



REPORT

Weyburn Wind Farm

Submitted to:

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Submitted by:

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CA0026414.7023

June 2024

A large, solid red graphic element that occupies the lower half of the page. It has a triangular shape on the left side, with the hypotenuse sloping upwards from the bottom left towards the right. The rest of the shape is a rectangle. The red color is a vibrant, slightly darker shade of red.

Review List

Review #	Reviewed By NAME & REVIEW TYPE e.g., "Peer"; "Technical":	Date	Comments
1	Jerry Leung	May 25, 2024	Start report
2	Steve Ash	June 10, 2024	Review
3			
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1.0 INTRODUCTION

WSP Canada Inc. (WSP) was retained by EDF Renewables Development Inc. (EDF) to complete a preliminary geotechnical investigation to support initial design considerations for the proposed Weyburn Wind Farm project, southwest of Weyburn, Saskatchewan.

The purpose of the investigation was to evaluate the general subsurface conditions at selected locations in the site area and provide preliminary geotechnical design parameters and construction considerations for the project.

The scope of work for this investigation and report were outlined in WSP's Fee Proposal dated April 1, 2024, and included the following main tasks:

- Contact Sask One Call to clear buried services at planned borehole locations.
- Advance seven (7) geotechnical boreholes using commercial drill rig solid stem augers and split-spoon (SPT) samplers.
- Obtain one sample (upper 1.2 m of soil profile) for Thermal Resistivity testing.
- Selective laboratory testing of borehole samples.
- Scoped geotechnical analysis and report preparation.

The recommendations provided in this report are intended for the guidance of the design engineer in determining the suitability of the site for the intended development purposes. Where comments are made on the general site conditions and construction, they are provided to highlight aspects that could affect the design of the project. Those requiring information on geotechnical aspects of the site beyond the scope of this report must make their own interpretation of the subsurface information, particularly as it affects their proposed construction methods, costs, equipment selection, scheduling and the like.

It is understood that a more detailed geotechnical investigation will be undertaken at the project site, to obtain critical information for detailed designs, including turbine and ancillary structure foundations, services and other required infrastructure.

2.0 SITE AND PROJECT DESCRIPTION

The project location is located approximately 10 km to 20km southeast of Weyburn, Saskatchewan. The proposed development is expected to include more than 45 turbines, plus substations and meteorological towers which are situated within various farm and pasture lands that comprise the project development site. In this report, we have assumed a typical wind turbine foundation diameter of approximately 20 m, embedded at a depth of 2.7 m below the final grade (minimal grade changes anticipated).

The preliminary design inputs in Table 1 are assumed for the preparation of this geotechnical report.

Table 1: Turbine Design Inputs

Input	
Typical Minimum Foundation Embedment Depth (m)	2.7
Foundation Diameter (m)	20
Moment (kNm)	117,900 (unfactored), 159,165(factored)
Axial Loading (kN)	6,000
Total Loading – Includes Foundation Weight (kN)	20,000

3.0 GEOTECHNICAL INVESTIGATION

3.1 Geology

A public geological map (Simpson, 1997)¹ including the site area overlay is provided in Figure 1 which follows.

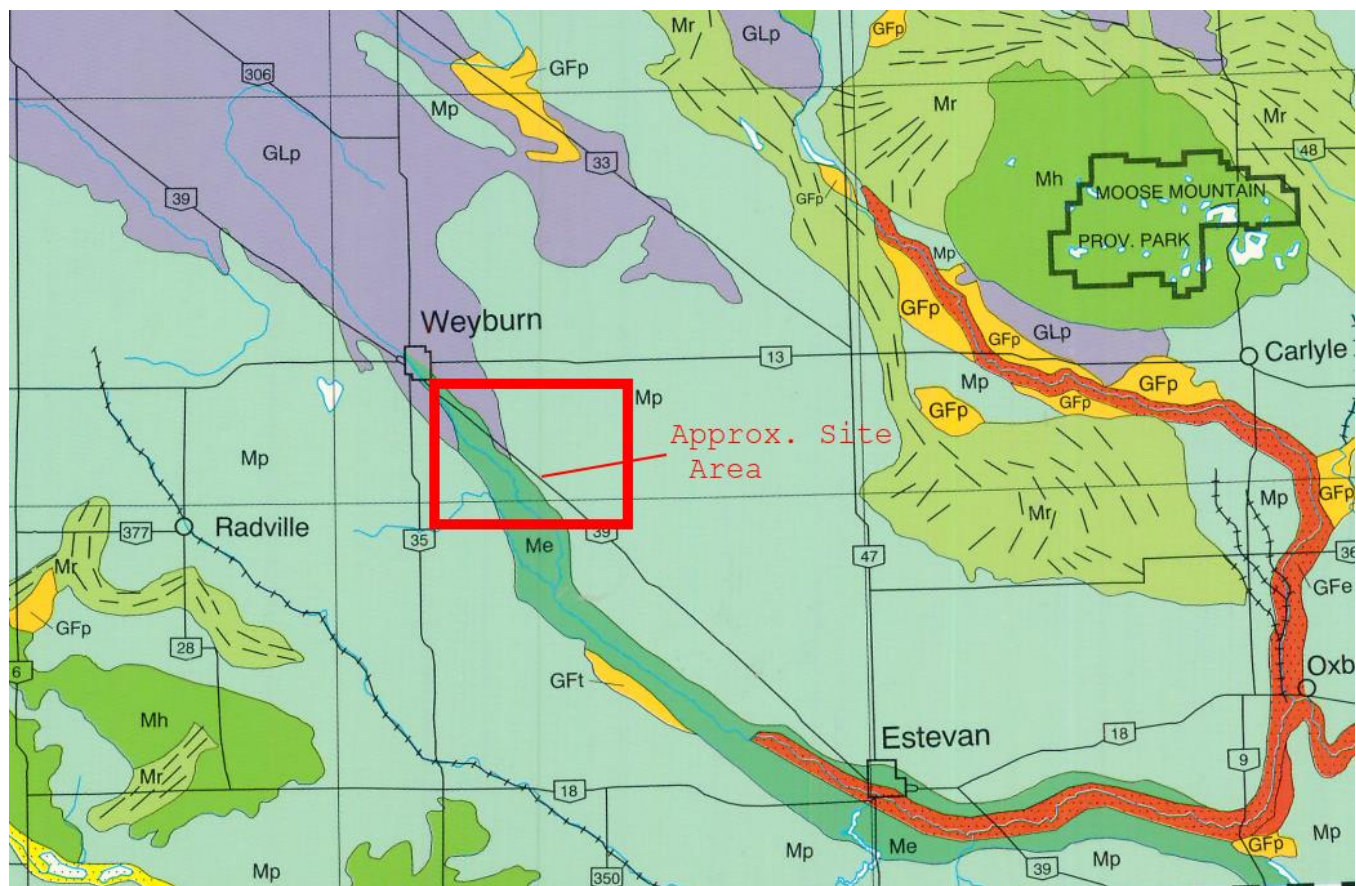


Figure 1: Approximate Site (Red Rectangle) with Overlaid Surficial Geology Map (Simpson, 1997)

¹ M.A. Simpson (compiler) (1997); Surficial Geology Map of Saskatchewan, Scale: 1:1,000,000; Saskatchewan Energy and Mines – Saskatchewan Geological Survey.

A screenshot of the relevant legend for the Map is provided in Figure 2

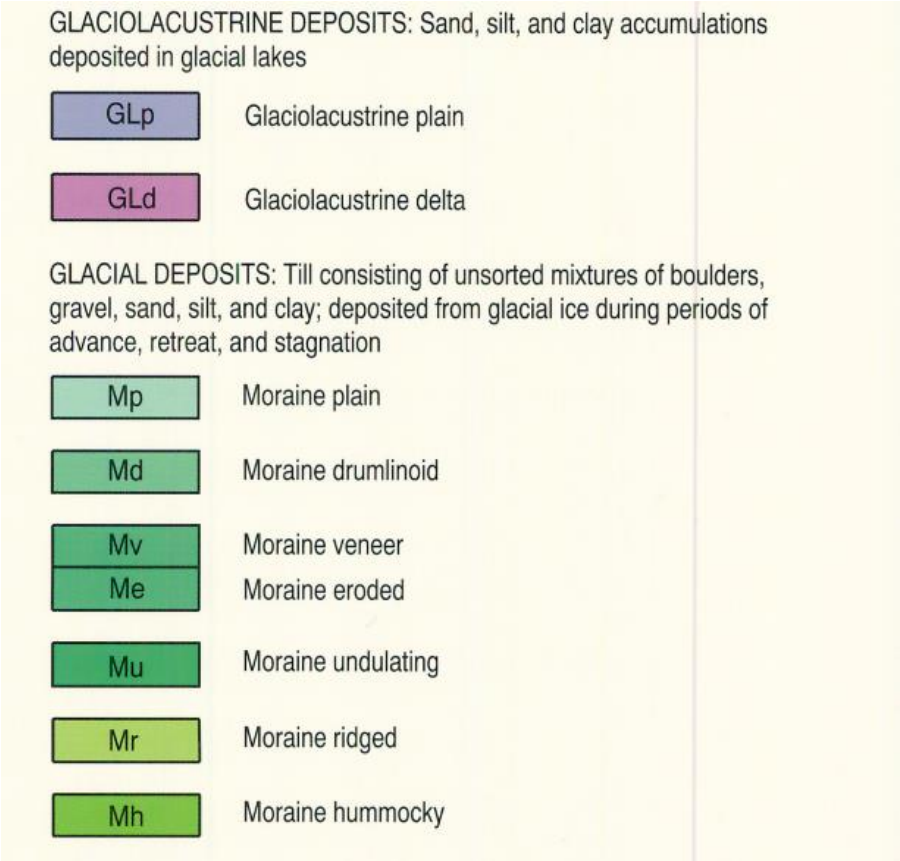


Figure 2: Legend

The turbine layout appears to lie within zones GLp, MP and ME based on the map legend, where the upper soils reportedly comprise unsorted gravel, sand, silt, and clay deposits of glaciolacustrine and morainic (glacial ice-contact) provenance. Based on the mapping, the depth to sedimentary bedrock ranges widely, from 0 to 50 meters below ground surface (mbgs).

3.2 Abandoned Coal Mines

Based on Sask Interactive Mapping², no mines are reported within the site area.

3.3 Field Drilling

Before conducting the proposed subsurface investigation, WSP completed Sask One Call notifications and contracted a third-party utility locator to identify buried utilities and clear the proposed borehole locations of underground and overhead utilities.

The boreholes were drilled as close to the provided coordinates as possible using a hand-held GPS with an accuracy of +/- of 5 m.

A summary of the field investigation details is provided in Table 2.

² <https://gisappl.saskatchewan.ca/html5ext/?viewer=saskinteractive&layerTheme=3&runworkflowbyID=FacilitiesStartup>.

3.4 Geotechnical Boreholes

WSP oversaw the drilling of the geotechnical boreholes between April 23 and April 25, 2024. The boreholes were drilled by All Services Drilling Inc. (a subcontractor retained by WSP) using a track-mounted drill rig equipped with solid stem continuous flight augers and split-spoon samplers driven with a 140kg auto-hammer. The “N” values were obtained over a 450mm sampling interval according to the SPT method, generally according to ASTM D1586.

Qualified WSP field personnel logged and sampled the soil conditions and noted any groundwater seepage encountered within each borehole. Using the Unified Soils Classification System (USCS), the soils were classified based on visual, physical, and textural properties from field observations. Split-spoon soil samples were retrieved at depth intervals of 0.75 m to 1.5 m in all boreholes.

Where feasible, owing to material consistency, undisturbed Shelby Tube (75 mm OD) samples were collected at selected borehole locations and at selected various depths. Additionally, WSP collected one (1) bulk sample at Turbine T-25 locations for laboratory thermal resistivity testing.

PVC standpipes (25 mm OD) were installed in all boreholes to allow for groundwater level monitoring. Groundwater and sloughing conditions observed during the drilling process are also described in Section 4.2, later in this report.

Borehole locations and depths undertaken for this preliminary investigation are summarized in the following Table 2. A borehole location plan is included in Figure 3 in APPENDIX A.

Table 2: WSP Borehole Locations and Depths

Borehole ID	Termination Depth (mbgs)	Coordinates *	
		Latitude (°)	Longitude (°)
BH24-T01	15.7	49.61231	-103.76149
BH24-T06	15.6	49.60183	-103.73738
BH24-T09	15.7	49.61818	-103.69617
BH24-T24	15.7	49.64455	-103.64910
BH24-T25	15.7	49.59305	-103.64497
BH24-T34	15.7	49.57151	-103.62450
BH24-T46	15.5	49.64968	-103.56841

*Measured by using a hand-held GPS with an accuracy of +/- of 5 m

4.0 SUBSURFACE CONDITIONS

4.1 Subsurface Soil Layers

Detailed descriptions of the subsurface conditions encountered in each borehole are presented in the Record of Borehole Sheets appended to this report. Classification and identification of the soils have been based on commonly accepted methods (i.e., USCS) employed in the practice of geotechnical engineering in Saskatchewan. As observed in previous studies of the subject wind farm areas, the stratigraphic boundaries shown on the Record of Borehole Sheets represent transitions between soil types rather than distinct lithologic boundaries. It should be recognized that subsurface conditions may vary both laterally and with depth between individual borehole locations.

The subsurface stratigraphy encountered at the borehole locations generally consisted of topsoil underlain by clay till or sand to the borehole termination depths.

A stratigraphic summary is provided in the following Table 3.

Table 3: Stratigraphic Summary of Auger Boreholes (limited sampling)

Borehole ID	Topsoil (mm thick)	* Layer Depths (mbgs)			
		Sand		Clay Till	
		Top of Layer Depths (mbgs)	Bottom of Layer Depths (mbgs)	Top of Layer Depths (mbgs)	Bottom of Layer or Borehole Termination Depths (mbgs)
BH24-T01	0.2	-	-	0.2	15.7
BH24-T06	0.2	-	-	0.3	15.7
BH24-T09	0.3	-	--	0.3	15.7
BH24-T24	0.2	3.3	4.7	0.2 4.7	3.3 15.7
BH24-T25	0.25	2.7 8.2	6.4 15.7	0.25 6.4	2.7 8.2
BH24-T34	0.2	-	-	0.2	15.7
BH24-T46	0.2	0.2 2.1 3.6	1.2 2.7 4.5	1.2 2.7 4.5	2.1 3.6 15.7

Notes: mbgs = metres below ground surface

Descriptions of the individual (primary) soil layers are provided as follows.

4.1.1 Topsoil

A layer of topsoil with varied thicknesses between 200 mm and 250 mm was encountered in all boreholes.

4.1.2 Lean Clay and Fat Clay (Till)

Lean clay (CL) was encountered in all boreholes (refer to the attached soil records and Table 3 for the encountered depths). The lean clay (also referred to as silty clay glacial till, or simply till) contained mainly low plastic fines, sandy to with sand, and was light brown.

Fat clay (CH) was encountered in BH24-T06 at about below 3.5mbgs to 6.1 mbgs and in BH24-T25 between about 0.3 mbgs and 2.7 mbgs.

SPTs were completed within the silty clay till recorded N-values ranging from 5 to over 50 blows for 305 mm penetration. Results are indicative of firm-to-hard consistency (in consideration of cohesive soil type).

The laboratory testing completed on the clay till is summarized in the following Table 4.

Table 4: Test Results for Lean Clay (Till)

Borehole ID	Approximate Sample Depth (mbgs)	Atterberg Limits (per MUSCS)			Natural Moisture Content (%)	Sieve and Hydrometer Particle Size Distributions (by mass)			
		Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH24-T01	3.1	45	15	34	19	0	34	36	30
BH24-T06	3.8	88	24	64	28.8	0	1	56	43
BH24-T09	1.5	35	13	22	11.0	0	37	43	19
BH24-T09	4.6	45	15	30	18.8	0	31	41	27
BH24-T24	0.8	47	15	32	10	2	5	86	7
BH24-T24	3.8	26	13	13	9.1	0	48	39	13
BH24-T25	1.5	77	22	55	24.3	3	4	15	78
BH24-T25	3.8	35	14	21	24.1	0	34	41	25
BH24-T34	3.1	44	14	30	19.9	1	31	43	25
BH24-T34	7.6	85	21	64	26	0	5	60	35
BH24-T46	1.5	46	15	31	12.4	2	33	37	28
BH24-T46	2.3	45	15	30	12.0	4	3	40	23

Six one-dimensional consolidation and swelling tests were completed on samples collected. A summary of the results is provided in Table 5.

Table 5: Consolidation Parameters from Testing

Borehole ID	Depth Sample (mbgs)	Preconsolidation Pressure (kPa)	Comp. Index (Cc)	Re-Comp. Index, Cr	Swelling Pressure (kPa)
BH24-T01	2.3	>200	0.13	0.04	<60
BH24-T06	2.3	150	0.13	0.08	<60
BH24-T24	2.3	100	0.08	0.03	<60
BH24-T25	2.3	150	0.13	0.04	<60
BH24-T34	2.3	>200	0.12	0.06	<60
BH24-T46	3.1	150	0.19	0.07	<80

Unconfined compressive strength (UCS) tests were completed on selected Shelby Tube samples. The results are summarized in Table 6. The undrained shear strength (s_u) is calculated as one-half of the UCS.

Table 6: UCS Testing

Borehole ID	Sample Depth (mbgs)	Dry Density, kg/m ³	Unconfined Compressive Strength (kPa)	Undrained Shear Strength (kPa)
BH24-T01	2.3	1,672	257	129
BH24-T06	2.3	1,486	142	71*
BH24-T09	2.3	1,788	337	169
BH24-T25	3.1	1,690	82	41*
BH24-T34	2.3	1,806	195	97
BH24-T46	2.3	1,878	279	140

*-considered not representative due to relatively high sand content

4.1.3 Sand

Sand (silty sand) was also encountered in borehole locations BH24-T24 -T25, and -T46.

SPTs completed within the silty sand recorded N-values ranging from 6 to over 50 blows for 305 mm penetration, indicating loose to very dense compactness conditions.

4.2 Groundwater and Sloughing Observations

Groundwater conditions observed during drilling are described in the Record of Borehole Sheets in Appendix B. Groundwater levels observed in the open boreholes are summarized in the following Table 7. It should be noted that the actual groundwater levels can vary and are subject to seasonal fluctuations and in response to weather events.

Table 7: Groundwater Level Readings

Borehole ID	Water Level, May 23, 2024 (mbgs)
BH24-T01	3.5
BH24-T06	Dry
BH24-T09	Dry
BH24-T24	Dry
BH24-T25	Dry
BH24-T34	3.2
BH24-T46	3.8

*mbgs = metres below existing ground surface

4.3 Thermal Conductivity, Standard Proctor, Corrosivity and Soluble Sulphate Laboratory Testing Results

A thermal conductivity and Standard Proctor Maximum Dry Density Test was performed on one (1) sample collected at borehole BH24-T25. The thermal conductivity test results on collected bulk samples are shown in Table 8, and the remaining test results are shown in Appendix D.

Table 8: Thermal Conductivity Test Results

Borehole ID	Maximum Standard Proctor Dry Density (kg/m ³)	Moisture Content	Thermal Conductivity, K(WW/m.K)
BH24-T25	1,702@20.5% Moisture Content	22.3	1.147
		15.9	1.114
		10.3	0.836
		5.2	0.646
		2.5	0.556

Corrosivity laboratory testing is summarized in Table 9, and the full results are attached in Appendix C. Based on the electrical resistivity (ER), pH and chloride test results, galvanized steel and/or corrosion protection to the steel may be required. The corrosivity results, as well as the corrosion aspects related to this project, should be analyzed by a corrosion specialist.

Table 9: Corrosivity and Soluble Sulphate Laboratory Testing Results

Turbine or Substation ID	Sample Depth (mbgs)	pH	Chloride	ER (Ohm*cm)	Soluble Sulphate (%)
BH24-T01	3.1	7.98	0.0043	200	1.52
BH24-T06	3.8	8.55	0.0073	280	0.921
BH24-T09	1.5	8.95	<0.0025	4930	<0.1
BH24-T24	0.76	8.61	<0.0025	1140	<0.1
BH24-T25	1.5	7.91	<0.0025	270	1.96
BH24-T34	3.1	8.22	0.0045	300	0.512
BH24-T46	1.5	8.45	<0.0025	3200	<0.1
BH24-T46	2.3	8.40	<0.0025	5400	<0.1

Notes: mbgs = metres below ground surface.

5.0 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

The recommendations are based on WSP's interpretation of borehole sampling and laboratory testing program for this preliminary investigation. Our comments also consider our review of available and pertinent background data, and WSP's understanding of the site conditions and experience with similar sites and projects. Parties requiring information beyond the scope or purpose of this report must make their interpretation of the information provided.

Upon reviewing the limited field investigation and groundwater monitoring results, the site can be considered geotechnically feasible for wind project development, subject to considerations, comments and related recommendations presented in this report.

This section of the report provides the geotechnical design and construction recommendations for the foundations of the wind turbines, substations, and access roads. WSP recommendations are based on:

- Understanding of the proposed site development, including turbine type and preliminary loading data,
- Experience in wind energy projects,
- Other project requirements.

5.1 Frost Penetration Depth and Susceptibility

The maximum seasonal frost penetration depth was calculated for the near-surface soils using the procedure described in the Canadian Foundation Engineering Manual (CFEM). A mean freezing index of 1,417 Degree Days Celsius (°C-days) was used for the subject site location. The average seasonal frost penetration depth is estimated to be approximately 2.1 m. Any shallow foundations should have a minimum soil cover of at least 2.1 m for frost protection purposes. The burial depth of electrical and fibre optic cables should also consider frost conditions. .

The estimated frost penetration depth assumes a uniform soil type with snow cover. Frost susceptibility refers to the tendency of soil to grow ice lenses and heave during freezing. The estimated frost heaving potential (CFEM, 2023) of the surficial soils encountered within the design frost depth is medium susceptible (i.e., Group F3 to F4).

Foundation elements of heated and unheated structures should have a minimum frost protection equivalent to a soil cover of at least 1.5 m and 2.1 m for frost protection purposes, respectively. Rigid insulation may be used to provide frost protection equivalent to the required soil cover. The insulation used for frost protection should be placed at a minimum depth of 0.6 m below the finished ground surface or per the manufacturer's requirement, and the top 0.6 m of backfill should be ignored for equivalent frost penetration calculation purposes.

5.2 General Comments on Feasibility

There are two main general concerns relating to the geotechnical feasibility of the project as follows:

- **Variable Bearing Soil for Gravity Base Foundations:** There are variable (sand, low plastic clay or high plastic) soil types at the turbine locations. In general, the native undisturbed clay till and native compact sand are considered a competent material for shallow (gravity design) turbine foundations.
- **Swelling soil** – Our test results suggest that the swelling or shrinkage potential of the high plastic clay is high in the presence of fluctuating moisture conditions, such as access to water or drying conditions. Volume change of the soil may result in swelling if the moisture content increases or in shrinking below heated structures due to moisture content decrease.
- **Shallow groundwater level:** based on monitoring well measurements taken on May 23, 2024, the depth of groundwater was shallower than 4.5 mbgs at turbine locations T01, T34 and T46. The Designer should review the borehole and groundwater data, consider possible groundwater fluctuations of potentially 1.0 m (estimated), and determine if a buoyant design approach should be taken at all locations.

5.3 General Site Preparation

Site preparation should include stripping off unsuitable organic soils (topsoil), existing fills if encountered, and other deleterious materials from within the footprint area. At the borehole locations, the observed thickness of the topsoil ranged between 200 mm and 300 mm. However, it is important to note that subsurface conditions may change in intermediate locations not explicitly investigated.

Subgrade soils that are exposed after the removal of deleterious materials should be protected against construction traffic and provided with positive drainage. Site grading should be designed to promote positive drainage of surface water away from the proposed structures, avoiding potential water ponding issues. Site grading design should be completed by a qualified civil engineer. Subgrade preparation within the proposed development footprints should follow the applicable sections of the subsequent portion of this report.

General fill that may be required to raise local grades beyond the structural footprints may comprise approved on-site borrow and/or imported material. The low plastic clay till material on-site that has similar soil properties to the native materials is suitable for re-use and engineered fill. If imported materials are required, the materials should be approved by the Geotechnical EOR before delivery and placement. All engineered fill materials must be free of oversized rocks over 100 mm in diameter, frozen material, organics, roots, debris, and other deleterious materials. Advise WSP of grade raises more than 1.2 m (4ft) before proceeding. Additional settlement from the fill materials should be considered.

The general engineered fill materials may be placed in uniform layers not exceeding 200 mm thickness and compacted to a minimum of 98% Standard Proctor Maximum Dry Density (SPMDD per ASTM D698) and within $\pm 2\%$ of its Optimum Moisture Content (OMC) unless specified differently in the subsequent sections of this report. The exposed subgrade before placement of fill should be reviewed and approved by a qualified geotechnical engineer.

Structural engineered fill consisting of well-graded granular material is recommended for engineered fill beneath ground slabs. Well-graded granular fill as per Saskatchewan Ministry of Highways and Infrastructure Specification or approved equivalent material can be used as structural engineering fill. Granular fill should be placed in loose lift thickness not exceeding 200 mm and be compacted to 100% SPMDD at -3% to +1% of OMC. non-woven geotextile for separation with a minimum grab tensile strength of 400 N should be placed between native cohesive soils and granular fill to prevent the migration of fine particles into the granular engineering fill.

Subgrade surfaces should be protected from freezing. In addition, the subgrade should be protected from wetting or drying, both before and after the placement of fill. Subgrade surfaces that are allowed to dry or become wet must be sub-excavated and replaced with engineering fill of a similar soil type to the native soil.

5.4 Turbine Foundation Design Recommendations

Based on the borehole investigations and laboratory testing program, the existing subsurface conditions are generally considered feasible to support the proposed gravity base foundations.

The frost penetration depth shall be considered in the foundation designs; assume unheated conditions for the substation structures. WSP understands that the desired embedment depth for the turbine foundations is approximately 2.7 m below the final grade. As such, the foundations will be below the estimated frost penetration depth.

The National Building Code of Canada [NBCC] stipulates that geotechnical aspects of foundation design should be conducted using limit states design (LSD) methodology. Under LSD methodology, the serviceability limit state bearing resistance must be considered in addition to analyzing and providing the ultimate limit state (ULS) bearing resistance for a foundation. The foundation recommendations provided in this report have been prepared in general conformance with LSD methodology. Design loadings consider partial safety factors stipulated by guidelines and standards, and a geotechnical resistance factor (ϕ) of 0.5 applies to bearing capacity analysis based on laboratory and in situ test data.

Detailed recommendations for shallow foundations are provided in the following sections.

5.4.1 Gravity Base Foundation

At some of the turbine locations, the clay within the expected bearing level (2.7 mbgs) was found to have high plasticity (see Table 4) and swelling potential. Therefore, appropriate measures should be taken to limit such

changes, including, protecting soils from drying out or becoming wet after excavation, uses of clay backfill around foundations to prevent surface infiltration, and promoting positive surface drainage away from all structures.

The geotechnical bearing resistance at ULS is dependent on foundation dimensions such as bearing area width (effective area) and embedment depth, as well as loading eccentricity (factored forces and moments). Foundation design shall be optimized based on actual dimensions and load conditions to be applied, including considerations for normal and extreme loading cases.

The foundations must also be designed to resist resonance³ to ensure dynamic properties are within permissible values for the turbine, and that bearing soil meets stiffness criteria from the Manufacturer. Dimension criteria have been developed by various jurisdictions to guide the Engineer in sizing the foundation. It is understood that the foundation will be designed by numerical modelling (such as ANSYS or Plaxis 3D), using bearing capacity and stiffness parameters to determine safe size, depth, reinforcement and material strength criteria.

The lateral capacity of shallow foundations may be calculated considering the sliding resistance along the base of the foundation. The ultimate sliding resistance at the foundation base may be calculated by multiplying the total vertical load acting on the foundation by the coefficient of friction. For preliminary design considerations, a coefficient of friction of 0.4 is recommended between a cast-in-place concrete foundation base and the native clay till-bearing surface or a mud slab. A geotechnical resistance factor of 0.8 should be considered to determine the factored lateral capacity of the foundation. Passive earth pressure may also be considered when determining the lateral capacity of shallow foundations but should be neglected within the frost zone.

In addition, the general site preparation recommendations in Section 5.3 should also be followed.

Bearing surfaces shall be protected from the ingress of free water, typically resulting in softening and swelling of the soil. Footings must not be placed on fill, organic, disturbed, or frozen soil. Bearing material that becomes frozen, dried, or softened must be removed, and the remediation measures will be provided based on the actual field conditions determined by the geotechnical engineer. It is also essential the foundation subsoil is not allowed to freeze after the concrete for footings has been placed.

5.4.2 Geotechnical Design Parameters

The foundations should be placed on undisturbed native clay till or native compacted sand materials.

The estimated factored ($\Phi = 0.5$) ultimate geotechnical bearing resistance (at ULS) of turbine gravity base foundations with a minimum embedment depth of 2.7 mbgs and presumed minimum diameter (D) of 20m is shown in Table 10.

Table 10: Factored Geotechnical Bearing Resistance

Borehole ID	Anticipated Soil Conditions at Foundation Depths (2.7m)	Water Level on May 23, 2024 (m)	Factored ULS Geotechnical Bearing Resistance, (kPa)*
BH24-T01	Clay Till	3.5	250
BH24-T06	Clay Till	Dry	250
BH24-T09	Sand	Dry	250
BH24-T24	Clay Till	Dry	250

³ Resonance is an effect caused when the vibrating frequency of a machine equals the natural frequency of the underlying soil. Resonance leads to excessive displacement or amplitude, which is undesirable for any structural unit.

Borehole ID	Anticipated Soil Conditions at Foundation Depths (2.7m)	Water Level on May 23, 2024 (m)	Factored ULS Geotechnical Bearing Resistance, (kPa)*
BH24-T25	Sand	Dry	250
BH24-T34	Clay Till	3.2	250
BH24-T46	Clay Till	3.8	250

Notes:

* Bearing resistance is calculated based on the formula presented in Guidelines for Design of Wind Turbines (DNV, 2016):

For Sand: $q_d = \frac{1}{2} \gamma' b_{eff} N_\gamma s_\gamma i_\gamma + p_o N_q s_q i_q + c_d N_c s_c i_c$

For Clay Till (undrained conditions): $q_d = s_{ud} N_c s_c i_c + p_o$

5.4.2.1 Dynamic Properties and Stiffness

The recommended shear wave velocity parameters are based on published correlations. Dynamic soil properties were not measured at these locations; therefore, the soil parameters provided are to be used for design estimates. Based on the results of the SPTs conducted in the field, the shear wave velocity can be estimated using the following equation (Prakash and Puri, 1988):

$$V_s = 90N^{0.309}$$

Where: V_s = shear wave velocity (m/s)

N = SPT N-value of the soil

The elastic theory relates shear wave velocity with the dynamic shear modulus at small strain using the following equation:

$$G_{\max} = \rho V_s^2$$

Where: $G_{\max}$ = small strain dynamic shear modulus (Pa)

ρ = bulk density of soil (kg/m³)

The dynamic shear modulus varies non-linearly with strain amplitude; therefore, the shear modulus should be reduced for larger amplitudes. Moderate strains for wind loads are generally in the order of 10^{-3} . Based on published correlations by DNV-Riso (2002), the dynamic shear modulus values calculated with the formula above should be multiplied by a modulus reduction factor of 0.35 to account for higher strains and reduce dynamic wind loading conditions.

Young's Modulus is computed from:

$$E_s = 2G(1+\nu)$$

Where: E_s = Young Modulus

G = Shear Modulus for applicable strain

ν = Poisson's Ratio of 0.45

The estimated geotechnical dynamic design parameters determined from the investigations and testing are presented in the following Table 11.

Table 11: Dynamic Design Parameters

Turbine ID	*Shear Wave Velocity – V_s (m/s)	Small Strain Dynamic Shear Modulus- G_{max} (MPa)	Reduced Shear Modulus Values – G (MPa)*	Young Modulus, E_s (MPa)
BH24-T01	210	85	30	85
BH24-T06	200	80	25	80
BH24-T09	200	80	25	80
BH24-T24	200	80	25	80
BH24-T25	205	80	25	80
BH24-T34	195	75	25	75
BH24-T46	230	100	35	100

*Assuming shear modulus reduction ratio of 0.35 for G_{max} .

The estimated foundation stiffness parameters for modes of motion are presented in the following Table 12.

Table 12: Estimated Foundation Stiffness Parameters for Modes of Motion

Turbine ID	*Mode of Motion			
	Vertical, K_v (MN/m)	Horizontal, K_H (MN/m)	Rocking, K_R (MN-m/rad)	Torsion, K_T (MN-m)
BH24-T01	4,600	2,600	339,400	333,900
BH24-T06	4,250	2,400	312,500	307,400
BH24-T09	4,250	2,400	312,500	307,400
BH24-T24	4,250	2,400	312,500	307,400
BH24-T25	4,400	2,500	326,100	320,800
BH24-T34	4,050	2,300	298,500	293,700
BH24-T46	5,450	3,100	401,500	395,000

* Based on the equations presented in DNV-Riso (2016). The values provided correspond to the approximate foundation embedment depth of 2.7mbgs.

$$K_v = \frac{4GR}{1-\nu} \left(1 + 1.28 \frac{R}{H}\right) \left(1 + \frac{D}{2R}\right) \left(1 + (0.85 - 0.28 \frac{D}{R}) \frac{D/H}{1-D/H}\right), \quad K_H = \frac{8GR}{2-\nu} \left(1 + \frac{R}{2H}\right) \left(1 + \frac{2}{3} \frac{D}{R}\right) \left(1 + \frac{5}{4} \frac{D}{H}\right), \quad K_R = \frac{8GR^3}{3(1-\nu)} \left(1 + \frac{R}{6H}\right) \left(1 + 2 \frac{D}{R}\right) \left(1 + 0.7 \frac{D}{H}\right), \quad K_T = \frac{16GR^3}{3} \left(1 + \frac{8D}{3R}\right)$$

5.4.3 Temporary Excavations

Temporary excavations at the site should be sloped or shored for worker and foundation protection. Construction must conform to good practice and comply with regulations. Based on the investigation, the soil should be classified as “likely to crack to crumble” or sandy soil. Therefore, excavation walls must be sloped at an angle of no steeper than 45 degrees (i.e.1H:1V), 1 m from the bottom of the excavation. WSP should review the proposed excavation layout and provide further guidance if steeper cut slopes are desired.

Excavations must be protected from rain, snow or any ingress of free water. Prolonged exposure of excavated areas should be avoided to prevent deterioration of exposed soil with resultant slope instability. Similarly, excavated materials should be stockpiled away from the excavations to avoid any slope instability and to prevent materials from falling back into the excavations. Temporary surcharge loads, such as stocks of material or heavy equipment, should be kept back from the excavation faces at a distance equal to the excavation depth. For crane pads, the distance should be increased equal to three times the excavation depth.

All underground pipes, cables, culverts or utilities must be placed on competent ground. Any soft, loose, organic, or otherwise deleterious soil existing below the pipes must be over-excavated and replaced with suitable well-compacted material. The subgrade soil and bedding soil beneath the pipes should not be allowed to freeze. All fill and backfill material in the trench should be free of wet, organic, and/or frozen soil. All material for filling and backfilling purposes should be placed in lifts not exceeding 200 mm in thickness (loose measure) and compacted to 98% SPMDD.

5.4.4 Backfill Above and Around the Foundation

Backfill placed adjacent to and above the base of wind turbine foundations should not contain topsoil, cobbles, boulders, sand or other deleterious materials. It should consist of cohesive soils only since the use of granular soils would allow surface water to infiltrate into the backfill and cause buoyancy. Lean clay (low plastic clay till) above and around the turbine foundations would be the ideal engineered fill candidate. Lateral resistance should be neglected for the backfill above the frost depth (i.e., approximately 90% of the planned embedment depth).

The surface topsoil should be stripped and wasted or stockpiled in a suitable location for final landscaping. WSP assumes that, for the most part, native cohesive soils excavated to make way for the footing will be used for backfilling above and adjacent to the turbine footings. Sand, cobbles and boulders, if encountered, should preferably be removed from the excavated soils prior to stockpiling.

The cohesive backfill should be placed in relatively thin lifts (200 mm maximum), and each lift should be uniformly compacted to not less than 95% SPMDD within 0 to +2% of OMC. The final surface of the backfill should be adequately sloped to promote surface drainage away from the turbine tower. The surface elevation of the fill at the outer edges of the foundation should lie above exterior grades, including allowances for long-term fill settlement. The long-term fill settlement is expected to be in the order of 1.5 and 3% times the fill height, compacted to 95% SPMDD.

5.4.5 Drainage and Buoyancy

The prepared subgrade surface for the proposed development area should be graded to prevent water ponding on the site. Excess water should not be allowed into the pond and should be drained or pumped from the site as quickly as possible, both during and after construction.

Based on the investigation findings, groundwater seepage may be encountered within some of the excavations on site (see Table 7 of this report). If water seepage is encountered, the dewatering of excavations will be dependent upon weather conditions such as the intensity of precipitation and /or seepage. Dewatering is also dependent on the time of year in which the construction begins, as seasonal factors have a significant impact on precipitation volumes and fluctuating groundwater levels. If seepage is encountered during construction, groundwater may be controlled by filtered sump pumps inside the excavation. The groundwater level should be maintained to a minimum of 0.5 m below excavation grade at all times during construction.

The potential for water seepage during excavation and/or foundations designed for buoyancy will need to be considered at all borehole locations where shallow groundwater (i.e., about 4.5 mbgs or less) was encountered.

It should be noted that groundwater levels may fluctuate over time, and higher or lower groundwater levels may be experienced during construction. Excavations should be allowed to dry before continuing with construction. At no time should water be allowed to the pond on the base of the excavations as it may lead to softening of the subgrade soils.

5.5 Seismic Site Classification

Available information was reviewed to assess the seismic classification of the project site. The reviewed information included the Borehole Records, the National Building Code of Canada (NBCC)⁴ and CFEM.

The site classification for Seismic Site Response is provided in Sections 4.1.8.4 of NBCC (2020) and Chapter 6 of CFEM and is determined using the expected shear wave velocity, Standard Penetration Resistance N-value and undrained shear strength within the top 30 m. Based on the available information, the average ground properties in the upper 30 m at the site are inferred to be stiff soil, corresponding to Class D as per Table 6.1A, CFEM.

The seismic spectra for site Class D were obtained from Natural Resources of Canada, <https://earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/nbc2020-cnb2020-en.php>, and they are summarized in Table 13. The structural designer can use site coefficients and foundation factors from the 2020 National Building Code to determine the code-based design spectra.

Table 13: Seismic Data for Site Class D

NBC 2020 – 2%/50 Years Probability							
S _a (0.2, X _D)	S _a (0.5, X _D)	S _a (1.0, X _D)	S _a (2.0, X _D)	S _a (5.0, X _D)	S _a (10.0, X _D)	PGA(X _D)	PGV(X _D)
0.31	0.242	0.121	0.048	0.0101	0.00283	0.195	0.14

5.6 Foundation Settlement

Consolidation test results, undrained shear strength, and other laboratory test results were considered when establishing the compressibility parameters to use this preliminary analysis. The consolidation parameters summarized in Table 5 were used in the analyses. In addition, Young's modulus was used in the analyses for the immediate settlement component of the total settlement. Settlement of the turbine bases will depend on the loading conditions, foundation dimensions, and soil profiles at the specific turbine locations. A bearing pressure of 145kPa (under normal operating conditions) is considered in the settlement analysis.

The estimated settlement was calculated using the computer program Settle3D by RocScience over an influence depth of 25 m with groundwater at 2.0 mbgs. The immediate settlement of the native soils is estimated to be on the order of 16mm. The estimated settlement for consolidation is expected to be up to 140 mm (assuming rigid foundation). It should be noticed that cyclic loadings would also affect the soil estimation. As such, an advanced deformation analysis using Finite Element (FE) software such as Plaxis2D/3D or SigmaW should be completed considering the total loading (Static and cyclic) and moment (eccentricity) once the detailed design of the turbines is available.

5.7 Water Soluble Sulphate

The results from the soluble sulphate content laboratory tests are summarized in Table 9. The sulphate concentrations in the samples varied from <0.1% to 1.96%. Based on these values, the degree of exposure is considered to be Negligible to Severe per CSA A23.1-19, Table 3, Class F-2 and S-2 (CSA, 2019).

6.0 FIELD REVIEW

The recommendations in this report assume that an adequate level of inspection is provided during the preparation and construction of the site and that a qualified and experienced contractor is employed to carry out

the work. Should the information presented in this report be used for the proposed structures, it is recommended that WSP perform on-site field reviews to verify that actual site conditions are consistent with the conditions assumed in the design of foundations as per this report.

The field reviews are recommended to include the following:

- Field Inspections – actual subsurface conditions exposed after excavations, final subgrade or bearing soil conditions, earthworks, piles installation, etc.
- QA/QC tests – such as compaction tests, material testing, and full-time monitoring during installation of deep foundations.

The field reviews are recommended to be conducted under the Geotechnical Engineer of Record's control, as the standard care practice requires.

7.0 WSP CERTIFICATE OFF WORK

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The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

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Overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-site.

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As boreholes are a localized representation of the total study area, subsurface conditions may vary between and/or beyond the borehole locations. If conditions encountered at the site vary significantly from those reported herein, WSP should be notified immediately so that our interpretation and recommendations can be reviewed and revised if necessary.

9.0 REFERENCES

- Natural Resources Canada - NRC (2024). Canada's Minerals and Mining Map, <https://atlas.gc.ca/mins/en/index.html>.
- Canadian Geotechnical Society (2023). *Canadian Foundation Engineering Manual*; Fifth Edition.
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- National Research Council Canada – (2024). *National Building Code of Canada Seismic Hazard Tool* (<https://earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/nbc2020-cnb2020-en.php>).
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Signature Page

WSP Canada Inc.

A handwritten signature in blue ink, appearing to read 'Steve Ash', with a stylized flourish at the end.

Jerry Leung, P.Eng
Senior Geotechnical Engineer

Steve Ash, P.Eng
Lead Principal Geotechnical Engineer

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APPENDIX A

Site Plan

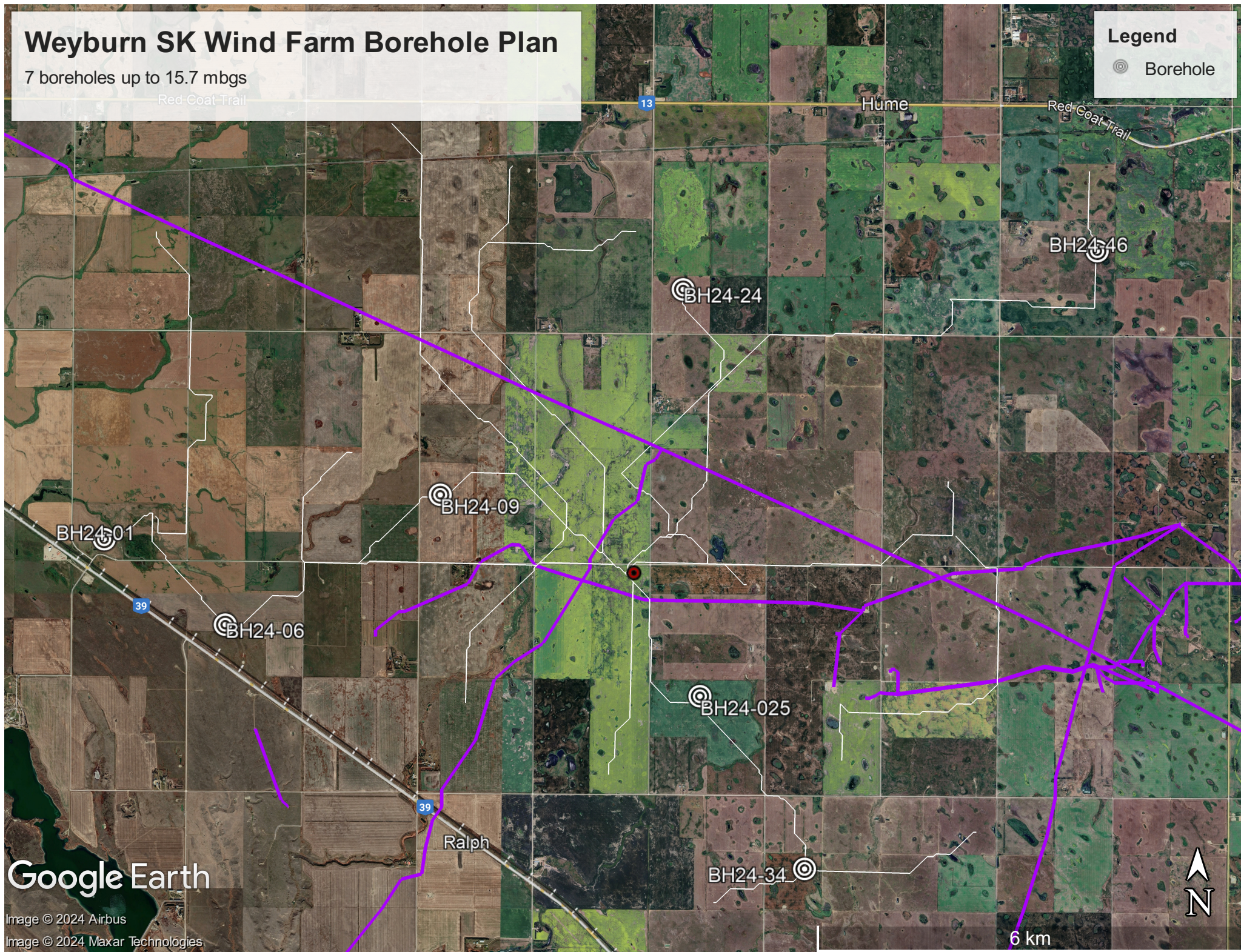
Weyburn SK Wind Farm Borehole Plan

7 boreholes up to 15.7 mbgs

Red Coat Trail

Legend

 Borehole



Google Earth

Image © 2024 Airbus

Image © 2024 Maxar Technologies

APPENDIX B

Record of Borehole Sheets

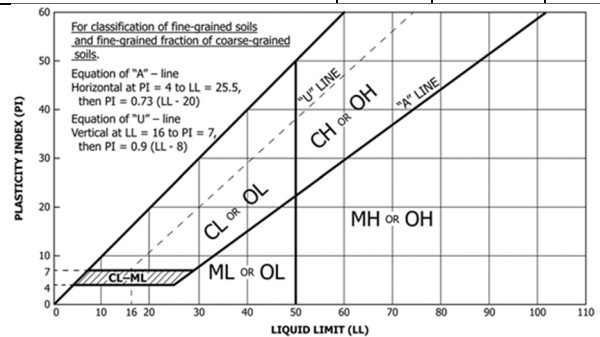
METHOD OF SOIL CLASSIFICATION

The WSP Canada Soil Classification¹ System is based on the Unified Soil Classification System (USCS) (after ASTM D2487)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$		$Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$		Organic Content ^{6,9}	USCS Group Symbol ^{3,5,7}	Primary Group Name ²				
INORGANIC (Organic Content <30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Clean Gravels with <5% fines ³ (by mass)	Well Graded	≥4	(and)	≥1 to ≤3		≤30%	GW	Well-graded GRAVEL ^{4,6}				
				Poorly Graded	<4	(and/or)	<1 or >3			GP	Poorly graded GRAVEL ^{4,6}				
			Gravels with >12% fines ³ (by mass)	Below A Line	n/a						GM	SILTY GRAVEL ^{4,6}			
				Above A Line	n/a						GC	CLAYEY GRAVEL ^{4,5,6}			
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Clean Sands with <5% fines ⁷ (by mass)	Well Graded	≥6	(and)	≥1 to ≤3			SW	Well-graded SAND ^{6,8}				
				Poorly Graded	<6	(and/or)	<1 or >3			SP	Poorly graded SAND ^{6,8}				
			Sands with >12% fines ⁷ (by mass)	Below A Line	n/a						SM	SILTY SAND ^{6,8}			
				Above A Line	n/a						SC	CLAYEY SAND ^{5,6,8}			
			Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content ^{8,10}	USCS Group Symbol ^A	Primary Group Name ^A	
							Dilatancy	Dry Strength		Shine Test	Thread Diameter (mm)				Toughness (of 3 mm thread)
		INORGANIC (Organic Content <30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Nonplastic or PI and LL plot <u>below A-Line</u> on Plasticity Chart ^C below)	Liquid Limit	Rapid	None to Low	Dull to None		3 to >6	Low/can't roll 3 mm	<15%	ML	SILT ^H	
						<50 ^D	None to Slow	Low to Medium		Dull to Slight	3 to 6	Low	15% to 30%	OL	ORGANIC SILT
Liquid Limit	None to V.Slow				Low to Medium	Slight	3 to 6	Low to Medium	<15%	MH	ELASTIC SILT ^H				
	≥50 ^D				None	Medium to High	Dull to Slight	1 to 3	Low to Medium	15% to <30%	OH	ORGANIC SILT			
CLAYS (PI and LL plot <u>above A-Line</u> on Plasticity Chart below) ^A	Liquid Limit			None to Medium Slow	Medium to High	Slight to Shiny	1 to 3	Medium	<15%	CL	LEAN CLAY ^{A,E,F,G,H}				
				<50 ^D	None to V.Slow	Medium to High	Slight to Shiny	1 to 3	Medium	15% to <30%	OL	ORGANIC CLAY ^{E,F,G}			
	Liquid Limit			None	High to V.High	Shiny	<1	High	<15%	CH	FAT CLAY ^{E,F,G,H}				
				≥50 ^D	None	High	Shiny	<1 to 1	High	15% to <30%	OH	ORGANIC CLAY ^{E,F,G}			
	HIGHLY ORGANIC SOILS (Organic Content >30% by mass)				Peat and mineral soil mixtures	Relatively lightweight, possibly spongy. Some water may squeeze from sample. Some shrinkage may occur on air drying. Sand fraction may be visible. Low to high dilatancy. Thread weak near plastic limit. Low to medium dry strength.					30% to <75%	PT	SILTY PEAT, SANDY PEAT		
					Predominantly peat, may contain some mineral soil, fibrous or amorphous peat	Lightweight, spongy. Much water squeezes from sample. Shrinks considerably on air drying (i.e., very high water content). Plant structure identifiable to altered.					75% to 100%		PEAT		

Coarse-Grained Soil Note(s):

- Based on the material passing the 75 mm sieve.
- If field sample contains or drilling observations indicate cobbles or boulders or both, add, "with cobbles" or "with cobbles and boulders". Include notes on the depth(s) encountered, and sizes if possible.
- Gravels with 5% to 12% fines require dual symbols:
(GW-GM) Well-graded GRAVEL with silt,
(GW-GC) Well-graded GRAVEL with clay,
(GP-GM) Poorly graded GRAVEL with silt,
(GP-GC) Poorly graded GRAVEL with clay.
- If soil contains ≥15% sand, add "with sand" to Group Name.
- If fines classify as CL-ML, use dual symbol (GC-GM) or (SC-SM) for Group Symbol.
- If the soil has an organic content (OC) 15%≤OC<30% the prefix "Organic" should be added before the Group Name. If the soil has an organic content 3%≤OC<15% add "with organic fines" to Group Name. If the soil contains >0% to ≤3% organics, the descriptor "trace organics" may be added.
- Sands with 5% to 12% fines require dual symbols:
(SW-SM) Well-graded SAND with silt,
(SW-SC) Well-graded SAND with clay,
(SP-SM) Poorly graded SAND with silt,
(SP-SC) Poorly graded SAND with clay.
- If soil contains ≥15% gravel, add "with gravel" to Group Name.



Fine-Grained Soil Note(s):

- If Atterberg limits plot above the A-line but in the 'hatched' area on the plasticity chart, soil is a (CL-ML) SILTY CLAY.
- If the soil contains >0% to ≤3% organics, the descriptor "trace organics" may be added.
- If fine-grained materials are nonplastic (i.e., a plastic limit (PL) cannot be measured), soil is a (ML) SILT.
- If soil has a liquid limit (LL) >30% to <50%, the term 'medium plasticity' may be included in the description, but the Group Name/Symbol is not changed.
- If soil contains 15% to <30% +No.200, add "with sand" or "with gravel".
- If soil contains ≥30% +No.200 mainly sand, add "Sandy" to Group Name.
- If soil contains ≥30% +No.200 mainly gravel, add "Gravelly" to Group Name.
- If the soil has an organic content (OC) 3%≤OC<15% add "with organic fines" to Group Name.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

GRADATIONAL COMPONENT TERMS

% (by mass)	Term
≤ 5	Use "trace"
> 5 to ≤ 12	Use "few"
> 12 to <30	Use "little"
≥ 30 to <50	Use "some"
≥ 50	Use "mostly"

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); Nd:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven, pushed tube sampler, or geoprobe macro-core – note size
DS	Denison type sample
FS	Foil Sample
GS	Grab Sample
MC	Modified California Samples – note sample diameter and hammer weight
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split-spoon sampler (50 mm OD); larger sizes use MC
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, w _L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, G _s)
DS	direct shear test
GS	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
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness²

Term	SPT 'N' (blows/0.3m) ¹
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in general accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grain size. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N' ^{1,2} (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in general accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$	natural logarithm of x
$\log_{10}$	x or $\log x$, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index $= (w_l - w_p)$
NP	nonplastic
w_s	shrinkage limit
I_L	liquidity index $= (w - w_p) / I_p$
I_C	consistency index $= (w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction $= \tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$

RECORD OF BOREHOLE: BH24-T01

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 23, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.612306° Long: -103.761489°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT		GRADATION %			DYNAMIC PENETRATION		ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV.	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) ○ Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	1 2 3 4 5 6 7 8 9 ○ Nat Vane ○ Rem Vane ○ Pocket Pen	X				
																				DEPTH (m)	
			TOPSOIL.			0.00															
			(CL) Sandy Lean Clay, mostly low plasticity FINES, trace gravel; light brown; moist, stiff to hard, (Clay till).	CL		0.20															
1							S-1	SS	72	7-6-6	12										
2							S-2	SS	106	3-5-6	11							192			
3							GS-1	TO	100									192			
4							UD-1														
5							S-3	SS	100	3-7-9	16			34	66			192			
6							S-4	SS	100	6-10-11	21							192			
7							S-5	SS	100	6-10-13	23							287			
8							S-6	SS	100	6-12-17	29							383			
9							S-7	SS	100	11-14-19	33										
10							S-8	SS	100	8-14-20	34										

RECORD OF BOREHOLE: BH24-T01

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 23, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.612306° Long: -103.761489°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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RECORD OF BOREHOLE: BH24-T06

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

DATE:April 23, 2024

ELEVATION:Data Not Available

PROJECT:Weyburn SK Wind

COORDINATES:Lat: 49.601825° Long: -103.737384°

PROJECT NO:CA0026414.7023

INCLINATION:90.0°

COORD SYS:Geographical Coordinates

LOCATION:Weyburn, SK

CONTRACTOR:All Service Drilling Inc

HORZ DATUM:NAD27

VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT		GRADATION %			DYNAMIC PENETRATION										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	RESISTANCE, BLOW/0.3m												
																1	2	3	4	5	6	7	8	9	10		11	12

1	CME 55 Track	Solid Stem Auger	TOPSOIL.	CL		0.00																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic



LOGGED: Philip Chong
CHECKED: Jerry Leung

DATE: Apr 23, 2024
DATE: May 30, 2024

REV:

RECORD OF BOREHOLE: BH24-T06

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 23, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.601825° Long: -103.737384°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS					
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	X	Nat Vane	Ram Vane	Pocket Pen	1	2	3	4	5	6	7	8		9					
11	CME 55 Track Solid Stem Auger		(CL) Lean Clay, mostly low plasticity FINES, trace sand, trace gravel; light brown; moist, very stiff to hard, (Clay till).	CL			S-9	SS	100	8-10-22	32																			6.10 - 15.62 m bgs: Backfill				
12							S-10	SS	95	20-25-50/27mm																								
13							S-11	SS	98	20-41-50/142mm																								
14																																		
15																																		
16			End of hole at 15.62 m. Backfilled with cuttings and bentonite. Standpipe installed and dry upon completion. No water encountered on May 20, 2024.				S-12	SS	96	31-47-50/96mm																								
17																																		
18																																		
19																																		
20																																		

RECORD OF BOREHOLE: BH24-T09

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

DATE:April 23, 2024

ELEVATION:Data Not Available

PROJECT:Weyburn SK Wind

COORDINATES:Lat: 49.618177° Long: -103.696167°

PROJECT NO:CA0026414.7023

INCLINATION:90.0°

COORD SYS:Geographical Coordinates

LOCATION:Weyburn, SK

CONTRACTOR:All Service Drilling Inc

HORZ DATUM:NAD27

VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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DEPTH SCALE: 1:51
HAMMER TYPE: Automatic



LOGGED: Philip Chong
CHECKED: Jerry Leung

DATE: Apr 23, 2024
DATE: May 30, 2024

REV:

RECORD OF BOREHOLE: BH24-T09

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 23, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.618177° Long: -103.696167°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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RECORD OF BOREHOLE: BH24-T24

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 24, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.644550° Long: -103.649101°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27

VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES					WATER CONTENT				GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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DEPTH SCALE: 1:51
HAMMER TYPE: Automatic



LOGGED: Philip Chong
CHECKED: Jerry Leung

DATE: Apr 24, 2024
DATE: May 30, 2024

REV:

RECORD OF BOREHOLE: BH24-T24

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 24, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.644550° Long: -103.649101°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	X	Nat Vane Ram Vane Pocket Pen	1	2	3	4	5	6	7	8	9						
11	CME 55 Track Solid Stem Auger		(CL) Lean clay with sand, mostly low plasticity FINES, few sand, trace gravel; mottled orangish brown; moist, very stiff to hard. - 12.19 to 14.33 m: brown mottled gray	CL			S-9	SS	100	12-23-36	59																		6.10 - 15.70 m bgs: Backfill			
12							S-10	SS	100	9-19-31	50																					
13																																
14							S-11	SS	100	9-23-33	56																					
15																																
16			End of hole at 15.70 m. Backfilled with cuttings and bentonite. Standpipe installed and dry upon completion. No water encountered on May 20, 2024.				S-12	SS	100	8-17-31	48																					
17																																
18																																
19																																
20																																

RECORD OF BOREHOLE: BH24-T25

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 24, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.593049° Long: -103.644967°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27

VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES					WATER CONTENT		GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																														
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500

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DEPTH SCALE: 1:51
HAMMER TYPE: Automatic



LOGGED: Philip Chong
CHECKED: Jerry Leung

DATE: Apr 24, 2024
DATE: May 30, 2024

REV:

RECORD OF BOREHOLE: BH24-T25

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 24, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.593049° Long: -103.644967°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %			DYNAMIC PENETRATION		ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%)	O Water Content (%)	NP Nonplastic	GRAVEL	SAND	FINES	1 2 3 4 5 6 7 8 9	X Nat Vane	O Rem Vane	O Pocket Pen		
11	CME 55 Track Solid Stem Auger		(ML) Sandy Silt, mostly low plasticity FINES, little sand; light grey, weathered; moist. - 10.06 to 10.36 m: coal inclusions	ML			S-9	SS	100	9-13-16	29		O										
			- 11.28 to 15.70 m: increased clay content																				
12			- 12.19 to 12.50 m: coal inclusions				S-10	SS	100	8-12-17	29		O										
13																							
14							S-11	SS	100	11-16-22	38		O										
15																							
16			End of hole at 15.70 m. Backfilled with cuttings and bentonite. Standpipe installed and water at 15.5 mbgs upon completion. No water encountered on May 20, 2024.																				
17																							
18																							
19																							
20																							

RECORD OF BOREHOLE: BH24-T34

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

DATE:April 24, 2024

ELEVATION:Data Not Available

PROJECT:Weyburn SK Wind

COORDINATES:Lat: 49.571510° Long: -103.624500°

PROJECT NO:CA0026414.7023

INCLINATION:90.0°

COORD SYS:Geographical Coordinates

LOCATION:Weyburn, SK

CONTRACTOR:All S ervice Drilling Inc

HORZ DATUM:NAD27

VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT		GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) ○ Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	1 2 3 4 5 6 7 8 9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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Continued on Next Page

RECORD OF BOREHOLE: BH24-T34

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 24, 2024

INCLINATION:90.0°

CONTRACTOR:All S ervice Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.571510° Long: -103.624500°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				WATER CONTENT				GRADATION %				DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																									
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) ○ Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	1 2 3 4 5 6 7 8 9										Pipe Stickup: 1.22 m																																																																																																																																																																														
																Nat Vane Rem Vane Pocket Pen	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500		0 100 200 300 400 500	0 100 200 300 400 500			0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500	0 100 200 300 400 500

RECORD OF BOREHOLE: BH24-T46

Sheet 1 of 2

CLIENT:EDF Renewables Development Inc.

DATE:April 25, 2024

ELEVATION:Data Not Available

PROJECT:Weyburn SK Wind

COORDINATES:Lat: 49.649681° Long: -103.568409°

PROJECT NO:CA0026414.7023

INCLINATION:90.0°

COORD SYS:Geographical Coordinates

LOCATION:Weyburn, SK

CONTRACTOR:All Service Drilling Inc

HORZ DATUM:NAD27

VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT		GRADATION %			DYNAMIC PENETRATION		ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV.	DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%)	O Water Content (%)	NP Nonplastic	GRAVEL	SAND			FINES	1 2 3 4 5 6 7 8 9	
																					0 100 200 300 400 500	0 100 200 300 400 500
			TOPSOIL.			0.00																
1			(SM) Silty SAND with gravel, little gravel, little non plastic fines; light brown; dry to moist, compact.	SM		0.20	S-1	SS	44	7-10-11	21	O							144		0.00 - 0.46 m bgs: Backfill	
2			(CL) Sandy Lean Clay, mostly low plasticity FINES, trace gravel; light brown; moist, very stiff, (Clay till).	CL		1.22	S-2	SS	17	6-10-13	23	Q	I	2	33	65		96		0.46 - 0.91 m bgs: Bentonite Chips 1		
			(SM) Silty SAND, little non plastic fines, trace gravel; light brown; moist, compact.	SM		2.13	S-3	SS	56	13-16-21	37	Q	I	4	33	63						
3			(CL) Sandy Lean Clay, mostly low plasticity FINES, trace gravel; light brown mottled brown; moist, hard, iron oxide stains.	CL		2.74	GS-1	TO	100			O						144				
4			(SM) Silty SAND, little non plastic fines, trace gravel; light brown; moist, compact.	SM		3.66	S-4	SS	100	13-14-16	30	O						168			0.91 - 6.10 m bgs: Backfill	
5	CME 55 Track	Solid Stem Auger	(CL) Sandy Lean Clay, mostly low plasticity FINES, trace gravel; brown mottled; moist, hard, iron oxide stain.			4.57	S-5	SS	60	13-14-16	7m	O						168			3.66 - 6.10 m bgs: Screen Interval	
6							S-6	SS	56	11-21-31	52	O						335				
7																						
8							S-7	SS	67	8-21-24	45	O										
9																						
10							S-8	SS	72	9-21-28	49	O										

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic



LOGGED: Philip Chong

CHECKED: Jerry Leung

DATE: Apr 25, 2024

DATE: May 30, 2024

REV:

RECORD OF BOREHOLE: BH24-T46

Sheet 2 of 2

CLIENT:EDF Renewables Development Inc.

PROJECT:Weyburn SK Wind

PROJECT NO:CA0026414.7023

LOCATION:Weyburn, SK

DATE:April 25, 2024

INCLINATION:90.0°

CONTRACTOR:All Service Drilling Inc

ELEVATION:Data Not Available

COORDINATES:Lat: 49.649681° Long: -103.568409°

COORD SYS:Geographical Coordinates

HORZ DATUM:NAD27 VERT DATUM:NAVD88

HOLE LOC:Crop field

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE		SAMPLES					WATER CONTENT		GRADATION %			DYNAMIC PENETRATION RESISTANCE, BLOW/0.3m										ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	H Plastic & Liquid Limits (%) ○ Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	1	2	3	4	5	6	7	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
11	CME 55 Track Solid Stem Auger		(CL) Sandy Lean Clay, mostly low plasticity FINES, trace gravel; brown mottled; moist, hard, iron oxide stain.	CL			S-9	SS	67	10-13-24	37	○																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										</

APPENDIX C

Laboratory Test Results



PRAIRIES AND NORTH LABORATORIES

ATTN: Jerry Leung, P.Eng.
Geotechnical Engineer
WSP Canada Inc.

Received: 30-Apr-24
Report Date: 20-Jun-24
Version: Final

GEOTECHNICAL LABORATORY TEST REPORT

Client: EDF Renewables Development Inc.
Project Title: CA-Enbridge_Weyburn Wind Geotech
Project No.: CA0026414.7023
LWO No.: F069

A handwritten signature in blue ink, appearing to read 'Jeff Stone', written over a horizontal line.

Jeff Stone, M.Eng., P.Eng
Lead Geotechnical Engineer
WSP Canada Inc.

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling or transport of the sample, application or interpretation of the test data or results.

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GENERAL LAB TESTING SUMMARY

Project No.: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: DS/JG

Phase: -
LWO No.: F069
Date: 30-May-24

Sample Identification					Laboratory Test Results			
Borehole No.	Sample No.	Depth (m)		Lab No.	As Received Water Content (%)	Atterberg Limits		
		from	to			Liquid Limit	Plastic Limit	Plasticity Index
T-01	SS1	0.76	1.22	F069-001	12.9	-	-	-
T-01	SS2	1.52	1.98	F069-002	16.0	-	-	-
T-01	ST1	2.29	3.05	F069-003	21.8	-	-	-
T-01	SS3	3.05	3.51	F069-004	19.0	45	15	34
T-01	SS4	3.81	4.27	F069-005	31.1	-	-	-
T-01	SS5	4.57	5.03	F069-006	29.7	-	-	-
T-01	SS6	6.10	6.55	F069-007	29.4	-	-	-
T-01	SS7	7.62	8.08	F069-008	27.1	-	-	-
T-01	SS8	9.14	9.60	F069-009	27.0	-	-	-
T-01	SS9	10.67	11.13	F069-010	25.1	-	-	-
T-01	SS10	12.19	12.65	F069-011	24.3	-	-	-
T-01	SS11	13.72	14.17	F069-012	23.6	-	-	-
T-01	SS12	15.24	15.70	F069-013	22.9	-	-	-
T-06	SS1	0.76	1.22	F069-014	12.2	-	-	-
T-06	SS2	1.52	1.98	F069-015	15.9	-	-	-
T-06	ST1	2.29	3.05	F069-016	29.8	-	-	-
T-06	SS3	3.05	3.51	F069-017	29.6	-	-	-
T-06	SS4	3.81	4.27	F069-018	28.8	88	24	64
T-06	SS5	4.57	5.03	F069-019	29.2	-	-	-
T-06	SS6	6.10	6.55	F069-020	27.1	-	-	-
T-06	SS7	7.62	8.08	F069-021	25.2	-	-	-
T-06	SS8	9.14	9.60	F069-022	27.6	-	-	-
T-06	SS9	10.67	11.13	F069-023	25.1	-	-	-
T-06	SS10	12.19	12.65	F069-024	23.1	-	-	-
T-06	SS11	13.72	14.17	F069-025	22.1	-	-	-
T-06	SS12	15.24	15.70	F069-026	22.3	-	-	-



GENERAL LAB TESTING SUMMARY

Project No.: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: DS/JG

Phase: -
LWO No.: F069
Date: 30-May-24

Sample Identification					Laboratory Test Results			
Borehole No.	Sample No.	Depth (m)		Lab No.	As Received Water Content (%)	Atterberg Limits		
		from	to			Liquid Limit	Plastic Limit	Plasticity Index
T-09	SS1	0.76	1.22	F069-027	5.3	-	-	-
T-09	SS2	1.52	1.98	F069-028	11.0	35	13	22
T-09	SS3	2.29	2.74	F069-029	12.8	-	-	-
T-09	SS4	3.05	3.51	F069-030	10.9	-	-	-
T-09	SS5	3.81	4.27	F069-031	14.5	-	-	-
T-09	SS6	4.57	5.03	F069-032	18.8	45	15	30
T-09	SS7	6.10	6.55	F069-033	19.7	-	-	-
T-09	SS8	7.62	8.08	F069-034	24.2	-	-	-
T-09	SS9	9.14	9.60	F069-035	24.0	-	-	-
T-09	SS10	10.67	11.13	F069-036	23.6	-	-	-
T-09	SS11	12.19	12.65	F069-037	21.7	-	-	-
T-09	SS12	13.72	14.17	F069-038	23.5	-	-	-
T-09	SS13	15.24	15.70	F069-039	23.5	-	-	-
T-24	SS1	0.76	1.22	F069-040	10.0	47	15	32
T-24	SS2	1.52	1.98	F069-041	11.1	-	-	-
T-24	ST1	2.29	3.05	F069-042	13.0	-	-	-
T-24	SS3	3.05	3.51	F069-043	16.1	-	-	-
T-24	SS4	3.81	4.27	F069-044	9.1	26	13	13
T-24	SS5	4.57	5.03	F069-045	11.3	-	-	-
T-24	SS6	6.10	6.55	F069-046	18.0	-	-	-
T-24	SS7	7.62	8.08	F069-047	15.5	-	-	-
T-24	SS8	9.14	9.60	F069-048	16.0	-	-	-
T-24	SS9	10.67	11.13	F069-049	15.2	-	-	-
T-24	SS10	12.19	12.65	F069-050	18.5	-	-	-
T-24	SS11	13.72	14.17	F069-051	16.8	-	-	-
T-24	SS12	15.24	15.70	F069-052	18.4	-	-	-



GENERAL LAB TESTING SUMMARY

Project No.: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: DS/JG

Phase: -
LWO No.: F069
Date: 30-May-24

Sample Identification					Laboratory Test Results			
Borehole No.	Sample No.	Depth (m)		Lab No.	As Received Water Content (%)	Atterberg Limits		
		from	to			Liquid Limit	Plastic Limit	Plasticity Index
T-25	SS1	0.76	1.22	F069-053	18.9	-	-	-
T-25	SS2	1.52	1.98	F069-054	24.3	77	22	55
T-25	ST1	2.29	3.05	F069-055	17.8	-	-	-
T-25	SS3	3.05	3.51	F069-056	20.2	-	-	-
T-25	SS4	3.81	4.27	F069-057	24.1	35	14	21
T-25	SS5	4.57	5.03	F069-058	26.8	-	-	-
T-25	SS6	6.10	6.55	F069-059	21.4	-	-	-
T-25	SS7	7.62	8.08	F069-060	18.4	-	-	-
T-25	SS8	9.14	9.60	F069-061	21.9	-	-	-
T-25	SS9	10.67	11.13	F069-062	21.2	-	-	-
T-25	SS10	12.19	12.65	F069-063	23.9	-	-	-
T-25	SS11	13.72	14.17	F069-064	23.8	-	-	-
T-25	SS12	15.24	15.70	F069-065	22.6	-	-	-
T-34	SS1	0.76	1.22	F069-066	15.3	-	-	-
T-34	SS2	1.52	1.98	F069-067	21.2	-	-	-
T-34	ST1	2.29	3.05	F069-068	18.7	-	-	-
T-34	SS3	3.05	3.51	F069-069	19.9	44	14	30
T-34	SS4	3.81	4.27	F069-070	19.0	-	-	-
T-34	SS5	4.57	5.03	F069-071	18.7	-	-	-
T-34	SS6	6.10	6.55	F069-072	29.0	-	-	-
T-34	SS7	7.62	8.08	F069-073	26.0	85	21	64
T-34	SS8	9.14	9.60	F069-074	24.7	-	-	-
T-34	SS9	10.67	11.13	F069-075	29.4	-	-	-
T-34	SS10	12.19	12.65	F069-076	27.6	-	-	-
T-34	SS11	13.72	14.17	F069-077	30.0	-	-	-
T-34	SS12	15.24	15.70	F069-078	30.5	-	-	-



GENERAL LAB TESTING SUMMARY

Project No.: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: DS/JG

Phase: -
LWO No.: F069
Date: 30-May-24

Sample Identification					Laboratory Test Results			
Borehole No.	Sample No.	Depth (m)		Lab No.	As Received Water Content (%)	Atterberg Limits		
		from	to			Liquid Limit	Plastic Limit	Plasticity Index
T-46	SS1	0.76	1.22	F069-079	5.3	-	-	-
T-46	SS2	1.52	1.98	F069-080	12.4	46	15	31
T-46	SS3	2.29	2.74	F069-081	12.0	45	15	30
T-46	ST1	3.05	3.81	F069-082	14.6	-	-	-
T-46	SS4	3.81	4.27	F069-083	9.3	-	-	-
T-46	SS5	4.57	5.03	F069-084	18.5	-	-	-
T-46	SS6	6.10	6.55	F069-085	10.1	-	-	-
T-46	SS7	7.62	8.08	F069-086	10.1	-	-	-
T-46	SS8	9.14	9.60	F069-087	11.1	-	-	-
T-46	SS9	10.67	11.13	F069-088	10.3	-	-	-
T-46	SS10	12.19	12.65	F069-089	10.9	-	-	-
T-46	SS11	13.72	14.17	F069-090	10.0	-	-	-
T-46	SS12	15.24	15.70	F069-091	10.1	-	-	-
T-25	BULK	0.00	2.00	F069-092	24.6	-	-	-

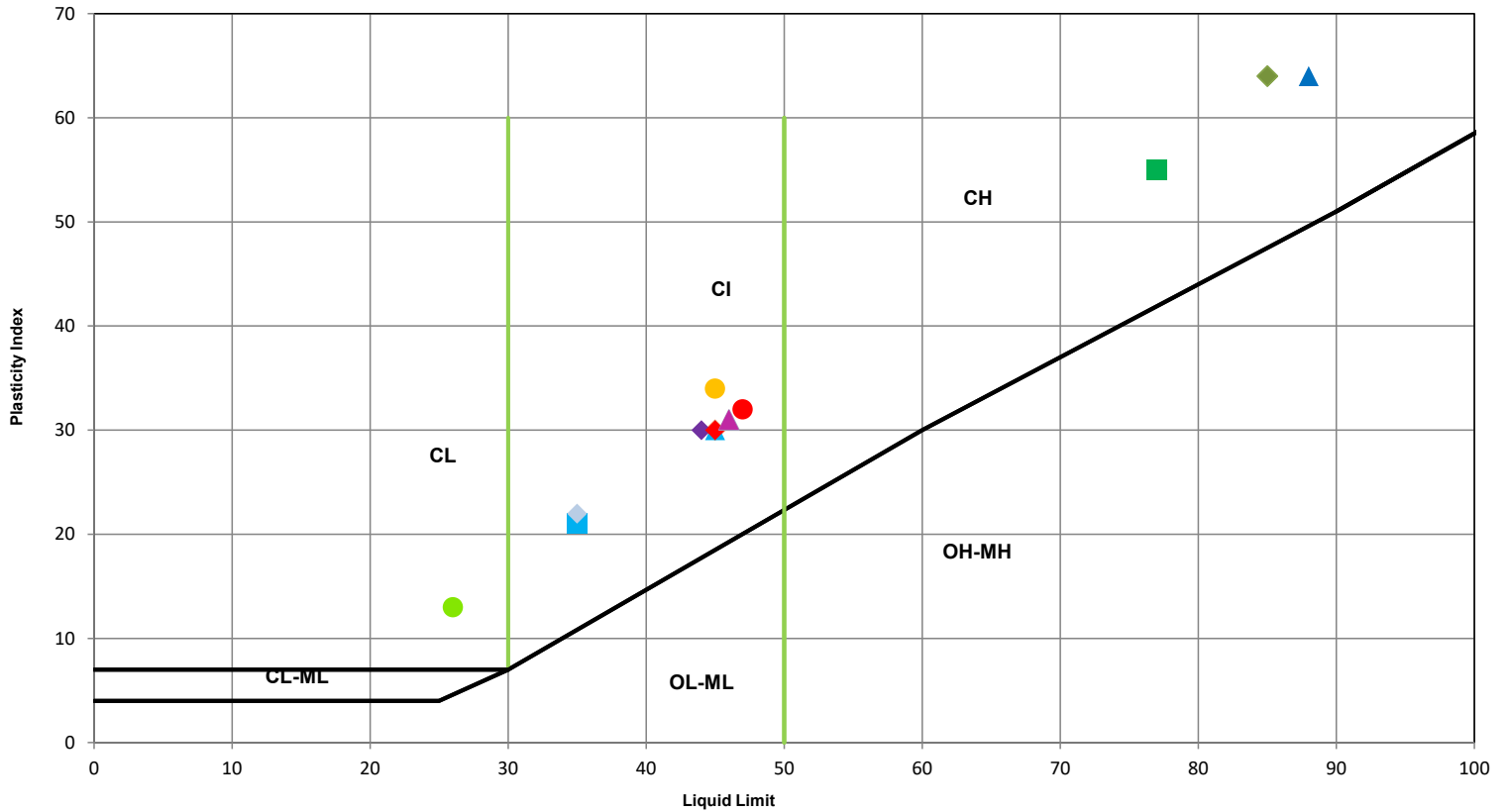


ATTERBERG LIMIT SUMMARY

(ASTM D4318)

Project No.: CA0026414.7023	Phase: -
Short Title: CA-Enbridge_Weyburn Wind Geotech	Sched.: F069
Tested By: DS/BU	Date: 23-May-24

Plasticity Chart for Soil Passing 425 µm Sieve



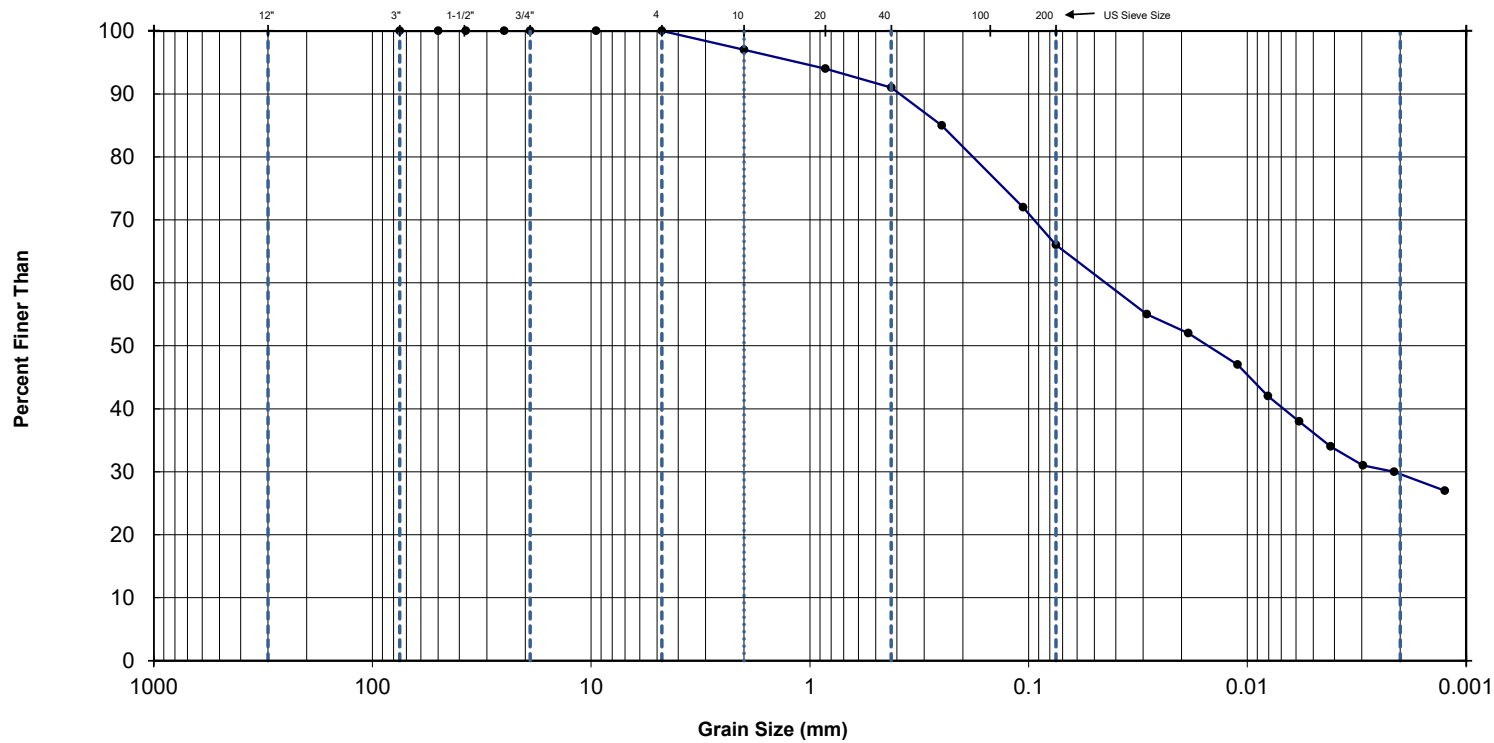
Borehole No.	Sample No.	Depth (m)		Lab No.:	LL	PL	PI	Symbol
		from	to					
T-01	SS3	3.05	3.51	F069-004	45	15	34	●
T-06	SS4	3.81	4.27	F069-018	88	24	64	▲
T-09	SS2	1.52	1.98	F069-028	35	13	22	◆
T-09	SS6	4.57	5.03	F069-032	45	15	30	▲
T-24	SS1	0.76	1.22	F069-040	47	15	32	●
T-24	SS4	3.81	4.27	F069-044	26	13	13	●
T-25	SS2	1.52	1.98	F069-054	77	22	55	■
T-25	SS4	3.81	4.27	F069-057	35	14	21	■
T-34	SS3	3.05	3.51	F069-069	44	14	30	◆
T-34	SS7	7.62	8.08	F069-073	85	21	64	◆
T-46	SS2	1.52	1.98	F069-080	46	15	31	▲
T-46	SS3	2.29	2.74	F069-081	45	15	30	◆



Project No.: CA0026414.7023 Lab No.: F069-004
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-01 Sample No.: SS3
Depth: 3.05 to 3.51 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	100
2.00	97
0.850	94
0.425	91
0.250	85
0.106	72
0.075	66
0.029	55
0.019	52
0.011	47
0.008	42
0.006	38
0.004	34
0.003	31
0.002	30
0.001	27

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

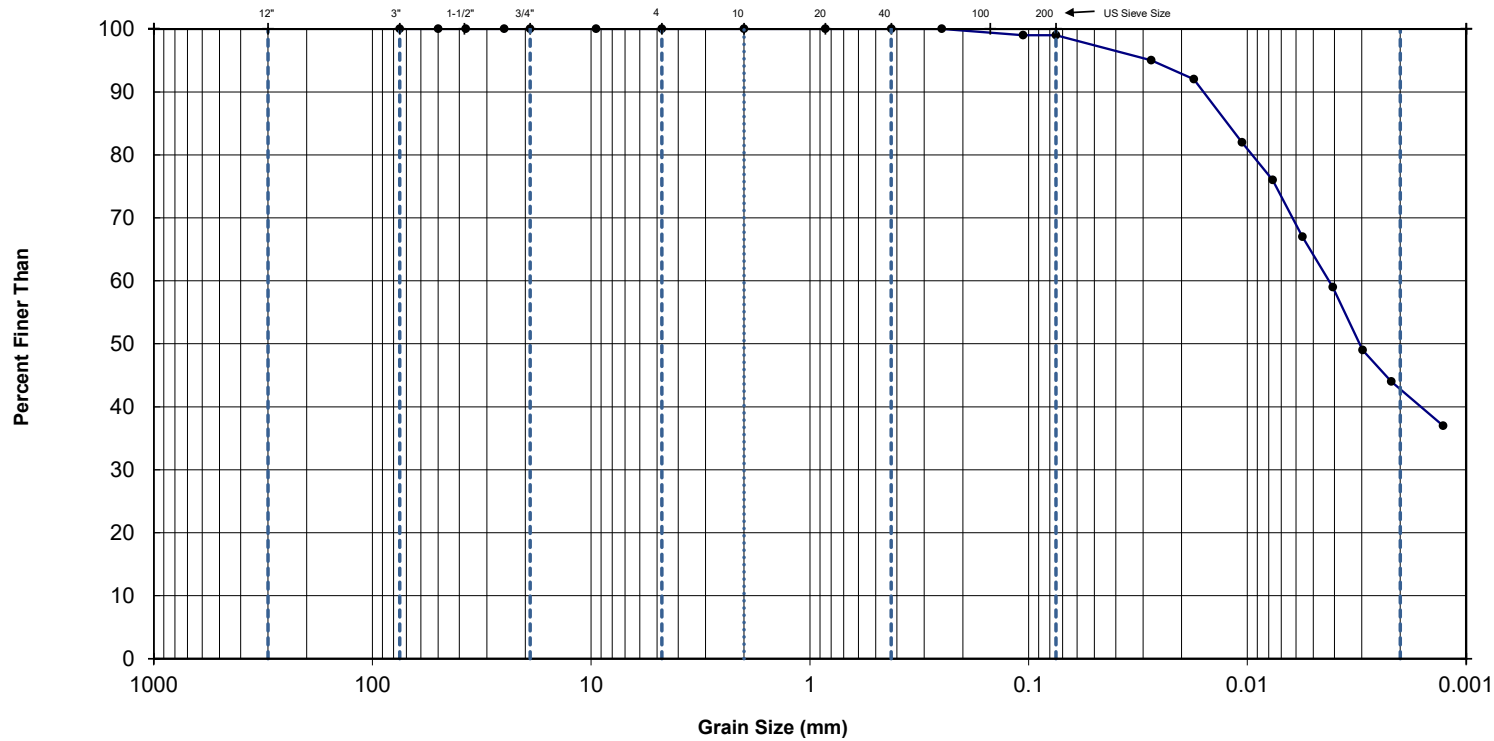
PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	0%	3%	6%	25%	36%	30%
0%		34%			66%	



Project No.: CA0026414.7023 Lab No.: F069-018
Project Title: Weyburn SK Wind
Borehole No.: T-06 Sample No.: SS4
Depth: 3.81 to 4.27 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL (AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	100
2.00	100
0.850	100
0.425	100
0.250	100
0.106	99
0.075	99
0.028	95
0.018	92
0.011	82
0.008	76
0.006	67
0.004	59
0.003	49
0.002	44
0.001	37

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

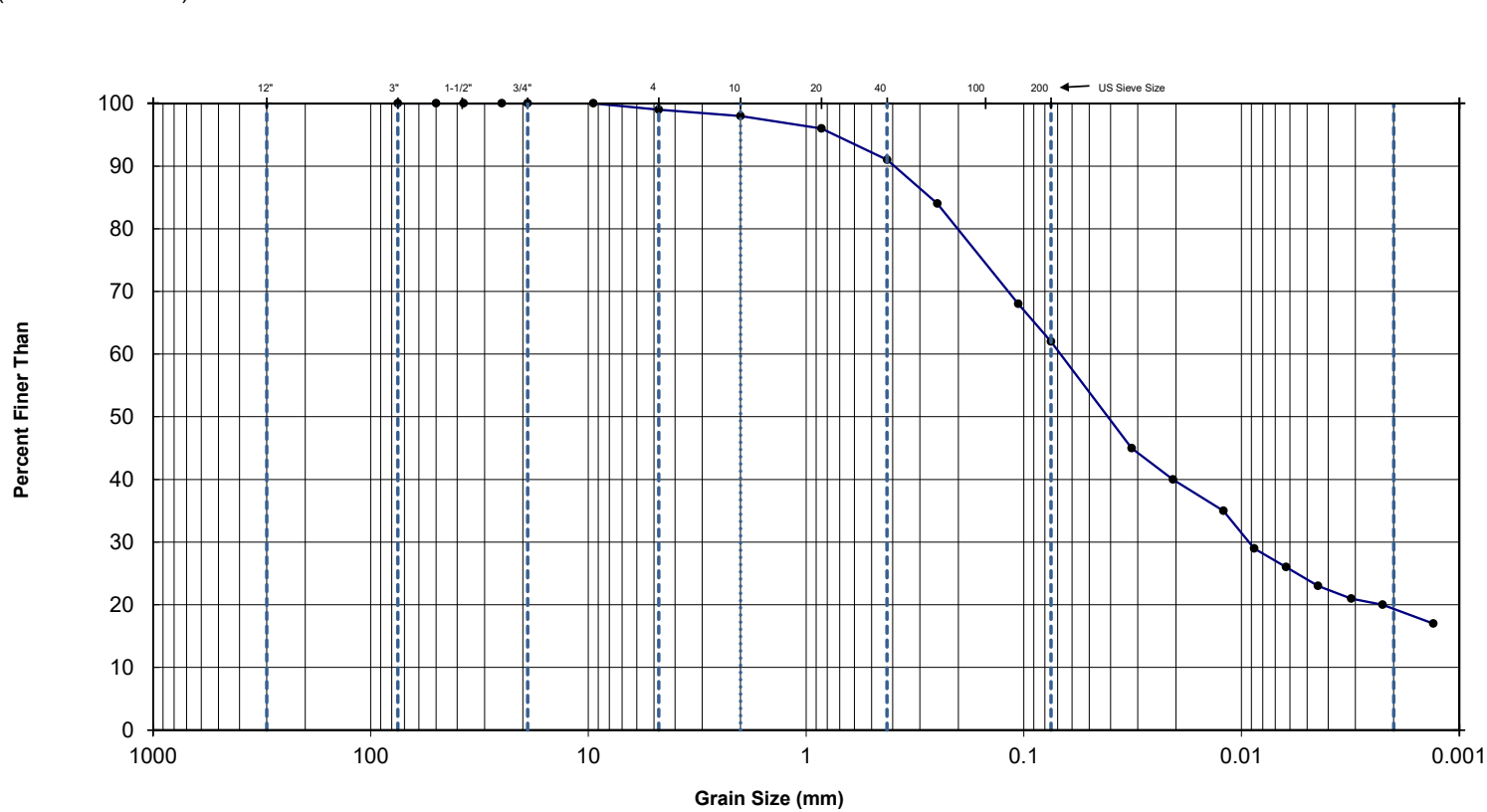
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	0%	0%	0%	1%	56%	43%
0%		1%			99%	



Project No.: CA0026414.7023 Lab No.: F069-028
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-09 Sample No.: SS2
Depth: 1.52 to 1.98 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

Comments:

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

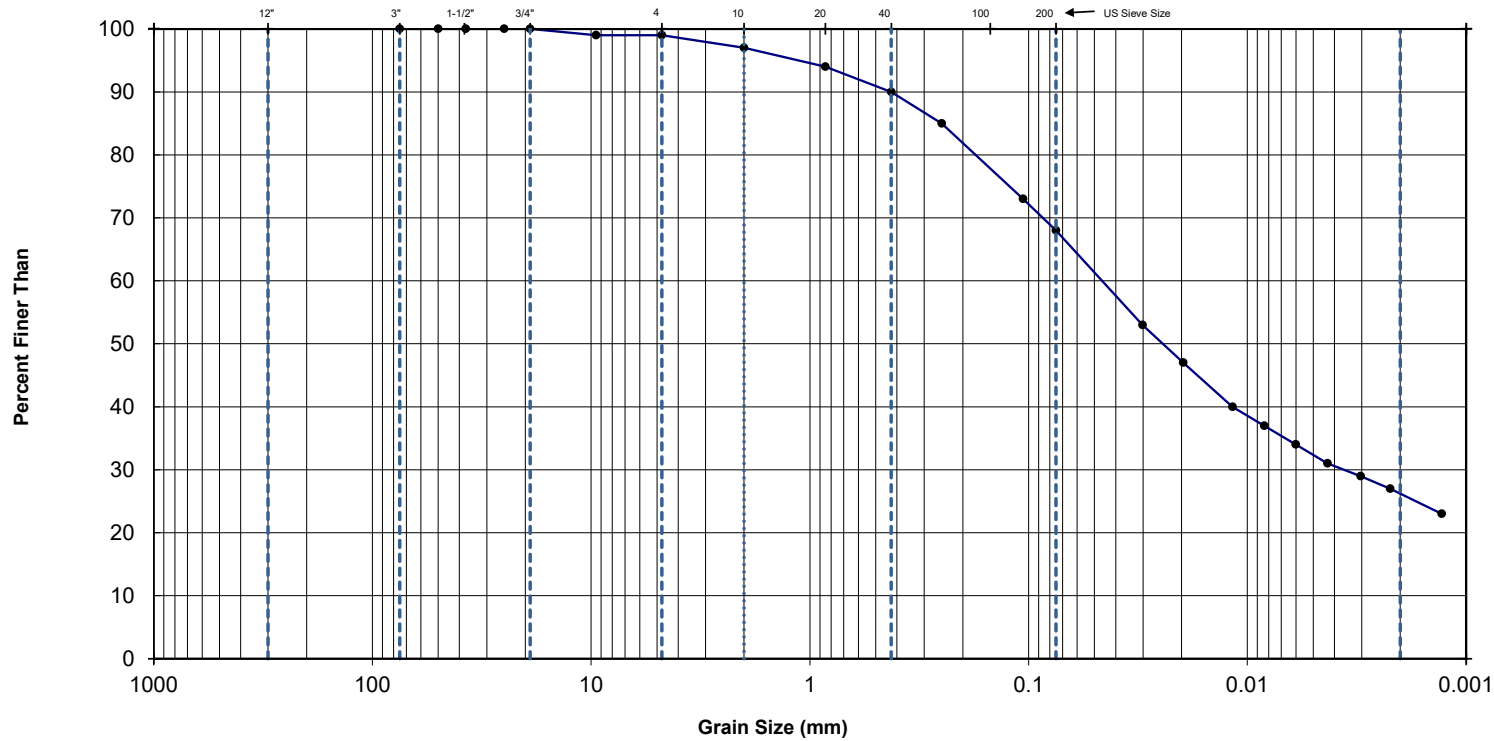
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	1%	1%	7%	29%	43%	19%
1%		37%			62%	



Project No.: CA0026414.7023 Lab No.: F069-032
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-09 Sample No.: SS6
Depth: 4.57 to 5.03 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	99
4.75	99
2.00	97
0.850	94
0.425	90
0.250	85
0.106	73
0.075	68
0.030	53
0.020	47
0.012	40
0.008	37
0.006	34
0.004	31
0.003	29
0.002	27
0.001	23

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

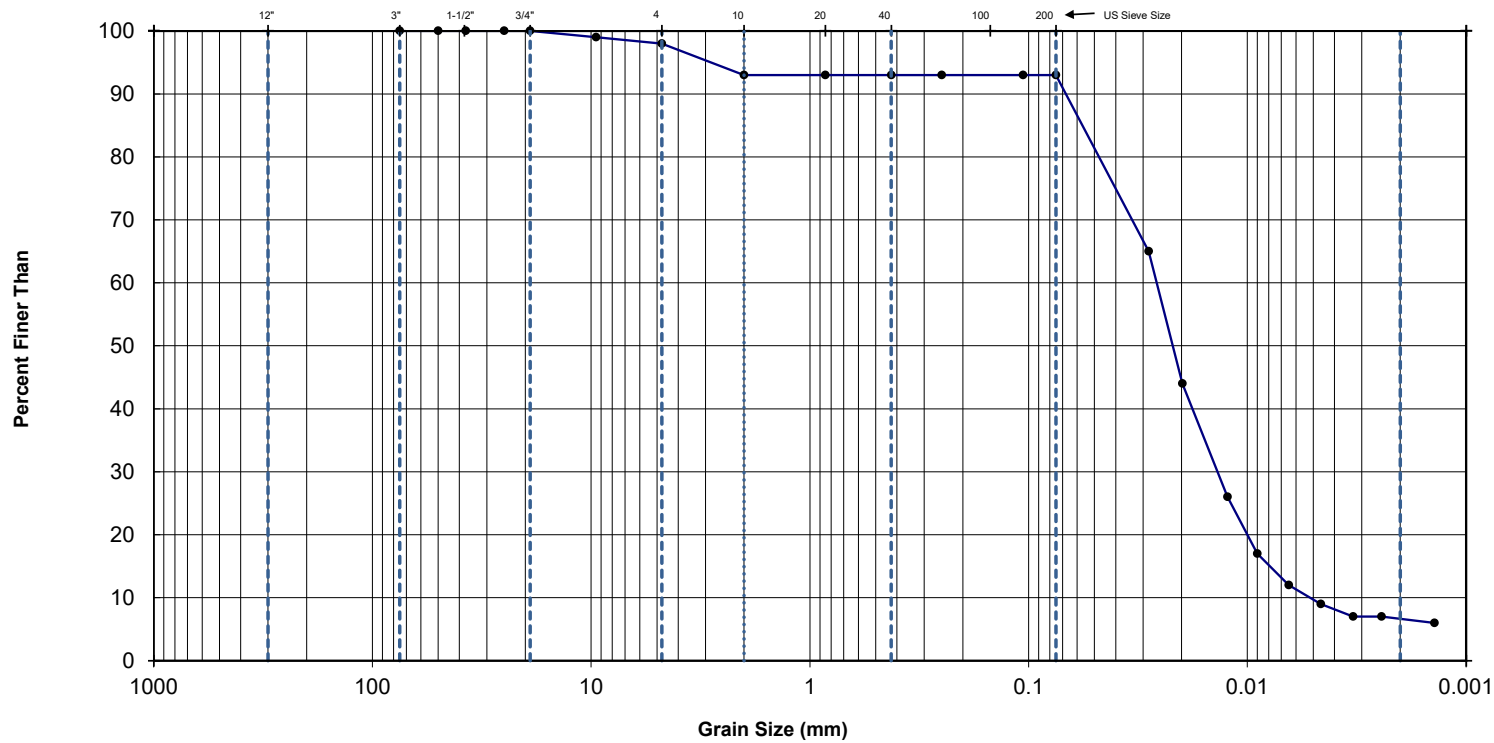
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	1%	2%	7%	22%	41%	27%
1%		31%			68%	



Project No.: CA0026414.7023 Lab No.: F069-040
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-24 Sample No.: SS1
Depth: 0.76 to 1.22 m
Date Tested: 03-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	99
4.75	98
2.00	93
0.850	93
0.425	93
0.250	93
0.106	93
0.075	93
0.028	65
0.020	44
0.012	26
0.009	17
0.006	12
0.005	9
0.003	7
0.002	7
0.001	6

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

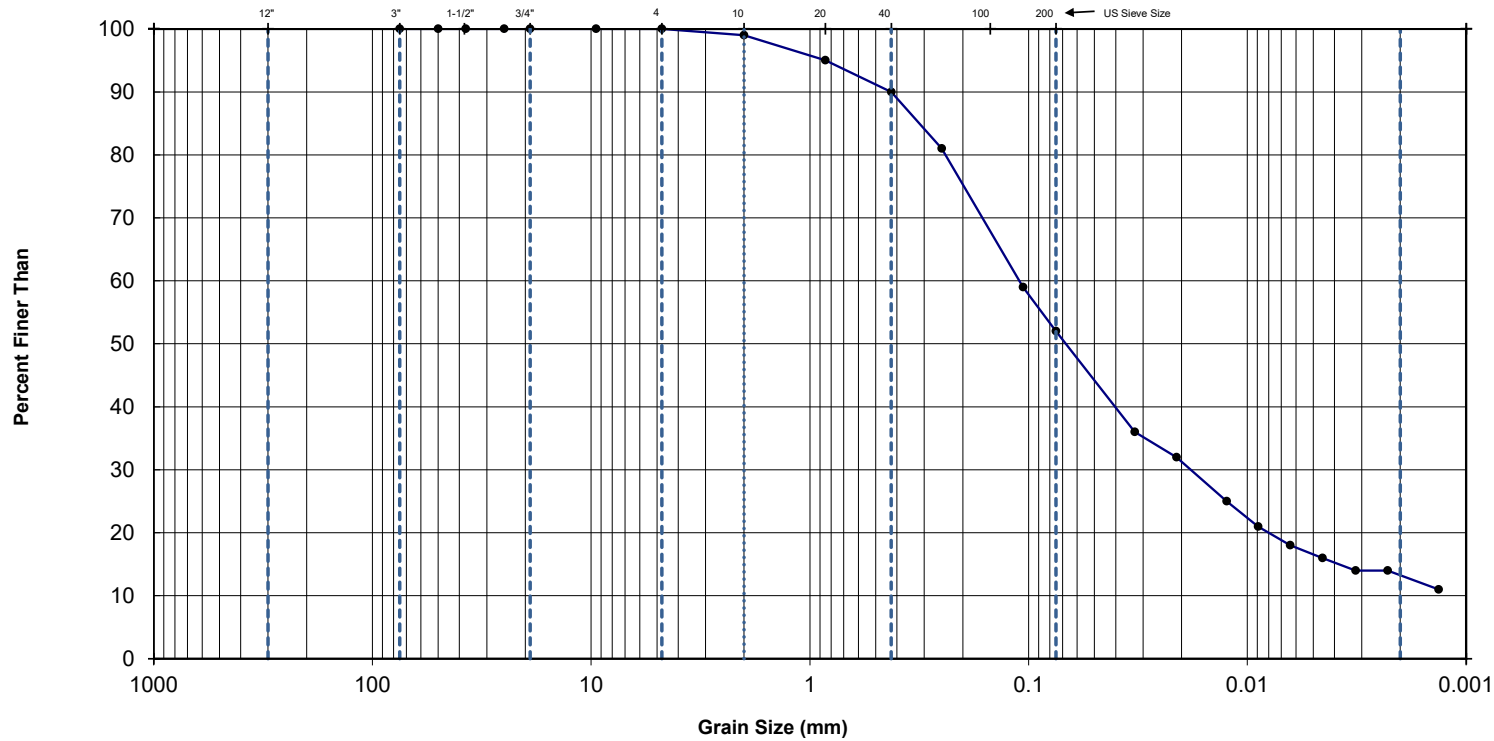
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	2%	5%	0%	0%	86%	7%
2%		5%			93%	



Project No.: CA0026414.7023 Lab No.: F069-044
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-24 Sample No.: SS4
Depth: 3.81 to 4.27 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	100
2.00	99
0.850	95
0.425	90
0.250	81
0.106	59
0.075	52
0.033	36
0.021	32
0.012	25
0.009	21
0.006	18
0.005	16
0.003	14
0.002	14
0.001	11

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

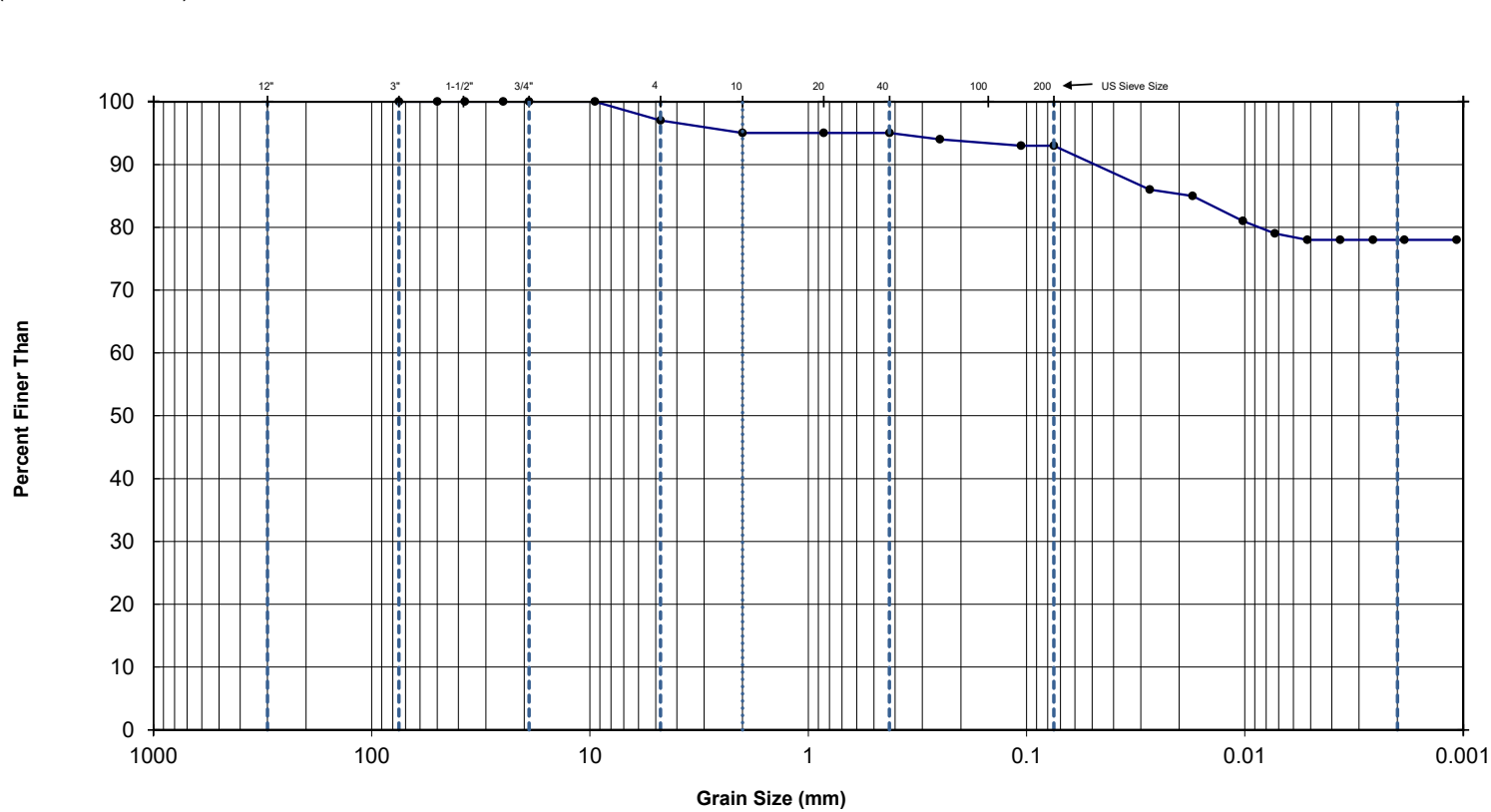
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	0%	1%	9%	38%	39%	13%
0%		48%			52%	



Project No.: CA0026414.7023 Lab No.: F069-054
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-25 Sample No.: SS2
Depth: 1.52 to 1.98 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

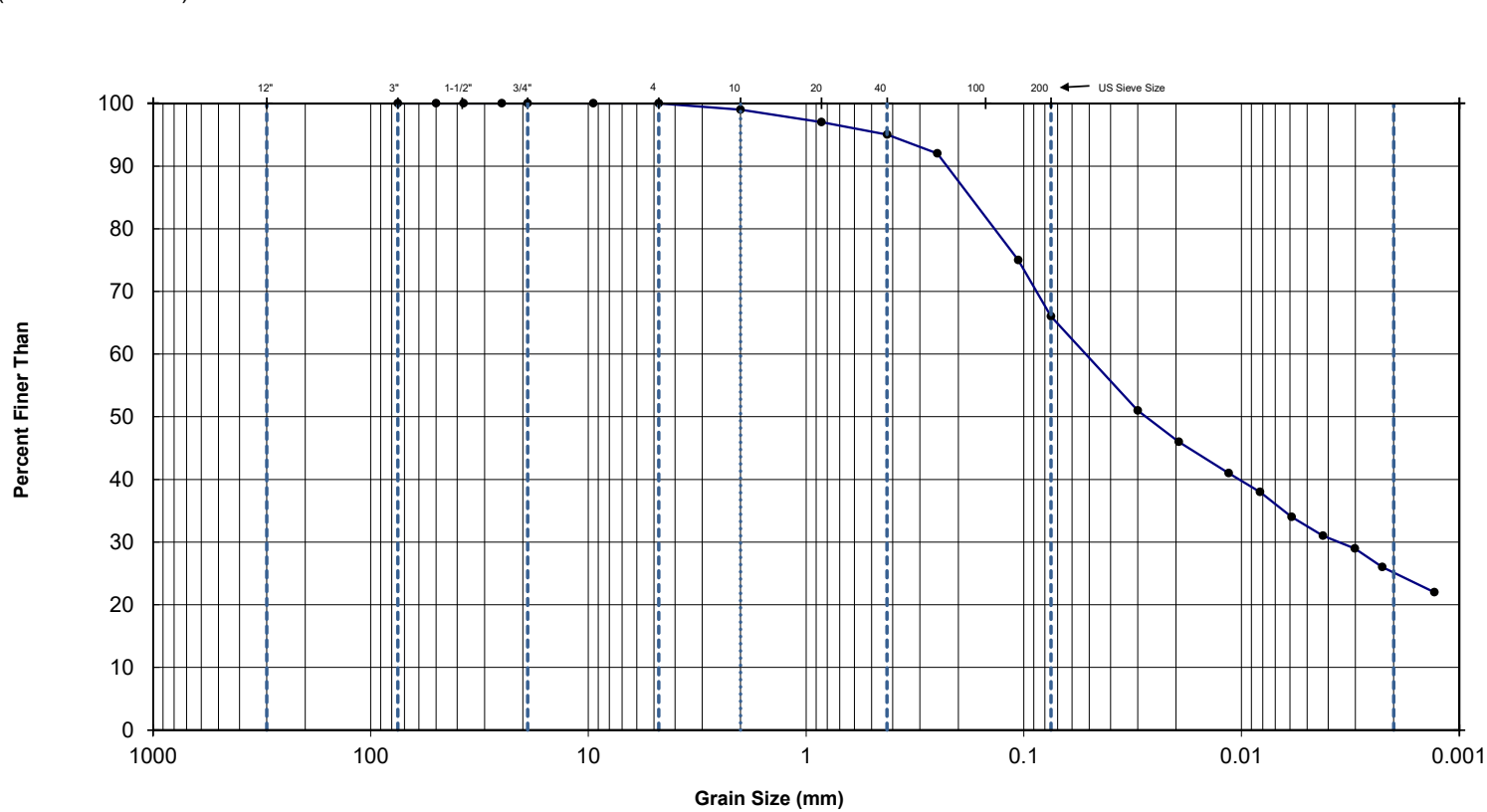
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	3%	2%	0%	2%	15%	78%
3%		4%			93%	



Project No.: CA0026414.7023 Lab No.: F069-057
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-25 Sample No.: SS4
Depth: 3.81 to 4.27 m
Date Tested: 03-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	100
2.00	99
0.850	97
0.425	95
0.250	92
0.106	75
0.075	66
0.030	51
0.019	46
0.011	41
0.008	38
0.006	34
0.004	31
0.003	29
0.002	26
0.001	22

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

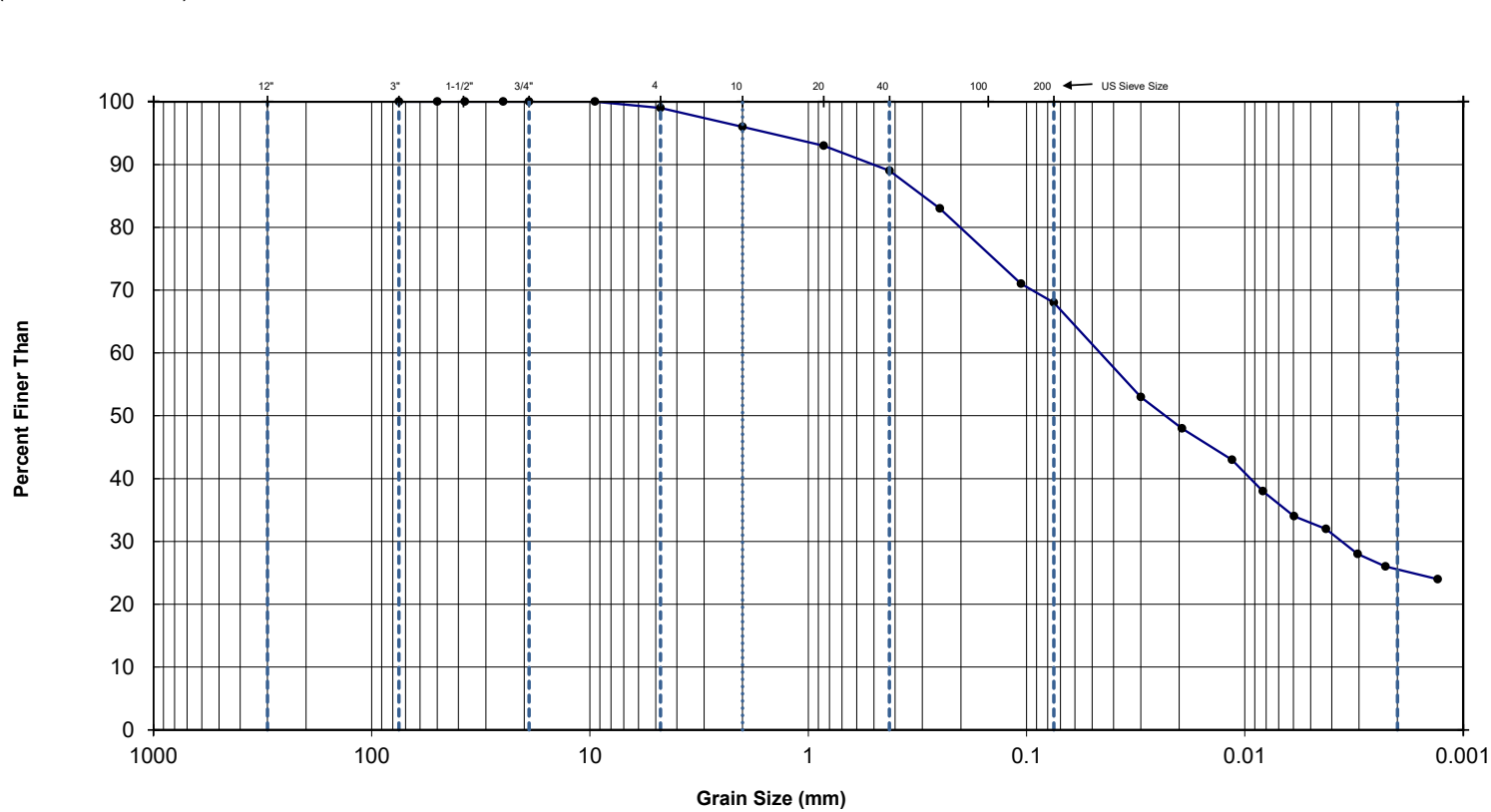
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	0%	1%	4%	29%	41%	25%
0%		34%			66%	



Project No.: CA0026414.7023 Lab No.: F069-069
Project Title: Weyburn SK Wind
Borehole No.: T-34 Sample No.: SS3
Depth: 3.05 to 3.51 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	99
2.00	96
0.850	93
0.425	89
0.250	83
0.106	71
0.075	68
0.030	53
0.019	48
0.011	43
0.008	38
0.006	34
0.004	32
0.003	28
0.002	26
0.001	24

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

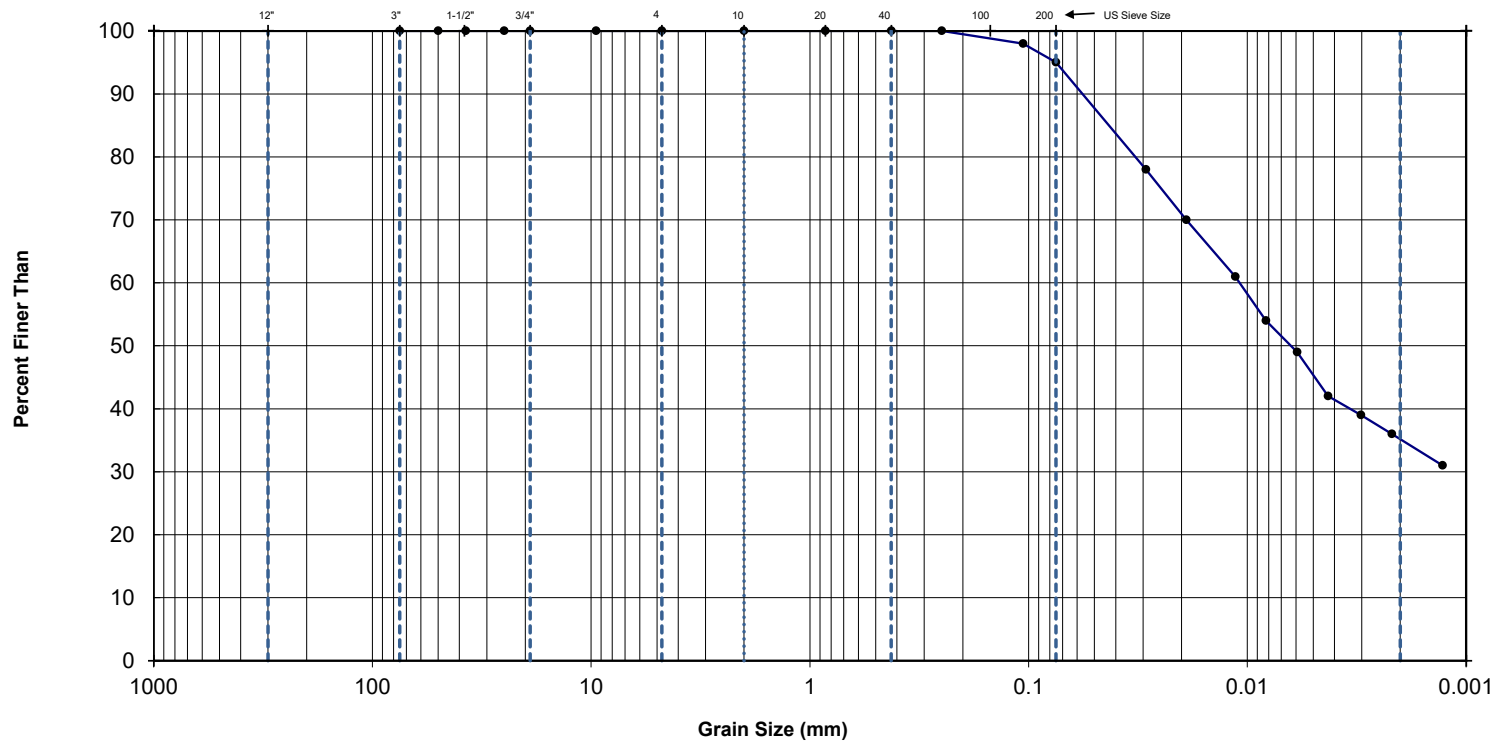
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	1%	3%	7%	21%	43%	25%
1%		31%			68%	



Project No.: CA0026414.7023 Lab No.: F069-073
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-34 Sample No.: SS7
Depth: 7.62 to 8.08 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	100
2.00	100
0.850	100
0.425	100
0.250	100
0.106	98
0.075	95
0.029	78
0.019	70
0.011	61
0.008	54
0.006	49
0.004	42
0.003	39
0.002	36
0.001	31

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

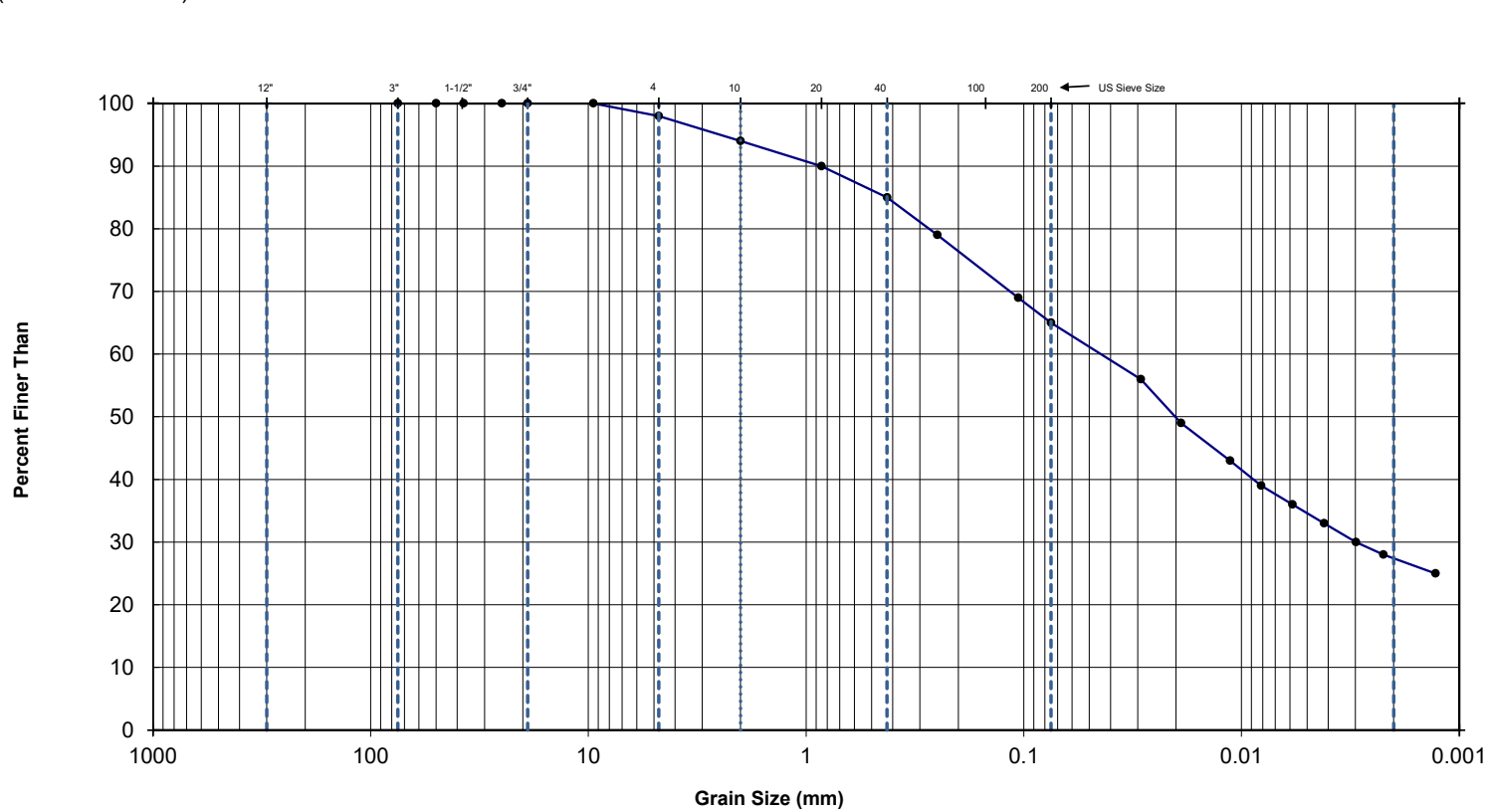
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	0%	0%	0%	5%	60%	35%
0%		5%			95%	



Project No.: CA0026414.7023 Lab No.: F069-080
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-46 Sample No.: SS2
Depth: 1.52 to 1.98 m
Date Tested: 01-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	100
4.75	98
2.00	94
0.850	90
0.425	85
0.250	79
0.106	69
0.075	65
0.029	56
0.019	49
0.011	43
0.008	39
0.006	36
0.004	33
0.003	30
0.002	28
0.001	25

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

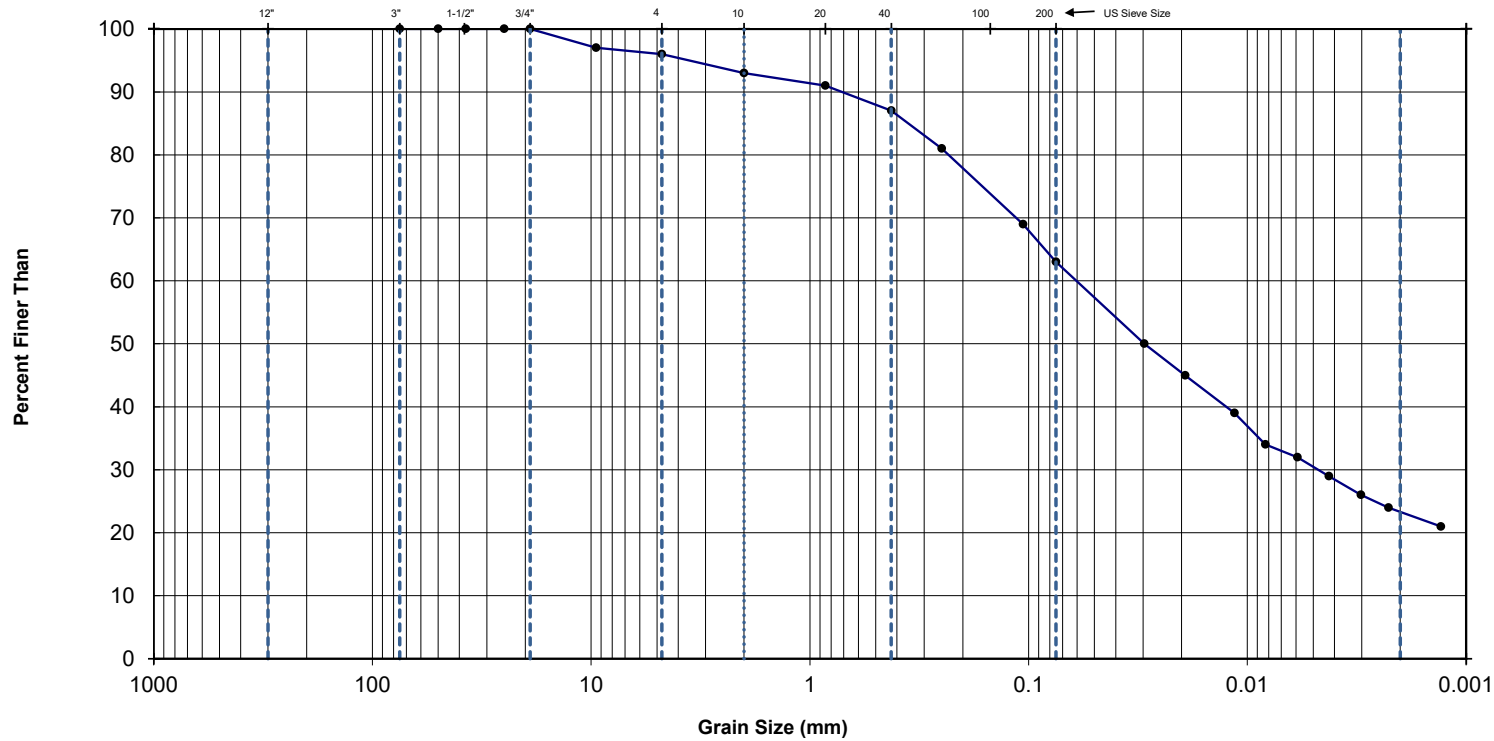
GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	2%	4%	9%	20%	37%	28%
2%		33%			65%	



Project No.: CA0026414.7023 Lab No.: F069-081
Project Title: CA-Enbridge Weyburn Wind Geotech
Borehole No.: T-46 Sample No.: SS3
Depth: 2.29 to 2.74 m
Date Tested: 03-May-24 By: JG

PARTICLE SIZE ANALYSIS OF SOIL

(AASHTO T88-13)



Diameter of Sieve (mm)	Percent Passing (%)
75.0	100
50.0	100
37.5	100
25.0	100
19.0	100
9.50	97
4.75	96
2.00	93
0.850	91
0.425	87
0.250	81
0.106	69
0.075	63
0.030	50
0.019	45
0.011	39
0.008	34
0.006	32
0.004	29
0.003	26
0.002	24
0.001	21

Comments:

Boulder Size	Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		Gravel Size		Sand Size				

PERCENT GRAVEL, SAND, SILT AND CLAY OF SAMPLE

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		
0%	4%	3%	6%	24%	40%	23%
4%		33%			63%	



LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT

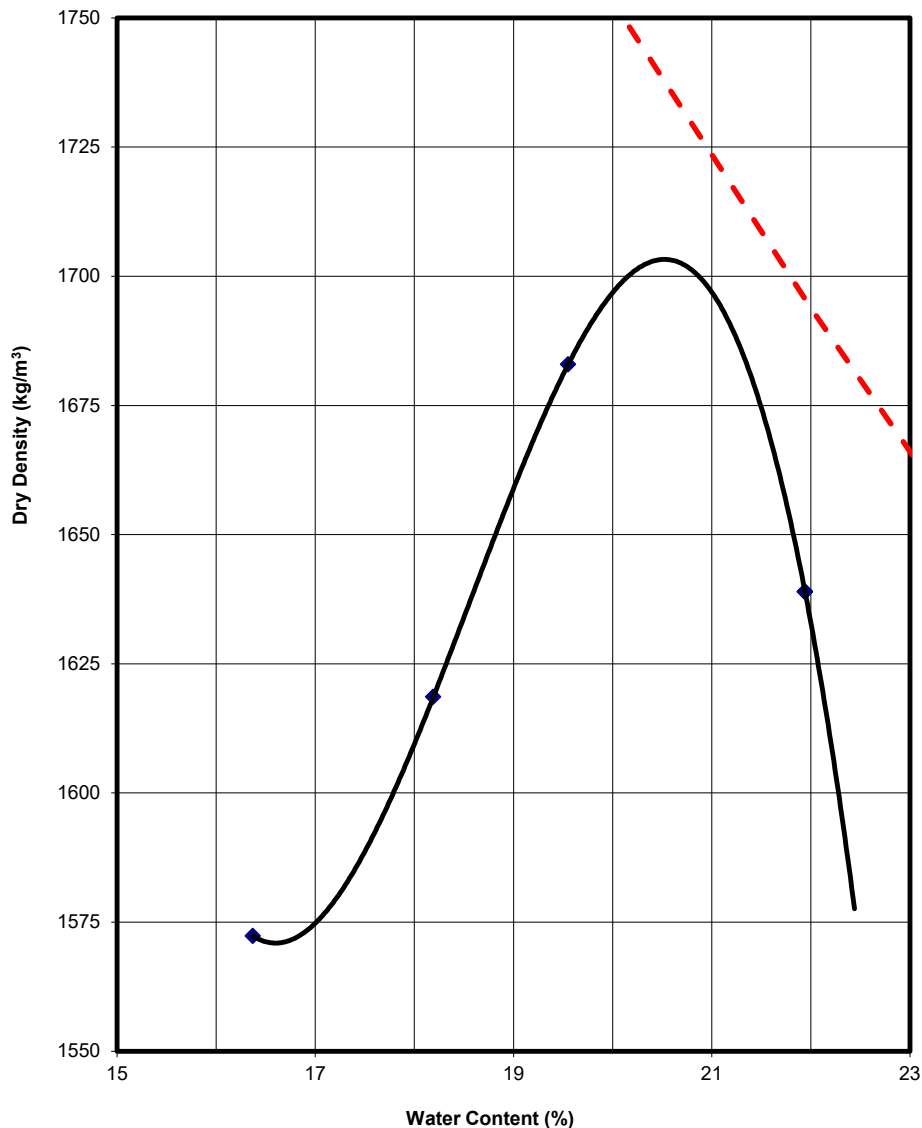
(ASTM D698)

Project No.: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: KS

Phase: -
Lab No.: F069-092
Test Date: 14-Dec-23

Borehole No.: T-25	Date Sampled: 21-Apr-24
Sample No.: BULK	Source: Sole
Sampled By: P. Chong	Depth: 0.00 - 2.00 (m)

MOISTURE DENSITY RELATIONSHIP



Maximum Dry Density

Max. Dry Density 1702 kg/m³
Optimum w 20.5 %

Method A

Rock Correction (if required)

% Oversize _____ %

Max. Dry Density _____ kg/m³
Optimum w _____ %

Assumed Specific Gravity: 2.70

Note:

Sample Description:

(CI) sandy SILTY CLAY, fine to coarse sand, medium plasticity fines; brown; cohesive, moist

As Received Water Content: 24.5%

◆ Dry Density - - - ZAV (2.70) — Density Curve



UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24

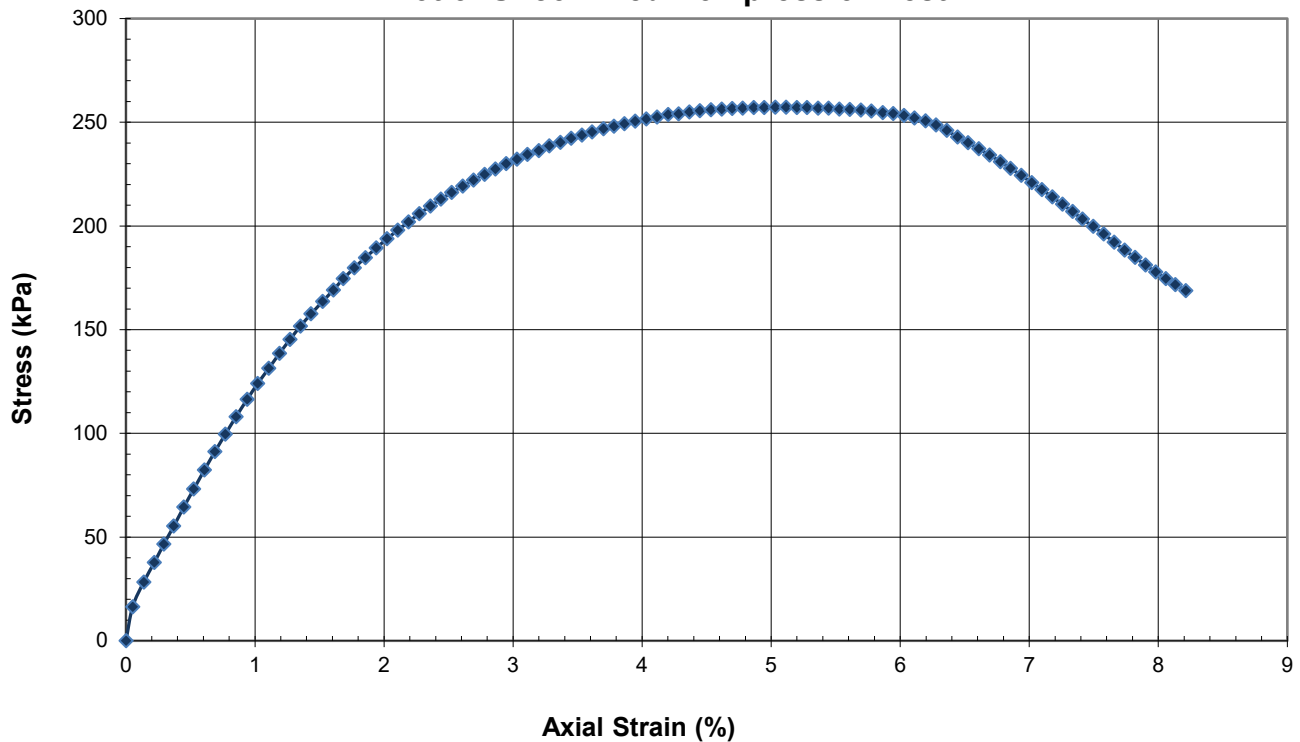
Borehole No.:	T-01	Sample No.:	ST1	Depth:	2.29-3.05 m	Lab No.:	F069-003
Location:	-						
Sample Description:	(CI) SILTY CLAY, trace sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, very stiff						

Compressive Strength (q_u):	257 kPa
Shear Strength (s_u):	129 kPa
Strain at Failure:	5.0 %

Strain Rate:	0.99 %/min
Failure Type:	Diagonal Shear

Diameter:	7.35 cm
Height:	14.17 cm
H/D Ratio:	1.9
Dry Density:	1672 kg/m ³
Water Content:	21.8 % on entire sample (posttest)
Sample Type:	Undisturbed

Plot of Unconfined Compression Test



Remarks:

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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24
Borehole No.:	T-01	Sample No.:	ST1
		Depth:	2.29-3.05 m
Location:	-	Lab No.:	F069-003
Sample Description:	(CI) SILTY CLAY, trace sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, very stiff		

Post Test Photo or Sketch



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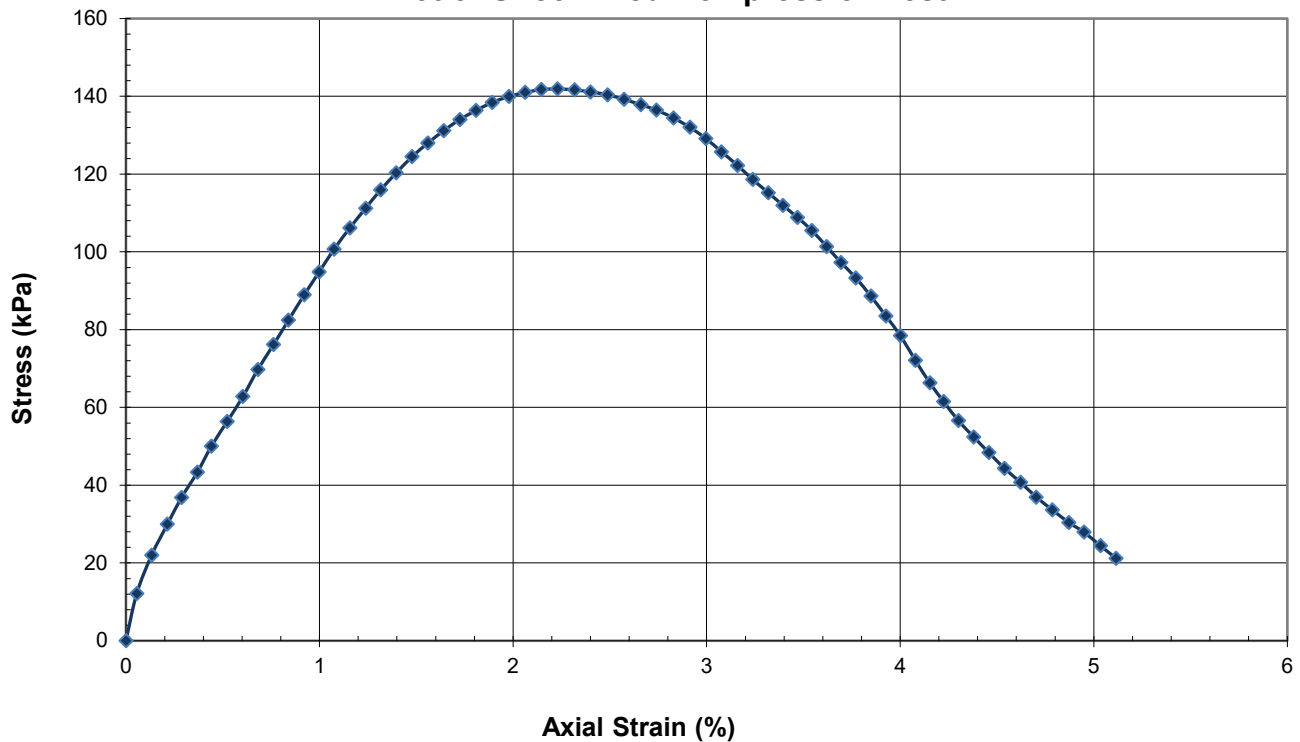
UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24
Borehole No.:	T-06	Sample No.:	ST1
		Depth:	2.29-3.05 m
Location:	-	Lab No.:	F069-016
Sample Description:	(CI) SILTY CLAY, trace fine gravel, medium plasticity fines; dark brown; cohesive, moist, stiff		

Compressive Strength (q_u):	142 kPa	Diameter:	7.31 cm
Shear Strength (s_u):	71 kPa	Height:	14.24 cm
Strain at Failure:	2.1 %	H/D Ratio:	1.9
		Dry Density:	1486 kg/m ³
Strain Rate:	0.96 %/min	Water Content:	29.8 % on entire sample (posttest)
Failure Type:	Diagonal Shear	Sample Type:	Undisturbed

Plot of Unconfined Compression Test



Remarks:

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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24
Borehole No.:	T-06	Sample No.:	ST1 Depth: 2.29-3.05 m Lab No.: F069-016
Location:	-		
Sample Description:	(CI) SILTY CLAY, trace fine gravel, medium plasticity fines; dark brown; cohesive, moist, stiff		

Post Test Photo or Sketch



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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	09-May-24

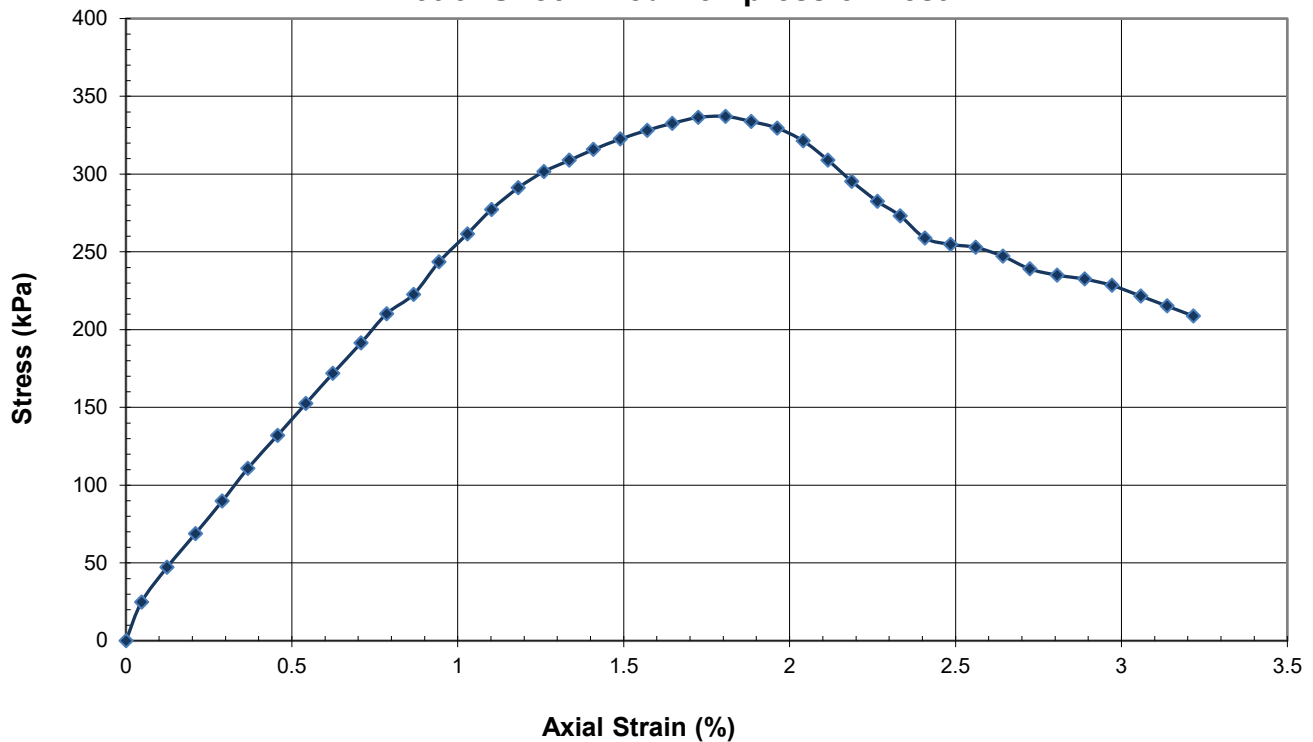
Borehole No.:	T-24	Sample No.:	ST1	Depth:	2.29-3.05 m	Lab No.:	F069-042
Location:	-						
Sample Description:	(CI) SILTY CLAY, trace fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, very stiff						

Compressive Strength (q_u):	337 kPa
Shear Strength (s_u):	169 kPa
Strain at Failure:	1.7 %

Strain Rate:	0.96 %/min
Failure Type:	Vertical Split

Diameter:	7.14 cm
Height:	14.29 cm
H/D Ratio:	2.0
Dry Density:	1788 kg/m ³
Water Content:	13.0 % on entire sample (posttest)
Sample Type:	Undisturbed

Plot of Unconfined Compression Test



Remarks:

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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	09-May-24
Borehole No.:	T-24	Sample No.:	ST1
		Depth:	2.29-3.05 m
Location:	-	Lab No.:	F069-042
Sample Description:	(CI) SILTY CLAY, trace fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, very stiff		

Post Test Photo or Sketch



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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

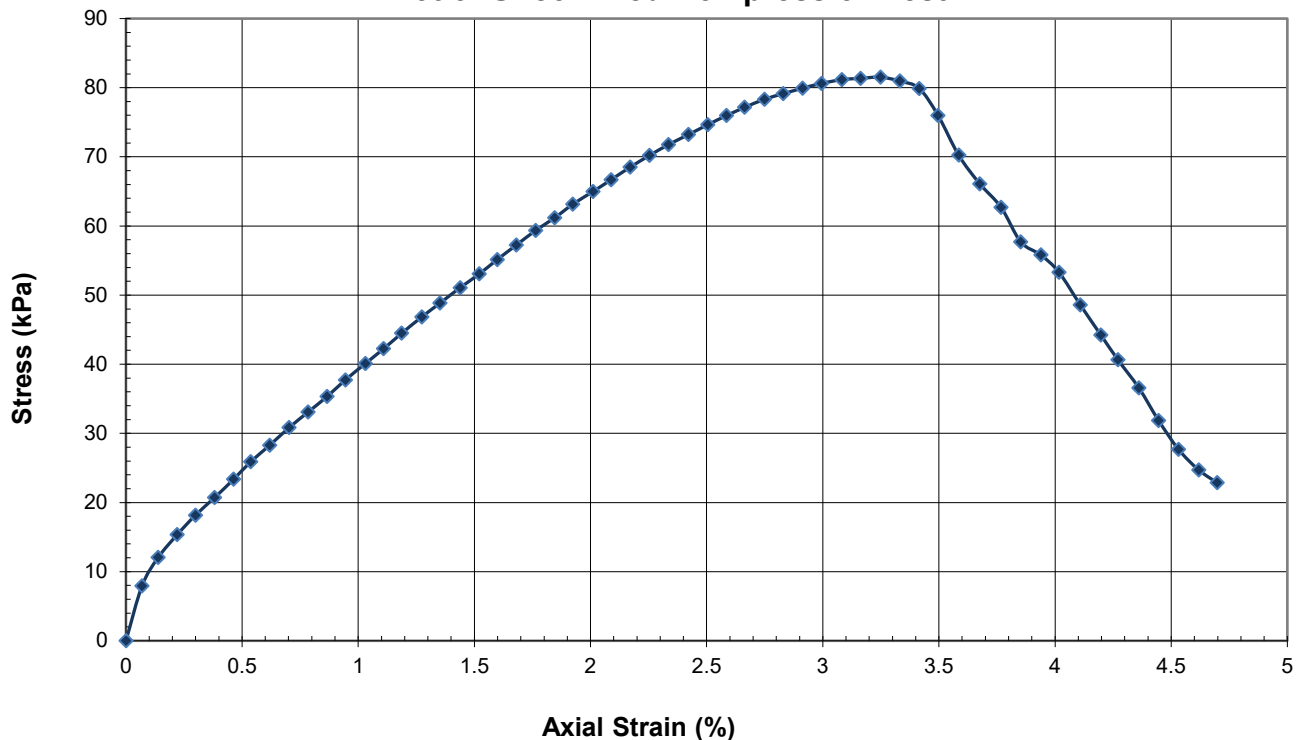
Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	10-May-24
Borehole No.:	T-25	Sample No.:	ST1
		Depth:	2.29-3.05 m
Location:	-	Lab No.:	F069-055
Sample Description:	(CI) sandy SILTY CLAY, fine to medium sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, firm		

Compressive Strength (q_u): **82 kPa**
Shear Strength (s_u): **41 kPa**
Strain at Failure: **3.2 %**

Strain Rate: 0.98 %/min
Failure Type: Diagonal Shear

Diameter: 7.37 cm
Height: 14.08 cm
H/D Ratio: 1.9
Dry Density: 1690 kg/m³
Water Content: 17.8 % on entire sample (posttest)
Sample Type: Undisturbed

Plot of Unconfined Compression Test



Remarks:

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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	10-May-24
Borehole No.:	T-25	Sample No.:	ST1
		Depth:	2.29-3.05 m
Location:	-	Lab No.:	F069-055
Sample Description:	(CI) sandy SILTY CLAY, fine to medium sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, firm		

Post Test Photo or Sketch



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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023			Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech			Date:	08-May-24
Tested By:	BL				
Borehole No.:	T-34	Sample No.:	ST1	Depth:	2.29-3.05 m
Location:	-			Lab No.:	F069-068
Sample Description:	(CI) SILTY CLAY, trace fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, stiff				

Compressive Strength (q_u): **195 kPa**

Shear Strength (s_u): **97 kPa**

Strain at Failure: **9.3 %**

Strain Rate: 1.01 %/min

Failure Type: Diagonal Shear

Diameter: 7.25 cm

Height: 14.11 cm

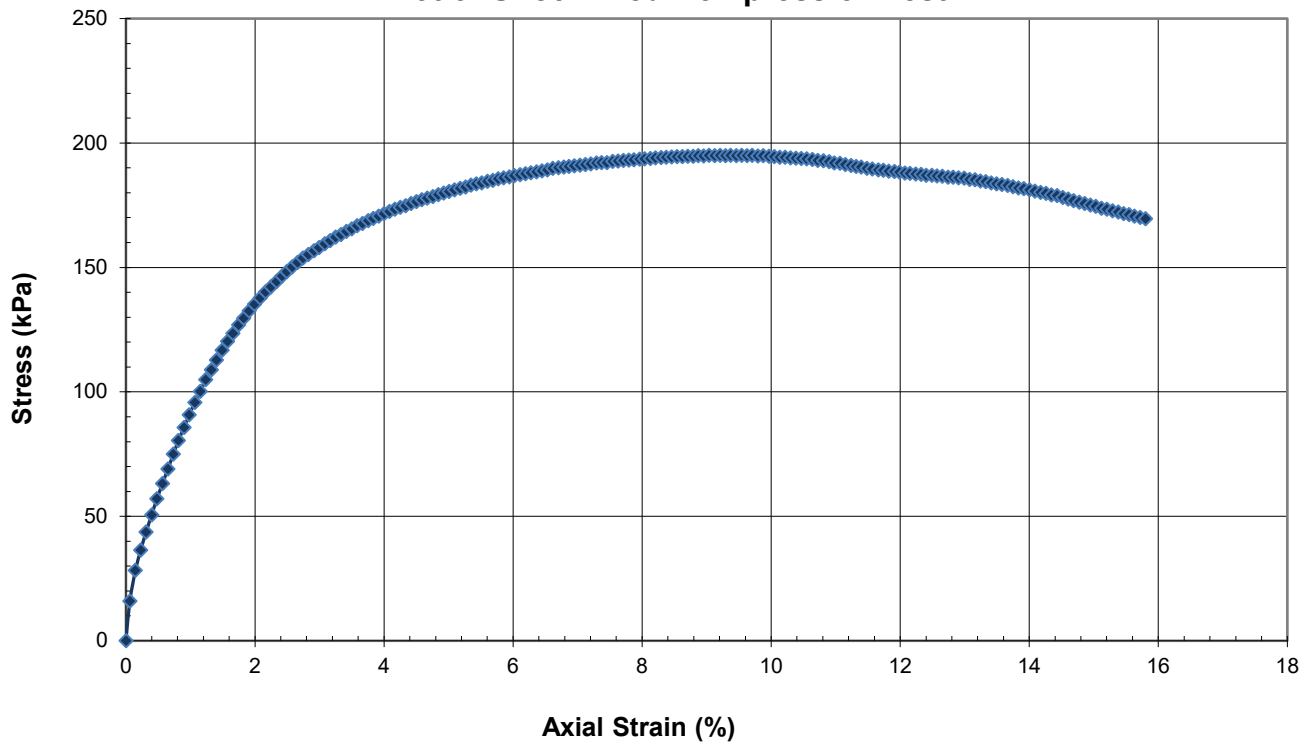
H/D Ratio: 1.9

Dry Density: 1806 kg/m³

Water Content: 18.6 % on entire sample (posttest)

Sample Type: Undisturbed

Plot of Unconfined Compression Test



Remarks:

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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24
Borehole No.:	T-34	Sample No.:	ST1
		Depth:	2.29-3.05 m
Location:	-	Lab No.:	F069-068
Sample Description:	(CI) SILTY CLAY, trace fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, stiff		

Post Test Photo or Sketch



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UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

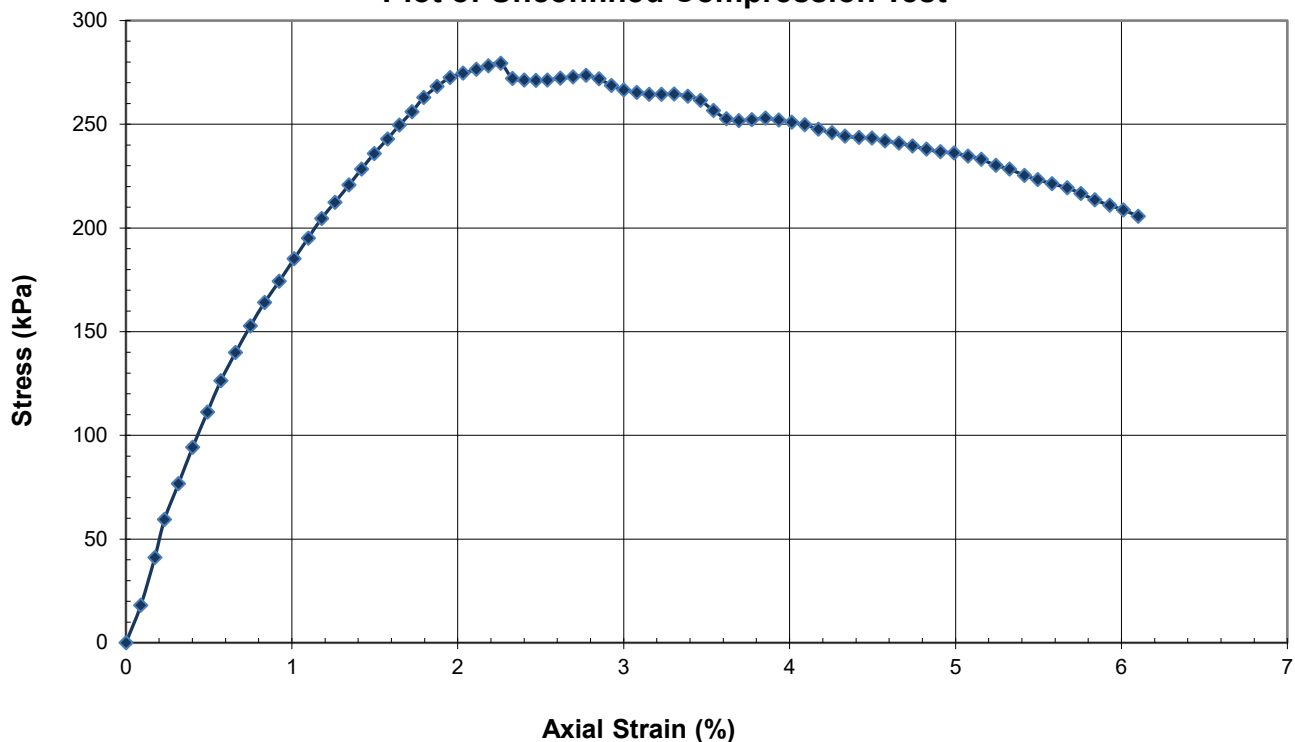
Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24

Borehole No.:	T-46	Sample No.:	ST1	Depth:	3.05-3.81 m	Lab No.:	F069-082
Location:	-						
Sample Description:	(CI) sandy SILTY CLAY, fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, dry-moist, very stiff						

Compressive Strength (q_u):	279 kPa
Shear Strength (s_u):	140 kPa
Strain at Failure:	2.2 %
Strain Rate:	0.98 %/min
Failure Type:	Diagonal Shear

Diameter:	7.23 cm
Height:	13.66 cm
H/D Ratio:	1.9
Dry Density:	1878 kg/m ³
Water Content:	14.6 % on entire sample (posttest)
Sample Type:	Undisturbed

Plot of Unconfined Compression Test



Remarks:

Sample was friable during trimming; irregular and uneven surfaces were present, prior to start of compressive test



UNCONFINED COMPRESSIVE STRENGTH

(ASTM D2166 - 06)

Project No.:	CA0026414.7023	Phase:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	BL	Date:	08-May-24
Borehole No.:	T-46	Sample No.:	ST1
		Depth:	3.05-3.81 m
Location:	-	Lab No.:	F069-082
Sample Description:	(CI) sandy SILTY CLAY, fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, dry-moist, very stiff		

Post Test Photo or Sketch



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Thermal Conductivity of Soil by Thermal Needle Probe

(ASTM D5334)

Project No.: CA0026414.7023

Task: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested by: FC

Date: 21-May-24

Test: F069-092
Sample No.: T-25, Bulk
Height (mm): 150.7
Diameter (mm): 102.6
Thermal Probe No.: TR1 03937
Probe Length (mm): 100

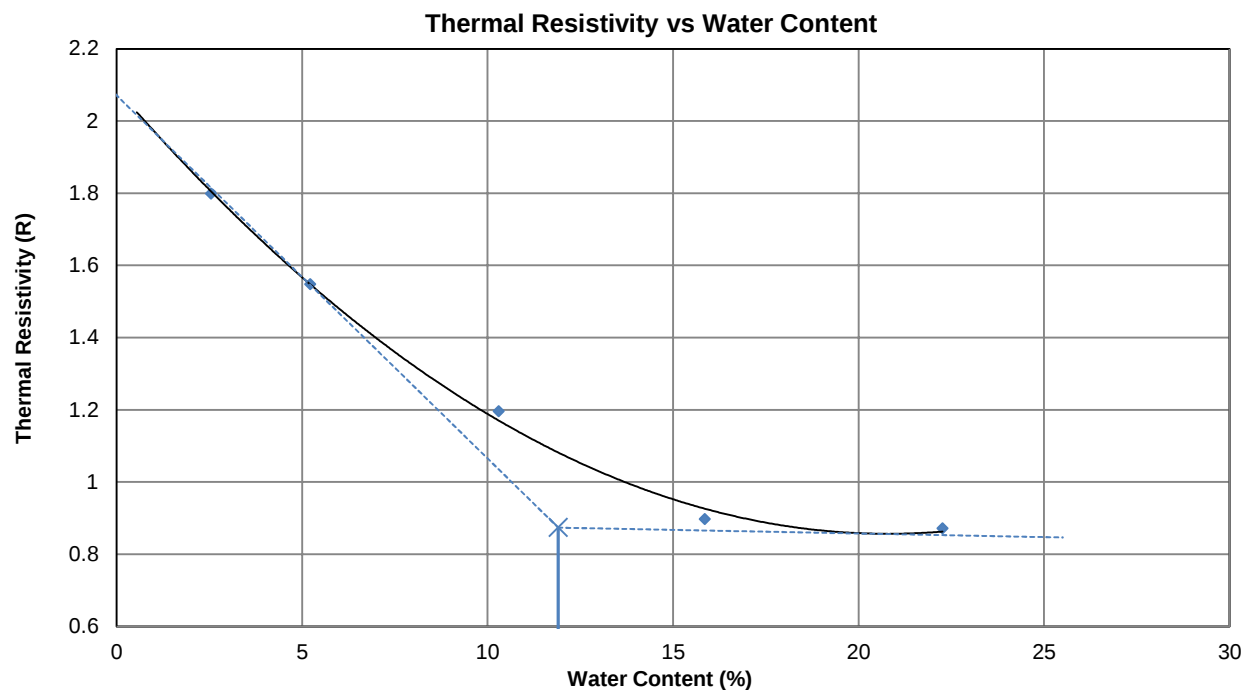
Undist. or Reconstituted: Reconstituted
Initial Target Dry Density (kg/m^3): 1447
Initial Water Content (%): 22.2

Thermal Dryout Curve Test Results

Single Specimen

Critical Water Content: 11.9 %

Test No.	Water Content (%)	Wet Density (kg/m^3)	Thermal Conductivity, K (W/m.K)	Thermal Resistivity, R (m.K/W)
1	22.3	1766	1.147	0.872
2	15.9	-	1.114	0.898
3	10.3	-	0.836	1.196
4	5.2	-	0.646	1.548
5	2.5	-	0.556	1.799



Remarks:

Thermal conductivity value has a precision of +/- 10%

Test conducted using KD2-Pro Thermal Properties Analyzer



ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023

Phase: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested By: FC

Date: May 9, 2024

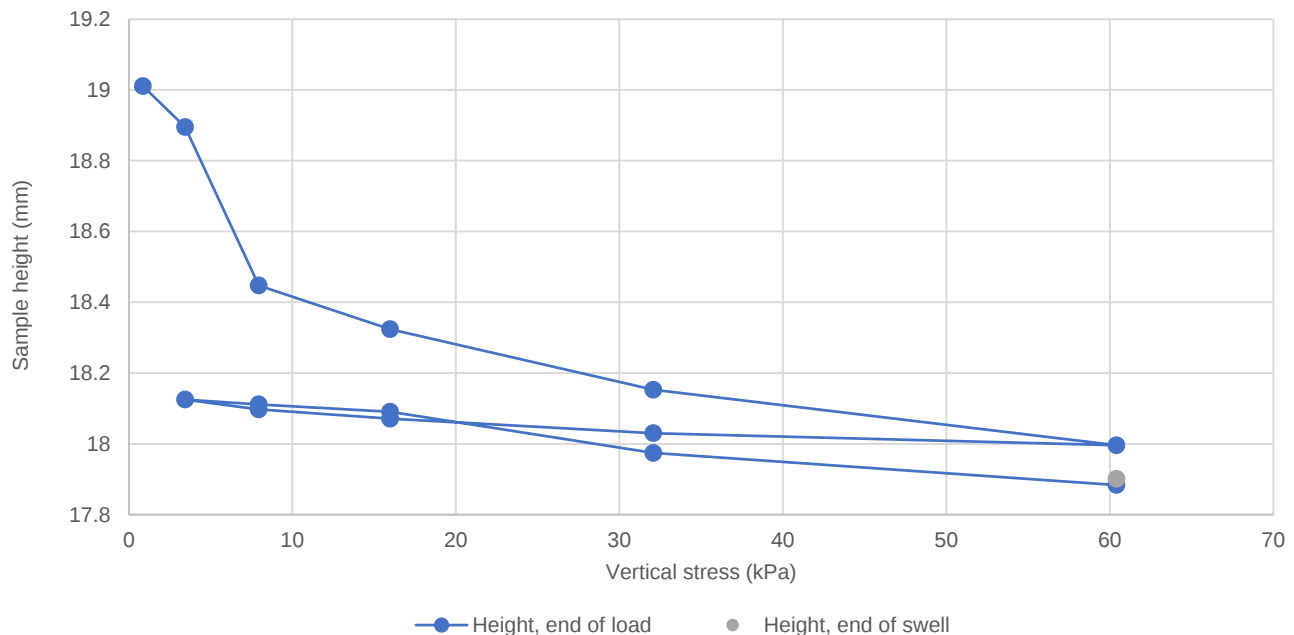
Sample #: T-01, ST1

WSP sample: F069-003

Sample description: (CI) sandy SILTY CLAY, medium plasticity fines; brown, sand pockets observed; cohesive, moist, very stiff

Specimen:	1	2	
Vertical stress (kPa):	60.0		Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.6		Water type: tap
Initial height, h (mm):	19.0		Condition: intact
Initial wet mass (g):	150.9		
Initial water content:	17.1%		
Initial dry density (kg/m ³):	1780		
Initial void ratio:	0.52		
Height after dry loading, h ₁ (mm):	17.9		
Final height, h ₂ (mm):	17.9		
Final wet mass (g):	152.1		
Final water content:	19.4%	(see note below)	
Final dry density (kg/m ³):	1890		
Final void ratio:	0.43		
Swell/collapse strain:	0.1%		

Stress versus Wetting Induced Swell / Collapse Strain



Comments:

A consolidation test was conducted on the sample immediately after this test. The final water content shown above was measured after the consolidation test.

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ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

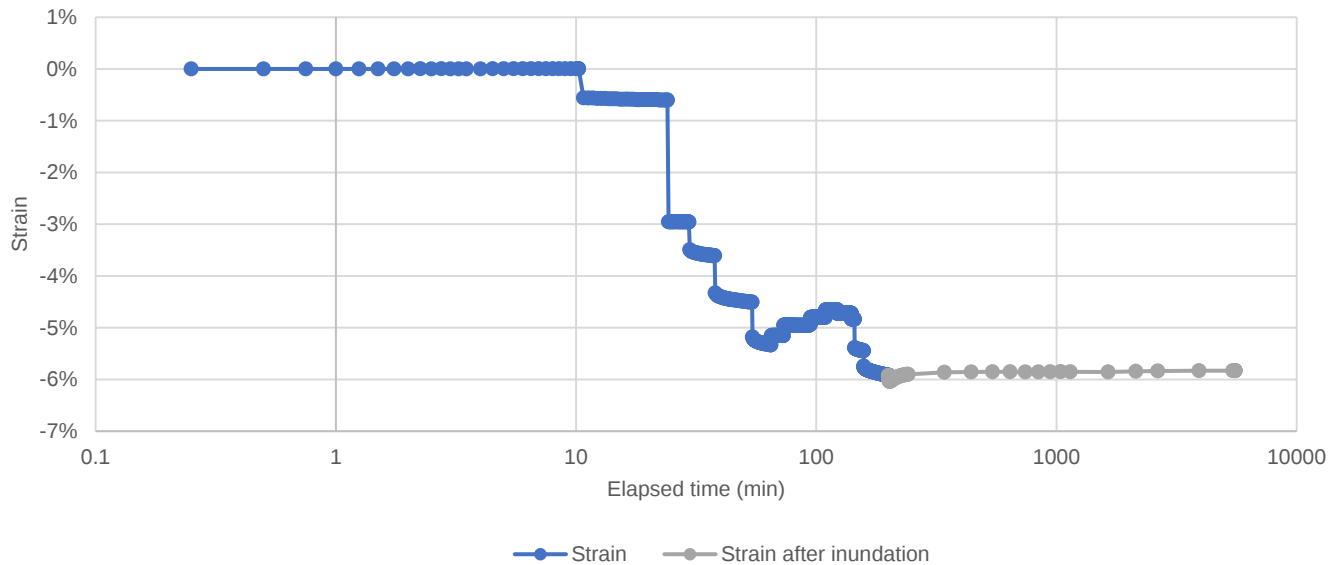
ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Phase: -
Date: May 9, 2024

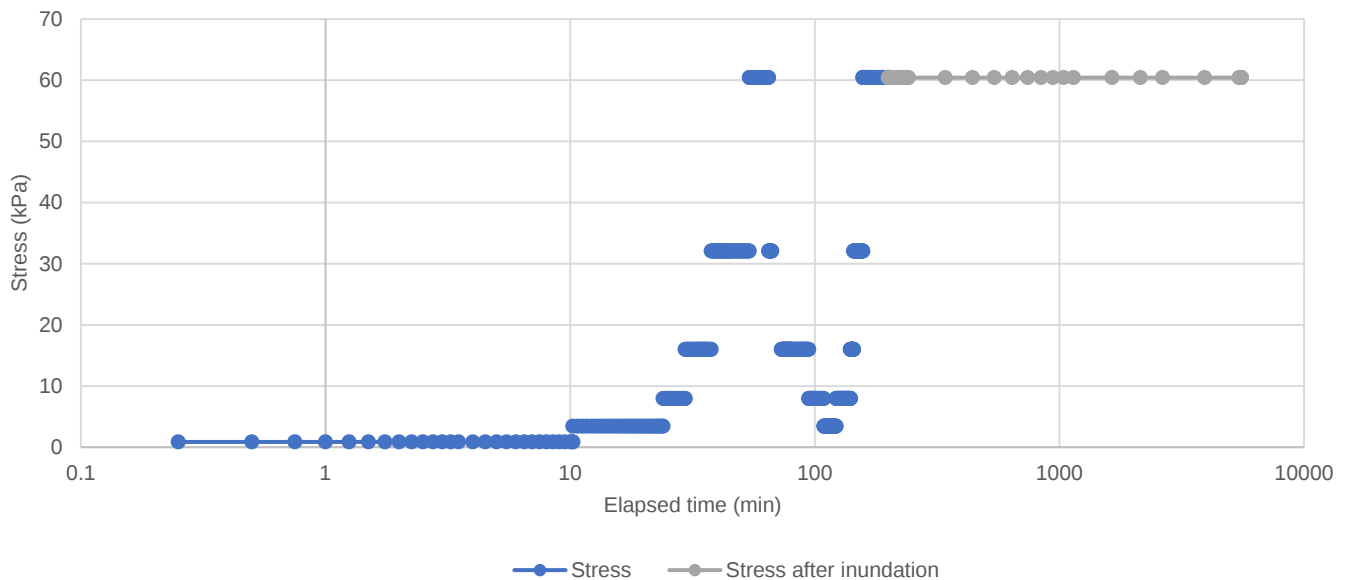
Sample #: T-01, ST1
WSP sample: F069-003

Total Strain versus Elapsed Time



(strain calculated based on sample height at start of test)

Stress versus Elapsed Time



Specimen: 1 2
Inundation at (min): 200



ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023

Phase: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested By: FC

Date: May 9, 2024

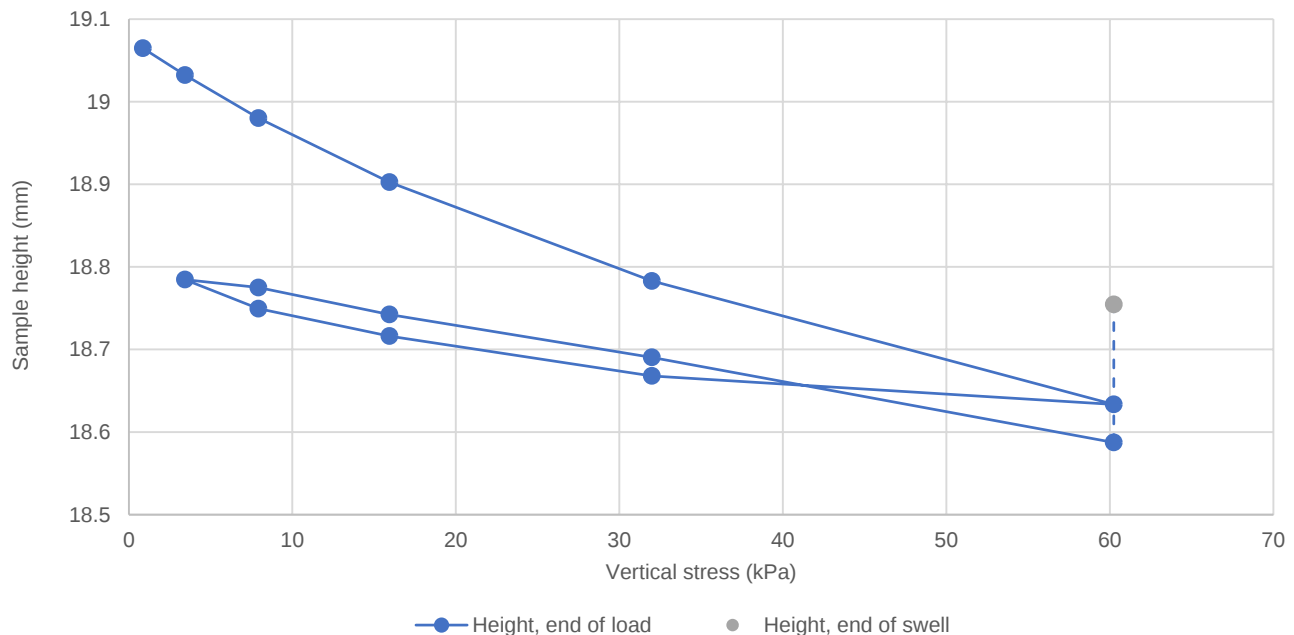
Sample #: T-06, ST1

WSP sample: F069-016

Sample description: (CI) SILTY CLAY, medium plasticity fines; brown, sand pockets observed; cohesive, moist, stiff

Specimen:	1	2	
Vertical stress (kPa):	60.0		Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.7		Water type: tap
Initial height, h (mm):	19.1		Condition: intact
Initial wet mass (g):	138.3		
Initial water content:	28.3%		
Initial dry density (kg/m ³):	1479		
Initial void ratio:	0.83		
Height after dry loading, h ₁ (mm):	18.6		
Final height, h ₂ (mm):	18.8		
Final wet mass (g):	141.9		
Final water content:	32.3%	(see note below)	
Final dry density (kg/m ³):	1504		
Final void ratio:	0.80		
Swell/collapse strain:	0.9%		

Stress versus Wetting Induced Swell / Collapse Strain



Comments:

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ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

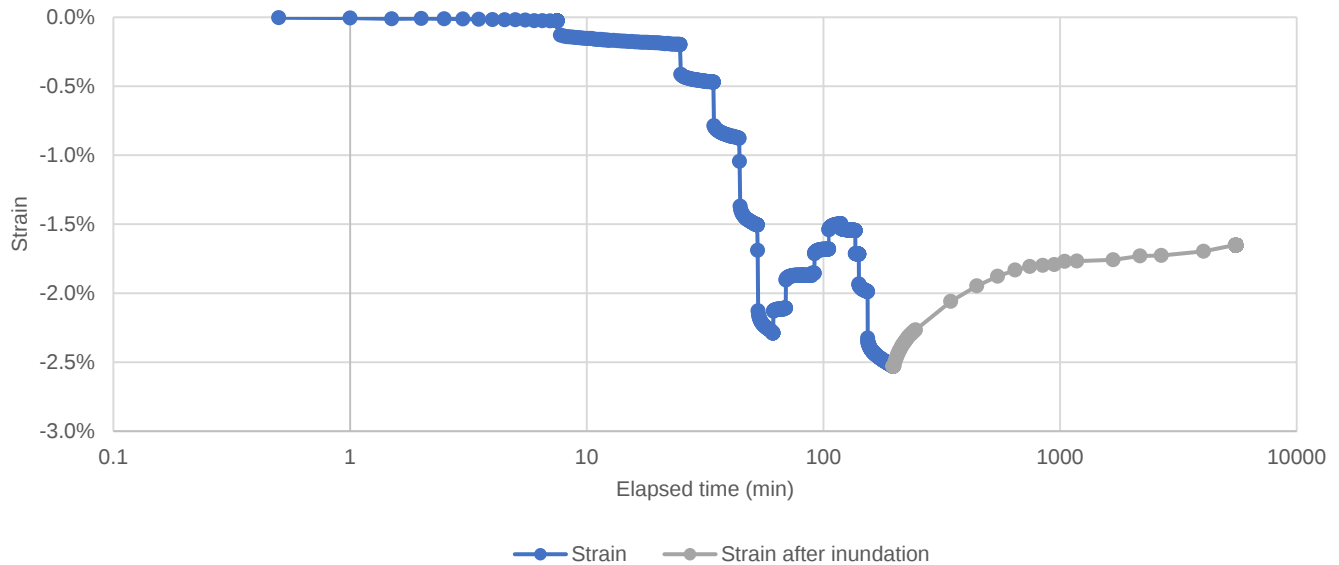
ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Phase: -
Date: May 9, 2024

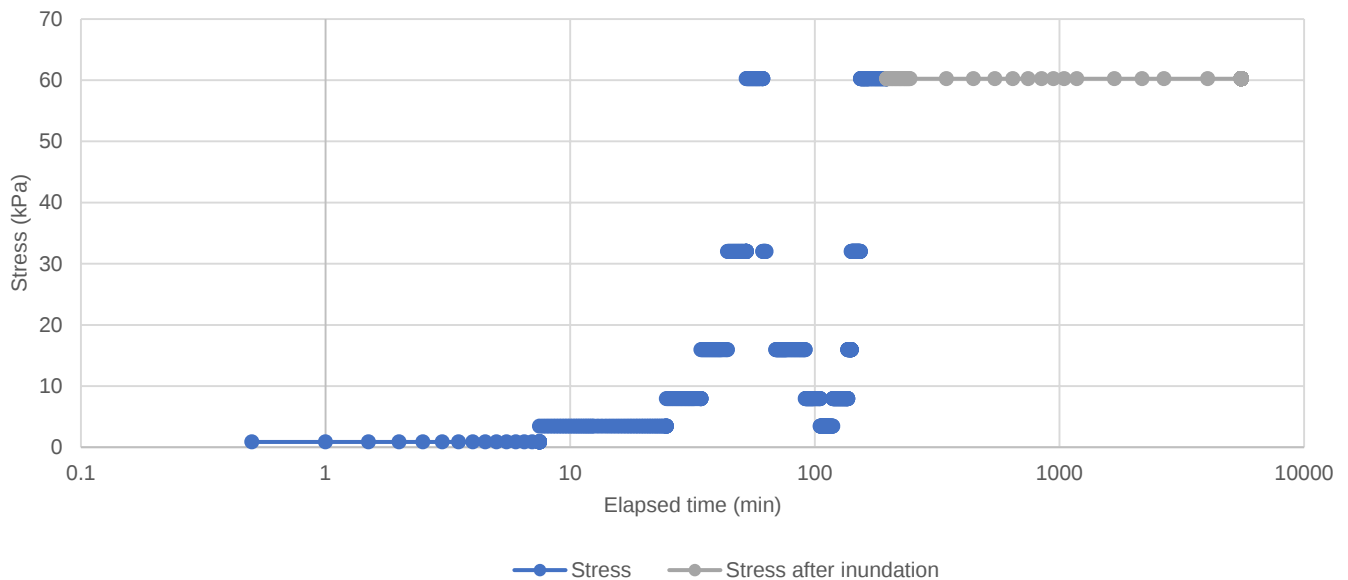
Sample #: T-06, ST1
WSP sample: F069-016

Total Strain versus Elapsed Time



(strain calculated based on sample height at start of test)

Stress versus Elapsed Time



Specimen: 1 2
Inundation at (min): 197



ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023

Phase: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested By: FC

Date: May 9, 2024

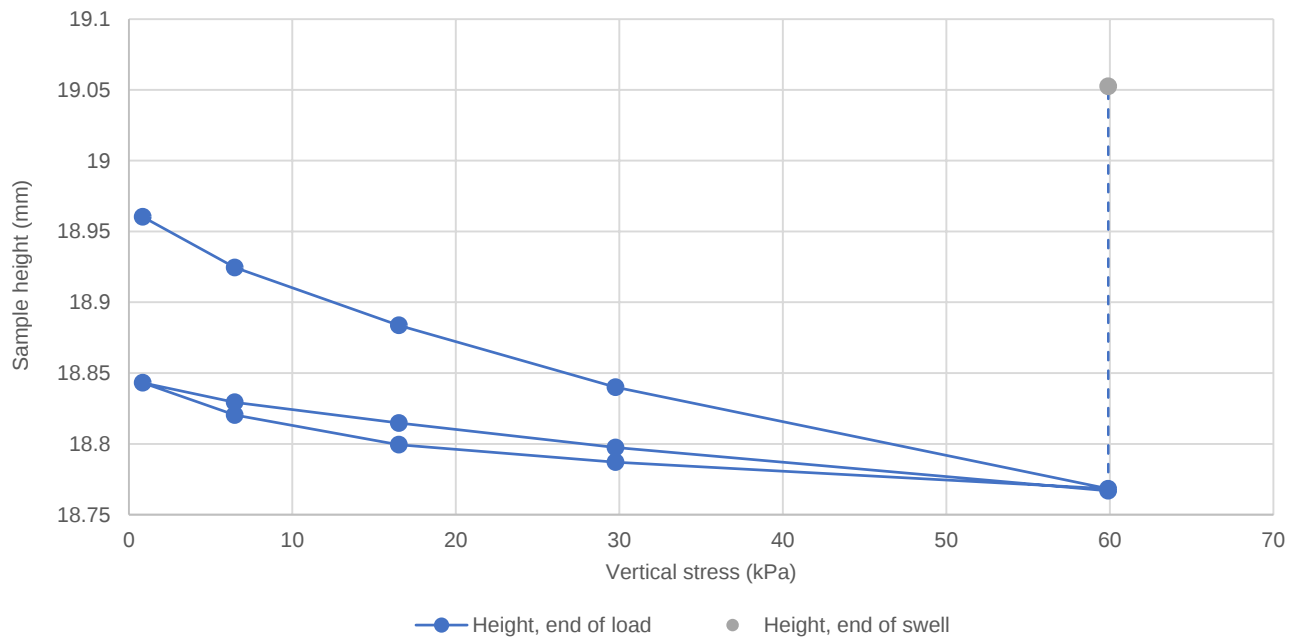
Sample #: T-24, ST1

WSP sample: F069-042

Sample description: (CI) SILTY CLAY, trace fine sand, trace fine gravel, medium plasticity fines; brown;
cohesive, moist, very stiff

Specimen:	1	2		
Vertical stress (kPa):	60.0		Specific gravity:	2.7 (assumed)
Sample diameter (mm):	62.3		Water type:	tap
Initial height, h (mm):	19.0		Condition:	intact
Initial wet mass (g):	122.0			
Initial water content:	12.0%			
Initial dry density (kg/m ³):	1883			
Initial void ratio:	0.43			
Height after dry loading, h ₁ (mm):	18.8			
Final height, h ₂ (mm):	19.1			
Final wet mass (g):	129.5			
Final water content:	18.5%	(see note below)		
Final dry density (kg/m ³):	1874			
Final void ratio:	0.44			
Swell/collapse strain:	1.5%			

Stress versus Wetting Induced Swell / Collapse Strain



Comments:

A consolidation test was conducted on the sample immediately after this test. The final water content shown above was measured after the consolidation test.

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ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

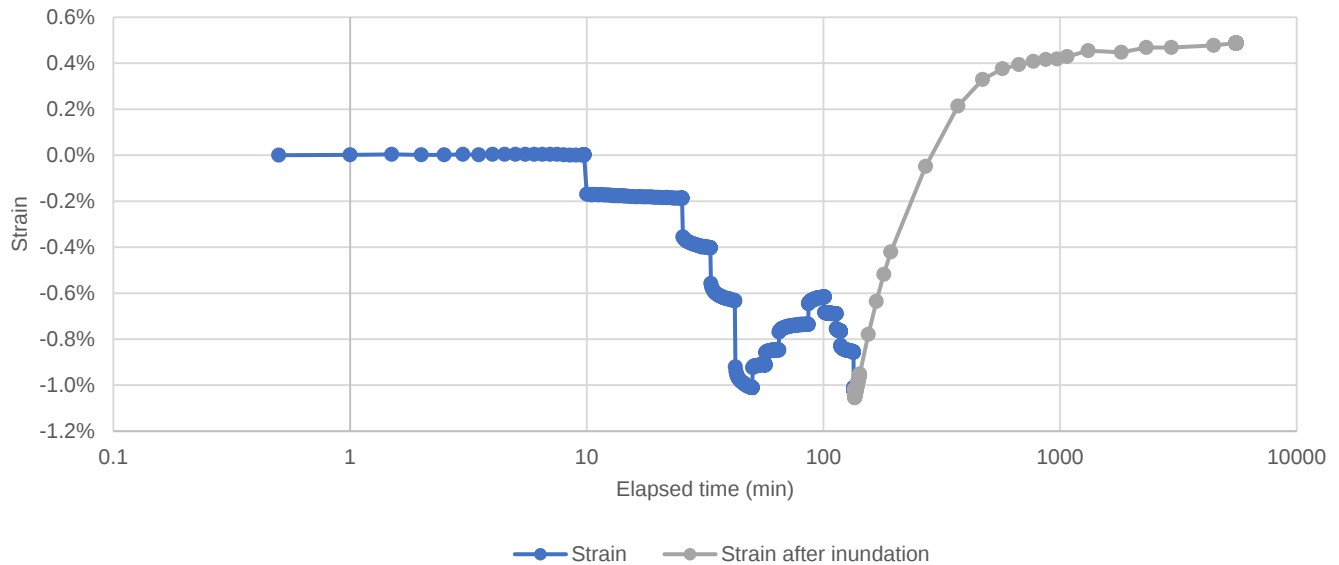
ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Phase: -
Date: May 9, 2024

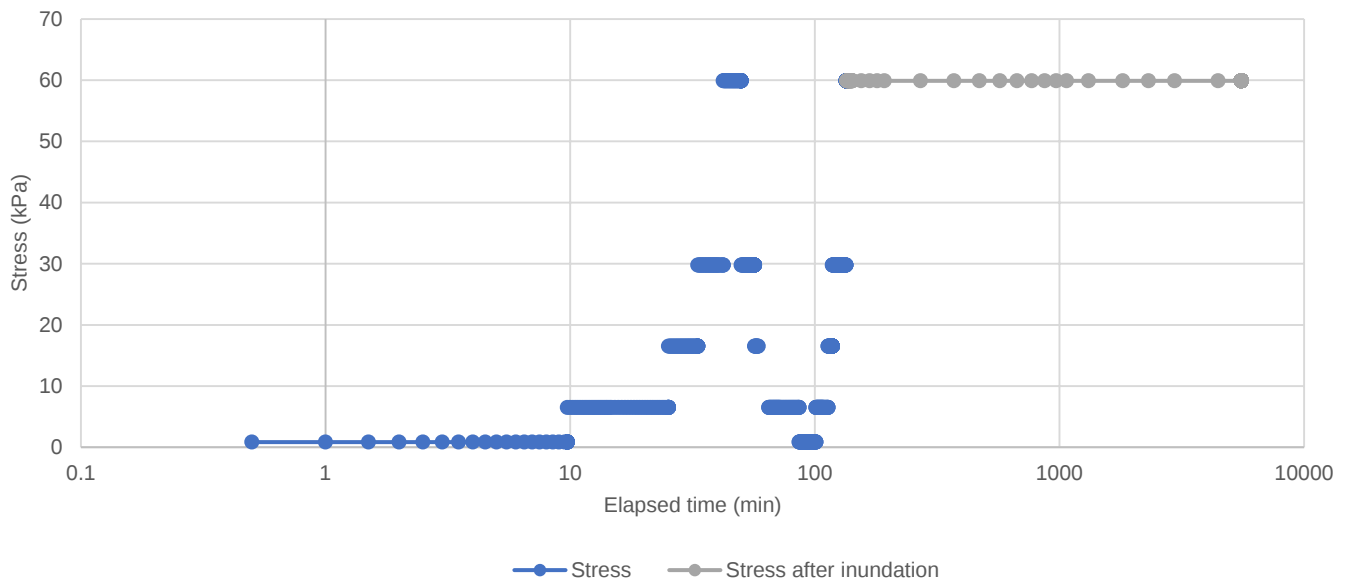
Sample #: T-24, ST1
WSP sample: F069-042

Total Strain versus Elapsed Time



(strain calculated based on sample height at start of test)

Stress versus Elapsed Time



Specimen: 1 2
Inundation at (min): 135



ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023

Phase: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested By: FC

Date: May 30, 2024

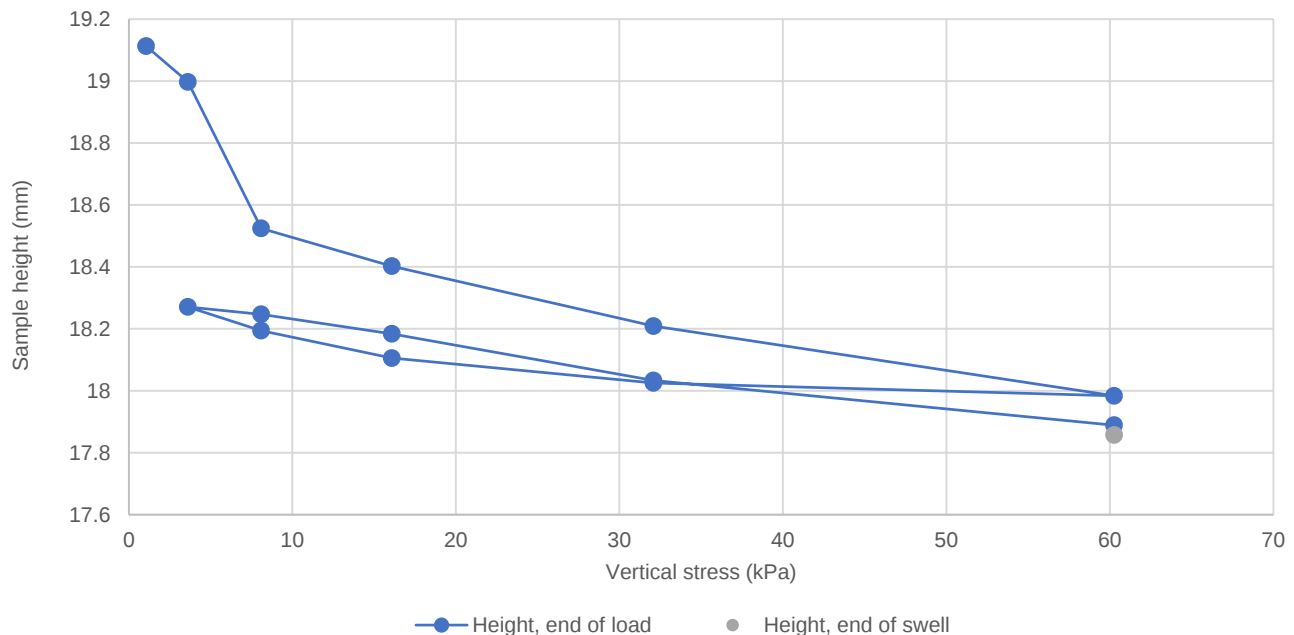
Sample #: T-25, ST1

WSP sample: F069-055

Sample description: (CI) SILTY CLAY, some fine sand, medium plasticity fines; brown; cohesive, moist, stiff

Specimen:	1	2	
Vertical stress (kPa):	60.0		Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.8		Water type: tap
Initial height, h (mm):	19.1		Condition: intact
Initial wet mass (g):	144.9		
Initial water content:	21.0%		
Initial dry density (kg/m ³):	1636		
Initial void ratio:	0.65		
Height after dry loading, h ₁ (mm):	17.9		
Final height, h ₂ (mm):	17.9		
Final wet mass (g):	144.2		
Final water content:	18.7%	(see note below)	
Final dry density (kg/m ³):	1751		
Final void ratio:	0.54		
Swell/collapse strain:	-0.2%		

Stress versus Wetting Induced Swell / Collapse Strain



Comments:

A consolidation test was conducted on the sample immediately after this test. The final water content shown above was measured after the consolidation test.

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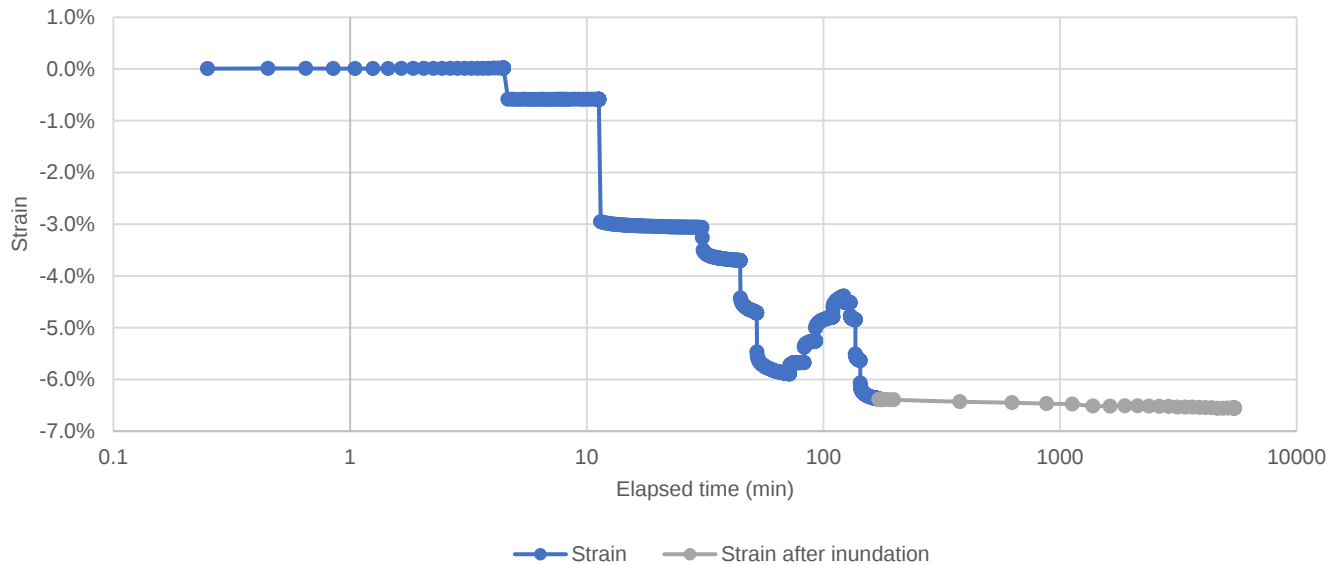
ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC
Sample #: T-25, ST1
WSP sample: F069-055

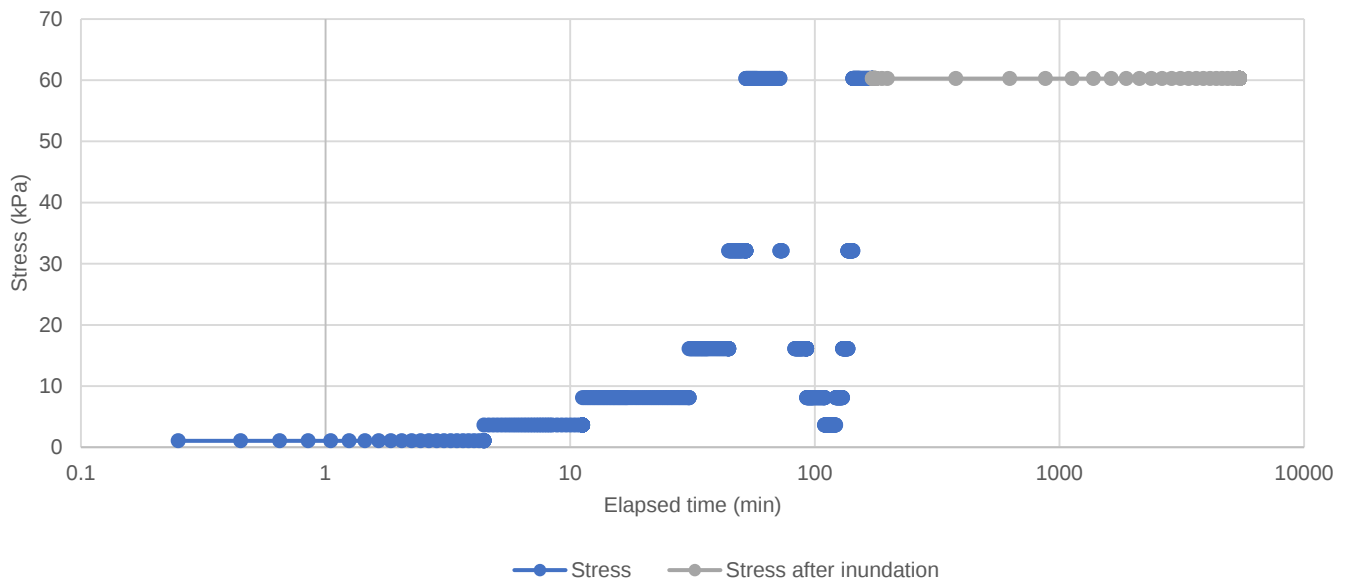
Phase: -
Date: May 30, 2024

Total Strain versus Elapsed Time



(strain calculated based on sample height at start of test)

Stress versus Elapsed Time



Specimen: 1 2
Inundation at (min): 172



ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

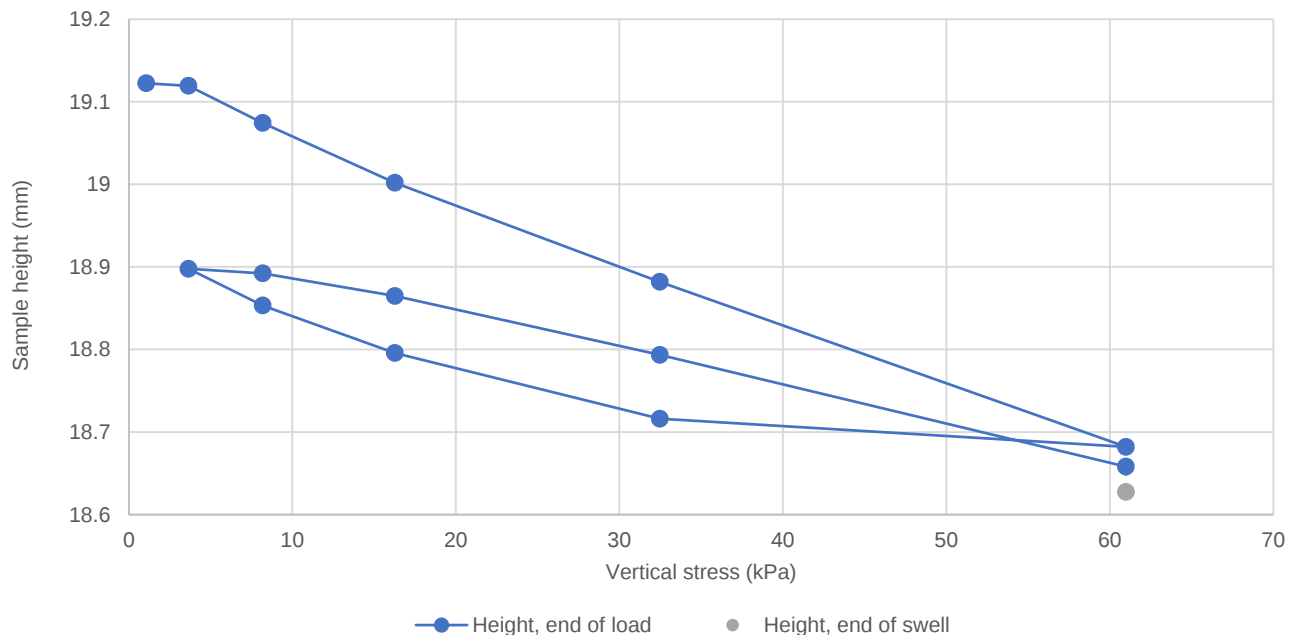
Phase: -
Date: May 30, 2024

Sample #: T-34, ST1
WSP sample: F069-068

Sample description: (CI) SILTY CLAY, some fine sand, medium plasticity fines; brown; cohesive, moist, stiff

Specimen:	1	2	
Vertical stress (kPa):	60.0		Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.4		Water type: tap
Initial height, h (mm):	19.1		Condition: intact
Initial wet mass (g):	152.9		
Initial water content:	18.4%		
Initial dry density (kg/m ³):	1784		
Initial void ratio:	0.51		
Height after dry loading, h ₁ (mm):	18.7		
Final height, h ₂ (mm):	18.6		
Final wet mass (g):	152.6		
Final water content:	18.6% (see note below)		
Final dry density (kg/m ³):	1831		
Final void ratio:	0.47		
Swell/collapse strain:	-0.2%		

Stress versus Wetting Induced Swell / Collapse Strain



Comments:

A consolidation test was conducted on the sample immediately after this test. The final water content shown above was measured after the consolidation test.

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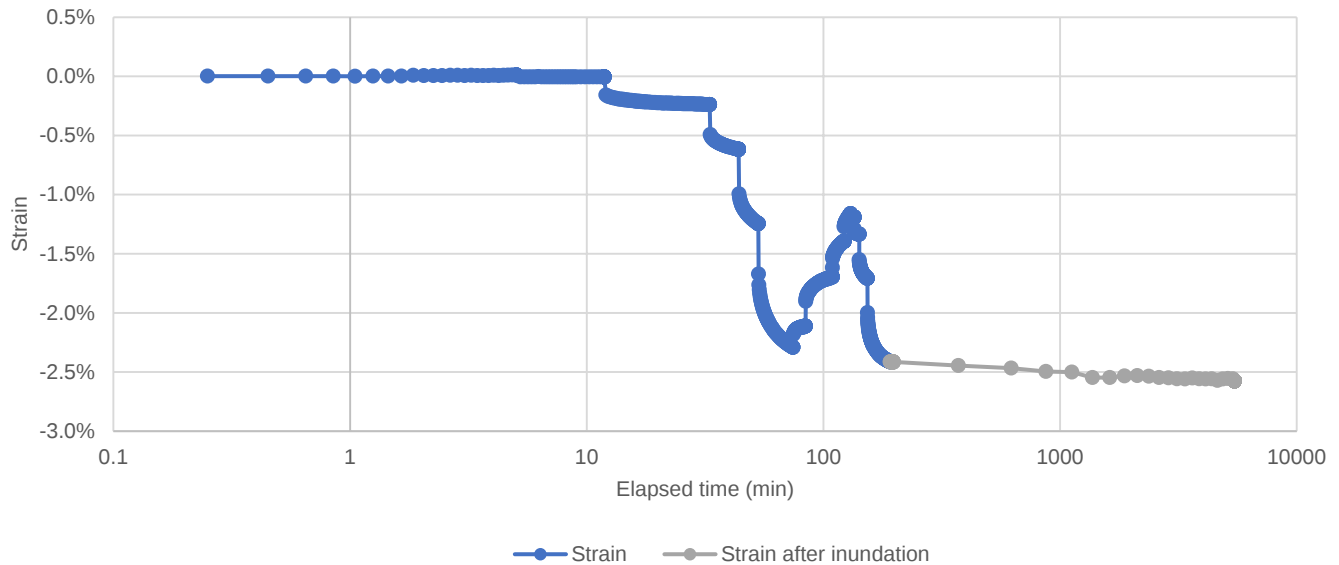
ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC
Sample #: T-34, ST1
WSP sample: F069-068

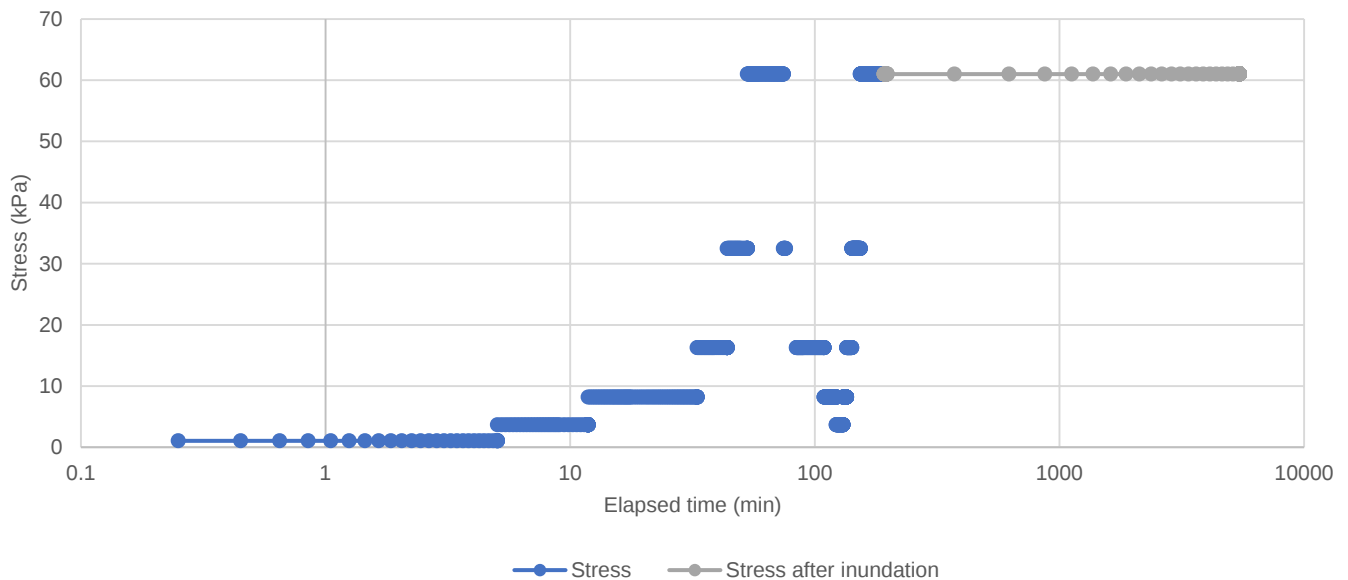
Phase: -
Date: May 30, 2024

Total Strain versus Elapsed Time



(strain calculated based on sample height at start of test)

Stress versus Elapsed Time



Specimen: 1 2
Inundation at (min): 192



ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

ASTM D4546 Method B

Project #: CA0026414.7023

Phase: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested By: FC

Date: May 30, 2024

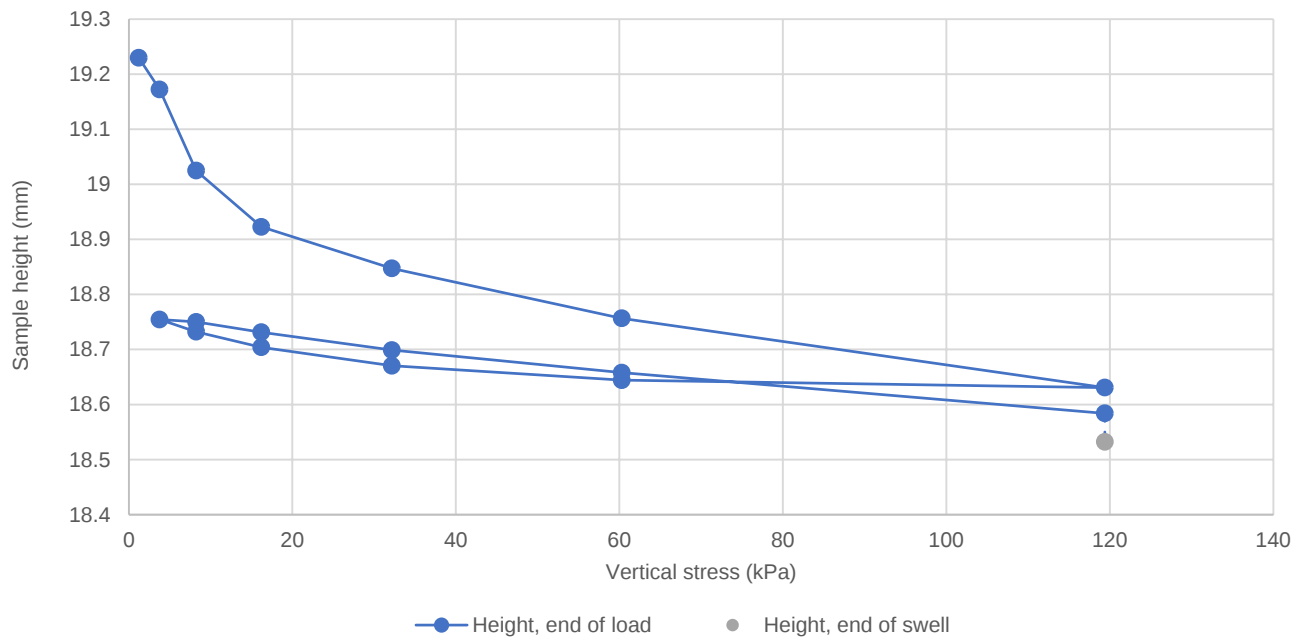
Sample #: T-46, ST1

WSP sample: F069-082

Sample description: (CI) sandy SILTY CLAY, some fine gravel, medium plasticity fines; brown; cohesive, moist, hard

Specimen:	1	2	
Vertical stress (kPa):	120.0		Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.9		Water type: tap
Initial height, h (mm):	19.2		Condition: intact
Initial wet mass (g):	140.9		
Initial water content:	13.6%		
Initial dry density (kg/m ³):	1681		
Initial void ratio:	0.61		
Height after dry loading, h ₁ (mm):	18.6		
Final height, h ₂ (mm):	18.5		
Final wet mass (g):	148.1		
Final water content:	17.2%	(see note below)	
Final dry density (kg/m ³):	1744		
Final void ratio:	0.55		
Swell/collapse strain:	-0.3%		

Stress versus Wetting Induced Swell / Collapse Strain



Comments:

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ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS

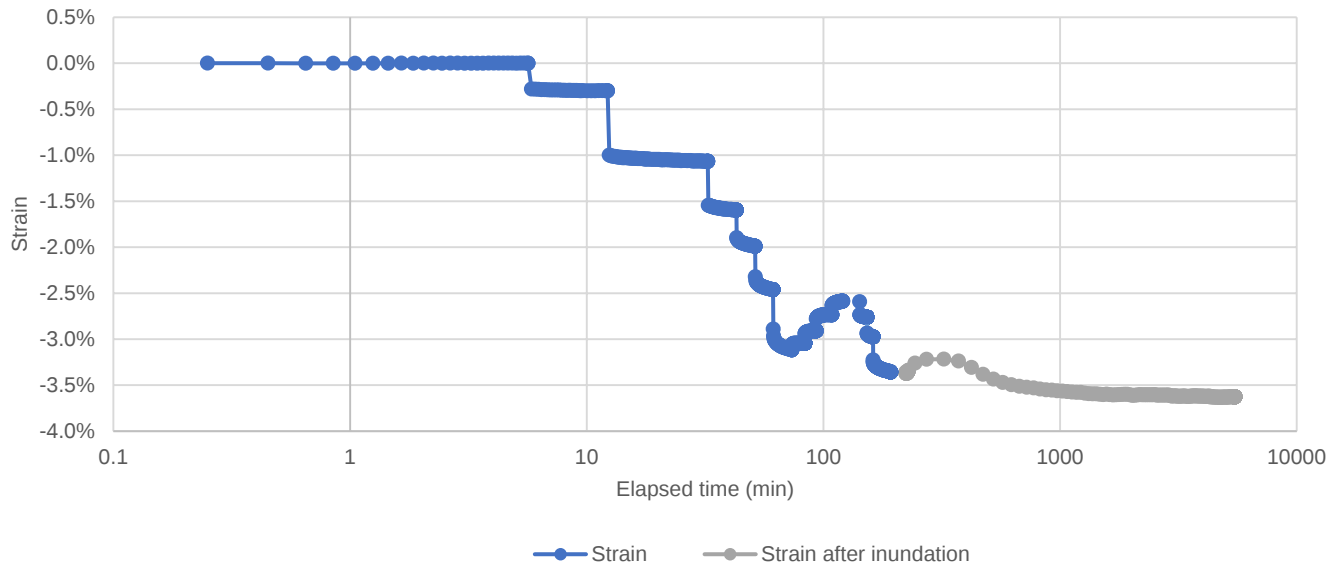
ASTM D4546 Method B

Project #: CA0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Phase: -
Date: May 30, 2024

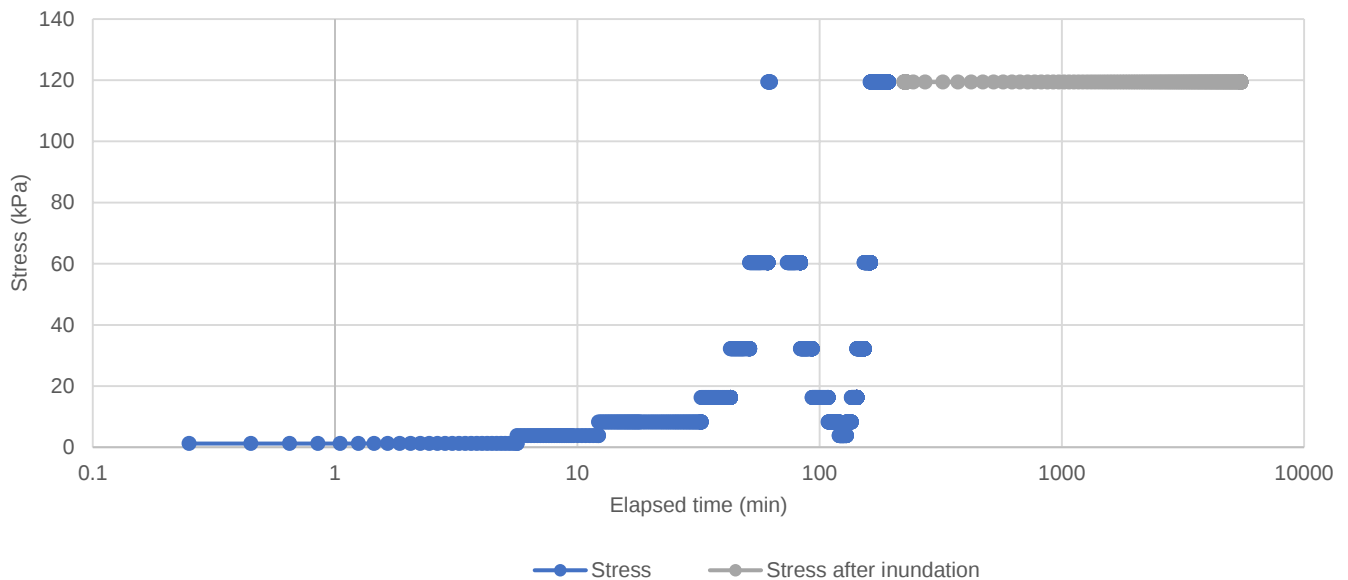
Sample #: T-46, ST1
WSP sample: F069-082

Total Strain versus Elapsed Time



(strain calculated based on sample height at start of test)

Stress versus Elapsed Time



Specimen: 1 2
Inundation at (min): 193



ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

	Initial	Final	
Sample height (mm):	19.5	18.9	Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.6	69.6	
Sample area (cm ²):	38.1	38.1	Loading cap (kPa): 3.4
Volume (cm ³):	74	72	
Wet mass (g):	150.9	152.4	
Dry mass (g):	127.7	127.7	
Water content (%):	18.1	19.4	
Solids content (%):	84.6	83.8	
Wet density (kg/m ³):	2029	2120	
Dry density (kg/m ³):	1717	1776	
Void ratio:	0.57	0.53	Soil description: (CI) sandy SILTY CLAY, medium plasticity
Height of solids (mm):	12.4	12.4	finer; brown, sand pockets observed; cohesive, moist, very
Degree of saturation (%):	86	98	stiff

Load #	H _{sample} (mm)	Stone Correction (mm)	H _{corrected} (mm)	Stress (kPa)	Void ratio	Strain (%)	Incremental Work (kJ/m ³)	Cumulative Work (kJ/m ³)
0	19.5	0.0	19.5	3.4	0.57	0.0	0.0	0.0
1	19.5	0.0	19.5	7.9	0.57	-0.1	0.0	0.0
2	19.5	0.0	19.6	16	0.58	-0.2	0.0	0.0
3	19.5	0.1	19.6	32	0.58	-0.5	-0.1	-0.1
4	19.4	0.1	19.6	60	0.58	-0.3	0.1	0.0
5	19.4	0.2	19.6	101	0.58	-0.2	0.1	0.1
6	19.2	0.2	19.4	202	0.56	0.6	1.2	1.3
7	18.9	0.3	19.1	403	0.54	2.0	4.1	5.5
8	18.3	0.3	18.6	805	0.50	4.5	15.7	21.1
9	17.7	0.4	18.1	1,602	0.46	7.2	34.2	55.3
10	17.8	0.3	18.1	403	0.46	7.4		
11	18.0	0.3	18.3	101	0.48	6.1		
12	18.4	0.2	18.6	32	0.50	4.6		
13	18.9	0.2	19.0	7.9	0.53	2.4		

Comments:

- data for load numbers 0 to 4 taken from swell test.
- prior to this test, the specimen was preconsolidated to 60 kPa stress then rebounded to 8 kPa as part of swell test (ASTM D4546 Method B).
- specimen was inundated with water near the start of the 60 kPa load



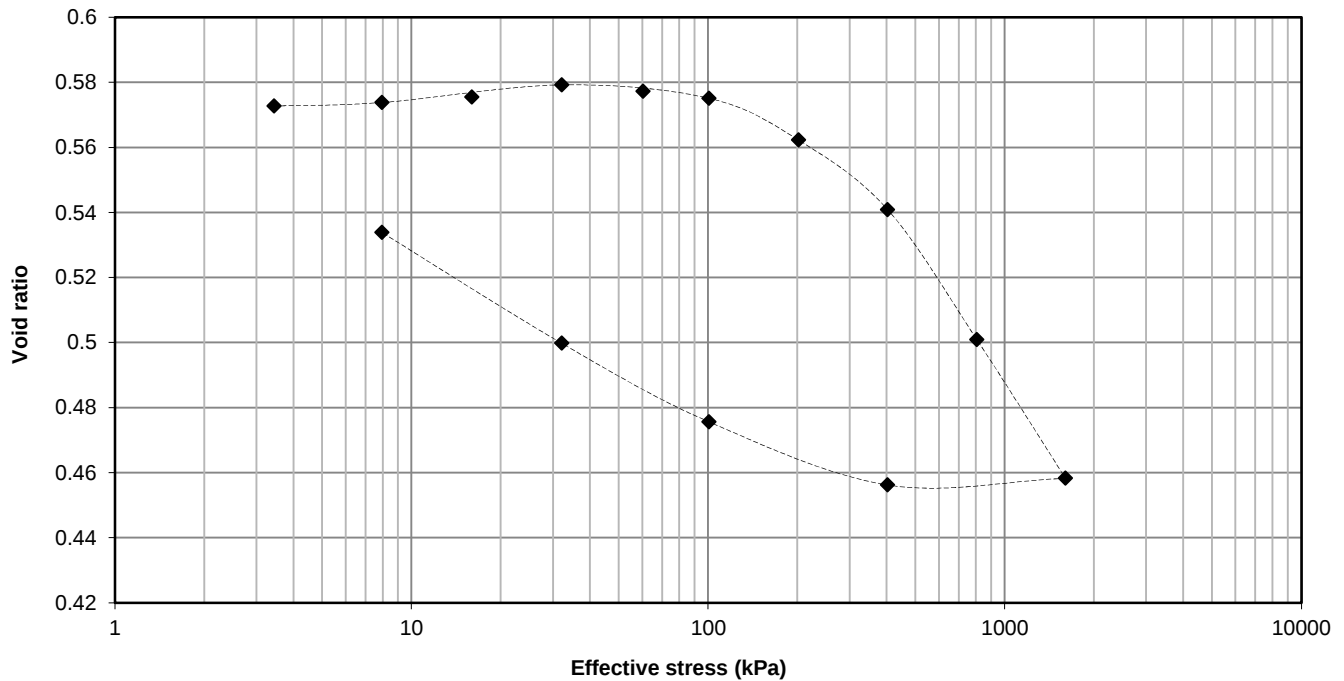
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

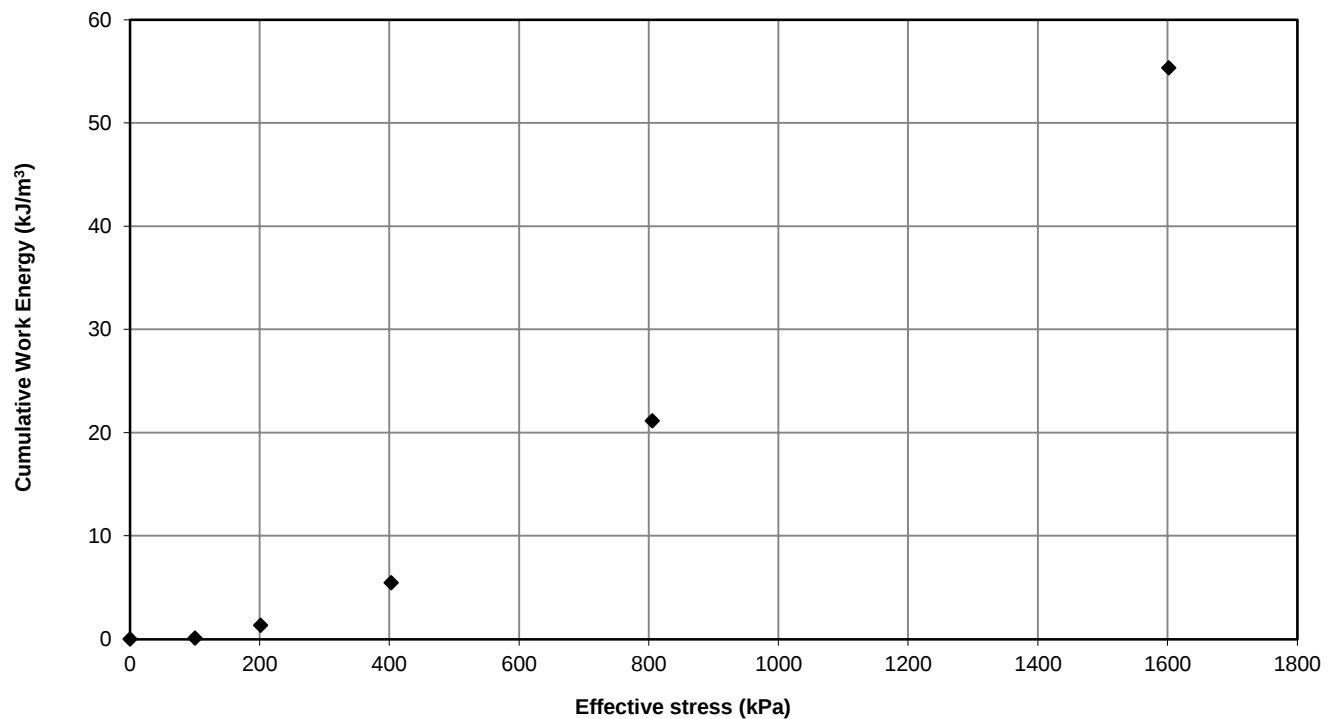
Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

Void Ratio versus Effective Stress



Cumulative Work Energy versus Effective Stress



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

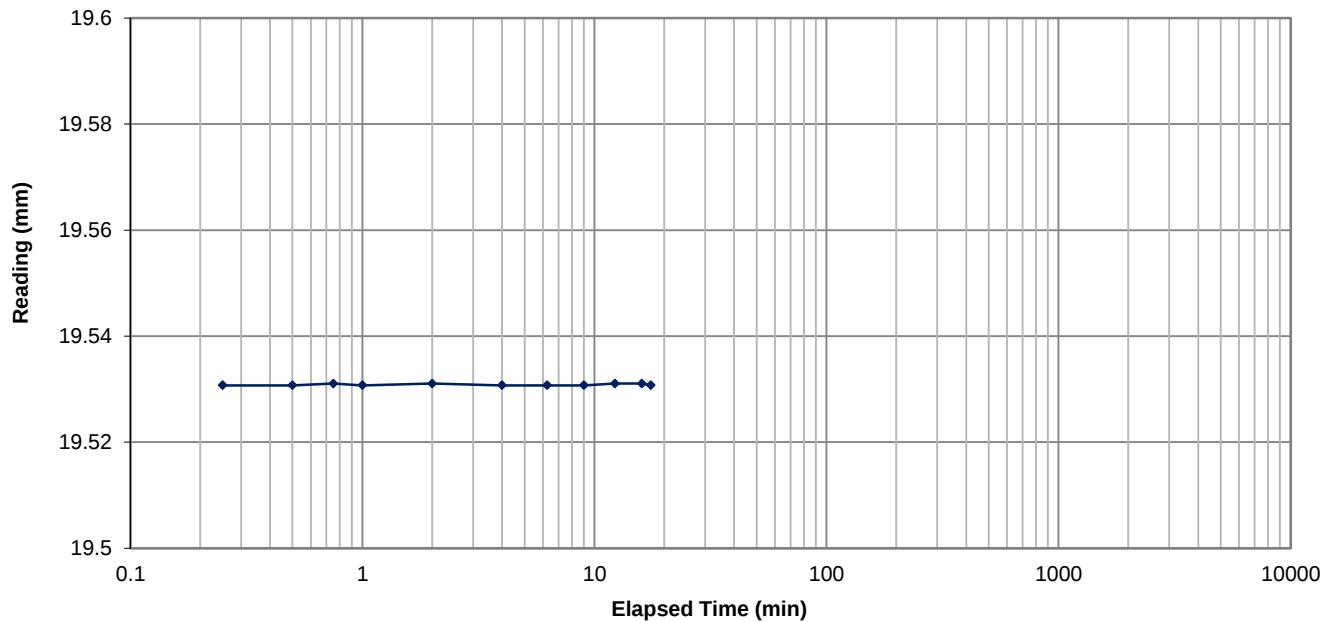
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

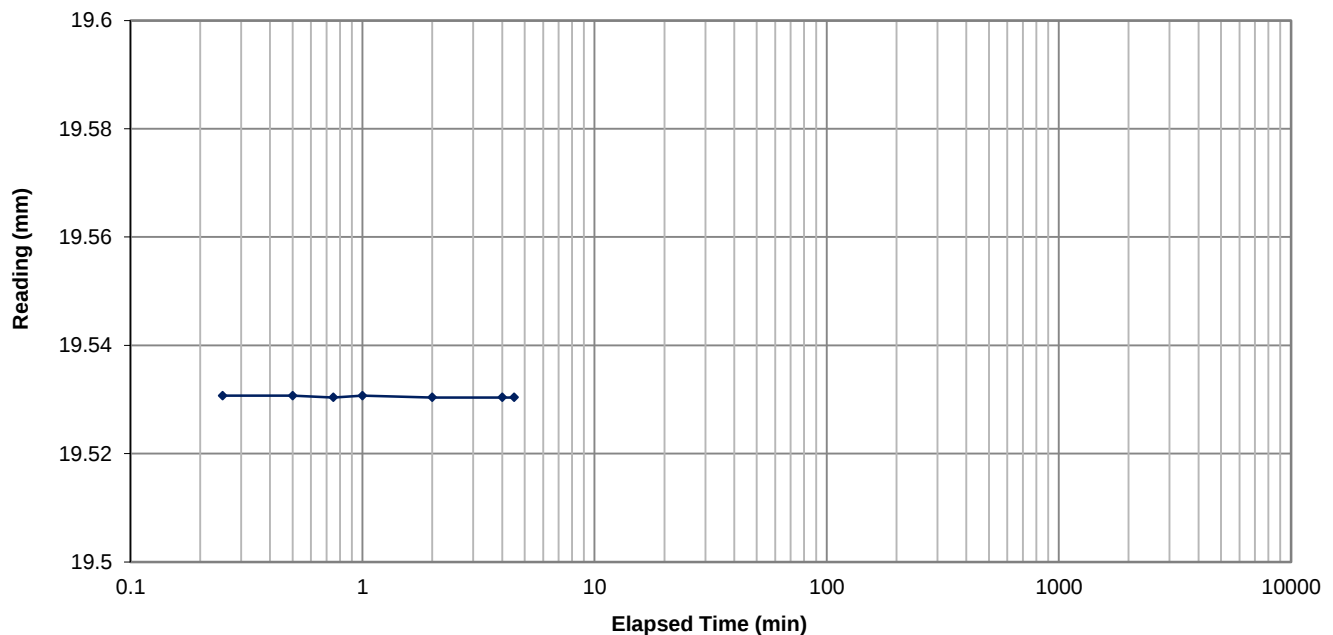
Load #: 1
Stress: 7.9 kPa

Dial Reading versus Elapsed Time



Load #: 2
Stress: 16 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 18, 2024

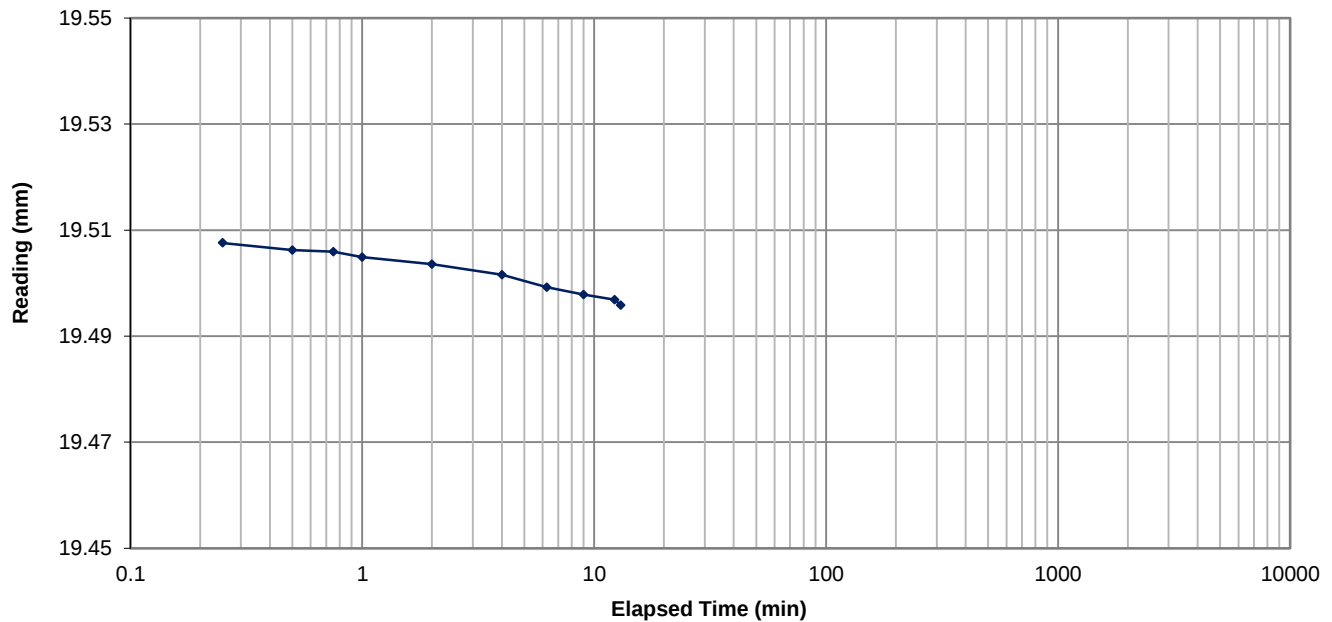
Borehole: T-01
Lab #: F069-003

Sample: ST1

Depth: 2.29 - 3.05 m

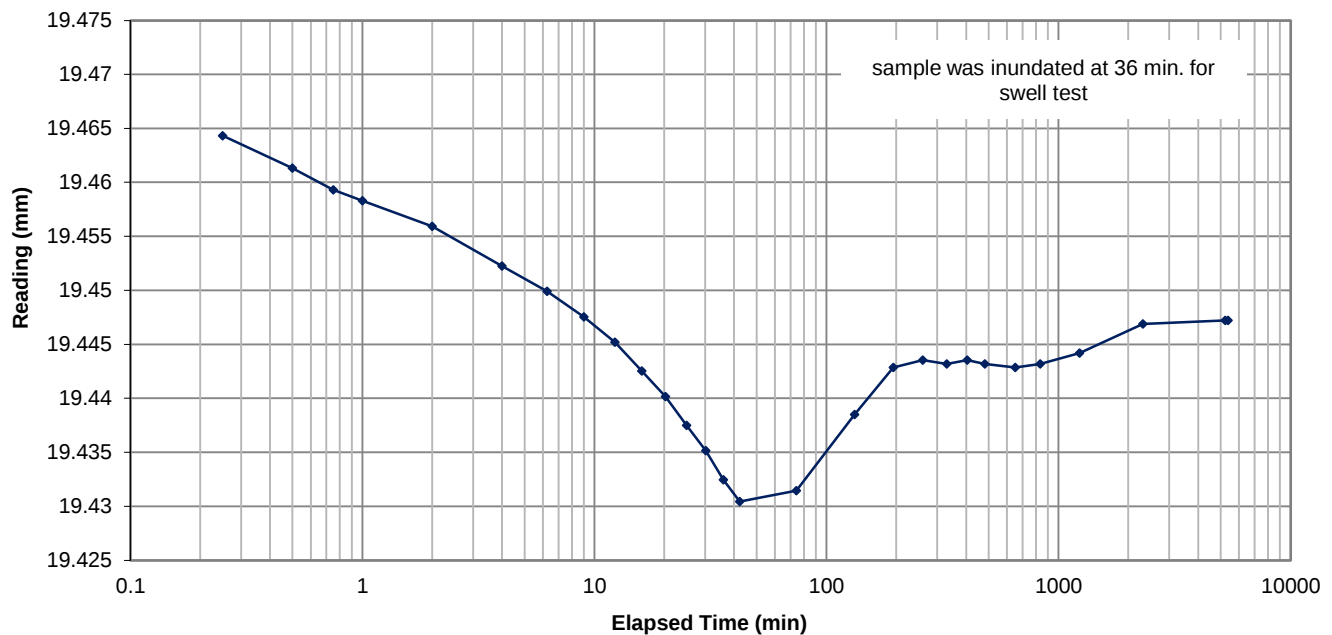
Load #: 3
Stress: 32 kPa

Dial Reading versus Elapsed Time



Load #: 4
Stress: 60 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

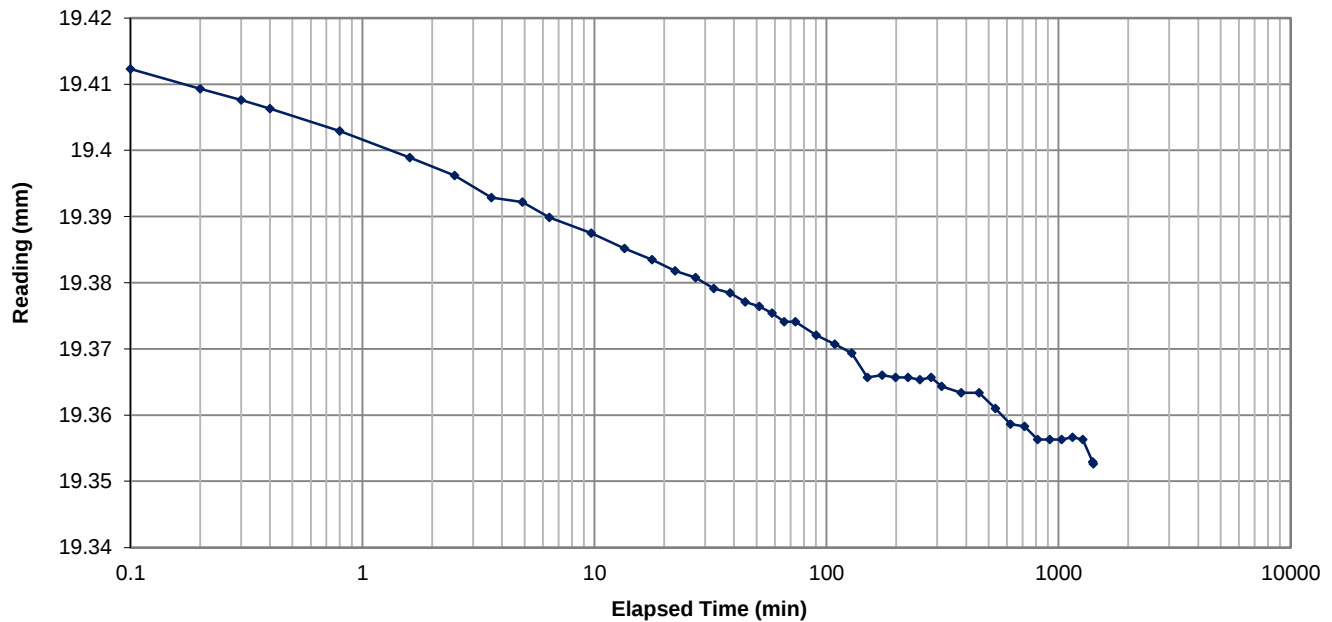
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

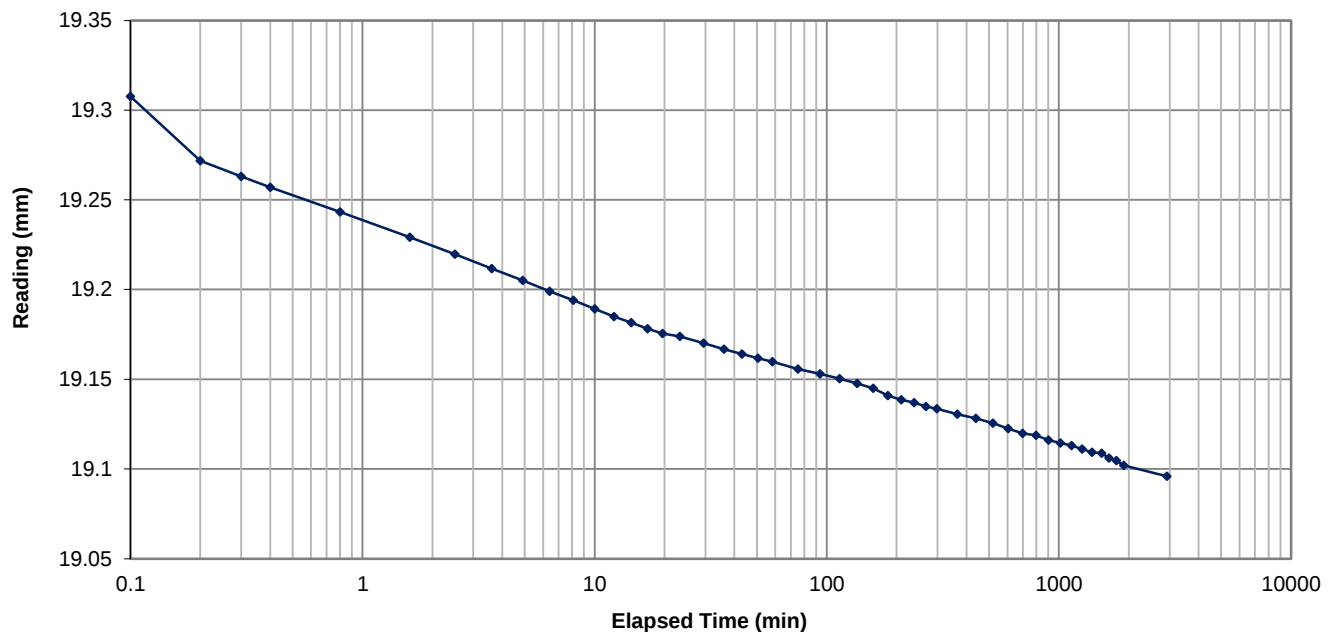
Load #: 5
Stress: 101 kPa

Dial Reading versus Elapsed Time



Load #: 6
Stress: 202 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

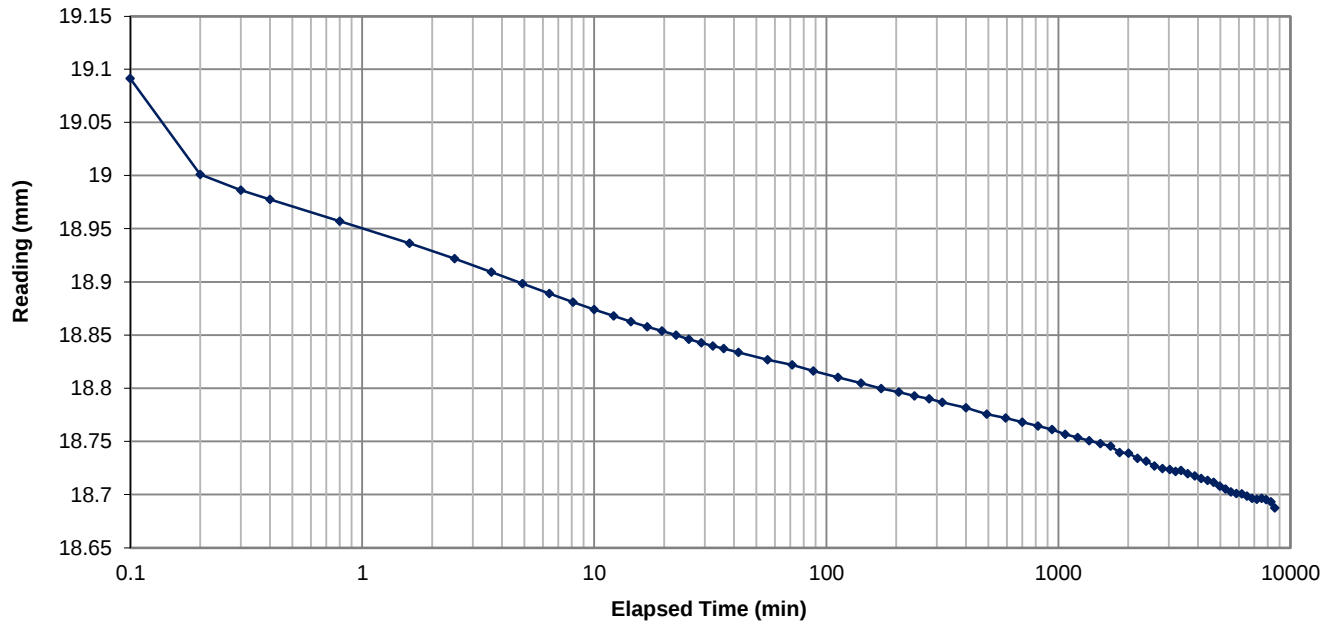
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

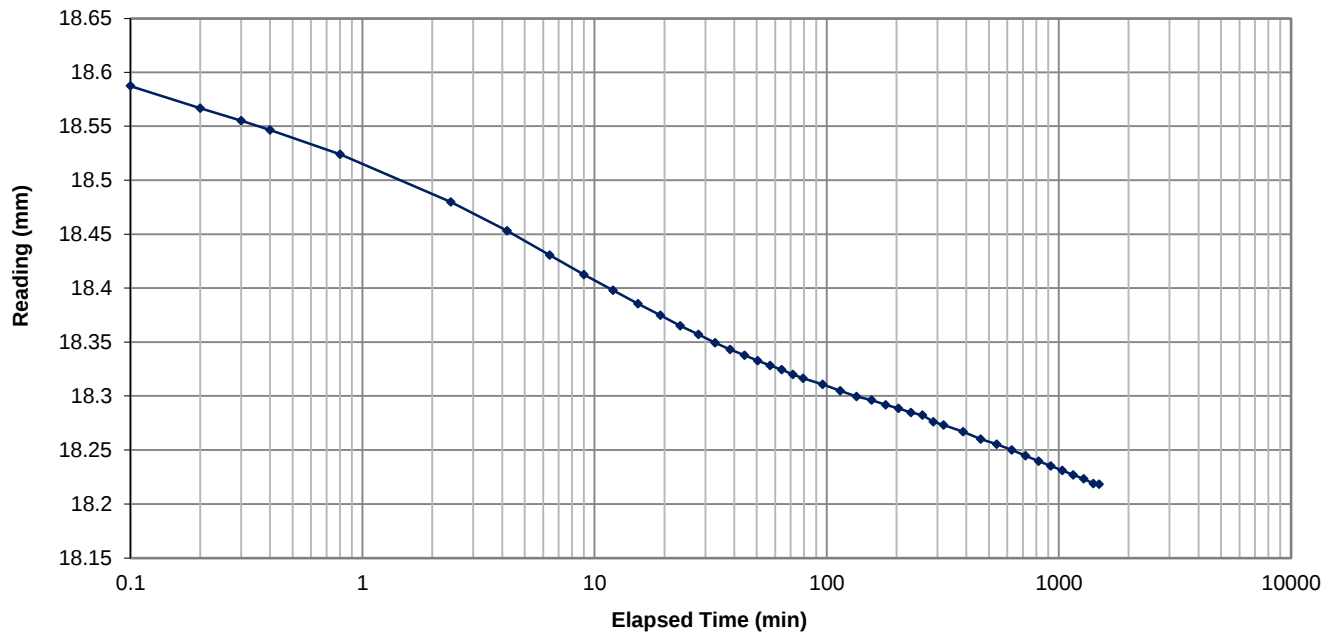
Load #: 7
Stress: 403 kPa

Dial Reading versus Elapsed Time



Load #: 8
Stress: 805 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

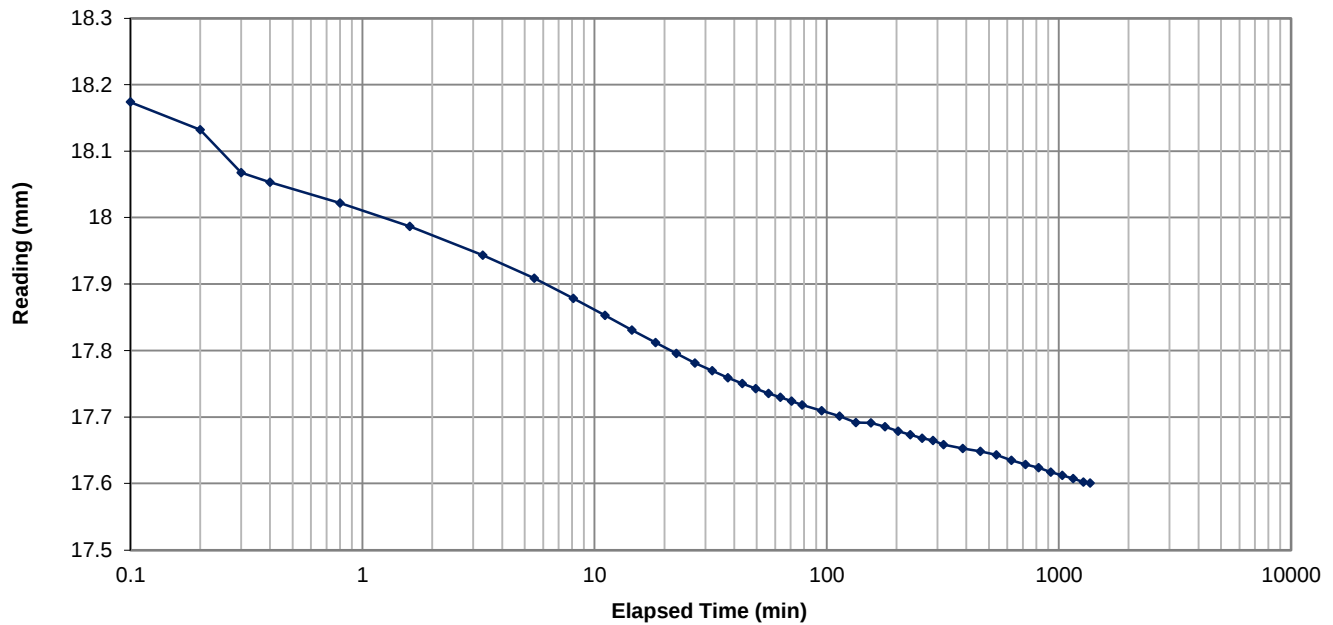
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

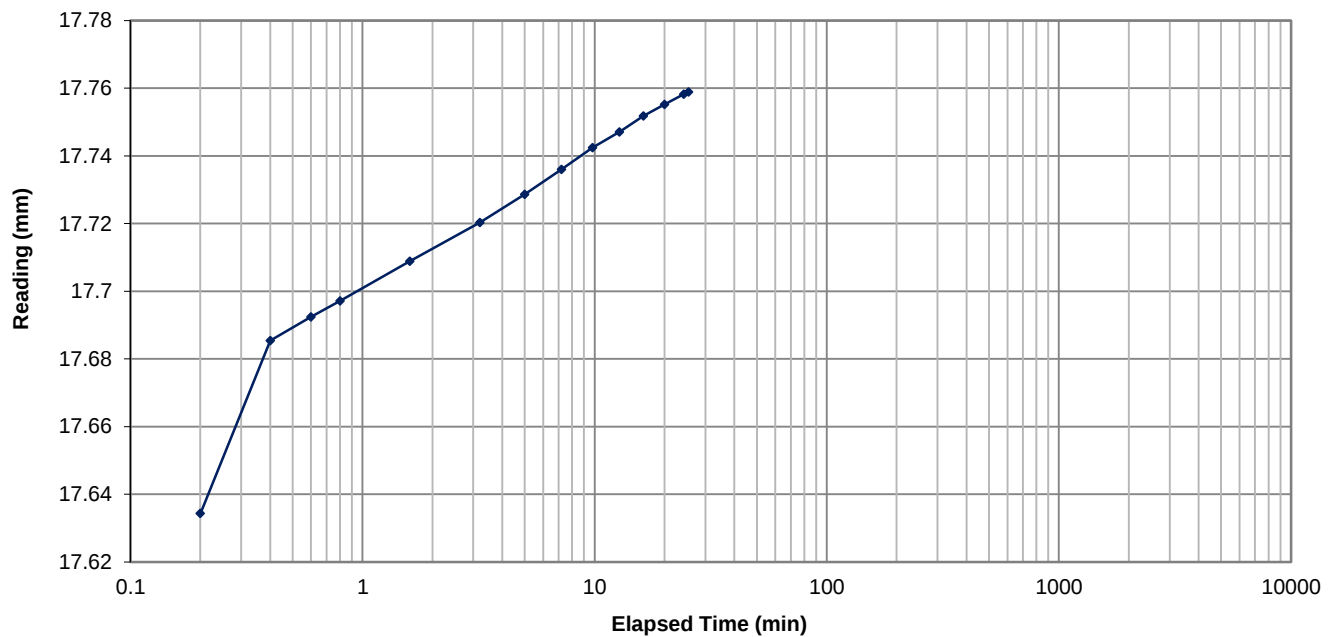
Load #: 9
Stress: 1,602 kPa

Dial Reading versus Elapsed Time



Load #: 10
Stress: 403 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

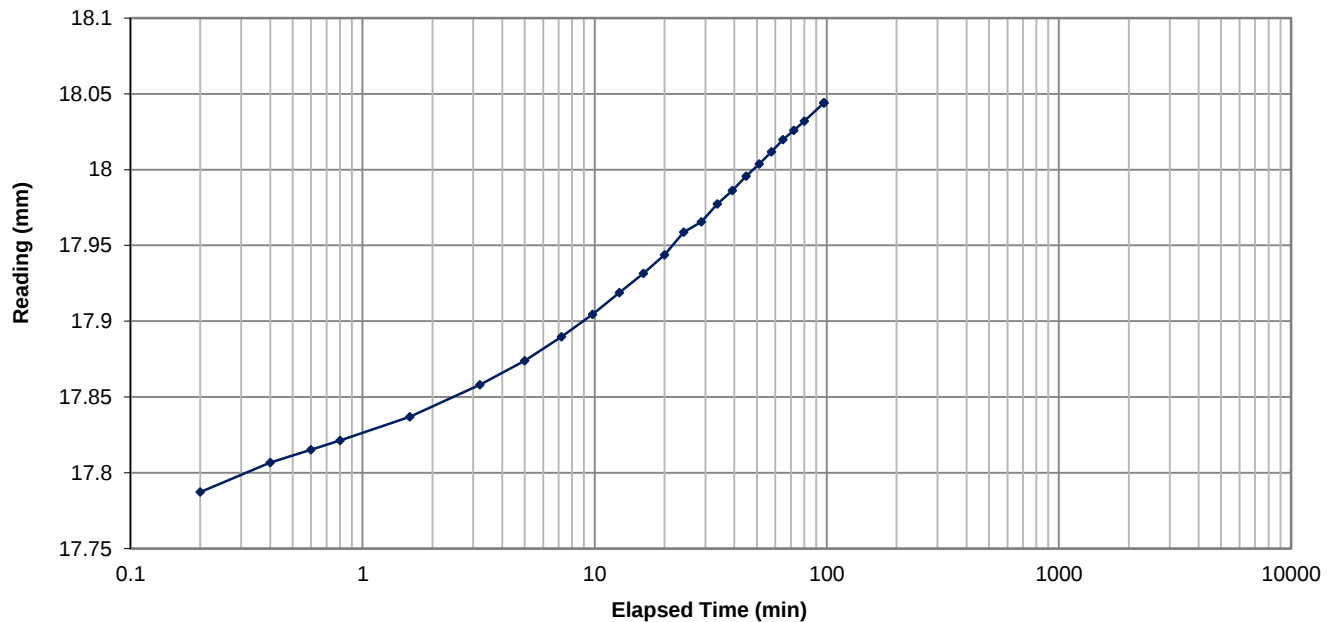
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-01 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-003

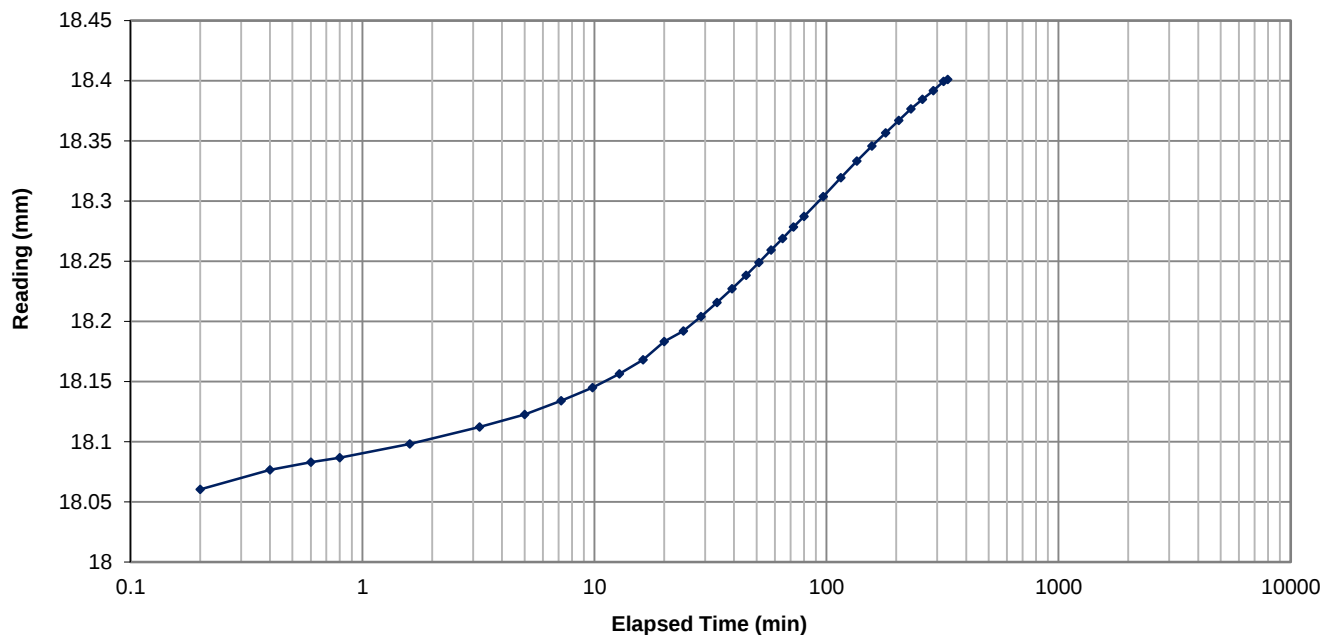
Load #: 11
Stress: 101 kPa

Dial Reading versus Elapsed Time



Load #: 12
Stress: 32 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 18, 2024

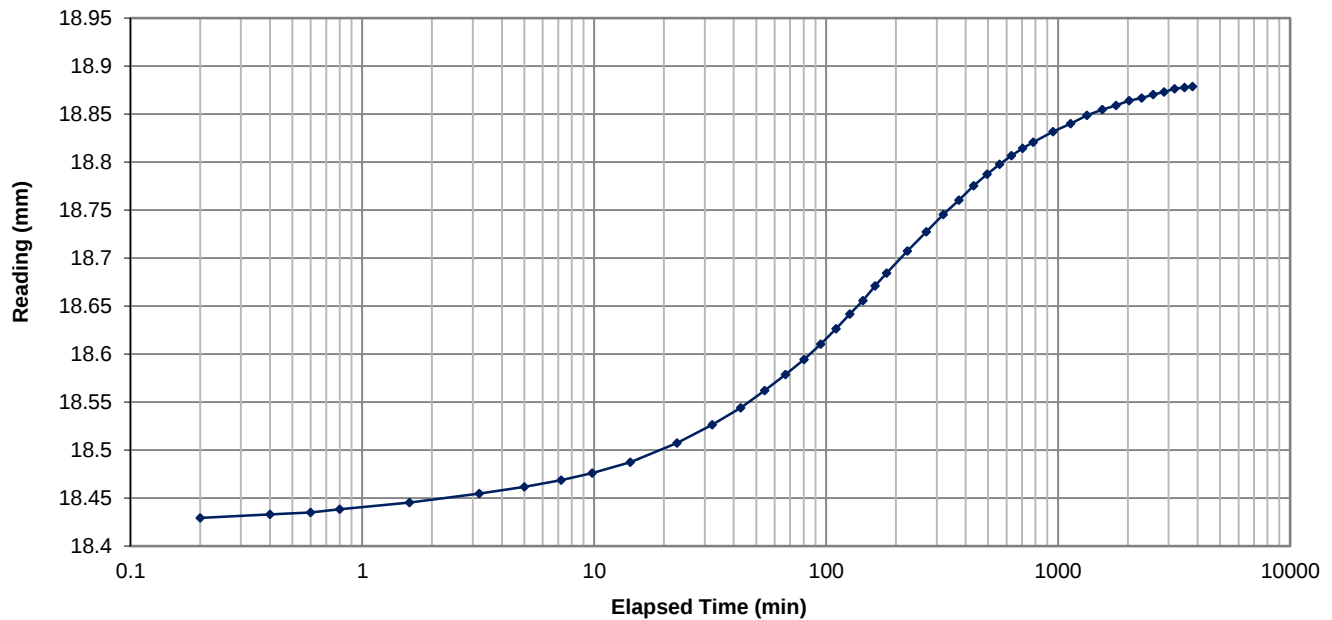
Borehole: T-01
Lab #: F069-003

Sample: ST1

Depth: 2.29 - 3.05 m

Load #: 13
Stress: 7.9 kPa

Dial Reading versus Elapsed Time





ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023 Task: -
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

	Initial	Final	
Sample height (mm):	19.1	19.3	Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.7	69.7	
Sample area (cm ²):	38.2	38.2	Loading cap (kPa): 3.4
Volume (cm ³):	73	74	
Wet mass (g):	138.3	142.1	
Dry mass (g):	107.4	107.4	
Water content (%):	28.8	32.3	
Solids content (%):	77.7	75.6	
Wet density (kg/m ³):	1895	1926	
Dry density (kg/m ³):	1472	1456	
Void ratio:	0.83	0.86	Soil description: (CI) SILTY CLAY, medium plasticity fines; brown, sand pockets observed; cohesive, moist, stiff
Height of solids (mm):	10.4	10.4	
Degree of saturation (%):	93	101	

Load #	H _{sample} (mm)	Stone Correction (mm)	H _{corrected} (mm)	Stress (kPa)	Void ratio	Strain (%)	Incremental Work (kJ/m ³)	Cumulative Work (kJ/m ³)
0	19.1	0.0	19.1	3.4	0.84	-0.1	0.0	0.0
1	19.1	0.0	19.1	7.9	0.84	-0.1	0.0	0.0
2	19.1	0.0	19.1	16	0.84	-0.1	0.0	0.0
3	19.1	0.0	19.1	32	0.83	0.0	0.0	0.0
4	19.2	0.1	19.2	60	0.84	-0.6	-0.3	-0.2
5	19.1	0.1	19.2	100	0.84	-0.5	0.0	-0.2
6	18.8	0.1	18.9	201	0.82	0.8	2.1	1.9
7	18.4	0.2	18.6	402	0.78	2.7	5.7	7.6
8	17.9	0.2	18.1	803	0.74	5.3	16.2	23.8
9	17.2	0.3	17.5	1,598	0.68	8.4	39.4	63.2
10	17.5	0.2	17.7	402	0.70	7.4		
11	18.1	0.2	18.2	100	0.75	4.5		
12	18.5	0.1	18.6	32	0.79	2.7		
13	19.3	0.1	19.4	7.9	0.86	-1.5		

Comments:

- data for load numbers 0 to 4 taken from swell test.
- prior to this test, the specimen was preconsolidated to 60 kPa stress then rebounded to 7.9 kPa as part of swell test (ASTM D4546 Method B).
- specimen was inundated with water near the start of the 60 kPa load

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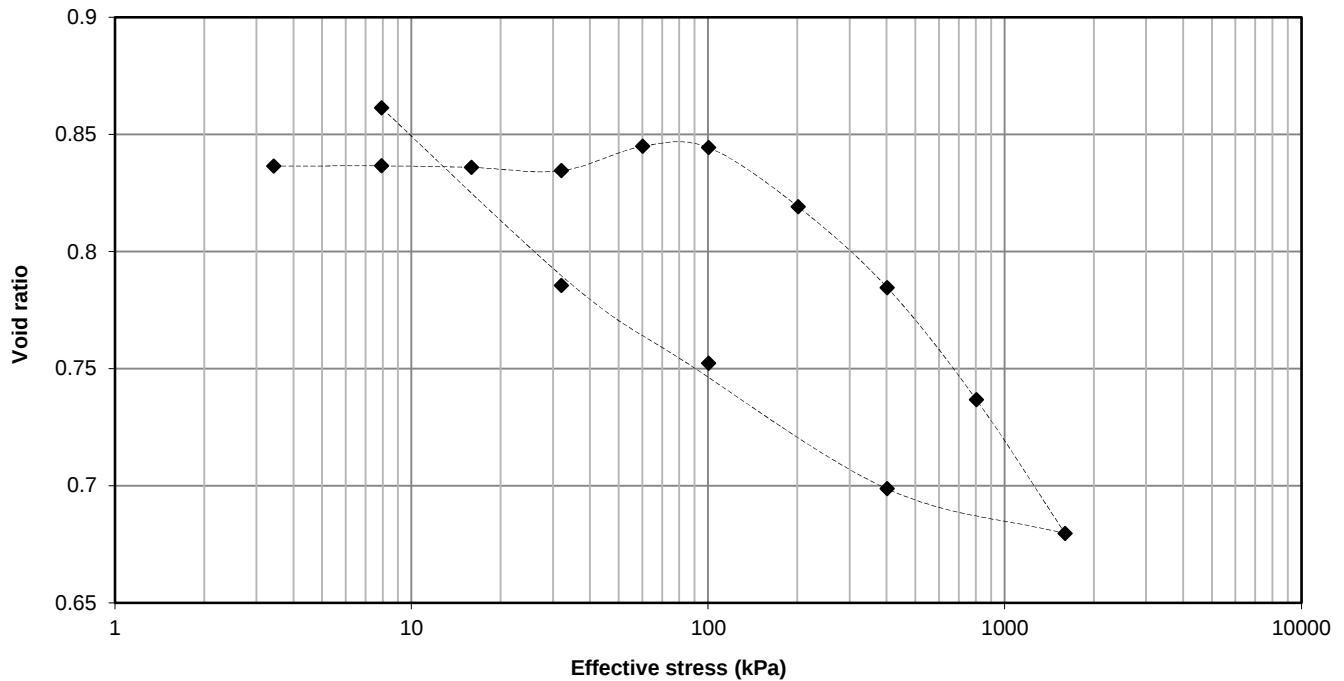
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

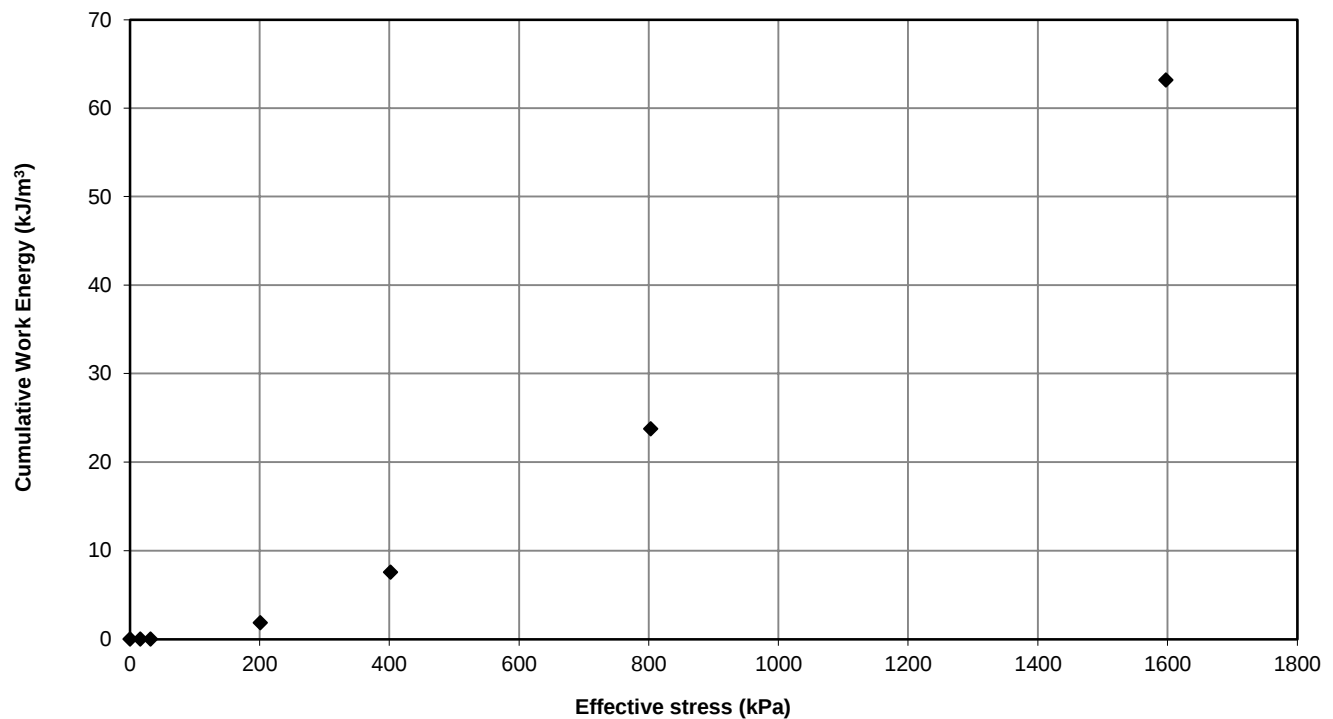
Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

Void Ratio versus Effective Stress



Cumulative Work Energy versus Effective Stress



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

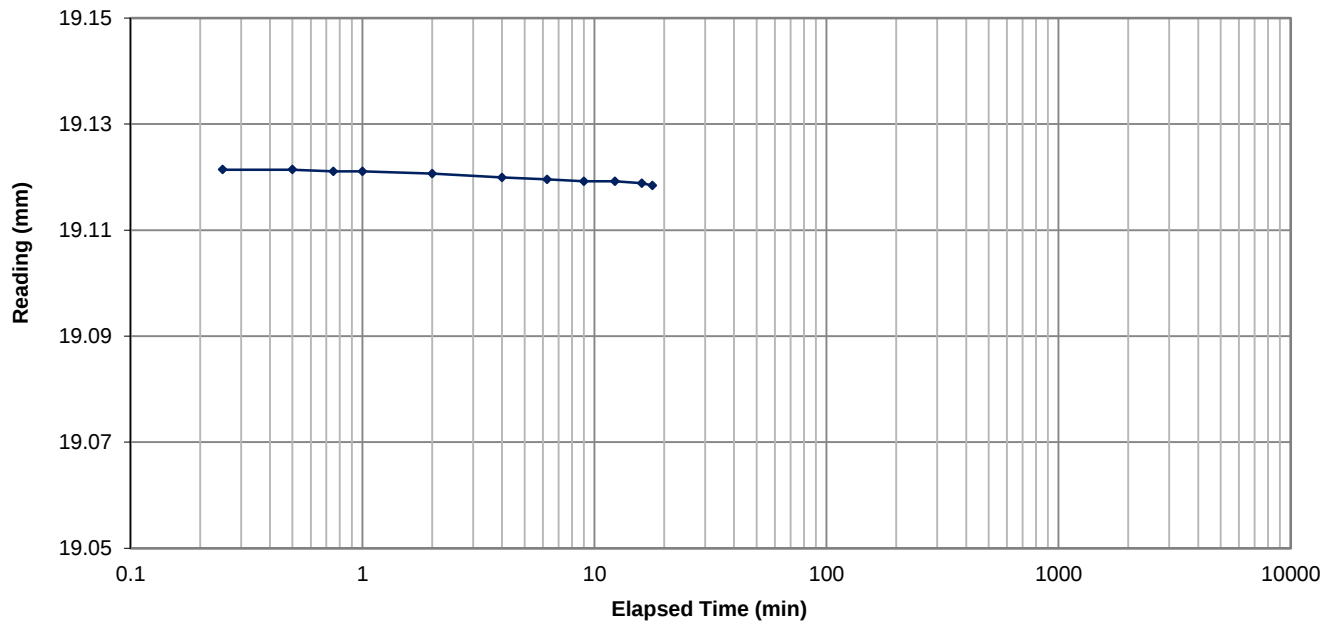
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

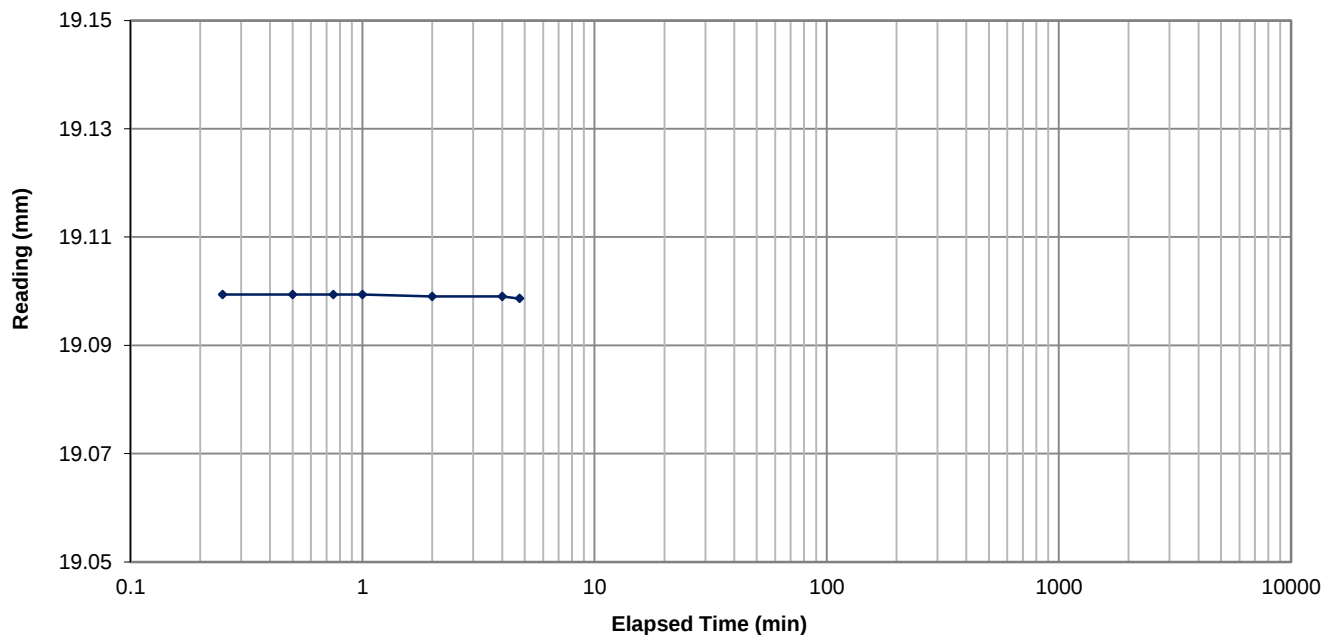
Load #: 1
Stress: 7.9 kPa

Dial Reading versus Elapsed Time



Load #: 2
Stress: 16 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

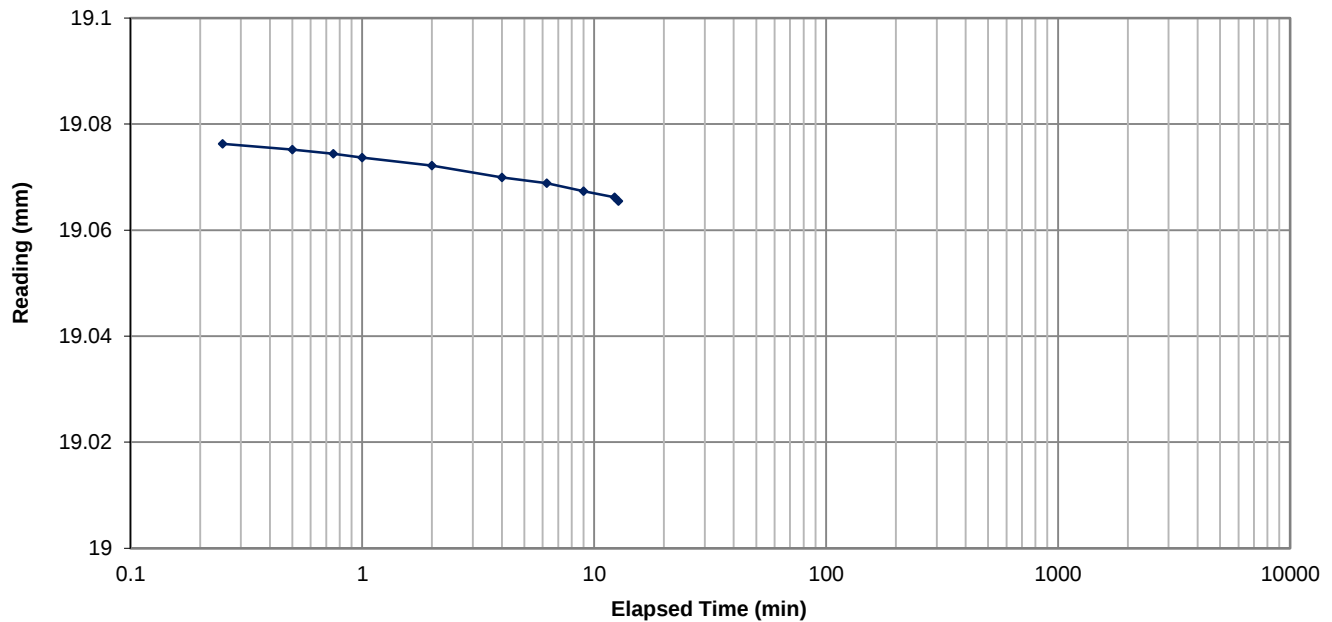
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

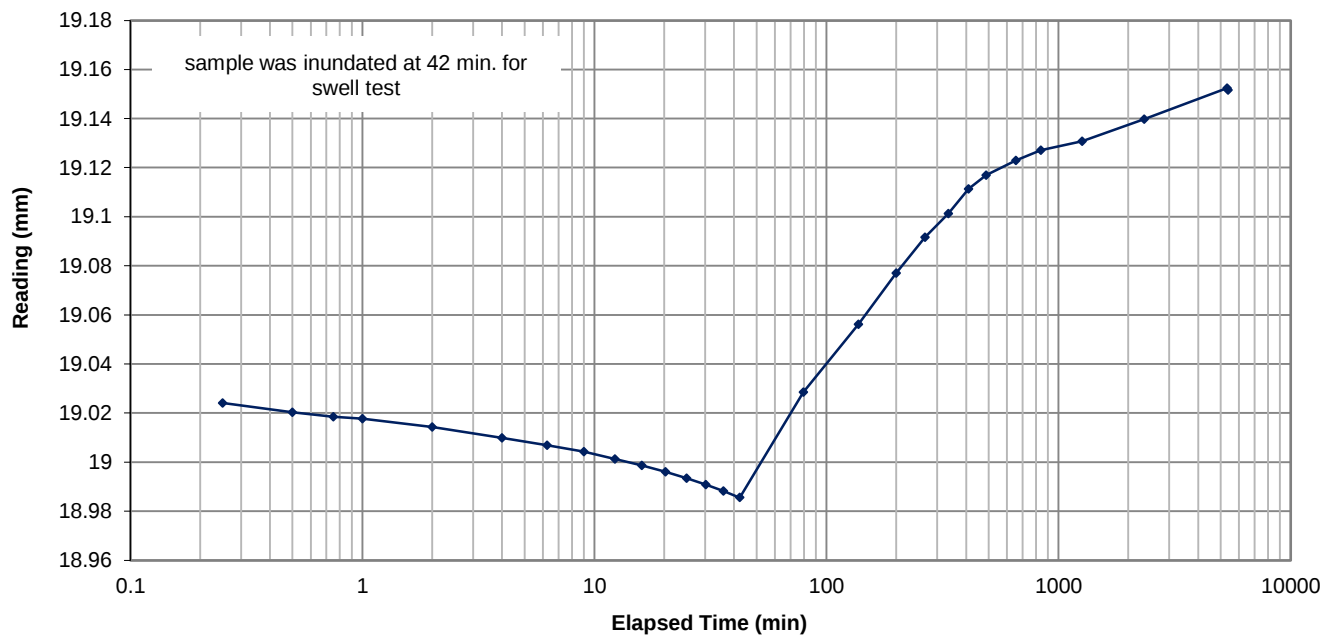
Load #: 3
Stress: 32 kPa

Dial Reading versus Elapsed Time



Load #: 4
Stress: 60 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

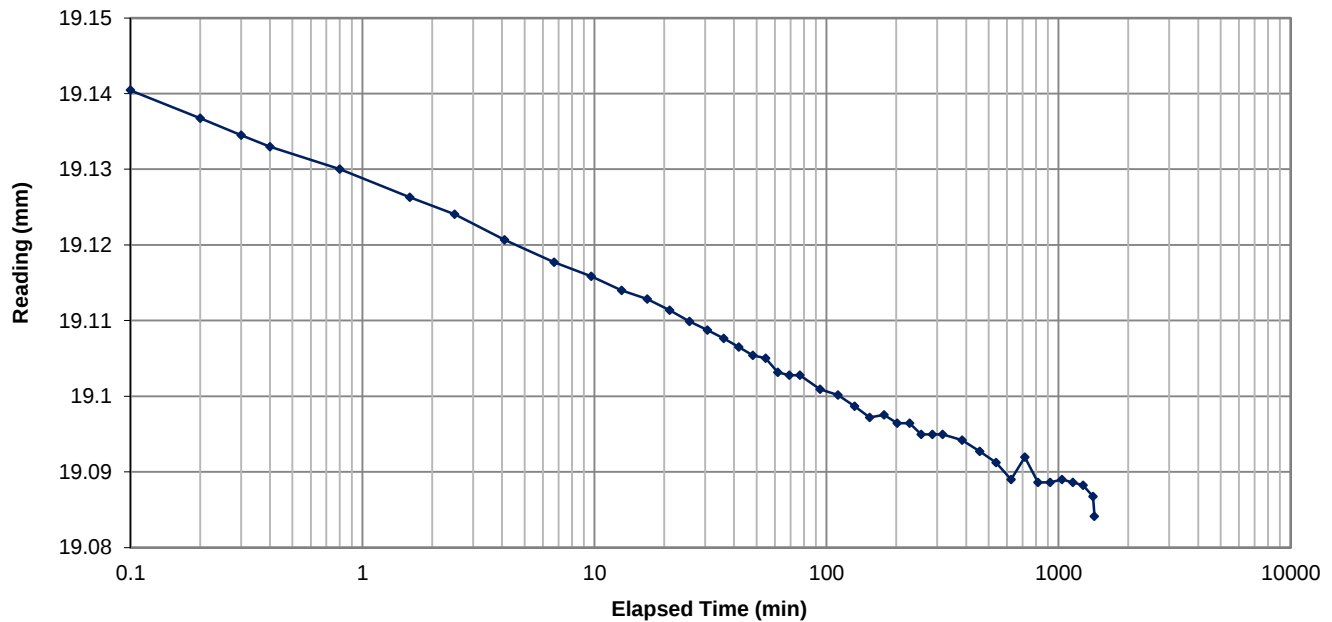
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

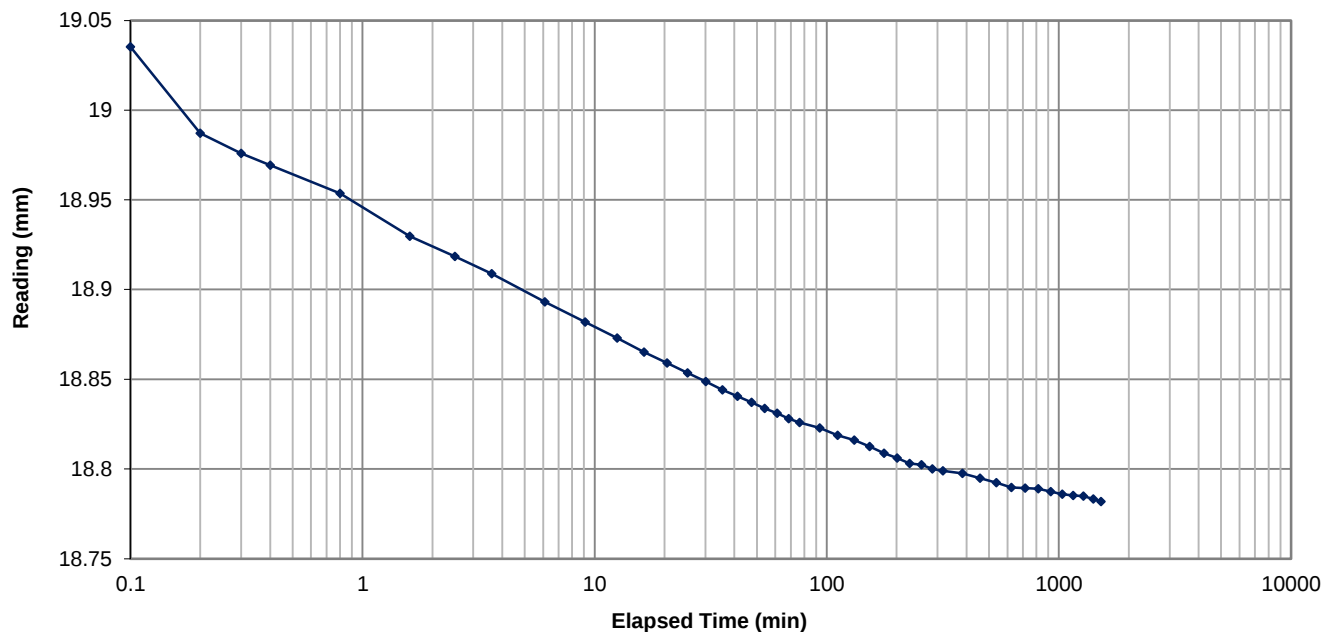
Load #: 5
Stress: 100 kPa

Dial Reading versus Elapsed Time



Load #: 6
Stress: 201 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

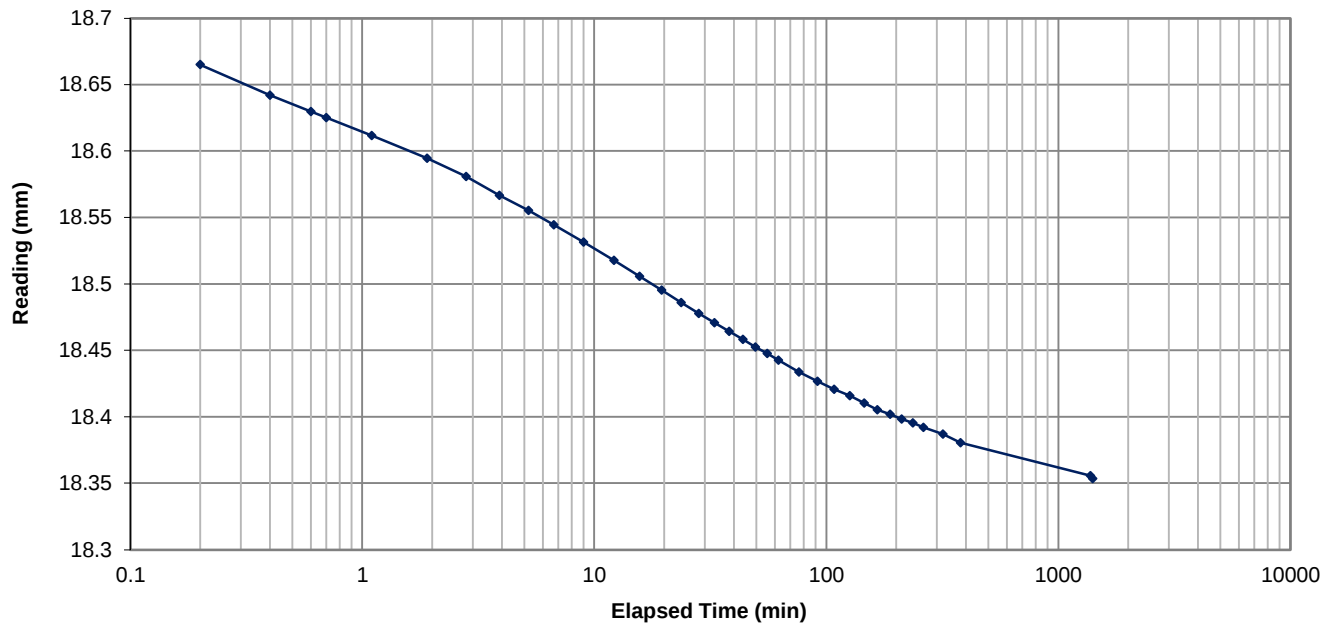
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

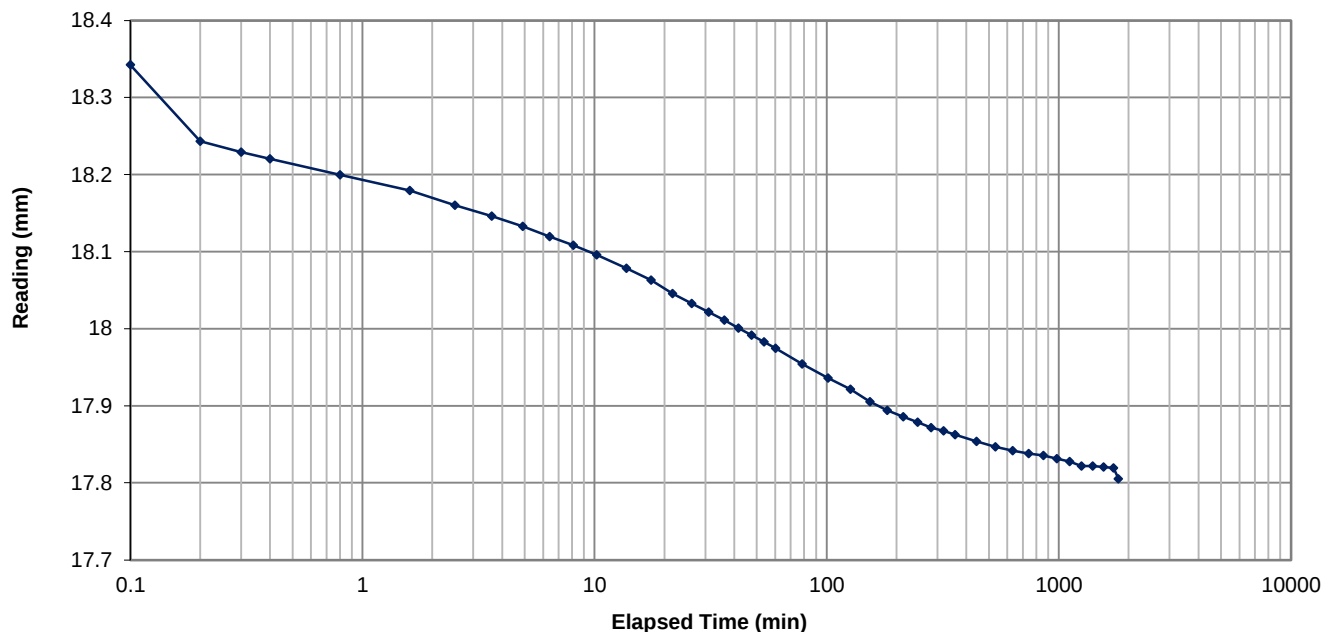
Load #: 7
Stress: 402 kPa

Dial Reading versus Elapsed Time



Load #: 8
Stress: 803 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

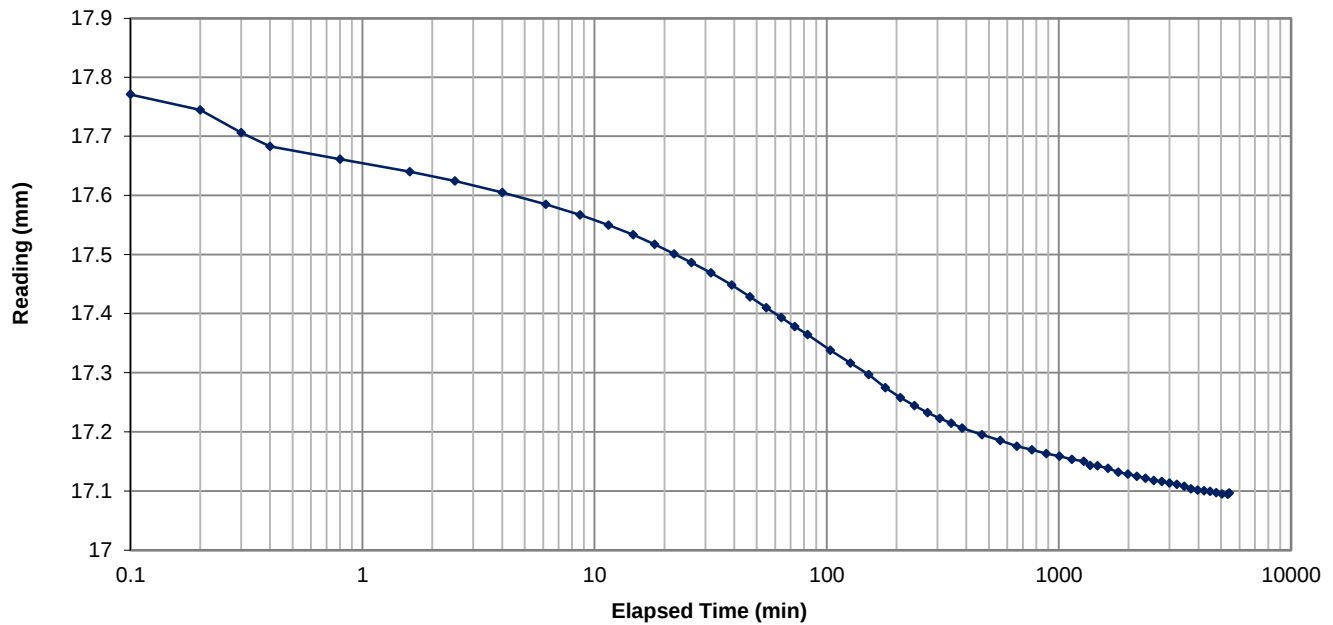
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

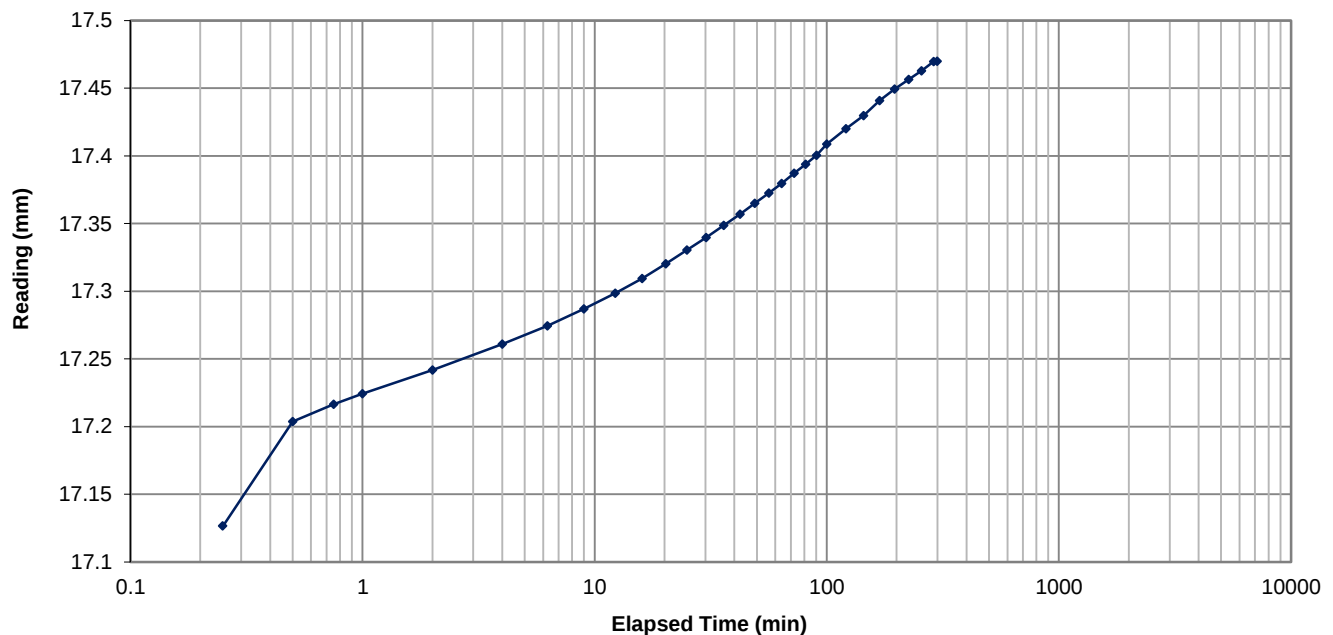
Load #: 9
Stress: 1,598 kPa

Dial Reading versus Elapsed Time



Load #: 10
Stress: 402 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

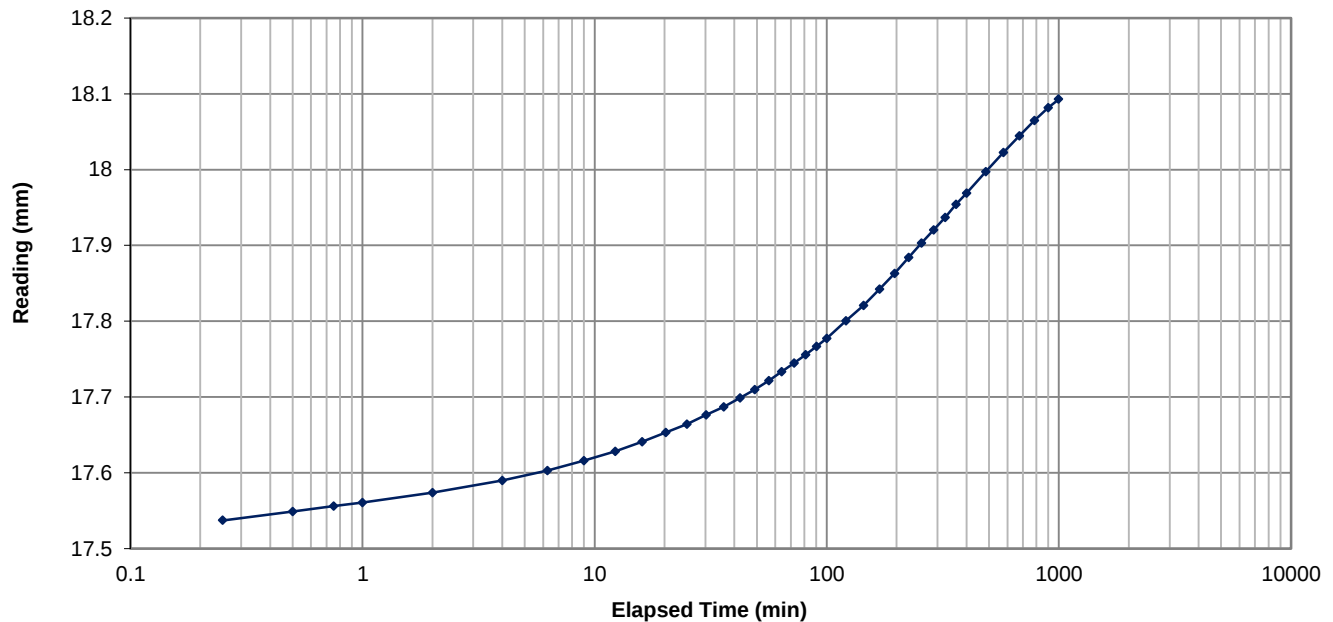
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

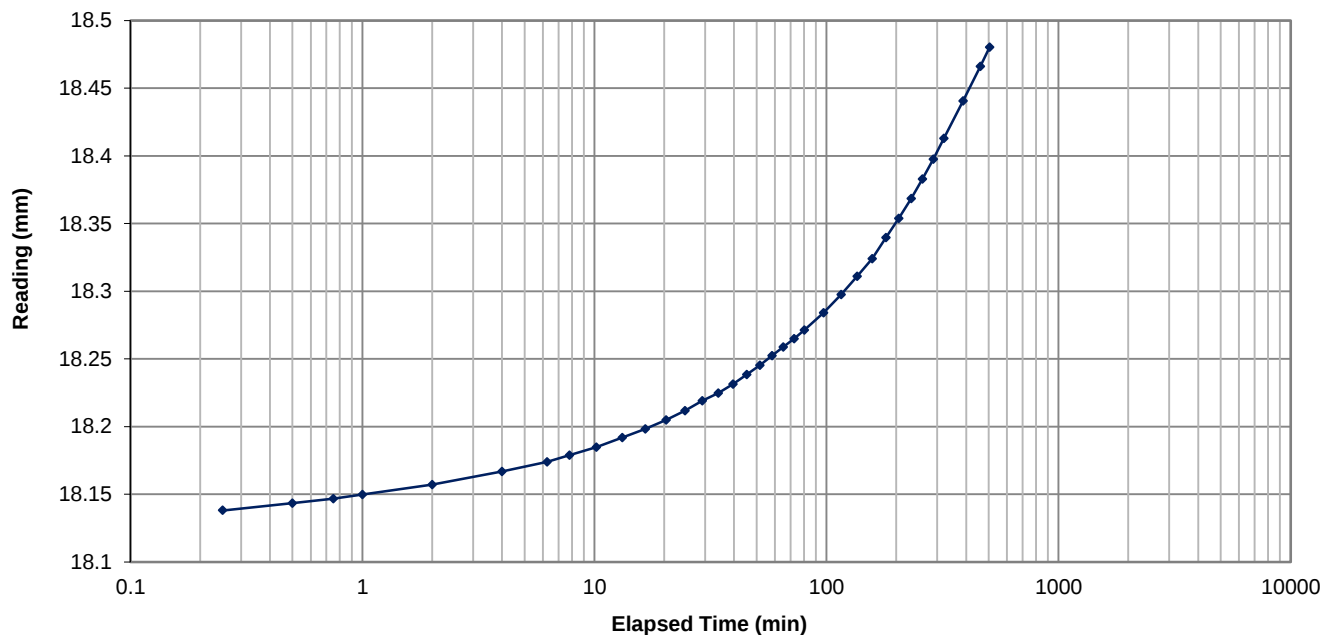
Load #: 11
Stress: 100 kPa

Dial Reading versus Elapsed Time



Load #: 12
Stress: 32 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

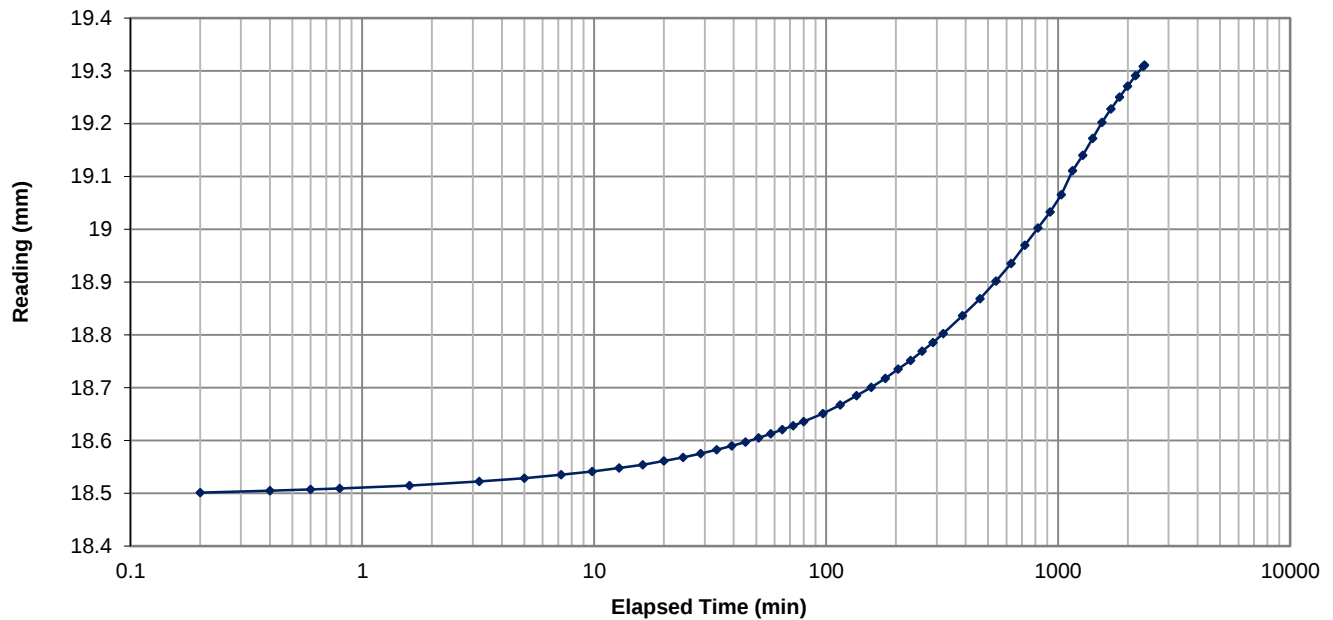
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-06 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-016

Load #: 13
Stress: 7.9 kPa

Dial Reading versus Elapsed Time





ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023 Task: -
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

	Initial	Final	
Sample height (mm):	19.4	19.2	Specific gravity: 2.7 (assumed)
Sample diameter (mm):	62.3	62.3	
Sample area (cm ²):	30.5	30.5	Loading cap (kPa): 0.9
Volume (cm ³):	59	59	
Wet mass (g):	122.0	129.7	
Dry mass (g):	109.5	109.5	
Water content (%):	11.4	18.5	
Solids content (%):	89.8	84.4	
Wet density (kg/m ³):	2059	2217	
Dry density (kg/m ³):	1848	1871	
Void ratio:	0.46	0.45	Soil description: (CI) SILTY CLAY, trace fine sand, trace fine gravel, medium plasticity fines; brown; cohesive, moist, very stiff
Height of solids (mm):	13.3	13.3	
Degree of saturation (%):	67	112	

Load #	H _{sample} (mm)	Stone Correction (mm)	H _{corrected} (mm)	Stress (kPa)	Void ratio	Strain (%)	Incremental Work (kJ/m ³)	Cumulative Work (kJ/m ³)
0	19.4	0.0	19.4	0.86	0.46	-0.1	0.0	0.0
1	19.4	0.0	19.4	6.5	0.46	-0.1	0.0	0.0
2	19.4	0.0	19.4	17	0.46	0.0	0.0	0.0
3	19.4	0.0	19.4	30	0.46	0.0	0.0	0.0
4	19.7	0.0	19.7	60	0.48	-1.4	-0.6	-0.6
5	19.6	0.0	19.6	102	0.48	-1.0	0.3	-0.3
6	19.4	0.0	19.4	203	0.46	0.1	1.7	1.4
7	19.0	0.1	19.1	404	0.44	1.6	4.5	5.9
8	18.7	0.1	18.7	798	0.41	3.5	11.3	17.2
9	18.2	0.1	18.3	1,602	0.38	5.6	27.1	44.3
10	18.3	0.1	18.4	404	0.38	5.5		
11	18.5	0.1	18.6	102	0.40	4.5		
12	18.8	0.0	18.9	30	0.42	2.8		
13	19.2	0.0	19.2	6.5	0.45	1.1		

Comments:

- data for load numbers 0 to 4 taken from swell test.
- prior to this test, the specimen was preconsolidated to 60 kPa stress then rebounded to 0.9 kPa as part of swell test (ASTM D4546 Method B).
- specimen was inundated with water near the start of the 60 kPa load

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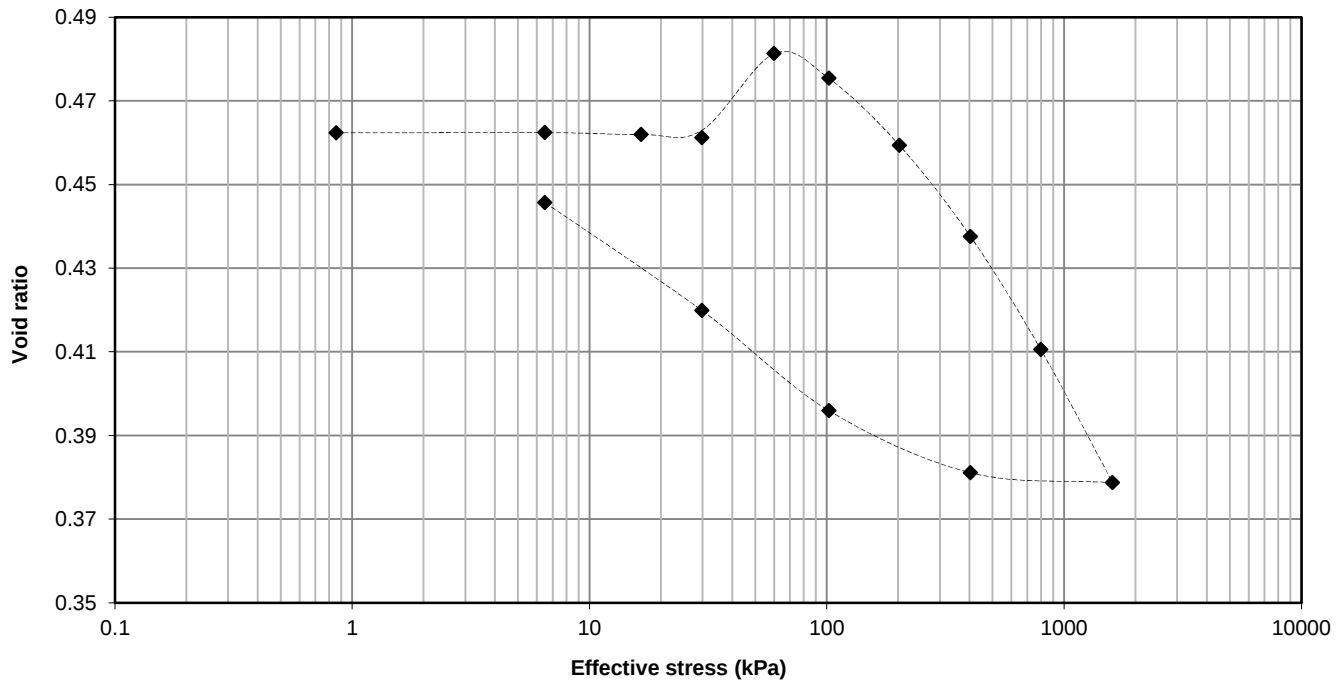
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

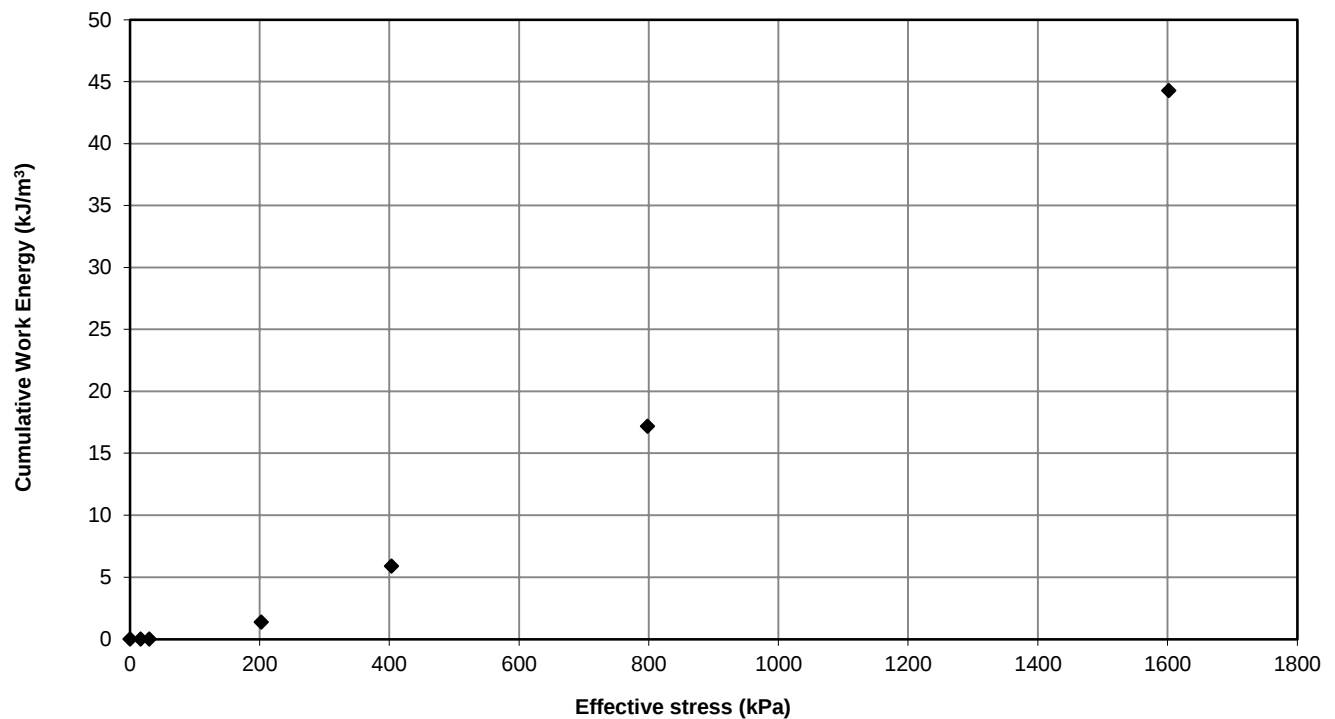
Task: -
Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

Void Ratio versus Effective Stress



Cumulative Work Energy versus Effective Stress



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

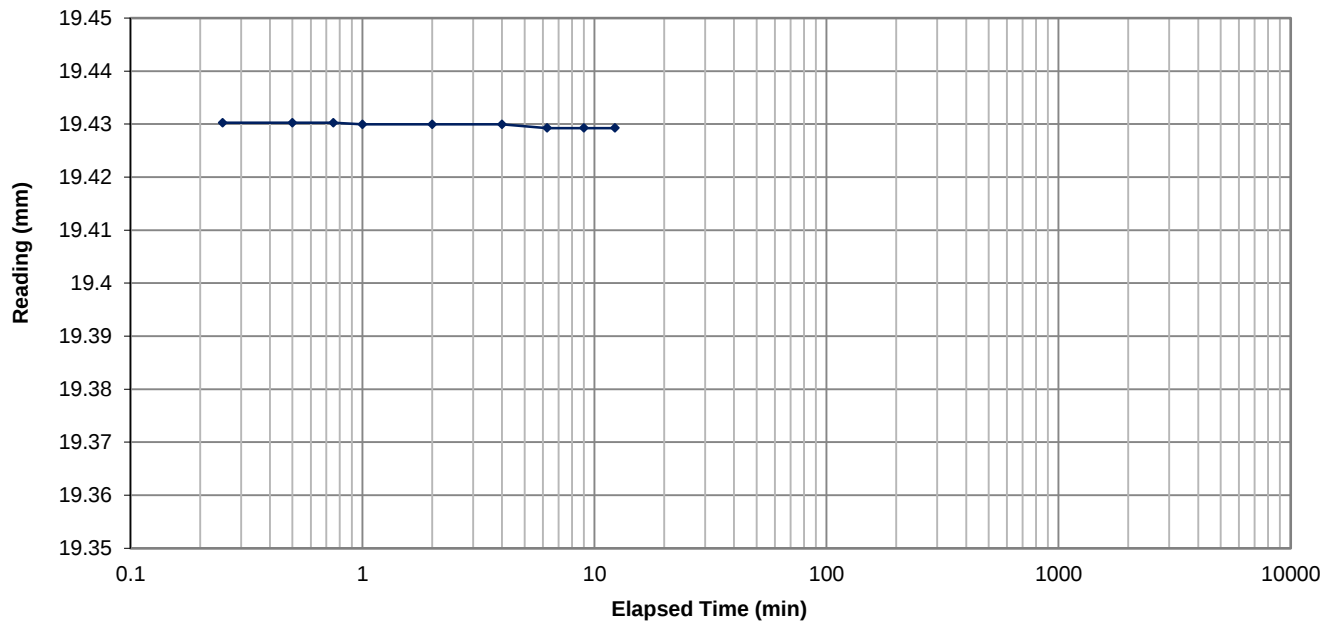
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

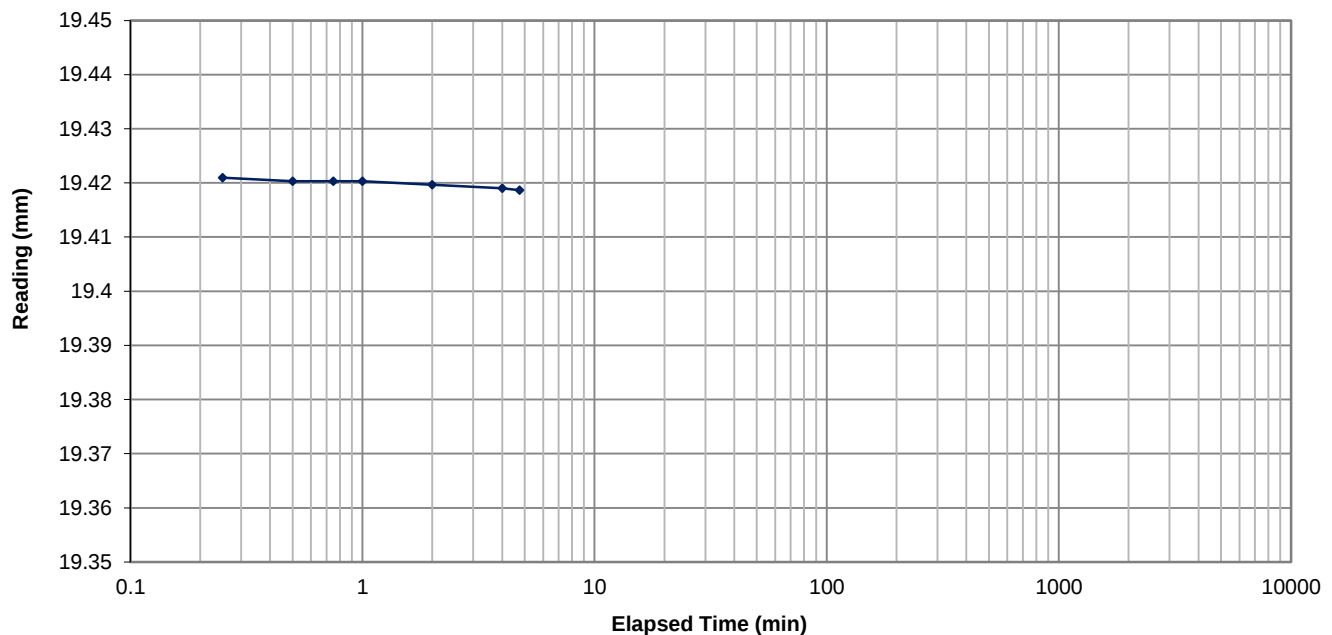
Load #: 1
Stress: 6.5 kPa

Dial Reading versus Elapsed Time



Load #: 2
Stress: 17 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

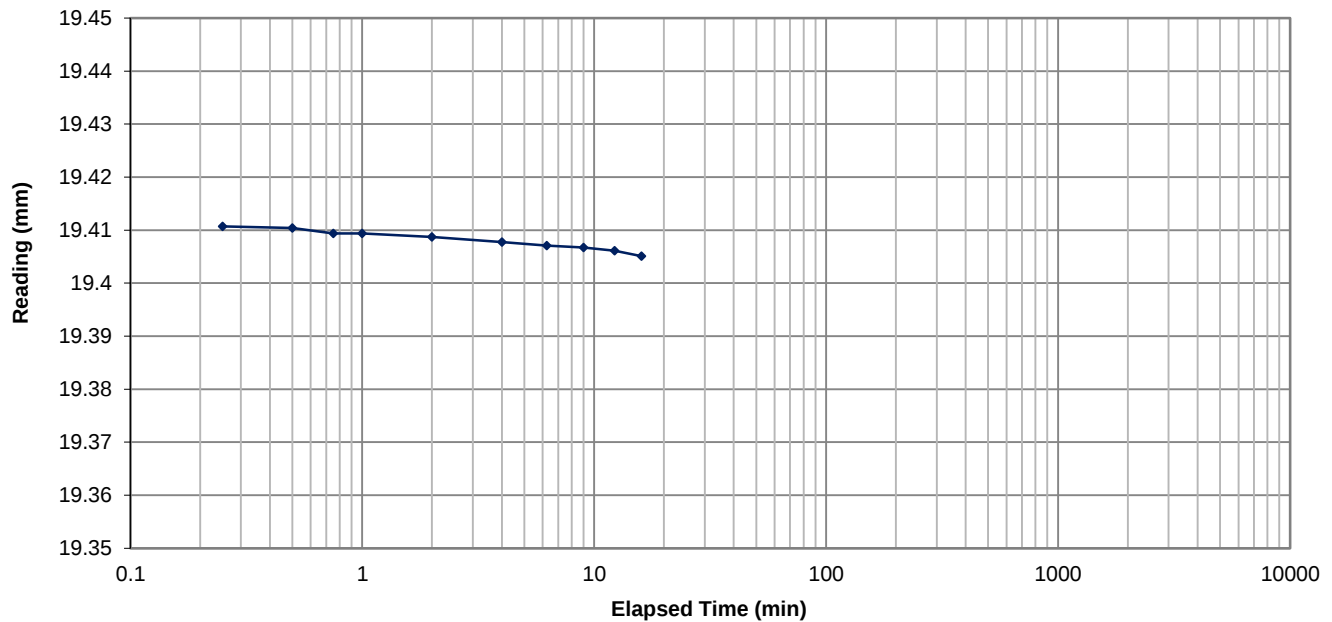
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

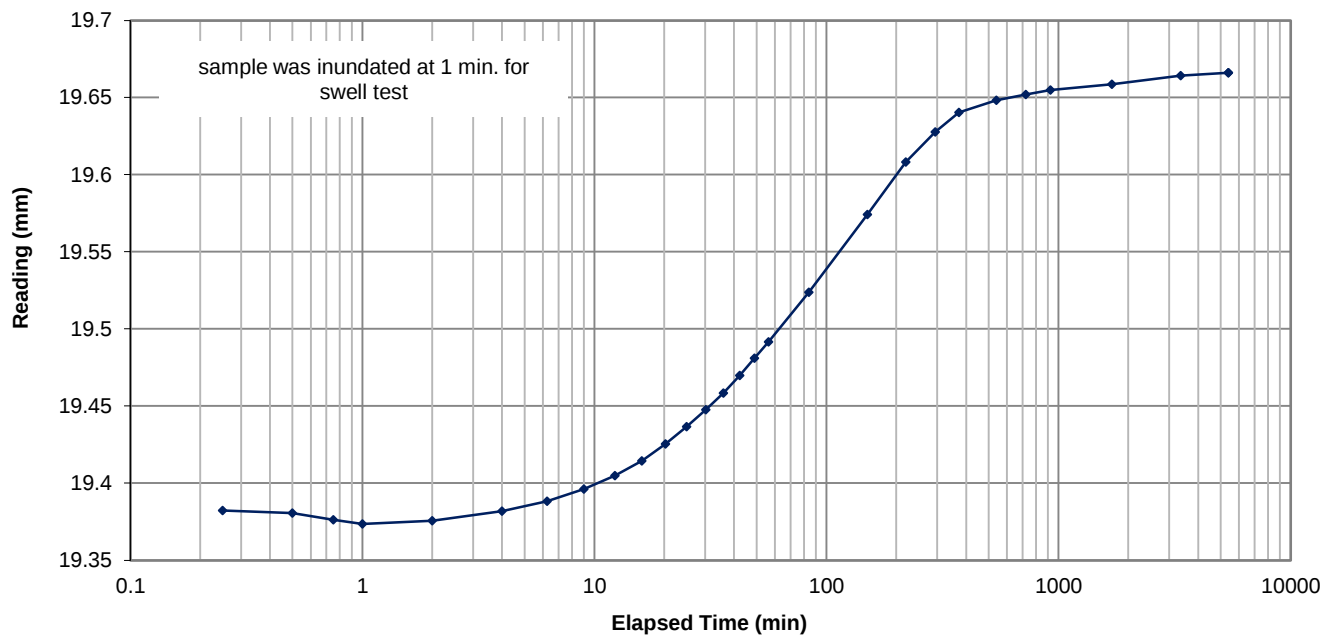
Load #: 3
Stress: 30 kPa

Dial Reading versus Elapsed Time



Load #: 4
Stress: 60 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

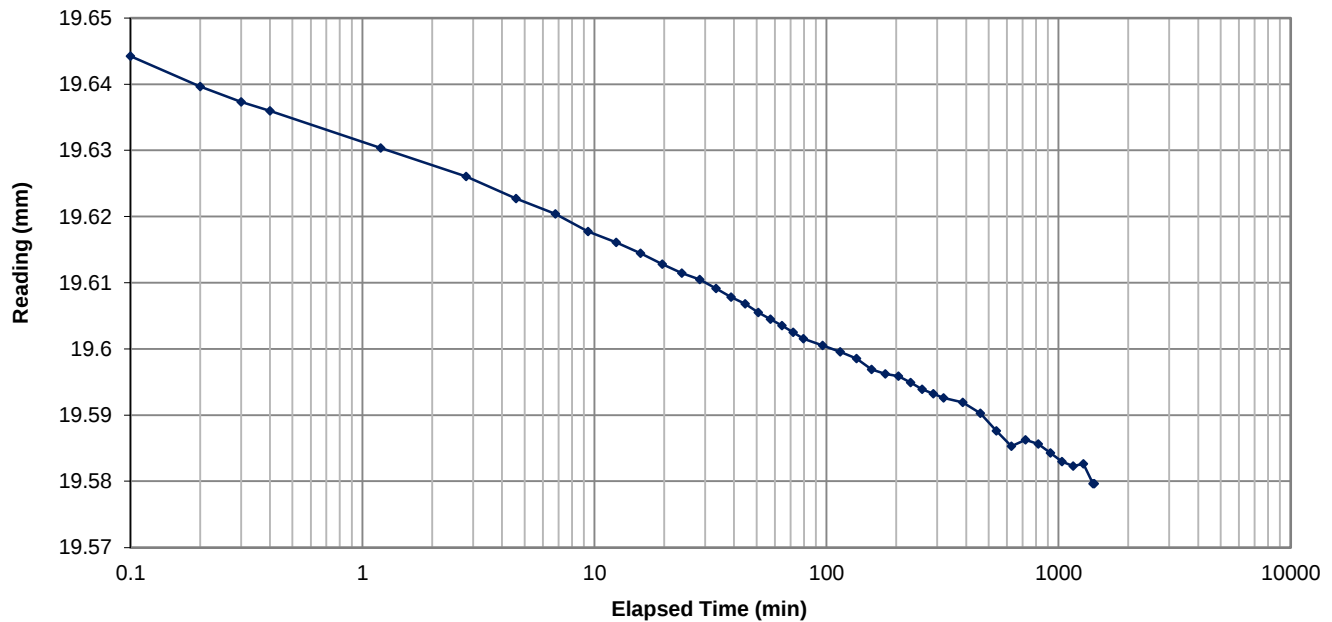
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

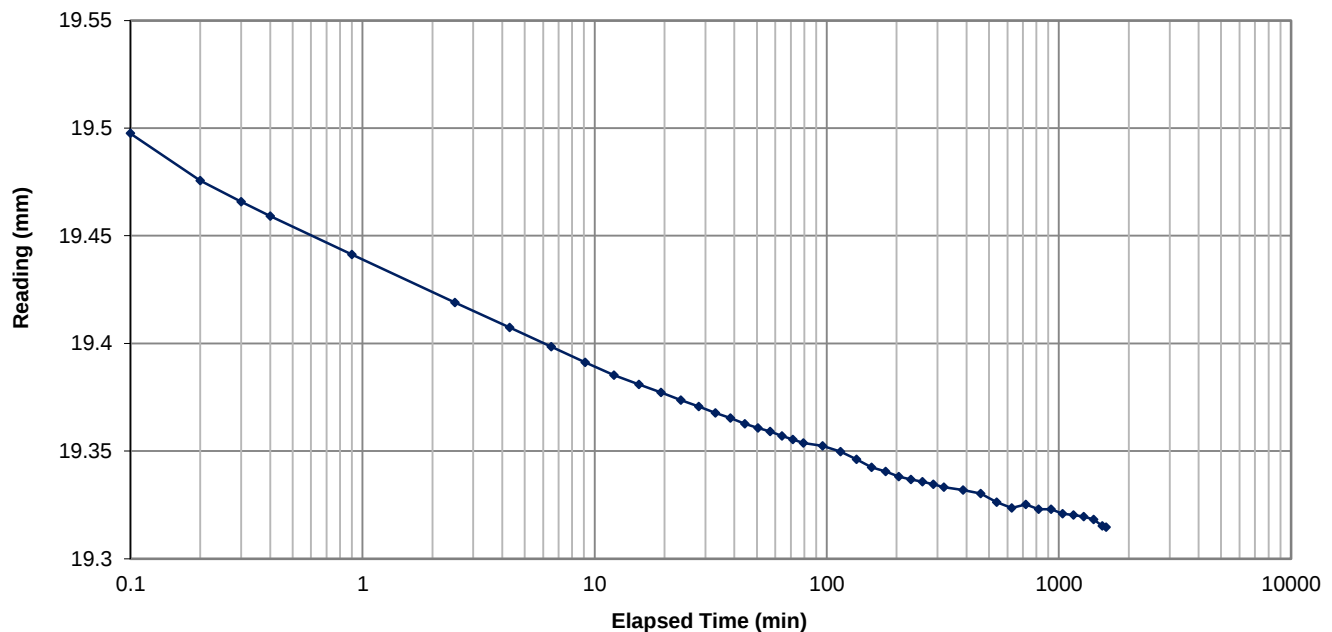
Load #: 5
Stress: 102 kPa

Dial Reading versus Elapsed Time



Load #: 6
Stress: 203 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

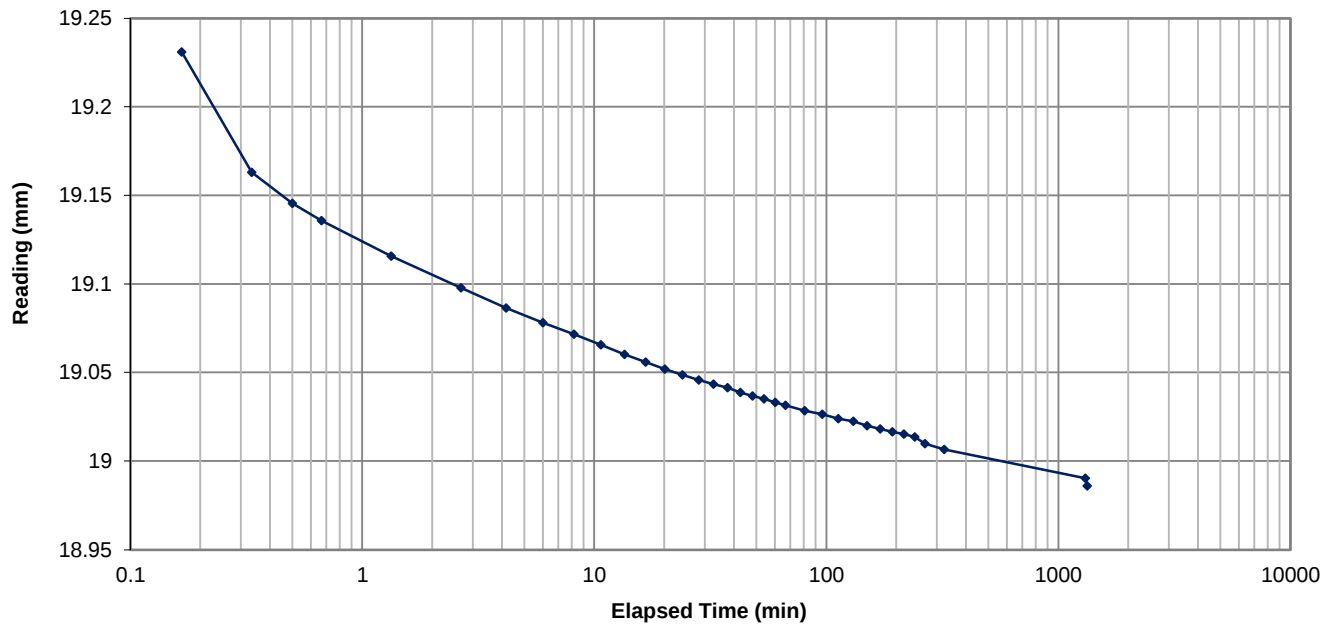
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

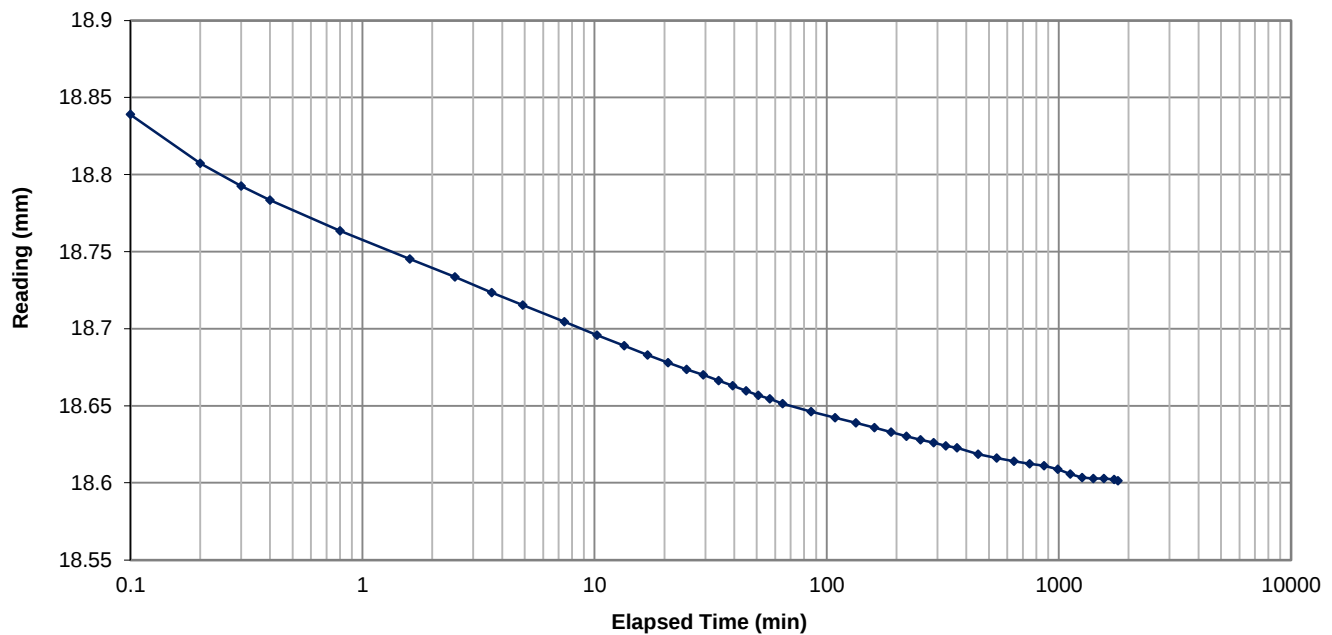
Load #: 7
Stress: 404 kPa

Dial Reading versus Elapsed Time



Load #: 8
Stress: 798 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 18, 2024

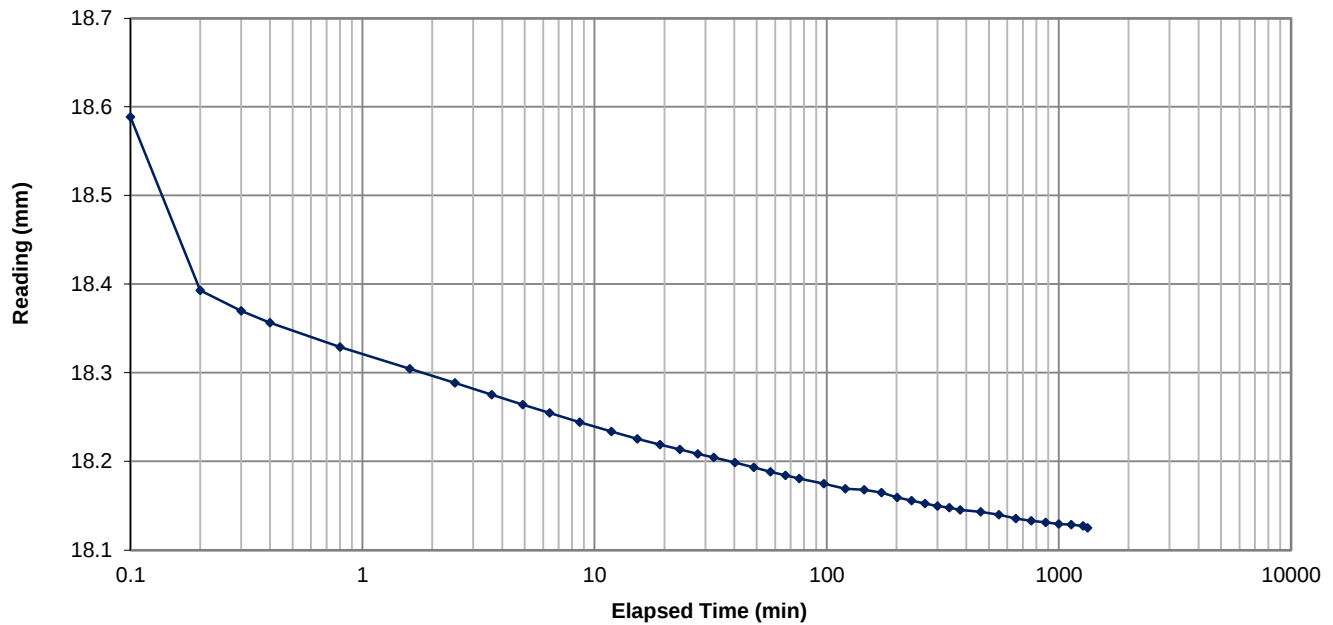
Borehole: T-24
Lab #: F069-042

Sample: ST1

Depth: 2.29 - 3.05 m

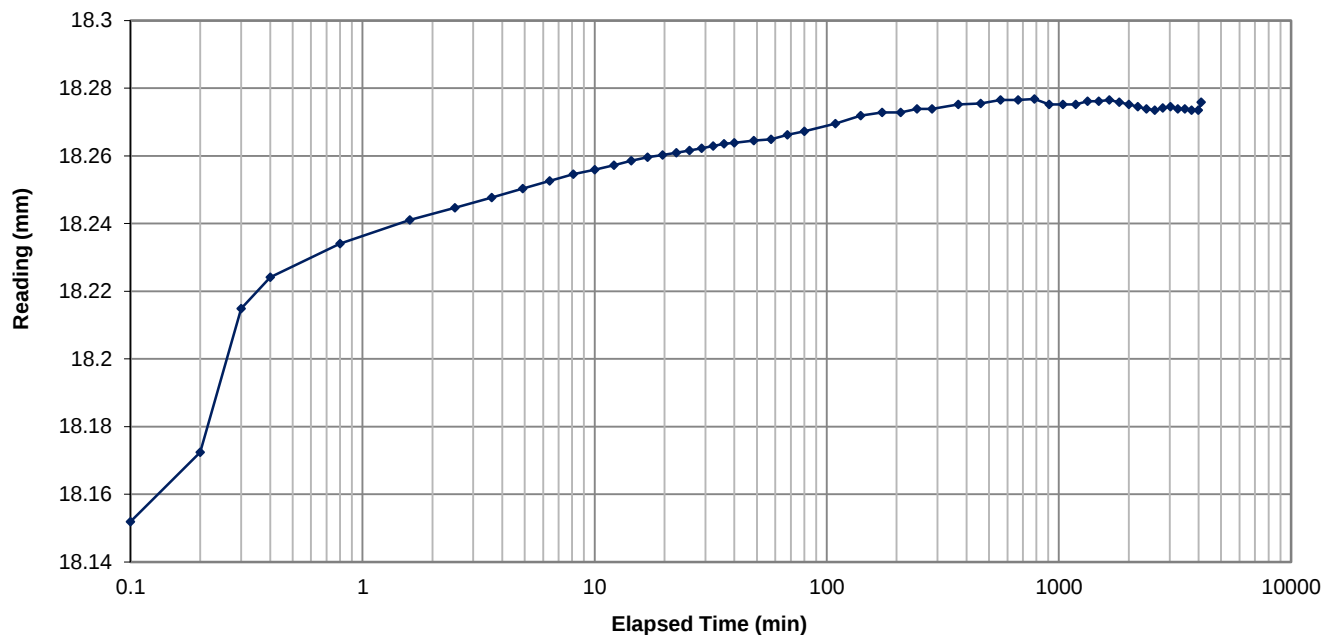
Load #: 9
Stress: 1,602 kPa

Dial Reading versus Elapsed Time



Load #: 10
Stress: 404 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

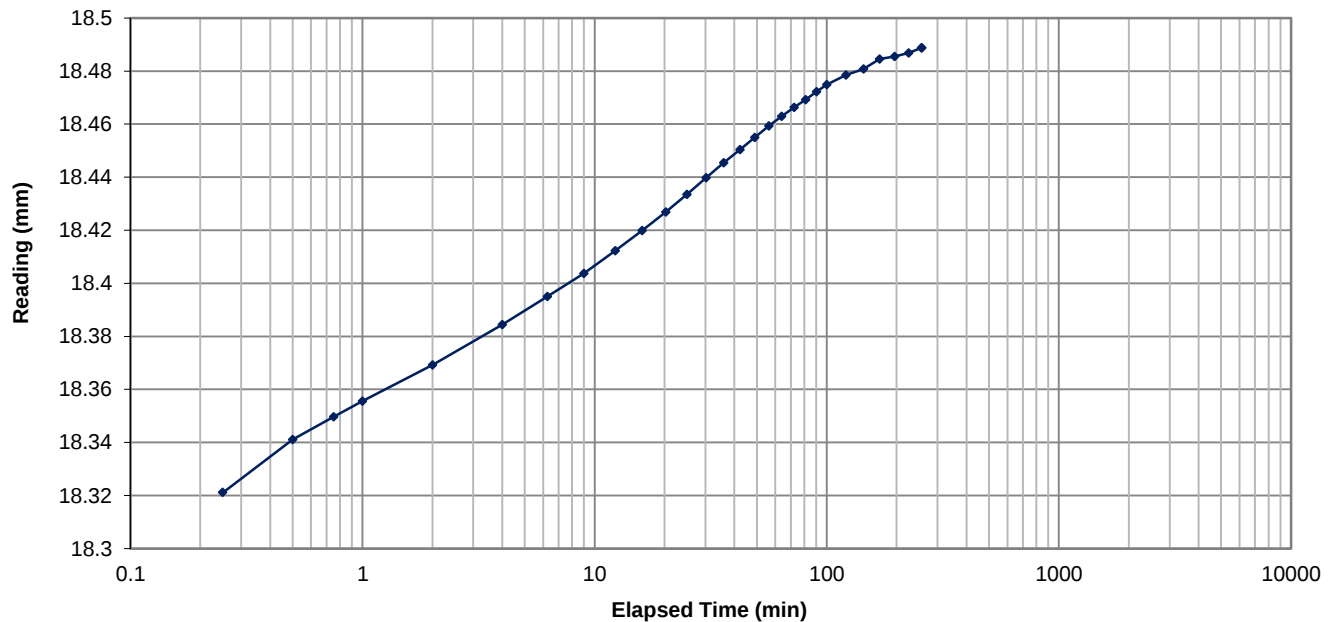
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 18, 2024

Borehole: T-24 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-042

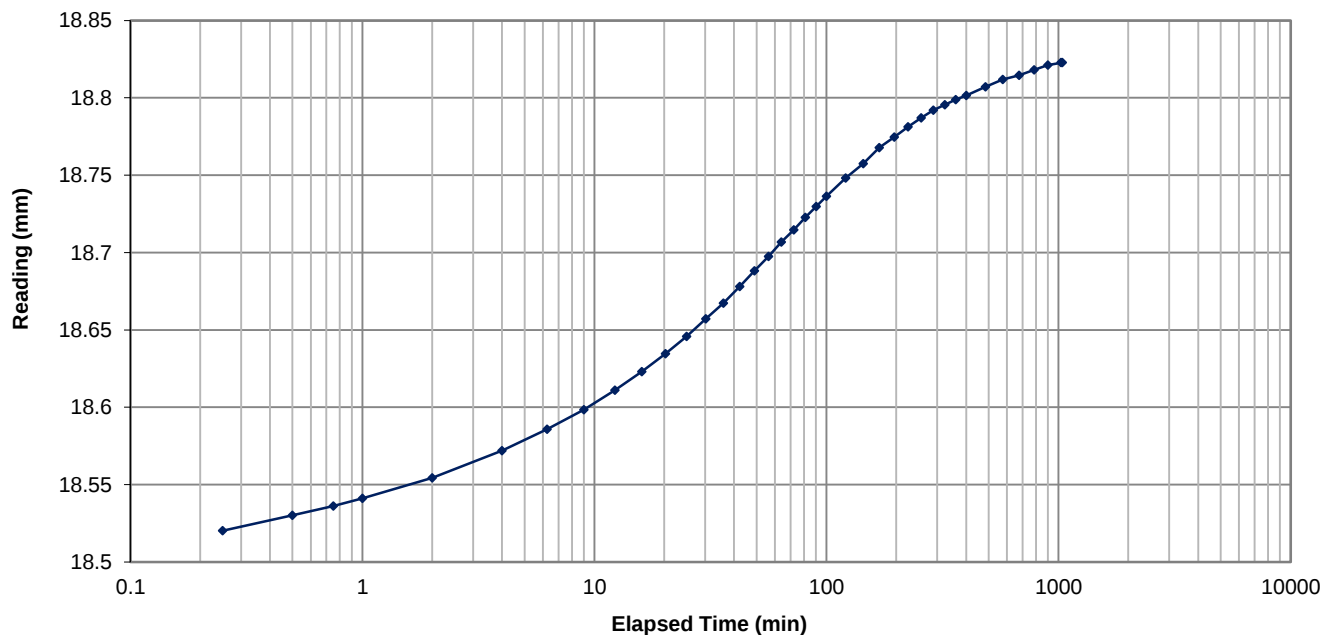
Load #: 11
Stress: 102 kPa

Dial Reading versus Elapsed Time



Load #: 12
Stress: 30 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 18, 2024

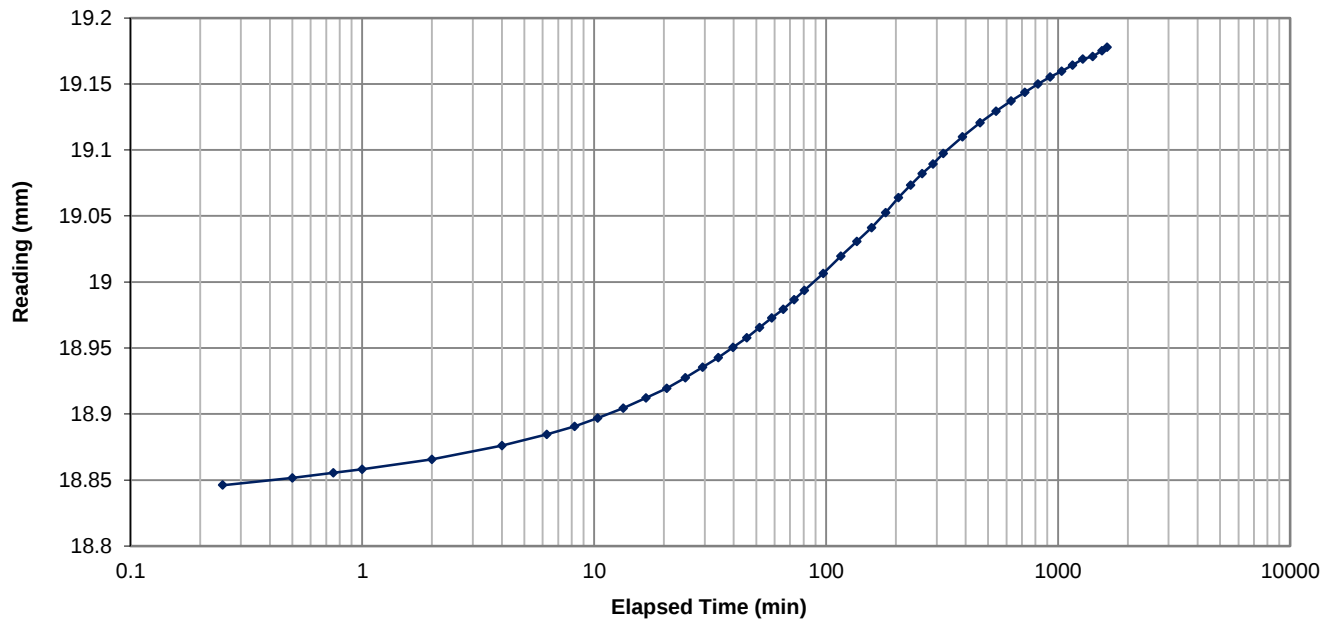
Borehole: T-24
Lab #: F069-042

Sample: ST1

Depth: 2.29 - 3.05 m

Load #: 13
Stress: 6.5 kPa

Dial Reading versus Elapsed Time





ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023 Task: -
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC Date: June 19, 2024

Borehole: T-25 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-055

	Initial	Final	
Sample height (mm):	19.0	17.5	Specific gravity: 2.7 (assumed)
Sample diameter (mm):	69.8	69.8	
Sample area (cm ²):	38.3	38.3	Loading cap (kPa): 3.6
Volume (cm ³):	73	67	
Wet mass (g):	144.9	144.0	
Dry mass (g):	121.3	121.3	
Water content (%):	19.4	18.7	
Solids content (%):	83.7	84.2	
Wet density (kg/m ³):	1991	2154	
Dry density (kg/m ³):	1667	1815	
Void ratio:	0.62	0.50	Soil description: (CI) SILTY CLAY, some fine sand, medium plasticity fines; brown; cohesive, moist, stiff
Height of solids (mm):	11.7	11.7	
Degree of saturation (%):	85	101	

Load #	H _{sample} (mm)	Stone Correction (mm)	H _{corrected} (mm)	Stress (kPa)	Void ratio	Strain (%)	Incremental Work (kJ/m ³)	Cumulative Work (kJ/m ³)
0	19.1	0.0	19.1	3.6	0.62	-0.3	0.0	0.0
1	19.0	0.0	19.1	8.1	0.62	-0.3	0.0	0.0
2	19.0	0.0	19.0	16	0.62	-0.2	0.0	0.0
3	18.9	0.1	19.0	32	0.62	-0.3	0.0	0.0
4	18.8	0.1	19.0	60	0.62	0.2	0.2	0.2
5	18.6	0.2	18.8	100	0.60	1.0	0.6	0.9
6	18.2	0.2	18.5	201	0.57	2.8	2.8	3.6
7	17.7	0.3	18.0	401	0.53	5.3	7.7	11.4
8	17.2	0.3	17.5	801	0.49	8.1	17.4	28.7
9	16.6	0.4	16.9	1,593	0.44	10.8	35.7	64.5
10	16.7	0.3	17.0	401	0.45	10.6		
11	16.9	0.3	17.2	100	0.46	9.7		
12	17.1	0.2	17.4	32	0.48	8.6		
13	17.5	0.2	17.6	8.1	0.50	7.3		

Comments:

- data for load numbers 0 to 4 taken from swell test.
- prior to this test, the specimen was preconsolidated to 60 kPa stress then rebounded to 8 kPa as part of swell test (ASTM D4546 Method B).
- specimen was inundated with water near the start of the 60 kPa load



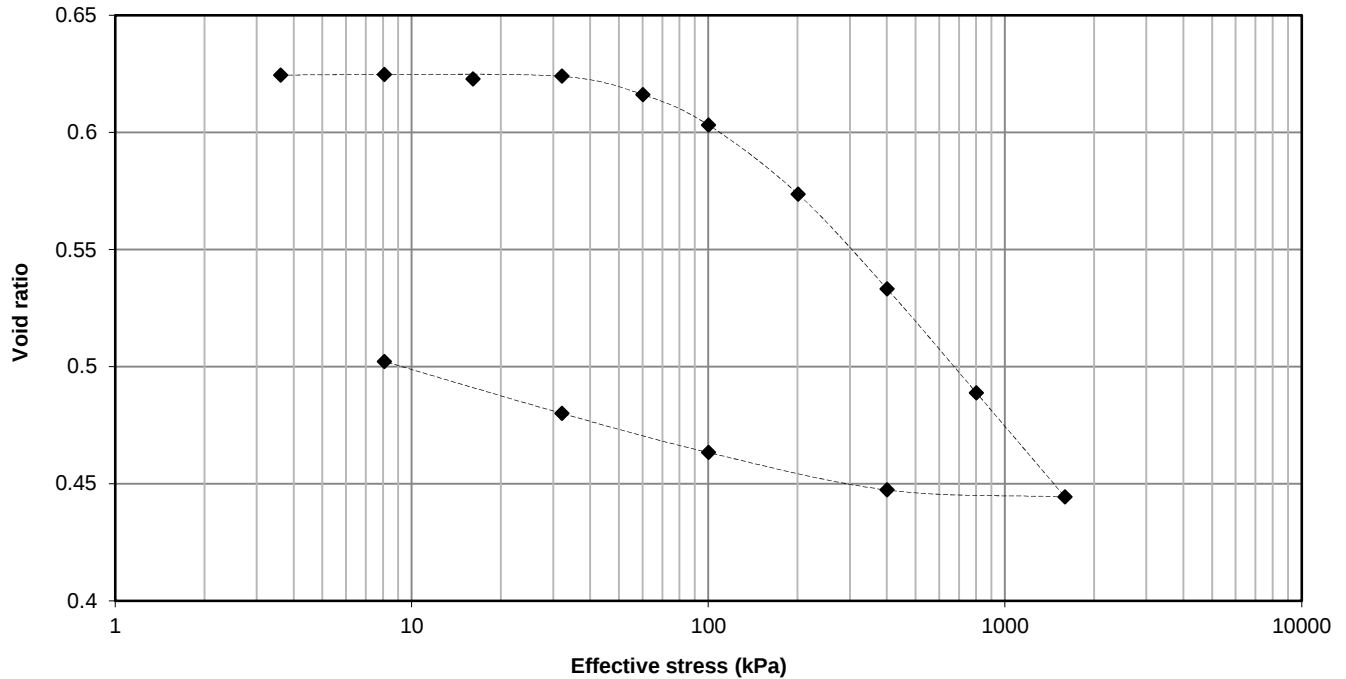
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

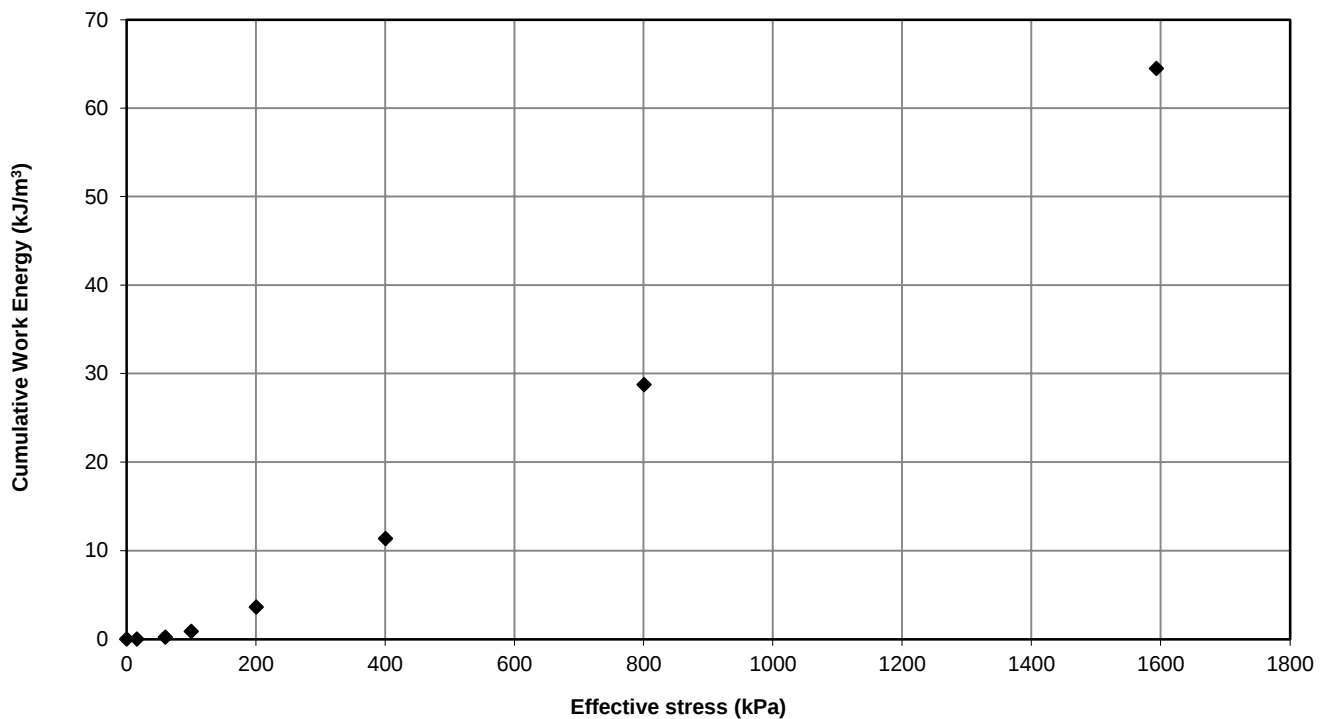
Task: -
Date: June 19, 2024

Borehole: T-25 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-055

Void Ratio versus Effective Stress



Cumulative Work Energy versus Effective Stress



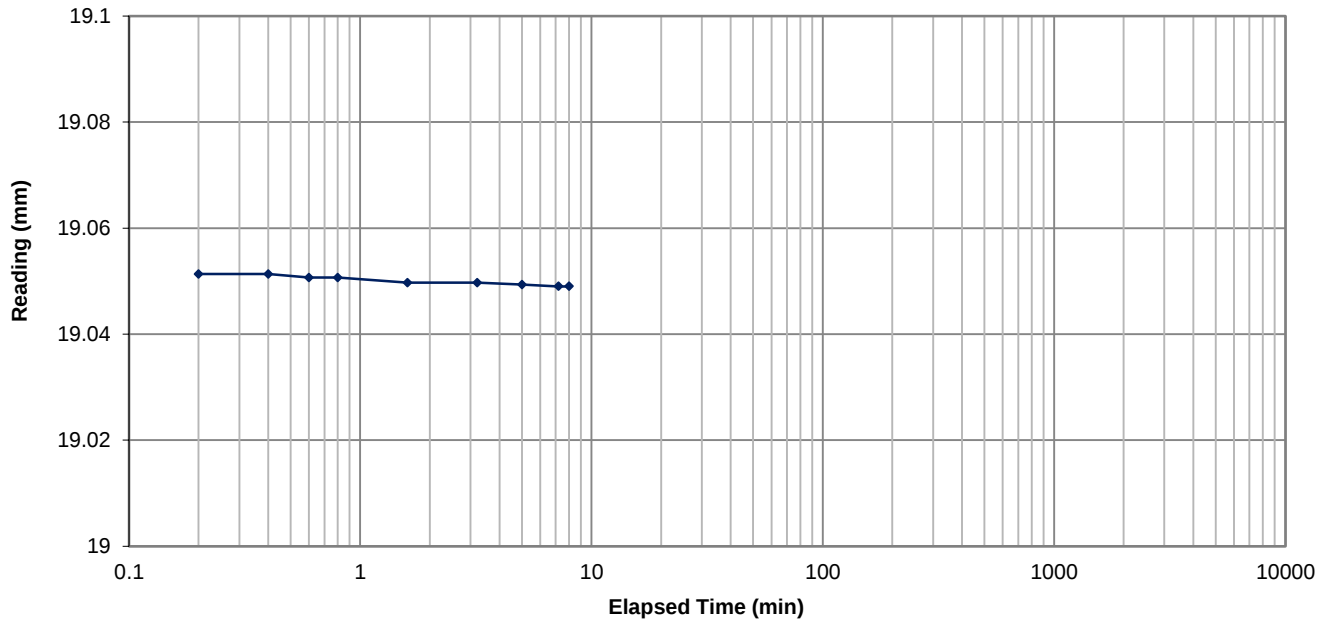
The testing services reported herein have been performed in accordance with the indicated recognized standard, or in accordance with local industry practice. This report is for the sole use of the designated client. This report constitutes a testing service only and does not represent any results interpretation or opinion regarding specification compliance or material suitability. Engineering interpretation can be provided by WSP Canada Inc. upon request.



ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

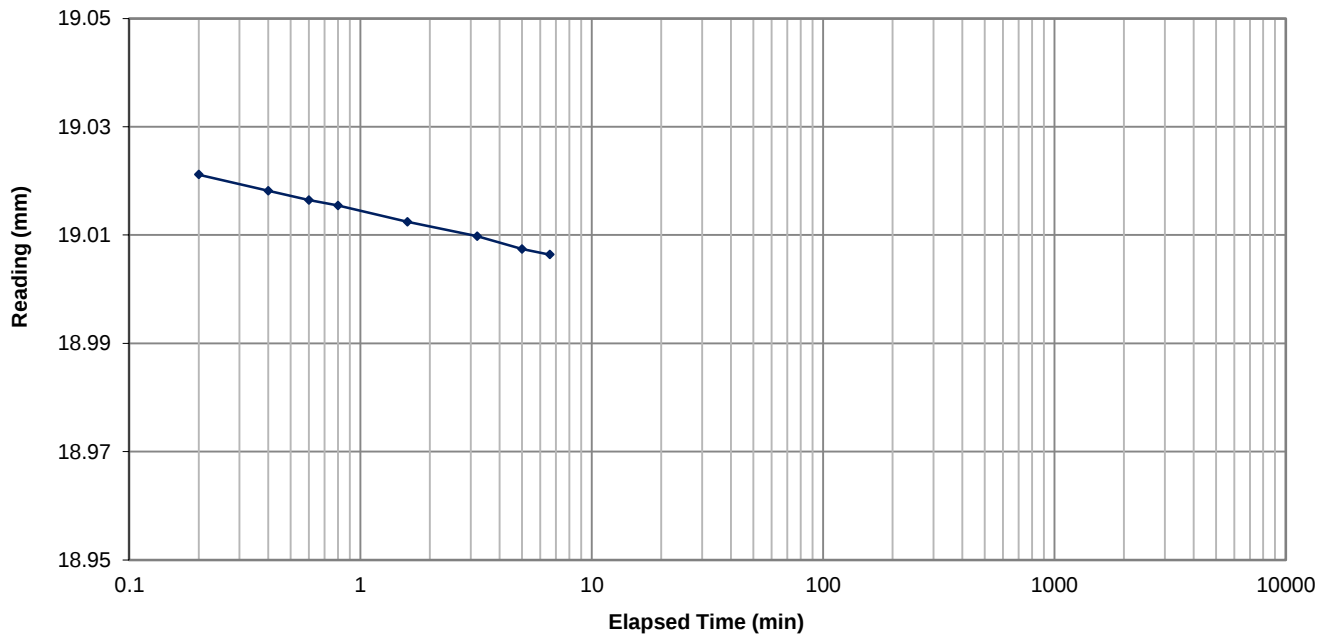
Project #:	CA-0026414.7023	Task:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	FC	Date:	June 19, 2024
Borehole:	T-25	Sample:	ST1
Lab #:	F069-055	Depth:	2.29 - 3.05 m
Load #:	1		
Stress:	8.1 kPa		

Dial Reading versus Elapsed Time



Load #:	2
Stress:	16 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

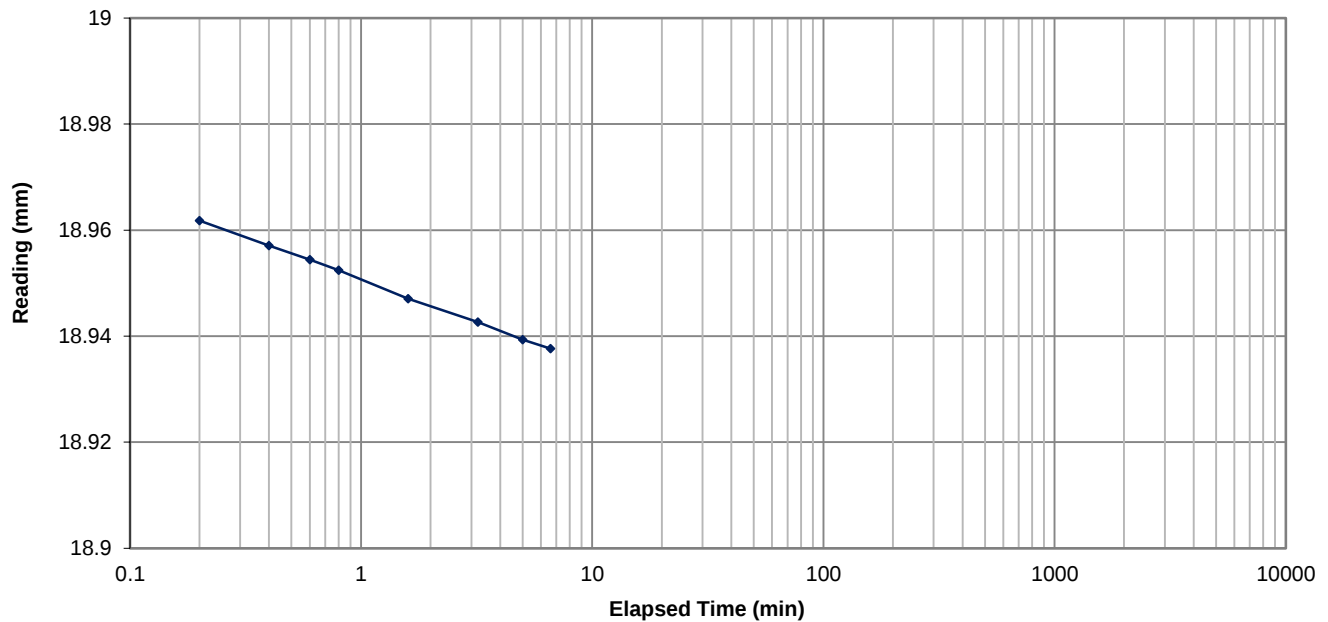
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 19, 2024

Borehole: T-25 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-055

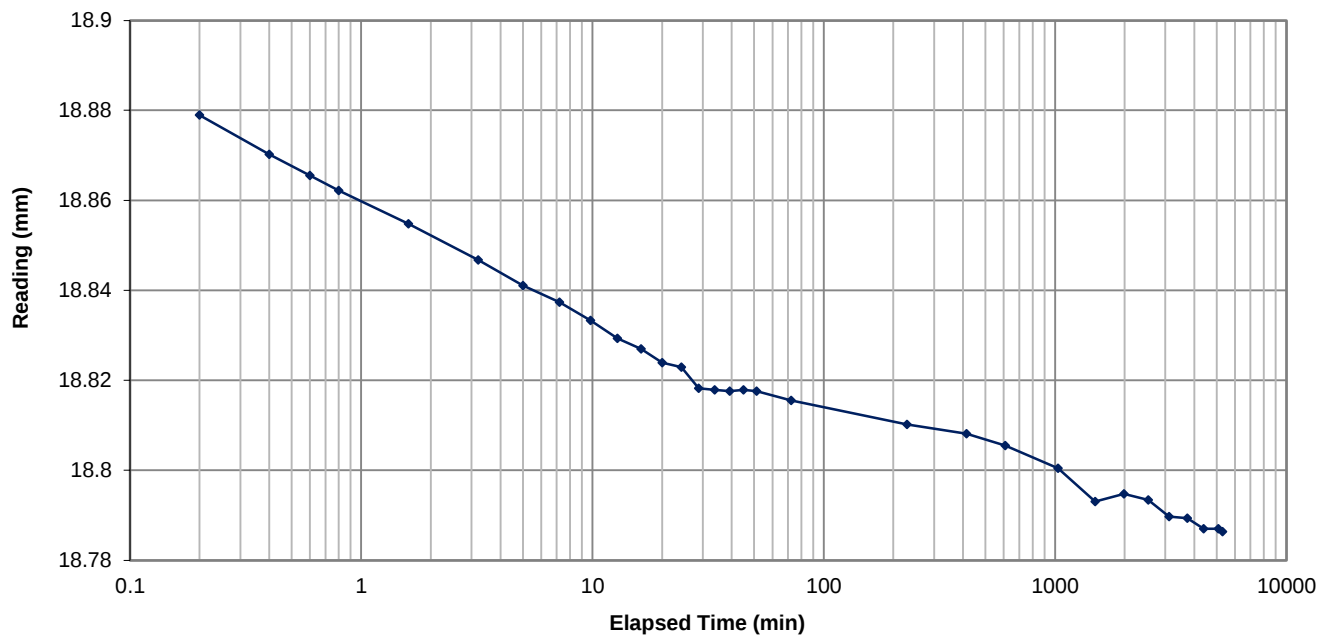
Load #: 3
Stress: 32 kPa

Dial Reading versus Elapsed Time



Load #: 4
Stress: 60 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

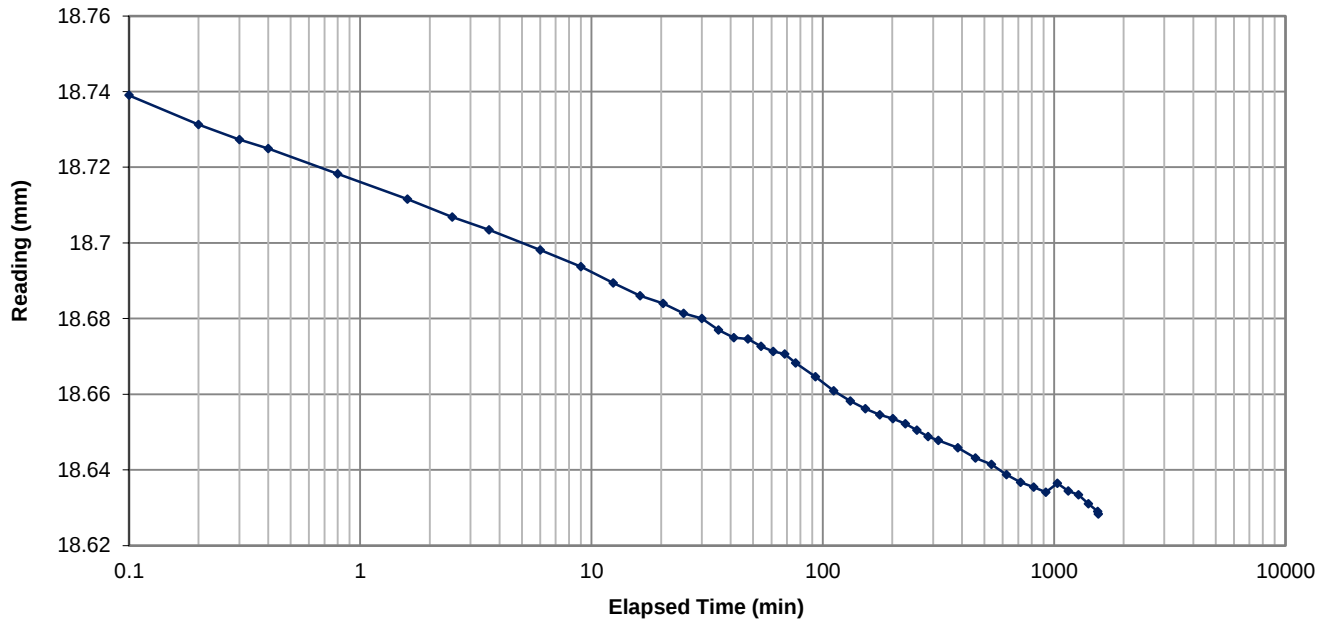
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 19, 2024

Borehole: T-25 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-055

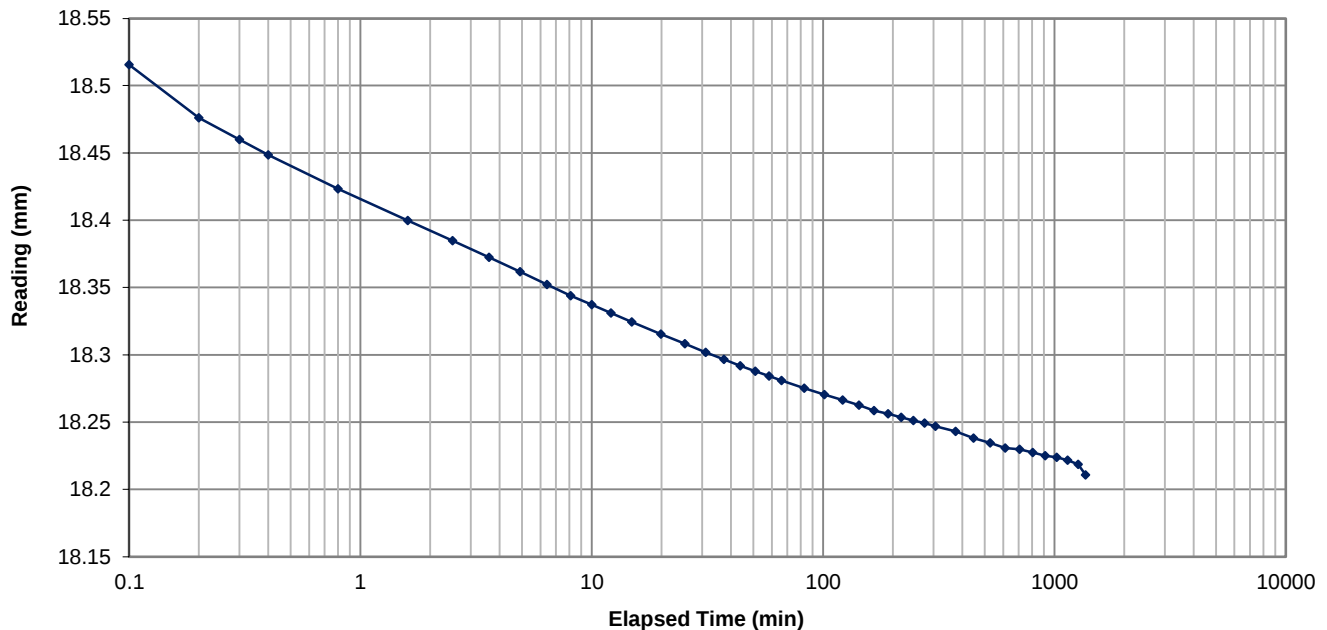
Load #: 5
Stress: 100 kPa

Dial Reading versus Elapsed Time



Load #: 6
Stress: 201 kPa

Dial Reading versus Elapsed Time



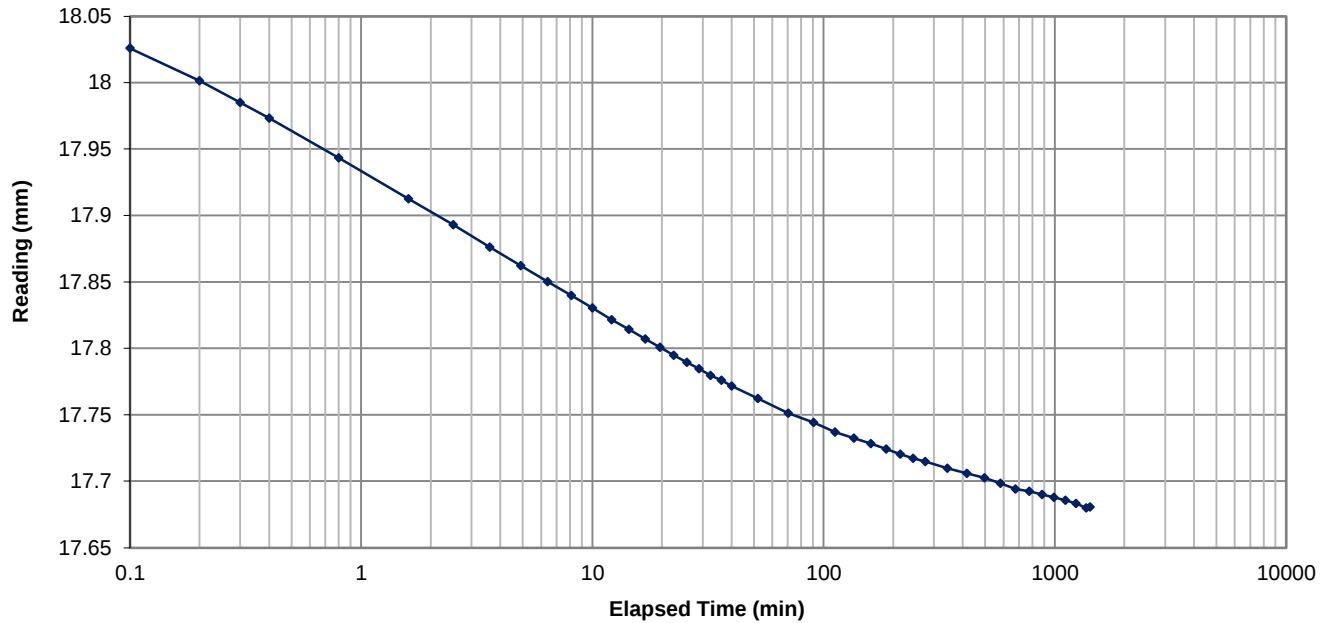
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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

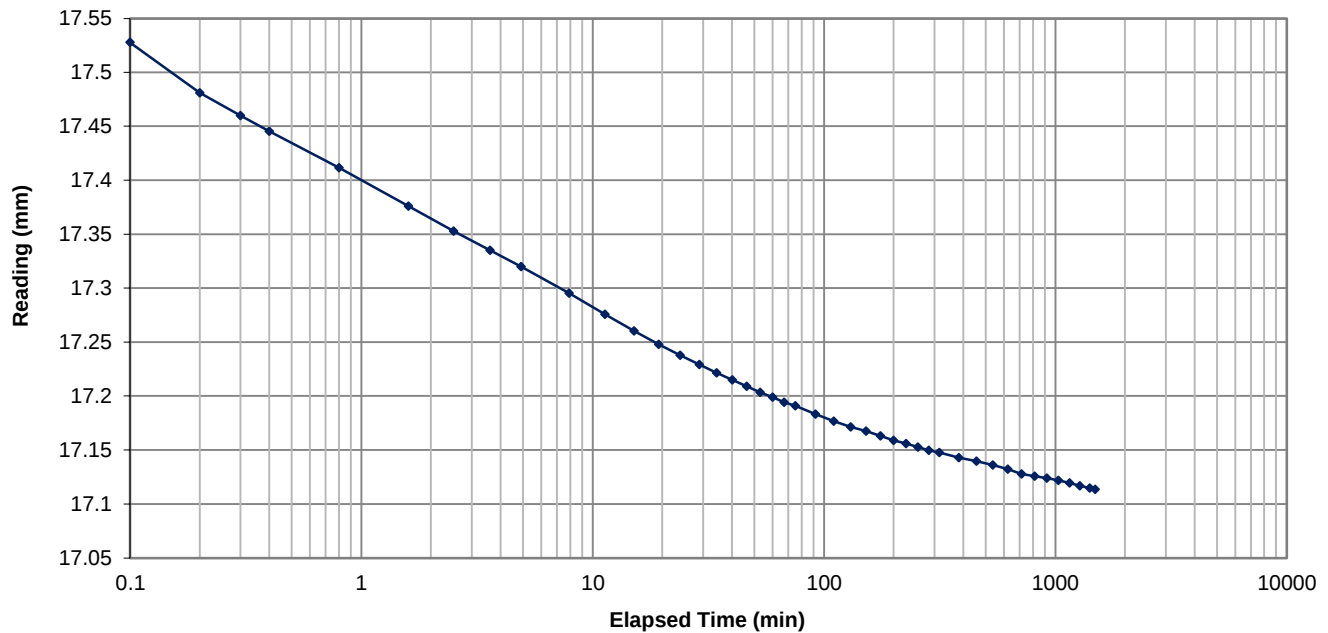
Project #:	CA-0026414.7023	Task:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	FC	Date:	June 19, 2024
Borehole:	T-25	Sample:	ST1
Lab #:	F069-055	Depth:	2.29 - 3.05 m
Load #:	7		
Stress:	401 kPa		

Dial Reading versus Elapsed Time



Load #:	8
Stress:	801 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

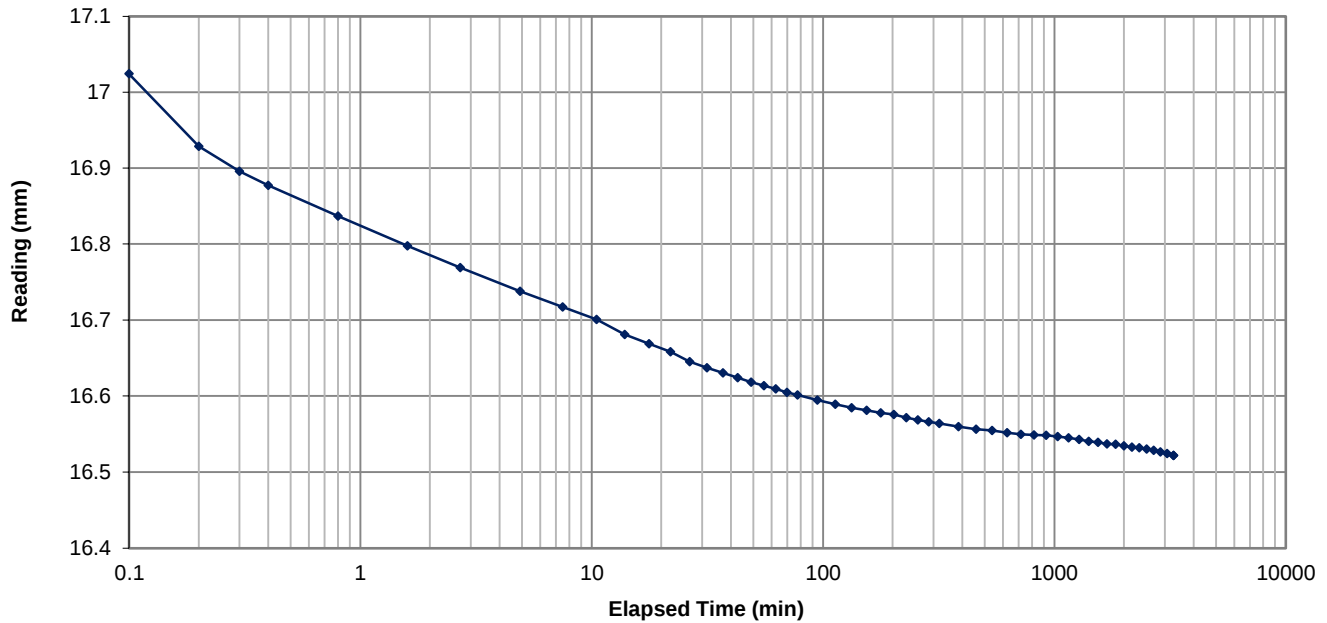
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 19, 2024

Borehole: T-25 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-055

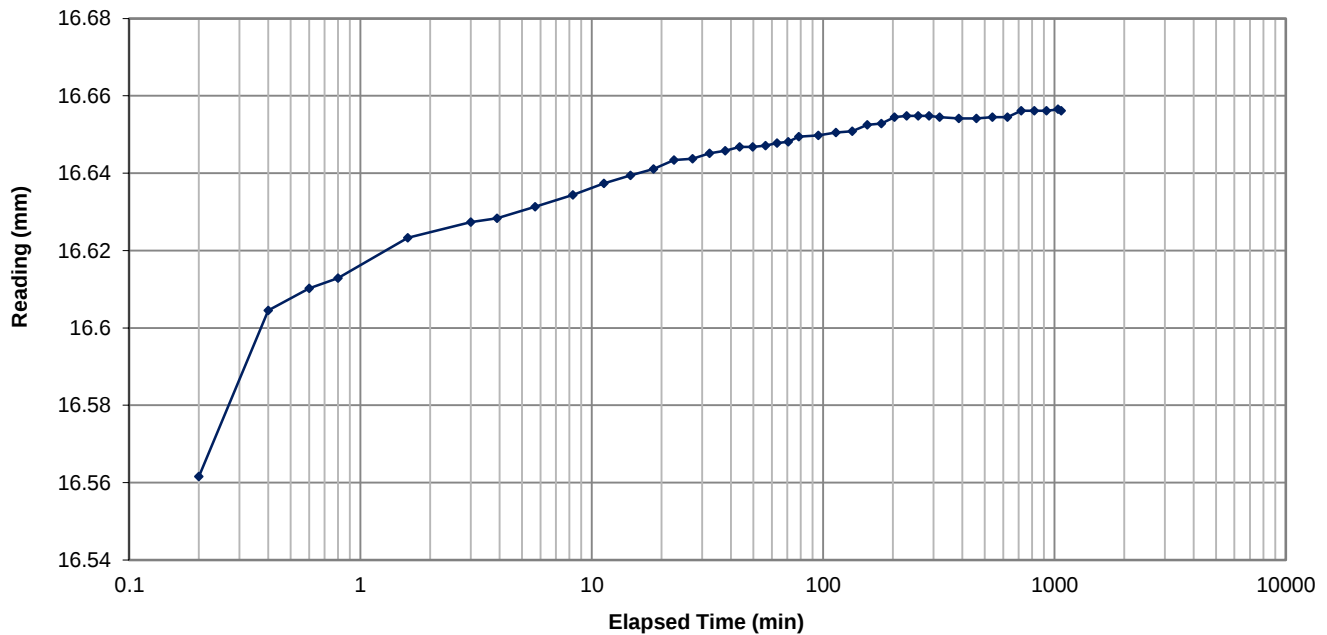
Load #: 9
Stress: 1,593 kPa

Dial Reading versus Elapsed Time



Load #: 10
Stress: 401 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

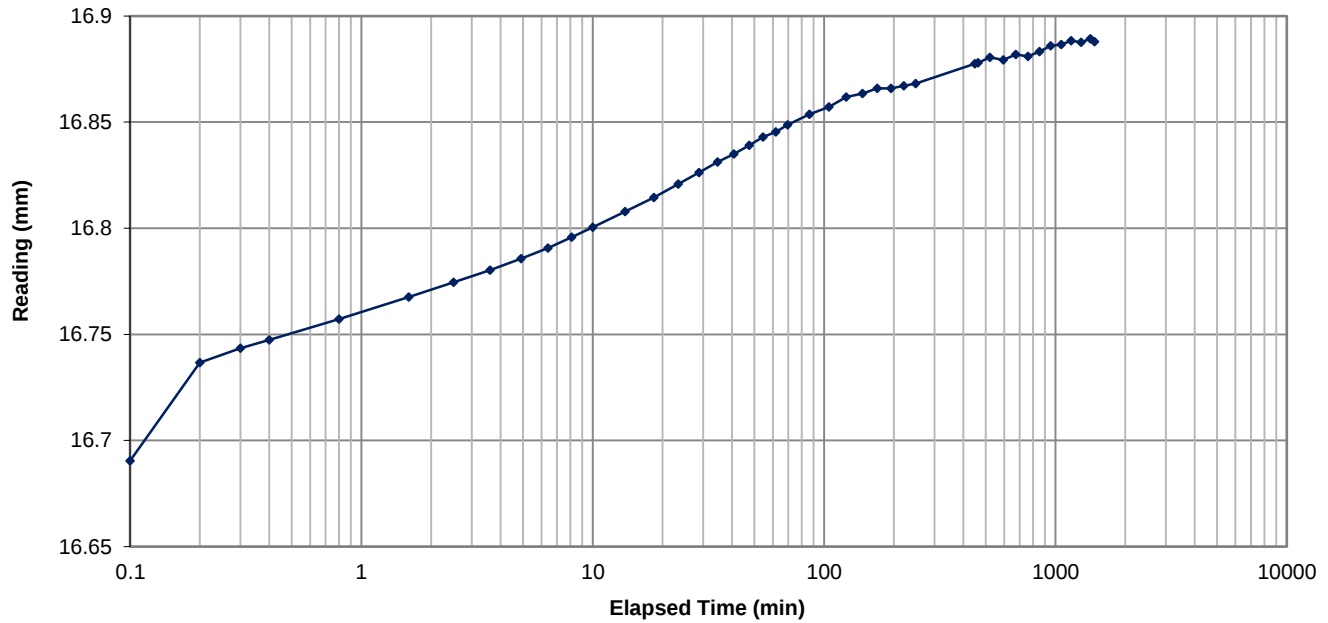
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 19, 2024

Borehole: T-25 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-055

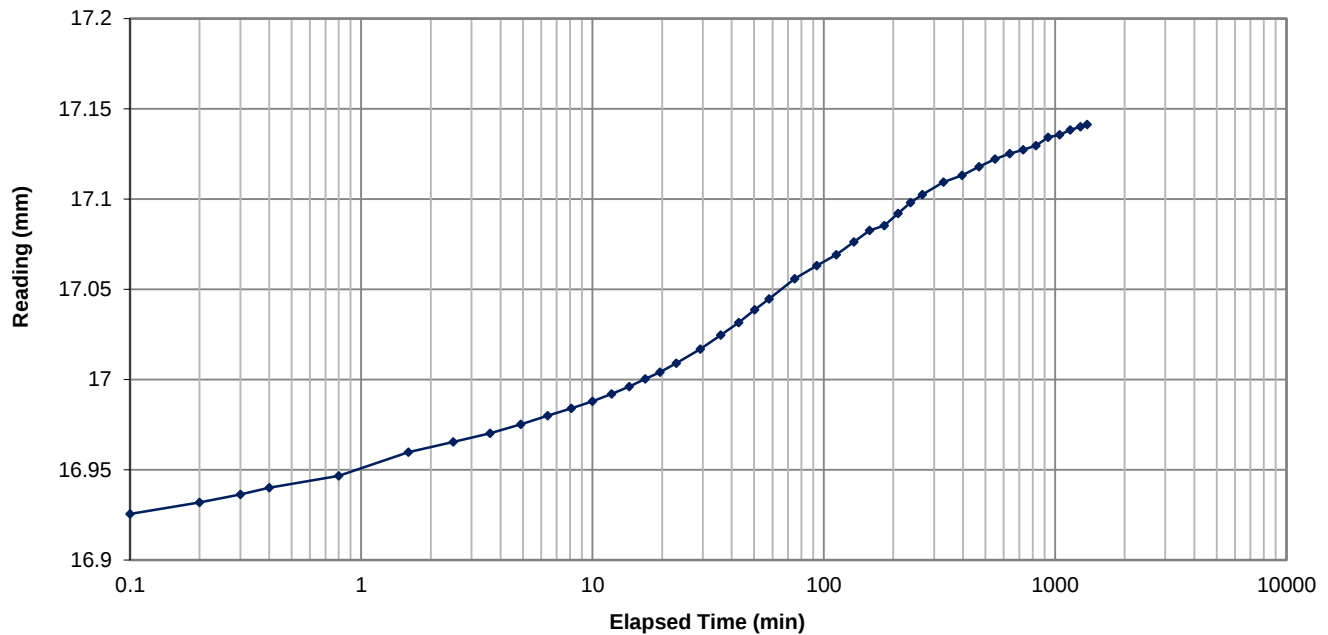
Load #: 11
Stress: 100 kPa

Dial Reading versus Elapsed Time



Load #: 12
Stress: 32 kPa

Dial Reading versus Elapsed Time



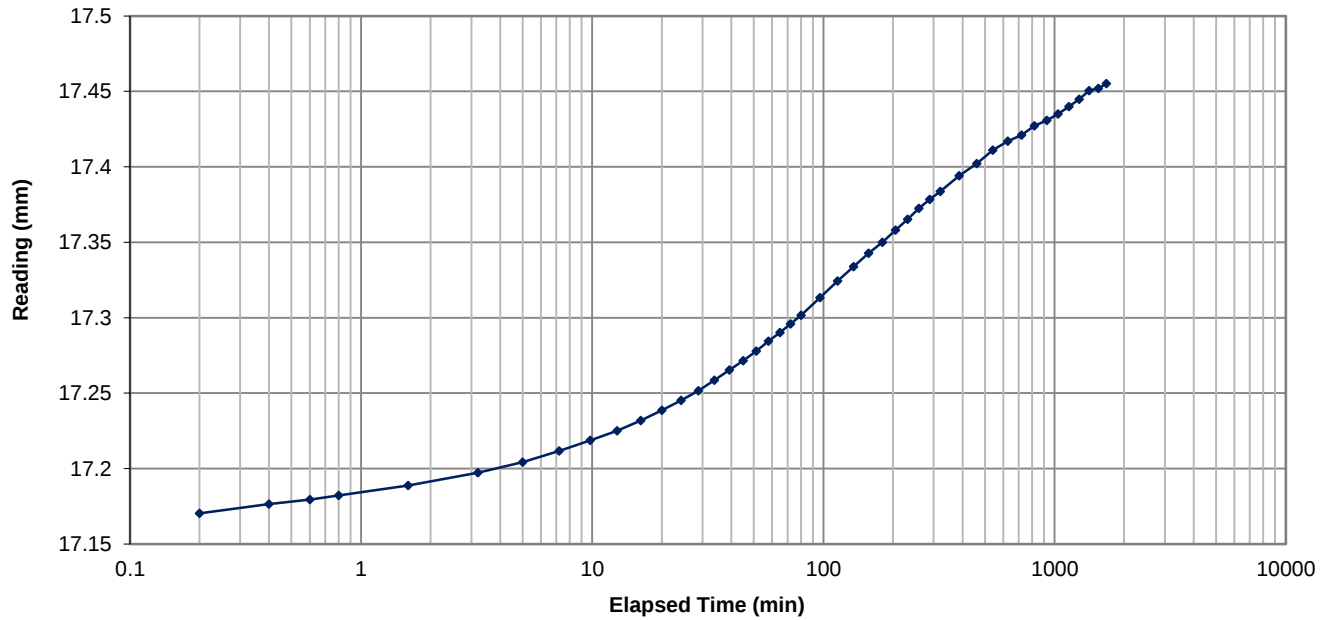
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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

Project #:	CA-0026414.7023	Task:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	FC	Date:	June 19, 2024
Borehole:	T-25	Sample:	ST1
Lab #:	F069-055	Depth:	2.29 - 3.05 m
Load #:	13		
Stress:	8.1 kPa		

Dial Reading versus Elapsed Time





ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

Borehole: T-34
Lab #: F069-068

Sample: ST1

Depth: 2.29 - 3.05 m

	Initial	Final		
Sample height (mm):	19.2	18.4	Specific gravity:	2.7 (assumed)
Sample diameter (mm):	69.9	69.9		
Sample area (cm ²):	38.4	38.4	Loading cap (kPa):	3.6
Volume (cm ³):	74	71		
Wet mass (g):	152.9	152.5		
Dry mass (g):	128.6	128.6		
Water content (%):	18.9	18.6		
Solids content (%):	84.1	84.3		
Wet density (kg/m ³):	2074	2154		
Dry density (kg/m ³):	1744	1816		
Void ratio:	0.55	0.49	Soil description: (CI) SILTY CLAY, some fine sand, medium	
Height of solids (mm):	12.4	12.4	plasticity fines; brown; cohesive, moist, stiff	
Degree of saturation (%):	93	102		

Load #	H _{sample} (mm)	Stone Correction (mm)	H _{corrected} (mm)	Stress (kPa)	Void ratio	Strain (%)	Incremental Work (kJ/m ³)	Cumulative Work (kJ/m ³)
0	19.2	0.0	19.2	3.6	0.55	-0.2	0.0	0.0
1	19.2	0.0	19.2	8.1	0.55	-0.2	0.0	0.0
2	19.2	0.0	19.2	16	0.55	-0.2	0.0	0.0
3	19.2	0.0	19.2	32	0.55	0.0	0.0	0.0
4	19.0	0.1	19.1	60	0.54	0.5	0.2	0.3
5	18.9	0.1	19.0	100	0.53	1.0	0.5	0.7
6	18.6	0.1	18.7	200	0.51	2.4	2.1	2.8
7	18.2	0.2	18.4	400	0.48	4.3	5.8	8.5
8	17.7	0.2	17.9	799	0.44	6.9	16.6	25.1
9	17.0	0.3	17.3	1,590	0.39	10.0	39.3	64.4
10	17.1	0.2	17.4	400	0.40	9.5		
11	17.5	0.2	17.7	100	0.43	7.8		
12	17.9	0.1	18.0	32	0.46	6.0		
13	18.4	0.1	18.5	8.1	0.49	3.6		

Comments:

- data for load numbers 0 to 4 taken from swell test.
- prior to this test, the specimen was preconsolidated to 60 kPa stress then rebounded to 8 kPa as part of swell test (ASTM D4546 Method B).
- specimen was inundated with water near the start of the 60 kPa load

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

Project #: CA-0026414.7023

Task: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested By: FC

Date: June 20, 2024

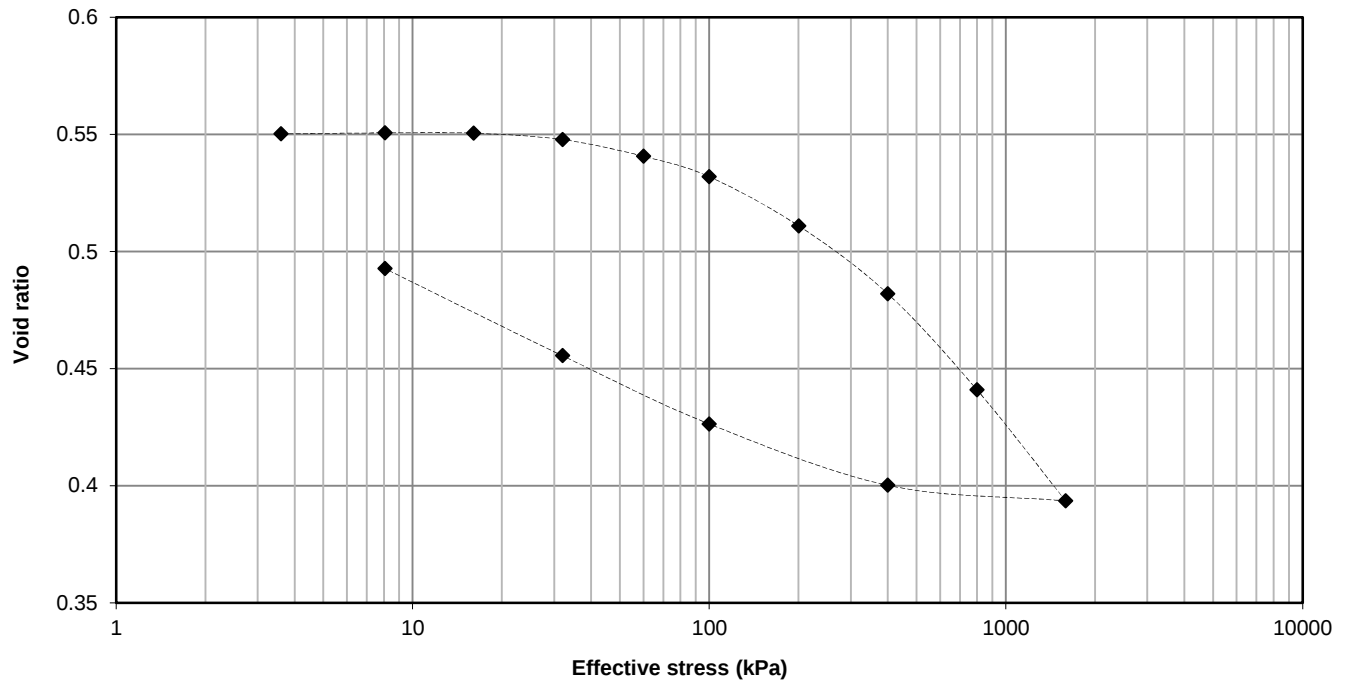
Borehole: T-34

Sample: ST1

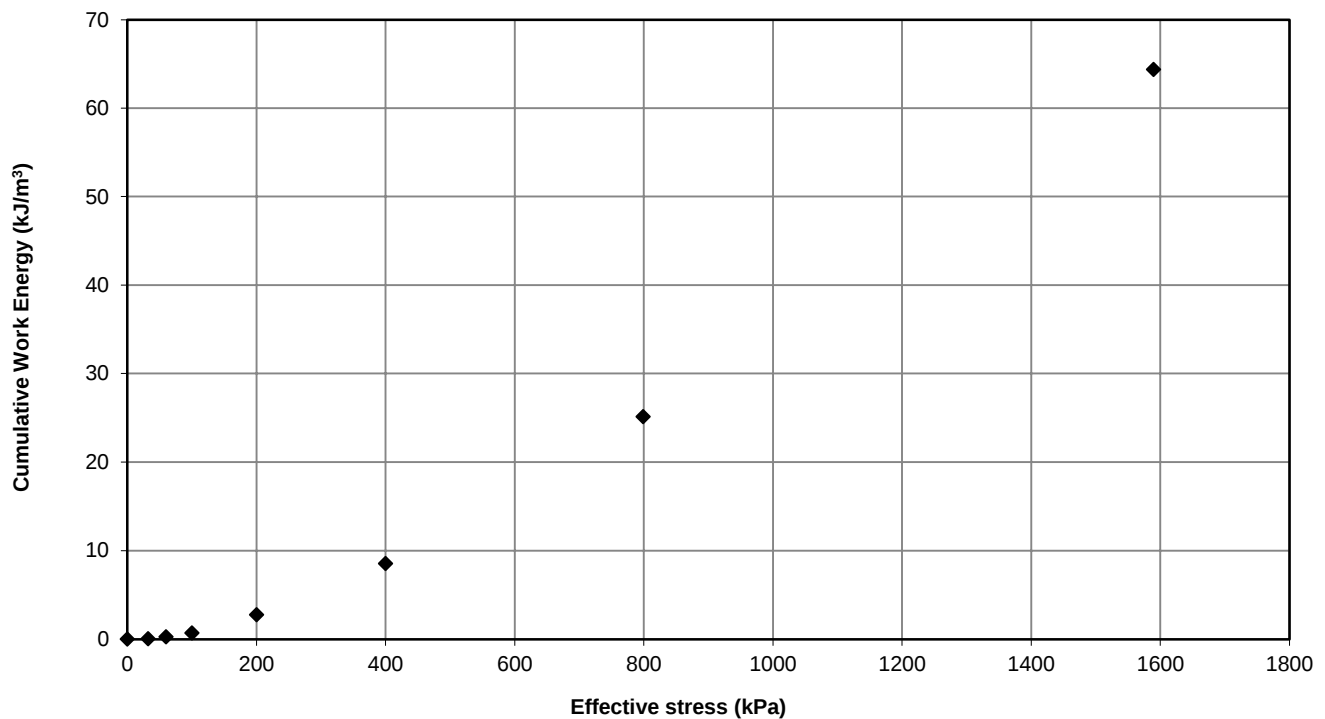
Depth: 2.29 - 3.05 m

Lab #: F069-068

Void Ratio versus Effective Stress



Cumulative Work Energy versus Effective Stress



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

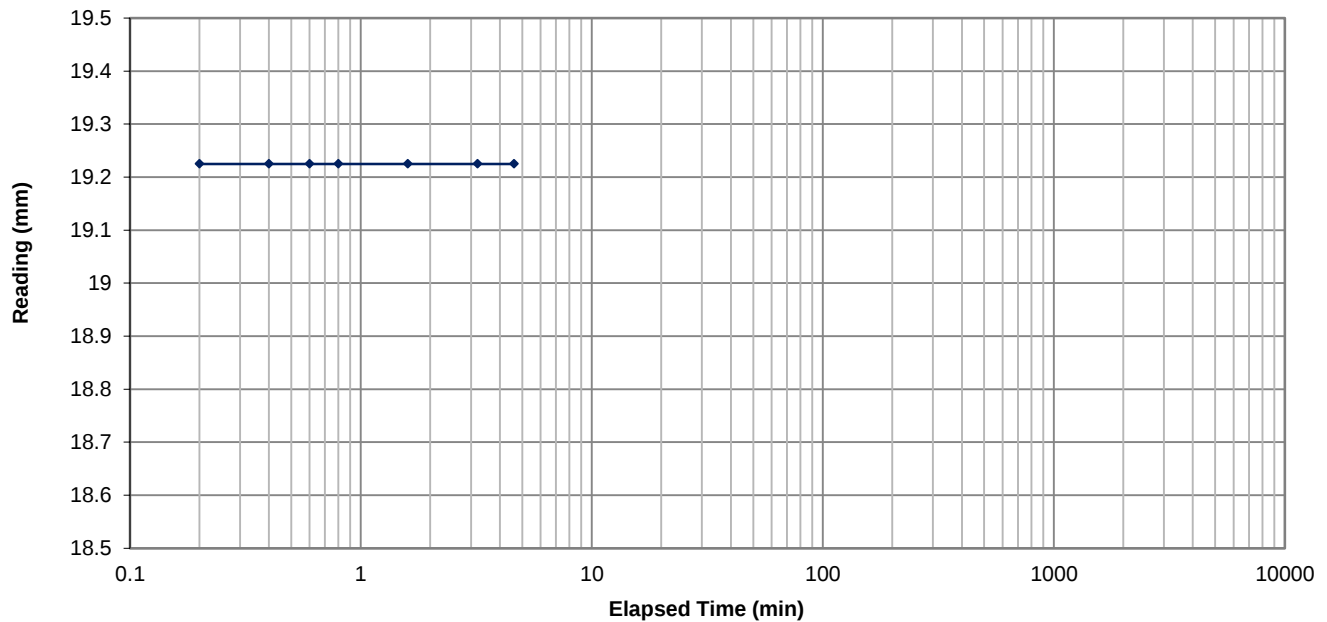
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-34 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-068

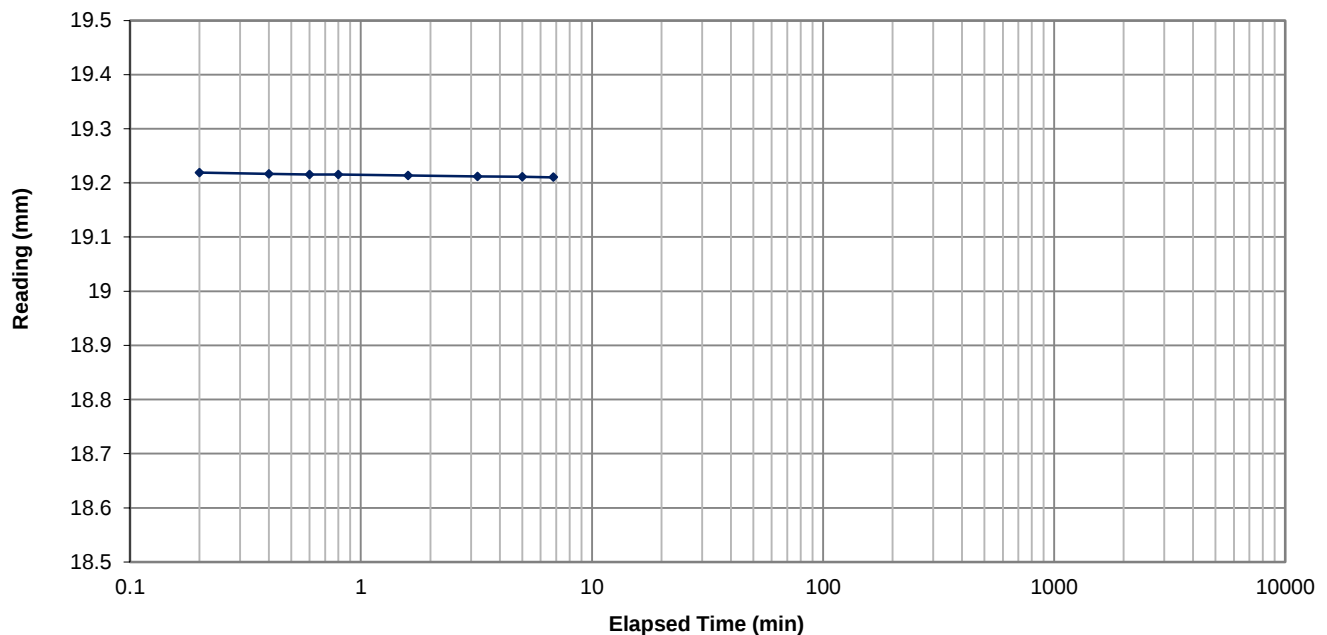
Load #: 1
Stress: 8.1 kPa

Dial Reading versus Elapsed Time



Load #: 2
Stress: 16 kPa

Dial Reading versus Elapsed Time



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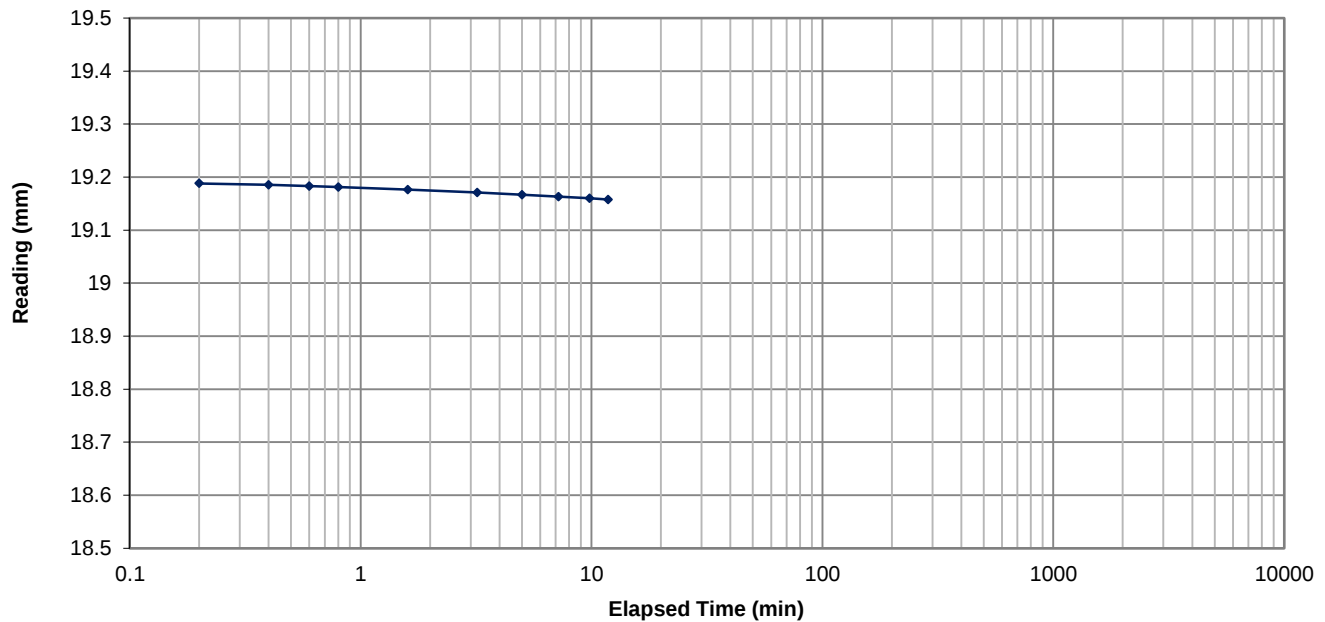


ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

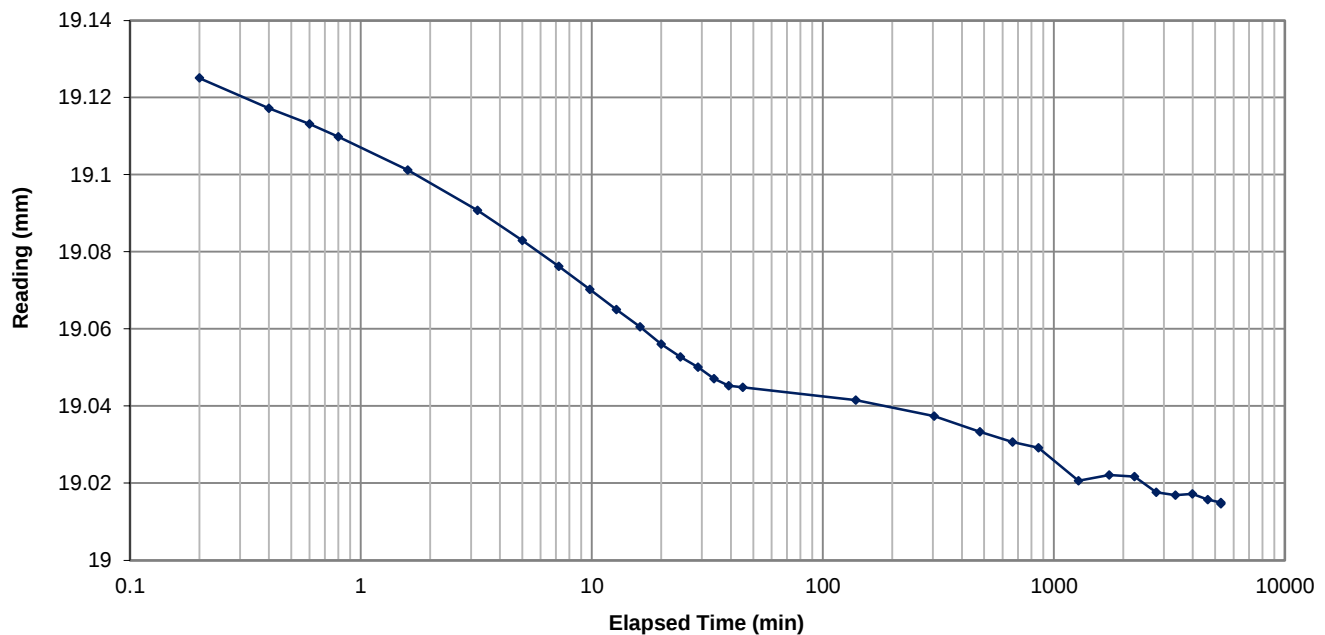
Project #:	CA-0026414.7023	Task:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	FC	Date:	June 20, 2024
Borehole:	T-34	Sample:	ST1
Lab #:	F069-068	Depth:	2.29 - 3.05 m
Load #:	3		
Stress:	32 kPa		

Dial Reading versus Elapsed Time



Load #:	4
Stress:	60 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

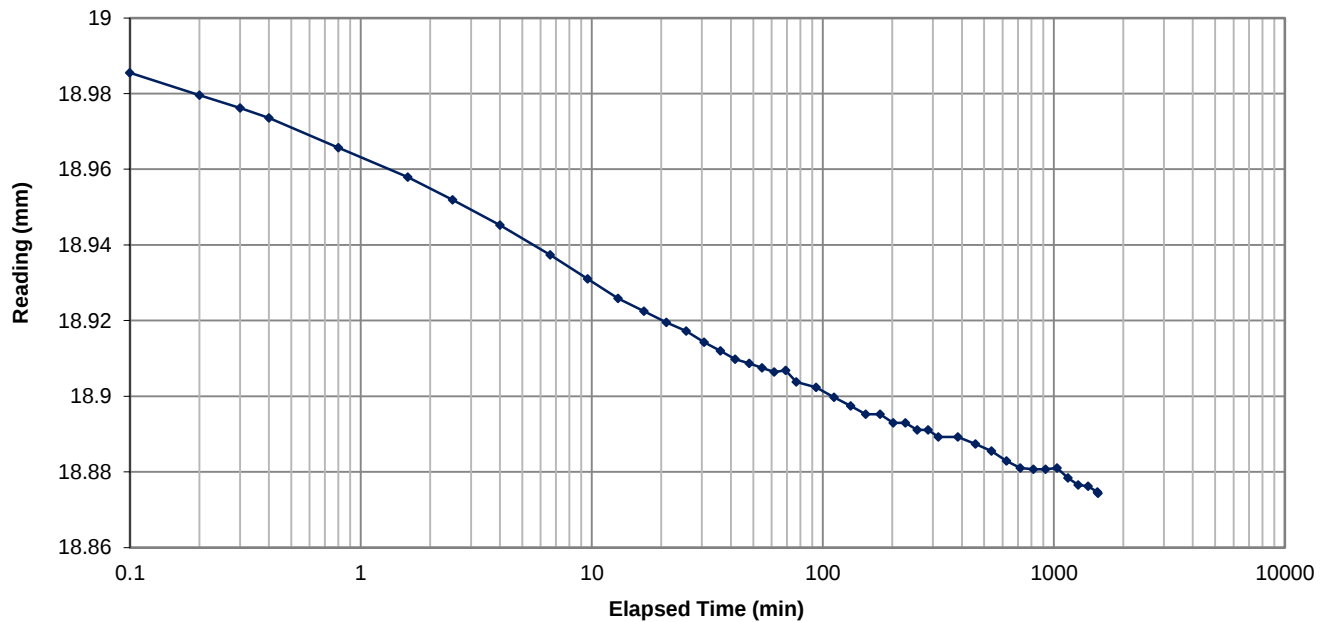
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-34 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-068

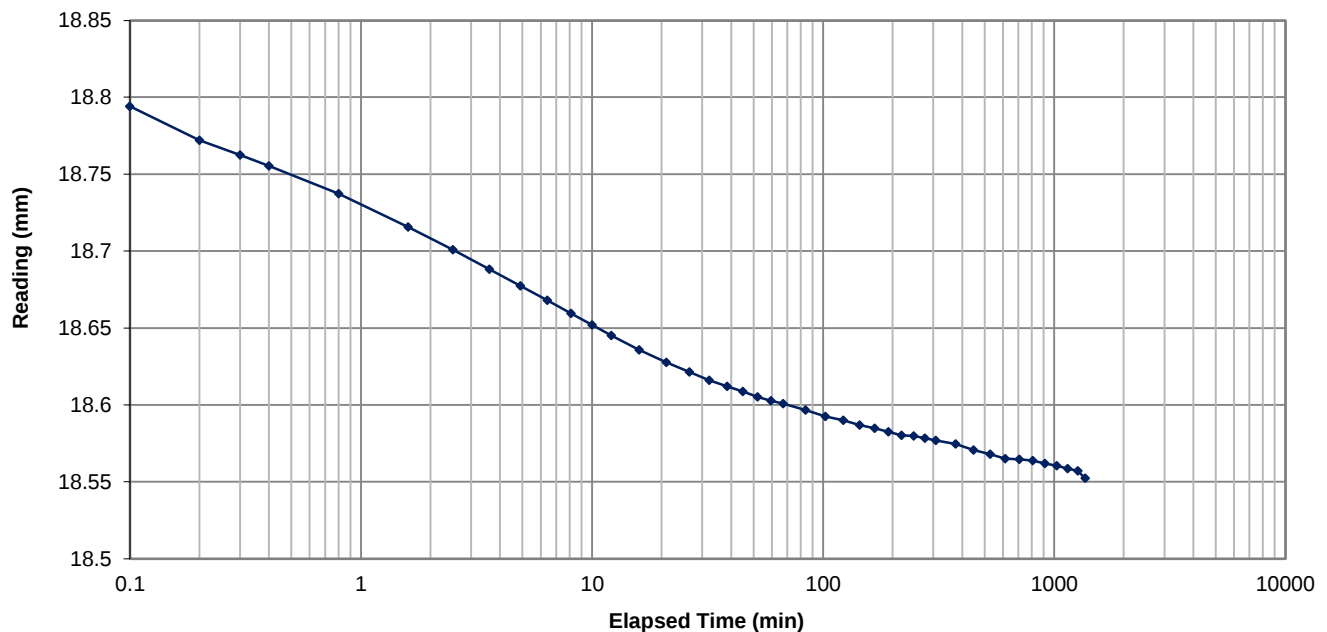
Load #: 5
Stress: 100 kPa

Dial Reading versus Elapsed Time



Load #: 6
Stress: 200 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

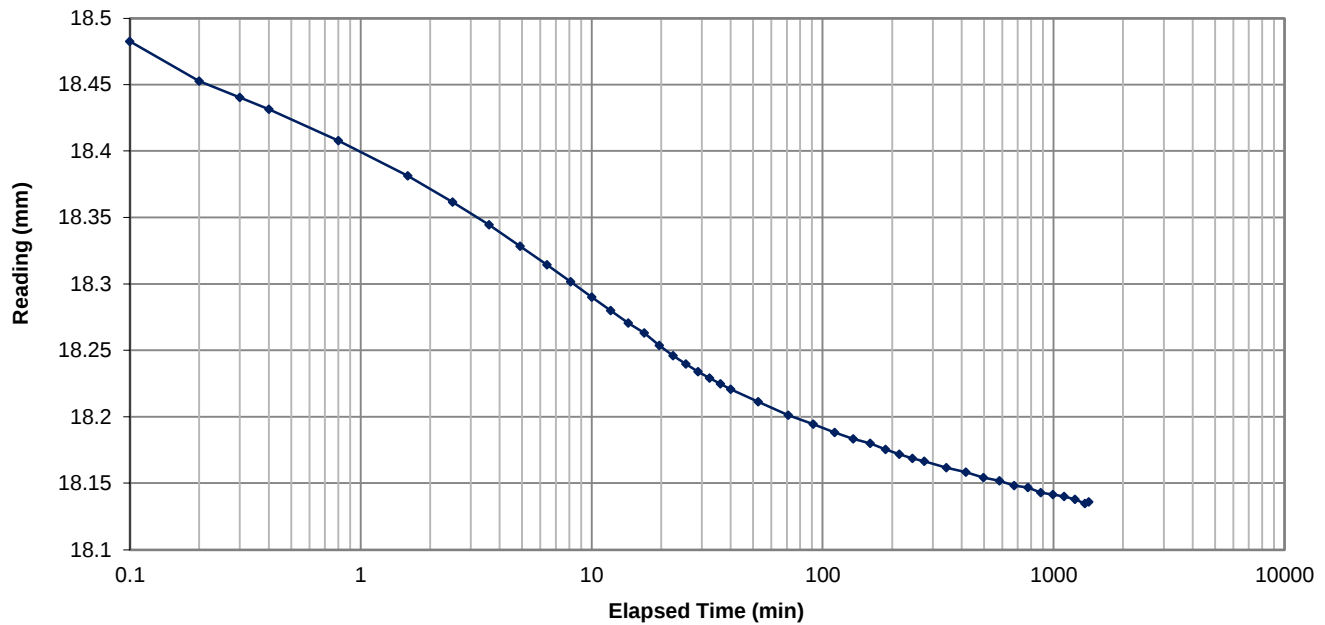
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-34 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-068

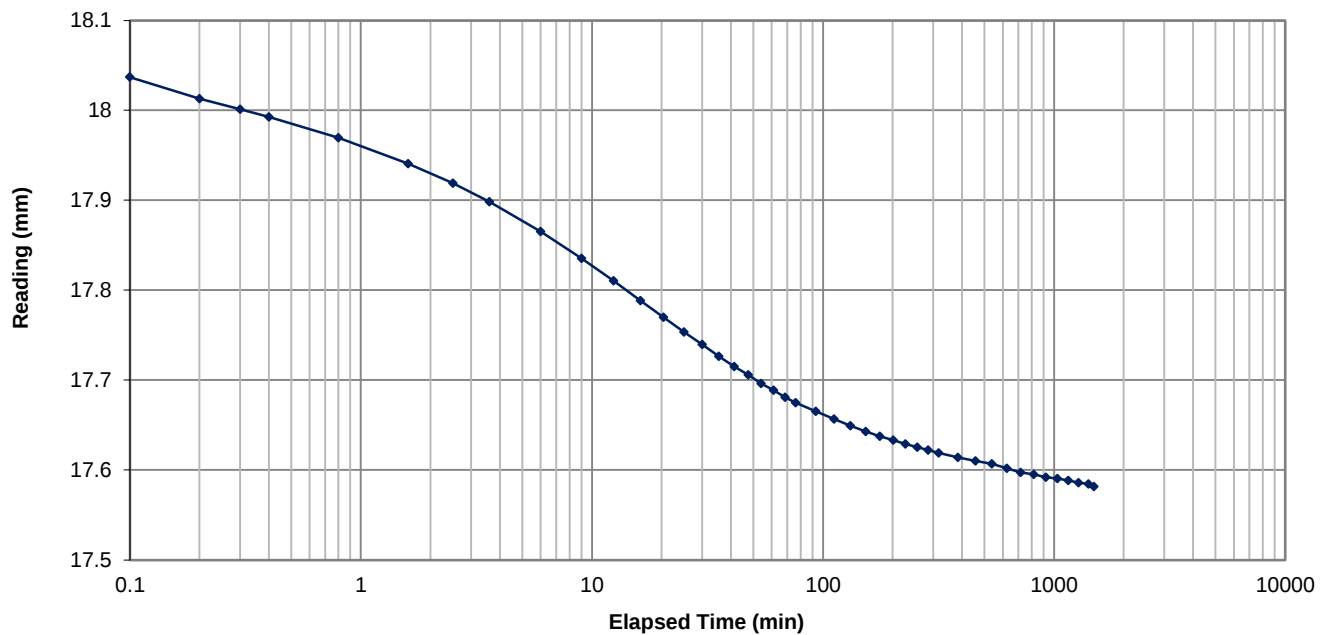
Load #: 7
Stress: 400 kPa

Dial Reading versus Elapsed Time



Load #: 8
Stress: 799 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

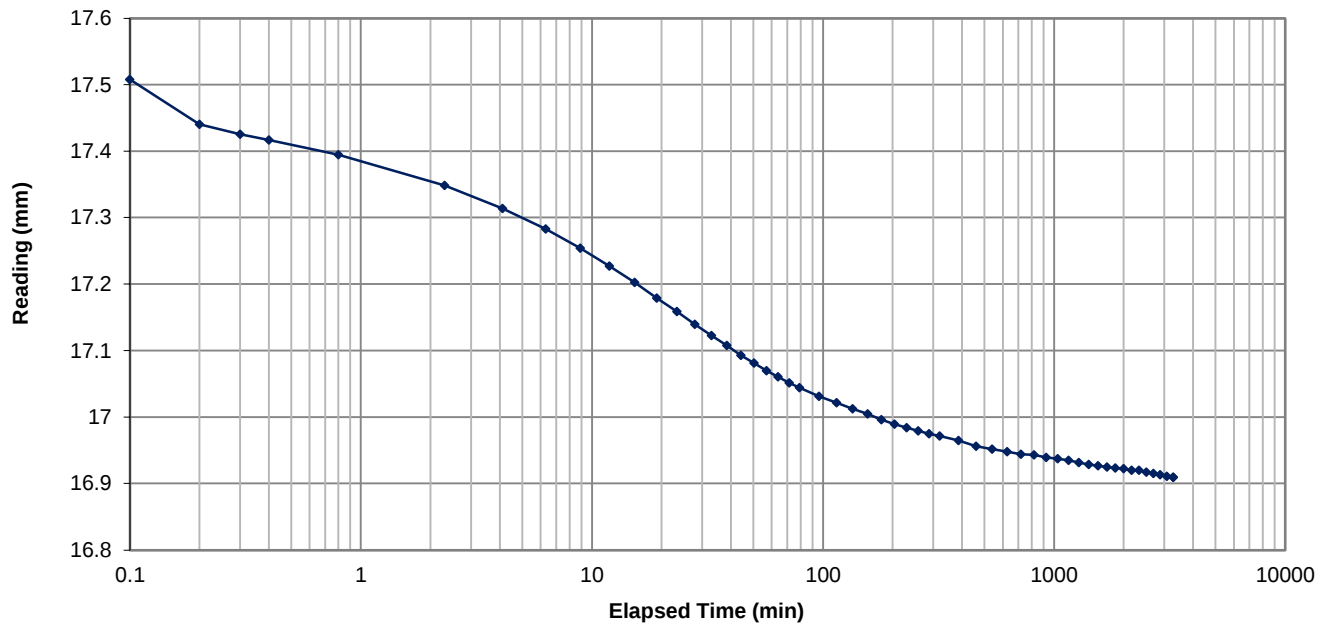
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-34 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-068

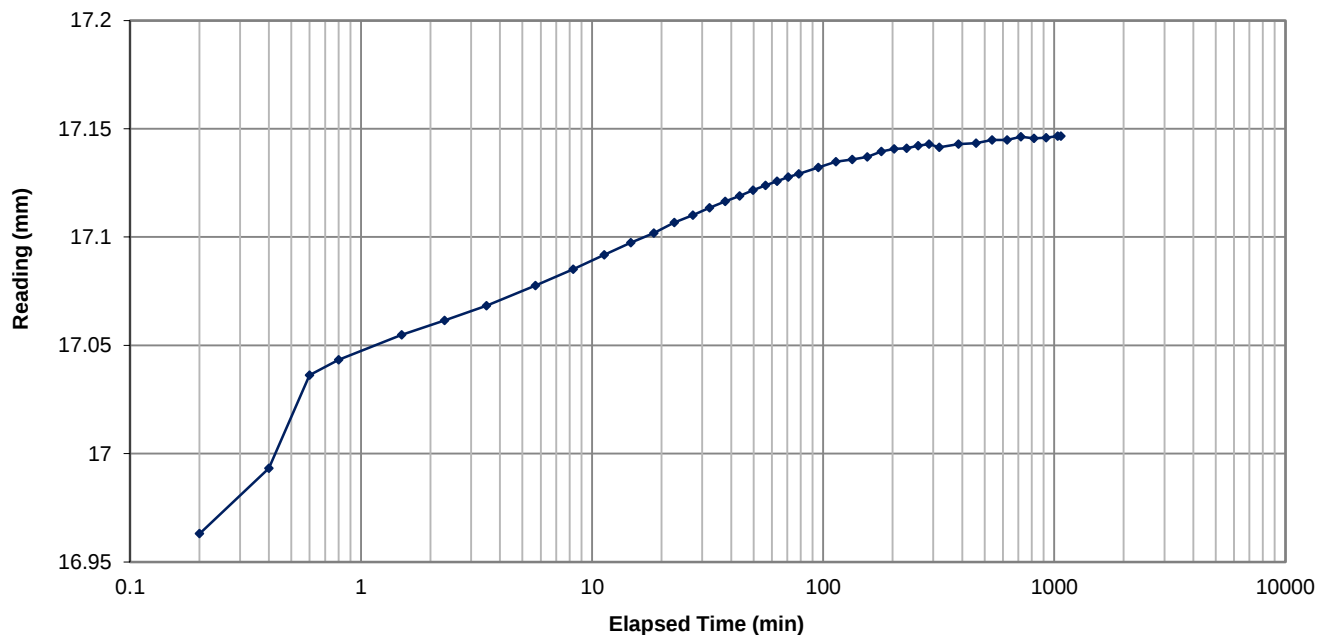
Load #: 9
Stress: 1,590 kPa

Dial Reading versus Elapsed Time



Load #: 10
Stress: 400 kPa

Dial Reading versus Elapsed Time



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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

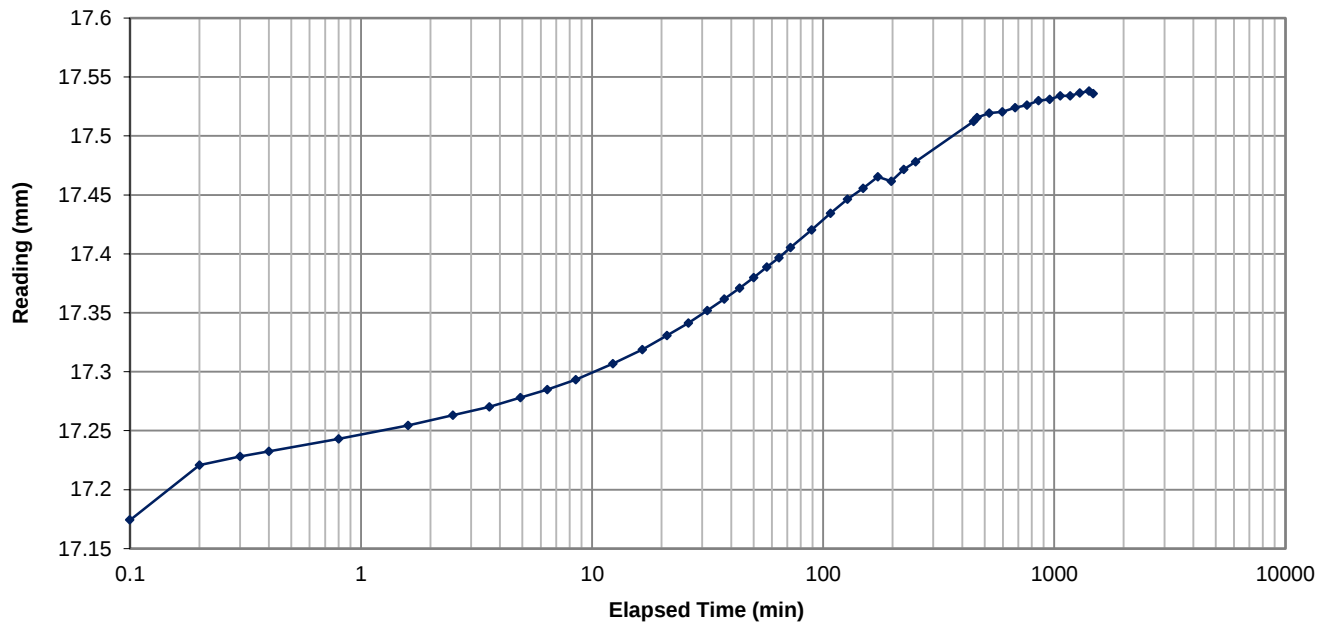
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-34 Sample: ST1 Depth: 2.29 - 3.05 m
Lab #: F069-068

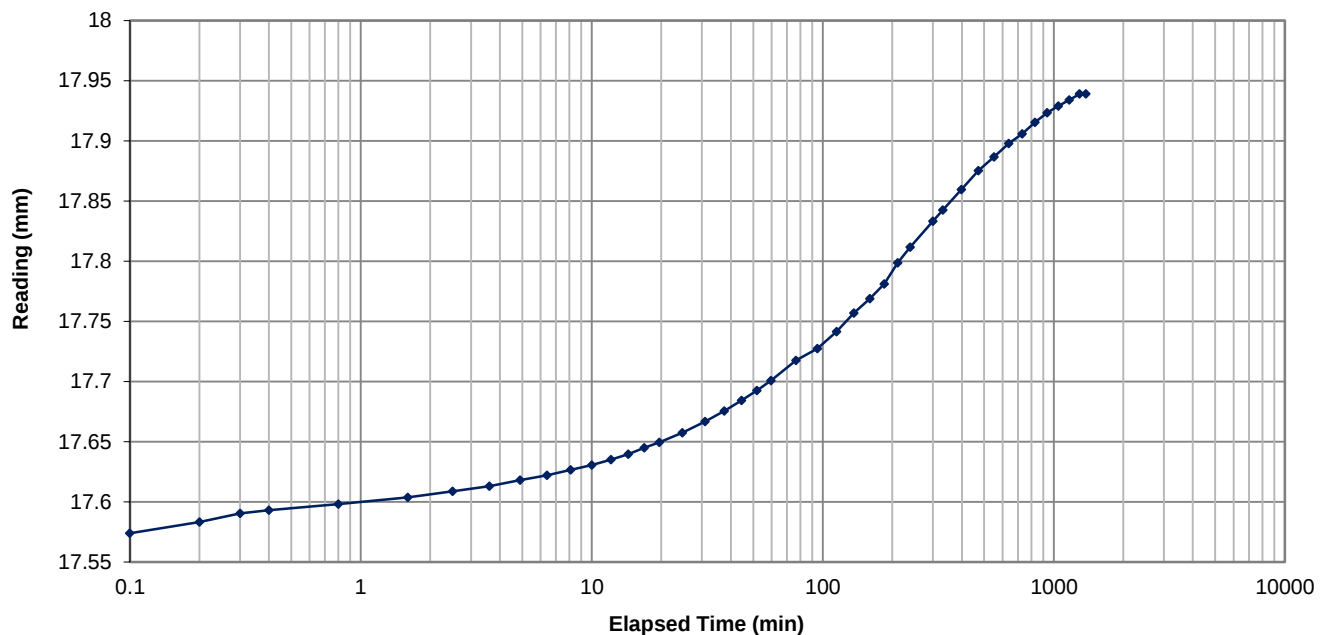
Load #: 11
Stress: 100 kPa

Dial Reading versus Elapsed Time



Load #: 12
Stress: 32 kPa

Dial Reading versus Elapsed Time



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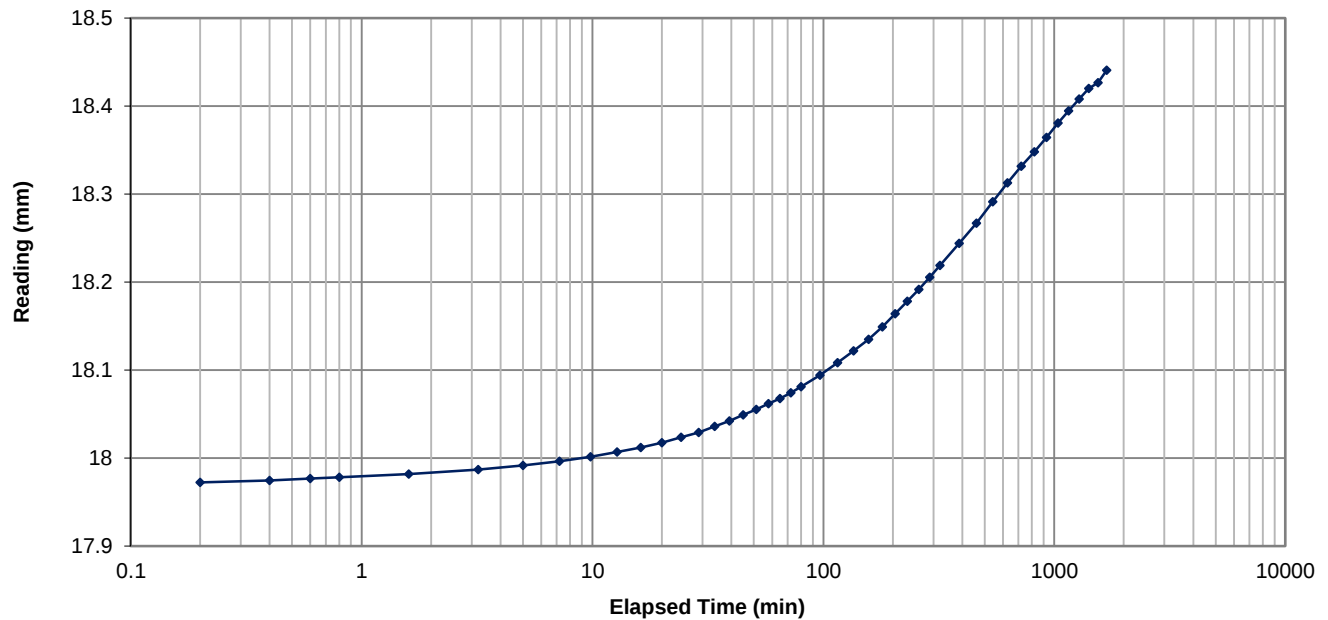


ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

Project #:	CA-0026414.7023	Task:	-
Short Title:	CA-Enbridge_Weyburn Wind Geotech		
Tested By:	FC	Date:	June 20, 2024
Borehole:	T-34	Sample:	ST1
Lab #:	F069-068	Depth:	2.29 - 3.05 m
Load #:	13		
Stress:	8.1 kPa		

Dial Reading versus Elapsed Time





ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

Borehole: T-46
Lab #: F069-082

Sample: ST1

Depth: 3.05 - 3.81 m

	Initial	Final		
Sample height (mm):	19.0	18.0	Specific gravity:	2.7 (assumed)
Sample diameter (mm):	69.9	69.9		
Sample area (cm ²):	38.4	38.4	Loading cap (kPa):	3.8
Volume (cm ³):	73	69		
Wet mass (g):	140.9	147.9		
Dry mass (g):	123.1	123.1		
Water content (%):	14.4	20.1		
Solids content (%):	87.4	83.3		
Wet density (kg/m ³):	1930	2135		
Dry density (kg/m ³):	1687	1778		
Void ratio:	0.60	0.52	Soil description: (CI) sandy SILTY CLAY, some fine gravel,	
Height of solids (mm):	11.9	11.9	medium plasticity fines; brown; cohesive, moist, hard	
Degree of saturation (%):	65	104		

Load #	H _{sample} (mm)	Stone Correction (mm)	H _{corrected} (mm)	Stress (kPa)	Void ratio	Strain (%)	Incremental Work (kJ/m ³)	Cumulative Work (kJ/m ³)
0	19.0	0.0	19.0	3.8	0.60	-0.1	0.0	0.0
1	19.0	0.0	19.0	8.2	0.60	-0.1	0.0	0.0
2	19.0	0.0	19.0	16	0.60	-0.1	0.0	0.0
3	19.0	0.0	19.0	32	0.60	-0.1	0.0	0.0
4	19.0	0.0	19.0	60	0.60	0.0	0.0	0.1
5	18.9	0.0	18.9	119	0.59	0.5	0.4	0.5
6	18.5	0.1	18.6	199	0.56	2.3	2.9	3.4
7	18.2	0.1	18.2	278	0.53	4.1	4.4	7.8
8	17.8	0.1	17.9	401	0.50	6.1	7.0	14.7
9	17.0	0.1	17.1	800	0.44	9.9	24.6	39.4
10	16.3	0.2	16.5	1,597	0.39	13.0	41.2	80.6
11	16.6	0.1	16.7	401	0.41	12.1		
12	16.9	0.1	17.0	119	0.43	10.4		
13	17.3	0.1	17.4	32	0.47	8.5		
14	18.0	0.1	18.1	8.2	0.52	4.8		

Comments:

- data for load numbers 0 to 5 taken from swell test.
- prior to this test, the specimen was preconsolidated to 120 kPa stress then rebounded to 8 kPa as part of swell test (ASTM D4546 Method B).
- specimen was inundated with water near the start of the 120 kPa loading

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING

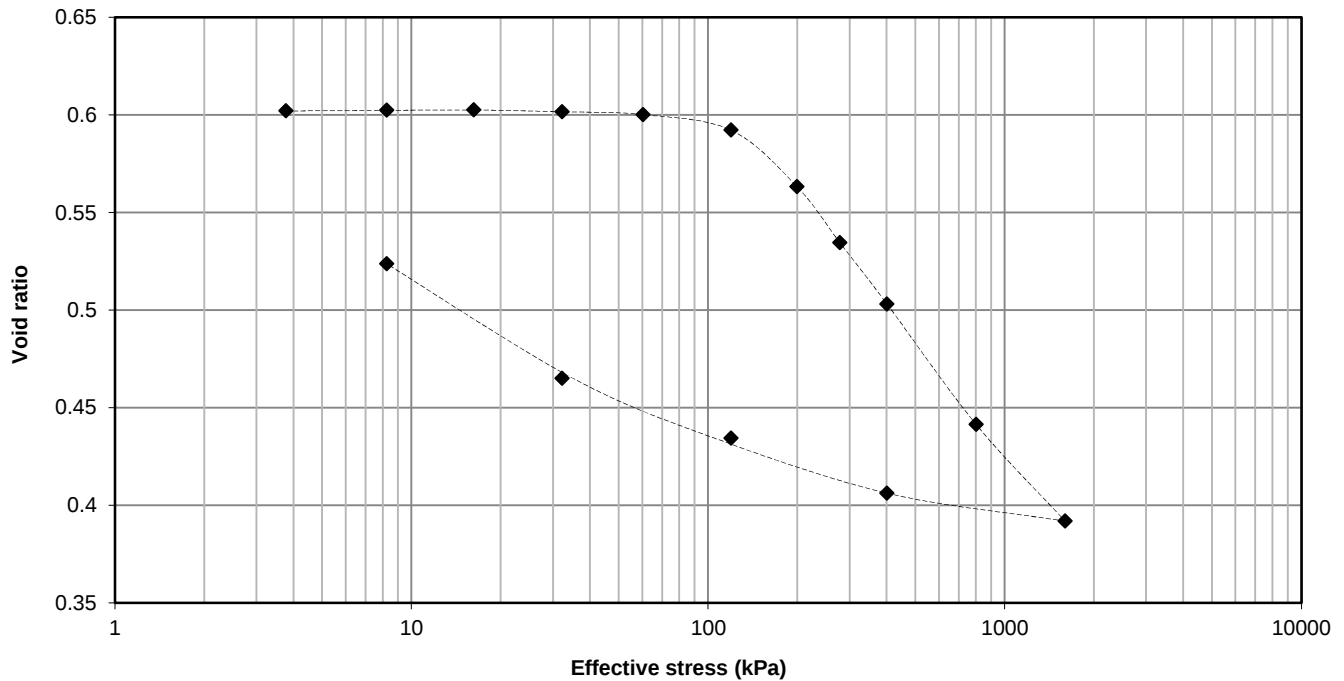
ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

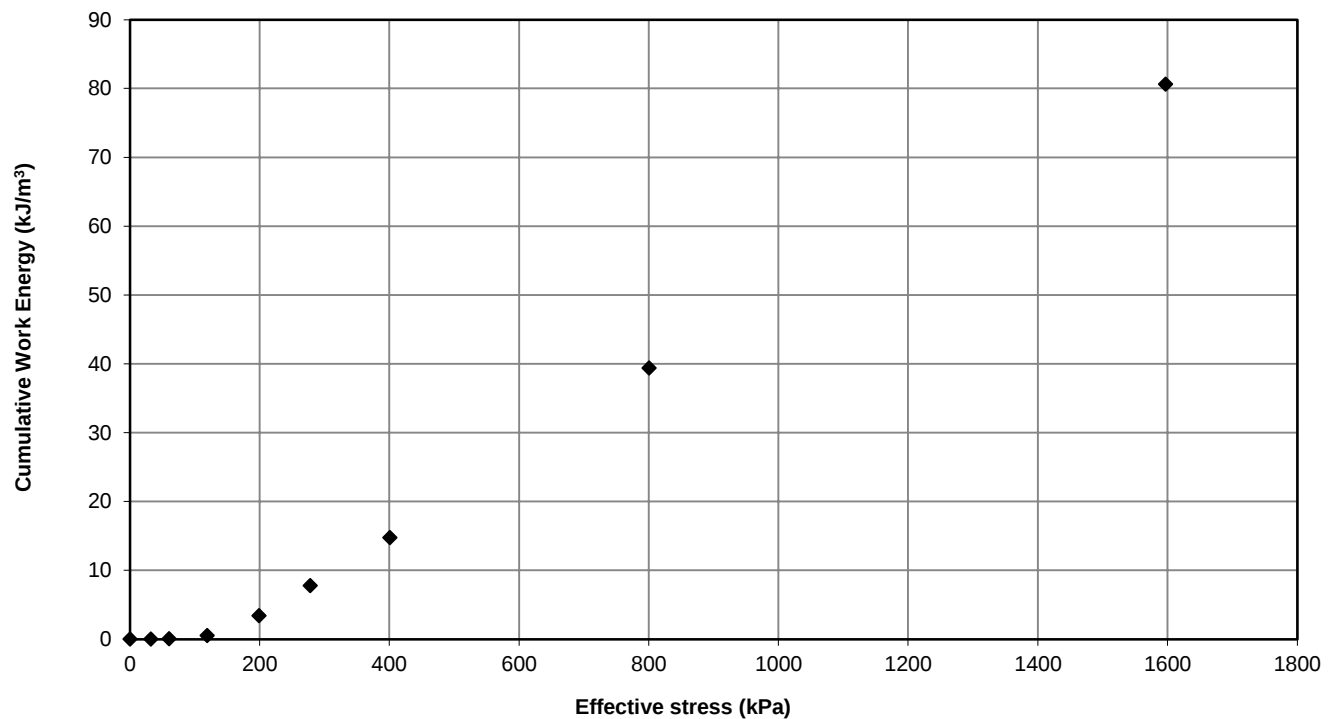
Task: -
Date: June 20, 2024

Borehole: T-46 Sample: ST1 Depth: 3.05 - 3.81 m
Lab #: F069-082

Void Ratio versus Effective Stress



Cumulative Work Energy versus Effective Stress



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ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

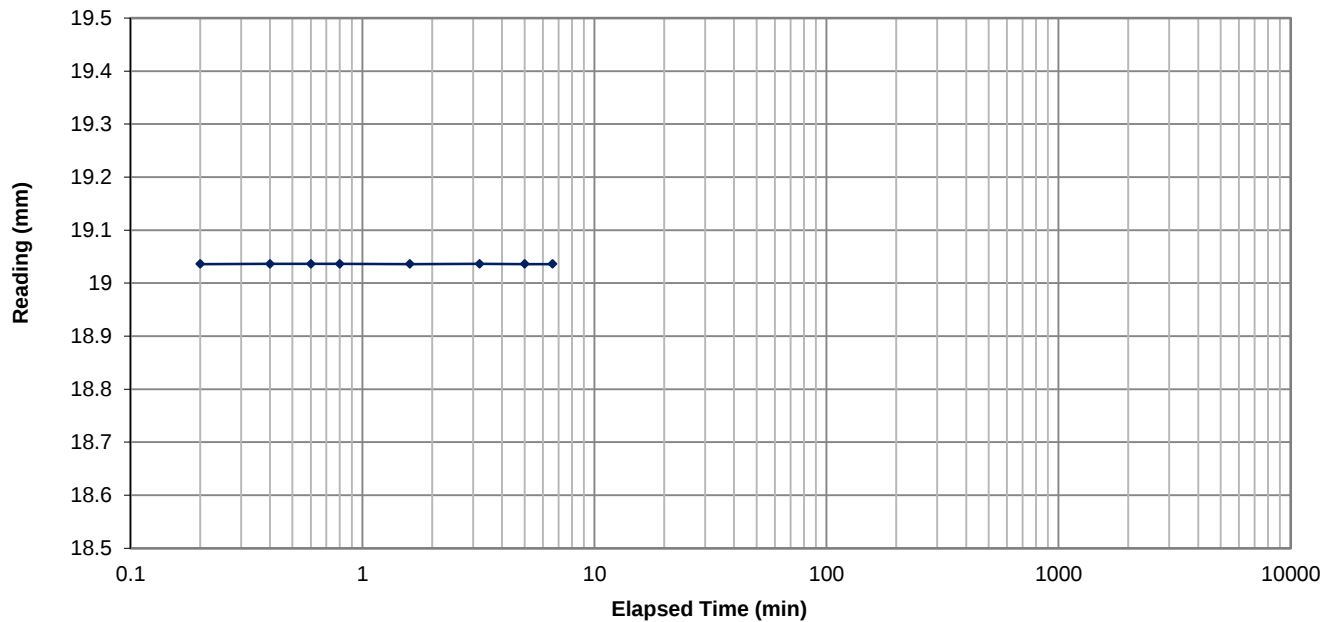
Borehole: T-46
Lab #: F069-082

Sample: ST1

Depth: 3.05 - 3.81 m

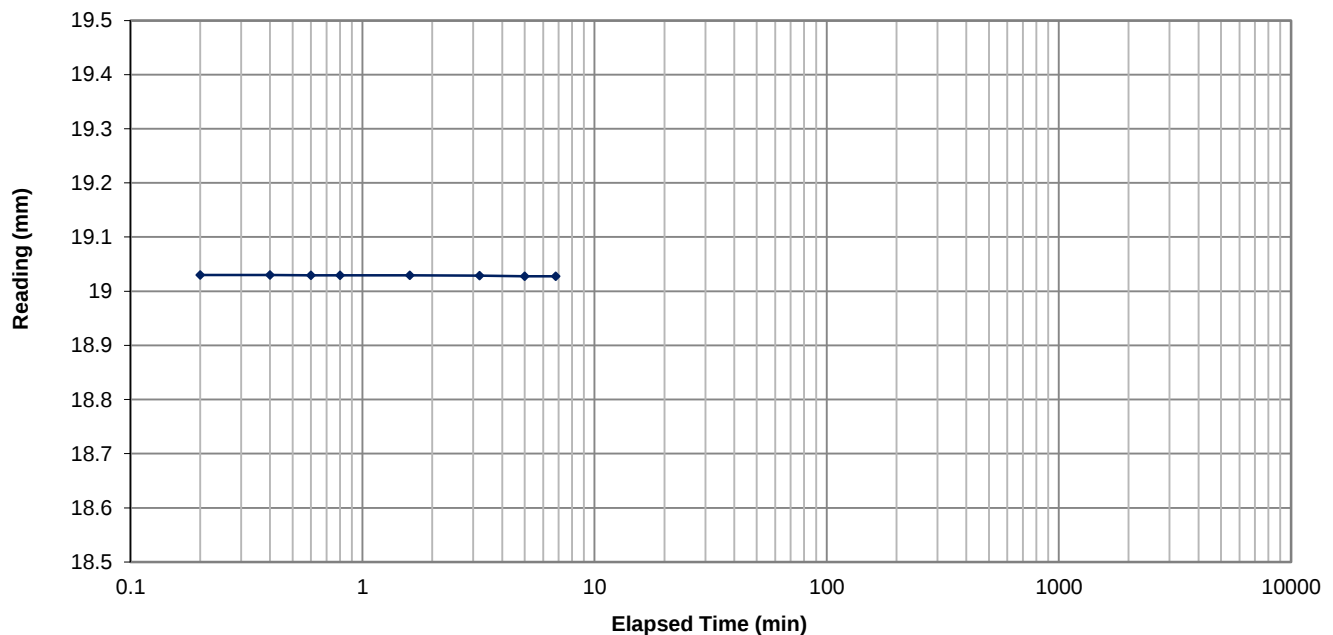
Load #: 1
Stress: 8.2 kPa

Dial Reading versus Elapsed Time



Load #: 2
Stress: 16 kPa

Dial Reading versus Elapsed Time



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ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

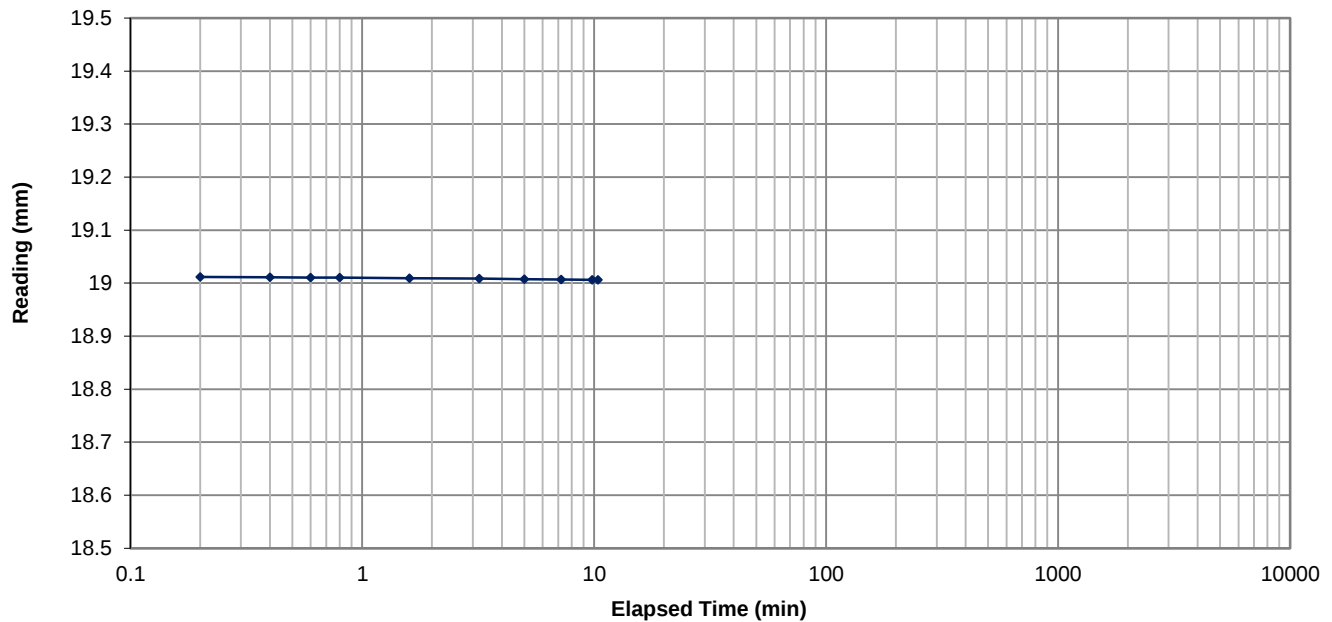
Borehole: T-46
Lab #: F069-082

Sample: ST1

Depth: 3.05 - 3.81 m

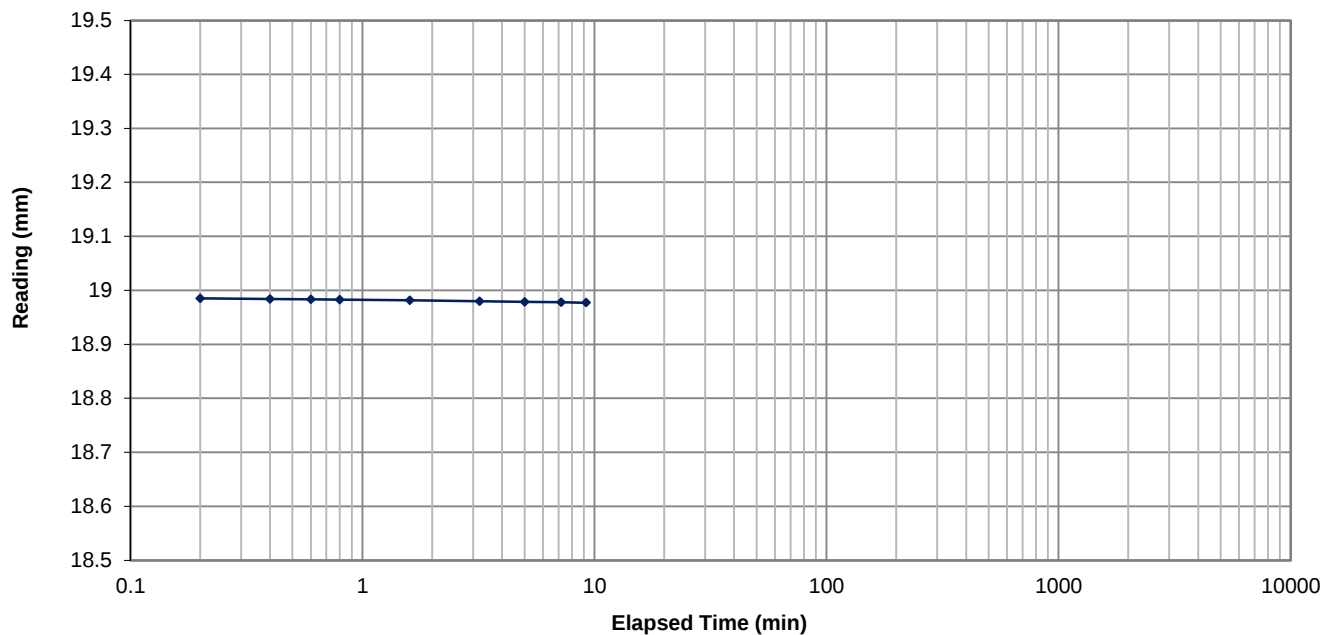
Load #: 3
Stress: 32 kPa

Dial Reading versus Elapsed Time



Load #: 4
Stress: 60 kPa

Dial Reading versus Elapsed Time



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ASTM D2435

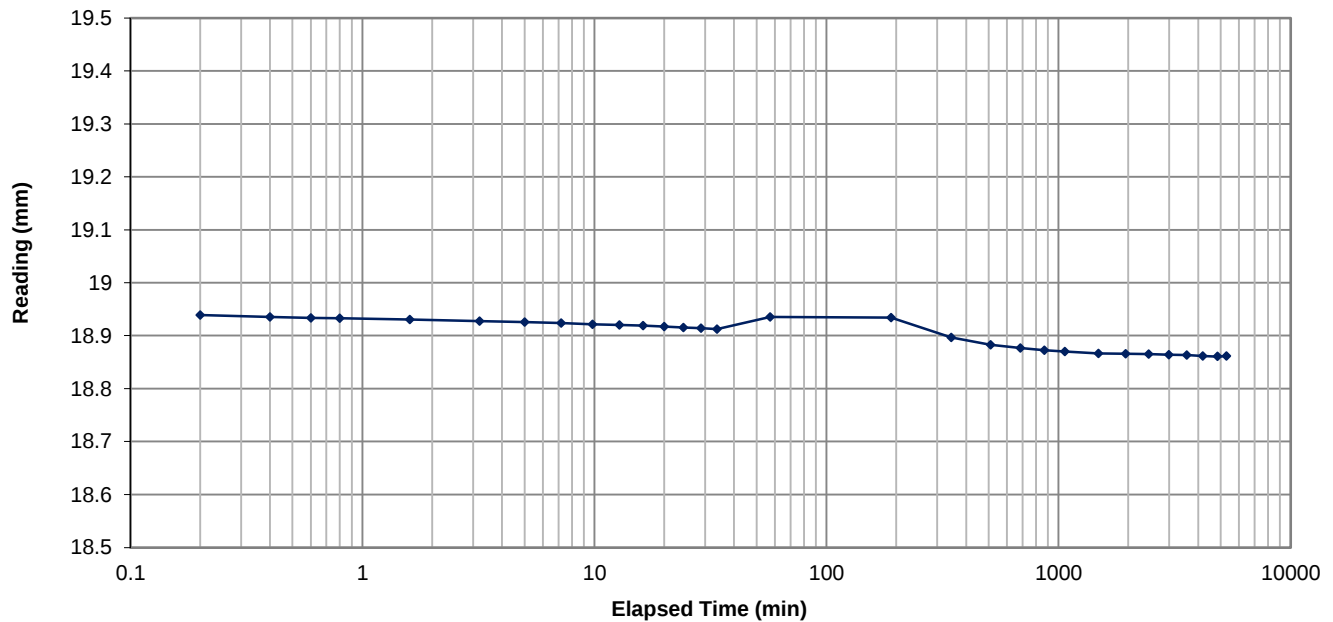
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-46 Sample: ST1 Depth: 3.05 - 3.81 m
Lab #: F069-082

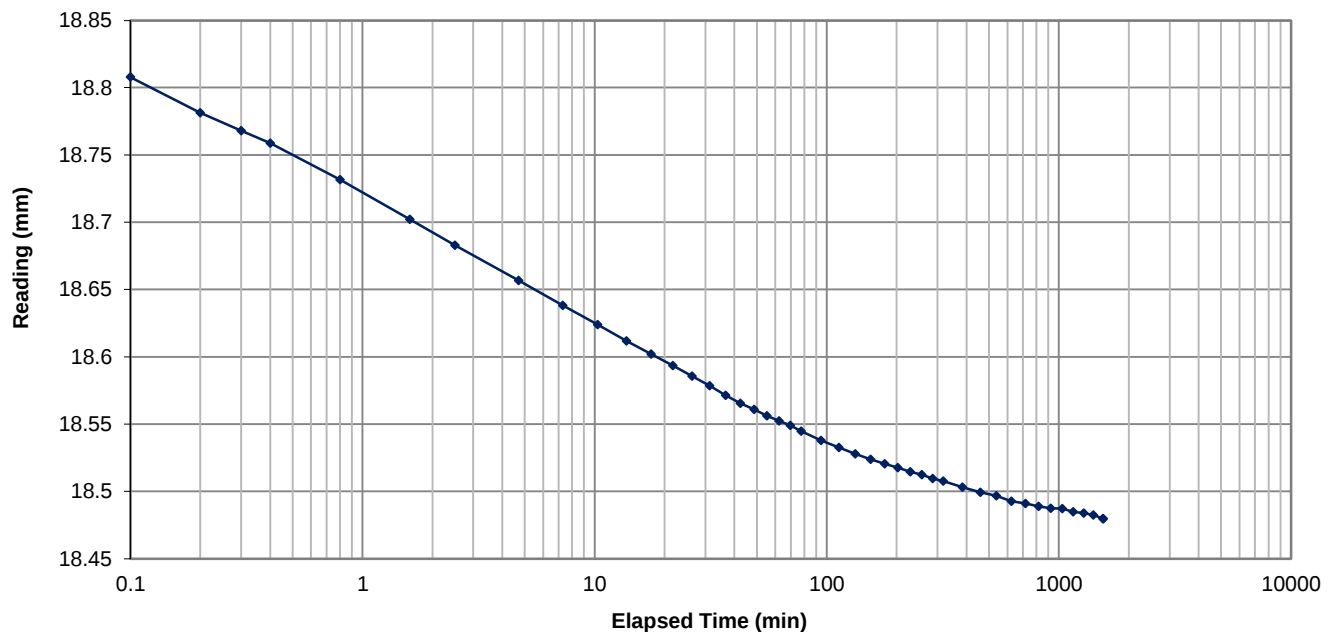
Load #: 5
Stress: 119 kPa

Dial Reading versus Elapsed Time



Load #: 6
Stress: 199 kPa

Dial Reading versus Elapsed Time



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ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

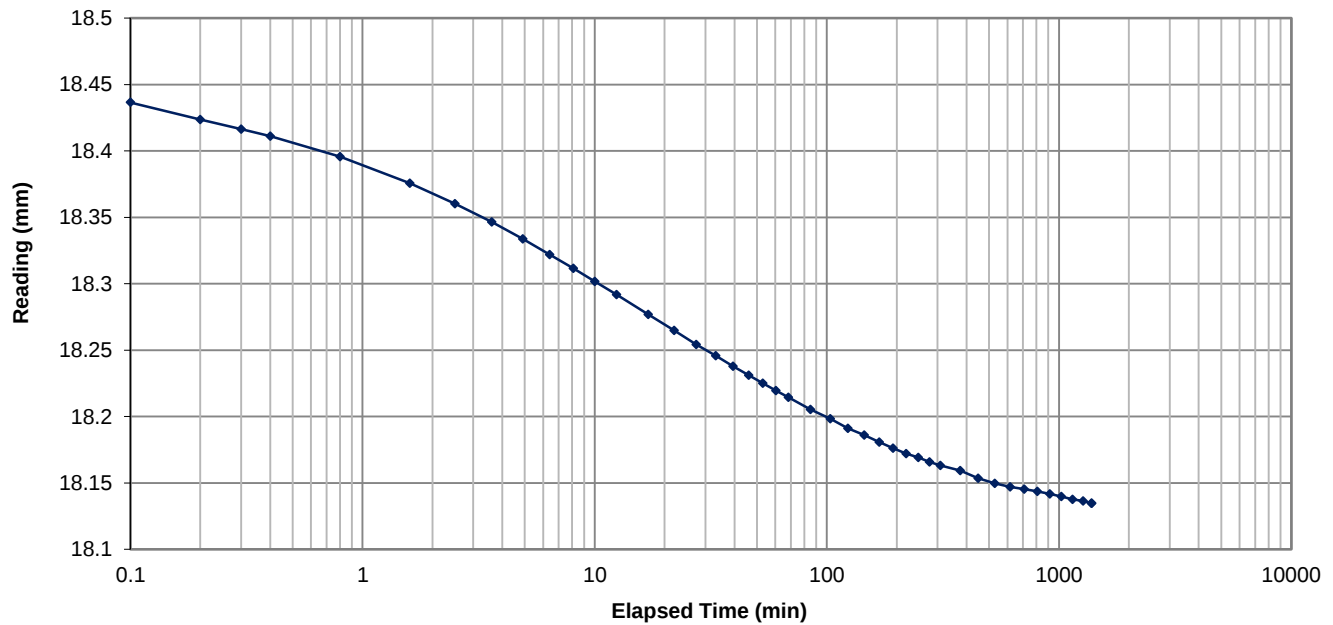
Borehole: T-46
Lab #: F069-082

Sample: ST1

Depth: 3.05 - 3.81 m

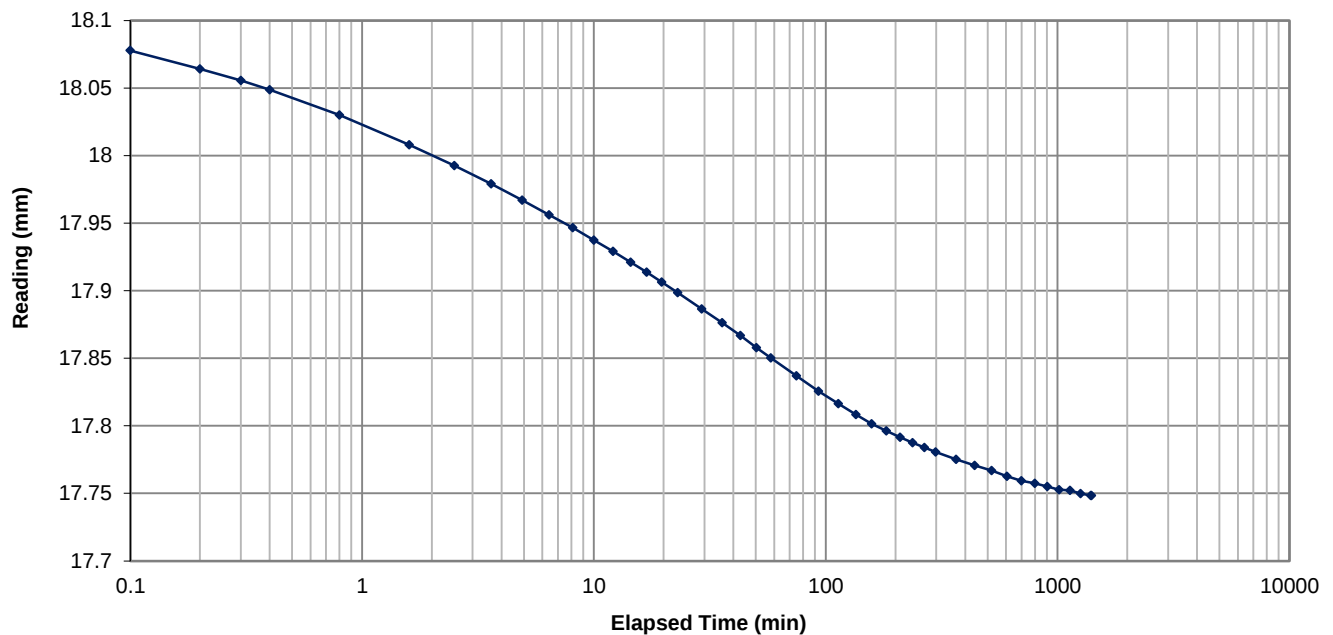
Load #: 7
Stress: 278 kPa

Dial Reading versus Elapsed Time



Load #: 8
Stress: 401 kPa

Dial Reading versus Elapsed Time



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ASTM D2435

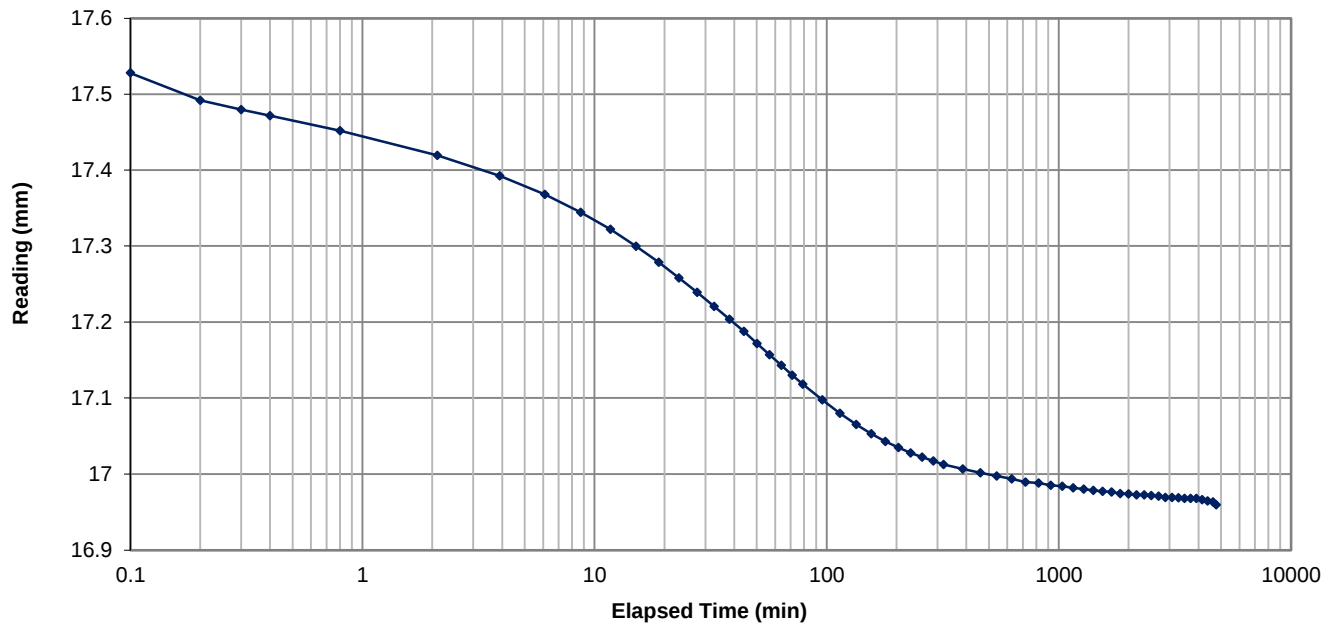
Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -
Date: June 20, 2024

Borehole: T-46 Sample: ST1 Depth: 3.05 - 3.81 m
Lab #: F069-082

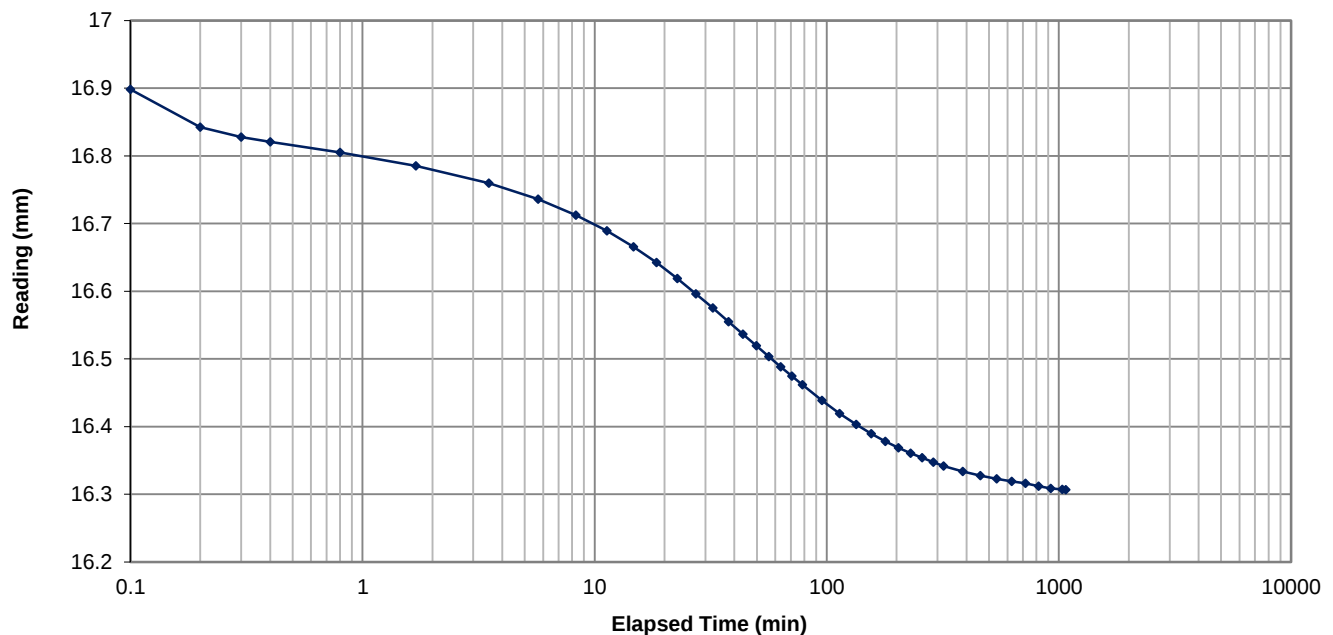
Load #: 9
Stress: 800 kPa

Dial Reading versus Elapsed Time



Load #: 10
Stress: 1,597 kPa

Dial Reading versus Elapsed Time



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ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

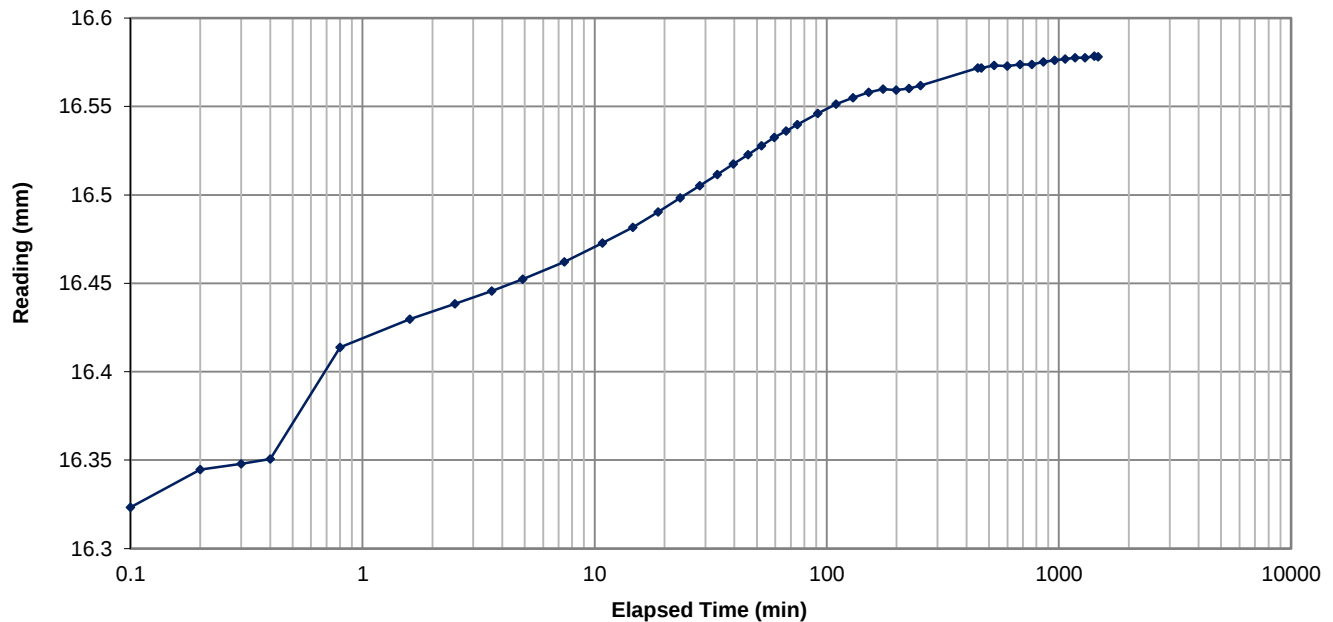
Borehole: T-46
Lab #: F069-082

Sample: ST1

Depth: 3.05 - 3.81 m

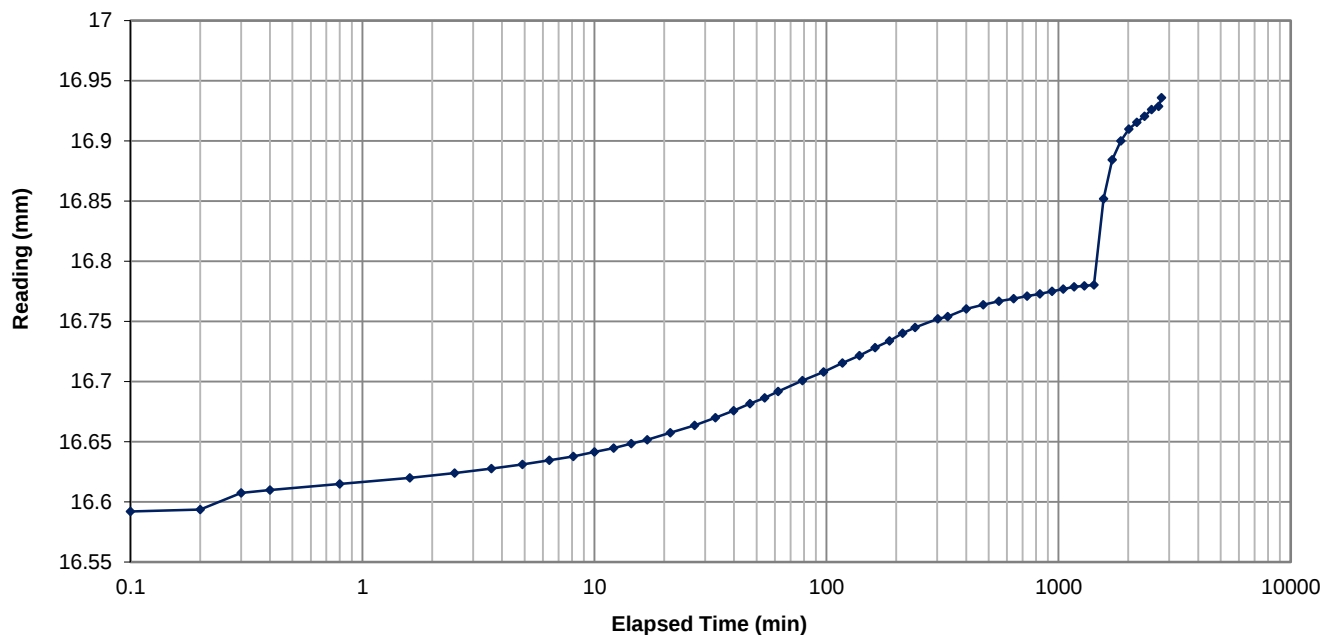
Load #: 11
Stress: 401 kPa

Dial Reading versus Elapsed Time



Load #: 12
Stress: 119 kPa

Dial Reading versus Elapsed Time



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ASTM D2435

Project #: CA-0026414.7023
Short Title: CA-Enbridge_Weyburn Wind Geotech
Tested By: FC

Task: -

Date: June 20, 2024

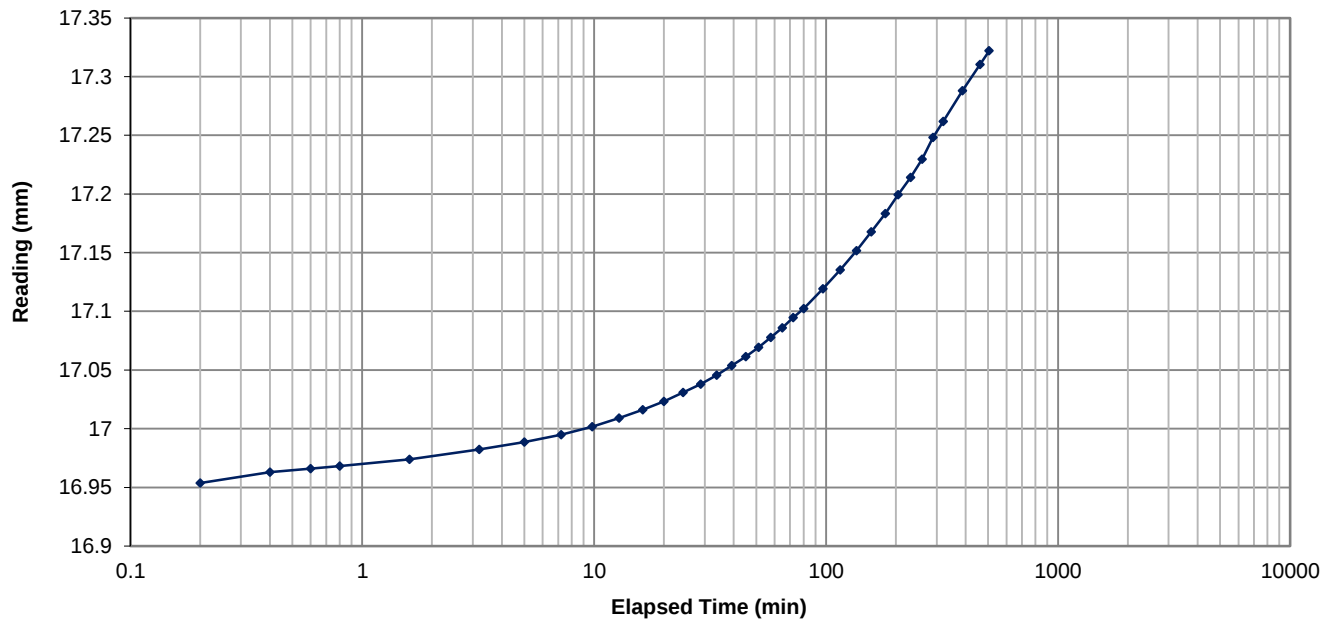
Borehole: T-46
Lab #: F069-082

Sample: ST1

Depth: 3.05 - 3.81 m

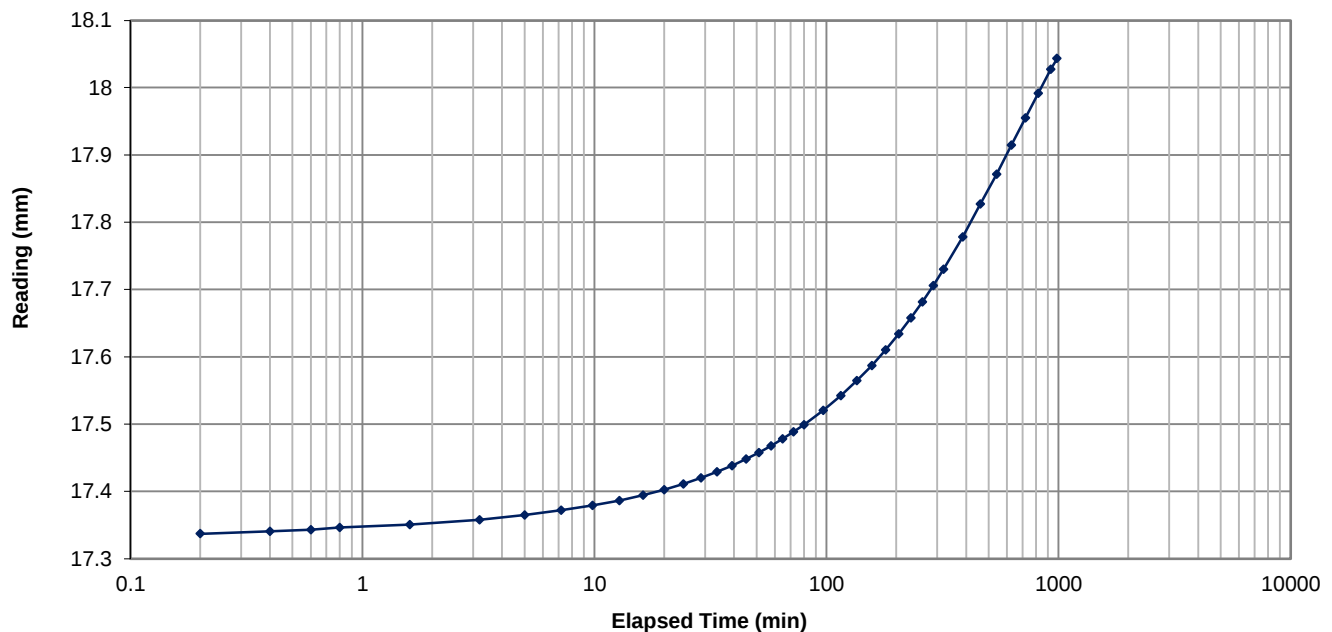
Load #: 13
Stress: 32 kPa

Dial Reading versus Elapsed Time



Load #: 14
Stress: 8.2 kPa

Dial Reading versus Elapsed Time



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Analytical Results

Sub-Matrix: Soil (Matrix: Soil/Solid)					Client sample ID	T-01 SS3 (3.05-3.51m)	T-06 SS4 (3.81-4.27m)	T-09 SS2 (1.52-1.98m)	T-24 SS1 (0.76-1.22m)	T-25 SS2 (1.52-1.98m)
Client sampling date / time					06-May-2024 00:00	06-May-2024 00:00	06-May-2024 00:00	06-May-2024 00:00	06-May-2024 00:00	
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2405762-001	CG2405762-002	CG2405762-003	CG2405762-004	CG2405762-005	
					Result	Result	Result	Result	Result	
Physical Tests										
Conductivity (1:2 leachate)	----	E100-L/WT	0.00500	mS/cm	5.02	3.63	0.203	0.877	3.64	
pH (1:2 soil:water)	----	E108/CG	0.10	pH units	7.98	8.55	8.95	8.61	7.91	
Resistivity	----	EC100R/WT	100	ohm cm	200	280	4930	1140	270	
Inorganics										
Chloride, soluble ion content	16887-00-6	E246.CL/EO	0.0025	%	0.0043	0.0073	<0.0025	<0.0025	<0.0025	
Sulfate, total, ion content	14808-79-8	E246.SO4/CG	0.050	%	1.62	1.06	<0.050	0.106	2.50	
Sulfate, soluble ion content	14808-79-8	E246A.SO4/C G	0.05	%	----	----	NR	NR	----	
Sulfate, soluble ion content	14808-79-8	E246A.SO4/C G	0.050	%	1.52	0.921	----	----	1.96	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Soil (Matrix: Soil/Solid)					Client sample ID	T-34 SS3 (3.05-3.51m)	T-46 SS2 (1.52-1.98m)	T-46 SS3 (2.29-2.74m)	----	----
					Client sampling date / time	06-May-2024 00:00	06-May-2024 00:00	06-May-2024 00:00	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2405762-006	CG2405762-007	CG2405762-008	-----	-----	
					Result	Result	Result	----	----	
Physical Tests										
Conductivity (1:2 leachate)	----	E100-L/WT	0.00500	mS/cm	3.30	0.312	0.185	----	----	
pH (1:2 soil:water)	----	E108/CG	0.10	pH units	8.22	8.45	8.40	----	----	
Resistivity	----	EC100R/WT	100	ohm cm	300	3200	5400	----	----	
Inorganics										
Chloride, soluble ion content	16887-00-6	E246.CL/EO	0.0025	%	0.0045	<0.0025	<0.0025	----	----	
Sulfate, total, ion content	14808-79-8	E246.SO4/CG	0.050	%	0.660	<0.050	<0.050	----	----	
Sulfate, soluble ion content	14808-79-8	E246A.SO4/C G	0.05	%	----	NR	NR	----	----	
Sulfate, soluble ion content	14808-79-8	E246A.SO4/C G	0.050	%	0.512	----	----	----	----	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

APPENDIX D

Thermal Conductivity Results



Thermal Conductivity of Soil by Thermal Needle Probe

(ASTM D5334)

Project No.: CA0026414.7023

Task: -

Short Title: CA-Enbridge_Weyburn Wind Geotech

Tested by: FC

Date: 21-May-24

Test: F069-092
Sample No.: T-25, Bulk
Height (mm): 150.7
Diameter (mm): 102.6
Thermal Probe No.: TR1 03937
Probe Length (mm): 100

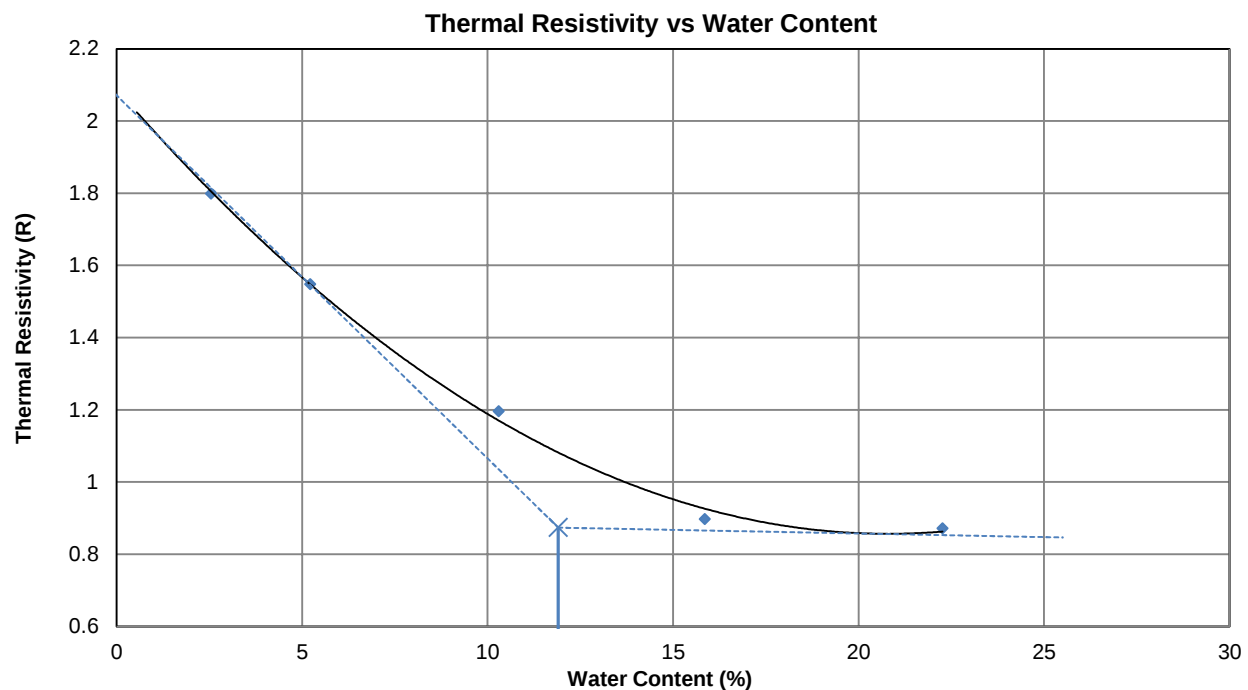
Undist. or Reconstituted: Reconstituted
Initial Target Dry Density (kg/m^3): 1447
Initial Water Content (%): 22.2

Thermal Dryout Curve Test Results

Single Specimen

Critical Water Content: 11.9 %

Test No.	Water Content (%)	Wet Density (kg/m^3)	Thermal Conductivity, K (W/m.K)	Thermal Resistivity, R (m.K/W)
1	22.3	1766	1.147	0.872
2	15.9	-	1.114	0.898
3	10.3	-	0.836	1.196
4	5.2	-	0.646	1.548
5	2.5	-	0.556	1.799



Remarks:

Thermal conductivity value has a precision of +/- 10%

Test conducted using KD2-Pro Thermal Properties Analyzer

