

## Memorandum

**Date:** June 26, 2025  
**To:** RioCan Holdings Inc.  
**From:** Berend Velderman, Geosyntec Consultants International, Inc.  
**Subject:** **Supplemental Hydrogeological Memorandum**  
**1309 Carling Avenue, Ottawa, Ontario**

---

### INTRODUCTION

In February 2025, Geosyntec Consultants International Inc. (Geosyntec) was retained by RioCan Management Inc., an agent of RioCan Holdings Inc. (RioCan), to conduct a geotechnical investigation supporting the redevelopment design and construction of 1309 Carling Avenue, Ottawa, Ontario, for use as a commercial space. That scope included a Phase Two Environmental Site Assessment Report and Geotechnical Investigation Report for a proposed warehouse structure within the existing Westgate Mall footprint. Subsequently, the report entitled “Geotechnical Investigation Report – Proposed New Warehouse Structure 1309 Carling Avenue, Ottawa, Ontario” was provided to the City of Ottawa in May 2025. Upon the City’s review, a hydrogeological report was requested to better understand groundwater management needs for the proposed building during construction and post-construction. This memorandum is intended to address the City’s request.

In this memorandum, the overall Westgate Mall property is termed 'The Property' to distinguish between the location of the new building (The Site) and the remaining site area. **Figure 1** shows the Site and **Figure 2** the borehole locations. This hydrogeological memo interprets the geotechnical investigation results as they pertain to the hydrogeology information gleaned from the report.

### GROUNDWATER INFORMATION

Four monitoring wells were installed in the completed geotechnical boreholes located near or within the proposed building footprint. Additionally, three monitoring wells installed as part of the environmental site assessment, located elsewhere on the property, are also referenced in this memorandum. These monitoring wells were constructed using flush-threaded, Schedule 40, clean polyvinyl chloride (PVC) casings with slotted well screens. The exterior wells had a diameter of 50-millimeter (mm) (2 inches), except for well 25-02, which had a 38 mm (1.5 inches) diameter PVC casing. The interior wells had a diameter of 31 mm (1.25 inches). The screens ranged from 0.61 to 3.0 meters (m) in length and were installed to intersect the water table. Detailed information about the installed monitoring wells can be found in the relevant borehole logs in **Appendix A**.

Groundwater levels were measured with a water level tape on April 11, 2025. The groundwater level measurement recorded on April 11, 2025, is summarized in **Table 1**.

**Table 1     Groundwater Measurement on 11 April 2025**

Boring ID	Depth of Groundwater (m btoc)	Riser Elevation (m amsl)	Groundwater Elevation (m amsl)
25 -02	3.60	73.79	70.19
25 -03	1.59	73.79	72.20
25 -04	0.77	74.02	73.24
25 -05	1.04	74.01	72.97
25 -06	2.73	73.60	70.87
25 -07	2.30	74.25	71.94
25 -08	0.31	73.88	73.57

Acronyms:

m btoc: meters Below Top of Casing

m amsl: meters Above Mean Sea Level

The groundwater table fluctuates seasonally in response to precipitation and snowmelt events.

## **SUBSURFACE CONDITIONS**

Asphaltic concrete with a thickness between 100 mm and 150 mm was encountered at exterior borehole locations. Inside the existing building, concrete with a thickness of 150 mm, and tile and concrete with a combined thickness of 270 mm were encountered at boreholes 25 - 04 and 25- 05, respectively.

### **Fill**

Fill comprised predominantly of gravel and sand was encountered at the borehole locations, with a thickness between approximately 0.5 m and 1.5 m in the geotechnical drilled boreholes.

Borings were advanced through the fill without split spoon sampling, except for 25 01. The recorded SPT 'N' values for the fill materials at borehole 25 01 ranged between 6 to 16 blows per 0.3 m of penetration, indicating a loose to compact condition.

The measured moisture content by weight on samples from this material is approximately 8 percent (%), indicating a moist condition. Depending on the location, the fill may have a perched water table.

### **Silty Clay/Clayey Silt**

A silty clay to clayey silt soil unit was encountered at the borehole locations. The characteristics of the unit varied from the interior to the exterior of the existing structures, likely because of consolidation induced by building loads. Additionally, the upper clayey soil unit at the interior borehole locations is classified as silt to clayey silt, whereas at the exterior borehole locations, the upper soil unit is classified as silty clay. The thickness of this clay ranges from 5 m to 9 m. It is noted that variation in silt and clay content within this soil unit across the Site and with depth should be expected. Typically, the water table is near the top of the surface of the silty clay.

Below the silty clay a glacial till is encountered that ranges from a gravelly sand to sand and gravel. This glacial till overlies a limestone bedrock.

### **INTERPRETATION**

Based on the above findings, the following interpretation is presented for the hydrogeology at 1309 Carling Avenue in Ottawa, Ontario:

- The water table is variable at the Site from near surface to several metres below the ground surface. The variation may be explained by leaky stormwater or municipal water services.
- The hydraulic conductivity (K) for the fill/possible fill unit is estimated to be on the order of  $2 \times 10^{-5}$  meters per second (m/s). This estimated conductivity for the fill/possible fill unit corresponds with typical values for sand and silty sand.
- The K for the silty clay unit is estimated to be on the order of  $5 \times 10^{-8}$  m/s. This estimated conductivity for the clay unit corresponds with typical values for clay.
- If services were to be excavated at the Site, they likely would be excavated in the clay and fill no deeper than 5 m below the ground surface. Groundwater management would be limited to temporary drainage of the fill; however, flows of less than 50,000 liters per day (L/day) would be expected if construction of services involves short sections at a time and is followed by installation of low permeability plugs. Stormwater would be additional and can be managed by minimizing open excavation during storm events.
- Services will channel flows in this type of soil environment; therefore, it is recommended that low-permeability plugs be installed at 20 m intervals to limit services from becoming groundwater migration routes.
- If groundwater discharge is required, a sewer use bylaw discharge agreement should be obtained before discharging to sewers. Management water could be temporarily stored in holding tanks, such that test results for representative discharge quality can be obtained and a discharge permit can be applied for.

- It is understood that the building will be a slab on grade. As such, no groundwater management would be required after construction.
- If conditions differ than those described are encountered or implemented, Geosyntec should be requested to re-evaluate this assessment.

## CLOSURE

Respectfully submitted,

Geosyntec Consultants International, Inc.



Bahareh Vazhbakht, M.A.Sc., P.Eng ON  
Senior Engineer



Berend Jan Velderman QP<sub>ESA/RA</sub>, M.Sc. P.Geo ON  
Senior Hydrogeologist

Encl.

Tables      Table 1: Groundwater Measurement on 11 April 2025 (in text)

Figures      Figure 1: Site Location  
                Figure 2: Borehole Location Plan

Attachments   Attachment 1: Borehole Logs  
                     Attachment 2: Borehole Logs

## REFERENCES

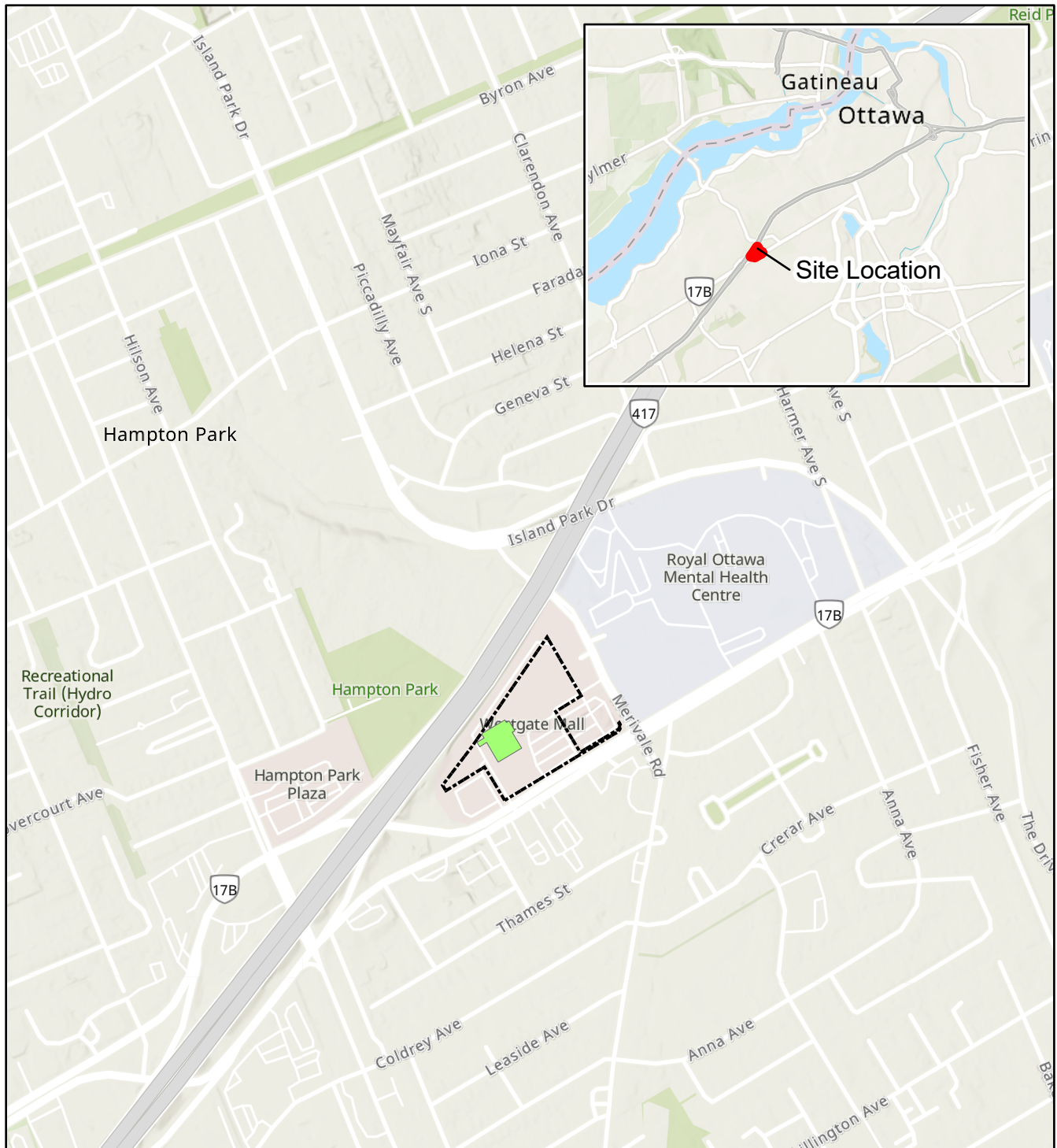
Freeze, A., and Cherry, J. 1979. Groundwater, 1<sup>st</sup> edition. Pearson

Geosyntec Consultants International, Inc. (2025). *Geotechnical Investigation Report – Proposed New Warehouse Structure 1309 Carling Avenue, Ottawa, Ontario*

Geosyntec Consultants International, Inc. (2025). *Phase Two Environmental Site Assessment – Proposed New Warehouse Structure 1309 Carling Avenue, Ottawa, Ontario*

\* \* \* \* \*

## Figures



<b>Legend:</b> Phase Two Property Boundary Building Footprint - Geotechnical Investigation Target Area		<b>FIGURE 1</b> <b>PROPERTY LOCATION MAP</b>  1309 CARLING AVENUE, OTTAWA, ONTARIO	
<b>Notes:</b> 1) Map Projection: NAD 1983 CSRS UTM Zone 18N 2) Imagery Credits: World Topographic Map: Esri Community Maps Contributors, City of Ottawa, Province of Ontario, Ville de Gatineau, Esri Canada, Esri, TomTom, Garmin, SafeGraph, <small>The information and figures reflected in this document were prepared by Geosyntec Consultants, Inc. in relation to a specific scope of work and are the intellectual property of Geosyntec and its Client. Any use of the document or the information reflected therein, except by Geosyntec's Client in accordance with the terms of the agreement between the two, is not authorized.</small>		OFFICE LOCATION <b>WATERLOO</b> DATE PLOTTED 30-Apr-2025 APPROX. SCALE 1:10,000	DATE REVISED 30-Apr-2025 PAGE SIZE 8.5 x 11 in
		REVISION 00 REVIEWED PH CHECKED EN DRAWN JK	 TRUE NORTH 





- Legend:
- Borehole (Geosyntec)
  - Monitoring Well (Geosyntec)
  - Previous Borehole (Golder)
  - Previous Monitoring Well (Golder)
  - Unlocatable Previous Monitoring Well (Golder)
  - Phase Two Property Boundary
  - Building Footprint (approximate)

Notes:  
1) Map Projection: NAD 1983 MTM 9  
2) Imagery Credits: Streets and Basemap - City of Ottawa, 2021

The information and figures reflected in this document were prepared by Geosyntec Consultants, Inc. in relation to a specific scope of work and are the intellectual property of Geosyntec and its Client. Any use of the document or the information reflected therein, except by Geosyntec's Client in accordance with the terms of the agreement between the two, is not authorized.

**FIGURE 2**  
**BOREHOLE LOCATION PLAN -**  
**PHASE TWO ESA AND GEOTECHNICAL**  
**INVESTIGATION**  
1309 CARLING AVENUE  
OTTAWA, ONTARIO

OFFICE LOCATION OTTAWA		REVISION 00	 TRUE NORTH  0 10 20 30 Meters
DATE PLOTTED 01-May-2025	DATE REVISED 01-May-2025	REVIEWED BV	
		CHECKED EN	
APPROX. SCALE 1:1,100	PAGE SIZE 11 x 17 in	DRAWN JK	



**Attachment 1**  
**Borehole Logs**



MTM : 9	Driller Rig : CME 75 HT	Job Number : TR1363B
Easting : 364627.74	Driller Supplier : OGS	Client : RioCan
Northing : 5027683.11	Logged By : EN, TK	Project : RioCan Westage - 1309 Carling Ave
RL : 73.838(m)	Reviewed By : BV	Location : 1309 Carling Avenue, Ottawa, ON, Canada
Total Depth : 14.63 m	Date : 23/03/2025	Loc Comment :

Depth (ft)	Depth (m)	Elevation (m amsl)	Drilling Method	Graphic Log	Classification Code	Material Description	Moisture	Sample Type	SS	SPT	Recovery	Shear Vane	PL	MC	LL	SPT N	Water	Well Diagram
						ASPHALT												
1	0.1				GP	FILL, granular fill, some sand, black to grey, compact, wet	W		SS1	12,8,8,4/90mm (N=16)	50%							
2	0.64				SM	FILL, silty sand, some gravel and some clay, black to grey, loose, wet	W		SS2	5,3,3,4 (N=6)	40%							
3	1	73			CI	SILTY CLAY, with some sand and gravel, brown to grey, firm, wet	W		SS3	1,2,3,3 (N=5)	100%							
4	1.22					soft												
5	1.82	72			CI		W		SS4	3,2,1,1 (N=3)	100%							
6	2.43																	
7	2				GP	SANDY GRAVEL, with trace silt, black to brown, very loose, wet	W		SS5	1,2,1,2 (N=3)	100%							
8	3.2	71																
9						SILTY CLAY, grey, stiff, wet			SS6	0, 0, 0, 0	100%							
10																		
11																		
12		70																
13	4				CI		W		SS7	0, 0, 0, 0	100%							
14																		
15																		
16	5	69																
17									ST1									
18																		
19		68																
20	6.1																	
21					SM	GRAVELLY SILTY SAND, with clay, grey, very loose, wet	W		SS8	1,1,2,3 (N=3)	5%							
22	6.86	67																
23	7					trace clay, loose			SS9	2,2,3,2 (N=5)	60%							
24																		
25					SM		W		SS10	2,3,4,3 (N=7)	80%							
26	8	66																
27																		
28																		
29	8.84	65				boulder, grey, wet												
30	9																	
31					SM		W											
32		64																

MTM : 9	Driller Rig : CME 75 HT	Job Number : TR1363B
Easting : 364627.74	Driller Supplier : OGS	Client : RioCan
Northing : 5027683.11	Logged By : EN, TK	Project : RioCan Westage - 1309 Carling Ave
RL : 73.838(m)	Reviewed By : BV	Location : 1309 Carling Avenue, Ottawa, ON, Canada
Total Depth : 14.63 m	Date : 23/03/2025	Loc Comment :

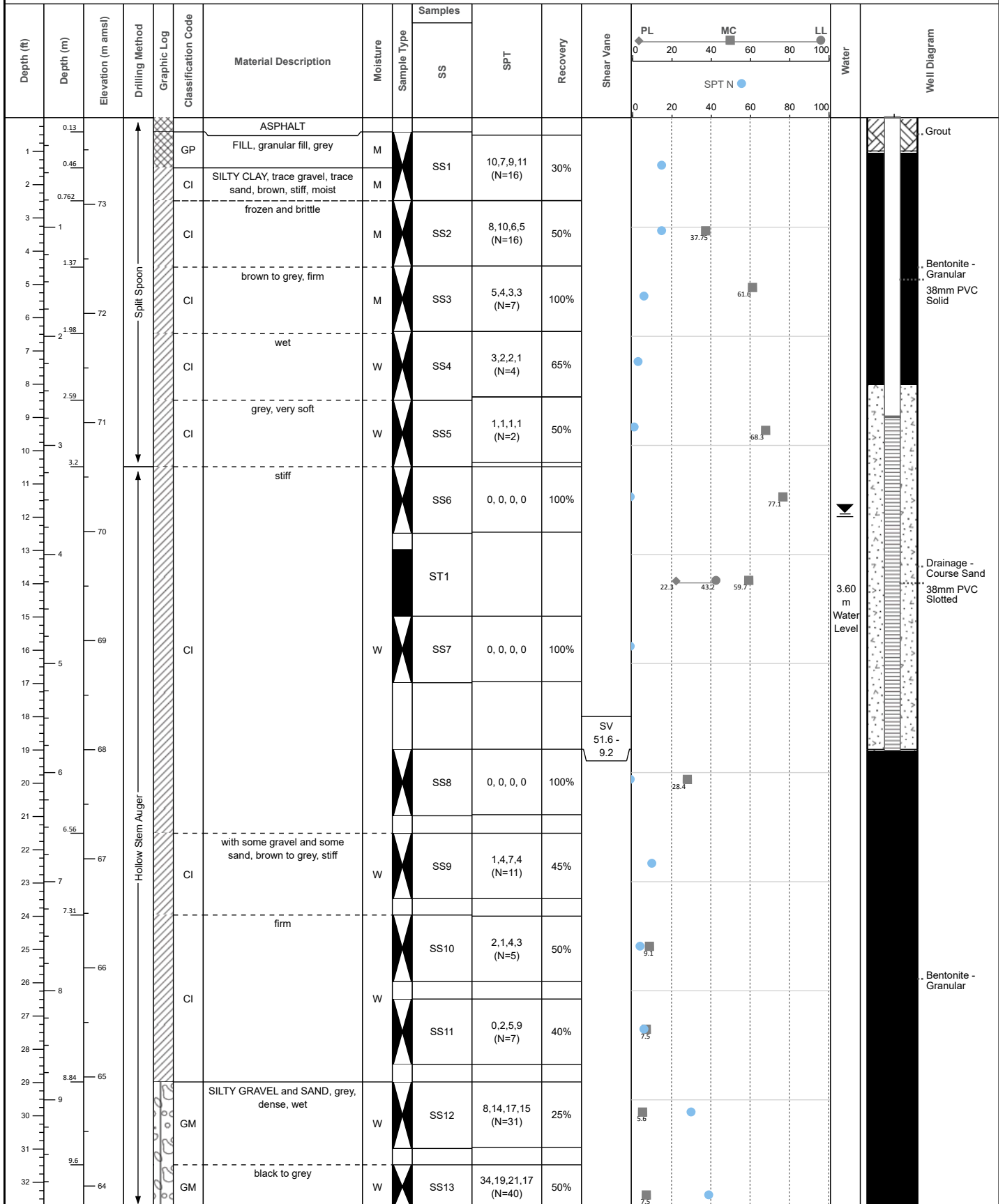
Depth (ft)	Depth (m)	Elevation (m amsl)	Drilling Method	Graphic Log	Classification Code	Material Description	Moisture	Sample Type	Samples		SPT	Recovery	Shear Vane	0 20 40 60 80 100			Water	Well Diagram	
									SS					PL	MC	LL			
34			Hollow Stem Auger		SM	boulder, grey, wet	W												
35		63																	
36	11																		
37	11.28																		
38																			
39	12	62			SM	less sand and fines	W	SS11	5,3,6,10 (N=9)	20%									
40	12.37																		
Commenced Coring at 12.37m																			

<b>MTM</b> : 9	<b>Driller Rig</b> : CME 75 HT	<b>Job Number</b> : TR1363B
<b>Easting</b> : 364627.74	<b>Driller Supplier</b> : OGS	<b>Client</b> : RioCan
<b>Northing</b> : 5027683.11	<b>Logged By</b> : EN, TK	<b>Project</b> : RioCan Westage - 1309 Carling Ave
<b>RL</b> : 73.838(m)	<b>Reviewed By</b> : BV	<b>Location</b> : 1309 Carling Avenue, Ottawa, ON, Canada
<b>Total Depth</b> : 14.63 m	<b>Date</b> : 23/03/2025	<b>Loc Comment</b> :

Depth (ft)	Depth (m)	Elevation (m)	Drilling Method	Classification Code	Graphic Log	Material Description	Stratigraphy	Samples	RQD% and TCR%	RQD	Water	Well Diagram	Remarks / Observations
34										0			
35										20			
36	11	63								40			
37										60			
38										80			
39										100			
40	12	62				Commenced Coring at 12.37m							
41													
42	61			LIMST		LIMESTONE: grey limestone with black shale bedding, highly weathered and fractured, fine grained, thinly to medium bedded, very poor quality	Bedrock		RQD = 0%				
43	13												
44			NMLC Coring			excellent quality, very strong							
45	60			LIMST					RQD = 95%				
46	14												
47													
						25-01 Terminated at 14.63m (upon reaching target depth. Backfilled with bentonite.)							



MTM : 9	Driller Rig : CME 75 HT	Job Number : TR1363B
Easting : 364645.68	Driller Supplier : OGS	Client : RioCan
Northing : 5027656.31	Logged By : EN, TK	Project : RioCan Westage - 1309 Carling Ave
RL : 73.791(m)	Reviewed By : BV	Location : 1309 Carling Avenue, Ottawa, ON, Canada
Total Depth : 13.33 m	Date : 17/03/2025	Loc Comment : Elevation is Top of PVC Casing (GCVD28)



<b>MTM</b> : 9 <b>Easting</b> : 364645.68 <b>Northing</b> : 5027656.31 <b>RL</b> : 73.791(m) <b>Total Depth</b> : 13.33 m	<b>Driller Rig</b> : CME 75 HT <b>Driller Supplier</b> : OGS <b>Logged By</b> : EN, TK <b>Reviewed By</b> : BV <b>Date</b> : 17/03/2025	<b>Job Number</b> : TR1363B <b>Client</b> : RioCan <b>Project</b> : RioCan Westage - 1309 Carling Ave <b>Location</b> : 1309 Carling Avenue, Ottawa, ON, Canada <b>Loc Comment</b> : Elevation is Top of PVC Casing (GCVD28)
---	---	--

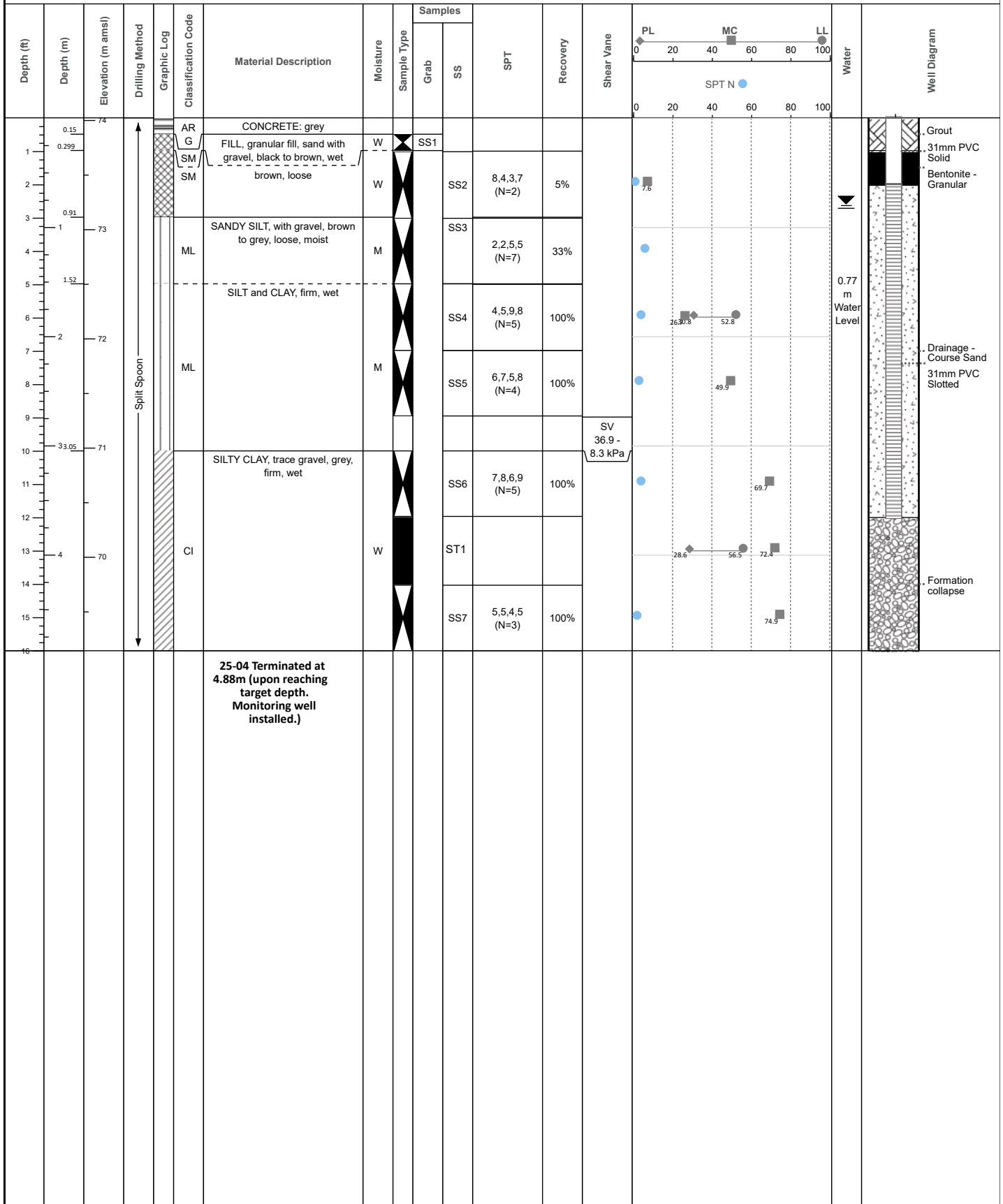
Depth (ft)	Depth (m)	Elevation (m amsl)	Drilling Method	Graphic Log	Classification Code	Material Description	Moisture	Sample Type	SS	SPT	Recovery	Shear Vane	0 20 40 60 80 100					Water	Well Diagram
			↓ Hollow Stem Auger ↑										PL	MC	LL				
													SPT N						
													0	20	40	60	80	100	
34																			
35		63																	
36	11																		
	11.28																		

<b>MTM</b> : 9	<b>Driller Rig</b> : CME 75 HT	<b>Job Number</b> : TR1363B
<b>Easting</b> : 364645.68	<b>Driller Supplier</b> : OGS	<b>Client</b> : RioCan
<b>Northing</b> : 5027656.31	<b>Logged By</b> : EN, TK	<b>Project</b> : RioCan Westage - 1309 Carling Ave
<b>RL</b> : 73.791(m)	<b>Reviewed By</b> : BV	<b>Location</b> : 1309 Carling Avenue, Ottawa, ON, Canada
<b>Total Depth</b> : 13.33 m	<b>Date</b> : 17/03/2025	<b>Loc Comment</b> : Elevation is Top of PVC Casing (GCVD28)

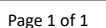
Depth (ft)	Depth (m)	Elevation (m)	Drilling Method	Graphic Log	Classification Code	Material Description	RQD% and TCR%	RQD	Water	Well Diagram
34		63						0 20 40 60 80 100		
35										
36	11									
37						<b>Commenced Coring at 11.28m</b>				
38					LIMST	LIMESTONE: grey limestone with black shale interbeds, fresh, fine grained, thinly to medium bedded, good quality, very strong	RQD = 82%			
38.736	11.81	62								
39						fractured zone, very poor quality				
40	12				LIMST					
41						excellent quality	RQD = 52%			
41	12.5									
42		61			LIMST					
43	13									
						<b>25-02 Terminated at 13.33m (upon reaching target depth. Monitoring well installed, details shown on the graph.)</b>				



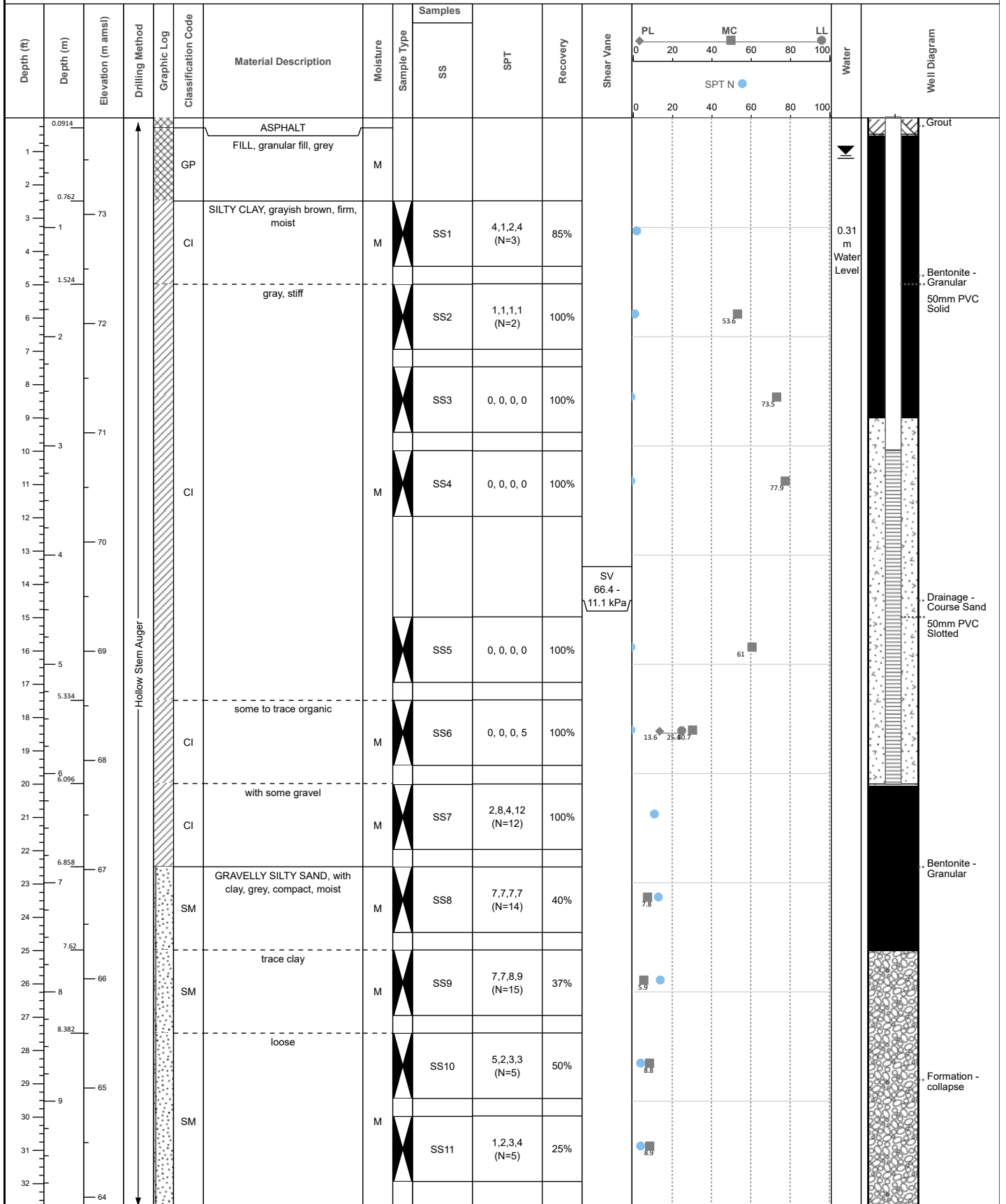
<b>MTM</b> : 9 <b>Easting</b> : 364665.65 <b>Northing</b> : 5027721.99 <b>RL</b> : 74.015(m) <b>Total Depth</b> : 4.88 m	<b>Driller Rig</b> : Hilti DD250 <b>Driller Supplier</b> : OGS <b>Logged By</b> : TK <b>Reviewed By</b> : BV <b>Date</b> : 24/03/2025	<b>Job Number</b> : TR1363B <b>Client</b> : RioCan <b>Project</b> : RioCan Westage - 1309 Carling Ave <b>Location</b> : 1309 Carling Avenue, Ottawa, ON, Canada <b>Loc Comment</b> : Elevation is Top of PVC Casing (GCVD28)
--	---	--



**Job Number** : TR1363B  
**Client** : RioCan  
**Project** : RioCan Westage - 1309 Carling Ave  
**Location** : 1309 Carling Avenue, Ottawa, ON, Canada  
**Loc Comment** : Elevation is Top of PVC Casing (GCVD28)



MTM : 9	Driller Rig : CME 75 HT	Job Number : TR1363B
Easting : 364703.62	Driller Supplier : OGS	Client : RioCan
Northing : 5027715.34	Logged By : EN, TK	Project : RioCan Westgate - 1309 Carling Ave
RL : 73.884(m)	Reviewed By : BV	Location : 1309 Carling Avenue, Ottawa, ON, Canada
Total Depth : 20.57 m	Date : 11/03/2025	Loc Comment : Elevation is Top of PVC Casing

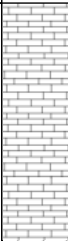











<b>MTM</b> : 9 <b>Easting</b> : 364703.62 <b>Northing</b> : 5027715.34 <b>RL</b> : 73.884(m) <b>Total Depth</b> : 20.57 m	<b>Driller Rig</b> : CME 75 HT <b>Driller Supplier</b> : OGS <b>Logged By</b> : EN, TK <b>Reviewed By</b> : BV <b>Date</b> : 11/03/2025	<b>Job Number</b> : TR1363B <b>Client</b> : RioCan <b>Project</b> : RioCan Westgate - 1309 Carling Ave <b>Location</b> : 1309 Carling Avenue, Ottawa, ON, Canada <b>Loc Comment</b> : Elevation is Top of PVC Casing
---	---	--

Depth (ft)	Depth (m)	Elevation (m amsl)	Drilling Method	Graphic Log	Classification Code	Material Description	Moisture	Sample Type	SS	SPT	Recovery	Shear Vane	PL	MC	LL	SPT N	Water	Well Diagram
34					SM	loose	M											
35	10.668	63			SM	compact, wet	W		SS12	4,9,12 (N=R)	60%		12.9					
36	11					boulder												
37	11.2776																	
38																		
39		62																
40	12				SM		W											
41																		
42		61																
43	13																	
44																		
45	13.72	60				GRAVELLY SAND, with some silt and trace clay, grey, dense, wet			SS13	18,16,22,8 (N=38)	40%		8.9					
46	14				SM		W											
47																		
48		59																
49	15																	
50																		
51	15.54					more gravel and less sand			SS14	8,11,19,17 (N=30)	25%		9.9					
52	16	58																
53																		
54					SM		W											
55		57																
56	17								SS15	15,19,33 (N=R)	50%		13.7					
57																		
58	17.83																	
Commenced Coring at 17.83m																		

<b>MTM</b> : 9	<b>Driller Rig</b> : CME 75 HT	<b>Job Number</b> : TR1363B
<b>Easting</b> : 364703.62	<b>Driller Supplier</b> : OGS	<b>Client</b> : RioCan
<b>Northing</b> : 5027715.34	<b>Logged By</b> : EN, TK	<b>Project</b> : RioCan Westage - 1309 Carling Ave
<b>RL</b> : 73.884(m)	<b>Reviewed By</b> : BV	<b>Location</b> : 1309 Carling Avenue, Ottawa, ON, Canada
<b>Total Depth</b> : 20.57 m	<b>Date</b> : 11/03/2025	<b>Loc Comment</b> : Elevation is Top of PVC Casing

Depth (ft)	Depth (m)	Elevation (m)	Drilling Method	Graphic Log	Classification Code	Material Description	RQD% and TCR%	RQD	Water	Well Diagram
34								0		
35								20		
36	11	63						40		
37								60		
38								80		
39		62						100		
40	12									
41										
42										
43	13	61								
44										
45										
46	14	60								
47										
48										
49	15	59								
50										
51										
52	16	58								
53										
54										
55										
56	17	57								
57										
58										
Commenced Coring at 17.83m										
59	18	56	NMLC Coring		LIMST	LIMESTONE: grey limestone with shale interbeds, highly weathered and fractured, fine grain, thinly to medium bedded, very poor quality	RQD = 0%			
60										
61										
62	19	55								
63										
63.468	19.35									
64										
65		54			LIMST	good quality, very strong	RQD = 80%			

MTM : 9	Driller Rig : CME 75 HT	Job Number : TR1363B
Easting : 364703.62	Driller Supplier : OGS	Client : RioCan
Northing : 5027715.34	Logged By : EN, TK	Project : RioCan Westage - 1309 Carling Ave
RL : 73.884(m)	Reviewed By : BV	Location : 1309 Carling Avenue, Ottawa, ON, Canada
Total Depth : 20.57 m	Date : 11/03/2025	Loc Comment : Elevation is Top of PVC Casing

Depth (ft)	Depth (m)	Elevation (m)	Drilling Method	Graphic Log	Classification Code	Material Description	RQD% and TCR%	RQD	Water	Well Diagram
67			NMLC Coring		LIMST	good quality, very strong	RQD = 80%			
						25-08 Terminated at 20.57m (upon reaching target depth Monitoring well installed.)				