MINI STORAGE - 273 & 275 RUSS BRADLEY ROAD CARP, ON - GEOTECHNICAL REPORT

Project No.: CCO-22-1643

Prepared for:

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January 2023

McINTOSH PERRY

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273 & 275 Russ Bradley Road – Mini Storage System

1.0 INTRODUCTION

This report presents the factual findings of the geotechnical engineering investigation conducted for the proposed development site at 273 & 275 Russ Bradley Road, Carp, ON. The proposed development involves the construction of multiple low-rise structures for a mini-storage system with adequate space for parking and pathways to access the storage area within the site.

The report will describe the methodology and findings of the geotechnical engineering investigation consisting of five (5) Cone Penetration Test (CPT) with one (1) Seismic CPT, three (3) exploratory subsurface boreholes, laboratory testing procedures, and details of the subsurface soil stratigraphy of the Proposed Site. The report will explain the anticipated geotechnical engineering conditions influencing the design and construction of the proposed development, and recommendations for foundation design.

2.0 SITE DESCRIPTION

The Proposed Site is located south of the intersection of Carp Road and Russ Bradley Road. The Proposed Site is clear of structures, it is relatively flat with cleared and wooded area with a low-lying watershed. The surrounding area of the site includes a variety of commercial properties and Carp Airport to the west of the Proposed Site location. The Proposed Site location is shown in Figure 1, Appendix A.

3.0 FIELD PROCEDURES

The staff of McIntosh Perry Consulting Engineers (McIntosh Perry) conducted a site investigation prior to the planned drill date to identify and mark the proposed borehole and Cone Penetration Test locations; additionally, requisitions were submitted to Ontario-1-Call tickets for utility clearance locates, obtained utility clearance permits and approvals, and coordinated with the client regarding the intended geotechnical exploration drill-date.

The cone penetration and seismic cone penetration test were done by pushing the cone penetrometer into the ground using a drill rig, the penetrometer was pushed below the ground surface at a standard rate (20 mm/s). During the insertion of the penetrometer, geotechnical data was continuously collected and recorded for soil characteristic analysis, the CPT sounding graphs are shown in Appendix B.

The seismic test measurement was done by recording the shear wave velocity through the soil, a sound wave was generated at the surface through the percussion method, while the penetrometer was at a predetermined depth. The resulting shear wave velocity data was then collected through the cone penetrometer's tip at each depth, the shear wave velocity graph is shown in Appendix D.

The boreholes were drilled using a track-mounted boring drill rig: a 200 mm hollow stem helical auger drilling machine. The drill was advanced incrementally below ground surface (BGS), while intermittent soil samples were taken at 0.75 m intervals. Each soil sample was retrieved with a 51 mm outside diameter (OD) Standard Penetration Test (SPT) split spoon (SS) sampler in accordance with ASTM D1586, SPT test procedures.

The three (3) boreholes BH21-1 MW, BH21-4, and BH21-6 were advanced into the subsurface to a depth of 6.7 m BGS, BH21-1MW was fitted with a groundwater (GW) level monitoring well (MW) to monitor the changing groundwater level.

At the end of the drilling operations, a monument well cover was installed on BH21-1 MW, and all other boreholes were backfilled with auger cuttings and restored to their original surface condition. Boreholes and CPT locations and elevations are shown in Figure 2. Appendix A.

4.0 LABORATORY TEST PROCEDURES

Mechanical analysis: grain-size distribution was done on nine (9) representative soil samples at the McIntosh Perry geotechnical laboratory (MP Geotech lab), the test was conducted in accordance with the American Society for Testing Materials (ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates, LS-602) standards and procedures.

Analytical and corrosivity testing was conducted on two (2) representative soil samples for the following analysis: pH level, electrical resistivity, chloride, and sulphate concentration levels.

All remaining samples are stored at MP Geotech lab for 30 days after the final report is submitted, thereafter the soil samples are disposed of according to MP Geotech lab policies.

5.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Site Geology

A desk-top study using the published physiography maps of the area (Ontario Geological Survey or OGS) indicates that the Site is located within clay and sand plains, and the surficial geology indicates coarse-textured glaciomarine deposits, ranging from sand, gravel, minor silt, and clay. The bedrock geology of the area consists of limestone, dolostone, shale, arkose, and sandstone of the Simcoe group of the Shadow Lake Formation.

5.2 Subsurface Conditions

The Site subsurface stratigraphy consists of several layers of soil, such as topsoil, sandy silt, silty sand, and sand. The main soils components were divided into four (4) distinct strata and identified accordingly to the Unified Soil Classification System (USCS) as:

- Topsoil
- Sandy Silt to Clayey Silt
- Silty Sand
- Sand

The borehole logs and the CPT sounding graphs show a cross-section view of the subsurface soil stratigraphy of the location. The Borehole logs and CPT sounding graphs are shown in Appendix C.

5.2.1 Topsoil

Cohesionless surface layers containing sand and gravel were observed in all boreholes from the surface (0 m) to depths ranging from 0.2 to 0.7 m BGS. This layer consisted of gravelly sand with trace cobbles, moist, brown to grey in color. The qualitative measure of the denseness condition of this layer was interpreted by the Standard Penetration Test (SPT) 'N' values ranging from 3 to 6, which is consistent with loose soils.

The surface layer soils in the CPT sounding graphs indicated a range of soils from silty clay to sandy silt to a depth of 0.5 m BGS.

5.2.2 Sandy Silt to Clayey Silt

Sandy silt was observed in boreholes BH21-1 and 4 ranging from depths of 0.7 to 6.7 m BGS. In BH21-6 sandy silt was observed from a depth of 0.2 to 1.3 m BGS, this layer underlies the topsoil of the area. The compactness condition of this layer ranged from loose to dense, and the water content was *wet*. Six (6) samples were subjected to gradation analysis from the sandy silt to clayey silt layer, the grain-size distribution indicated the following soil constituent materials in percent weight which are shown in Table 5-1.

The CPT sounding graphs indicate a mixture of sandy silt to clayey silt deposits with a dominant presence of sandy silt to silty sand layers and sporadic thin layers of clayey silt in CPT21-1 and 2.

Table 5-1: Grain-size constituent materials in percent weight for sandy silt

BOREHOLE	GRAVEL (%)	SAND (%)	FINES (%)	
			Silt (%)	Clay (%)
BH21-1 MW SS-2	0	38	45	17
BH21-1 MW SS-4	0	38	53	9
BH21-1 MW SS-6	0	42	48	10
BH21-1 MW SS-8	0	27	59	14
BH21-4 SS-3	0	46	43	11
BH21-4 SS-6	0	41	49	10

The grain-size distribution graph for sandy silt is shown in Figure 3, Appendix C.

5.2.3 Silty Sand

Silty sand layers were observed in BH21-4 from a depth of 0.7 – 4.1 m and in BH21-6 from a depth of 0.2 – 1.3 m BGS. CPT21-3 indicates strata of silty sand with an intermittent layer of clayey silt from an approximate depth of 4.0 – 6.2 m BGS, and on CPT21-5 and 7 silty sand was observed at depths ranging from 6.5 – 8.5 m BGS. The Silty sand layers in CPT21-1 and 2 were observed in thin sporadic layers.

5.2.4 Sand

The sand was observed in BH21-6 from a depth of 1.3 m to 6.7 m BGS, grain-size constituent materials in percent weight for sand is shown in Grain-size constituent materials in percent weight for sand in Table 5-2. In CPT21-5 and 7 the main constituent material was observed to be sand from an approximate depth of 1.8 to 6.5 m BGS, in CPT21-3 sand was observed at depths of 1.8 – 3.8 m BGS. A grain-size distribution graph for sand is shown in Figure 4, Appendix C.

Table 5-2: Grain-size constituent materials in percent weight for sand

BOREHOLE	GRAVEL (%)	SAND (%)	FINES (%)	
			Silt (%)	Clay (%)
BH21-6 SS-3	5	89	6	
BH21-6 SS-6	1	95	4	
BH21-6 SS-8	1	97	3	

5.3 Chemical Analysis

Two (2) representative soil samples BH21-1 and 4 were sent for soil chemical analysis testing for the following; pH level, resistivity level, chloride, and sulphate concentration. The corresponding test results indicate the following levels of concentration shown in Table 5-3.

Table 5-3: Chemical Analysis Summary

BOREHOLE	SAMPLE	DEPTH El. (m)	Chemical Analysis			
			pH (pH units)	Resistivity (Ohm.cm)	Chloride (ppm)	sulphate (ppm)
BH21-1	SS-3	111.6	7.84	9460	8	10
BH21-4	SS-3	111.7	7.83	4530	6	148

The laboratory test result and Certificate of Analysis are shown in Appendix C.

5.4 Groundwater

Groundwater (GW) was encountered at depths ranging from 1.17 to 2.9 m BGS in all open boreholes, a monitoring well was installed in BH21-1 MW to observe the groundwater level fluctuation in the Proposed Site. The groundwater in the Proposed Site is expected to fluctuate seasonally. The monitoring well installation details are shown in borehole logs (see Appendix B). No chemical analysis was done on groundwater from the Proposed Site.

6.0 DISCUSSIONS AND RECOMMENDATIONS

6.1 General

This section of the report provides engineering recommendations on the geotechnical design aspect of the project based on the project requirements and our interpretation of the subsurface soil information. The recommendations presented herein are subject to the limitations noted in Appendix F “Limitations of Report” which forms an integral part of this document.

The foundation engineering recommendations presented in this section have been developed following Part 4 of the 2015 National Building Code of Canada (NBCC) and 2012 Ontario Building Code (OBC) extending the Limit State Design approach.

6.2 Overview

It is understood the proposed buildings are single-story structures of storage or warehouse type. If shallow footing systems are chosen as foundation systems, such as a strip or spread footings, the minimum soil cover equal to the noted frost penetration depth shall be provided for all footings. If the foundation system is to be a structural slab-on-grade, then adequate synthetic insulation, equal to the soil frost cover in insulation value shall be provided for all slab-on-grade footings.

The subgrade is of high silt content which makes it frost susceptible, and prone to disturbance induced by construction traffic.

Proper dewatering, to a minimum depth of 0.6 m below the subgrade is needed before any excavation or compaction. The dewatering depth below the subgrade is a function of the compaction energy penetration below the surface depending on the selected compaction equipment.

6.3 Site Preparation

The upper soil layer with organic content shall be entirely removed from the footprint of the buildings and hard landscaping.

The Occupational Health and Safety Act (OHSA) of Ontario indicated that the sandy silt could be classified as Type 4 soil and sloped no steeper than 3H:1V or be shored. If space restrictions exist, the excavations can be carried out within trench boxes, which are fully braced to resist lateral earth pressure. A dewatering program to a depth below the target excavation shall be carried out before excavation.

6.4 Foundations

Geotechnical parameters which are used for design recommendations are interpreted from the CPTu test results.

The drained internal friction angle of sand is used for the calculation of ultimate limit state geotechnical resistance. The effective drained internal friction angle was calculated using the normalized tip resistance as shown in the following correlations published by Uzielli et al (2013);

$$q_{t1} = q_t/(\sigma_{atm} \cdot \sigma_{vo})^{0.5}$$

$$\phi' = 25.0(q_{t1})^{0.10}$$

Variations of effective internal friction angle are shown in Figure 6-1.

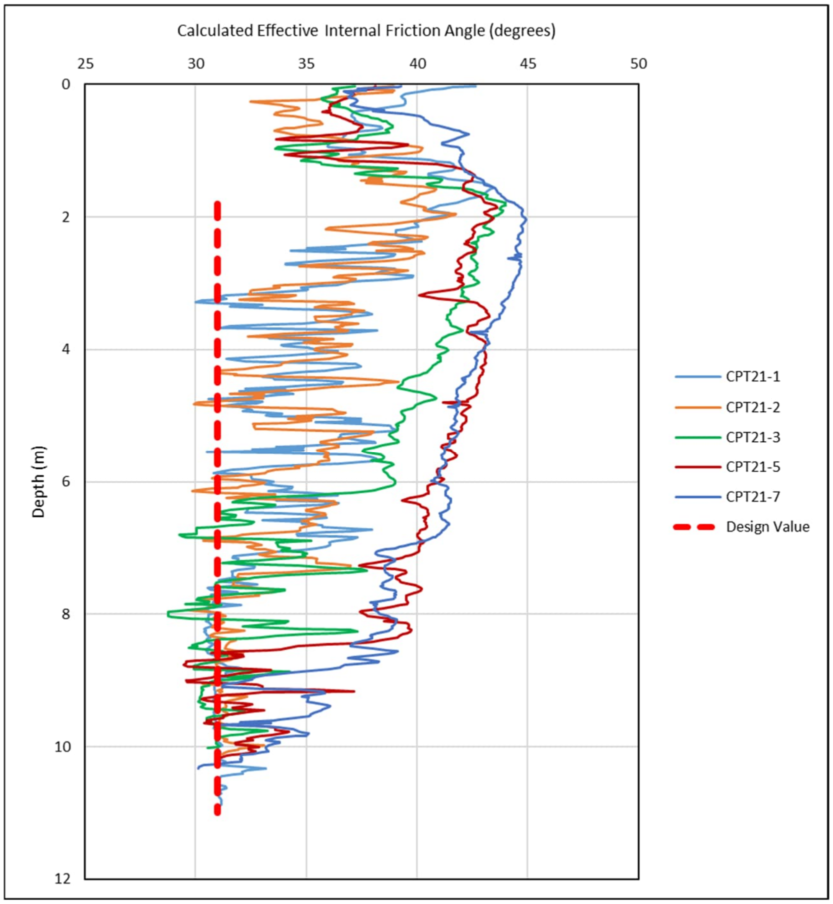

Figure 6-1: Estimation of Effective Internal Friction Angle based on CPTu Tip Resistance

Effective modulus of elasticity is used for the calculation of elastic deformations under the service loads. The elastic behavior of soils is highly nonlinear. The elastic modulus is estimated based on the tip resistance. Elastic modulus is affected by the footing size. The modulus responding to strip footing with the smaller dimension of 0.75 m is shown here.

The effective modulus of elasticity is estimated based on the following equation (Mayne 2014);

$$E' = q_t \cdot 0.5\sqrt{B/s}$$

And the interpretations are shown in Figure 6-2.

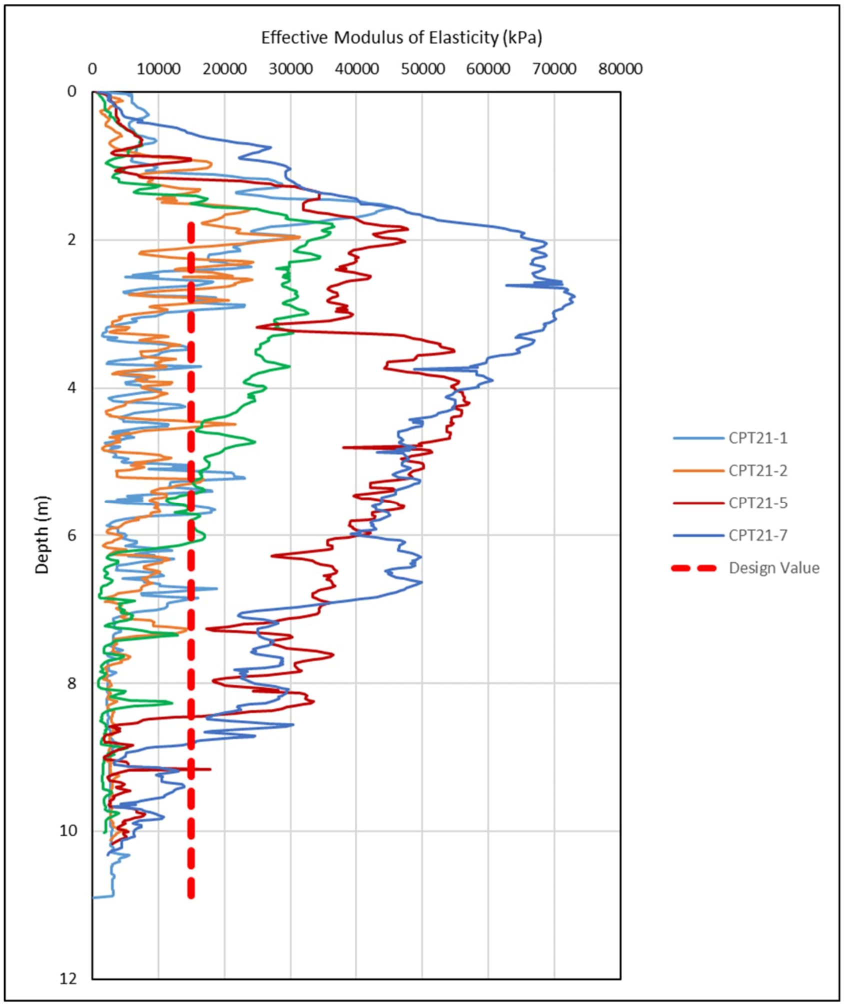

Figure 6-2: Estimation of Effective Modulus of Elasticity

Value of I_s interpolated from Figure 11.1 of the Canadian Foundation Engineering Manual (CFEM) an average value of I_s = 2 based on υ = 0.2 was picked for the drained condition.

Based on the above-mentioned parameters, the following geotechnical resistances can be used for the design.

Table 6-1: Geotechnical Resistance

Footing	ULS (kPa)	SLS (kPa)
Strip Footings (min. 0.75 m wide)	180	90
Spread Footings (1.5 m to 3.0 m shorter side)	210	75

ULS bearing capacities are calculated for footings with a minimum of 1.8 m of soil cover.

6.4.1 Frost Protection

Based on the subsurface investigation results, the encountered sandy silt is of high frost susceptibility. Frost penetration depth is 1.8 m below the surface for the subject site. Frost penetration depth is estimated based on the OPSD 3090.101, Foundation Frost Penetration Depths for Southern Ontario.

All perimeter and exterior foundation elements, or interior foundation elements in unheated areas should be provided with a minimum of 1.8 m of earth cover or equivalent thermal rigid insulation for frost protection purposes.

6.5 Slabs-on-Grade

Slab-on-grades are considered free-floating (not attached to the foundation walls) and should be supported on a minimum of 300 mm of Granular A bedding compacted to 100% SPMDD.

The grading fill, below the slab bedding, can be Granular B Type II material as per the OPSS 1010 and compacted to a minimum of 98% SPMDD.

It is recommended that subgrade preparation and compaction efforts be approved under the supervision of a geotechnical representative.

If for the design of any portions of the slab-on-grade, the modulus of subgrade reaction (k) is required, the following recommendation can be used for structural modeling. The modulus of the subgrade reaction is a multi-function complex correlation that varies with the subgrade material, grade-raise fill material, and the flexural stiffness of the structural slab. However, simplified assumptions were made to estimate the spring modulus for slab-on-grade on compacted Granular A. To estimate the modulus of subgrade reaction, through a simplistic approach, a 2 m square section of the concrete slab-on-grade under the applied loads. Since the modulus of subgrade reaction is needed for the ultimate failure design of the slab, it is assumed the failure can occur at a 25 mm deformation. Considering these assumptions, a subgrade reaction modulus of 20,000 $kN/m^2/m$ can be used for the design of the interior slab-on-grade. This k-value is only valid for the construction of slab-on-grade on compacted Granular A bedding. This value shall not be used for the native subgrade.

6.6 Frost Protection for Slab-on-grade

In the absence of soil cover equal to frost penetration depth, insulation shall be provided below and projected beyond the slabs. The R-value of the insulation should equal 1.8 m of soil cover. The thickness of the insulation material is product-specific. The insulation sheets shall extend beyond the slab in such a way that the summation of the insulation projection and the cover thickness equals 1.8 m.

6.7 Seismic Site Classification

The shear wave velocity profile was interpreted based on seismic waves picked up by geophones built in the CPT cone and the profile for the upper 8 m of the soil is shown in Appendix D.

Seismic site classification is completed based on NBCC (2015) and OBC (2012) Section 4.1.8.4 and Table 4.1.8.4.A. This classification system is based on the average soil properties below the founding level, the site can be classified as Seismic Site Class (D).

Seismic hazard calculations are included in Appendix E.

6.8 Engineered Fill

Footings shall be installed on undisturbed soil. If grade raise is needed OPSS Granular A compacted to a minimum of 100% SPMDD can be used to raise the subgrade over the undisturbed subgrade.

The proposed engineered fill, beyond the footing's influence zone, can be any material conforming to 'Granular' criteria as outlined in OPSS.MUNI 1010. Material conforming to 'Granular' criteria is considered free draining and compactable and can be utilized as the engineered fill. This can apply to the backfill beyond foundation walls and engineered fill in between the footings. The engineered fill shall be compacted to a minimum of 98% SPMDD.

All fill should be placed in horizontal lifts of uniform thickness of no more than 300 mm before compaction at appropriate moisture content determined by the Proctor test. The requirement for fill material and compaction may be addressed with a note on the structural drawing for foundation or grading drawing, and with a Non-Standard Special Provision (NSSP). Any topsoil, organics, or loose sand should be removed before placing engineered fill material.

Please refer to the section 'Construction Considerations' for dewatering needs before placing fill and compaction.

Any 'Granular' fill to be placed over the subgrade, shall be separated from the native sandy silt native soil with a layer of Class II woven geotextile to provide both separation and subgrade support.

6.9 Lateral Earth Pressure

Free-draining material should be used as backfill material for foundation walls. If proper drainage is provided, an "at rest" condition may be assumed for the calculation of earth pressure on foundation walls. The following parameters are recommended for the granular backfill.

Table 6-2: Lateral Pressure parameters for Granular A and B and Horizontal Backfill

Pressure Parameter		Expected Value		
		Granular A	Granular B	Other OPSS1010 'Granular'
Unit Weight (γ) kN/m^3	Above groundwater	22.5	21.7	21.7
	Below groundwater	12.7	11.9	11.9
Angle of Internal Friction (ϕ)		35°	32°	31°
Coefficient of Active Earth Pressure (k_a)		0.27	0.31	0.32
Coefficient of Passive Earth Pressure (k_p)		3.69	3.23	3.12
Coefficient of Earth Pressure at Rest (k_o)		0.43	0.47	0.48

The native sandy silt is not suitable for backfilling foundation walls.

7.0 PAVEMENT AND HARD SURFACING

7.1 Flexible Pavement

For the majority of the site, the pavement structure is most likely to be placed on engineered fill material overlaying the native soil.

The pavement structure proposed in this design considers the relatively high traffic volume of truck traffic, moving trailers, and passenger vehicles which is included in Table 7-1.

Table 7-1: Heavy and Light Duty Pavement Structures

Material		Thickness (mm)	
		Heavy duty	Light duty
Surface	Superpave 12.5 mm, PG 58-34	40	50
Binder	Superpave 19 mm, PG 58-34	50	--
Base	OPSS Granular A	150	150
Sub-base	OPSS Granular B Type II	500	450

The base and sub-base materials, i.e., Granular A for the base and Granular B Type II for sub-base, shall be in accordance with OPSS.MUNI 1010. Both base and sub-base should be compacted to 100% SPMDD. Asphalt layers should be compacted to comply with OPSS 310. All compactions are to be in accordance with the City of Ottawa specifications D-029.

The light duty pavement is expected to render a lower quality performance and it is only recommended for the passenger car parking areas or those areas with low truck traffic. Identification of light-duty traffic needs is beyond the scope of this geotechnical report, and it is the site designers' responsibility.

7.2 Gravel Road Surface

For the majority of the site, the gravel road structure is most likely to be placed on engineered fill material overlaying the native soil.

The heavy-duty gravel road structure proposed in this design considers the relatively high traffic volume of the truck traffic including fire trucks, moving trailers, and passenger vehicles which is included in Table 7-2. In contrast, the light-duty gravel road structure is expected to render a lower quality performance and it is only recommended for the passenger car parking areas or those areas with low truck traffic. Identification of light-duty traffic needs is beyond the scope of this geotechnical report, and it is the site designers' responsibility.

Table 7-2: Gravel Road Structures

Material		Thickness (mm)	
		Heavy duty	Light duty
Base	OPSS Granular A	200	150
Sub-base	OPSS Granular B Type II	500	400

The base and sub-base materials, i.e., Granular A for the base and Granular B Type II for sub-base, shall be in accordance with OPSS.MUNI 1010. Both base and sub-base should be compacted to 100% SPMDD. All compactions to be in accordance with the City of Ottawa specifications D-029.

7.3 Sidewalks and Hard Surfacing

The width and extent of the sidewalks will be defined as per the architectural drawings. The designer shall provision adequate slope, based on applicable codes, to provide appropriate runoff discharge. Sidewalks can be categorized under residential/commercial use.

The City of Ottawa SC4 'Typical Concrete Sidewalk in Boulevard' standard is recommended for the construction of the concrete sidewalk. Expansion, construction, and dummy joints shall be spaced per the City of Ottawa standards SC5 'Sidewalk Construction Joints' and SC14 'Sidewalk Joints'. A minimum of 150 mm bedding of OPSS Granular 'A' compacted to 100% SPMDD is required for the concrete sidewalk panels.

All proposed new curbs shall be constructed as per applicable standards. It is recommended to follow City of Ottawa detail provided in SC1.4 'Concrete Barrier Curb with Sidewalk'. Curbs should receive a minimum of 150 mm Granular ‘A’ bedding compacted to 100% SPMDD on a proof rolled subgrade that is free from soft, loose, and organic materials.

If interlocking concrete pavers are selected for the design, the concrete pavers should meet the requirements of ASTM C936. The concrete pavers used for walkways (no vehicle traffic) should be placed on a minimum of 25 mm sand bedding which should meet the gradation requirements for concrete sand as described in CSA A23.2-04, Section 4.2.3.3. Below the sand, a minimum of 300 mm OPSS Granular ‘A’ compacted to 100% SPMDD should be provided.

7.4 Cement Type and Corrosion Potential

Two soil sample was submitted to Parcel laboratories for testing of chemical properties relevant to exposure of concrete elements to sulphate attacks as well as potential soil corrosivity effects on buried metallic structural elements. Test results are presented in Table 5-1 and included in Appendix C.

The potential for sulphate attack on concrete structures is moderate to low. Therefore, Type GU Portland cement may be adequate to protect buried concrete elements in the subsurface conditions encountered.

Based on electrical resistivity results and chloride content, the corrosion potential for buried steel elements is within the nonaggressive range. The designers are encouraged to review the chemical test results and make conclusions based on the material used in their design.

8.0 CONSTRUCTION CONSIDERATIONS

Any organic material and loose sand of any kind should be removed from the footprint of the footings and all structurally load-bearing elements. Site preparation and requirements of engineered fill placement are noted in previous sections. Refer to relevant sections for material and compaction requirements.

As noted in the previous sections, all grade adjustments due to over-excavation, within the shallow footing influence zone, shall be done using OPSS Granular A compacted to a minimum of 100% SPMDD.

The constructors should be mindful of the high groundwater table. The groundwater table shall be lowered below the subgrade by a minimum of 0.6 m before starting any compaction work. Otherwise, achieving compaction targets will not be possible in the presence of high groundwater table. Once minimum dewatering is achieved, compaction shall be done using a small diesel plate to minimize penetration of compaction energy below the subgrade.

Alternatively, over-excavation can be compensated by placing lean concrete of minimum 15 MPa mature strength.

Foundation walls should be backfilled with free-draining material with granular material conforming to OPSS 1010 Granular criteria. The native soil is not suitable for backfill due to its high fine content.

A geotechnical engineer or technician should attend the site to confirm the native subgrade, type of fill material, and level of compaction. All bearing surfaces should be inspected by experienced geotechnical personnel prior to placing the footings to ensure the excavated subgrade it as the reported and recommended condition.

9.0 GROUNDWATER SEEPAGE

The groundwater is expected at shallow depths below the existing subgrade. Hydraulic conductivity is expected to be relatively high due to high sand content. Dewatering shall be carefully planned before the start of construction.

Under the new regulations (O.Reg 63/16 and O.Reg 387/04), a Permit To Take Water (PTTW) is required from the Ministry of the Environment, Conservation, and Parks (MOECP) if a volume of water greater than 400,000 liters per day is pumped from the excavation under normal operation, but less than 50,000 liters per day, the water taking will not require a PTTW, but will need to be registered in the EASR as a prescribed activity. Based on the observed soil and groundwater conditions, a PTTW is very likely needed.

The design of the dewatering system should be the responsibility of the contractor. An outlet(s) should be identified, which the contractor can use to dispose of the pumped groundwater and incident precipitation. It is recommended the contractor should perform a hydraulic conductivity test of their own to satisfy their proposed dewatering plan.

10.0 SITE SERVICES

At the subject site, the burial depth of water-bearing utility lines is typically 2.2 m below the ground surface. If this depth is not achievable, equivalent thermal insulation should be provided. The contractor should retain a professional engineer to provide detailed drawings for excavation and temporary support of the excavation walls during construction.

Excavation will proceed through the topsoil and native sandy silt. Excavating of overburden soil shall be performed using conventional hydraulic excavating equipment. Cobbles or boulders larger than 300 mm in diameter, if encountered, should be removed from the side slopes for worker safety.

The Occupational Health and Safety Act (OHSA) of Ontario indicated that side slopes in the sandy silt could be classified as Type 4 soil and sloped no steeper than 3H:1V or be shored. If space restrictions exist, the excavations can be carried out within trench boxes, which are fully braced to resist lateral earth pressure. A dewatering program to a depth below the target excavation shall be carried out before excavation.

Due to the potential for long-term settlement of topsoil and organic materials and the effects of this settlement on service lines sensitive to level change, the existing topsoil, and organic materials are not considered suitable for the support of site services. Utilities should be supported on a minimum of 150 mm bedding of Granular A compacted to a minimum of 98% of SPMDD. Utility cover can be Granular A or Granular B type II compacted to 96% SPMDD. All covers are to be compacted to 100% SPMDD if they are intersecting structural elements. The engineer designing utilities shall ensure the proposed utility pipes can tolerate compaction loads. Due to the presence of excessive silt content, the utility bedding shall be separated from the native subgrade by a layer of filter geotextile.

11.0 CLOSURE

We trust this geotechnical investigation report meets the requirements of your project. The "Limitations of Report" presented in Appendix F are an integral part of this report. Please contact the undersigned should you have any questions or concerns.

McIntosh Perry Consulting Engineers Ltd.

Mizral Hameem, B.Eng. EIT
Engineering Intern

N'eem Tavakkoli, M.Eng., P.Eng.
Senior Geotechnical Engineer

REFERENCES

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2) Ontario Ministry of Natural Resources (OMNR), Ontario Geological Survey, Special Volume 2, "The Physiography of Southern Ontario", 3rd Edition, 1984.

3) Google Earth, Google, 2015.

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5) Canadian Standards Association (CSA), "Concrete Materials and Methods of Concrete Construction", A23.1, 2009

6) Government of Ontario, "Ontario Building Code (OBC)," (online), 2012.

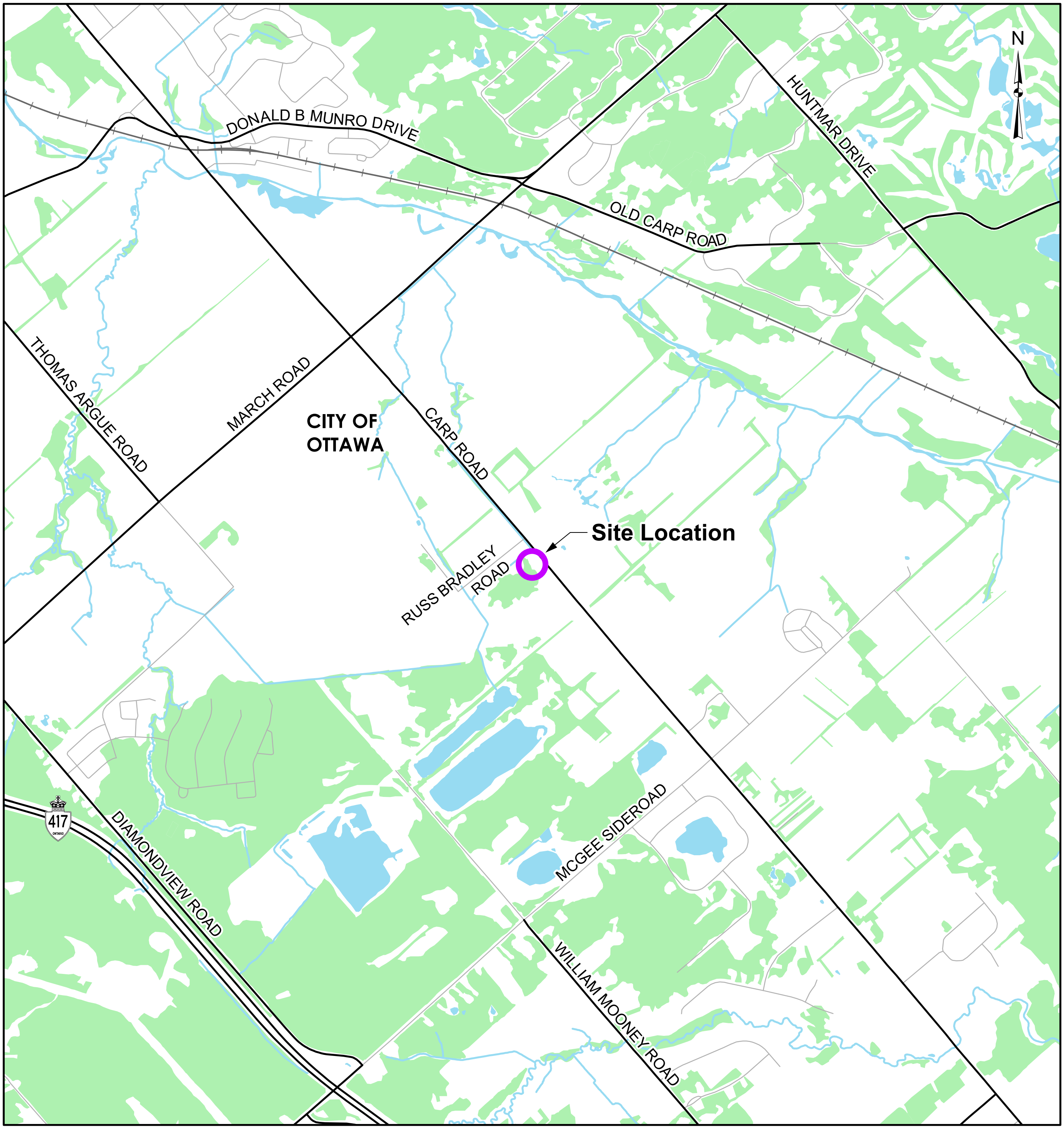
7) MTO – Pavement Design and Rehabilitation Manual

8) Natural Resources Canada – Seismic Hazard Calculator

MINI-STORAGE - CARP, ONTARIO

APPENDIX A
PLANS

MCINTOSH PERRY



LEGEND

- Site Location
- Local Road
- Major Road
- Railroad
- Watercourse
- Waterbody
- Wooded Area

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2021.

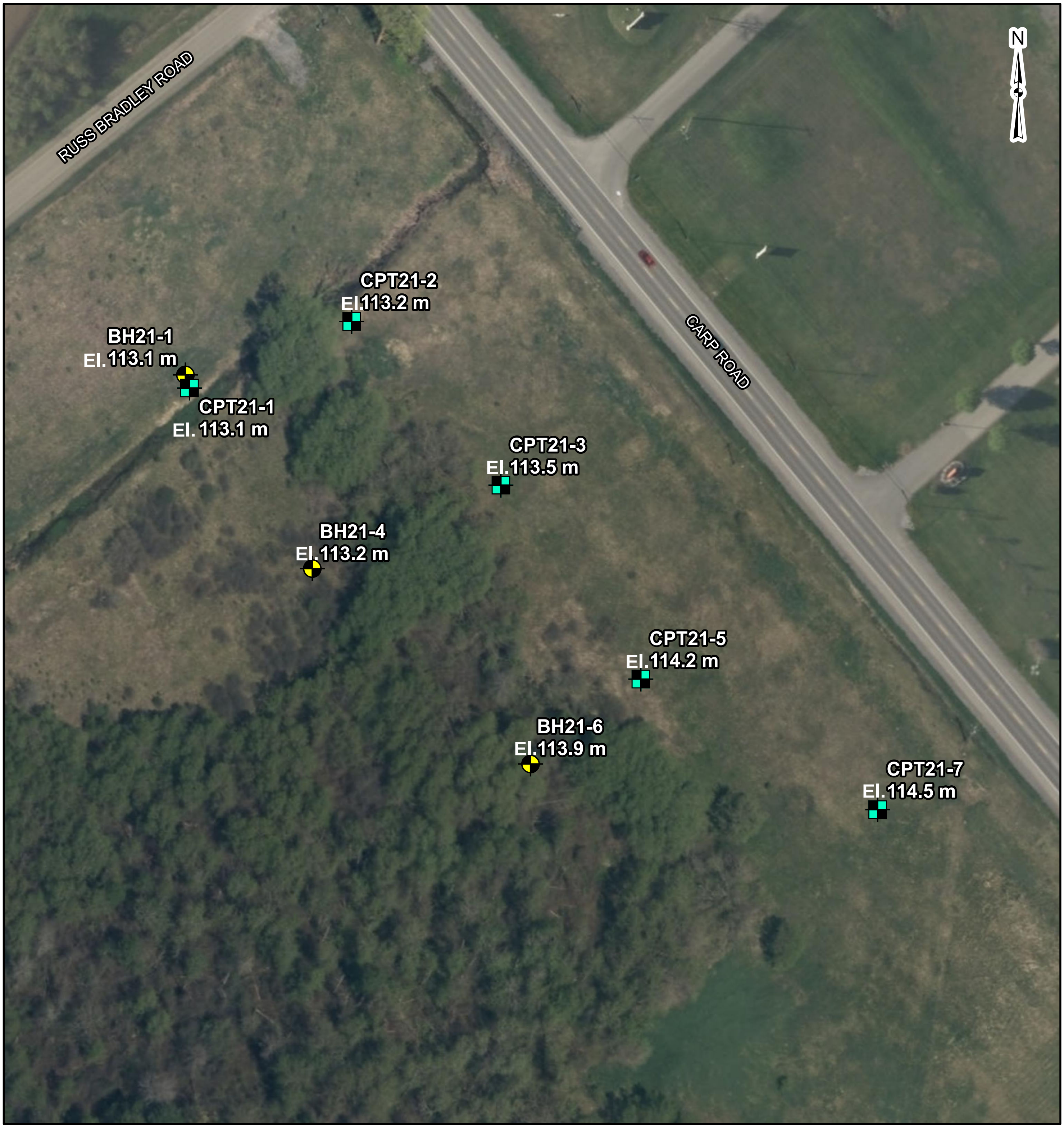
CLIENT: TREVOR WATKINS

PROJECT: GEOTECHNICAL INVESTIGATION RUSS BRADLEY ROAD, CARP, ON

TITLE: SITE LOCATION

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CCO-22-1643
Date	Nov., 18, 2021
GIS	EU
Checked By	MM
FIGURE:	1



40 20 0 40

Scale 1:1,250 Metres

LEGEND

- Borehole Location
- CPT Location

CLIENT:	TREVOR WATKINS
PROJECT:	GEOTECHNICAL INVESTIGATION RUSS BRADLEY ROAD, CARP, ON
TITLE:	BOREHOLE AND CPT LOCATION

McINTOSH PERRY 115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com	PROJECT NO:CCO-22-1643		FIGURE: 2
	Date	Dec., 14, 2021	
	GIS	EU	
	Checked By	MM	

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2021.

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MINI-STORAGE - CARP, ONTARIO

APPENDIX B

CPT AND BOREHOLE LOGS

McINTOSH PERRY

EXPLANATION OF TERMS USED IN REPORT

N-VALUE: THE STANDARD PENETRATION TEST (SPT) N-VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5 kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N-VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N-VALUE IS DENOTED THUS $\overline{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

C_u (kPa)	0 – 12	12 – 25	25 – 50	50 – 100	100 – 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 – 5	5 – 10	10 – 30	30 – 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSION AND STRUCUTRAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY IS:

RQD (%)	0 – 25	25 – 50	50 – 75	75 – 90	90 – 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINT AND BEDDING:

SPACING	50mm	50 – 300mm	0.3m – 1m	1m – 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_l, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ε	%	LINEAR STRAIN
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICALL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
c_c	1	COMPRESSION INDEX
c_s	1	SWELLING INDEX
c_a	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
Φ'	$-^o$	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
Φ_u	$-^o$	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = c_u / τ_r

PHYSICAL PROPERTIES OF SOIL

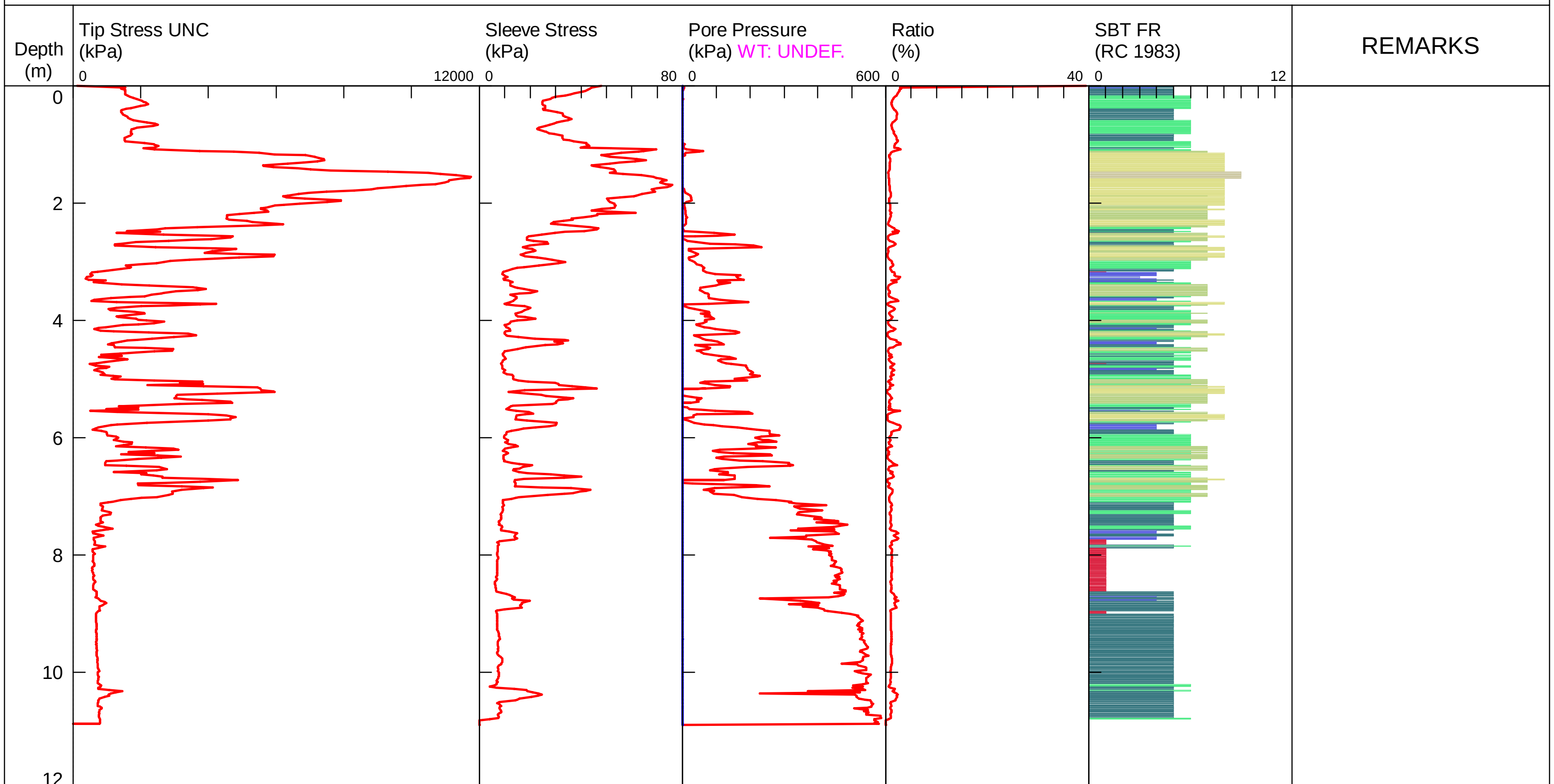
ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1,%	VOID RATIO	e_{min}	1,%	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1,%	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1,%	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	s_r	%	DEGREE OF SATURATION	D_n	mm	N PERCENT – DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_P	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_P	%	PLASTICITY INDEX = $(W_L – W_L)$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $(W – W_P)/ I_P$	i	1	HYDAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $(W_L – W) / 1_P$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERED SOIL	$e_{,max}$	1,%	VOID RATIO IN LOOSEST STATE	j	kN/m^3	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

SOUNDING

McINTOSH PERRY

TOTAL DEPTH: 10.902 m
SITE: 273 Russ Bradley
SOUNDING
COMPANY: McIntosh Perry Consulting Engineers
FILENAME: CPT21-1_clamp_PD.DAT

PROBE ID: 46244.153XX
TEST ID: CPT21-1
PROJECT: CCO-22-1643
LOCATION: Carp, ON



SOUNDING

1	sensitive fine grained
2	organic material
3	clay
4	silty clay to clay
5	clayey silt to silty clay
6	sandy silt to clayey silt
7	silty sand to sandy silt
8	sand to silty sand
9	sand
10	gravelly sand to sand
11	very stiff fine grained (*)
12	sand to clayey sand (*)

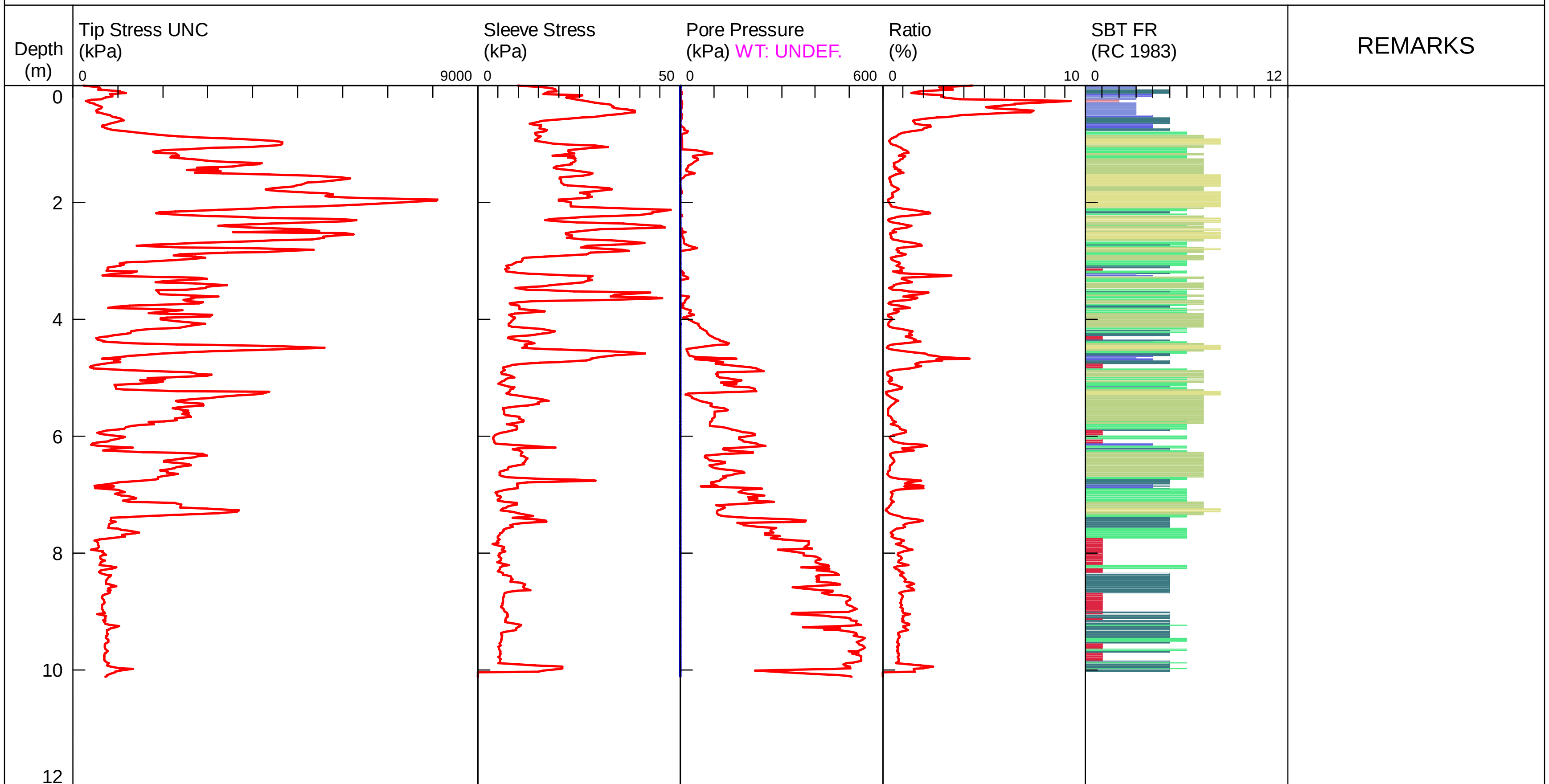
*SBT/SPT CORRELATION: UBC-1983

SOUNDING

McINTOSH PERRY

TOTAL DEPTH: 10.120 m
SITE: 273 Russ Bradley
SOUNDING
COMPANY: McIntosh Perry Consulting Engineers
FILENAME: CPT21-2_clamp_PD.DAT

PROBE ID: 4644.153XX
TEST ID: CPT21-2
PROJECT: CCO-22-1643
LOCATION: Carp, ON



SOUNDING

1	sensitive fine grained
2	organic material
3	clay
4	silty clay to clay
5	clayey silt to silty clay
6	sandy silt to clayey silt
7	silty sand to sandy silt
8	sand to silty sand
9	sand
10	gravelly sand to sand
11	very stiff fine grained (*)
12	sand to clayey sand (*)

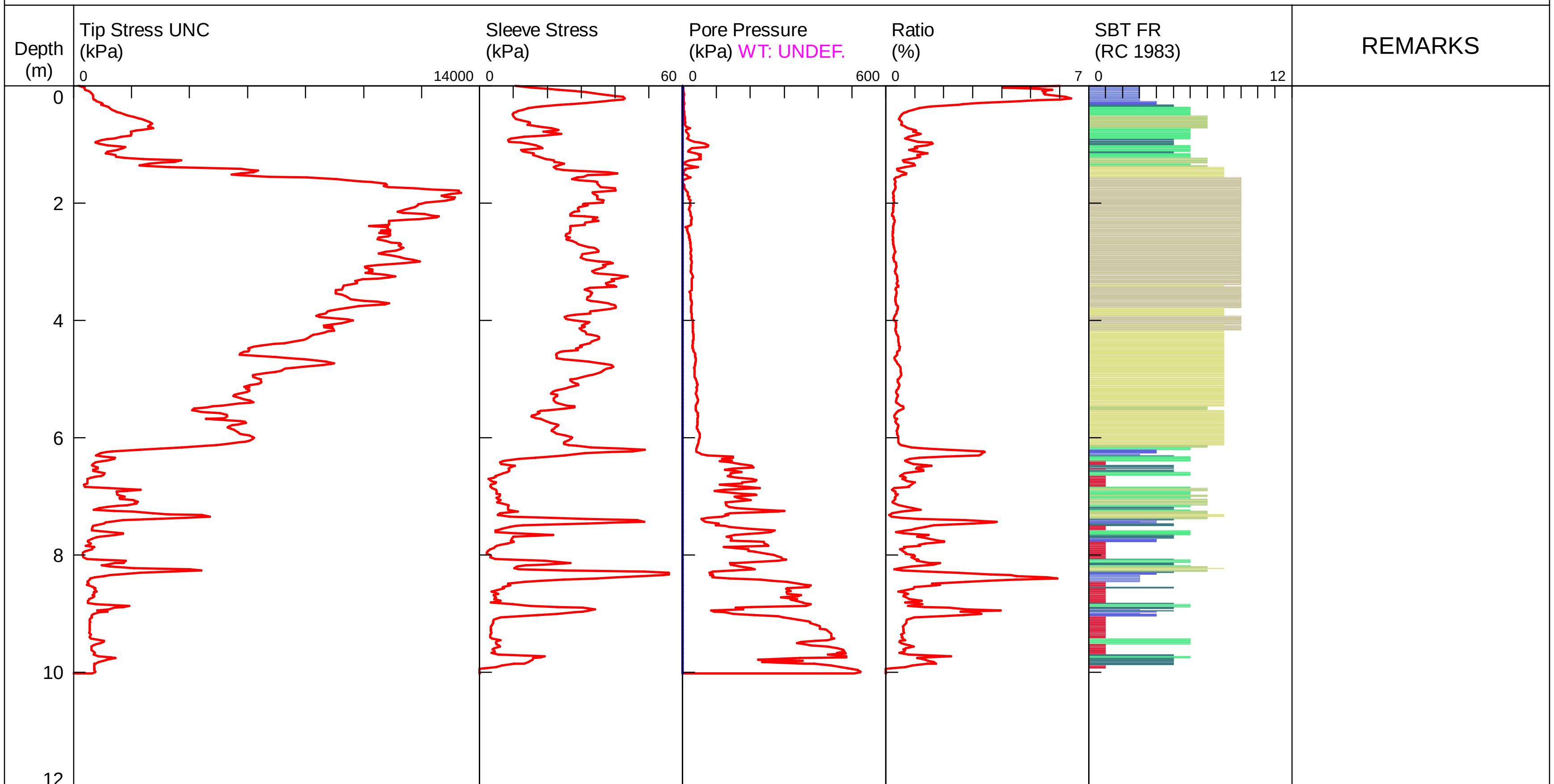
*SBT/SPT CORRELATION: UBC-1983

SOUNDING

McINTOSH PERRY

TOTAL DEPTH: 10.022 m
SITE: 273 Russ Bradley
SOUNDING
COMPANY: McIntosh Perry Consulting Engineers
FILENAME: CPT21-3_PD.DAT

PROBE ID: 4644.153XX
TEST ID: CPT21-3
PROJECT: CCO-22-1643
LOCATION: Carp, ON



SOUNDING

- 1 sensitive fine grained
- 2 organic material
- 3 clay
- 4 silty clay to clay
- 5 clayey silt to silty clay
- 6 sandy silt to clayey silt
- 7 silty sand to sandy silt
- 8 sand to silty sand
- 9 sand
- 10 gravelly sand to sand
- 11 very stiff fine grained (*)
- 12 sand to clayey sand (*)

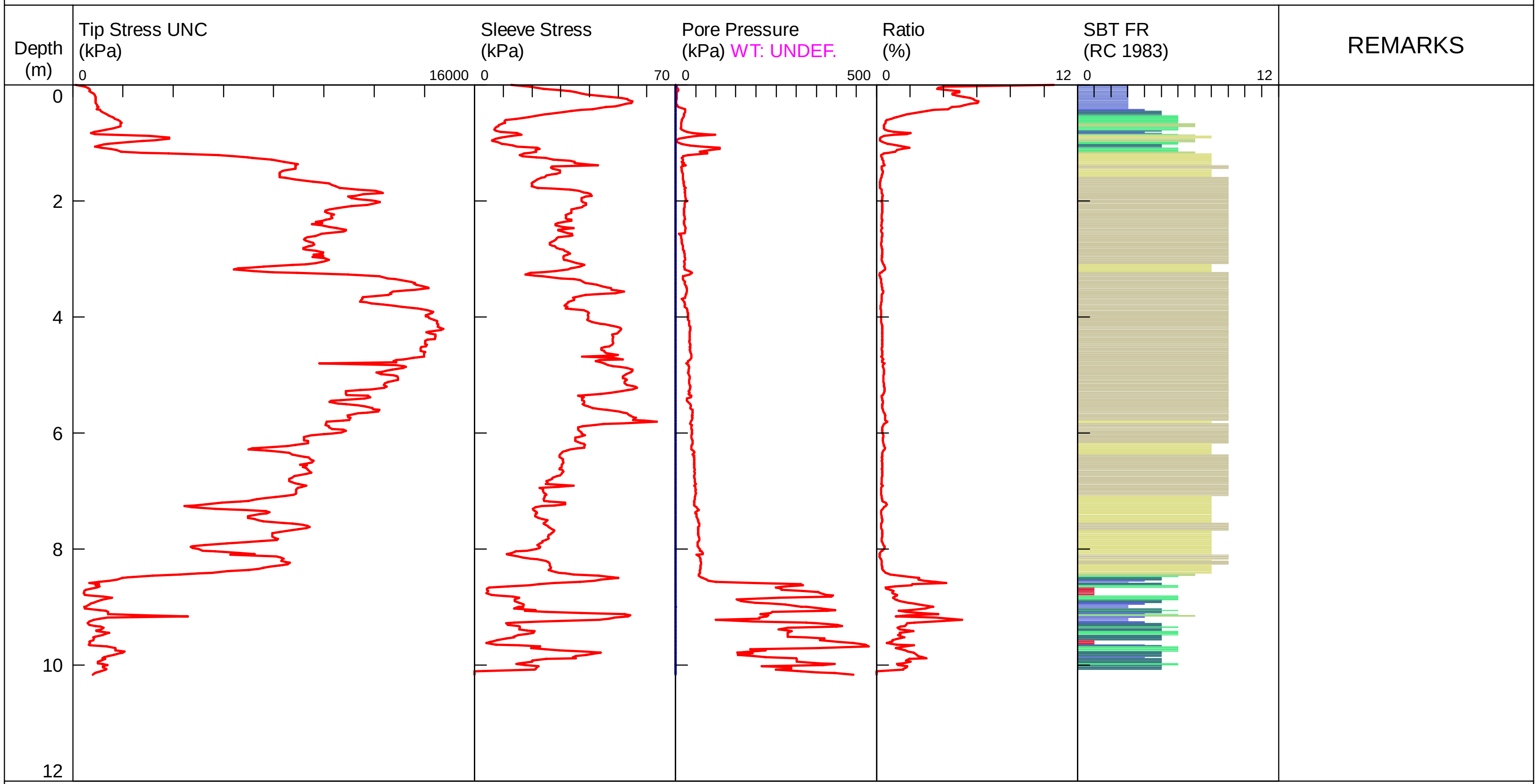
*SBT/SPT CORRELATION: UBC-1983

SOUNDING

McINTOSH PERRY

TOTAL DEPTH: 10.172 m
SITE: 273 Russ Bradley
SOUNDING
COMPANY: McIntosh Perry Consulting Engineers
FILENAME: CPT21-5_PD.DAT

PROBE ID: 4644.153XX
TEST ID: CPT21-5
PROJECT: CCO-22-1643
LOCATION: Carp, ON



SOUNDING

1	sensitive fine grained
2	organic material
3	clay
4	silty clay to clay
5	clayey silt to silty clay
6	sandy silt to clayey silt
7	silty sand to sandy silt
8	sand to silty sand
9	sand
10	gravelly sand to sand
11	very stiff fine grained (*)
12	sand to clayey sand (*)

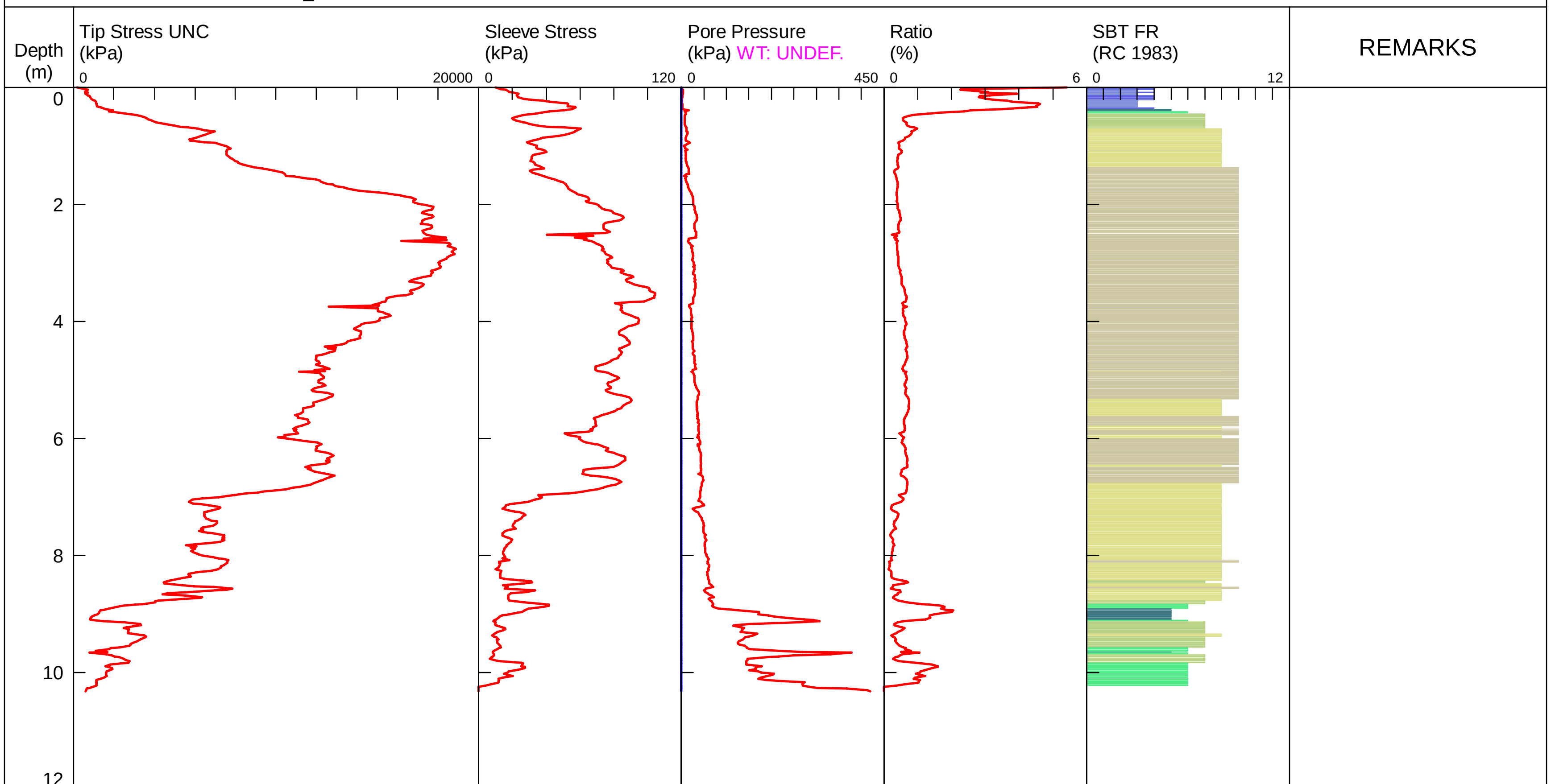
*SBT/SPT CORRELATION: UBC-1983

SOUNDING

McINTOSH PERRY

TOTAL DEPTH: 10.325 m
SITE: 273 Russ Bradley
SOUNDING
COMPANY: McIntosh Perry Consulting Engineers
FILENAME: CPT21-7_PD.DAT

PROBE ID: 4644.153XX
TEST ID: CPT21-7
PROJECT: CCO-22-1643
LOCATION: Carp, ON



SOUNDING

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

PROJECT NO.: CCO-22-1643
PROJECT: Outdoor Mini Storage
CLIENT: Trevor Watkins
PROJECT LOCATION: 273/275 Russ Bradley

DRILLING DATA
Date: Nov-10-2021
Method: Hollow Stem Auger
Diameter: 200 mm
BH Location: N 5020533 E 343147

BH No: BH21-1 MW
DATUM: MTM zon 9
ENCL NO.: 1

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	WATER CONTENT (%)	Remarks and Grain Size Distribution (%) GR SA SI CL
113.1 / 0.0	Natural ground surface					113		
0.0	**Sand**, some gravel, trace cobbles, dark brown, loose, moist, organic. [Topsoil]	1	SS	6	W. L. 112.9 m Dec 02, 2021			WL @ 0.22 m BGS on 2021-11-17; WL @ 0.25 m BGS on 2021-12-02
112.4 / 0.7	**Sandy Silt**, trace Clay, grey, soft, wet.	2	SS	5		112	24	0 38 45 17
		3	SS	11			19	WL @ 0.5 m BGS on 2021-11-11
		4	SS	6		111	20	0 38 53 9
	Sandy Silt, trace clay.	5	SS	5		110	22	WL @ 2.9 m BGS on 2021-11-10
		6	SS	2		109	22	0 42 48 10
	Sandy Silt, trace clay.	7	SS	2		108	24	
107.6 / 5.5	**Silt**, some sand, trace clay, grey, soft, wet.	8	SS	3			24	0 27 59 14
		9	SS	3		107	22	
106.4 / 6.7	**END OF BOREHOLE** G.W @ 2.9 m BGS BH terminated at planned depth: 6.7 m BGS							

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80
SHEAR STRENGTH (kPa): + Field. Shear Vane & Sensitivity; ● Quick Triaxial; ○ Unconfined: 20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40 50 60 70 80 90
Unit Weight (kN/m³); Pocket Penetro. (kPa)

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ $^{\varepsilon}$=3% Strain at Failure

PROJECT NO.: CCO-22-1643
PROJECT: Outdoor Mini Storage
CLIENT: Trevor Watkins
PROJECT LOCATION: 273/275 Russ Bradley

DRILLING DATA
Date: Nov-11-2021
Method: Hollow Stem Auger
Diameter: 200 mm
BH Location: N 5020489 E 343139

BH No: BH21-4
DATUM: MTM zon 9
ENCL NO.: 2

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
113.2	Natural ground surface
0.0	**Sand**, gravel, trace cobbles, dark brown, loose, dry. [Topsoil]
112.5 / 0.7	**Silty Sand**, trace caly, grey, moist to wet, soft.
	Silty Sand, trace clay.
109.1 / 4.1	**Sandy Silt**, trace clay, grey, wet, loose.
106.5 / 6.7	**END OF BOREHOLE**

G.W. @ 2.9 m BGS
BH terminated at planned depth: 6.7 m BGS

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m	Natural Moisture Content w (%)	Remarks and Grain Size Distribution (%) GR SA SI CL
1	SS	4		
2	SS	8	21	
3	SS	10	20	0 46 43 11
4	SS	6	21	
5	SS	3	21	
6	SS	4	21	0 41 49 10
7	SS	4	23	
8	SS	4	26	
9	SS	2	24	

GROUND WATER CONDITIONS: W. L. 110.3 m Nov 10, 2021

Remarks: G.W @ 2.9 m BGS

ELEVATION: 113, 112, 111, 110, 109, 108, 107
DEPTH: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80
SHEAR STRENGTH (kPa): + Field. Shear Vane & Sensitivity; ● Quick Triaxial; ○ Unconfined: 20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40 50 60 70 80 90
Unit Weight (kN/m³); Pocket Penetro. (kPa)

GRAPH NOTES: +³, ×³: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT NO.: CCO-22-1643
PROJECT: Outdoor Mini Storage
CLIENT: Trevor Watkins
PROJECT LOCATION: 273/275 Russ Bradley

DRILLING DATA
Date: Nov-10-2021
Method: Hollow Stem Auger
Diameter: 200 mm
BH Location: N 5020445 E 343190

BH No: BH21-6
DATUM: MTM zon 9
ENCL NO.: 3

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	WATER CONTENT (%)	Remarks and Grain Size Distribution (%) GR SA SI CL
113.9 / 0.0	Natural ground surface							
113.7 / 0.0	**Sand**, gravel, some cobbles, dark brown, loose, damp.							
0.2	**Silty sand**, trace clay, grey, soft, moist to wet.	1	SS	3				G.W. @ 1.17 m BGS
		2	SS	5	∇ W. L. 112.7 m Nov 10, 2021	113		
112.6 / 1.3	**Sand**, trace silt, trace gravel, brown to grey, compact to loose, wet.	3	SS	13		112		5 89 (6)
		4	SS	9				
		5	SS	11		111		
	Sand, trace silt, trace gravel.	6	SS	6		110		1 95 (4)
		7	SS	7		109		
	Sand, trace silt, trace gravel.	8	SS	8		108		1 97 (3)
		9	SS	3			20	
107.2 / 6.7	**END OF BOREHOLE** G.W. @ 1.17 m BH terminated at planned depth: 6.7 m BGS							

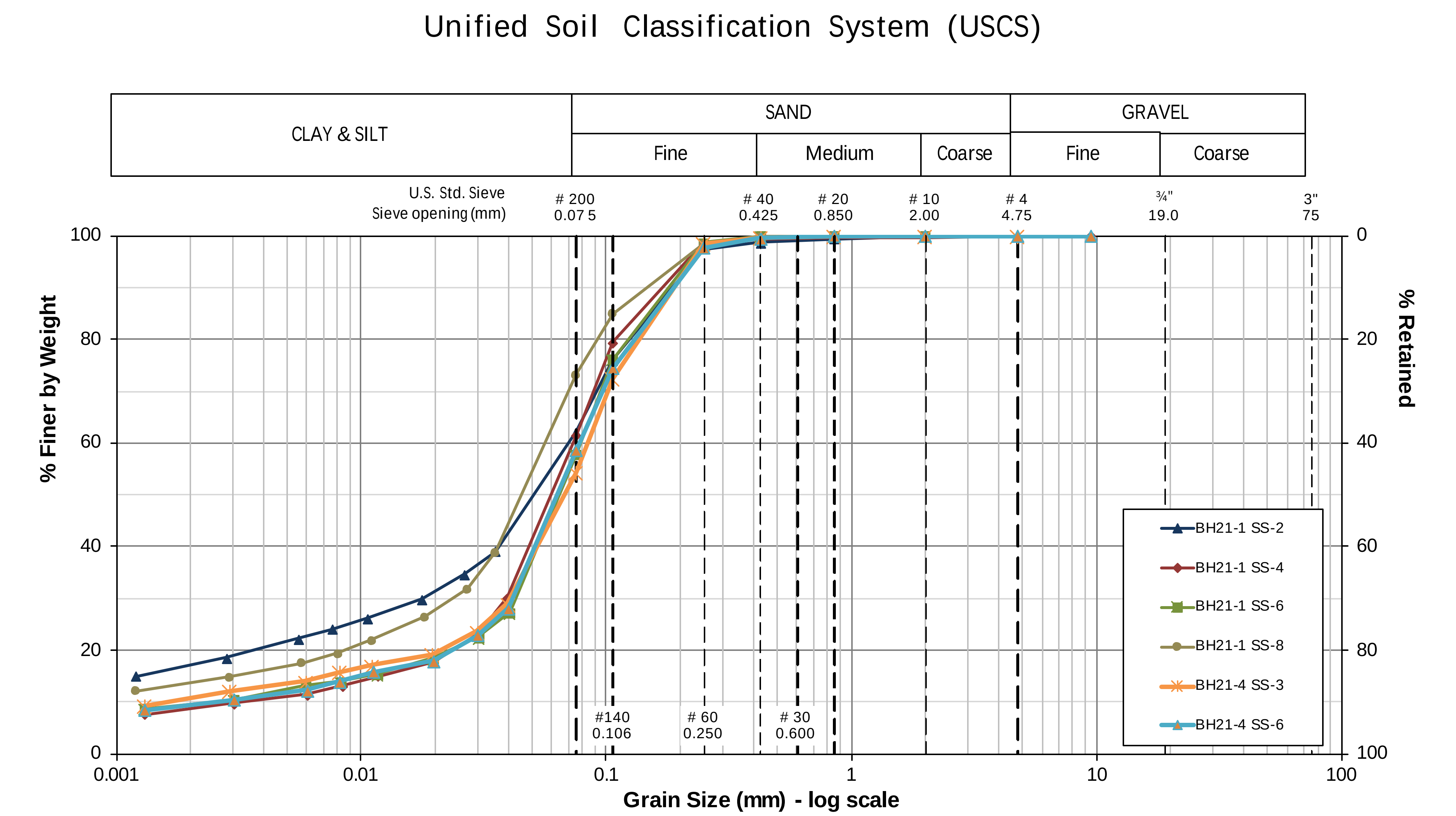
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80
SHEAR STRENGTH (kPa): + Field. Shear Vane & Sensitivity; ● Quick Triaxial; ○ Unconfined: 20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40 50 60 70 80 90
Unit Weight (kN/m³), Pocket Penetro. (kPa)

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

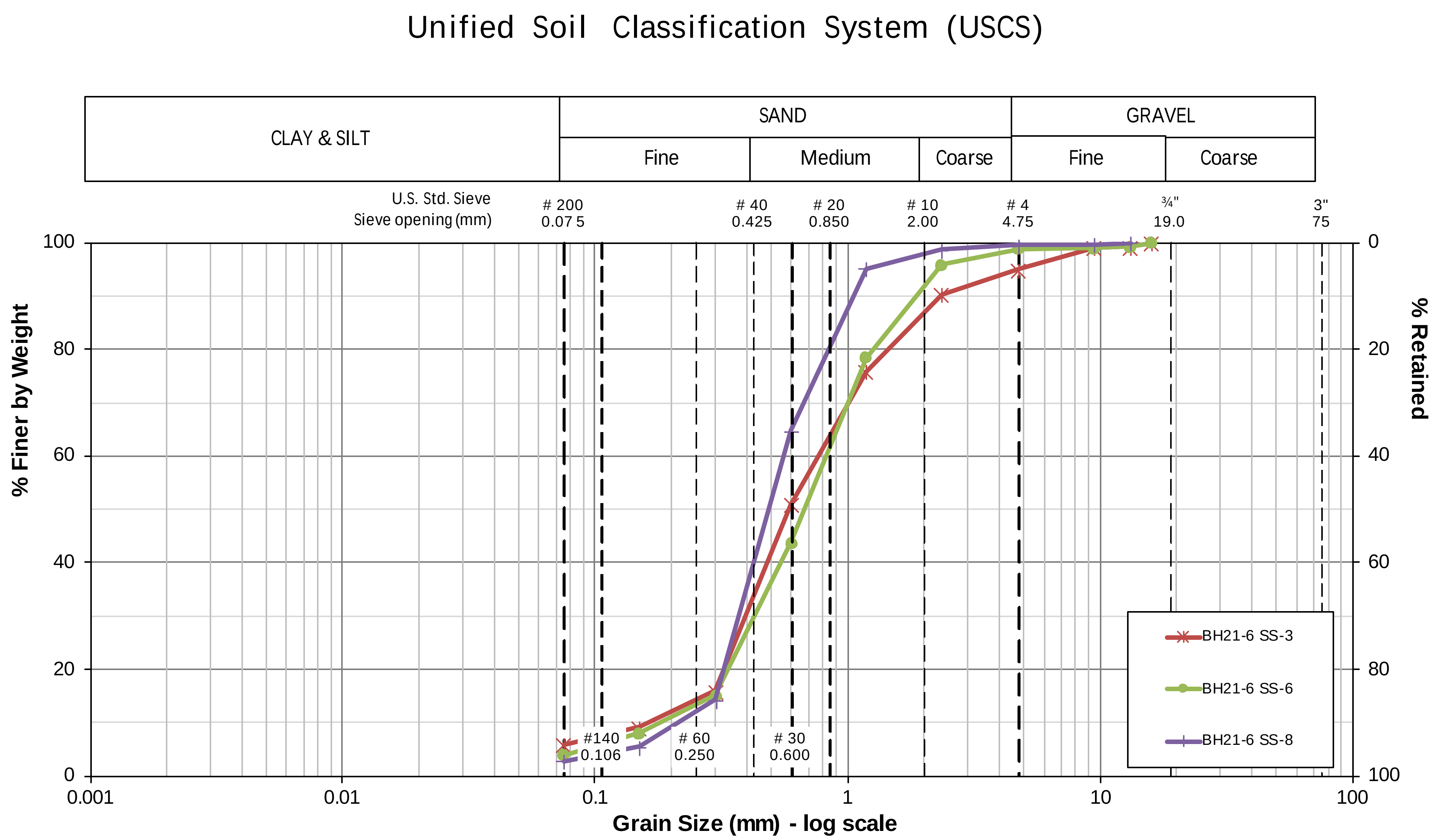
MINI-STORAGE - CARP, ONTARIO

APPENDIX C
LABORATORY TEST RESULTS

McINTOSH PERRY



McINTOSH PERRY	Grain-Size Distribution Curve	Figure No. 3
	Sandy Silt	
	Mini-Storage - Russ Bradley - Carp - ON.	CCO-22-1643



MCINTOSH PERRY

Grain-Size Distribution Curve	Figure No. 4
Sand	
Mini-Storage - Russ Bradley - Carp - ON.	CCO-22-1643

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Certificate of Analysis

McIntosh Perry Consulting Eng. (Nepean)

215 Menten Place, Unit 104
Nepean, ON K2H 9C1
Attn: Jason Hopwood-Jones

Client PO: CC0-22-1643
Project: Russ Bradley
Custody: 128766

Report Date: 29-Nov-2021
Order Date: 22-Nov-2021

Order #: 2148086

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

Paracel ID	Client ID
2148086-01	Borehole 21-1 SS-3
2148086-02	Borehole 21-4 SS-3

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	25-Nov-21	26-Nov-21
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	23-Nov-21	24-Nov-21
Resistivity	EPA 120.1 - probe, water extraction	26-Nov-21	26-Nov-21
Solids, %	Gravimetric, calculation	24-Nov-21	25-Nov-21

Certificate of Analysis

Client: McIntosh Perry Consulting Eng. (Nepean)

Client PO: CC0-22-1643

Report Date: 29-Nov-2021

Order Date: 22-Nov-2021

Project Description: Russ Bradley

	Client ID:	Borehole 21-1 SS-3	Borehole 21-4 SS-3	-	-
	Sample Date:	10-Nov-21 08:30	11-Nov-21 08:30	-	-
	Sample ID:	2148086-01	2148086-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	87.0	83.6	-	-
General Inorganics					
pH	0.05 pH Units	7.87	7.83	-	-
Resistivity	0.10 Ohm.m	94.6	45.3	-	-
Anions					
Chloride	5 ug/g dry	8	6	-	-
Sulphate	5 ug/g dry	10	148	-	-

Method Quality Control: Blank

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

Certificate of Analysis

Client: **McIntosh Perry Consulting Eng. (Nepean)**

Client PO: **CC0-22-1643**

Report Date: 29-Nov-2021

Order Date: 22-Nov-2021

Project Description: Russ Bradley

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	6.8	5	ug/g dry	6.7			1.3	20	
Sulphate	6.80	5	ug/g dry	7.05			3.7	20	
General Inorganics									
pH	7.55	0.05	pH Units	7.59			0.5	2.3	
Resistivity	21.2	0.10	Ohm.m	21.0			0.9	20	
Physical Characteristics									
% Solids	85.5	0.1	% by Wt.	86.7			1.3	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	97.5	5	ug/g	6.7	90.8	82-118			
Sulphate	95.7	5	ug/g	7.05	88.6	80-120			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

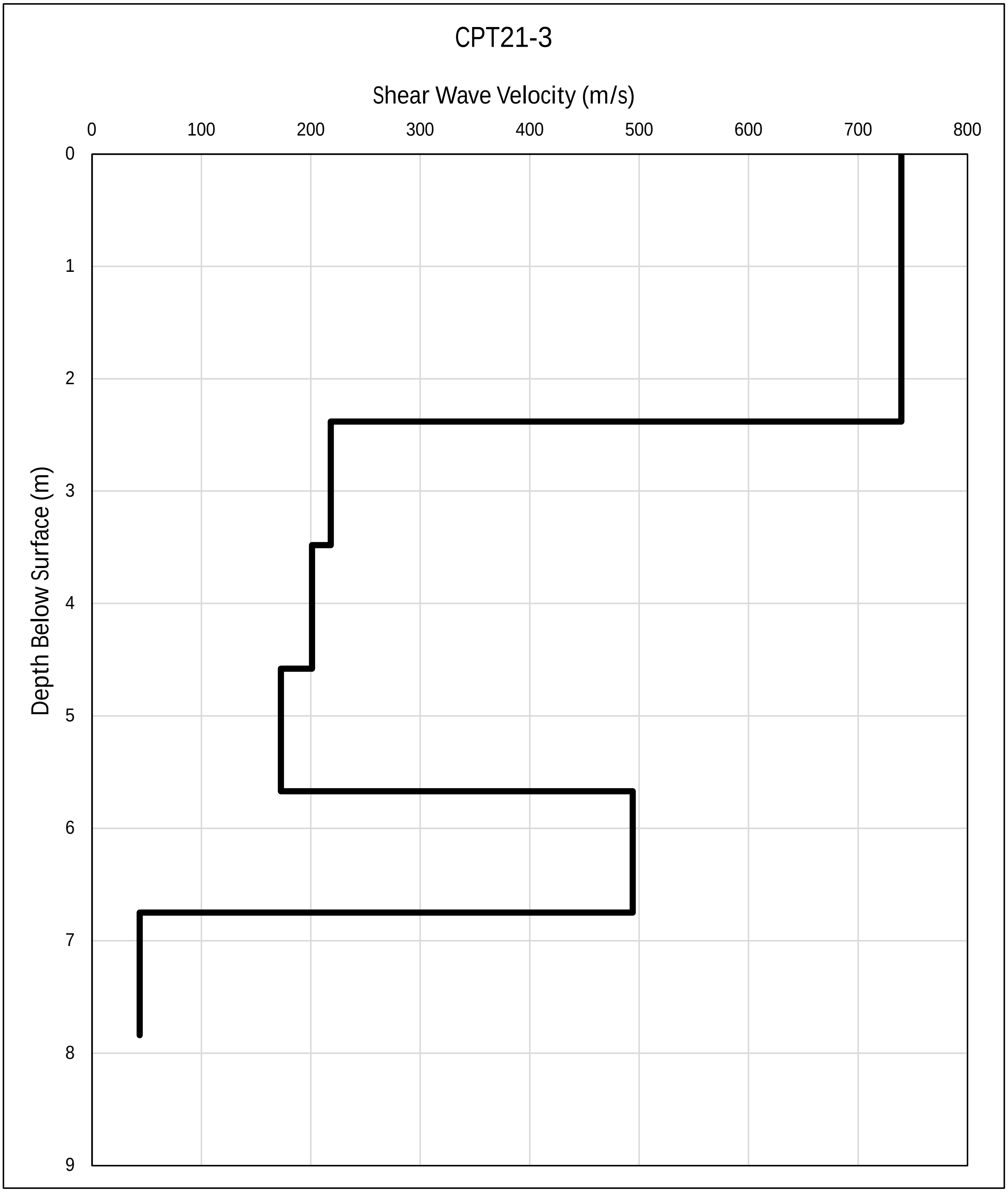
Other Report Notes:

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 when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

MINI-STORAGE - CARP, ONTARIO

APPENDIX D
SHEAR WAVE VELOCITY PROFILE



Shear Wave Velocity Profile	Project Name:	Russ Bradley
	Project Number:	CCO-22-1643
McINTOSH PERRY	Probe Number:	CPT21-3
	Ground Elevation:	113.5
	Date Tested:	10-Nov-21

APPENDIX E
SEISMIC HAZARD CALCULATION

2010 National Building Code Seismic Hazard Calculation

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

Site: 45.323N 76.013W **User File Reference:** 273 Russ Bradley, Carp, ON. 2021-12-21 14:24 UT

Requested by: McIntosh Perry Consulting Engineers Ltd.

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.2)	0.615	0.374	0.238	0.084
Sa (0.5)	0.297	0.179	0.118	0.041
Sa (1.0)	0.133	0.085	0.054	0.017
Sa (2.0)	0.045	0.027	0.017	0.006
PGA (g)	0.314	0.194	0.117	0.035

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

References

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

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

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

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

MINI-STORAGE - CARP, ONTARIO

APPENDIX F
LIMITATIONS OF REPORT

McINTOSH PERRY

LIMITATIONS OF REPORT

McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) carried out the field work and prepared the report. This document is an integral part of the Foundation Investigation and Design report presented.

The conclusions and recommendations provided in this report are based on the information obtained at the borehole locations where the tests were conducted. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the specific locations where tests were conducted and conditions may become apparent during construction, which were not detected and could not be anticipated at the time of the site investigation. The benchmark level used and borehole elevations presented in this report are primarily to establish relative differenced in elevations between the borehole locations and should not be used for other purposes such as to establish elevations for grading, depth of excavations or for planning construction.

The recommendations presented in this report for design are applicable only to the intended structure and the project described in the scope of the work, and if constructed in accordance with the details outlined in the report. Unless otherwise noted, the information contained in this report does not reflect on any environmental aspects of either the site or the subsurface conditions.

The comments or recommendation provided in this report on potential construction problems and possible construction methods are intended only to guide the designer. The number of boreholes advanced at this site may not be sufficient or adequate to reveal all the subsurface information or factors that may affect the method and cost of construction. The contractors who are undertaking the construction shall make their own interpretation of the factual data presented in this report and make their conclusions, as to how the subsurface conditions of the site may affect their construction work.

The boundaries between soil strata presented in the report are based on information obtained at the borehole locations. The boundaries of the soil strata between borehole locations are assumed from geological evidences. If differing site conditions are encountered, or if the Client becomes aware of any additional information that differs from or is relevant to the McIntosh Perry findings, the Client agrees to immediately advise McIntosh Perry so that the conclusions presented in this report may be re-evaluated.

Under no circumstances shall the liability of McIntosh Perry for any claim in contract or in tort, related to the services provided and/or the content and recommendations in this report, exceed the extent that such liability is covered by such professional liability insurance from time to time in effect including the deductible therein, and which is available to indemnify McIntosh Perry. Such errors and omissions policies are available for inspection by the Client at all times upon request, and if the Client desires to obtain further insurance to protect it against any risks beyond the coverage provided by such policies, McIntosh Perry will co-operate with the Client to obtain such insurance.

McIntosh Perry prepared this report for the exclusive use of the Client. Any use which a third party makes of this report, or any reliance on or decision to be made based on it, are the responsibility of such third parties. McIntosh Perry accepts no responsibility and will not be liable for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.