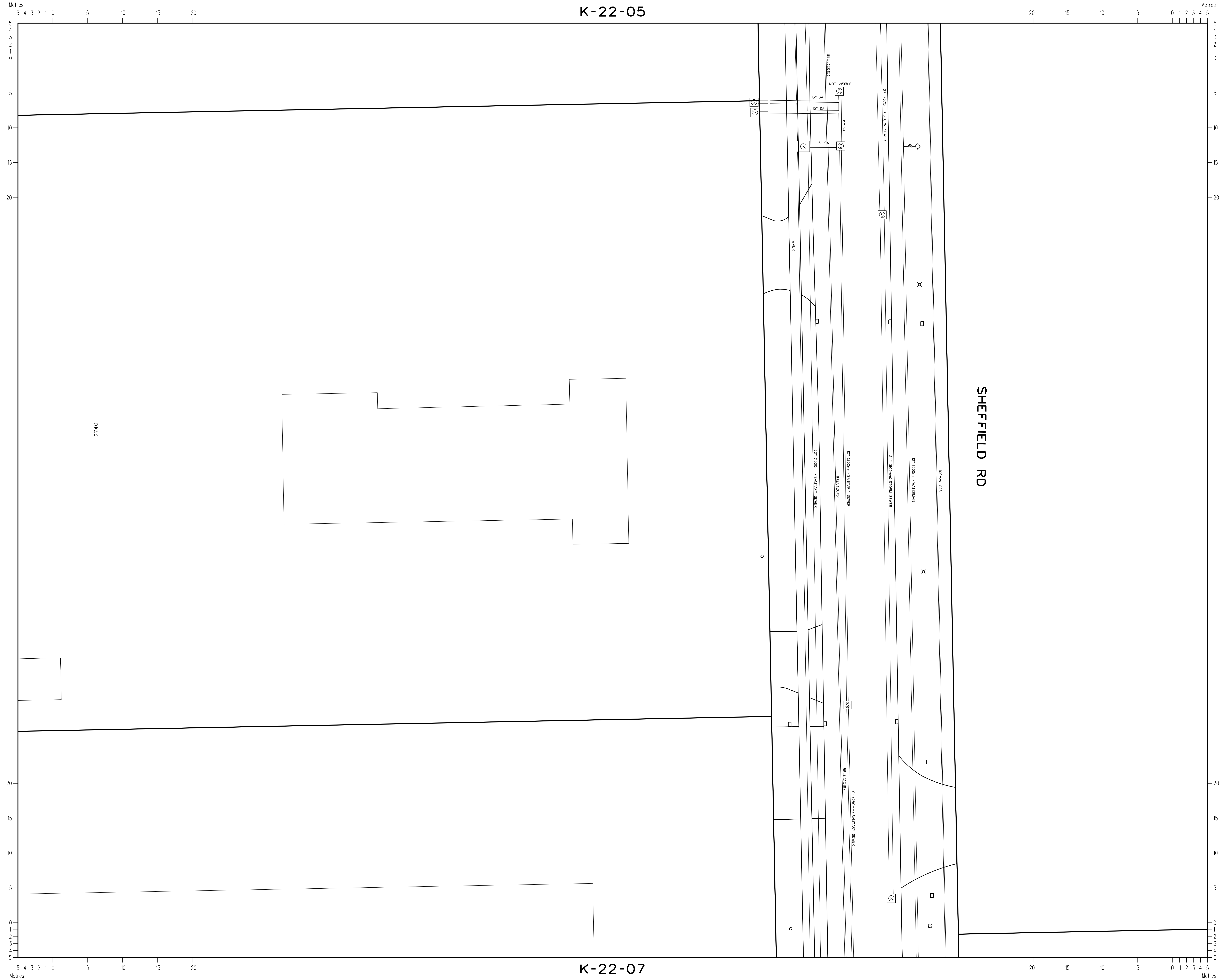
D. Curry P. Eng.
Commissioner

W.R. Cole P. Eng.
Branch Director

SHEFFIELD ROAD

Contract No.:	Survey Books:	Scales:	Plan No:
91 - 38	4706, 4761, 4869, 4879, 4886	HOR. 1:250 VERT. 1:50	2459 Sheet 6 of 6



REVISIONS / RÉVISIONS	DATE	BY
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BELL - BEL10082 (JAN 2015) BELL LINE ON SHEFFIELD	OCT. 2016	KJ
CITY, ALL EXTERNAL AGENCIES DIGITIZED FROM CITY/UTILITY DATA RECEIVED	MAY 2016	KJ

LEGEND

Water Valve, Valve Chamber, Fire Hydrant	⊗ ◎ ⌖
Sewer Manhole, Catch Basin Manhole	Ⓢ ⊡
Catch Basin / Drainage, Wing Wall, Head Wall	□ ▯ ⊞ ⊜ [|
Pole, Pole w/ light, Decorative, Lawn Light	○ ¤ ☼ ☼
Power Supply, Panel, Pedestal, Transformer, Tower, Regulator	P/S ▭ PED ☒ ☒ GR
Amp, Hand Hole, Vault, Gas Valve	AMP ▯ ◫ ⊘
OC Transpo: Bus Shelter-No Power, Energized, Isolated	BUS BUS BUS
Streetscape: Planter Box, Grate Square, Eng. Soil	□ TGS ⊡
Traffic Connect Box / Disconnect Box, SL Disconnect	▭ ▭ ▭
Red Light Hand Hole, Red Light Camera	○ ▭
Scada: Hand Hole, Monitoring Panel	S M
Reducer	▷
Pipe, Duct, Conduit, Lateral	═══
Culvert	═ ═ ═ ═
Ditch	—·—·—·
Abandoned	═X═X═
Capped	═══]
Buried Cable	— — — —
Property Line	━━━
Install Year	(2015)

TELECOM GLOSSARY

A	Allstream	P	Primus
AT	Atria	P2P	Canadian P2P Fibre
B	Bell	R	Rogers
BH	Birch Hill	S	Sprint
F	Fibre Noir	SL	Street Lighting
G	Globility	T	Traffic
GT	Group Telecom	TO	Telecom Ottawa
H	Hydro Ottawa	TU	Telus
H1	Hydro One	V	Videotron
L / L3	Level 3	Z	Zayo

GLOSSARY - OTHER

DD	Dept. of Defence	PED	Pedestal (owner unknown)
MH	Manhole (owner unknown)	PW	Public Works
O/OC	OCTranspo	UP	Utility Pole (owner unknown)
SCD	Scada		

CAUTION/ATTENTION

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Planning, Infrastructure and Economic Development Department /
Direction generale de la planification, de l'infrastructure et du developpement economique
100 Constellation Cres., 6th Floor East / 6ème Étage Est, Ottawa, ON K2G 6J8

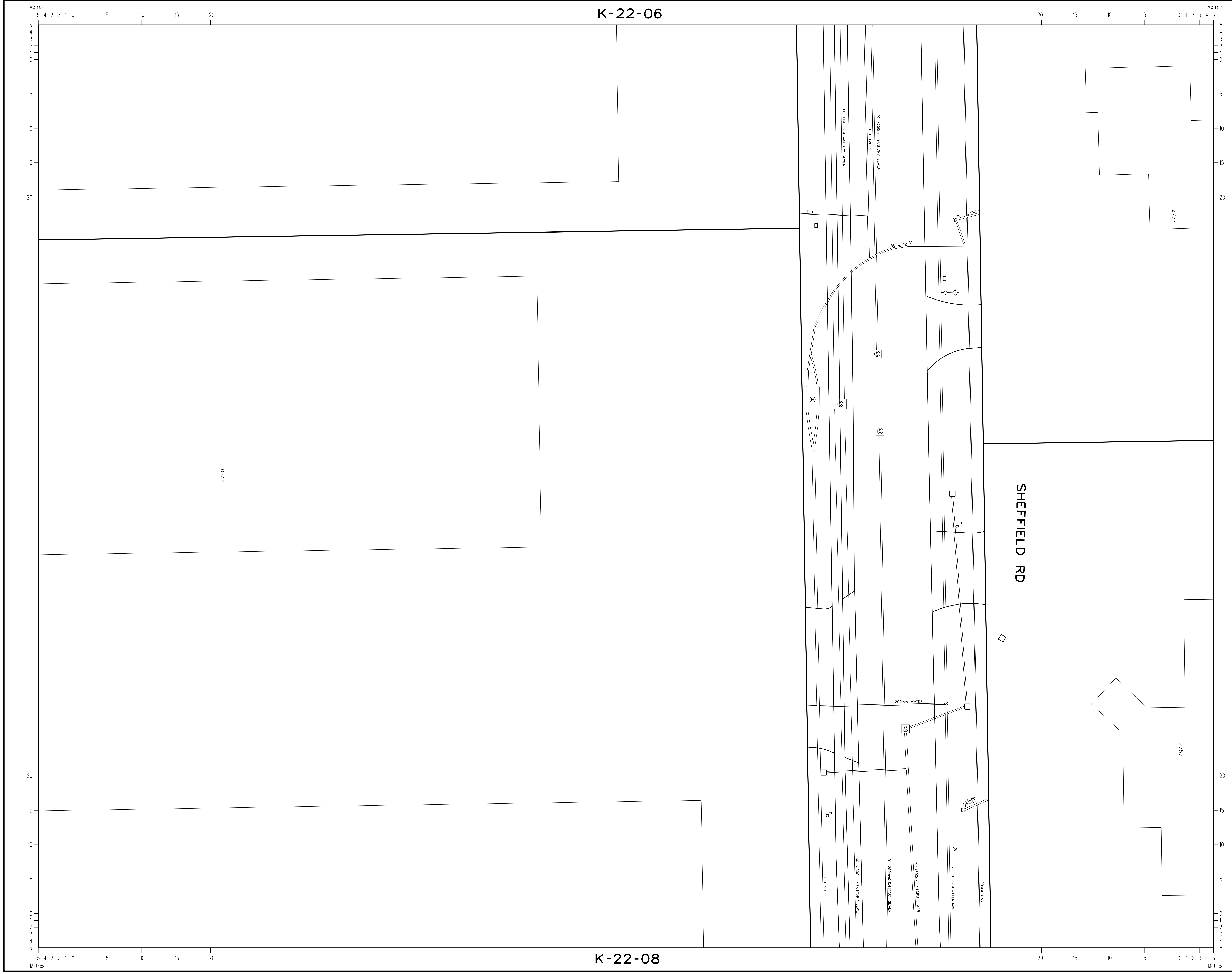
OTTAWA UTILITY COORDINATING COMMITTEE
CENTRAL REGISTRY

COMITÉ DE COORDINATION DES SERVICES PUBLICS D'OTTAWA
ENREGISTREMENT CENTRAL

PRODUCED BY: GIS & DATA MANAGEMENT BRANCH
INFORMATION CENTRE UNIT

SCALE: 1 : 250

SHEET NUMBER
K-22-06



REVISIONS / RÉVISIONS	DATE	BY
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CITY, ALL EXTERNAL AGENCIES DIGITIZED FROM CITY/UTILITY DATA RECEIVED	OCT 2016	KJ

LEGEND

Water Valve, Valve Chamber, Fire Hydrant	⊗ ◎ ⌖
Sewer Manhole, Catch Basin Manhole	Ⓢ ⊡
Catch Basin / Drainage, Wing Wall, Head Wall	□ ▯ ⁘ ▦ ⊖ [|
Pole, Pole w/ light, Decorative, Lawn Light	○ ☼ ☼ ☼
Power Supply, Panel, Pedestal, Transformer, Tower, Regulator	P/S ▭ PED ⊠ ⊠ GR
Amp, Hand Hole, Vault, Gas Valve	AMP ▯ ◫ ⊘
OC Transpo: Bus Shelter-No Power, Energized, Isolated	BUS BUS BUS
Streetscape: Planter Box, Grate Square, Eng. Soil	▢ TGS ⁘
Traffic Connect Box / Disconnect Box, SL Disconnect	TCB TDB SDB
Red Light Hand Hole, Red Light Camera	○THH ▭
Scada: Hand Hole, Monitoring Panel	S M
Reducer	▷
Pipe, Duct, Conduit, Lateral	═══
Culvert	═ ═ ═ ═
Ditch	—·—·—·—
Abandoned	═X═X═
Capped	═══╡
Buried Cable	— — — —
Property Line	━━━
Install Year	(2015)

TELECOM GLOSSARY

A.....Allstream	P.....Primus
AT.....Atria	P2P.....Canadian P2P Fibre
B.....Bell	R.....Rogers
BH.....Birch Hill	S.....Sprint
F.....Fibre Noir	SL.....Street Lighting
G.....Globility	T.....Traffic
GT.....Group Telecom	TO.....Telecom Ottawa
H.....Hydro Ottawa	TU.....Telus
H1.....Hydro One	V.....Videotron
L / L3.....Level 3	Z.....Zayo

GLOSSARY - OTHER

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MH.....Manhole (owner unknown)	PW.....Public Works
O/OC.....OCTranspo	UP.....Utility Pole (owner unknown)
SCD.....Scada	

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Planning, Infrastructure and Economic Development Department /
Direction generale de la planification, de l'infrastructure et du developpement economique
100 Constellation Cres., 6th Floor East / 6ème Étage Est, Ottawa, ON K2G 6J8

OTTAWA UTILITY COORDINATING COMMITTEE
CENTRAL REGISTRY
COMITÉ DE COORDINATION DES SERVICES PUBLICS D'OTTAWA
ENREGISTREMENT CENTRAL

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N

PRODUCED BY: GIS & DATA MANAGEMENT BRANCH
INFORMATION CENTRE UNIT

SCALE: 1 : 250

SHEET NUMBER
K-22-07

REVISIONS / RÉVISIONS	DATE	BY
CITY, ALL EXTERNAL AGENCIES DIGITIZED FROM CITY/UTILITY DATA RECEIVED	OCT 2016	KJ
BELL - MC V08683-1 (DEC. 2008) BPED ON SHEFFIELD	OCT. 2016	KJ
BELL - BEL10082 (JAN 2015) BELL LINE ON SHEFFIELD	OCT. 2016	KJ

LEGEND

Water Valve, Valve Chamber, Fire Hydrant	⊗ ◎ ⌖
Sewer Manhole, Catch Basin Manhole	Ⓢ ⊡
Catch Basin / Drainage, Wing Wall, Head Wall	□ ▯ ⁘ ▦ ⊜ [|
Pole, Pole w/ light, Decorative, Lawn Light	○ ¤ ☼ ☼
Power Supply, Panel, Pedestal, Transformer, Tower, Regulator	P/S ▭ PED ☒ ☒ GR
Amp, Hand Hole, Vault, Gas Valve	AMP ▯ ◫ ⊘
OC Transpo: Bus Shelter-No Power, Energized, Isolated	BUS BUS BUS
Streetscape: Planter Box, Grate Square, Eng. Soil	□ TGS □
Traffic Connect Box / Disconnect Box, SL Disconnect	TCB TDB SDB
Red Light Hand Hole, Red Light Camera	○THH ▭
Scada: Hand Hole, Monitoring Panel	S M
Reducer	▷
Pipe, Duct, Conduit, Lateral	═══
Culvert	═ ═ ═ ═
Ditch	—·—·—·
Abandoned	═X═X═
Capped	═══]
Buried Cable	— — — —
Property Line	━━━
Install Year	(2015)

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A......Allstream	P......Primus
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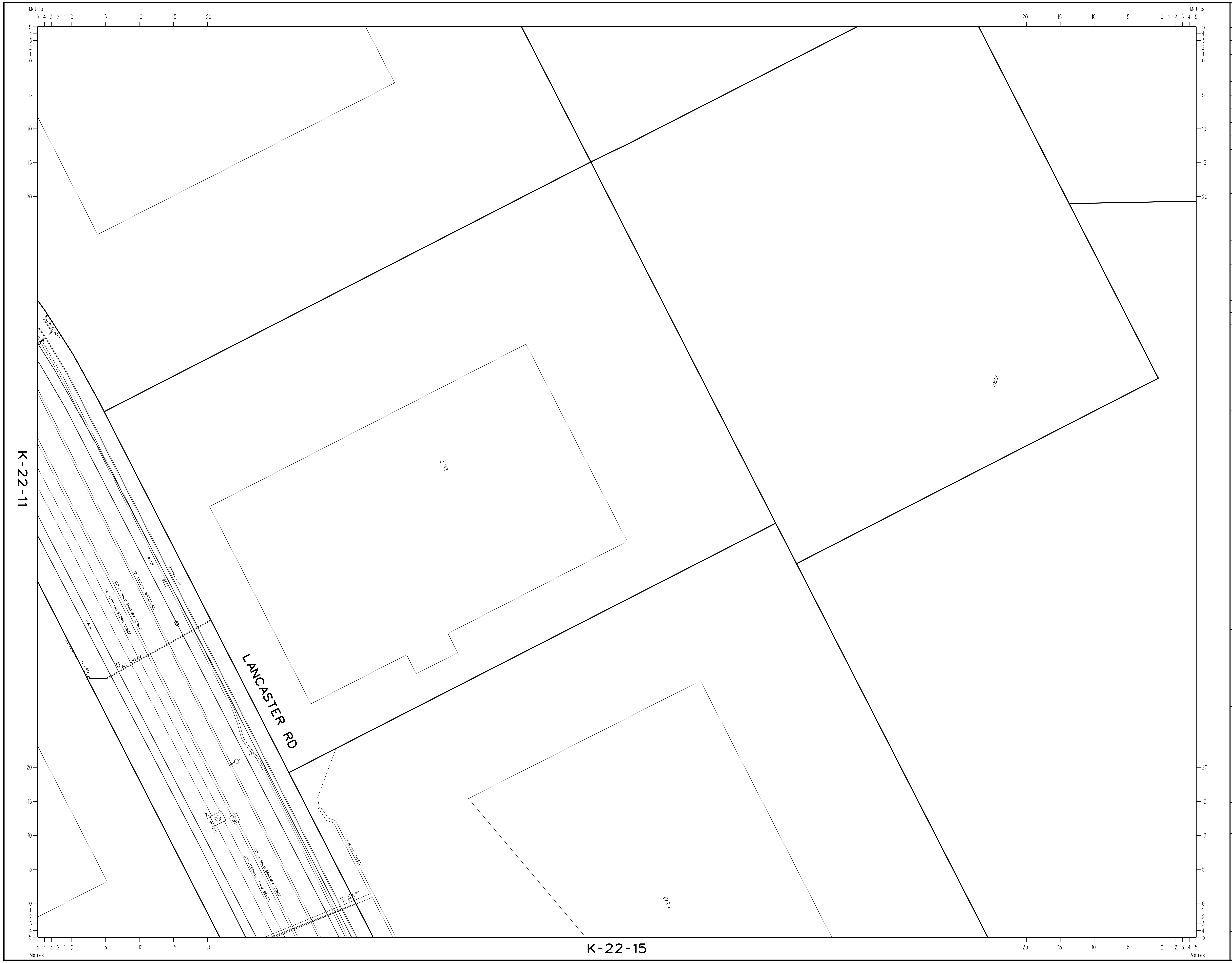
100 Constellation Cres., 6th Floor East / 6ème Étage Est, Ottawa, ON K2G 6J8

OTTAWA UTILITY COORDINATING COMMITTEE
CENTRAL REGISTRY
COMITÉ DE COORDINATION DES SERVICES PUBLICS D'OTTAWA
ENREGISTREMENT CENTRAL

PRODUCED BY: GIS & DATA MANAGEMENT BRANCH
INFORMATION CENTRE UNIT

SCALE: 1 : 250

SHEET NUMBER
K-22-08



REVISIONS / RÉVISIONS	DATE	BY
REDRAWN FROM VOIDED UTILITY PLAN K-22-13	JULY 2007	DC
TELECOM OTTAWA - TOL06076 (OCT. 2003) ALLSTREAM CONDUIT ADDED TO LANCASTER	JULY 2007	DC
HYDRO,BELL,ENBRIDGE,ROGERS, CITY SEWER, WATER, TRAFFIC, SL DIGITIZED FROM DATA RECEIVED	JUNE 2008	
ALLSTREAM FEB. 28/07 ALLSTREAM-FIBREOPTIC ADDED TO LANCASTER	OCT.30/08	KJ
ROGERS - ROG1815159(2018) ROGERS CONDUIT ADDED TO LANCASTER	OCT 2021	KJ
TOL08117 - LANCASTER RD. (2008) ATRIA - CONDUIT INSTALLED	OCT 2021	KJ

LEGEND

Water Valve, Valve Chamber, Fire Hydrant	⊗ ◎ ⌖
Sewer Manhole, Catch Basin Manhole	Ⓢ ▣
Catch Basin / Drainage, Wing Wall, Head Wall	□ ▯ ▦ ⊚
Pole, Pole w/ light, Decorative, Lawn Light	○ ☼ ✲ ☼
Power Supply, Panel, Pedestal, Transformer, Tower, Regulator	PS ▭ PED ☒ ☒ GR
Amp, Hand Hole, Vault, Gas Valve	AMP ▯ ◫ ⊘
OC Transpo: Bus Shelter-No Power, Energized, Isolated	BUS BUS BUS
Streetscape: Planter Box, Grate Square, Eng. Soil	▢ TGS □
Traffic Connect Box / Disconnect Box, SL Disconnect	TCB TDB SDB
Red Light Hand Hole, Red Light Camera	○RLHH ▭
Scada: Hand Hole, Monitoring Panel	▯ ▯
Reducer	▷
Pipe, Duct, Conduit, Lateral	═══
Culvert	═ ═ ═
Ditch	— · — · —
Abandoned	═X═X═
Capped	═══]
Buried Cable	— — —
Property Line	———
Install Year	(2015)

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A	Allstream	P	Primus
AT	Atria	P2P	Canadian P2P Fibre
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Property lines were compiled from plans and documents recorded in the Land Registry System and are for indexing purposes only.

Bien que l'emplacement des services publics soient établis en utilisant la meilleure information disponible, ils ne peuvent pas être garantis.
Des lignes de propriété ont été compilées en utilisant des plans et des documents enregistrés dans le système de cadastre et sont pour l'indexation seulement.

Ottawa

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