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**Subsurface Investigation Report
Proposed Watermain
570 March Rd. to Terry Fox Dr.
Ottawa, Ontario**

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Submitted to:

Broccolini Investment Inc.
130 Slater Street, Suite 1300
Ottawa, Ontario
K1P 6E2

**Subsurface Investigation Report
Proposed Watermain
570 March Rd. to Terry Fox Dr.
Ottawa, Ontario**

July 11, 2025
Project: 103940.007

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by Broccolini Investment Inc. (Broccolini) to provide engineering services in support of the proposed watermain to be installed along a section of Legget Drive in Ottawa, Ontario.

This report presents our factual findings from the geotechnical and hydrogeological aspects of the investigation. The purpose of the investigation was to identify the general subsurface and groundwater conditions at the site by means of a limited number of boreholes and monitoring wells, and, based on the information obtained, to provide engineering guidelines and recommendations on the geotechnical and hydrogeological aspects of the project.

Engineering guidelines and recommendations for the project are provided in the following report:

- Report titled “Geotechnical Design Report, Proposed Watermain, 570 March Rd. to Terry Fox Dr. Ottawa, Ontario”, dated July 11, 2025.

This report is subject to the Conditions and Limitations of This Report, which follows the text of the report, and which are considered an integral part of the report.

2.0 BACKGROUND

2.1 Project Description

In parallel with redevelopment of the property at 570 and 600 March Road, plans are being prepared to construct a section of watermain along Legget Drive, from 570 March Road to the intersection with Terry Fox Drive. The following is known about the proposed watermain, noting that the details had not been finalised at the time of investigation / reporting:

- The proposed watermain will be installed within the northern portion of the Legget Drive roadway Right of Way (RoW).
- The watermain will extend from the intersection between Legget Drive and Terry Fox Drive to beyond the entrance to 535 Legget, and cross Legget Drive to enter 570 March Road under an intersection that is to be constructed as part of the development of that property. This area is referred to further as “the Site”. The length of the watermain under consideration within the Site is about 270 metres.
- The depth of the watermain has not been established but is assumed to be below about 2.4 metres depth.
- Following installation of the watermain the pavement along Legget Drive above the trench excavation will be reinstated.

2.2 Review of Existing Source of Information on Subsurface Conditions

2.2.1 Public Information Sources

Surficial geology maps indicate a range of soil conditions at the Site. The mapped conditions are summarised below:

- Near surface Paleozoic aged bedrock is mapped beneath Legget Drive near the Terry Fox intersection;
- Further from the intersection fine textured glaciomarine deposits of silt and clay with minor sand and gravel are mapped along Legget Drive.

Bedrock geology maps indicate the presence of Paleozoic aged sandstone, dolomitic sandstone and dolostone of the March Formation below the soil cover. No faults are mapped within or nearby to the Site.

Ontario well records and public borehole records also indicate shallow bedrock at or in the vicinity of the Site.

In addition to the conditions described above, fill material associated with current and previous development in the area should also be anticipated. This may include materials associated with the existing roadways, parking areas, and below ground sewers and services / utilities.

2.2.2 Previous Investigations by Others

GEMTEC has considered the records of previous investigations carried out by others for the proposed redevelopment of the properties at 600 and 570 Legget Drive, which are contained in a report titled “Geotechnical Investigation and Hydrogeological Assessment, 600 March Road, Kanata (Ottawa), Ontario”, dated March 2024, which was provided to GEMTEC by Broccolini Investments Inc. This investigation and report are referred to further as GHD (2024). The GHD (2024) investigation encountered the following subsurface conditions:

- Fill Material – primarily comprised of asphaltic concrete and granular material;
- Discontinuous layers of silty clay to clayey silt;
- Glacial till which is typically coarse-grained i.e. silty sand to gravelly sand with varying amounts of gravel and clay and containing cobbles and boulders, which overlies;
- Relatively shallow bedrock. The bedrock type was confirmed by rotary coring to be slightly weathered to fresh, thinly to medium bedded dolomitic sandstone, of fair to excellent quality according to the measured Rock Quality Designation (RQD) of the length of recovered core. The unconfined compressive strength of samples of the rock core ranged from about 127 megapascals to about 155 megapascals and is classified as very strong.
- Groundwater level was variable but was typically found to be within the bedrock.

3.0 METHODOLOGY

3.1 Geotechnical Investigation

The fieldwork for this investigation was carried out between June 18 and 20, 2025. During that time four boreholes identified as 25-101 to 25-104 inclusive, were advanced at the approximate locations shown on the Site Plan, Figure 1 following the text of this report. The borehole locations were selected by GEMTEC personnel to avoid existing underground services and utilities and positioned relative to existing site features. Specifically, three of the boreholes were required to be positioned on the south side of Legget to maintain the necessary setback from an existing feeder watermain, as well as avoid buried fibre optic lines and hydro lines.

The boreholes were advanced using a truck mounted hollow stem drill rig supplied and operated by George Downing Estate Drilling Ltd. of Hawkesbury, Ontario. The boreholes were advanced using a combination of hollow stem auger drilling and rotary drilling to depths ranging from approximately 0.6 to 3.5 metres. Standard penetration tests were carried out in the boreholes at regular intervals of depth and samples of the soils encountered were recovered using a 50-millimetre diameter split barrel sampler. Rotary coring using NQ size rotary drilling equipment was carried out below the level of auger refusal at two boreholes to identify the material below the refusal level. Transient groundwater levels in the open boreholes were observed at the time of drilling and standpipe piezometers were installed in two boreholes to facilitate groundwater measurement, permeability testing and sampling at a later date, as described in subsequent sections of this report.

The fieldwork was supervised throughout by a member of our engineering staff who directed the drilling operations, observed the in-situ sampling, logged the soil stratigraphy and surveyed the locations and elevations of the ground investigation points using a precision GPS survey instrument. The coordinates are referenced to NAD83 (CSRS) Epoch 2010, vertical network CGVD28.

Following the fieldwork, the soil and bedrock samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content, and grain size distribution testing. Two samples of the bedrock were tested to determine the unconfined compressive strength of the core. In addition, one sample of soil was sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel.

3.2 Hydrogeological Investigation

3.2.1 Monitoring Well Construction

A single well screen with sand filter pack was installed in each of boreholes 25-101 and 25-103. Above the filter pack, bentonite pellets were used to seal the well screen from the soil above. The monitoring wells were each fitted with a flush mounted protective cover.

3.2.2 Groundwater Level Reading, Hydraulic Conductivity Testing and Water Quality Screening

On June 27, 2025, the monitoring wells were inspected to measure groundwater levels, recover water quality screening samples and to perform hydraulic conductivity testing. Details of the observed water levels are provided later in this report. The level of water present in the monitoring wells was insufficient to recover a representative sample, or to carry out insitu hydraulic conductivity testing. Reference should be made to GHD (2024) for the results of hydraulic conductivity testing performed in deeper boreholes nearby.

4.0 SUBSURFACE CONDITIONS

4.1 General

Descriptions of the subsurface conditions logged in the boreholes are provided on the Record of Borehole Sheets in Appendix A, which also includes details of the well construction and photos of the recovered core. The results of the laboratory classification testing are provided in Appendix B and also on the Record of Borehole Sheets. The results of the chemical analysis (corrosivity) are provided in Appendix C.

The following sections provide a description of the subsurface conditions encountered in the geotechnical boreholes.

4.2 Asphaltic Concrete

Asphaltic concrete was encountered from ground surface in all of the boreholes. Along Legget Drive the thickness of the asphaltic concrete ranges from 100 to 160 millimetres. Within the parking lot of 570/600 March Road, at the location of borehole 25-104, the thickness of asphaltic concrete is 40 millimetres.

4.3 Existing Pavement Structure

The boreholes were advanced through the existing pavement structure materials of Legget Drive and the existing parking lot at 570/600 March Road. These materials consist of base and subbase layers of varying mixtures of crushed, sand and gravel with trace to some non-cohesive silt. Along Legget Drive the combined thickness of the base and subbase ranges from about 520 to 750 millimetres. Within the parking lot of 570/600 March Road, at the location of borehole 25-104, the thickness of base and subbase is 520 millimetres.

Grain size distribution testing was carried out on three samples of the granular material. The results are summarized in Table 4.1. The water content of three samples of the base / subbase materials was about 2 to 3 percent.

Table 4.1 – Summary of Grain Size Distribution Test, Base/Subbase

Borehole ID	Sample Depth (millimetres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
25-101	100 – 280	50.7	38.1	8.5	2.7
25-103	260 – 750	36.0	41.4	16.9	5.6
25-104	35 – 240	48.4	35.2	13.9	2.5

4.4 Fill

Layers of fill material were encountered in boreholes 25-101 and 25-102 below the pavement structure. At these locations, the fill material extends to a depth of about 1.1 metres at which depth auger refusal occurred in borehole 25-101. At the location of borehole 25-102 auger refusal occurred at a depth of about 0.9 metres, and a subsequent SPT test further penetrated the fill material to about 1.1 metres depth. Hence, there is potential for the base of the fill material at the location of borehole 25-102 to be somewhat deeper than 1.1 metres, however this not considered likely.

The fill material encountered was primarily sand, with variable amounts gravel, and silt.

Two standard penetration tests carried out in the fill both gave N values greater than 50 blows per 0.3 metres of penetration which indicates a very dense relative density. However, the higher N values may also be due to the presence of larger gravel, cobbles, or other hard material in the fill.

4.5 Clayey Silt

A thin native deposit of fine-grained cohesive soil was encountered below the pavement materials in boreholes 25-103. The deposit can be described as clayey silt with trace sand. The thickness of the clayey silt layer is about 100 millimetres which is insufficient for SPT N testing or other detailed assessment.

4.6 Bedrock and Inferred Bedrock

Sandstone bedrock was proven at depths of 1.1 and 1.0 metres by coring below the level of auger refusal at the location of boreholes 25-101 and 25-103, respectively. At the location of borehole 25-101, below a relatively thin upper fractured zone the sandstone is generally fresh, and thinly to medium bedded within the depth of coring. At the location of borehole 25-103 the sandstone is fresh and generally very thinly to medium bedded. Based on the observations of the Rock Quality Designation (RQD) the bedrock within the depth of investigation can be classified as Fair to Excellent quality (excluding the near surface fractured zones), according to the system provided in the Canadian Foundation Engineering Manual, 5th Edition.

Two samples of the bedrock core, recovered from 25-101 at a depth of about 1.3 and 25-103 at a depth of about 1.9 metres, were tested to determine the unconfined compressive strength of the core. The determined values are about 130 and 149 MegaPascals. According to the core strength classification system set out in the Canadian Foundation Engineering Manual, 5th Edition, the core strength can be described as Very Strong (i.e. > 100 MPa).

At the location of boreholes 25-102 and 25-104 the presence of bedrock is inferred from auger refusal at depths of 1.1 and 0.6 metres, respectively.

4.7 Groundwater Observations and Measured Levels

All of the boreholes were dry to the depth of auger refusal on the dates of drilling on June 18th, June 19th and June 20th, 2025. During rotary coring at boreholes 25-101 and 25-103 drill water was observed to drain rapidly from the coreholes which suggests groundwater was below the level of coring.

On June 27th, 2025, the monitoring wells were inspected to measure the groundwater levels which are compiled in Table 4.2. Minimal water had gathered at the base of the standpipes, and it is likely that the groundwater level is below these levels.

The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

Table 4.2 – Groundwater Level Depths and Elevations (Monitoring Wells)

Borehole ID	Ground Surface Elevation (metres)	Groundwater Depth (metres)	Groundwater Elevation (metres)	Date of Reading
25-101	78.7	3.4	75.3	June 27, 2025
25-103	79.7	3.3	76.4	June 27, 2025

4.8 Chemistry Relating to Corrosion

One sample of the soil recovered from borehole 25-101 was sent to an accredited laboratory for basic chemical testing relating to corrosion of buried concrete and steel. The results of the testing are summarized in Table 4.3.

Table 4.3 – Summary of Corrosion Testing, Soil Sample

Parameter	Borehole 25-101 Sample 2, 0.8 to 1.0 m
Chloride Content (ug/g)	155
Resistivity (Ohm·m)	19.5
pH	7.79
Sulphate Content (ug/g)	349

4.9 Hydraulic Conductivity

Insitu hydraulic conductivities could not be determined due to the lack of water within the standpipes and rapid infiltration rates.

Published literature values of hydraulic conductivity for sandstone bedrock range from 10^{-10} to 10^{-6} m/s (Freeze & Cherry, 1979).

GHD (2024) estimates the hydraulic conductivity of the sandstone bedrock to range from 2.1×10^{-8} m/s to 9.2×10^{-6} m/s with a geometric mean value of about 3.9×10^{-7} m/s, which is within the typical published range of values.

4.10 Groundwater Quality

Sampling of groundwater for assessment of groundwater quality was not possible due to the shallow groundwater level.

It is anticipated that groundwater, if encountered, will preferably be discharged to a City of Ottawa storm sewer. Water quality sampling should be carried to demonstrate that any groundwater discharge will meet the City of Ottawa Sewer Use by-law requirements. Should exceedances be observed, it may be necessary to discharge to a sanitary sewer, treat the groundwater, or dispose of it at an alternative suitable location.

5.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.



Daire Cummins, M.Sc.
Geotechnical Specialist



Brent Wiebe, P.Eng.
Principal Geotechnical Engineer



DC/BW

CONDITIONS AND LIMITATIONS OF THIS REPORT

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4. **Basis of Report:** This Report has been prepared for the specific site, development, design objectives and purposes that were described to GEMTEC by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this report expressly addresses the proposed development, design objectives and purposes. Any change of site conditions, purpose or development plans may alter the validity of the report and GEMTEC cannot be responsible for use of this report, or portions thereof, unless GEMTEC is requested to review any changes and, if necessary, revise the report.
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6. **Use of This Report:** The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without GEMTEC's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, GEMTEC may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process.

Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety, and equipment capabilities.

7. **No Legal Representations:** GEMTEC makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.
8. **Decrease in Property Value:** GEMTEC shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.
9. **Reliance on Provided Information:** The evaluation and conclusions contained in this report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information

and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

10. **Investigation Limitations:** Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions but even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions.

The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. Accordingly, GEMTEC does not warrant or guarantee the exactness of the subsurface descriptions.

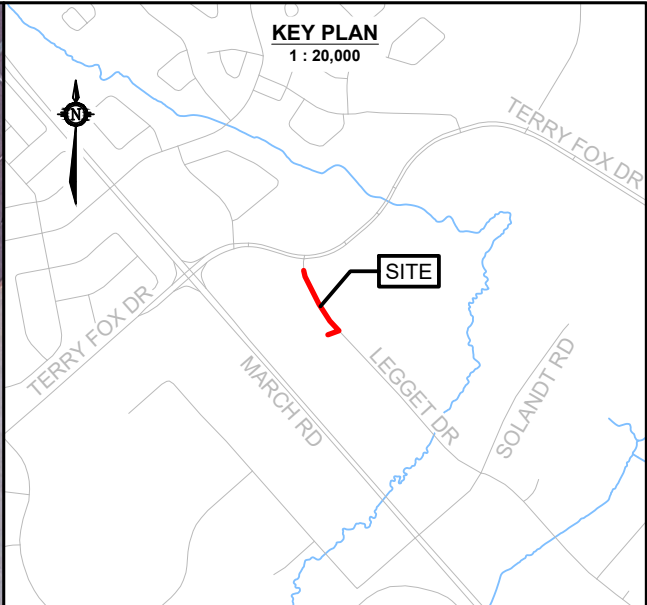
Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

In addition, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

11. **Sample Disposal:** GEMTEC will dispose of all uncontaminated soil and/or rock samples 60 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fill materials or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.
12. **Follow-Up and Construction Services:** All details of the design were not known at the time of submission of GEMTEC's report. GEMTEC should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of GEMTEC's report.

During construction, GEMTEC should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of GEMTEC's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in GEMTEC's report. Adequate field review, observation and testing during construction are necessary for GEMTEC to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, GEMTEC's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

13. **Changed Conditions:** Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that GEMTEC be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that GEMTEC be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.
14. **Drainage:** Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. GEMTEC takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATION, IN METRES

APPROXIMATE BOREHOLE LOCATION
(current investigation by GEMTEC)

PROJECT LIMIT

DATA SOURCES AND REFERENCES

1. Coordinate system: CSRS.UTM-18N
2. Distances, elevations, and coordinates are shown in metres unless denoted otherwise
3. This drawing is a schematic representation and should not be taken as a substitute for a legal survey.
4. Image ©2025 Google Maps, CNES / Airbus, First Base Solutions, Maxar Technologies
5. Contains information licensed under the Open Government Licence – Ontario
6. Geographic dataset source: Ontario GeoHub



DRAWING

SITE PLAN

CLIENT

BROCCOLINI INVESTMENT INC.

PROJECT

**SUBSURFACE INVESTIGATION
PROPOSED WATERMAIN
570 LEGGET DRIVE TO TERRY FOX DRIVE
OTTAWA, ONTARIO**

DRAWN BY **SL** CHECKED BY **DC**

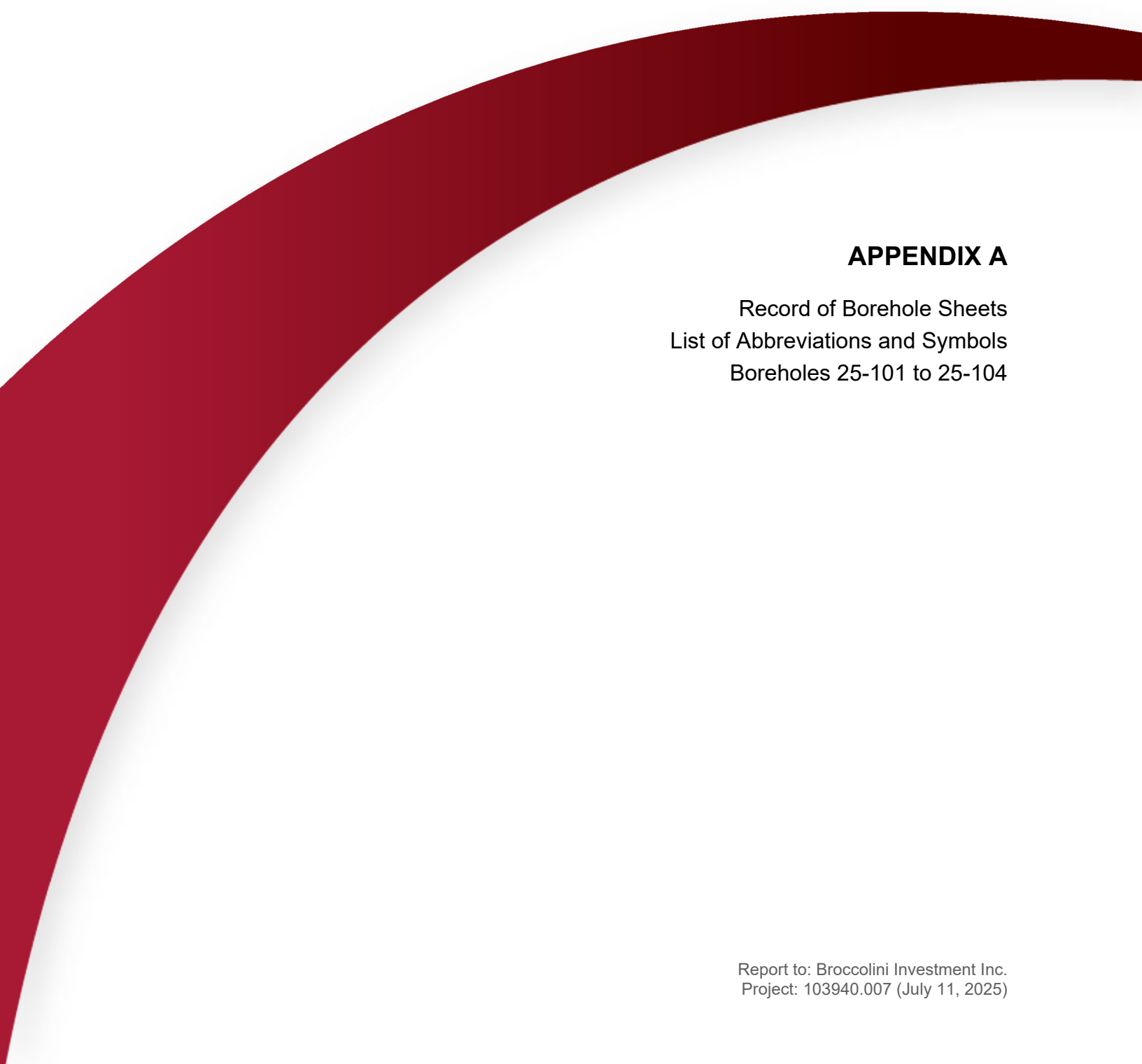
PROJECT NO. **103940.007** REVISION NO. **0**

DATE **JULY 2025** FIGURE NO. **FIGURE 1**

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

32 Steacie Drive
Ottawa, ON, K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

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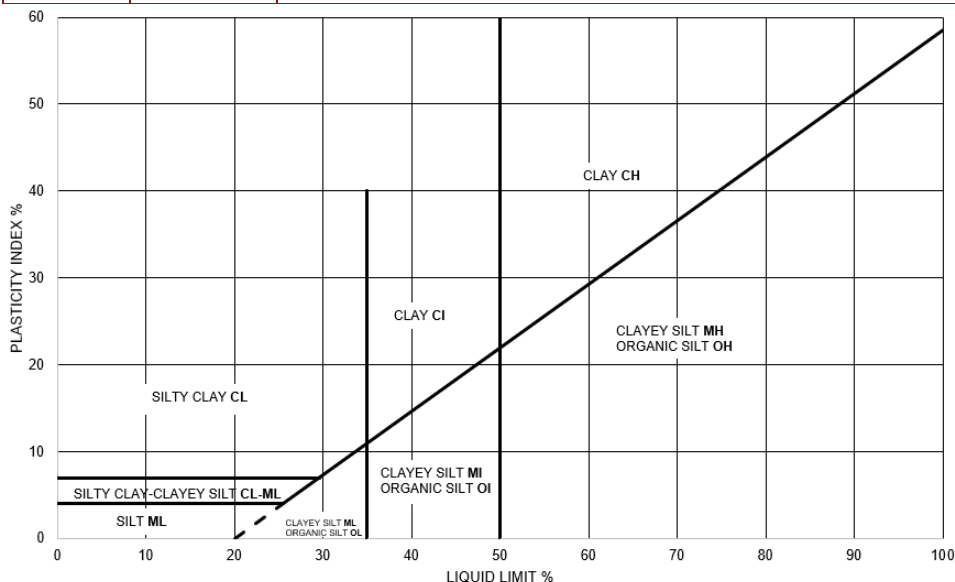
APPENDIX A

Record of Borehole Sheets
List of Abbreviations and Symbols
Boreholes 25-101 to 25-104

Method of Soil Classification

GEMTEC's Soil Classification is based on the MTC Soil Classification Manual (January 1980)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$C_u = \frac{D_{60}}{D_{10}}$	$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	USCS Group Symbol	Group Name	
Inorganic (Organic Content less than 30%)	Coarse Grained Soils (>50% is larger than 0.075 mm)	Gravel (>50% of coarse fraction is > 4.75 mm)	Gravel with ≤12% fines	Poorly Graded	<4	≤1 or ≥3		GP	Gravel
				Well Graded	≥4	1 to 3		GW	Gravel
			Gravel with >12% fines	Below A Line	N/A			GM	Silty Gravel
				Above A Line	N/A			GC	Clayey Gravel
		Sand (≥50% coarse fraction is > 4.75 mm)	Sand with ≤12% fines	Poorly Graded	<6	≤1 or ≥3		SP	Sand
				Well Graded	≥6	1 to 3		SW	Sand
			Sand with >12% fines	Below A Line	N/A			SM	Silty Sand
				Above A Line	N/A			SC	Clayey Sand
		Soil Group	Type of Soil	Liquid Limit	Field Tests			USCS Group Symbol	Group Name
					Dilatancy	Thread Diameter	Toughness		
	Fine Grained Soils (≥50% is smaller than 0.075 mm)	Silts (Non-Plastic or PI and LL plot below A- Line)	<50	Rapid	>6 mm	N/A	ML	Silt	
				Slow	3 to 6 mm	None to low	ML	Clayey Silt	
				Slow to V. Slow	3 to 6 mm	Low	OL	Organic Silt	
			≥50	Slow to V. Slow	3 to 6 mm	Low to Medium	MH	Clayey Silt	
				None	1 to 3 mm	Medium to High	OH	Organic Silt	
		Clays (PI and LL plot above A-Line)	Liquid Limit <35	None	~3 mm	Low to Medium	CL	Silty Clay	
			Liquid Limit 35 to 50	None	1 to 3 mm	Medium	CI	Silty Clay	
			Liquid Limit >50	None	<1 mm	High	CH	Clay	
		Highly Organic (> 30%)	Peat (Amorphous or Fibrous)						PT



Dual Symbol – Is used to indicate when soils are transitional. For coarse grained soils, it is used when the soil has between 5 and 12% fines (e.g., SP-SC, Sand to Silty Sand). For fine-grained soils it is used when the plasticity index and liquid limit values plot in the area shown in the plasticity chart on this page.

Borderline Symbol – Is used to indicate soils that are not clearly in one soil type but have similar behaviour and properties as similar materials (e.g., CL/CI or GM/SM).

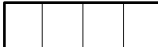
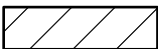
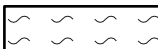
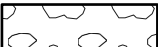
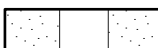
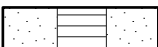
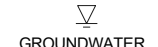
ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

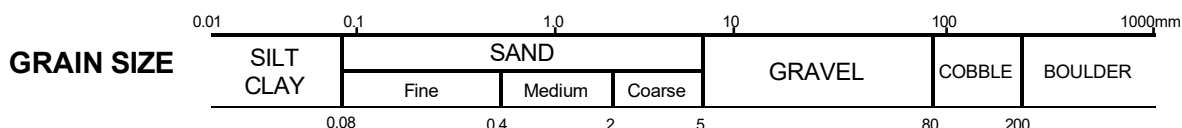
SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_s	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

PENETRATION RESISTANCE	
Standard Penetration Resistance, N The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.	
Dynamic Penetration Resistance The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).	
WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	Description	C_u , kPa	Description
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard

		
GRAVEL	SAND	SILT
		
CLAY	FILL	ORGANICS
		
BOULDER	BEDROCK	TILL
		
PIPE WITH BENTONITE	PIPE WITH BACKFILL	PIPE WITH SAND
		
SCREEN WITH SAND	GROUNDWATER LEVEL	



DESCRIPTIVE TERMINOLOGY

TRACE	SOME	ADJECTIVE	noun > 30% and main fraction
trace clay, etc	some gravel, etc.	silty, etc.	sand and gravel, etc.

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE	
Fresh	No visible sign of rock material weathering
Faintly weathered	Weathering limited to the surface of major discontinuities
Slightly weathered	Penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material
Moderately weathered	Weathering extends throughout the rock mass but the rock material is not friable
Completely weathered	Rock is wholly decomposed and in a friable condition but the rock and structure are preserved

CORE CONDITION
Total Core Recovery (TCR) The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run
Solid Core Recovery (SCR) The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.
Rock Quality Designation (RQD) The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completed broken core to 100% for core in solid segments.

BEDDING THICKNESS	
Description	Thickness
Thinly laminated	< 6 mm
Laminated	6 - 20 mm
Very thinly bedded	20 - 60 mm
Thinly bedded	60 - 200 mm
Medium bedded	200 - 600 mm
Thickly bedded	600 - 2000 mm
Very thickly bedded	2000 - 6000 mm

DISCONTINUITY SPACING	
Description	Spacing
Very close	20 - 60 mm
Close	60 - 200 mm
Moderate	200 - 600 mm
Wide	600 - 2000 mm
Very wide	2000 - 6000 mm

ROCK QUALITY	
RQD	Overall Quality
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK COMPRESSIVE STRENGTH	
Comp. Strength, MPa	Description
1 - 5	Very weak
5 - 25	Weak
25 - 50	Moderate
50 - 100	Strong
100 - 250	Very strong

RECORD OF BOREHOLE 25-101

CLIENT: Broccolini Investments Inc.
 PROJECT: Nokia March Road Campus Municipal Watermain
 JOB#: 103940.007
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
 DATUM: CGVD28
 BORING DATE: Jun 18 2025

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	SHEAR STRENGTH (Cu), kPa + NATURAL ⊕ REMOULDED		WATER CONTENT, % W _p — W — W _L	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m						
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		78.72									MH	Flush Mount
		ASPHALTIC CONCRETE		78.62 0.10										
		BASE - (GP-SP) GRAVEL and SAND, some silt, trace clay; brown, crushed; non-cohesive, moist, dense		78.44 0.28	1	SS	305	37	○					
		SUBBASE - (GP-SP) SAND and GRAVEL, trace to some silt, trace clay; brown, crushed, some cobbles; non-cohesive, moist		78.10 0.62										
		FILL - (SP) GRAVELLY SAND, trace to some silt; grey brown; non-cohesive; moist; dense		77.65 1.07	2	SS	203	79 for 280 mm						
1	Diamond Rotary Core HQ (89mm OD)	Fractured SANDSTONE / BOULDERS		77.45 1.27	3	RC	200	TCR=100% SCR=19% RQD=0%					UC	Bentonite
		Fresh, grey SANDSTONE, very thinly to medium bedded. Good to Excellent quality.												
2					4	RC	1448	TCR=92% SCR=72% RQD=71%						
3					5	RC	686	TCR=100% SCR=67% RQD=100%						
4		End of borehole		75.19 3.53										

GROUNDWATER OBSERVATIONS		
DATE	DEPTH (m)	ELEV. (m)
25/06/27	3.44	▽ 75.3

RECORD OF BOREHOLE 25-102

CLIENT: Broccolini Investments Inc.
 PROJECT: Nokia March Road Campus Municipal Watermain
 JOB#: 103940.007
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
 DATUM: CGVD28
 BORING DATE: Jun 18 2025

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				● PENETRATION RESISTANCE (N), BLOWS/0.3m ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	SHEAR STRENGTH (Cu), kPa + NATURAL ⊕ REMOULDED		WATER CONTENT, % W _p — W — W _L	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m						
0	Power Auger Drive open sampler Hollow Stem Auger (210mm OD)	Ground Surface		79.38										
		ASPHALTIC CONCRETE		79.28										
		BASE - (SP-GP) SAND and GRAVEL, trace to some silt; brown, crushed; non-cohesive, moist		79.16										
		SUBBASE - (SP-GP) SAND and GRAVEL, trace to some silt; grey brown, crushed; non-cohesive, moist, very dense		78.62	1	SS	305	74						
		FILL - (SP) SAND, some gravel, trace to some silt; grey brown; moist		78.29	2	SS	178	68 for 0.18 m						
1		Auger refusal at 0.9 m on inferred bedrock End of borehole		1.09										
2														
3														
4														

Asphaltic Cold Patch

Auger Cuttings

Borehole dry upon completion

RECORD OF BOREHOLE 25-103

CLIENT: Broccolini Investments Inc.
 PROJECT: Nokia March Road Campus Municipal Watermain
 JOB#: 103940.007
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
 DATUM: CGVD28
 BORING DATE: Jun 20 2025

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m												SHEAR STRENGTH (Cu), kPA				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m						WATER CONTENT, %						+ NATURAL		⊕ REMOULDED																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		79.65																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

GROUNDWATER OBSERVATIONS		
DATE	DEPTH (m)	ELEV. (m)
25/06/27	3.30	▽ 76.4

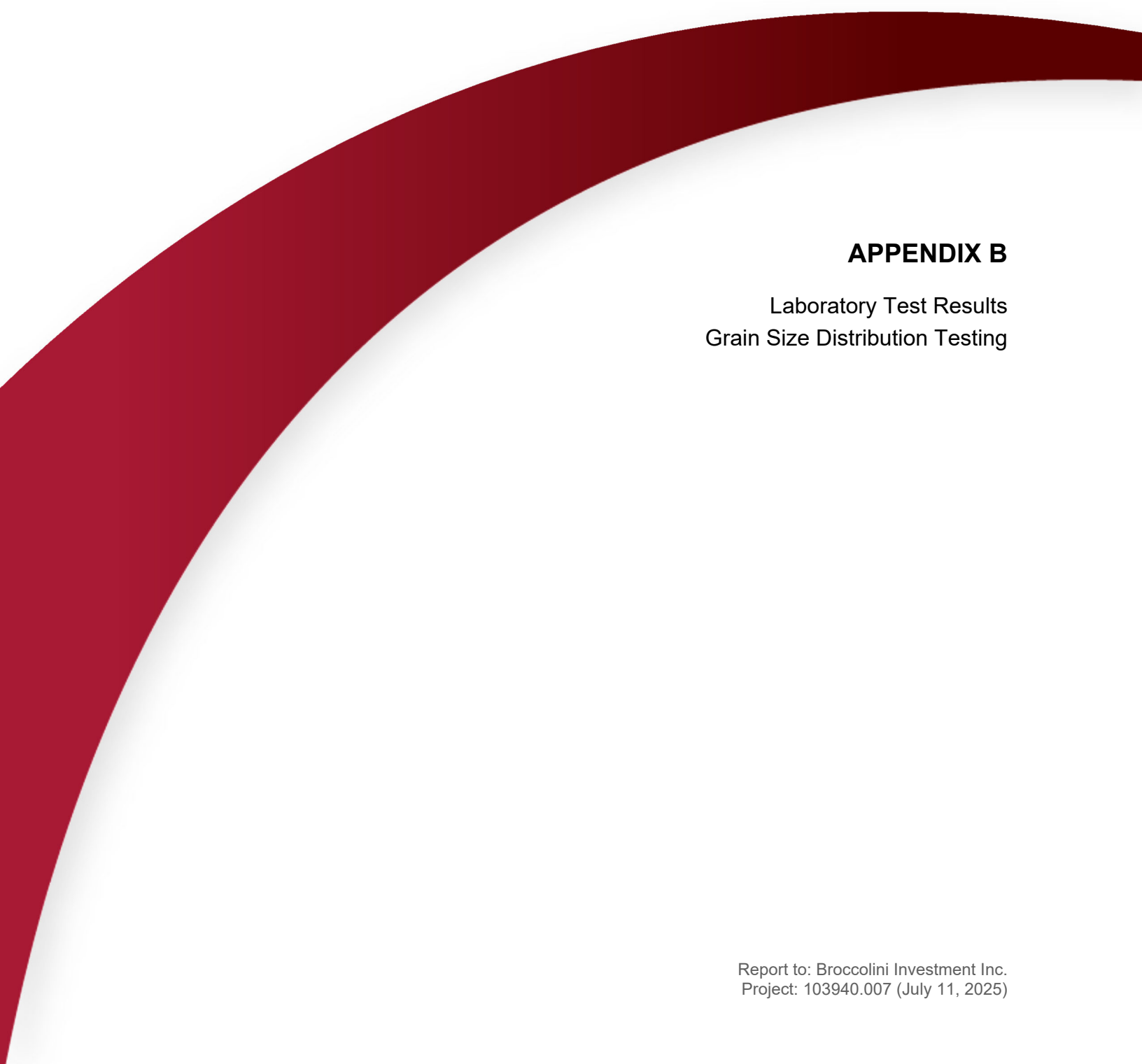
RECORD OF BOREHOLE 25-104

CLIENT: Broccolini Investments Inc.
 PROJECT: Nokia March Road Campus Municipal Watermain
 JOB#: 103940.007
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
 DATUM: CGVD28
 BORING DATE: Jun 19 2025

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				● PENETRATION RESISTANCE (N), BLOWS/0.3m ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED WATER CONTENT, % W _p — W — W _L	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m				
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		79.73								
		ASPHALTIC CONCRETE		79.70 0.04								Asphaltic cold patch
		BASE - (GM-SM) SILTY GRAVEL and SAND, trace clay; grey, crushed; non-cohesive, moist		79.49 0.24								Auger cuttings
		SUBBASE - (GP) SANDY GRAVEL, trace silt; grey, crushed; non-cohesive, moist		79.17 0.56	1	SS	229	68 for 0.23 m			MH	Borehole dry upon completion
		Auger refusal on inferred bedrock End of borehole										
1												
2												
3												
4												

GEO - BOREHOLE LOG 103940.007 LOG_BH 101 TO 104_2025-07-07.GPJ GEMTEC 2018.GDT 7/11/25



APPENDIX B

Laboratory Test Results Grain Size Distribution Testing



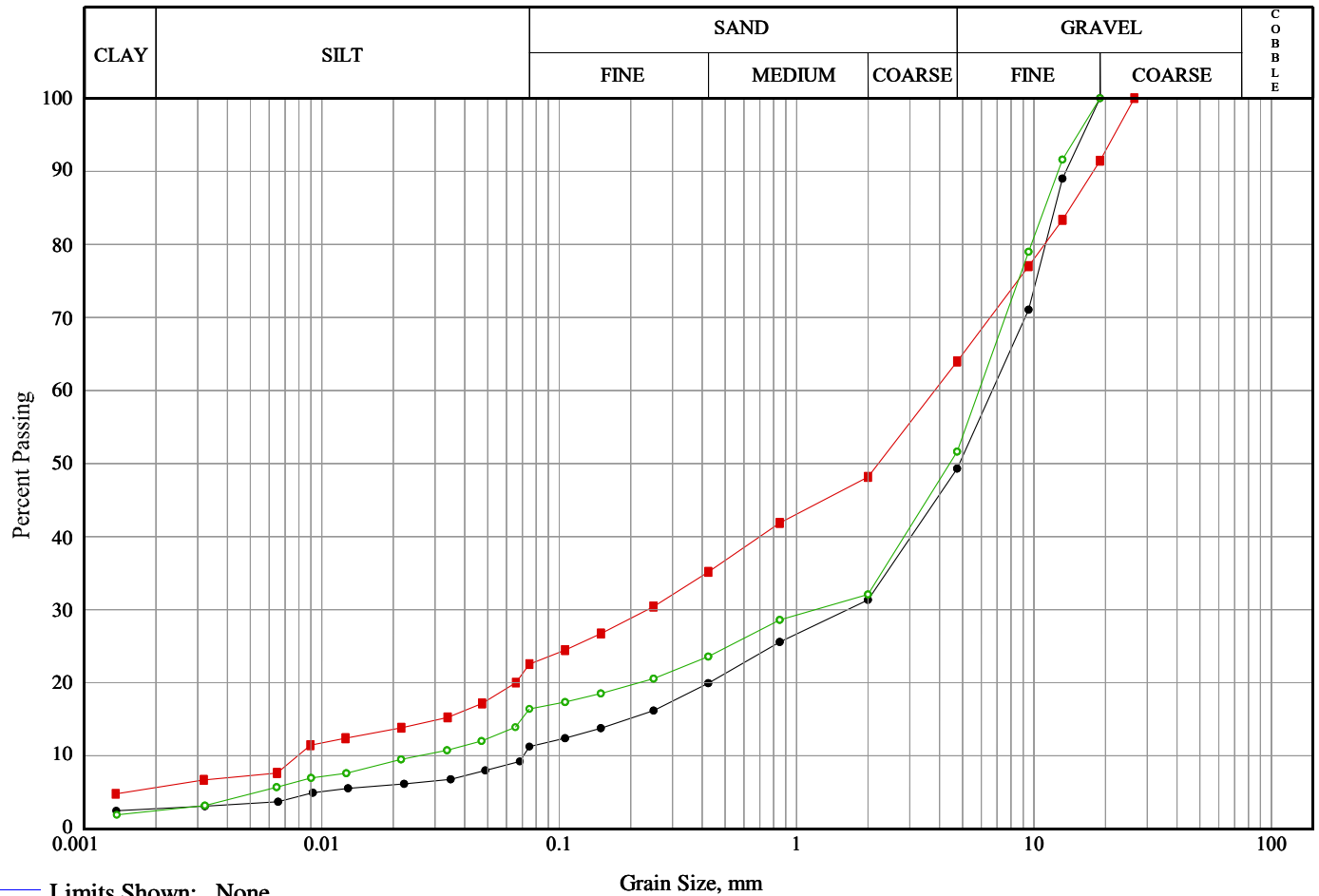
GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Client: Broccolini Investment Inc.

Project: Nokia March Road Campus Municipal Watermain along

Project #: 103940007

Soils Grading Chart
(LS-702/
ASTM D-422)



Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
—●—	Base Material	25-101	A	100-280	50.7	38.1	8.5	2.7
—■—	Subbase Material	25-103	B	260-750	36.0	41.4	16.9	5.6
—○—	Base Material	25-104	A	35-240	48.4	35.2	13.9	2.5

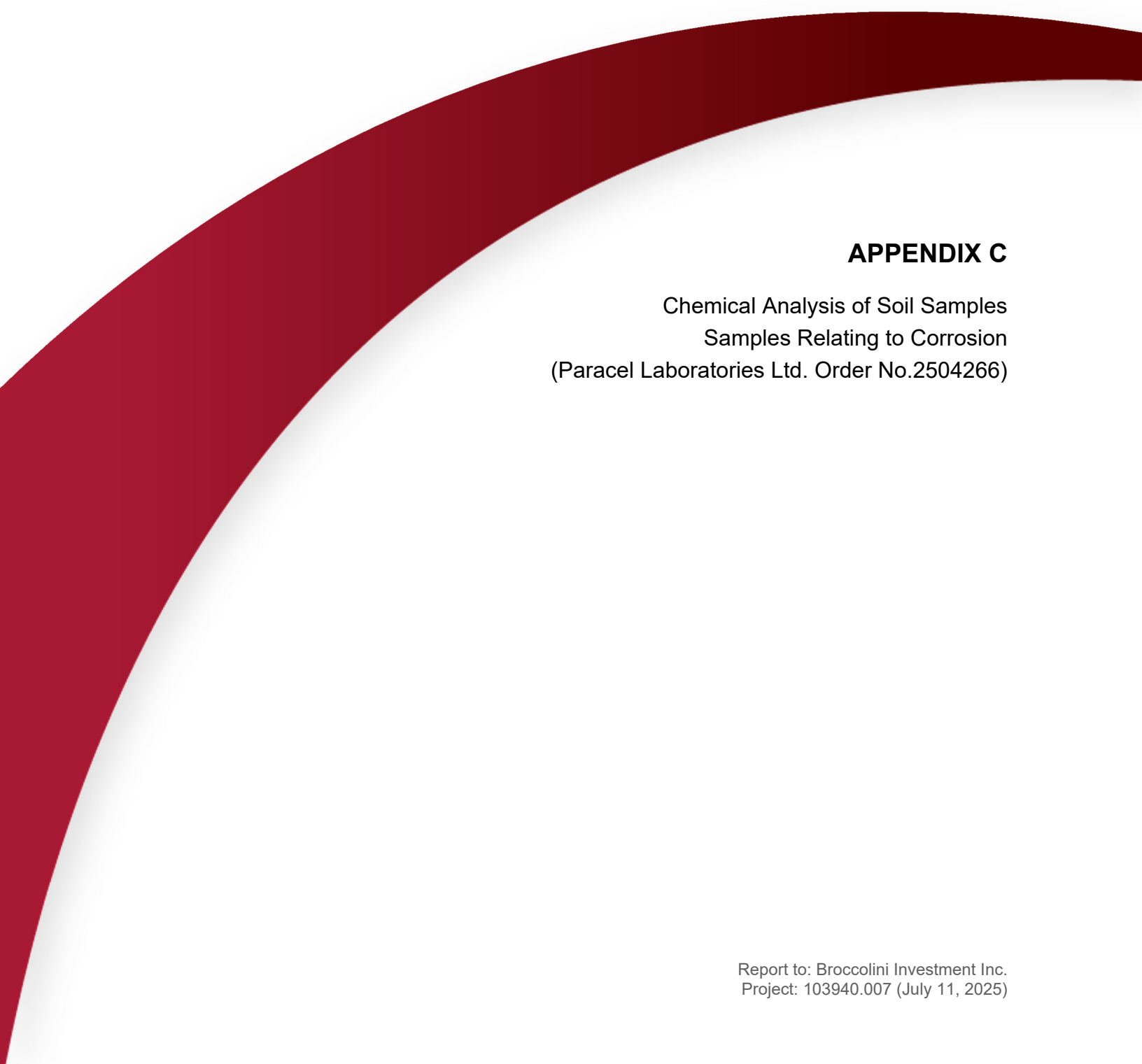
Line Symbol	CanFEM Classification	USCS Symbol	D ₁₀	D ₁₅	D ₃₀	D ₅₀	D ₆₀	D ₈₅	% 5-75µm
—●—	n/a	N/A	0.071	0.195	1.64	4.86	6.68	12.27	8.5
—■—	n/a	N/A	0.008	0.032	0.24	2.21	3.83	14.22	16.9
—○—	n/a	N/A	0.026	0.069	1.20	4.42	5.87	11.12	13.9

Note: More information available upon request

	Client: Broccolini Investment Inc.	Rock Core Compressive Strength
	Project: Nokia March Road Campus Municipal Watermain along Leggett Drive	
	Project #: 103940007	

Date/Time Sampled: 25/07/02 9:57:00 AM	Date/Time Tested: 25/07/02 9:58:20 AM
--	---------------------------------------

BH	Sample No	Depth	Description	Diameter, mm	Area, mm ²	Length After Capping, mm	L/D	Load, kN	Comp. Str., MPa
25-101	4	1.27-1.49		63.2	3134	118	1.87	410.370	129.6
25-103	4	1.82-2.08		62.9	3111	118	1.87	469.490	149.4



APPENDIX C

Chemical Analysis of Soil Samples
Samples Relating to Corrosion
(Paracel Laboratories Ltd. Order No.2504266)

Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Matt Rainville

Client PO:
Project: 103940.007
Custody:

Report Date: 2-Jul-2025

Order Date: 25-Jun-2025

Order #: 2526321

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2526321-01	25-101 SA2

Approved By:



Alex Enfield, MSc

Lab Manager

Certificate of Analysis

Report Date: 02-Jul-2025

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 25-Jun-2025

Client PO:

Project Description: 103940.007

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	30-Jun-25	2-Jul-25
Conductivity	MOE E3138 - probe @25 °C, water ext	2-Jul-25	2-Jul-25
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	2-Jul-25	2-Jul-25
Resistivity	EPA 120.1 - probe, water extraction	2-Jul-25	2-Jul-25
Solids, %	CWS Tier 1 - Gravimetric	30-Jun-25	2-Jul-25

Certificate of Analysis

Report Date: 02-Jul-2025

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 25-Jun-2025

Client PO:

Project Description: 103940.007

Client ID:	25-101 SA2	-	-	-	
Sample Date:	18-Jun-25 10:00	-	-	-	-
Sample ID:	2526321-01	-	-	-	
Matrix:	Soil	-	-	-	
MDL/Units					

Physical Characteristics

% Solids	0.1 % by Wt.	93.8	-	-	-	-
----------	--------------	------	---	---	---	---

General Inorganics

Conductivity	5 uS/cm	513	-	-	-	-
pH	0.05 pH Units	7.79	-	-	-	-
Resistivity	0.10 Ohm.m	19.5	-	-	-	-

Anions

Chloride	5 ug/g	155	-	-	-	-
Sulphate	5 ug/g	349	-	-	-	-

Certificate of Analysis

Report Date: 02-Jul-2025

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 25-Jun-2025

Client PO:

Project Description: 103940.007

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	5	ug/g					
Sulphate	ND	5	ug/g					
General Inorganics								
Conductivity	ND	5	uS/cm					
Resistivity	ND	0.10	Ohm.m					

Certificate of Analysis

Report Date: 02-Jul-2025

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 25-Jun-2025

Client PO:

Project Description: 103940.007

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	179	5	ug/g	183			2.0	20	
Sulphate	1910	5	ug/g	1920			0.6	20	
General Inorganics									
Conductivity	206	5	uS/cm	209			1.1	5	
pH	7.16	0.05	pH Units	7.25			1.3	10	
Resistivity	48.4	0.10	Ohm.m	47.9			1.1	20	
Physical Characteristics									
% Solids	83.6	0.1	% by Wt.	83.9			0.3	25	

Certificate of Analysis

Report Date: 02-Jul-2025

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 25-Jun-2025

Client PO:

Project Description: 103940.007

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	28.3	5	ug/g	18.3	99.8	80-120			
Sulphate	10.8	5	ug/g	ND	108	80-120			

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 02-Jul-2025

Order Date: 25-Jun-2025

Project Description: 103940.007

Qualifier Notes:**Sample Data Revisions:**

None

Work Order Revisions / Comments:

Received at temperature > 25C

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

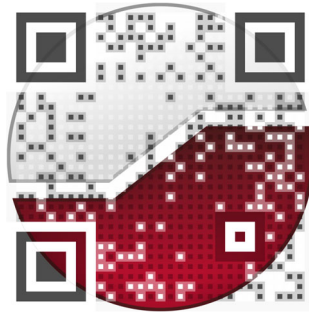
NC: Not Calculated

Soil results are reported on a dry weight basis unless otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

experience • knowledge • integrity



civil
geotechnical
environmental
field services
materials testing

civil
géotechnique
environnementale
surveillance de chantier
service de laboratoire des matériaux

expérience • connaissance • intégrité

