Phase 2 Expansion Detailed Design – Revision 3
Phase 2 West – Dry Stack Tailings Facility
Keno Hill District Mill Site, Yukon



PRESENTED TO
Alexco Keno Hill Mining Corporation

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AEP	Annual Exceedance Probabilities
AKHM	Alexco Keno Hill Mining Corp.
CPT	Cone Penetration Testing
CTTS	Contained Tailings Toe Structure
DR	Dimension Ratio
DSTF	Dry Stack Tailings Facility
ECCC	Environment and Climate Change Canada
EDF	Environmental Design Flood
FoS	Factors of Safety
GCL	Geosynthetic Clay Liner
Hecla	Hecla Mining Company
IDF	inflow design flood
IFC	Issued for Construction
IMP	Instrumentation and Monitoring Plan
ITP	Inspection and Test Plan
Keno Hill	Keno Hill Silver District Operation
LLDPE	Linear Low-Density Polyethylene
NBCC	National Building Code of Canada
NELPCo	NELPCo Limited Partnership
NNDDC	NND Development Corporation
OMS	Operations, Maintenance, and Surveillance
P1	Phase 1
P2E	Phase 2 East
P2W	Phase 2 West
PAG	Potentially Acid-generating
PGA	Peak Ground Acceleration
SCS	Soil Conservation Service
SPT	Standard Penetration Test
TARP	Trigger Action and Response Plan
Tetra Tech	Tetra Tech Canada Inc.
VST	Vane Shear Testing

LIMITATIONS OF REPORT

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1.0 INTRODUCTION

1.1 General

NND EBA Land Protection Corp., operating as NELPCo Limited Partnership (NELPCo) was retained by Alexco Keno Hill Mining Corp. (AKHM) to complete the design for the Phase 2 Expansion of the Dry Stack Tailings Facility (DSTF) at the Keno Hill mine site located near Keno City, YT.

NELPCo is a limited partnership corporation owned by the NND Development Corporation (NNDDC) and Tetra Tech Canada Inc. (Tetra Tech). Tetra Tech is NELPCo's exclusive engineering services provider.

This Revision 3 of the design summary report documents relevant design information for the Phase 2 West (P2W) expansion.

1.2 Project Description

The Keno Hill Silver District Operation (Keno Hill) consists of a silver-lead-zinc mine operated by AKHM, which was acquired by Hecla Mining Company (Hecla) in 2022. The mill site is located approximately 1 km west of Keno City, YT.

The site is operated by AKHM under Quartz Mining License QML-0009 issued by the Yukon Government, Energy, Mines and Resources (Yukon Government 2019), and Type A Quartz Mining Water License QZ18-044 issued by the Yukon Water Board (Yukon Water Board 2020).

AKHM is currently operating and depositing filtered tailings in the eastern portion of Phase 2 of the DSTF (P2E), located in the Flame and Moth mill area. Ongoing mining operations necessitate the design and construction of an expanded Phase 2 to meet mine planning and tailings storage capacity requirements. This report details the design process for P2W and supporting appurtenances.

1.3 Previous Designs

The detailed design for the existing DSTF Phase 1 (P1), was submitted in 2011. Tetra Tech (formally EBA Engineering and Tetra Tech EBA) originally prepared the DSTF P1 detailed design, as outlined in the report titled *Detailed Design – Dry Stacked Tailings Facility, Keno Hill District Mill Site, Yukon* (Tetra Tech EBA 2011), which provides documentation of the design and technical considerations.

In June 2015, Tetra Tech prepared a DSTF Phase 2 Expansion preliminary design report, titled *Dry Stacked Tailings Facility Phase II Expansion Preliminary Design – Revision 1, Keno Hill District Mill Site, YT* (Tetra Tech EBA 2015), which presents the background information related to the DSTF, summarizes the subsurface conditions encountered during the DSTF Phase 2 Expansion preliminary geotechnical investigation, and documents the preliminary design for the DSTF Phase 2 Expansion.

Phase II Expansion Detailed Design Report – Revision 2 for the Dry Stacked Tailings Facility (Tetra Tech 2024b) serves as an updated version of the DSTF Phase 2 Preliminary Design Report, focusing on the P2E expansion. This report was developed to provide relevant, updated design information and technical support for the continued development and expansion of the DSTF Phase 2. Detailed design packages for P2E were issued in October 2024, and substantial construction was achieved December 13, 2024.

1.4 Related Documents

Related documents for the P2W expansion are shown in Table 1-1 below.

Table 1-1: Relevant Background Information

Document	Date Issued	Reference	Key Information
Phase 2 Expansion Detailed Design Revision 2	September 18, 2024	Tetra Tech (2024b)	▪ Update to P2 Preliminary design report detailing P2E Expansion
Project Design Basis, Dry Stack Tailings Facility (DSTF)	December 14, 2024	AKHM (2024b)	▪ P2 Design Basis from AKHM
Instrumentation Monitoring Plan DSTF Phase 2 East	August 22, 2024	Tetra Tech (2024d)	▪ Instrumentation plan for Phase 2 East
Liner Type Change Evaluation	February 3, 2025	Tetra Tech (2025a)	▪ Liner Type Evaluation for P2W DSTF
Mill Pond, Flame and Moth Pond As-Built	March 17, 2025	Tetra Tech (2025e)	▪ Mill Pond and Flame and Moth As-builts for pre-2025 improvements construction conditions
Technical Construction Specifications Rev 2	August 15, 2025	Tetra Tech (2025g)	▪ Construction specifications for water management improvement project
Flame and Moth Hydrology Evaluation and Pond Design	June 16, 2025	Tetra Tech (2025h)	▪ Hydrologic Analysis ▪ Pond Sizing Designs
Phase 2 West Borrow Source Evaluation Memo	January 21, 2026	Tetra Tech (2026a)	▪ Borrow Geotechnical Investigation and Source Suitability
Phase 2 West Water Management Improvements Construction Record Report	January 30, 2026	Tetra Tech (2026b)	▪ Water Management Improvements Construction Record Report
Site Investigation Factual Data Report DSTF Phase	February 13, 2026	Tetra Tech (2026c)	▪ Summary of encountered subsurface conditions, lab testing, and CPT data collected during P1 drilling
Tailings and Foundation Soil Characterization Report DSTF Phase 1	February 18, 2026	Tetra Tech (2026d)	▪ Summary of interpreted P1 tailings characterizations based on drilling program, advanced lab test data, and CPT data
Slope Stability Assessment – Phase 2 West Dry Stack Tailings Facility	February 20, 2026	Tetra Tech (2026e)	▪ Updated slope stability assessment for P2W
Phase 2 West 95% Issued for Permitting Drawing Package	February 20, 2026	Tetra Tech (2026f)	▪ P2W DSTF 95% Issued for Permitting Drawings
Technical Construction Specifications Phase 2 West Dry Stack Tailings Facility Issued for Permitting	February 25, 2026	Tetra Tech (2026g)	▪ Construction specifications for DSTF P2W project
Updated Instrumentation Monitoring Plan DSTF Phase 2 West	February 2026	Tetra Tech (2026h)	▪ Instrumentation plan for Phase 2 West

2.0 DESCRIPTION OF SITE CONDITIONS

2.1 Site Location

The Phase 2 Expansion is located at the Flame and Moth site within the Keno Hill Silver District in central Yukon Territory, Canada. The property lies near Keno City, roughly 55 km north of Mayo and about 460 km northeast of Whitehorse by road. The site is accessible by road from Mayo (Silver Trail Highway) and by air via Mayo Airport (regional).

2.2 Surface Conditions

The Phase 2 DSTF expansion footprint generally slopes down 5% to 15% to the west and southwest. Prior to construction, the interior of the P2E Expansion area was vegetated with shrubs and spruce, with vegetation that was thicker and more mature to the east and southeast.

The P2W Expansion area is composed of granular fill placed during the P2E buttress and P1B buttress construction, and gravel fill used for the existing Flame and Moth laydown. Vegetation is located on the southern side, mainly shrubs and spruce, and will be removed as part of foundation preparation.

The Mill Pond, Flame and Moth Pond, and the P1 sump and conveyance area are located on gravel fill and are bordered by gravel roadways.

2.3 Subsurface Conditions

The Phase 2 DSTF subsurface consists of a thin organic layer over silt and sand, overlying glacial till (silt, sand, and gravel) and bedrock. These conditions are similar to the P1 DSTF, but lower ground-ice content and lower moisture contents were observed during Phase 2 drilling, particularly along the southeastern footprint. Localized ice-rich till zones are expected southwest of the P1B buttress and laydown within the P2W footprint; these will be removed during construction.

The Mill Pond, Flame and Moth Pond, and the P1 sump and conveyance area overlie gravel fill, silt and sand, glacial till (silt, sand, and gravel), and bedrock. Localized ice-rich silt zones are present around the P1 sump, and occurrences of massive ice have been observed to the west and north of this area.

Geotechnical boreholes and test pits were completed within or adjacent to the Phase 2 DSTF and pond footprints. Borehole and test pit locations and geotechnical logs are provided in Appendix B.

2.4 Bedrock

Bedrock in the Keno City area typically comprises quartzite, mudstone, phyllite, or schist and the bedrock profile varies spatially. Bedrock was not encountered in every borehole completed during the 2013 and 2022 site investigations, either because the bedrock contact lay below the borehole termination depth or because subsurface conditions limited drilling progress. A summary of bedrock encounters and estimated bedrock elevations from the drilling program is provided in the *Phase II Expansion Detailed Design Report – Revision 2 Dry Stacked Tailings Facility* (Tetra Tech 2024b). The observed bedrock depth ranges from 12.2 m to more than 30.5 m in the P2W area (BH22-01, 02, 03, and 10), and from 20.4 m to more than 30.5 m in the P2E area (BH22-04, 05, 06, 07, 08, and 09). Bedrock was once visible at the surface in a few locations near the southern border of P1 prior to P1B construction.

2.5 Permafrost

The site is located within the extensive discontinuous permafrost zone in the Yukon, where permafrost can be expected under 50% to 90% of the ground surface. Permafrost within the DSTF P2 footprint is warm (generally observed between -0.2°C to -0.4°C), discontinuous, and can contain ice-rich soil. Occurrences of massive ice have been observed outside of the footprint, to the north and west of P1.

During construction of P2E, ice-rich soils were removed from underneath critical facility components (i.e., buttress, interior shear berms) as practical, exposing thaw-stable soils. Generally, these conditions were observed in the upper 2 m to 3 m below original ground. This process will be repeated for P2W.

As recent as Fall 2025, meltwater was observed to daylight near the toe of the P2E buttress as shallow ice-rich and ice poor permafrost in the area west of the buttress thaws. P2W foundation construction will include sub-excavation of ice-rich material in this area, and construction of underdrains for non-contact water.

2.6 Groundwater

Groundwater was not observed in boreholes completed in the foundation soils during the 2013, 2022, or 2024 site investigation programs.

2.7 Surface Hydrology

2.7.1 Climate Data

Tetra Tech compiled precipitation records from Mayo Airport and the District Mill Weather Station for the P2W hydrologic modelling; the same datasets were used for P2E design. The rainfall data was validated by frequency analysis of full-year District Mill records for 2012–2023, comparing 24-hour depths for return periods of 2 to 200 years with Mayo-derived values. The comparison shows small, statistically insignificant differences and indicates Mayo Airport reasonably represents site precipitation. Because Mayo provides a longer continuous record, Tetra Tech selected Mayo Airport data for the modelling.

2.7.2 Climate Change Consideration

Tetra Tech estimated climate-change effects on flood flows using historical and projected data from ClimateData.ca under the RCP 8.5 (High Carbon) scenario for 2071–2100. An Environment and Climate Change Canada (ECCC) intensity–duration–frequency curve for Mayo Airport was extracted from ClimateData.ca and extrapolated/ interpolated to match the design storm return periods and durations specified in the AKHM Project Design Basis (Section 3.1.5, AKHM 2024b).

2.7.3 Design Storms

Tetra Tech updated the Personal Computer Storm Water Management Model (PCSWMM) and sized ponds using storm durations from 1 to 72 hours for the 100- and 200-year return periods per Design Basis Item 3.1.5.

An 18-storm synthetic precipitation time series was applied to revised catchments for P2W (Tetra Tech 2025h). Design events comprised 1-, 2-, 4-, 6-, 8-, 12-, 24-, 48-, and 72-hour storms at 100-year (Environmental Design Flood (EDF)) and 200-year (Inflow Design Flood) return periods for the 2071–2100 climate scenario.

The 4- and 8-hour depths were interpolated, and the 48- and 72-hour depths were extrapolated from the ECCC 1–24-hour rainfall depths used for curve fitting. Table 2-1 presents the ECCC depths and the interpolated/ extrapolated values.

Table 2-1: Mayo Airport Rainfall Depth (mm) for the EDF and Intensity–Duration–Frequency Design Storms (2071-2100)

Duration (hour)	Source or Method	100-year (EDF, mm)	200-year (intensity–duration–frequency, mm)
1	ECCC data	25.00	28.05
2	ECCC data	26.00	28.61
4	Interpolation	31.83	35.00
6	ECCC data	33.00	35.67
8	Interpolation	37.13	40.65
12	ECCC data	39.60	42.83
24	ECCC data	50.40	55.69
48	Extrapolation	55.31	59.85
72	Extrapolation	60.53	65.32

Uniform rainfall distribution was used for the 1- and 2-hour design storms. For storms longer than 2 hours, an SCS (Soil Conservation Service) Type II distribution was adopted. SCS distributions are not intended for very short durations and can yield unrealistically high intensities for 1- to 2-hour events; therefore, uniform distribution is more appropriate for short-duration storms.

Because SCS curves were developed for the United States, and no Canada-specific distribution map is available, representative SCS curves were compared to local data to select the most appropriate shape. The curves compared were SCS Type II (western U.S., east of the Rockies, and by geography extending toward the Canadian prairies), SCS Type IA (west coast U.S. and British Columbia), and SCS Type I (Alaska). Extreme 24-hour rainfall events from the District Mill station used for comparison (descending depths) include 27.2 mm on 9 Aug 2021, 25.4 mm on 13 Feb 2021, 24.4 mm on 4 Aug 2021, 19.5 mm on 16 Aug 2013, and 13.0 mm on 18 Jan 2021. Many observed events exhibit a peak shape similar to SCS Type II, supporting the selection of SCS Type II for the design storms.

2.8 Site Seismicity

Seismicity is the occurrence or frequency of earthquakes in a region, which is measured based on seismograph recordings of naturally occurring earthquakes. Although it can be observed that seismicity in northern Canada is low, based on the observed lack of strong earthquake motions, the seismic hazard for a given site is independent of the frequency of earthquakes. Seismic hazard is defined by the magnitude and ground motion of an earthquake that is permissible at a given site for a given annual exceedance period or return period. The seismic hazard can be considered as low or moderate for the Keno Hill based on the number of seismic sources (i.e., fault zones) in the region of the site and ground conditions at the site.

3.0 DESIGN CRITERIA AND FACILITY CLASSIFICATION

3.1 Applicable Design Documents Guidelines and Standards

The following guidelines, standards, design basis, and bulletins were referenced during design:

- Guidelines for Mine Waste Management Facilities (EMR 2023);
- AKHM DSTF Phase 2 Project Design Basis (AKHM 2024b);
- Dam Safety Guidelines by the Canadian Dam Association (CDA 2013);
- Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams by the Canadian Dam Association (CDA 2019); and
- Guidelines for Mine Waste Dump and Stockpile Design by Mark Hawley and John Cunning (Hawley and Cunning 2017).

3.2 Design Classification and Criteria Selection

The P2W expansion was classified and design criteria selected consistent with the manner completed for P2E.

The 2023 EMR Guidelines require filtered tailings facilities to be classified using Table 4-1 and designed using criteria for that classification in Table 5-2.

Using Table 4-1, a classification of Class II for this facility is appropriate. The driving characteristics for this selection of Class II, as quoted from the guidelines, are:

- Presence of permafrost and ice-rich permafrost removed to thaw stable materials under critical elements of the facility; and
- Potentially acid-generating (PAG) waste materials present but PAG materials are stored in-pit storage or unlikely to be mobilized in the event of a perimeter containment failure.

Other characteristics outlined by EMR for evaluation are generally understood to apply to a Class I facility. Therefore, the governing selection was Class II.

Based on a Class II facility, design criteria are provided in Table 5-2 of EMR's guidelines. Additionally, AKHM's design basis provides more site and facility specific design criteria that meet or exceed those provided by EMR.

Where a discrepancy was noted, the more stringent of the two was chosen. For example. Table 5-2 of EMR does not include minimum factor of safety (FoS) for post-seismic conditions, and AKHM's design basis includes a minimum FoS of 1.2, consistent with CDA guidelines.

3.3 Geotechnical Stability Criteria

EMR's Guidelines for a Class II facility provide the following geotechnical stability criteria:

- Design earthquake event for operations – 1:2,475-year event.

- Design earthquake for closure – same as operations unless long-term performance of the liner system is required to manage seepage from the facility, in which case the design event is the MCE.
  - Note, closure design and MCE evaluation will be completed under a separate scope.
- Lower bound shear strength properties including interface friction angles.
- Upper bound phreatic surfaces.
- Limit equilibrium methods of stability calculations.
- Pseudo-static calculations for earthquake design including deformation analyses.

The minimum FoS for slope stability are summarized in Table 3-1, based on the acceptance criteria available from EMR Guidelines (2023) considering a Class II facility, and AKHM's Dry Stack Tailings Disposal Facility Project Design Basis dated December 14, 2024.

Table 3-1: Minimum Factors of Safety for Slope Stability for the Phase 2 Expansion

Scenario	Factors of Safety	Source Document
Short-term static loading condition during initial construction (with no risk of breach or flow failure)	1.3	AKHM Design Basis
Long-term static loading condition (operation and after closure)	1.5	
Post-seismic	1.2	
Pseudo-static[2]	1.0	AKHM Design Basis and EMR Guidelines
Static during Operations for external slopes	1.5	EMR Guidelines[1] (Note no post-seismic requirements)
Static during closure	1.5	

Notes:
(1) Table 5-2 (EMR 2023).
(2) The design seismic event selected was a 1 in 2,475-year return period based on 2023 EMR Guidelines.

3.4 Hydrological Design Criteria

Water management design criteria provided by Table 5-2 of EMR's guidelines relevant to filtered tailings facilities includes the following inflow design flood (IDF) design events for surface water diversions:

- 1:200-year IDF for operations; and
- 1:500-year IDF for closure.

Other criteria included in EMR's Table 5-2 is primarily relevant to heap leach facilities, and not applicable to filtered tailings facilities.

AKHM's design basis provides more detail on design criteria for the management of contact and non-contact water, event critical durations, EDF, and freeboard requirements.

These design criteria as related to the overall water management improvements at the Flame and Moth area are summarized and evaluated in Flame and Moth Hydrology Evaluation and Pond Design (Tetra Tech 2025h).

4.0 PHASE 2 EXPANSION DESIGN SUMMARY

4.1 Geometry Summary

P2E DSTF was designed with 3.25H:1V tailings side slopes to 940 masl and is currently under construction. Based on improved understanding of tailings characterization data and selection of a liner system with an increased interface frictional strength, P2W DSTF was designed with nominal 3H:1V tailings side slopes to 950 masl and will be built above and southwest of P2E.

The total P2 DSTF footprint is approximately 35,000 m^2, with an estimated tailings capacity of 235,000 m^3.

P2W DSTF battery limits follow the Duncan Creek right-of-way and the limits provided by AKHM. The expansion ties into the southeastern extent of the P1 DSTF and progresses southward while widening to the east and west.

Along the western toe, a Contained Tailings Toe Structure (CTTS) has been used in lieu of a granular toe structure. The CTTS comprises of compacted filtered tailings fully encapsulated in LLDPE liner to allow for steeper sideslopes optimizing area usage and increasing tailings capacity. The liner encapsulation also protects the toe tailings against surface water and wind erosion, and seepage infiltration, improving overall long-term performance of the toe structure during operations until the final tailings shell buildout is constructed.

Refer to the appended figures, and the 95% Issued for Permitting (IFPs) drawings in Appendix E for additional information.

4.2 Geotechnical Design and Analyses

4.2.1 Tailings Parameters

For the shear strength parameters of tailings, the following sources were reviewed:

- Direct shear testing completed for the DSTF EOR laboratory testing scope (2023 to present); and
- P1 characterization program including advanced laboratory testing and sCPT data.

Select strength data are summarized in Table 4-1 below:

Table 4-1: Summary of Select Tailings Test Results

Material	Test Method	Sample, Description, or Reference	Model Friction Angle, (°)		Cohesion (kPa)	
			Peak	Residual	Peak	Residual
Tailings	Triaxial (Drained)	P1 Characterization Program (Tetra Tech 2026d)	41.8	NA	14.9	NA
	Triaxial (Undrained)		36.6	NA	21	NA
	SCPT		32 to 45	NA	NA	NA
	Direct Shear	SA02, April 22, 2025	34.2	28.7	19	0
		SA01, October 26, 2023	32.6	32.0	10.7	0.7

The EMR guidelines require use of lower-bound shear properties, therefore a peak friction angle of 32° and a residual friction angle of 28° were adopted for DSTF tailings. Within the CTTS the tailings will be placed under stricter moisture conditioning and compaction requirements and therefore were assigned a peak friction angle of 35° and residual friction angle of 30°. Cohesion results were variable and were not considered in slope stability analyses. Tetra Tech's 2024 site investigation of DSTF P1 included laboratory testing, CPT with pore-pressure dissipation, and SPT, which were also evaluated during analyses.

Additional details can be found in the 2026 Slope Stability Assessment Issued for Use memorandum.

4.2.2 Foundation Soil and Permafrost Considerations

As mentioned in Section 2.3, the Phase 2 DSTF subsurface consists of a thin organic layer over silt and sand, overlying glacial till (silt, sand, and gravel) and bedrock. Stratigraphy is similar to P1 DSTF, but Phase 2 generally has lower ground-ice and moisture, especially towards the southeast. Small ice-rich silt pockets may be present south of the P1B buttress and in the P2W laydown. However, identified thaw-unstable material will be removed during P2W foundation sub-excavation.

4.2.3 Stability Analyses

The location and geometry of the updated DSTF P2 (P2E and P2W), and the five representative typical sections used for slope stability assessment can be found in the 2026 Slope Stability Assessment Issued for Use memorandum.

The critical cross-sections for analyses were selected based on:

- Location relative to existing downstream infrastructure;
- Final height of tailings placement; and
- Existing topographic grades (as-built survey data).

The DSTF P2W design proposed the following modifications relative to the P2E design:

- The P2W final tailings slopes are 3H:1V, and the final exposed P2E tailings slopes on the south and east faces are 3.25H:1V and were selected for stability and closure requirements;
- Increase the stack height to elevation 950 m (i.e., maximum geometric limits allowing for a minimum crest width of approximately 20 m);
- Partial removal of the P2E toe buttress and P1B stabilization berm, including sub-excavation at a slope of 3H:1V. This allows for generation of borrow material, as well as an increase to tailings capacity;
- Replacement of a portion of the geosynthetic clay liner (GCL) with an 80 mil textured linear low-density polyethylene (LLDPE) to optimize geometry while achieving minimum required FoS; and
- Construct a CTTS downstream of the west and south slopes with 2.5H:1V slopes on both the upstream and downstream faces. This structure will be wrapped by LLDPE and form the facility perimeter allowing for management and conveyance of contact water runoff.

Surface topography information was interpreted from snow free Propeller survey exports and as-built surveys during the P2E construction activities. P2W geometry is based on current 95% design models. The geometry and configuration of the selected five critical cross-sections are presented in the 2026 Slope Stability Assessment Issued for Use memorandum.

Three cases were analyzed under several loading conditions, including short-term (construction and operation) in static loading condition, and long-term (operation and closure) in static, pseudo-static, and post-seismic loading conditions. These three cases are explained as follows:

- Case One – **Partially Thawed** – to model the short-term stability assuming that excess pore water pressure generation associated with permafrost thawing occurs. Note with the removal of ice rich materials, the likelihood of this case influencing global stability is remote.
- Case Two – **Fully Thawed** – to model the long-term stability assuming that permafrost is fully thawed.
- Case Three – **Failure along the Liner Interface** – to evaluate translational failure along the liner interface.

Table 4-2 presents the geotechnical design parameters (peak shear strength) used for slope stability analyses under static and seismic loading conditions. Table 4-3 presents the geotechnical design parameters (residual shear strength) used for slope stability analyses under post-seismic loading conditions. Values assigned to each material unit are based on laboratory testing, review of pertinent literature, and engineering judgement.

Table 4-2: Geotechnical Design Parameters for Slope Stability for Static and Seismic Conditions

Material	Unit Weight, γ (kN/m^3)	Model Friction Angle, φ (°)	Cohesion, c_u (kPa)
Bedrock[1]	25.0	-	-
Frozen Ice-Poor Silt Till[2]	17.0	36	0
Thawed Silt Till[2]	19.1	36	0
DSTF Tailings	22.5	32	0
Contained Tailings (toe structure)	22.5	35	0
Drainage Blanket Gravel	22.5	35	0
Buttress Gravel/Cover	22.5	35	0
5 mm Bedding Material and LLDPE Liner Interface[3]	16.0	32	13
Non-woven Geotextile and Geonet Interface[4]	16.0	20	0

Notes:
(1) Bedrock was considered impenetrable.
(2) Adopted from direct shear tests conducted on foundation till in the Flame and Moth Waste Rock Storage Area (WRSA). Unit weights for the ice-poor till were adjusted based on ground ice content, as ground ice results in lower unit weights. Note ice rich soils are expected to be removed during P2W foundation preparation.
(3) Appendix D. Interface between 5 mm Bedding Material and LLDPE Liner.
(4) Appendix D. The most critical peak strength parameter of liner system is derived from the interface strength between the non-woven geotextile and geonet.
Table adopted from *2026 Slope Stability Assessment Issued for Use Memorandum* (Tetra Tech 2026e).

Table 4-3: Material Properties for Slope Stability Analysis – Post-Seismic Conditions

Material	Unit Weight, γ (kN/m³)	Friction Angle, φ (°)	Cohesion, c (kPa)
Bedrock[1]	25	-	0
Frozen Ice-Poor Silt Till[2]	17	32	0
Thawed Silt Till[2]	19.1	32	0
DSTF Tailings[3]	22.5	28	0
Contained Tailings (toe structure) [3]	22.5	30	0
Drainage Blanket Gravel	22.5	35	0
Buttress Gravel/Cover	22.5	35	0
5 mm Bedding Material and LLDPE Liner Interface[4]	16.0	26.6	0
Drainage Blanket Material and GCL Liner Interface[5]	16.0	3	18

Notes:
(1) Bedrock was considered impenetrable and did not have an effective friction angle.
(2) Adopted from direct shear tests conducted on foundation till in the Flame and Moth WRSA. Unit weights for the ice-poor till were adjusted based on ground ice content, as ground ice results in lower unit weights.
(3) See Section 4.2.1.
(4) Appendix D. For the residual strength parameters, it was assumed that textured LLDPE materials are predominantly frictional.
(5) Appendix D. The most critical residual strength parameter of liner system is the interface strength between the GCL and the drainage blanket material.
Table adopted from *2026 Slope Stability Assessment Issued for Use Memorandum* (Tetra Tech 2026e).

Additional analyses completed evaluated sensitivity to phreatic surface elevations, final slope configurations, and interim stability during construction. Slope stability analyses completed on P2W – including the overall P2 buildout, have been summarized in 2026 Slope Stability Assessment Issued for Use memorandum. All sections meet or exceed the acceptance criteria under the evaluated loading conditions and failure mechanisms.

4.2.4 Seismic Design Parameters and Seismic Displacement

Based on the determined ground conditions, the site classification for seismic responses is “Class D.” The Peak Ground Acceleration (PGA) for a reference “Class D” site, corresponding to various Annual Exceedance Probabilities (AEP), was estimated to be 0.278 (1 in 2,475-year return period) based on the sixth-generation seismic hazard model (C6SHM) used in the 2020 edition of the National Building Code of Canada (NBCC) (NRC 2022).

However, considering a boundary issue in this model related to the Alaska Coastal areal source which allows synthetic ruptures to propagate inland in a way that is not considered physically relevant, and given that the NRC plans to address this issue in a future generation of its seismic hazard model, Tetra Tech reassessed the seismic hazard deaggregation values using an amended model referred to as C6.1SHM. A PGA of 0.248 g was obtained for a 'Class D' site under a 1 in 2,475-year return period and is used for analysis.

A summary of the hazard model selected for design is listed in Table 4-4 below.

Table 4-4: Summary of Design Seismic Hazard Model

Hazard Model	Site Class	Return Period	PGA
C6.1SHM	D	1 in 2,475	0.248

Source: NRC 2022

Seismic displacement was estimated using the methods of Bray and Macedo (2019) for shallow crustal earthquakes, using a yield coefficient derived limit equilibrium analysis using peak parameters. Under the design earthquake magnitude of 6.54, corresponding to the mean value from the preliminary C6.1SHM deaggregation, displacements along critical section were estimated to be approximately 1.5 cm with a probability of exceedance of 84%, 3.0 cm with a probability of exceedance of 50%, and 6.0 cm with a probability of exceedance of 16%. Considering the size of DSTF, the estimated magnitude of seismic displacement under design earthquake magnitude of 6.54 are considered acceptable.

4.2.5 Liquefaction

Tetra Tech conducted a 2024 site investigation within DSTF P1 to characterize tailings and foundation materials. The program included laboratory testing, cone penetration testing (CPT) with pore-pressure dissipation, and standard penetration tests (SPT).

Interpretation of the CPT data by Tetra Tech, with technical support from Dr. Peter K. Robertson, indicates that most tailings placed in DSTF P1 plot on the dilative side and behaved in a drained or partially drained manner during CPT soundings. Some exceptions were noted where a thin layer (or layers) with thickness typically ranging from 0.2 m to 0.5 m, and often near the liner, showed contractive behavior, possibly due to inconsistent quality control during the P1 tailings placement.

Tetra Tech understands that AKHM is implementing stricter tailings placement and QA/QC procedures for P2 DSTF compared to P1 DSTF, per the current Operations, Maintenance, and Surveillance (OMS) manual version referenced below in Section 6.0. Under the improved tailings placement, tailings placed in P2 are expected to generally display the same dilative behavior observed in the majority of P1 tailings, and it is therefore reasonable to assume that P2 tailings will exhibit a similar response.

It is recommended that as the facility approaches its final buildout during operations, a geotechnical tailings characterization program be conducted. The program should include geotechnical drilling with field logging and sampling, CPT, vane shear testing (VST), and geotechnical index testing (e.g., moisture content, Atterberg limits, particle size distribution, specific gravity, and unit weight). In addition, advanced laboratory testing should be carried out, including monotonic and cyclic direct simple shear tests (DSS and CDSS), consolidation tests, and consolidated isotropic drained and undrained triaxial compression tests (CID and CIU). The purpose of the investigation is to characterize and confirm the in-place tailings properties, informing any changes to closure design that may be required.

For additional details, refer to the *2026 Tailings and Foundation Soil Characterization Report Dry Stack Tailings Facility Phase 1 Report* (Tetra Tech 2026d).

4.2.6 Thaw Settlement Analysis

One-dimensional thaw consolidation testing was completed on select samples during the preliminary design of P1 DSTF. The analysis provided conservative, upper-bound estimates of long-term cumulative distortion from thaw of the ice-rich and ice-poor silt till and applied only to the sampled borehole. The detailed design in 2011 adopted a broader approach and identified the potential for localized differential movement and settlement beneath the DSTF.

The P2 DSTF expansion was designed with similar considerations. In P2W, ice-rich material is predominantly located beneath the CTTS based on prior geotechnical investigations. This thaw-unstable material will be removed as practical during construction. Thermal analysis indicates thaw will occur beneath the P2 DSTF footprint, but as the overall ice content is expected to be low, widespread thaw settlement is not expected to produce differential significant deformation. During the P2E design, Tetra Tech evaluated potential thaw and conventional vertical

consolidation. The results of the deformation analyses indicated a maximum vertical displacement of 153 cm and a maximum of 45 cm of thaw settlement.

A sensitivity analysis was completed to estimate liner strain if these deformations were imposed over 50 m, 20 m, and 10 m distances. The estimated strains determined were 0.08%, 0.5%, and 1.9%, respectively. All estimated strains are considered within the acceptable performance thresholds for the GCL and LLDPE liner systems. For further detail, see Tetra Tech's *Differential Settlement and Imposed Strains on GCL, Technical Memorandum*, (2024e).

4.2.7 Creep

Ice and ice-rich soils can creep over time. The magnitude of creep depends on the stresses in the ice or soils.

No massive ice was observed during the P2 geotechnical investigation. Ground ice contents, estimated visually and from sample moisture contents, are lower than those encountered in P1. Thaw-unstable materials beneath critical structures will be removed during foundation preparation.

Given these conditions, and the expectation of eventual thaw of ice-poor permafrost, creep deformation within or beneath P2 is expected to be negligible. Continued visual and survey monitoring of the DSTF during operations of the facility is recommended.

4.2.8 Thermal Analysis

Thermal analyses were previously completed for Phase 1 Pre-Construction (Tetra Tech EBA 2011), Phase 1 Post-Construction (Tetra Tech 2024ba), and Phase 2 (Tetra Tech 2024ba). Historic monthly air temperatures were obtained from Environment Canada's Mayo Station. The Phase 1 Pre-Construction analysis was conducted using GEOTHERM (Tetra Tech's proprietary two-dimensional finite element software), assuming a moderate greenhouse gas emission scenario with a 1971–2000 baseline in Zone W1 (CSA 2010). Phase 1 Post-Construction and Phase 2 analyses were performed using Temp/W in GeoStudio 2021 R2 (Seequent 2022) with CMIP6 climate scenarios SSP3-7.0 and SSP4-6.0. The thermal models were calibrated using ground temperature data from thermistors installed in boreholes within the DSTF Phase 1 and 2 footprints. Additional details are provided in Tetra Tech EBA (2011) and Tetra Tech (2024ba).

Based on updated thermal models in 2024, the thermal analysis indicates that the permafrost within the DSTF Phase 1 footprint after construction will disappear approximately in 2050 (considering a cut-off temperature -0.1°C), and the permafrost temperature within the DSTF Phase 2 footprint will be approximately at -0.1°C in 2030 and gradually warming up with time. The average permafrost temperature (Phase 2) in 2100 is -0.01°C (Tetra Tech 2024b).

No additional thermal analysis was completed for the P2W design.

4.3 Contact Water Management

4.3.1 General

The Phase 2 DSTF seepage collection system consists of a liner placed beneath the DSTF, lined perimeter diversion channels, and a conveyance system directing collected seepage (contact water) to the Mill Pond. Further details are provided in the following sections.

4.3.2 DSTF Seepage Collection System

The P2E seepage collection system beneath the DSTF comprises, from bottom to top, a 600 mm thick gravel drainage blanket, a GCL, a geonet, a non-woven geotextile, a confined gravel layer 500 mm thick, and the tailings. The P2E toe runoff collection ditch has an 8 m wide crest and 2.5H:1V sideslopes and contains a GCL lined V-notch channel to capture runoff from the DSTF and is connected to the seepage collection system beneath the DSTF. The berm is constructed of coarse bulk fill (CBF) with a drainage blanket placed between the CBF and the GCL. The collection ditch is situated on the north, east, and south sides of the P2E DSTF and generally slopes 2% around the perimeter. The diversion channel high point is located at the southeast corner of P2E, where flows split north towards the in-tailings conveyance pipe or south towards the collection system.

The P2W seepage collection system follows the same principles as the P2E system, with two key differences: a different liner system, and the use of compacted tailings in the toe structure to reduce the quantity of CBF required and to increase tailings capacity. From the flow direction split at the southeast corner, flows route north into above-tailings pipe near the P1 DSTF then discharge into a lined ditch beside the Flame and Moth portal then to Plunge Pool A, or southwest toward the P2W collection system.

The seepage collection system beneath the P2W DSTF uses an 80 mil textured LLDPE liner with a sand bedding layer directly above the liner, a gravel cover layer, and then dry stack tailings. Below the liner is a bedding layer underlain by a gravel drainage blanket (see Section 4.4 for details on the non-contact water system). The granular layers above the liner provide a permeable path for seepage to flow to the collection pipe at the system low point. The DSTF seepage collection system generally slopes toward the west after foundation preparation. To tie P2W into the existing P2E system, the P2E buttress, and a portion of its existing GCL will be removed where required. LLDPE and GCL tie-in locations will generally be completed near the western interior shear berm to maximize replacement of GCL to improve stability, recover P2E buttress material for possible reuse, and increase tailings capacity. P2E tailings rehandling is anticipated and will be sequenced for reuse in CTTS construction.

The seepage collection system under the DSTF continues up the perimeter-toe structures, referred to as the CTTS. The CTTS is trapezoidal, with variable height with 2.5H:1V sideslopes and is fully encapsulated with LLDPE liner. It is constructed from tailings that are placed, moisture-conditioned, and compacted to specified density. The CTTS has a 5 m running width at the top, surfaced with 600 mm of granular cover to accommodate light vehicle and excavator traffic. Where haul traffic is required, minimum cover thickness is 1.2 m. On the downstream face, a 500 mm thick granular cover is used for liner protection. To manage water within the CTTS, a perforated pipe surrounded by drain rock and non-woven geotextile is located at the CTTS low point to collect seepage and convey it into the 900 mm main pipe to the Mill Pond.

A perforated collection pipe embedded in drain rock and wrapped in geotextile is installed at the upstream toe outside of the CTTS to convey seepage toward the low point prior to full Phase 2 tailings configuration. After full tailings configuration build out, the tailings toe will terminate 1 m below the CTTS upstream crest to form a V-notch collection ditch. The V-notch channel will be lined and anchored into the CTTS granular surfacing material on one side, and up the slope into the tailings on the other.

At the CTTS low point, a 900 mm diameter pipe passes through the CTTS on both the upstream and downstream sides and includes a pipe riser to the crest of the CTTS to convey contact water to Plunge Pool A. A 300 mm diameter pipe runs parallel to the 900 mm pipe to convey above liner seepage directly to Plunge Pool A and includes a check valve at the discharge to minimize oxygen ingress.

The upstream inlet for both pipes is located on top of the seepage collection system and is surrounded by drain rock wrapped in geotextile. The upstream toe lateral French drain discharges into this drain rock and directs flow toward Plunge Pool A.

Before full tailings placement, the 900 mm pipe will be capped and buried with tailings and above-liner seepage will be conveyed through the 300 mm pipe directly to Plunge Pool A. Both pipes are provided to keep surface runoff contact water collected by the 900 mm system separate from above-liner contact water seepage for testing and monitoring.

At final tailings configuration, the tailings will locally steepen to 2H:1V to form an in-tailings sump that connects the perimeter diversion channels. Diversion ditch grades vary from 2% to 12%. The in-tailings sump is lined and has a storage capacity of 27 m^3. It is sized to withstand a 1:75-year EDF event. The sump contains a 900 mm slotted vertical pipe riser above the liner that ties into the horizontal CTTS pipe to convey overflow to Plunge Pool A.

The northern CTTS abuts the slope east of the Flame and Moth underground portal and west of the P1B buttress. At each abutment the CTTS terminates and transitions to CBF before tying into the abutment slopes. At this transition the seepage collection system is confined to the upstream face of the CBF berm to maintain upstream containment. The liner then runs up the slope of the P1B buttress and ties into the P1 DSTF GCL to form a fully contained system. The east abutment into the existing P2E diversion channel is similar in that CTTS transitions to CBF with the liner along the upstream face, and the liner ties into the upstream GCL of P2E to maintain containment.

4.3.3 Plunge Pool A to Plunge Pool B

Plunge Pool A is a lined sump that collects contact and non-contact water and allows for sampling of each prior to mixing. Plunge Pool A connects to a lined channel above the sump base that conveys flow to Plunge Pool B. Plunge Pool B is a lined sump with a 900 mm outlet pipe that discharges to previously constructed Manholes A and B and then to the Mill Pond. The 900 mm outlet is set 300 mm above the sump bottom to facilitate sediment cleanout. Minimum pond depth is 1 m. Dimensions for Plunge Pool A and Plunge Pool B will be finalized in the Issued for Construction (IFC) package.

4.3.4 Mill Pond Expansion

Prior to the 2025 water management improvements, the pond area was 30 m by 75 m with a crest-to-bottom depth of 4.3 m and a capacity of 5,242 m^3. Side slopes vary between 2.5H:1V and 3H:1V. The pond liner is 60 mil HDPE anchored at the crest.

Following construction, the pond was expanded to the west and the crest elevation was raised. The new area is 100 m by 40 m and a spillway was constructed to convey flows from Mill Pond to Flame and Moth Pond. The top of containment is 898.07 m and the spillway invert elevation is 897.70 m. Capacity to the spillway sill is 8,804 m^3. The spillway sill was set to contain 50-year EDF volumes and to pass overflow to the Flame and Moth Pond at the IDF-200-year event.

Additional details can be found in the *Flame and Moth Hydrology Evaluation and Pond Design* (Tetra Tech 2025h) report.

4.3.5 Flame and Moth Pond Infrastructure

Flame and Moth Pond was not raised during the 2025 water-management improvements, as capacity increases were not necessary. A 600 mm diameter HDPE pipe riser overflow spillway was installed on the western sideslope with an invert elevation of 896.07 m, approximately 0.4 m below the pond crest at 896.50 m. The riser tee lower section was capped and ballasted with concrete, and the pipe is trenched westward through the CLR then along a pipe bench to discharge to original ground approximately 150 m west of the pond.

Under the current arrangement, the Flame and Moth Pond does not need to be expanded. The pipe riser overflow is designed to spill any additional volume apart from the IDF. Additional details can be found in the *Flame and Moth Hydrology Evaluation and Pond Design* (Tetra Tech 2025h) report.

4.3.6 Phase 1 Sump and Conveyance Infrastructure

Prior to the 2025 water management improvements, the P1 sump measured 15 m by 5 m, with a crest-to-bottom depth of approximately 1 m. Side slopes vary between 1.3H:1V and 1.5H:1V. The sump liner was laid flat at the crests. A GCL channel routed around the P1 DSTF perimeter conveyed contact water runoff to the sump. Additionally, a 200 mm diameter HDPE pipe conveys flow from the south side of the P1 DSTF into the sump. An outlet pipe on the northwest side of the sump runs west of the Engineering Offices, through the CLR, along the west side of the substation, and discharges to the Mill Pond.

After the improvements, the sump measures 30 m by 9 m, with a crest-to-bottom depth of 2.2 m and 1.9H:1V to 2.1H:1V side slopes. The sump was relocated to the northwest side of the site Engineering Offices. The sump and channel liner is LLDPE, anchored at the crest with granular fill. The LLDPE channel connects to the original GCL about 70 m upstream of the original sump location. The original channel and sump footprint was filled with granular material and graded toward the new channel and sump. The original 200 mm diameter HDPE pipe from the P1 DSTF was extended and discharges into the new channel. Two corrugated HDPE pipes from the Process Mill Loadout area were extended and now discharge into the sump. A 750 mm outlet pipe was installed at the sump base, runs southwest, and is trenched through the CLR to the Mill Pond.

4.4 Non-Contact Water Management

Beneath the seepage collection liner described in Section 4.3.2, the non-contact collection system comprises a bedding layer over a gravel drainage blanket and the sub-excavation surface. The granular layers below the liner provide a permeable path that directs seepage to the collection pipe at the system low point. This system replicates the system constructed for P2E. The P2E system will remain in place during P2W construction and will discharge to the P2W system.

After foundation preparation, the sub-excavated surface generally slopes west. French drains are to be installed to convey non-contact seepage toward the system low point. Drain locations will be assessed after foundation preparation. Each French drain is about 1.5 m wide and 0.6 m deep, consists of free-draining coarse rock fill with a perforated pipe, and is wrapped in geotextile prior to placement of the overlying granular layers.

The French drain network under the P2W DSTF has a dendritic layout and discharges to a HDPE manhole downstream of the CTTS and discharges through a buried pipe across the laydown and into Plunge Pool A where contact and non-contact flows combine, eventually conveyed to the Mill Pond.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 General

Construction of the P2W DSTF will follow the Construction Specifications and Construction Drawings. These documents were issued to AKHM as a separate package accompanying this report. The Construction Specifications and Construction Drawings are the governing documents for tendering, construction planning, supervision, construction management, and execution of P2W DSTF.

The Construction Specifications describe foundation preparation, granular fill materials and placement, liner and pipe installation, and the quality assurance program. The selected contractor is expected to prepare a construction plan and an inspection and test plan (ITP). The construction plan should meet the requirements presented in the detailed Construction Specifications and Construction Drawings.

5.2 Materials

The P2W DSTF will be constructed using the material types shown on the Construction Drawings. Brief descriptions of each material are briefly described below. Layout and geometry are shown on the Construction Drawings, and material properties and installation procedures are provided in the Construction Specifications. The material types are as follows:

- Dry Stack Tailings material: Tailings from the dry stack or produced from the Mill specified for constructing the CTTS.
- 5 mm minus granular material: Well-graded fill specified for use as bedding material beneath and/or above the LLDPE liner.
- 20 mm minus granular material: Well graded fill specified for use as structural backfill around pipes. It may also be used for other engineered fill applications as required by the design or site conditions.
- 50 mm minus: Well graded fill specified for use as pipe bedding, pipe cover, and surfacing material. It may also be used for other engineered fill applications as required by the design or site conditions.
- 50 mm to 100 mm drain rock: Clean, coarse rock specified for use in the underliner French drain. May also be used in other areas requiring free drainage.
- 150 mm to 300 mm oversize rock: Clean oversize rock specified for use as riprap within select ditches.
- Coarse Bulk Fill: Well-graded 500 mm minus material sourced from nearby borrows. CBF is intended for structural fill and general earthworks where specified.
- LLDPE: 80 mil textured LLDPE liner specified for use in the seepage collection system and the CTTS.
- Geotextile: 16-oz nonwoven geotextile specified for use around drain rock in the French drain. May also be used in other locations requiring separation, filtration, or foundation stabilization as called for by the design or site conditions.
- Various diameters of HDPE pipe will be supplied in solid and perforated types with dimension ratio (DR) DR11 and DR17. Other supporting infrastructure includes HDPE manholes and check valves.

5.3 Foundation Preparation

Removal of uncontrolled fill and sub-excavation to thaw-stable material will occur during foundation preparation. Loose fill and unsuitable soils will be removed to provide a relatively smooth sub-excavation base. After foundation preparation is complete, a survey will be conducted to identify any required field adjustments.

Surface runoff may be encountered during foundation preparation. Any inflow to the excavation should be managed with temporary sumps and pumps to maintain a workable area.

6.0 OPERATION, MAINTENANCE, AND SURVEILLANCE

6.1 OMS Manual

An OMS manual for the P2 DSTF defines the procedures, responsibilities, and performance criteria needed to manage the facility for the duration of its operation. The OMS manual translates the design into field procedures for operating, maintaining, and monitoring the facility, and direct daily activities and support assessment of performance. The OMS also provides thresholds for trigger action and response planning (TARP) as well as emergency preparedness and response procedures specific to DSTF.

It is expected that the OMS manual will be updated as required and reviewed for necessary updates at least annually. The updating of the OMS is the responsibility of AKHM, with Tetra Tech providing input.

OMS activities are to follow the latest approved OMS manual (Rev 3, dated June 2025).

6.2 Instrumentation and Monitoring

The Instrumentation and Monitoring Plan (IMP) defines the objectives, instrumentation, locations, and procedures for the DSTF. The OMS manual (Rev 3, dated June 2025) includes the current version of the IMP, with specific requirements related to DSTF P2E. An updated IMP will be submitted under a separate cover to include P2W instrumentation and monitoring requirements to be incorporated into the OMS. The instrumentation for P2W will be at least consistent with that in the current facility (i.e., vibrating wire piezometers (VWPs), ground temperature cables (GTCs), slope inclinometers (Sis), and survey monuments).

AKHM and site staff are expected to perform routine visual inspections. Inspections by the Engineer of Record will be completed at frequencies described in the OMS manual. Readings should be collected by AKHM from existing ground temperature cables on at least a monthly basis, or as directed by Tetra Tech.

AKHM is responsible for implementing the IMP as well as completing any necessary maintenance or adjustments to instruments as required. AKHM is expected to collect or coordinate collection of instrumentation data and Tetra Tech will perform quality assurance checks at the frequencies noted in the OMS manual. Tailings placement record surveys shall follow the schedule in the OMS manual.

7.0 CLOSURE CONSIDERATIONS

Previous design submissions have assumed a closure concept consisting of a 0.5 m thick evapotranspirative cover of loosely placed granular and organic material placed over the compacted tailings surface to temporarily store runoff and allow it to evaporate or to be used by vegetation. After the final tailings geometry is established, placement of the cover should occur as soon as practicable to reduce erosion and windblown tailings.

Tetra Tech understands closure design considerations such as cover requirements, final geometry, and water management are under review and a final closure plan is anticipated to be advanced in 2026-2027.

The in-tailings sump, diversion berms, and ditches are assumed to be left in place, and the berms and toe structure will continue to divert runoff away from the DSTF footprint. Tetra Tech understands the footprint will be revegetated to support evapotranspiration processes. If an open channel option is preferred, the CTTS can be “breached” and allow open channel flow in lieu of using buried pipe for closure.

An annual geotechnical inspection is required for at least five years after closure. The need for continued inspections and their frequency will be reviewed after the initial five-year period.

8.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



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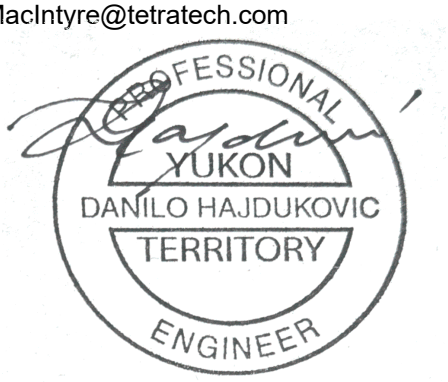

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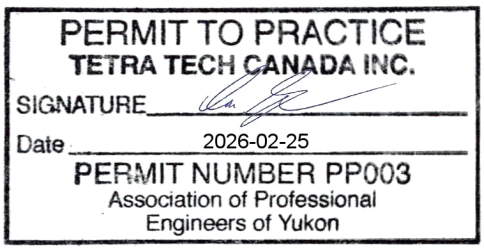

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Tetra Tech, 2025a. Liner Type Change Evaluation (DT411012) Phase 2 West, Dry Stack Tailings Facility, Keno Hill Mine, YT. Tetra Tech File No. 704-ENG.WARC04673-04 dated February 3, 2025.

Tetra Tech, 2025b. Hydrotechnical Assessment (DT411013) Phase 2 West, Dry Stack Tailings Facility, Keno Hill Mine, YT. Tetra Tech File No. 704-ENG.WARC04673-04 dated February 21, 2025.

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Tetra Tech, 2025d. 2024 Site Investigation Program Instrumentation Summary, DSTF Phase 1 – Keno Hill Mine, YT. Tetra Tech File No. 704-ENG.WARC04673-02 dated March 4, 2025.

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Tetra Tech, 2025f. Instrumentation Data Collection Guide DSTF Phase 1 and Phase 2 East, Keno Hill Mine, Yukon. Tetra Tech File No. 704-ENG.WARC04673-05.002 (Issued for Review) dated April 3, 2025.

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Tetra Tech, 2026b. Phase 2 West Water Management Improvements Construction Record Report, Keno Hill District Mine, YT. Tetra Tech File No. 704-ENG.WARC04673-11 dated January 30, 2026.

Tetra Tech, 2026c. Site Investigation Factual Data Report Dry Stack Tailings Facility Phase 1 Keno Hill Silver District, Yukon File No. 704-ENG.WARC04673-02 dated February 13, 2026.

Tetra Tech, 2026d. Tailings and Foundation Soil Characterization Report Dry Stack Tailings Facility Phase 1, Alexco Keno Hill Mine, Yukon. File No. 704-ENG.WARC04673-02 dated February 18, 2026.

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Tetra Tech, 2026f. Phase 2 West 95% Drawing Package, Keno Hill District Mine, YT. Tetra Tech File No. 704-ENG.WARC04673-04 dated February 20, 2026.

Tetra Tech, 2026g. Technical Construction Specifications, Phase 2 West Dry Stack Tailings Facility Project, Keno Hill Mine, YT. Tetra Tech File No. 704-ENG.WARC04673-04, Issued for Permitting, dated February 25, 2026.

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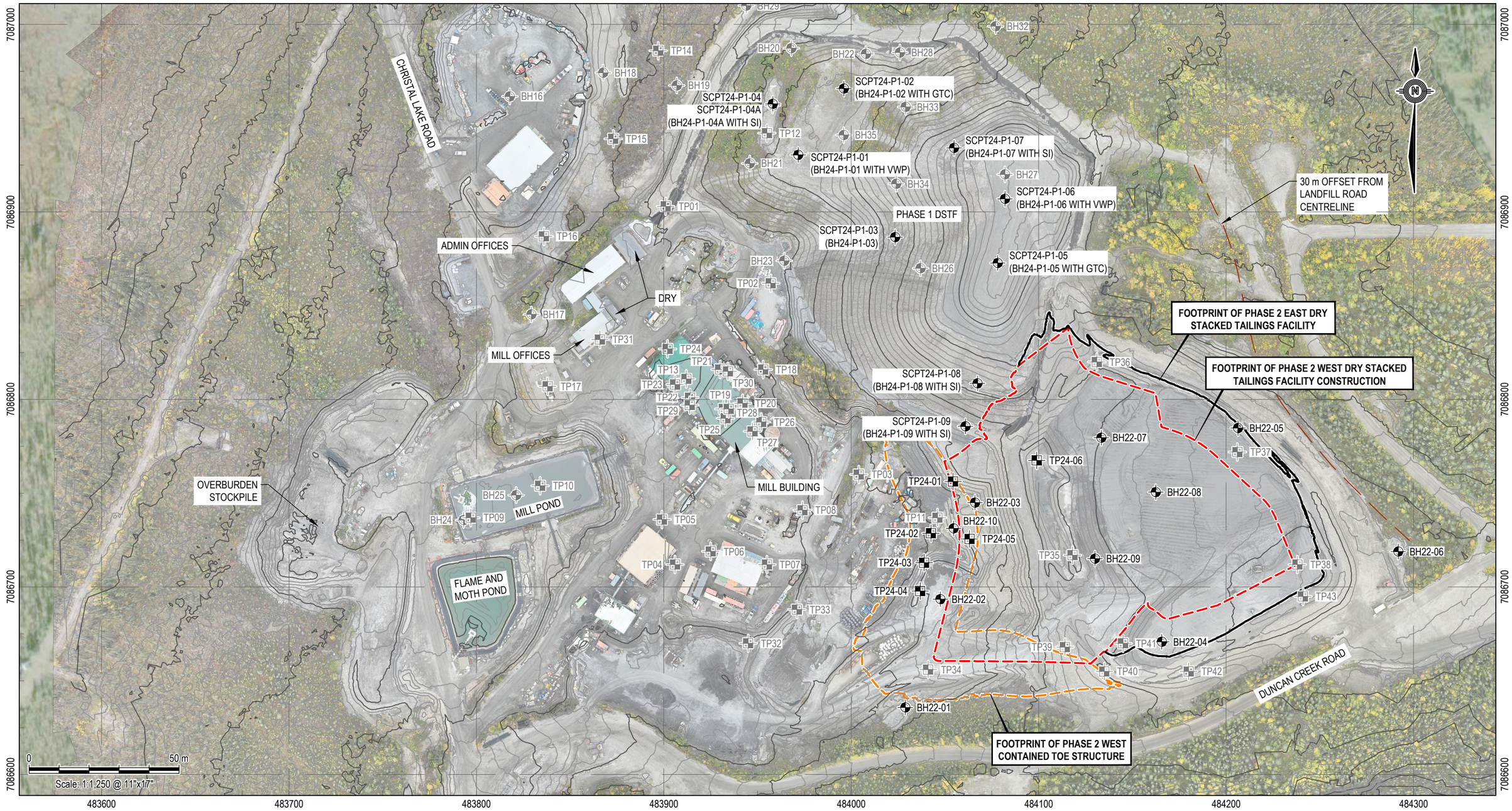
FIGURES

Figure 1 Borehole and Testpit Locations
Figure 2 Phase 2 West DSTF Final Tailings Configuration
Figure 3 Phase 2 West DSTF Final Tailings Configuration Cross-Sections



NOTES:
1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. DRONE IMAGERY AND LiDAR COLLECTED BY ALEXCO KENO HILL MINING, DATED SEPTEMBER 7, 2025.

CLIENT

Hecla MINING COMPANY

TETRA TECH

DRY STACKED TAILINGS FACILITY PHASE 2 DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

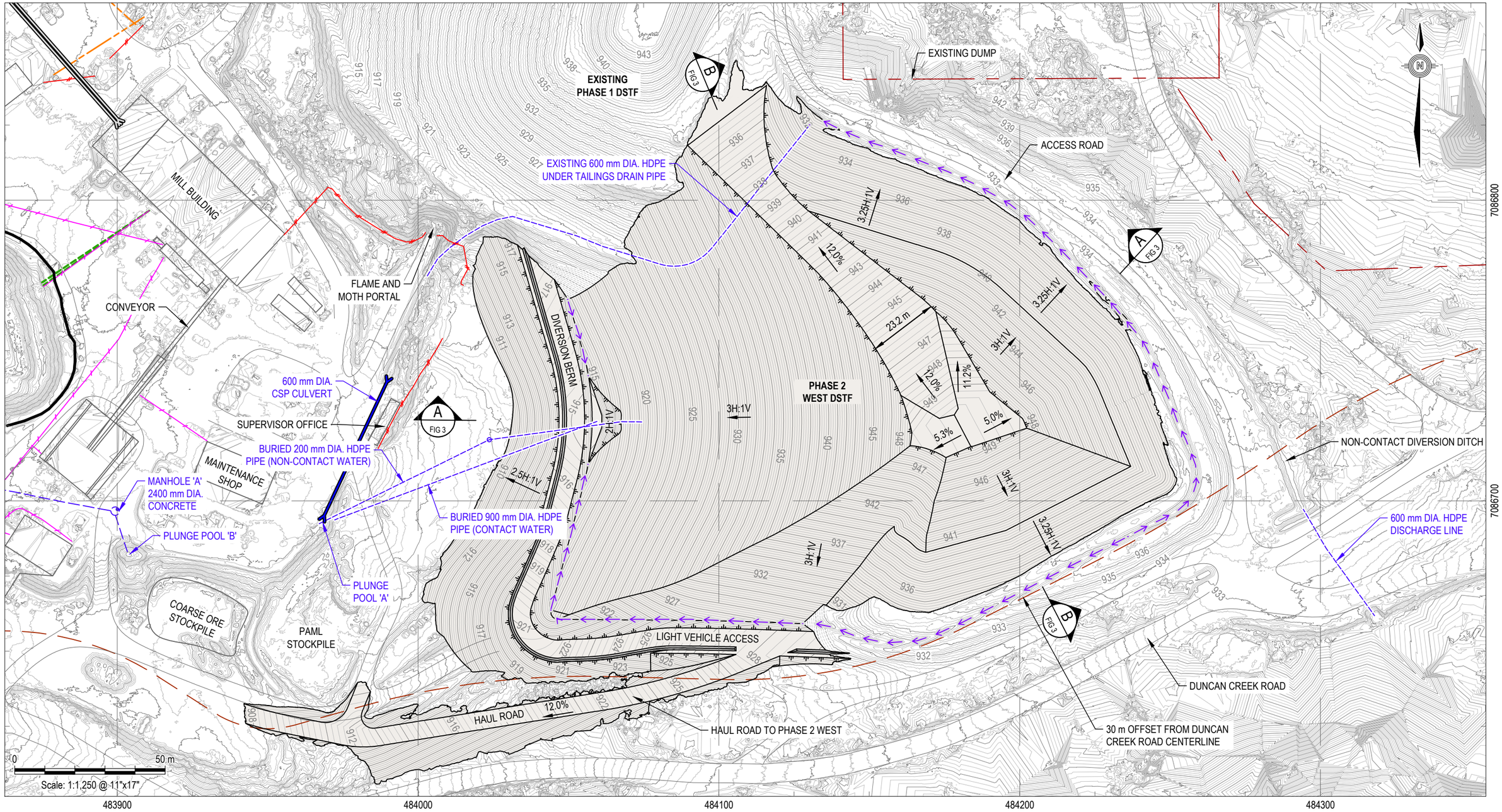
BOREHOLE AND TESTPIT LOCATIONS

PROJECT NO.	DWN	CKD	REV
ENG.WARC04673-02	EL	ME	A

OFFICE	DATE
EDMONTON	FEBRUARY 6, 2026

FIGURE 1

C:\Users\mark.estrada\Tetra Tech, Inc\HECLA - Keno Hill Elsa - Documents\AKHM_Ops\WARC04673-04 DSTF P2W\CAD\Production Drawings\Design Summary Report\ENG.WARC04673-02_Figure 1.dwg [FIGURE 1] February 09, 2026 - 10:04:49 am (BY: ESTRADA, MARK)



LEGEND

- EXISTING ABOVE GROUND POWER LINE
- EXISTING UNDER GROUND POWER LINE
- INSTALLED PHASE 2 WEST CONVEYANCE PIPES
- CONTACT WATER RUNOFF

NOTES:

1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
3. CONTOUR INTERVALS: 1 m INDEX; 0.25 m INTERMEDIATE.
4. PHASE 2 EAST AS-BUILT DATA PROVIDED BY AKHM AND / OR EXTRACTED FROM PROPELLER.
5. POWER LINE AND EXISTING WATER LINE UTILITY LINEWORK EXTRACTED FROM PROPELLER; PROVIDED BY AKHM.
6. ELECTRICAL CABLES ARE INFERRED FROM PROPELLER IMAGE DATED SEPTEMBER 7, 2025 AND NEED TO BE CONFIRMED IN THE FIELD.
7. DRAWING MUST BE VIEWED IN COLOR.

0 100m

Scale: 1:2,000 @ 11"x17"

CLIENT

Hecla MINING COMPANY

TETRA TECH

DRY STACKED TAILINGS FACILITY PHASE 2 DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
FINAL TAILINGS CONFIGURATION

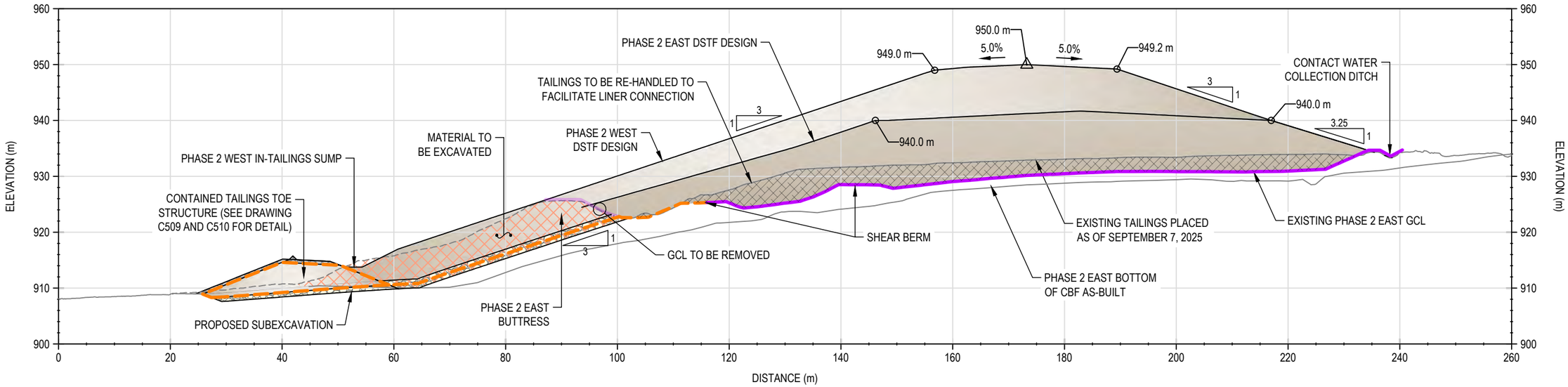
PROJECT NO.	DWN	CKD	REV
ENG.WARC04673-02	EL	ME	A

OFFICE: EDMONTON

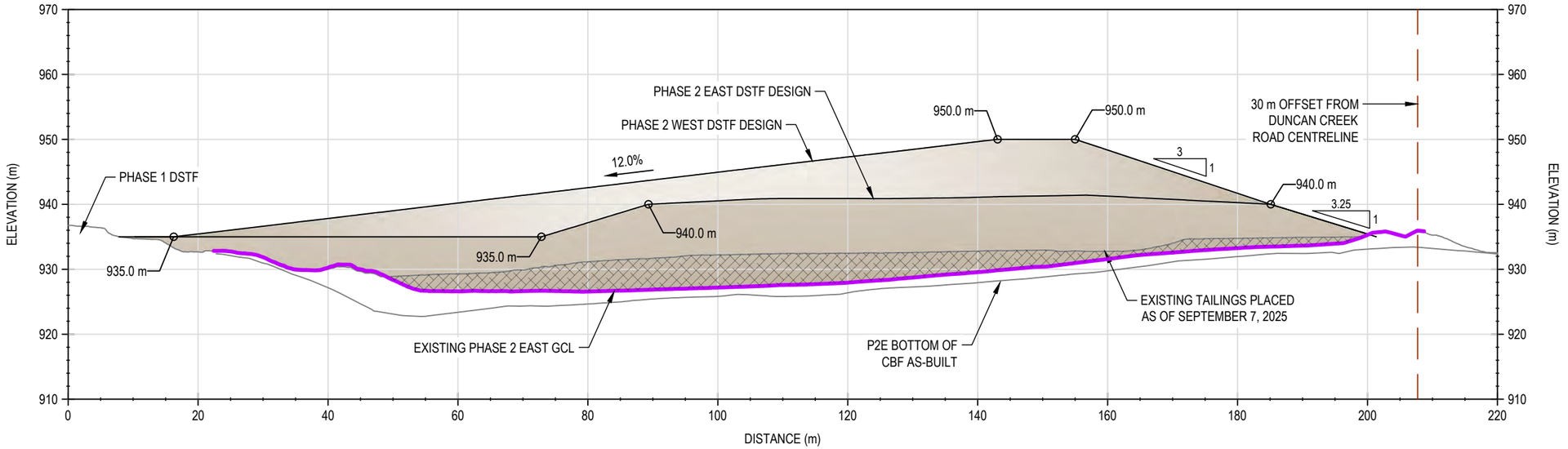
DATE: FEBRUARY 6, 2026

FIGURE 2

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\Design Summary Report\ENG.WARC04673-02_Figure 2-3.dwg [FIGURE 2] February 06, 2026 - 2:42:09 pm (BY: LEE, ELVIN)



A CROSS-SECTION
FIG 2 SCALE: 1:1000



B CROSS-SECTION
FIG 2 SCALE: 1:1000

NOTES:
1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. DRONE IMAGERY AND LiDAR COLLECTED BY ALEXCO KENO HILL MINING, DATED SEPTEMBER 7, 2025.

0 100m
Scale: 1:2,000 @ 11"x17"

CLIENT
Hecla MINING COMPANY

TETRA TECH

DRY STACKED TAILINGS FACILITY PHASE 2 DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
FINAL TAILINGS CONFIGURATION
CROSS-SECTIONS

PROJECT NO.	DWN	CKD	REV
ENG.WARC04673-02	EL	ME	A
OFFICE: EDMONTON	DATE: FEBRUARY 6, 2026		

FIGURE 3

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\Design Summary Report\ENG.WARC04673-02_Figure 2-3.dwg [FIGURE 3] February 06, 2026 - 2:42:15 pm (BY: LEE, ELVIN)

APPENDIX A

TETRA TECH'S LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B

BOREHOLE LOGS AND LABORATORY TESTING RESULTS

Borehole No: **BH22-01**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 917.7 m
Yukon	UTM: 484024.9195 E; 7086634.494 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	Elevation (m)
0													
1	Sonic	SAND AND GRAVEL (PAD FILL) - some silt, gravel to 300 mm diameter, wet, grey, (300 mm thick)	Unfrozen		SA11					20.1			917
		ORGANICS - (75 mm thick)											
2		SILT - some gravel, trace sand, wet, brown, organic inclusions, (225 mm thick)	Frozen, Vs, Vr 10%		SA12					14.1			916
		SAND AND GRAVEL - silty, wet, brown											
3		SILT (TILL) - some gravel, trace to some sand, wet, brown											915
4		- large boulder, SA13 has low moisture due to sample containing only rock			SA13					1			914
5		SILT AND SAND (TILL) - gravelly, gravel to 75 mm diameter, wet, brown			SA14					12.4			913
6			Vs		SA15					28.6			912
7					SA16					5.9			911
8					SA17	29	35	36		7.4			910
9													909
10		SILT (TILL) - trace sand, grave gravel, wet, brown	Nbn		SA18					23.5			908
11		SAND AND GRAVEL - silty, gravel to 75 mm diameter, wet, brown	Unfrozen		SA19					5.9			907
12													906
13		BEDROCK - dark grey, white streaks			SA20					0.4			905
14		- reddish grey			SA21					3.7			904
15													903
16		END OF BOREHOLE (15.2 metres) 25 mm PVC installed to 15.2 metres Ground temperature cable installed inside PVC pipe to 14.50 metres Note: Target depth reached											902
17													901
18													900
19													899
20													898

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 15.2 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 27
Logged By: JS	Completion Date: 2022 September 27
Reviewed By: IM	Page 1 of 1

Borehole No: **BH22-02**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 915.6 m
Yukon	UTM: 484047.3037 E; 7086693.741 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0	Sonic	SAND AND GRAVEL (FILL) - silty, moist, grey	Unfrozen		SA22	54	40	6		12.7		915
1												
		ORGANICS - (100 mm thick)										914
2		SILT (TILL) - some sand, some gravel, wet, brown, organic inclusions	Frozen, N/Nf		SA23					18.9		913
3		- no visible organics										
			Unfrozen									912
4					SA24					10.7		
			Frozen, Nf		SA25					17.4		911
5		GRAVEL - sandy, silty, gravel to 50 mm diameter, very wet, greyish brown	Unfrozen		SA26					10.1		
					SA27					6.2		910
6			Frozen, Nbe/Nbn									
					SA28					23.8		909
7		SILT (TILL) - some sand to sandy, some gravel, wet, brown										
												908
8		- trace gravel, trace sand	Nbn		SA29	0	6	94		26		
9												907
					SA30					21.8		
10												906
			Nbn/Nf									
11		- some gravel to gravelly			SA31					15.4		905
12												
			Unfrozen									904
13					SA32					9.3		
												903
14		- trace to some gravel, moist to wet, dense										
					SA33					12.2		902
15												
		- sandy, trace cobbles, moist										901
16					SA34	8	33	59		10.3		
												900
17												
					SA35					11.2		899
18		- gravelly seam										
												898
19					SA36					13.9		
		- large cobble										897
20												
												896

Contractor: Boart Longyear	Completion Depth: 30.5 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 28
Logged By: JS	Completion Date: 2022 September 28
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-02**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 915.6 m
Yukon	UTM: 484047.3037 E; 7086693.741 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
20												
	Sonic	SAND AND GRAVEL - silty, fine to coarse grained sand, subrounded to subangular gravel to 75 mm diameter, dry to damp, light brown			SA37					1.1		895
21												
		SILT (TILL) - gravelly, some sand, subrounded to subangular gravel to 100 mm diameter, dry to damp, loose, light brownish grey			SA38					1.5		894
22												
23												893
					SA39					5.5		892
24		- sandy										
		- gravelly layer, trace sand			SA40					8.5		891
25		- large cobble										
												890
26		GRAVEL - sandy, silty, fine to coarse grained sand, large cobble, subrounded to subangular gravel to 100 mm diameter, moist, brown			SA41					3.7		889
27												
		- some silt										888
28		- gravel to 75 mm diameter			SA42	58	30	12		3.6		887
29		- damp, brown grey										
					SA43					1.6		886
30												
		END OF BOREHOLE (30.5 metres) Note: Target depth reached										885
31												
32												884
33												883
34												882
35												881
36												880
37												879
38												878
39												877
40												876

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 30.5 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 28
Logged By: JS	Completion Date: 2022 September 28
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-03**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 919.6 m
Yukon	UTM: 484066.38 E; 7086745.73 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Particle Size Distribution: Sand (%)	Particle Size Distribution: Silt & Clay (%): Silt (%)	Particle Size Distribution: Silt & Clay (%): Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0												
0	Sonic	SAND (FILL) - gravelly, silty, subangular to angular gravel to 30 mm diameter, moist, grey	Unfrozen		SA44					13.2		919
1												
2					SA45					4		918
3		GRAVEL (FILL) - sandy, silty, very wet, dark grey, wood and metal inclusions										
4					SA46					12.3		917
5		SILT (TILL) - trace gravel, trace sand, wet, dark brown, organic inclusions	Frozen, Nbn/Nf		SA47					70.8		916
6		- sandy, some gravel	Vr 40%									915
7					SA48					58.6		914
8					SA49					30.8		913
9		- trace sand, trace gravel	Vx, Vr 30%		SA50					14.3		912
10		- gravel to 25 mm diameter	Nb/Nf		SA51					21.5		911
11		- sandy			SA52					13.3		910
12					SA53	19	37	44		12.7		909
13			Nbn		SA54					27.4		908
14		- some sand to sandy, some gravel, some cobbles, moist	Unfrozen		SA55					9.8		907
15												906
16		- some sand to sandy			SA56					10.8		905
17												904
18					SA57					9.7		903
19		END OF BOREHOLE (18.3 metres) Note: Stopped due to refusal Core barrel fell off										902
20												901
												900

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 18.3 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 28
Logged By: JS	Completion Date: 2022 September 29
Reviewed By: IM	Page 1 of 1

NORTHERN ZONE8.GPJ EBA.GDT 23-6-15

Borehole No: **BH22-04**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 930.8 m
Yukon	UTM: 484165.2557 E; 7086670.469 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0		SAND AND GRAVEL (PAD FILL) - silty, moist, grey	Unfrozen									
		ORGANICS - (50 mm thick)										
1		SILT - sandy, trace gravel, moist, brown, organic inclusions, (250 mm thick)			SA58					5.1		930
		SILT - sandy, some gravel, wet, greyish brown										
2		SAND - gravelly, some silt, fine to coarse grained sand, subrounded to subangular gravel to 50 mm diameter, moist, brown, organic inclusions			SA59					10.2		929
3		- silty, some gravel, finer grained sand, wet										928
		- trace gravel										
4		- gravelly, some silt, well graded, damp to moist			SA60					2.7		927
		- trace gravel										
5		- gravelly			SA61					7.9		926
6		- 300 mm thick gravel seam										925
		- silty, some gravel										
7		- gravelly, some silt			SA62	58	33	9		2.4		924
8					SA63					4		923
9												922
	Sonic	SILT - sandy, some gravel, wet, greyish brown			SA64					10.5		
10		SAND - gravelly, some silt, fine to coarse grained sand, subrounded to subangular gravel to 50 mm diameter, damp, brown										921
11		- trace silt			SA65					2.2		920
12		- silty, some gravel, gravel to 100 mm diameter, moist, brown										919
13					SA66					7.6		918
14		- gravelly, some silt, damp										917
		- no visible gravel			SA67					7.6		
		- some silt to silty										
15		- silty, trace to some gravel										916
16		- gravelly, some silt			SA68					10.9		915
17		- silty, trace to some gravel			SA69					11.8		914
18												913
		- gravelly, some silt, subangular to angular gravel, wet										
19		- silty, trace gravel, grey										912
					SA70					15.3		
20												911

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 20.4 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 29
Logged By: JS	Completion Date: 2022 September 29
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-04**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 930.8 m
Yukon	UTM: 484165.2557 E; 7086670.469 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
20			Unfrozen		SA71					4.1		
		END OF BOREHOLE (20.4 metres) Note: Stopped due to refusal on suspected bedrock										
21												910
22												909
23												908
24												907
25												906
26												905
27												904
28												903
29												902
30												901
31												900
32												899
33												898
34												897
35												896
36												895
37												894
38												893
39												892
40												891

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 20.4 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 29
Logged By: JS	Completion Date: 2022 September 29
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-05**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 931.7 m
Yukon	UTM: 484206.6407 E; 7086784.693 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Elevation (m)
0	Sonic	SAND AND GRAVEL (FILL) - silty, moist, grey, (150 mm thick)	Unfrozen								
		ORGANICS - (100 mm thick)	Frozen, Vx 25%								
1		SILT AND ORGANICS - some sand, dark brown									931
2		SAND (TILL) - silty, some gravel, greyish brown			SA72					290.2	930
3		- gravelly	Vx, N, frozen intermittently		SA73					13.9	929
4		- some silt, trace gravel			SA74					14.1	928
5					SA75	10	76	14		17.5	927
6		- some gravel, moist			SA76					7.7	926
7											925
8		- gravelly, coarse grained sand seams throughout			SA77					8.1	924
9											923
10		- some gravel	Nb		SA78					22.1	922
11					SA79					11.3	921
12		- gravelly									920
13					SA80					9.7	919
14		GRAVEL AND SAND - some silt, wet, brown	Unfrozen		SA81	49	37	14		12.6	918
15											917
16		- damp									916
17					SA82					5.6	915
18		- some silt to silty									914
19											913
20					SA83					6.5	912

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

GTC

Contractor: Boart Longyear	Completion Depth: 26.8 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 30
Logged By: JS	Completion Date: 2022 September 30
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-05**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 931.7 m
Yukon	UTM: 484206.6407 E; 7086784.693 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
20														
21	Sonic	GRAVEL - sandy, silty, medium to coarse grained sand, subangular to subrounded gravel, damp, brown			SA84					5.1				911
22		SAND AND GRAVEL - silty, medium to coarse grained sand, subrounded to subangular gravel, damp, brown			SA85					4.7				910
23		SAND - gravelly, silty, fine to coarse grained sand, subrounded to subangular gravel to 75 mm diameter, moist, brown												909
24					SA86					4.5				908
25		GRAVEL - trace sand, trace silt, subangular to subrounded gravel, damp, greyish brown			SA87					0.9				907
26														906
27		END OF BOREHOLE (26.8 metres) 25 mm PVC installed to 26.8 metres Ground temperature cable installed inside PVC pipe to 25.20 metres Note: Stopped due to refusal on suspected bedrock Beads 1-5 are coiled up outside of the monument and will be installed accordingly throughout the construction process												905
28														904
29														903
30														902
31														901
32														900
33														899
34														898
35														897
36														896
37														895
38														894
39														893
40														892

Contractor: Boart Longyear	Completion Depth: 26.8 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 30
Logged By: JS	Completion Date: 2022 September 30
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-06**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 933 m
Yukon	UTM: 484291.6924 E; 7086718.514 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	Elevation (m)
0		SAND AND GRAVEL (FILL) - silty, moist, grey, (150 mm thick)	Unfrozen									933
		ORGANICS - (50 mm thick)	Frozen, Vx, Vs 45%									
1		SAND (FILL) - silty, trace gravel, fine to coarse grained sand, wet, brown			SA88				37.6			932
2		- organic inclusions	Nbn									931
		ORGANICS - peat, dark brown to black, wood chunks			SA89				182.9			
3		SAND (TILL) - silty, trace gravel, moist, greyish brown			SA90				11.8			930
4		- gravelly										929
		SILT (TILL) - sandy, trace to some gravel, moist, greyish brown										
5		SAND (TILL) - gravelly, some silt, medium to coarse grained sand, wet			SA91				3.6			928
6		- damp										927
		SILT (TILL) - sandy, gravelly, fine to coarse grained sand, wet, brown			SA92	45	30	25	17.7			
7		- sand and gravel seam										926
		- large gravel and cobbles pieces to 100 mm diameter, moist			SA93				8.8			
8												925
		GRAVEL - silty, some sand, subrounded to subangular gravel to 50 mm diameter, wet										
9		SILT (TILL) - sandy, gravelly, wet, brown										924
10	Sonic											923
		SAND (TILL) - some silt, medium to coarse grained sand	Vx		SA94				21.7			
11		- 300 mm thick cobble			SA95				7.3			922
		- silty, gravelly, fine to coarse grained sand, moist, brown										
12												921
13		- damp			SA96				2.4			920
		GRAVEL - subrounded to angular gravel to 75 mm diameter			SA97				1			
14												919
15												918
		SAND (TILL) - silty, occasional gravel, fine grained sand, brown	Nbn-Nf									
16					SA98				24.1			917
17		- gravelly, some silt, fine to coarse grained sand, wet	Unfrozen		SA99	34	46	20	8.6			916
18												915
		- medium to coarse grained sand										
19		- trace gravel			SA100				8.8			914
20												913

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 30.5 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 30
Logged By: JS	Completion Date: 2022 September 30
Reviewed By: IM	Page 1 of 2

NORTHERN ZONE8.GPJ EBA.GDT 23-6-15

Borehole No: **BH22-06**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 933 m
Yukon	UTM: 484291.6924 E; 7086718.514 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
20														913
		- some silt, fine grained sand, damp			SA101					5.4				
21														912
		- trace silt, fine to medium grained sand, wet												
22														911
		- some silt												
23		- damp			SA102					16.1				910
					SA103					5.2				
24														909
		- silty, some gravel, moist												
25	Sonic	- gravelly, some silt												908
		- occasional gravel			SA104					4.4				
26														907
					SA105					19.5				
27														906
		- damp												
28														905
					SA106A					5.5				
29		- silty, wet, dark brown			SA107A					23.8				904
30		- some silt, moist, light brown												903
		END OF BOREHOLE (30.5 metres) 25 mm PVC installed to 30.5 metres Ground temperature cable installed inside PVC pipe to 29.33 metres Note: Target depth reached Beads 1 and 2 are coiled up outside of the monument and will be installed accordingly throughout the construction process												
31														902
32														901
33														900
34														899
35														898
36														897
37														896
38														895
39														894
40														893

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 30.5 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 30
Logged By: JS	Completion Date: 2022 September 30
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-07**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 924.4 m
Yukon	UTM: 484130.6059 E; 7086777.122 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	Elevation (m)
0	Sonic	SAND AND GRAVEL (PAD FILL) - silty, moist, grey	Unfrozen										924
1		ORGANICS - (50 mm thick)	Frozen, Nbn		SA106B					20.1			
		ORGANICS AND SILT - trace sand, trace gravel, wet, brown, organics inclusions											923
2		SILT (TILL) - sandy, some gravel, wet, brown	Vx 25%		SA107B					12.5			922
3			Nbe, Nbn										
					SA108					15.2			921
4													920
		SAND (TILL) - gravelly, silty											
5					SA109	38	36	26		24.6			919
6		- trace gravel			SA110					19.8			918
7													
		- some gravel	Nbn		SA111					18.4			917
8		- gravelly											916
9													
		- silty, some gravel, suspected cobble, gravel to 100 mm diameter, moist, brown			SA112					7.8			915
10													914
11		- gravelly, some silt, wet											
					SA113	45	35	20		9.2			913
12		- wet											912
13													
					SA114					6.7			911
14		- 150 mm thick gravel layer											
		- coarse grained sand			SA115					18.8			910
15					SA117					9.4			
		GRAVEL - sandy, silty, subrounded to subangular gravel to 75 mm diameter, medium to coarse grained sand, very wet, brown											909
16					SA116					23.3			
													908
17		SAND - silty, no visible gravel, wet, brown											
		- fine to coarse grained sand											907
18		- trace gravel, fine to medium grained sand											
		- some gravel, fine to coarse grained sand	Nbn-Nf										906
19													
			Nf		SA118					13.7			
		- trace gravel, medium to coarse grained sand, weak foliated flat rock throughout	Nbn										905
20					SA119					24.2			

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 27.4 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 2
Logged By: JS	Completion Date: 2022 October 2
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-07**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 924.4 m
Yukon	UTM: 484130.6059 E; 7086777.122 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
20														
21	Sonic	- fine to medium grained sand, no visible foliated rock SILT - sandy, no visible gravel, brown, grey laminations throughout - sandy seam			SA120					19.5				904 903
22		SAND - some silt, no visible gravel, fine to medium grained sand, brown			SA121					22.7				902
23		- some silt, wet	Unfrozen		SA122					23.4				901
24		- fine grained sand, damp												900
25					SA123					11.3				899
26		- silty, wet												898
27		- suspected bedrock			SA124					15.6				897
28		END OF BOREHOLE (27.4 metres) slough - 14.5 metres at completion PVC installed to 14.5 metres Ground temperature cable installed inside PVC pipe to 13.42 metres Note: Stopped due to refusal on suspected bedrock Beads 1-10 are coiled up outside of the monument and will be installed accordingly throughout the construction process												896
29														895
30														894
31														893
32														892
33														891
34														890
35														889
36														888
37														887
38														886
39														885
40														

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 27.4 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 2
Logged By: JS	Completion Date: 2022 October 2
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-08**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 926.5 m
Yukon	UTM: 484162.3135 E; 7086750.62 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
0		SAND AND GRAVEL (PAD FILL) - silty, wet, grey	Unfrozen											926
1		ORGANICS - (125 mm thick)	Frozen, Vx 10%		SA125					32.7				925
		SILT AND ORGANICS - dark brown	Vx, Nb											
2		SILT - trace sand, trace gravel, brown, organic inclusions			SA126					21.1				924
		- sandy, some gravel												
3		- coarse grained sand layers throughout	Nbn-Nf											
					SA127	1	45		54	22.1				923
4														
		- some sand, moist	Nbn											922
5					SA128					11.4				
6		- grey												921
7					SA129					10.6				
														920
8					SA130					10.6				
		SAND AND GRAVEL - silty, coarse grained sand, gravel to 50 mm diameter, wet, brown												919
9														
		SILT - gravelly, some sand, gravel to 50 mm diameter, wet, brown	Frozen intermittedly		SA131					8.5				918
10	Sonic	SAND AND GRAVEL - silty, fine to coarse grained sand, moist, brown			SA132					4.8				
11														917
12														916
13														915
14		SAND - some silt, no visible gravel, fine to coarse grained sand	Nf Nb-Nf		SA133					23.2				914
					SA134					22.1				
15														913
		- coarser grained sand												
16					SA135					20.8				912
17					SA136					21.1				911
18														910
		- silty												
19					SA137	0	53		47	23.5				909
20														908
														907

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 30.5 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 2
Logged By: JS	Completion Date: 2022 October 2
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-08**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 926.5 m
Yukon	UTM: 484162.3135 E; 7086750.62 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
20	Sonic	- trace gravel, damp	Unfrozen		SA138					2.9				906
21														
22		- silty, fine grained sand			SA139					13.3				905
23		- 300 mm thick fine to coarse grained sand layer												904
24		- trace gravel, moist, dense, greyish brown			SA140					10.5				903
25		- some silt, brown												902
26		- silty, some gravel, moist, grey			SA141					10.9				901
27					SA142					9.7				900
28		- some silt, medium to coarse grained sand												899
29		- silty, fine to coarse grained sand			SA143					2.6				898
30					SA144					8.4				897
31		END OF BOREHOLE (30.5 metres) 25 mm PVC installed to 22.9 metres Ground temperature cable installed inside PVC pipe to 22.47 metres Note: Target depth reached Beads 1-13 are coiled up outside of the monument and will be installed accordingly throughout the construction process												896
32														895
33														894
34														893
35														892
36														891
37														890
38														889
39														888
40														887

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 30.5 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 2
Logged By: JS	Completion Date: 2022 October 2
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-09**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 924.1 m
Yukon	UTM: 484129.5937 E; 7086715.272 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Elevation (m)
0	Sonic	SAND AND GRAVEL (PAD FILL) - silty, wet, grey, (250 mm thick)	Unfrozen								924
		ORGANICS - (50 mm thick)	Frozen, V 5-10%								
1		SILT - sandy, gravelly, fine to coarse grained sand			SA145					24.9	923
		- some gravel, moist to wet	Vx 30% Nf								
2					SA146					10.2	922
3		- trace gravel, moist	Nb-Nf								921
					SA147	7	31	62		14.9	
4											920
					SA148					11	
5											919
6			Intermittently frozen, Nbn								918
					SA149					24.3	
7		- gravelly, coarse grained sand									917
					SA150					10.9	
8		SAND - gravelly, silty, fine to coarse grained sand, wet, brown	Nf								916
		- trace gravel									
9		- some gravel, wet									915
					SA151					7.9	
10											914
11			Intermittently frozen								913
		- trace gravel, fine grained grained	Nbn		SA152					32.8	
12											912
		SILT (TILL) - sandy, some gravel, subrounded to subangular gravel to 50 mm diameter, moist, greyish brown			SA153					11.4	
13											911
		- trace clay, dark grey									
14			Unfrozen		SA154					11	910
15		- trace sand									909
16					SA155	18	39	43		9	908
17		- cobbles for 600 mm									907
					SA156					8.7	
18											906
		- dense									
19		- some sand, fine to coarse grained sand									905
20											

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

GTC

Contractor: Boart Longyear	Completion Depth: 28.3 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 3
Logged By: JS	Completion Date: 2022 October 3
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-09**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 924.1 m
Yukon	UTM: 484129.5937 E; 7086715.272 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
20		- damp												904
21					SA157					7.7	●			903
22					SA158					7.2	●			902
23					SA159					9.1	●			901
24	Sonic													900
25					SA160					8.3	●			899
26														898
27					SA161					6.9	●			897
28														896
29		END OF BOREHOLE (28.3 metres) 25 mm PVC to 28.3 metres Ground temperature cable installed inside PVC pipe to 27.63 metres Note: Stopped due to refusal Beads 1-8 are coiled up outside of the monument and will be installed accordingly throughout the construction process												895
30														894
31														893
32														892
33														891
34														890
35														889
36														888
37														887
38														886
39														885
40														

Contractor: Boart Longyear	Completion Depth: 28.3 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 3
Logged By: JS	Completion Date: 2022 October 3
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-10**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 918.7 m
Yukon	UTM: 484054.54 E; 7086731.18 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Moisture Content (%)	Elevation (m)
0	Sonic	SAND AND GRAVEL (FILL) - silty, angular to subangular fine grained gravel, moist, grey	Unfrozen		SA162					5.1	918
1											
2					SA163	62	28	10		5.8	917
3		- no recovery to 6.1 metres									916
4											915
5											914
6											913
7		ORGANICS - (50 mm thick) SILT AND ORGANICS - (150 mm thick) SILT (TILL) - sandy, some gravel, brown	Frozen, Nbn		SA164					18.9	912
8			V, 10-40% ice		SA165					20.6	911
9		- 150 mm thick organic layer - wood pieces	10-20% ice		SA166					45.3	910
10					SA167					14.2	909
11		- gravelly, cobbles, wet			SA168	35	33	32		10.2	908
12		- some gravel	Nbn								907
13					SA169					31.7	906
14		- some sand, trace gravel - clean sand layers throughout	Vx 5%, small ice inclusion Nbn		SA170					20.4	905
15											904
16											903
17		- sandy, some gravel, moist			SA171					9.7	902
18			Intermittently frozen								901
19											900
20			Nbn		SA172					26.1	899

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

GTC

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 23.2 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 4
Logged By: JS	Completion Date: 2022 October 4
Reviewed By: IM	Page 1 of 2

Borehole No: **BH22-10**

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 918.7 m
Yukon	UTM: 484054.54 E; 7086731.18 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	GTC	PVC	Elevation (m)
20														
21	Sonic	- gravelly, coarse grained sand - trace gravel, fine to medium grained sand	Unfrozen		SA173					13.7				898
22		- coarse grained angular gravel												897
23					SA174					0.6				896
24		END OF BOREHOLE (23.2 metres) 25 mm PVC installed to 22.6 metres Ground temperature cable installed inside PVC pipe to 20.04 metres Note: Stopped due to refusal Beads 1 and 2 are coiled up outside of the monument and will be installed accordingly throughout the construction process												895
25														894
26														893
27														892
28														891
29														890
30														889
31														888
32														887
33														886
34														885
35														884
36														883
37														882
38														881
39														880
40														879

Contractor: Boart Longyear	Completion Depth: 23.2 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 October 4
Logged By: JS	Completion Date: 2022 October 4
Reviewed By: IM	Page 2 of 2

Borehole No: **BH22-40B**

Hecla MINING COMPANY

Project: DSTF Phase 2 Detailed Design	Project No: ENG.WARC04307-01
Location: Keno Hill Mine	Ground Elev: 919.84 m
Yukon	UTM: 483978.2 E; 7086940 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Clay (%)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	PVC	Elevation (m)
0		ORGANICS - (100 mm thick)	Unfrozen										
1	Sonic	SAND AND SILT (TAILINGS) - moist, grey			SA01					11.4			919
2					SA02					12.4			918
3					SA03					12.4			917
4													916
5		- more compact to dense			SA04					16.9			915
6													914
7					SA05					13.1			913
8		SILT - trace sand, trace gravel, organics, gravel to 50 mm diameter, wet, brown, liner pieces			SA06					12.5			912
9		- 600 mm thick organic layer	Frozen, Nbn										911
10		- trace to some gravel, trace to some sand, gravel to 100 mm diameter - 50 mm thick drier layer			SA07					5.6			910
11													909
12					SA08					11.8			908
13		BEDROCK			SA09					0.4			907
14		END OF BOREHOLE (13.4 metres) 25 mm PVC installed to 13.4 metres Note: Target depth reached			SA10					0.6			906
15													905
16													904
17													903
18													902
19													901
20													900

TETRA TECH

Contractor: Boart Longyear	Completion Depth: 13.4 m
Equipment Type: Track Mounted LS250 Mini Sonic	Start Date: 2022 September 26
Logged By: JS	Completion Date: 2022 September 26
Reviewed By: IM	Page 1 of 1

NORTHERN ZONE8.GPJ EBA.GDT 23-6-15

MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 9, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	1 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-04B	SA01	11.4	
	SA02	12.4	
	SA03	12.4	
	SA04	16.9	
	SA05	13.1	
	SA06	12.5	
	SA07	5.6	
	SA08	11.8	
	SA09	0.4	
	SA10	0.6	
BH22-01	SA11	20.1	
	SA12	14.1	
	SA13	1.0	
	SA14	12.4	
	SA15	28.6	
	SA16	5.9	
	SA17	7.4	SILT and SAND - gravelly
	SA18	23.5	
	SA19	5.9	
	SA20	0.4	
	SA21	3.7	
BH22-02	SA22	12.7	GRAVEL and SAND - trace silt
	SA23	18.9	
	SA24	10.7	
	SA25	17.4	

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 9, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	2 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-02	SA26	10.1	
	SA27	6.2	
	SA28	23.8	
	SA29	26.0	SILT - trace sand
	SA30	21.8	
	SA31	15.4	
	SA32	9.3	
	SA33	12.2	
	SA34	10.3	SILT - sandy, trace gravel
	SA35	11.2	
	SA36	13.9	
	SA37	1.1	
	SA38	1.5	
	SA39	5.5	
	SA40	8.5	
	SA41	3.7	
	SA42	3.6	GRAVEL - sandy, some silt
	SA43	1.6	
BH22-03	SA44	13.2	
	SA45	4.0	
	SA46	12.3	
	SA47	70.8	
	SA48	58.6	
	SA49	30.8	
	SA50	14.3	

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 10, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	3 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-03	SA51	21.5	
	SA52	13.3	
	SA53	12.7	SILT and SAND - some gravel
	SA54	27.4	
	SA55	9.8	
	SA56	10.8	
	SA57	9.7	
BH22-04	SA58	5.1	
	SA59	10.2	
	SA60	2.7	
	SA61	7.9	
	SA62	2.4	GRAVEL - sandy, trace silt
	SA63	4.0	
	SA64	10.5	
	SA65	2.2	
	SA66	7.6	
	SA67	7.6	
	SA68	10.9	
	SA69	11.8	
	SA70	15.3	
	SA71	4.1	
BH22-05	SA72	290.2	
	SA73	13.9	
	SA74	14.1	
	SA75	17.5	SAND - some silt, trace gravel

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 11, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	4 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-05	SA76	7.7	
	SA77	8.1	
	SA78	22.1	
	SA79	11.3	
	SA80	9.7	
	SA81	12.6	GRAVEL and SAND - some silt
	SA82	5.6	
	SA83	6.5	
	SA84	5.1	
	SA85	4.7	
	SA86	4.5	
	SA87	0.9	
BH22-06	SA88	37.6	
	SA89	182.9	
	SA90	11.8	
	SA91	3.6	
	SA92	17.7	GRAVEL - sandy silty
	SA93	8.8	
	SA94	21.7	
	SA95	7.3	
	SA96	2.4	
	SA97	1.0	
	SA98	24.1	
	SA99	8.6	SAND - gravelly, some silt
	SA100	8.8	

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 15, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	5 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-06	SA101	5.4	
	SA102	16.1	
	SA103	5.2	
	SA104	4.4	
	SA105	19.5	
	SA106A	5.5	
	SA107A	23.8	
BH22-07	SA106B	20.1	
	SA107B	12.5	
	SA108	15.2	
	SA109	24.6	GRAVEL and SAND - silty
	SA110	19.8	
	SA111	18.4	
	SA112	7.8	
	SA113	9.2	GRAVEL - sandy, some silt
	SA114	6.7	
	SA115	18.8	
	SA116	9.4	
	SA117	23.3	
	SA118	13.7	
	SA119	24.2	
	SA120	19.5	
	SA121	22.7	
	SA122	23.4	
	SA123	11.3	

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 16, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	6 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-07	SA124	15.6	
BH22-08	SA125	32.7	
	SA126	20.1	
	SA127	22.1	SILT and SAND - trace gravel
	SA128	11.4	
	SA129	10.6	
	SA130	10.6	
	SA131	8.5	
	SA132	4.8	
	SA133	23.2	
	SA134	22.1	
	SA135	20.8	
	SA136	21.1	
	SA137	23.5	SAND and SILT
	SA138	2.9	
	SA139	13.3	
	SA140	10.5	
	SA141	10.9	
	SA142	9.7	
	SA143	2.6	
	SA144	8.4	
BH22-09	SA145	24.9	
	SA146	10.2	
	SA147	14.9	SILT - sandy, trace gravel
	SA148	11.0	

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 17, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	7 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-09	SA149	24.3	
	SA150	10.9	
	SA151	7.9	
	SA152	32.8	
	SA153	11.4	
	SA154	11.0	
	SA155	9.0	SILT and SAND - some gravel
	SA156	8.7	
	SA157	7.7	
	SA158	7.2	
	SA159	9.1	
	SA160	8.3	
	SA161	6.9	
BH22-10	SA162	5.1	
	SA163	5.8	GRAVEL - sandy, trace silt
	SA164	18.9	
	SA165	20.6	
	SA166	45.3	
	SA167	14.2	
	SA168	10.2	GRAVEL - sandy, silty
	SA169	31.7	
	SA170	20.4	
	SA171	9.7	
	SA172	26.1	
	SA173	13.7	

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MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	Various
Project Number:	ENG.WARC04307-01	Date Tested:	November 17, 2022
Client:	Hecla	Tested By:	BW
Project Manager:	Ian MacIntyre	Page:	8 of 8

B.H. Number	Sample Number	Moisture Content (%)	Visual Description of Soil
BH22-10	SA174	0.6	

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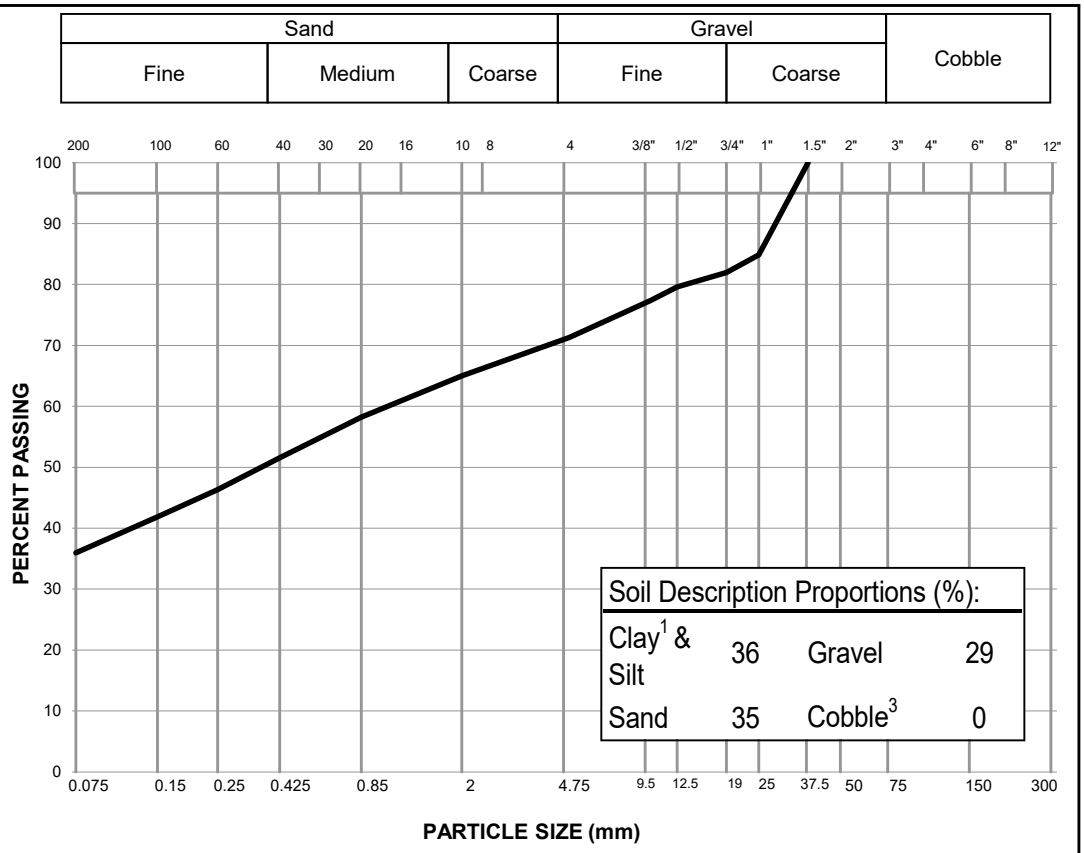
PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA17
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-01
Client:	Hecla	Sample Depth:	8.2 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 14, 2022 By: KD	Date Sampled:	-
Soil Description[2]:	SILT and SAND - gravelly	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	7.4%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	85
19	82
12.5	80
10	77
5	71
2	65
0.85	58
0.425	52
0.25	46
0.15	42
0.075	36.0



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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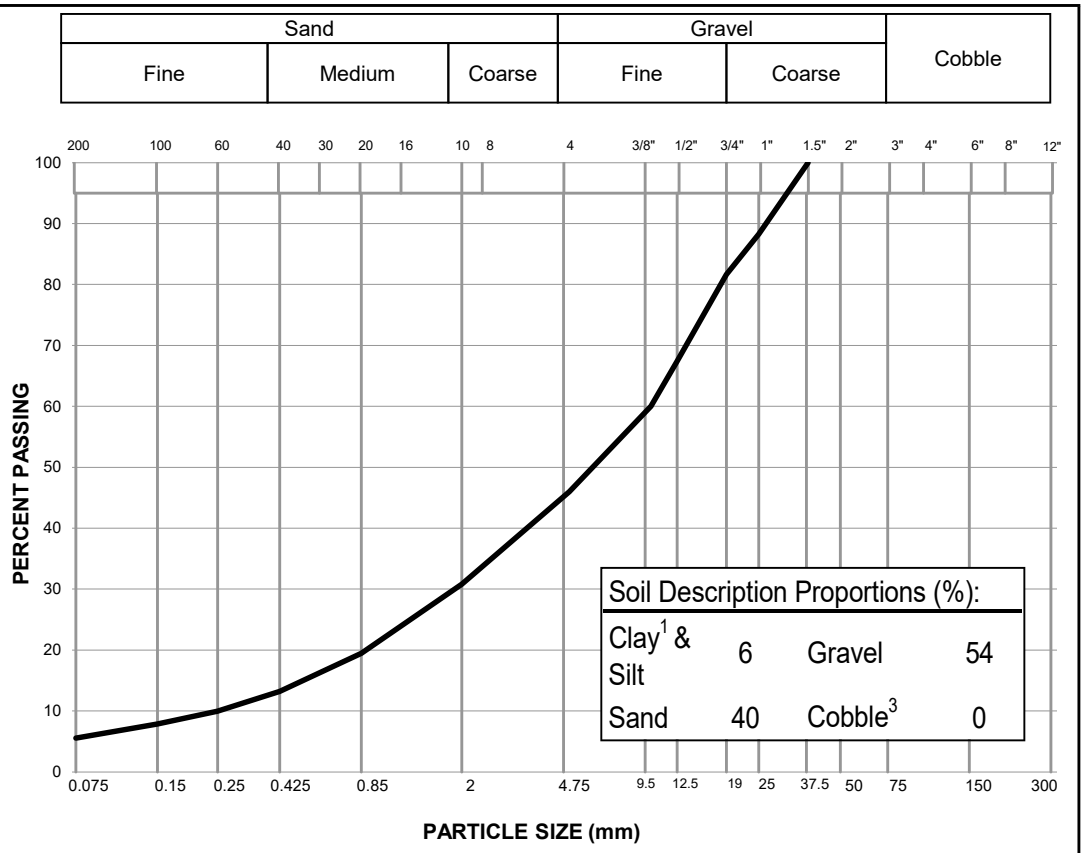
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA22
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-02
Client:	Hecla	Sample Depth:	0.8 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 14, 2022 By: KD	Date Sampled:	-
Soil Description[2]:	GRAVEL and SAND - trace silt	Sampled By:	JS
		USC Classification:	GW Cu: 39.8
Moisture Content:	12.7%		Cc: 1.5

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	88
19	82
12.5	67
10	60
5	46
2	31
0.85	19
0.425	13
0.25	10
0.15	8
0.075	5.6



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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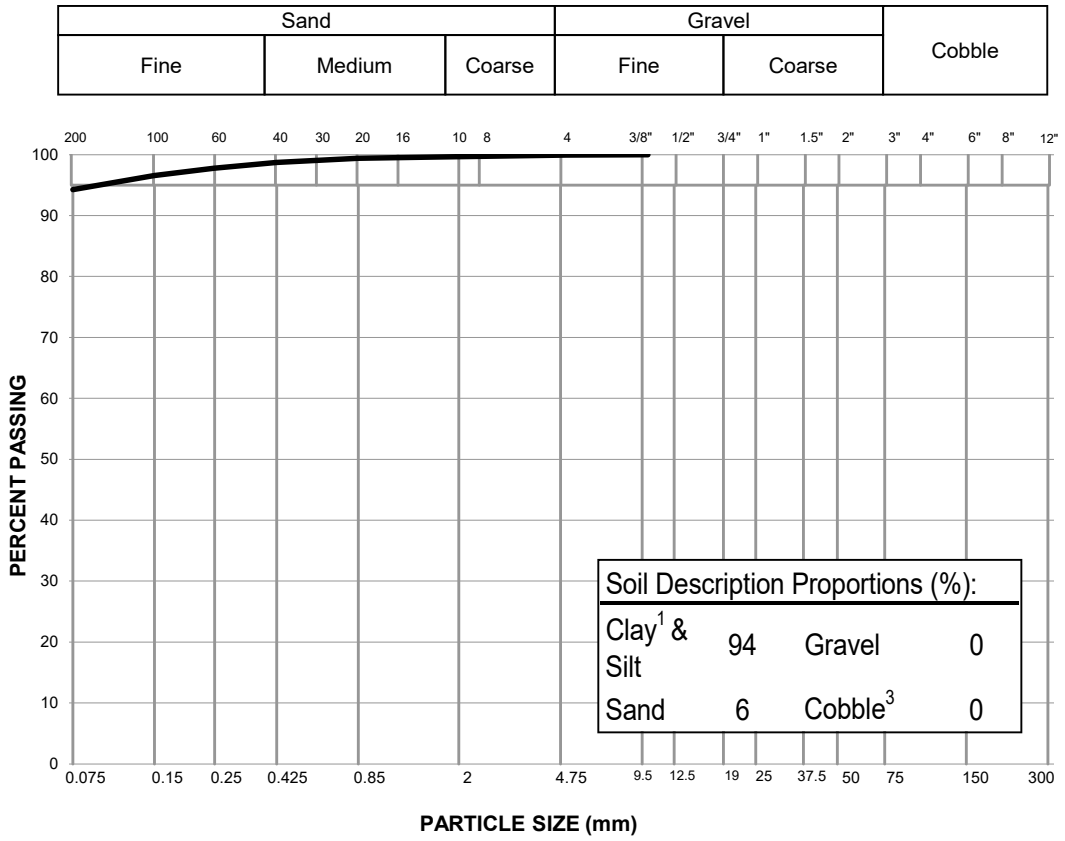
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA29
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-02
Client:	Hecla	Sample Depth:	7.9 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 14, 2022 By: KD	Date Sampled:	-
Soil Description[2]:	SILT - trace sand	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	26.0%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	
12.5	
10	100
5	100
2	100
0.85	99
0.425	99
0.25	98
0.15	97
0.075	94.3



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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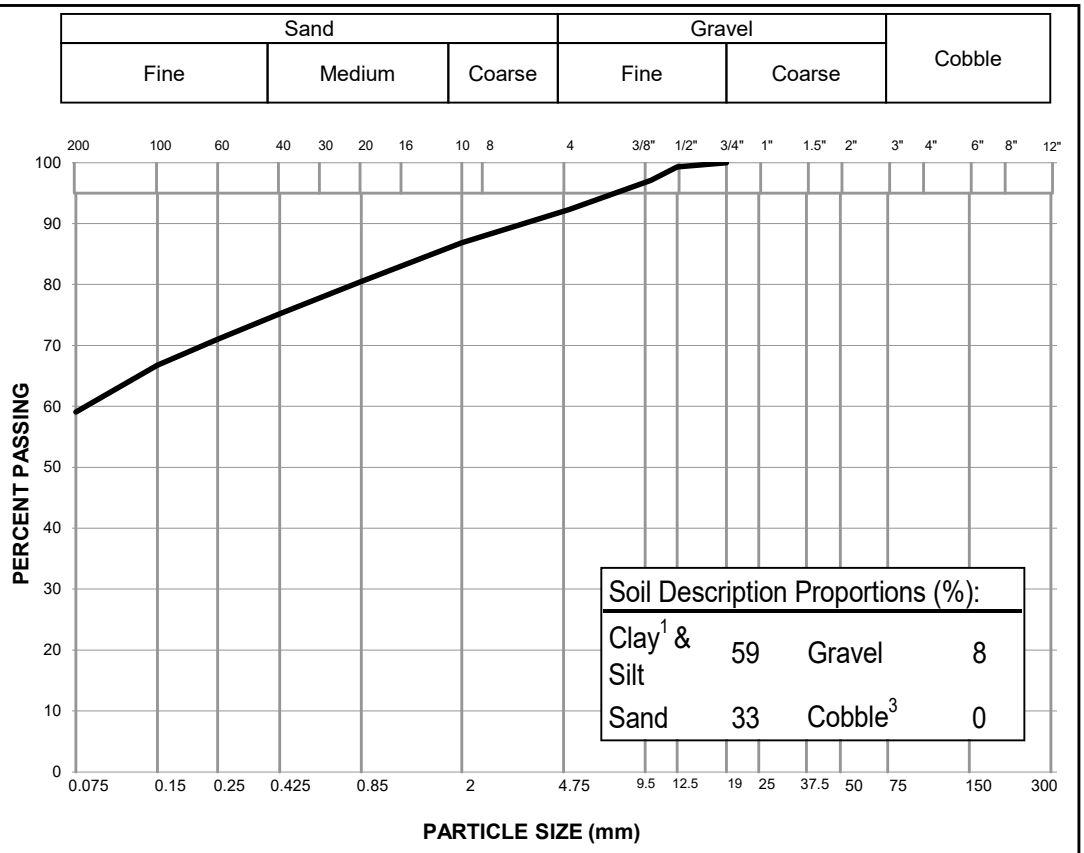
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA34
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-02
Client:	Hecla	Sample Depth:	15.8 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SILT - sandy, trace gravel	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	10.3%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	100
12.5	99
10	97
5	92
2	87
0.85	80
0.425	75
0.25	71
0.15	67
0.075	59.1



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

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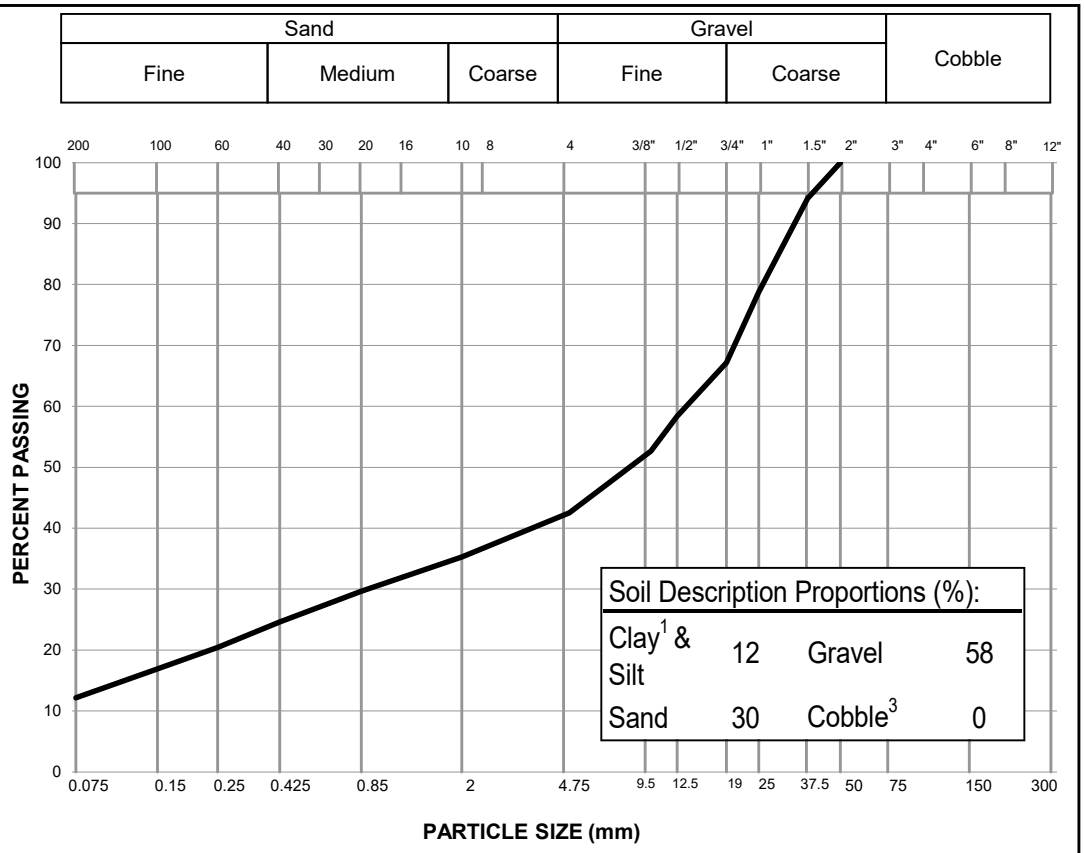
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA42
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-02
Client:	Hecla	Sample Depth:	28.3 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL - sandy, some silt	Sampled By:	JS
		USC Classification:	GP Cu: #N/A
Moisture Content:	3.6%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	94
25	79
19	67
12.5	58
10	53
5	43
2	35
0.85	30
0.425	25
0.25	20
0.15	17
0.075	12.2



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

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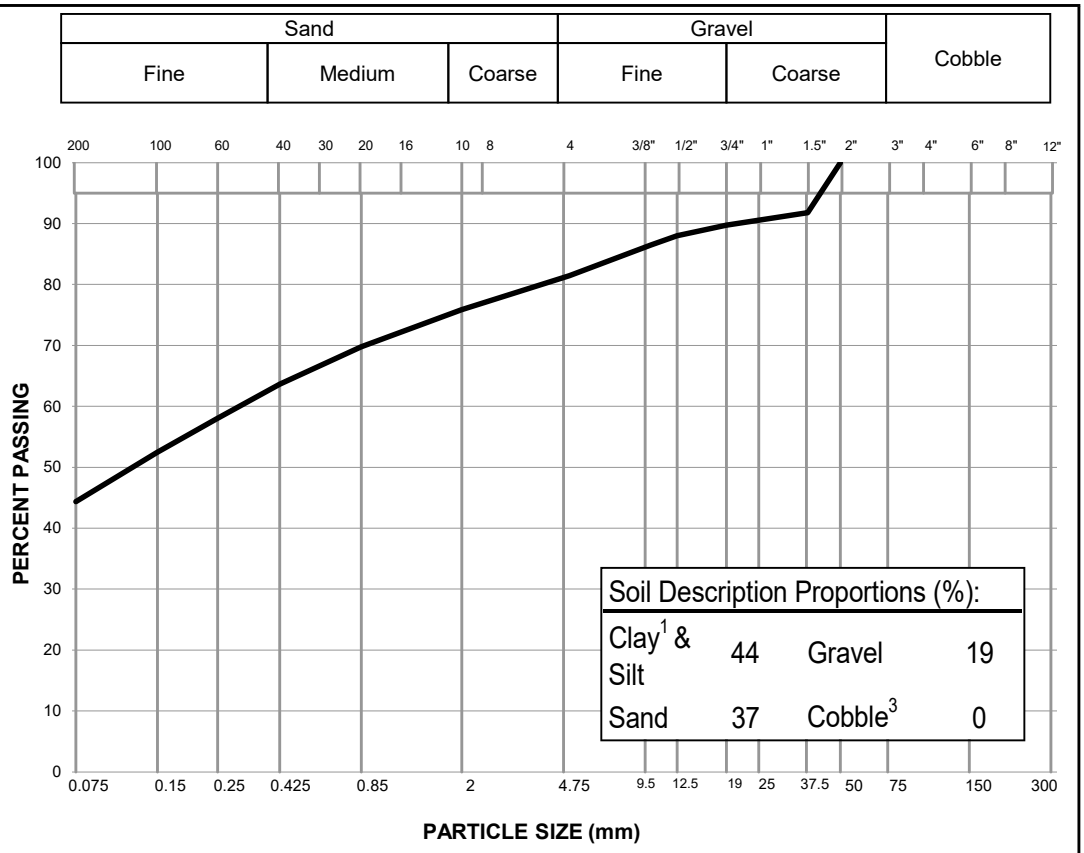
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA53
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-03
Client:	Hecla	Sample Depth:	11.3 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 14, 2022 By: KD	Date Sampled:	-
Soil Description[2]:	SILT and SAND - some gravel	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	12.7%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	92
25	
19	90
12.5	88
10	86
5	81
2	76
0.85	70
0.425	64
0.25	58
0.15	52
0.075	44.4



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

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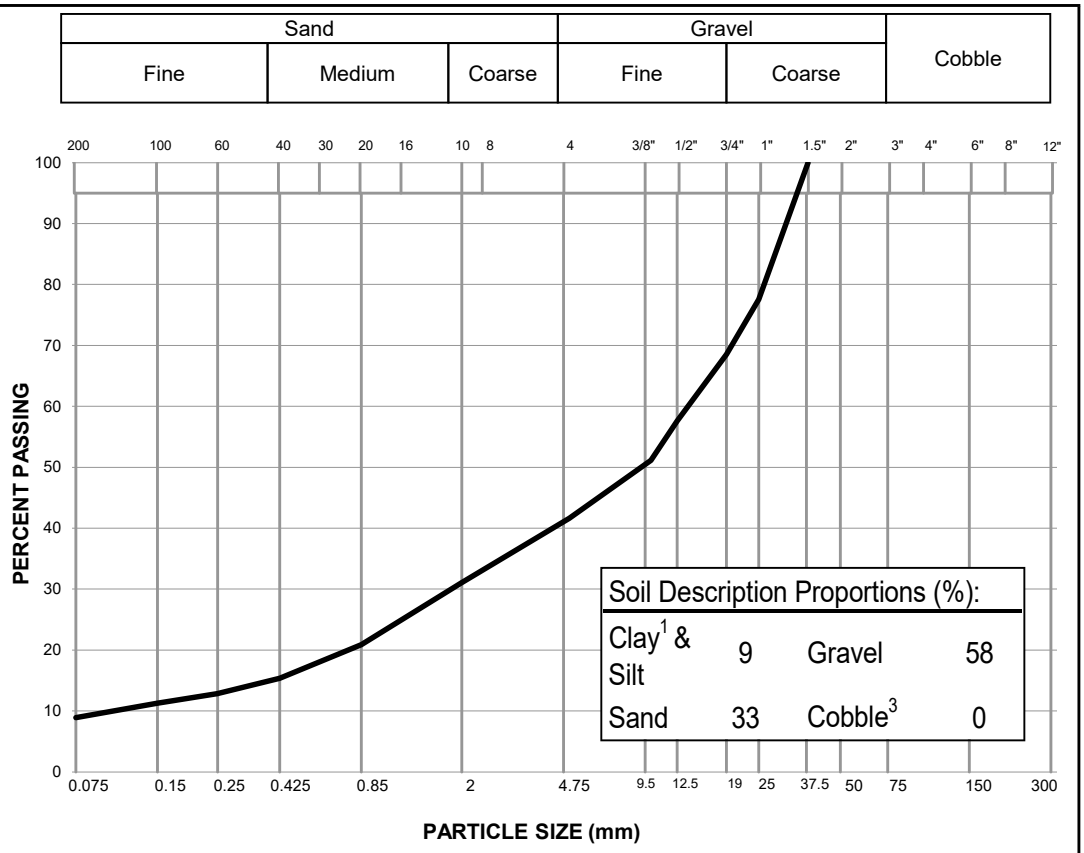
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA62
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-04
Client:	Hecla	Sample Depth:	7.3 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL - sandy, trace silt	Sampled By:	JS
		USC Classification:	GW Cu: 128.7
Moisture Content:	2.4%		Cc: 2.3

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	78
19	69
12.5	58
10	51
5	42
2	31
0.85	21
0.425	15
0.25	13
0.15	11
0.075	9.0



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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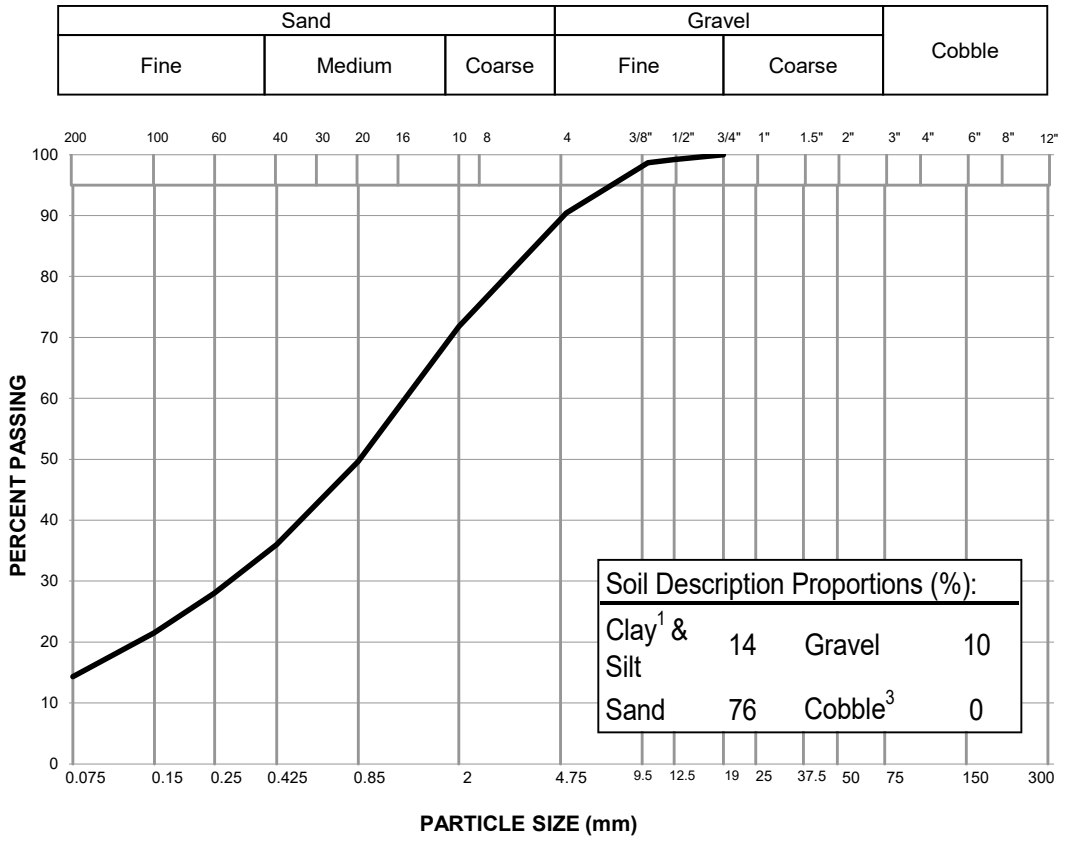
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA75
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-05
Client:	Hecla	Sample Depth:	5.2 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 18, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SAND - some silt, trace gravel	Sampled By:	JS
		USC Classification:	GM-ML Cu: #N/A
Moisture Content:	17.5%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	100
12.5	99
10	99
5	90
2	72
0.85	50
0.425	36
0.25	28
0.15	22
0.075	14.3



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
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Specification:

Remarks:

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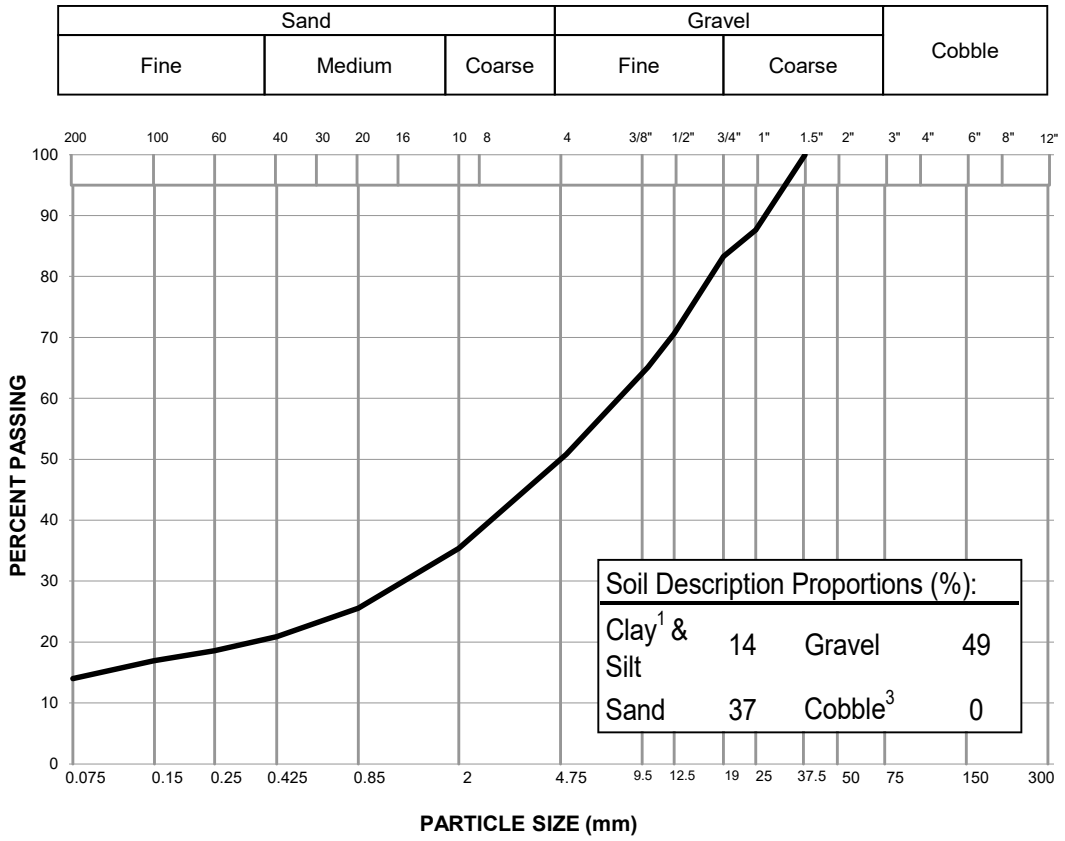
PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA81
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-05
Client:	Hecla	Sample Depth:	2.1 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL and SAND - some silt	Sampled By:	JS
		USC Classification:	GP-GM Cu: #N/A
Moisture Content:	12.6%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	88
19	83
12.5	71
10	65
5	51
2	35
0.85	26
0.425	21
0.25	19
0.15	17
0.075	14.0



Notes:
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Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

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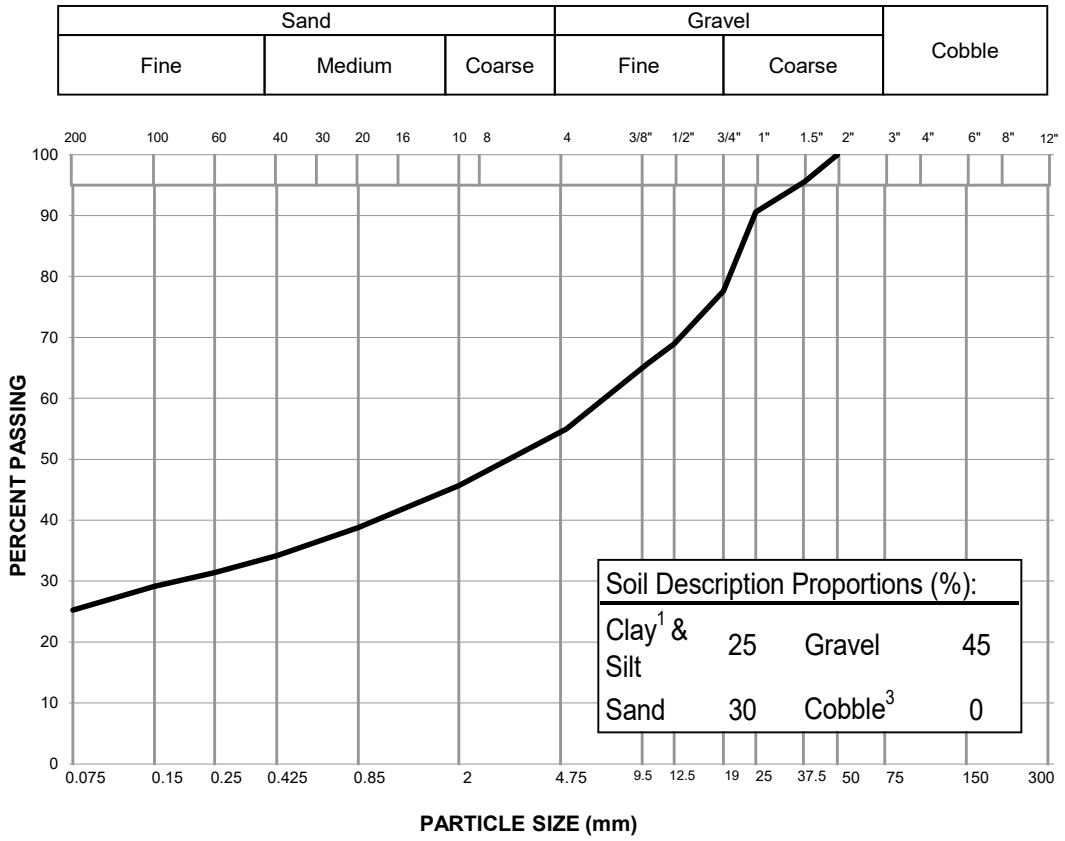
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA92
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-06
Client:	Hecla	Sample Depth:	6.7 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 18, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL - sandy, silty	Sampled By:	JS
		USC Classification:	GM-ML Cu: #N/A
Moisture Content:	17.7%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	96
25	91
19	78
12.5	69
10	66
5	55
2	46
0.85	39
0.425	34
0.25	31
0.15	29
0.075	25.3



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Specification:

Remarks:

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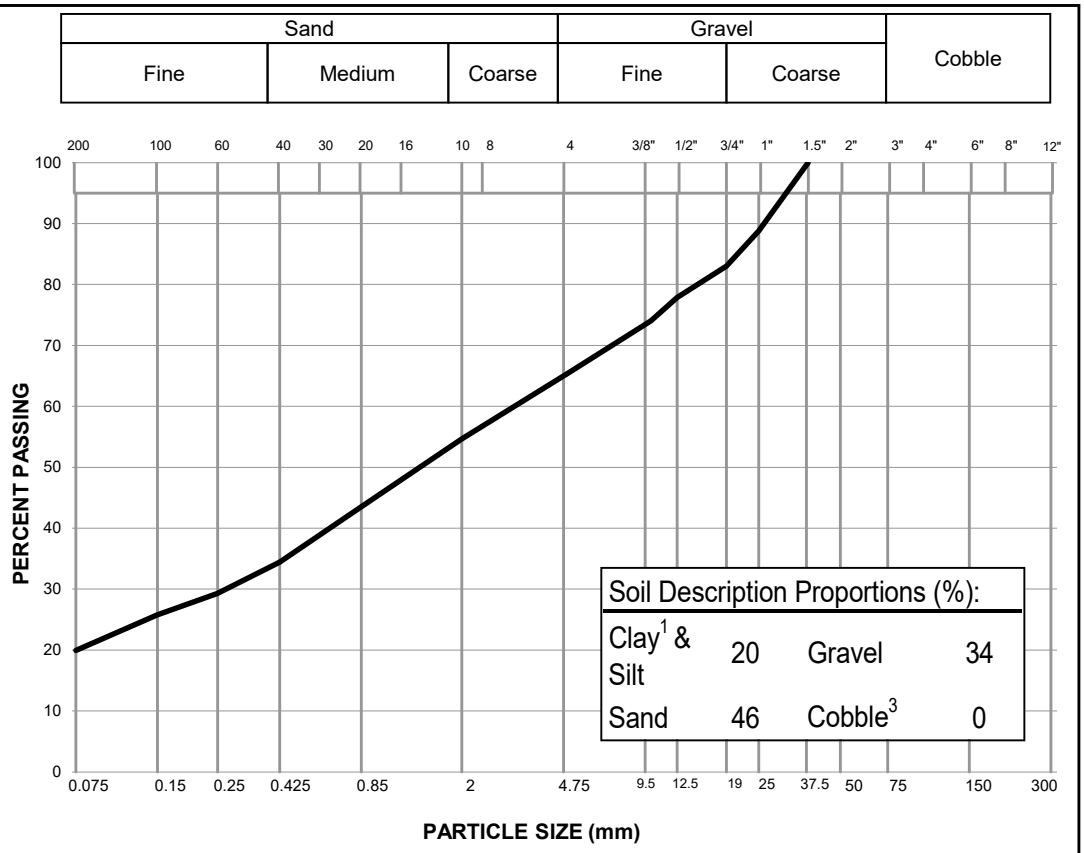
PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA99
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-06
Client:	Hecla	Sample Depth:	17.4 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SAND - gravelly, some silt	Sampled By:	JS
		USC Classification:	SP-SM Cu: #N/A
Moisture Content:	8.6%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	89
19	83
12.5	78
10	74
5	66
2	55
0.85	44
0.425	34
0.25	29
0.15	26
0.075	20.0



Notes:
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Specification:

Remarks:

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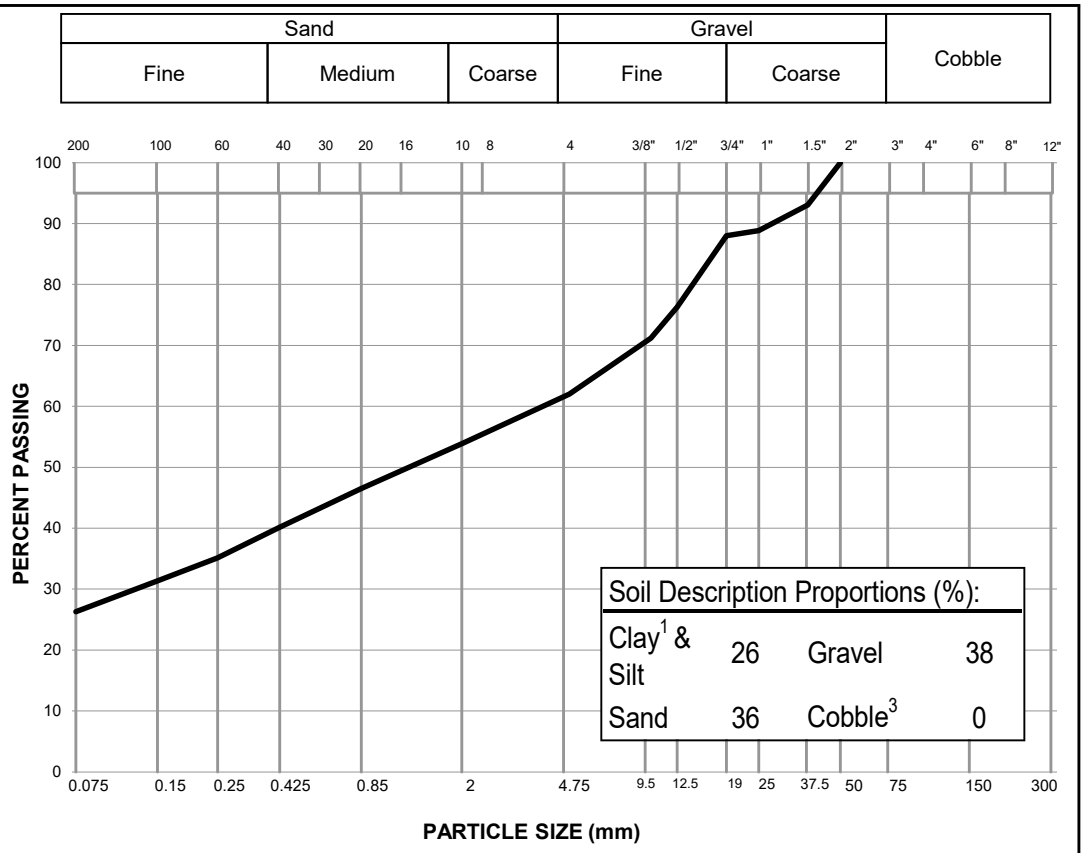
PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA109
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-07
Client:	Hecla	Sample Depth:	5.2 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 21, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL and SAND - silty	Sampled By:	JS
		USC Classification:	GM-ML Cu: #N/A
Moisture Content:	24.6%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	93
25	89
19	88
12.5	76
10	71
5	62
2	54
0.85	47
0.425	40
0.25	35
0.15	31
0.075	26.3



Notes:
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[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

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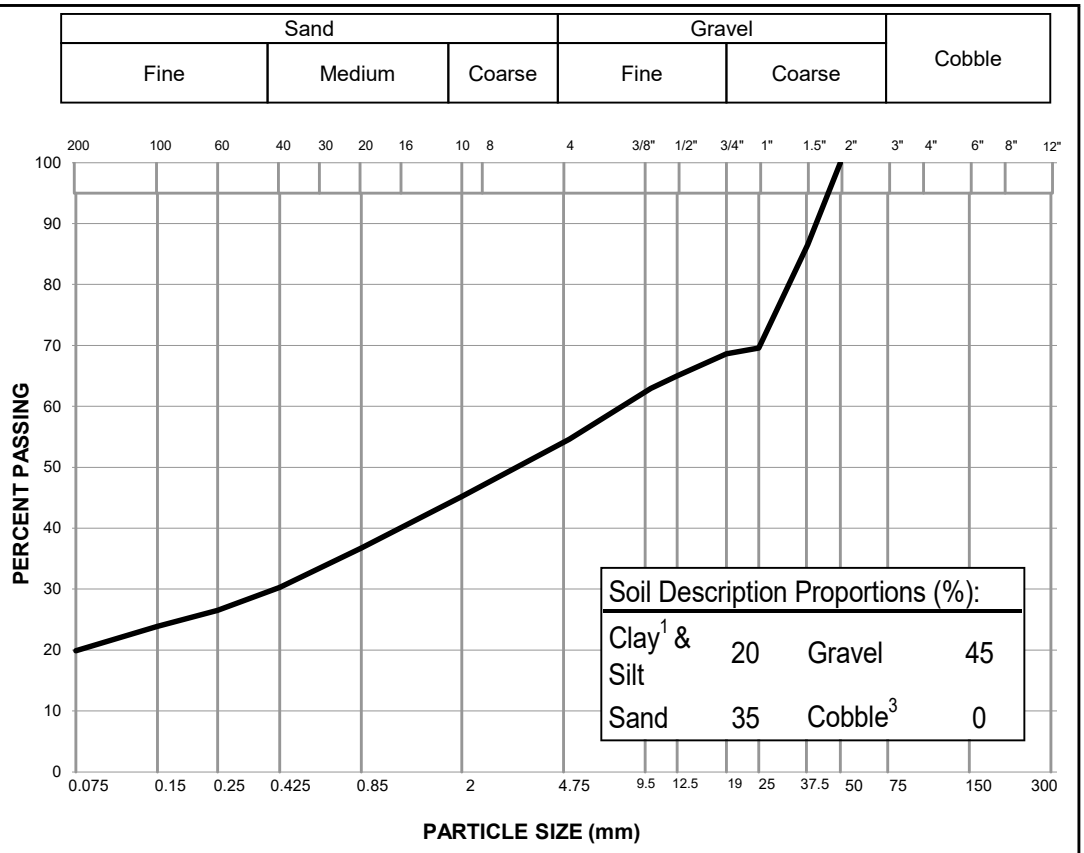
PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA113
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-07
Client:	Hecla	Sample Depth:	11.6 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 21, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL - sandy, some silt	Sampled By:	JS
		USC Classification:	GP-GM Cu: #N/A
Moisture Content:	9.2%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	86
25	70
19	69
12.5	65
10	63
5	55
2	45
0.85	37
0.425	30
0.25	26
0.15	24
0.075	19.9



Notes:
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[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

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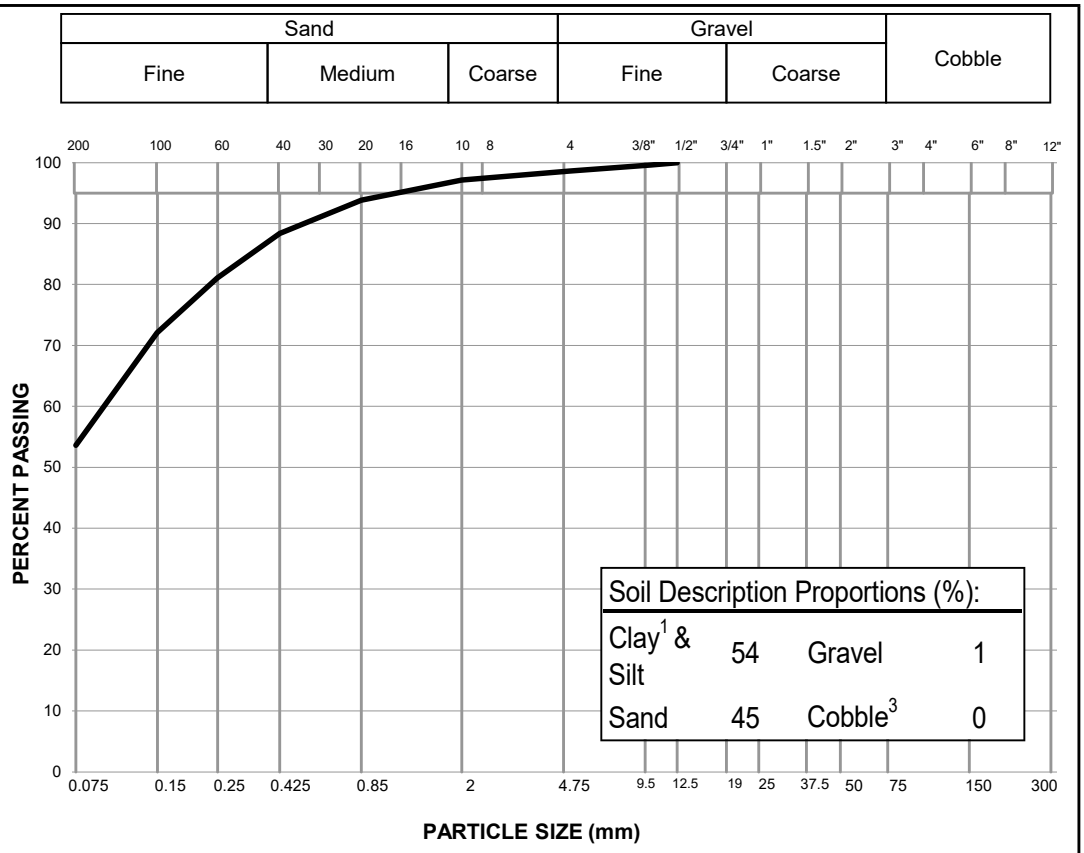
PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA127
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-08
Client:	Hecla	Sample Depth:	3.7 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SILT and SAND - trace gravel	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	22.1%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	
12.5	100
10	100
5	99
2	97
0.85	94
0.425	88
0.25	81
0.15	72
0.075	53.6



Notes:
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[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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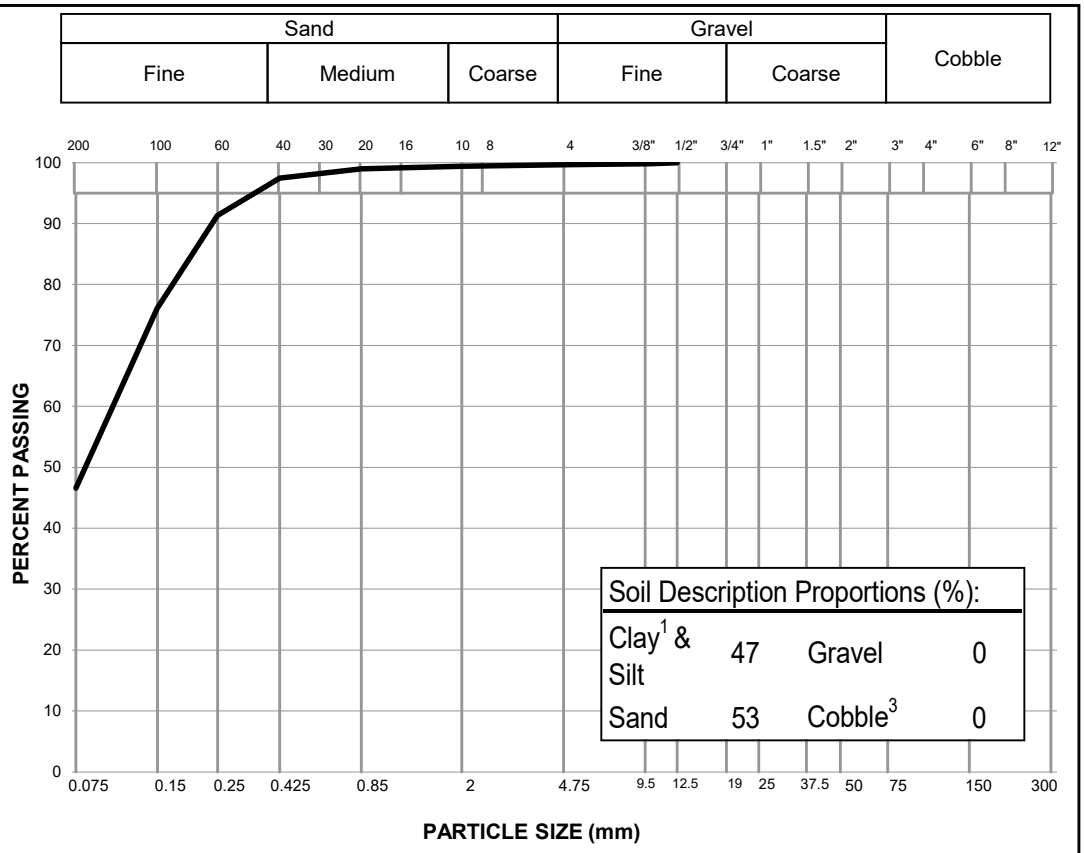
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA137
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-08
Client:	Hecla	Sample Depth:	18.9 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 18, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SAND and SILT	Sampled By:	JS
		USC Classification:	SM-ML Cu: #N/A
Moisture Content:	23.5%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	
12.5	100
10	100
5	100
2	99
0.85	99
0.425	97
0.25	91
0.15	76
0.075	46.6



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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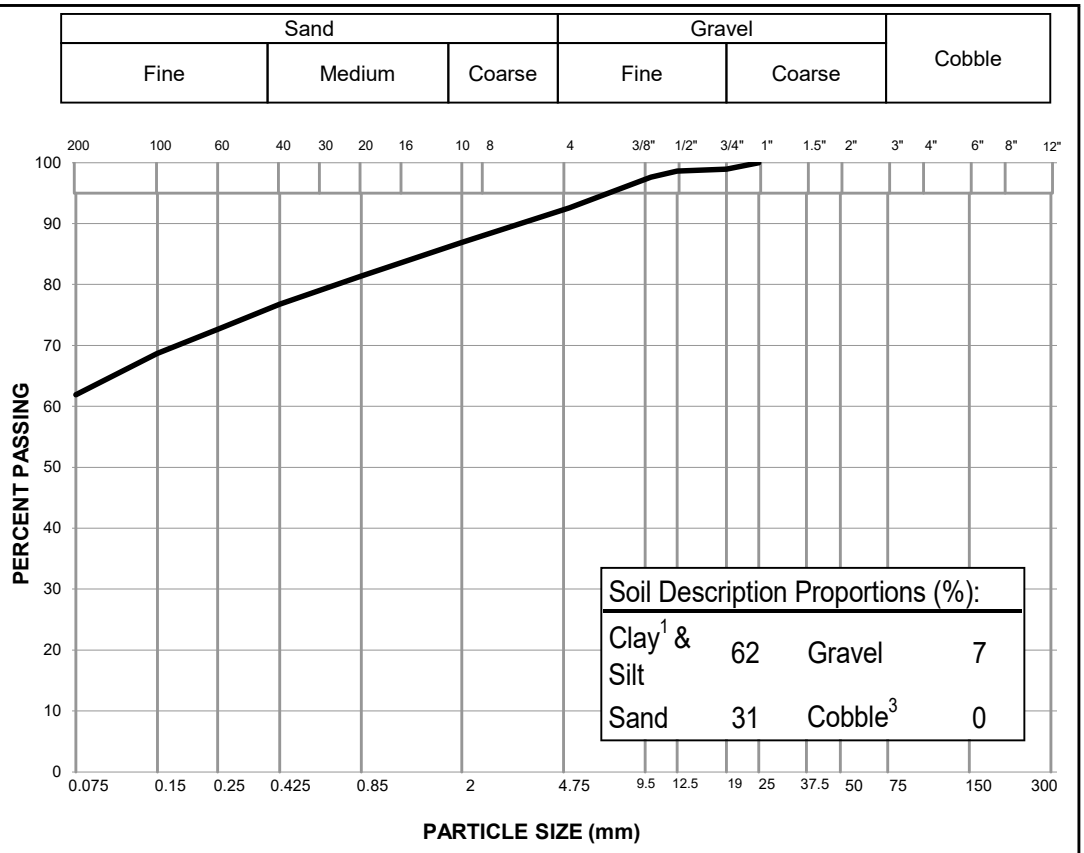
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA147
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-09
Client:	Hecla	Sample Depth:	3.7 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SILT - sandy, trace gravel	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	14.9%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	100
19	99
12.5	99
10	98
5	93
2	87
0.85	81
0.425	77
0.25	73
0.15	69
0.075	61.9



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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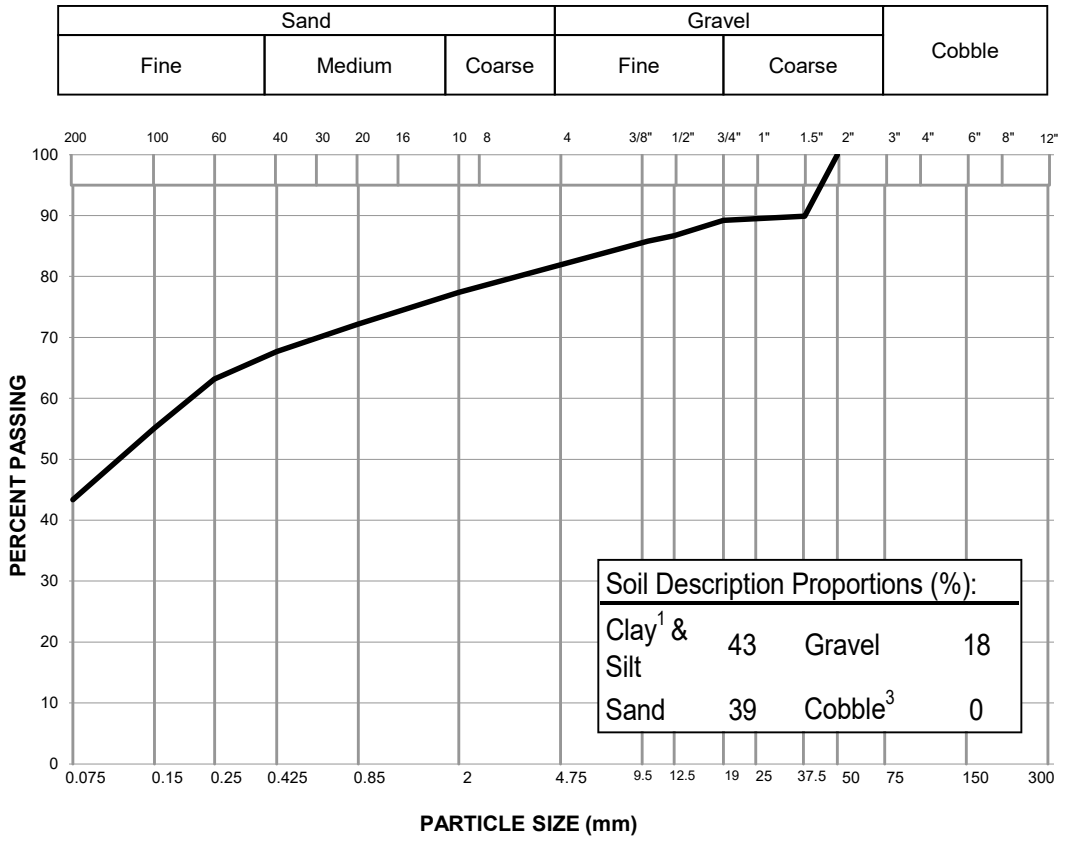
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA155
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-09
Client:	Hecla	Sample Depth:	16.2 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	SILT and SAND - some gravel	Sampled By:	JS
		USC Classification:	ML Cu: #N/A
Moisture Content:	9.0%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	90
25	
19	89
12.5	87
10	86
5	82
2	77
0.85	72
0.425	68
0.25	63
0.15	55
0.075	43.4



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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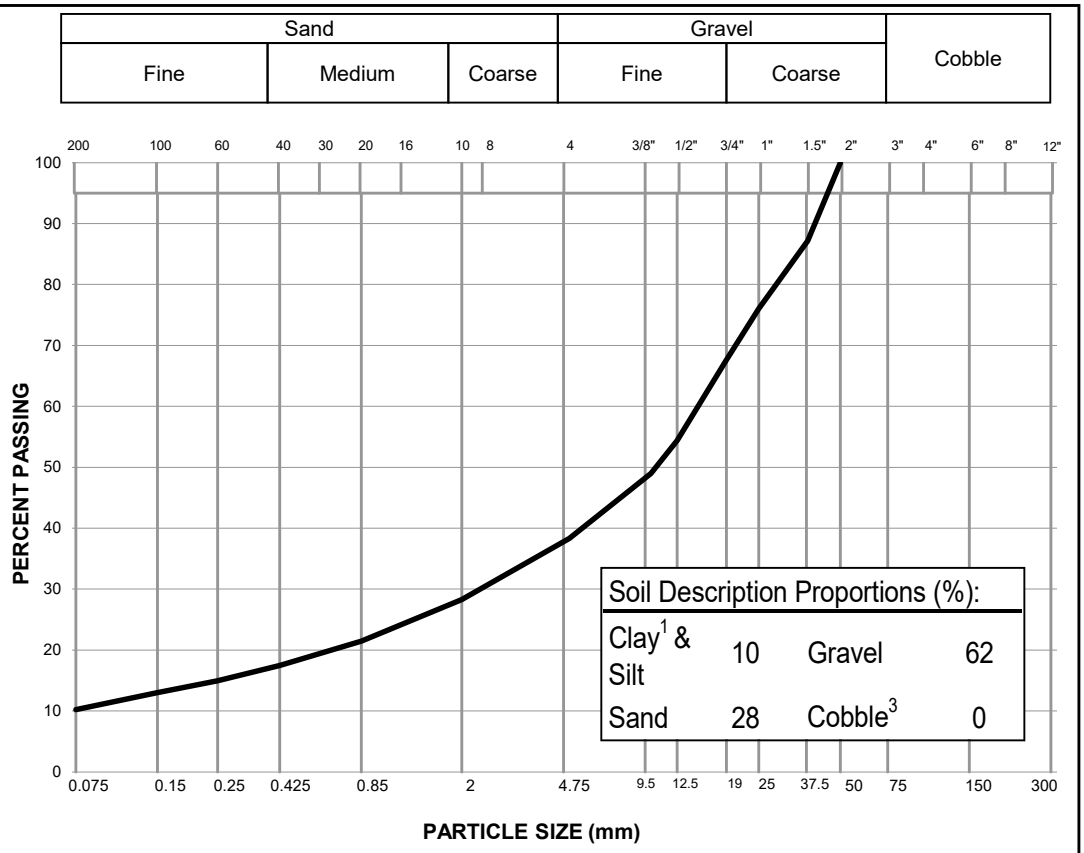
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA163
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-09
Client:	Hecla	Sample Depth:	2.1 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 18, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL - sandy, trace silt	Sampled By:	JS
		USC Classification:	GP Cu: #N/A
Moisture Content:	5.8%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	87
25	76
19	68
12.5	54
10	49
5	38
2	28
0.85	21
0.425	17
0.25	15
0.15	13
0.075	10.3



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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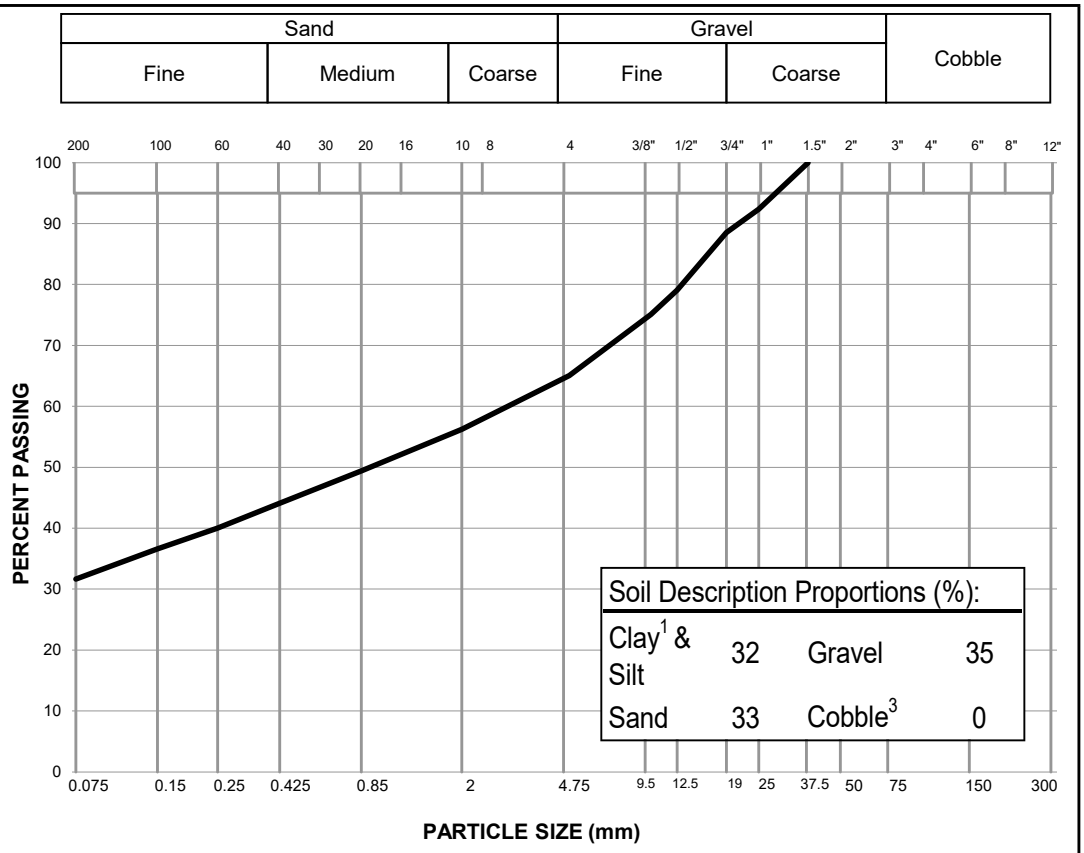
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF Phase 2 Detailed Design	Sample No.:	SA168
Project No.:	ENG.WARC04307-01	Material Type:	Foundation Soil
Site:	Alexco Keno Hill Mine	Sample Loc.:	BH22-10
Client:	Hecla	Sample Depth:	11.3 m
Client Rep.:	Peter Johnson	Sampling Method:	Grab
Date Tested:	November 17, 2022 By: BW	Date Sampled:	-
Soil Description[2]:	GRAVEL - sandy, silty	Sampled By:	JS
		USC Classification:	GM-ML Cu: #N/A
Moisture Content:	10.2%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	92
19	88
12.5	79
10	75
5	65
2	56
0.85	49
0.425	44
0.25	40
0.15	37
0.075	31.7



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: P.Eng.

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TETRA TECH

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP32
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086670N; 483945E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics		FROZEN, Nbe			0
	END OF TESTPIT @ 0.3 m (refusal in permafrost)					
1						5
2						
3						10
4						15
5						16

eba A TETRA TECH COMPANY

LOGGED BY: JTP	COMPLETION DEPTH: 0.3m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP33
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086688N; 783971E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics		FROZEN, Nbe			0
	END OF TESTPIT @ 0.4 m (refusal in permafrost)					
1						5
2						
3						10
4						15
5						16

eba A TETRA TECH COMPANY

LOGGED BY: JTP	COMPLETION DEPTH: 0.4m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP34
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086656N; 484041E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics			FROZEN, Nbe			0
	SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout			FROZEN, Vr, Vc, 5%			
1			SA01		●		
	END OF TESTPIT @ 1.0 m (refusal in permafrost)						
2							5
3							10
4							15
5							16

LOGGED BY: JTP	COMPLETION DEPTH: 1m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

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Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP35
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086717N; 484118E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics			FROZEN, Nbe			0
	SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout			FROZEN, Vr, Vc, 25%			
			SA02		●		
	END OF TESTPIT @ 0.6 m (refusal in permafrost)						
1							5
2							
3							10
4							
							15
5							16

LOGGED BY: JTP	COMPLETION DEPTH: 0.6m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

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Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP36
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086820N; 484131E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics		FROZEN, Nbe			0
	SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout		FROZEN, Vr, Vc, 25%			
	END OF TESTPIT @ 0.5 m (refusal in permafrost)					
1						5
2						
3						10
4						
						15
5						16

eba A TETRA TECH COMPANY	LOGGED BY: JTP	COMPLETION DEPTH: 0.5m
	REVIEWED BY: CPC	COMPLETE: 9/11/2013
	DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP37
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086772N; 484206E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics		FROZEN, Nbe			0
	SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout		FROZEN, Vr, Vc, 25%			
	END OF TESTPIT @ 0.5 m (refusal in permafrost)					
1						5
2						
3						10
4						15
5						16

eba A TETRA TECH COMPANY

LOGGED BY: JTP	COMPLETION DEPTH: 0.5m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP38
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086712N; 484238E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics			FROZEN, Nbe			0
	SILT - some gravel, trace sand, non-plastic, olive grey, cobbles and boulders throughout		SA03	FROZEN, Vr, Vc, 10%	●		
	END OF TESTPIT @ 0.4 m (refusal in permafrost)						
1							5
2							
3							10
4							15
5							16

eba A TETRA TECH COMPANY

LOGGED BY: JTP	COMPLETION DEPTH: 0.4m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP39
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086668N; 484114E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	PEAT - woody, roots, organics			FROZEN, Nbe			0
	SILT - some gravel, trace sand, non-plastic, olive grey, cobbles throughout			FROZEN, Vr, Vc, 10%			
			SA04		●		
	END OF TESTPIT @ 0.6 m (refusal in permafrost)						
1							5
2							
3							10
4							15
5							16

eba A TETRA TECH COMPANY	LOGGED BY: JTP	COMPLETION DEPTH: 0.6m
	REVIEWED BY: CPC	COMPLETE: 9/11/2013
	DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP40
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086655N; 484135E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) / SILT (%) / SAND (%) / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC COVER						0
	SILT - some gravel, trace sand, firm (est.), damp, non-plastic, olive grey, cobbles throughout						
1			SA05				
	SAND and GRAVEL - trace silt, well graded, medium grained, sub-rounded, loose (est.), damp, brown, cobbles throughout						5
2			SA06				
3							10
4							
	END OF TESTPIT @ 4.5 m (machine extent)						15
5							16

eba A TETRA TECH COMPANY

LOGGED BY: JTP	COMPLETION DEPTH: 4.5m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP41
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086670N; 484145E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC COVER						0
	SILT - some gravel, trace sand, firm (est.), damp, non-plastic, olive grey, cobbles throughout						
1							
							5
2			SA07		●		
	SAND and GRAVEL - trace silt, well graded, medium grained, sub-rounded, loose (est.), damp, brown, cobbles throughout						
3							10
4			SA08		●		
	END OF TESTPIT @ 4.5 m (machine extent)						15
5							16

eba A TETRA TECH COMPANY	LOGGED BY: JTP	COMPLETION DEPTH: 4.5m
	REVIEWED BY: CPC	COMPLETE: 9/11/2013
	DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP42
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086655N; 484180E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC COVER					0
	SILT - sandy, some gravel, firm (est.), damp, non-plastic, olive grey, cobbles throughout					
1						
	- becomes some sand, some gravel, cobbles and boulders throughout					5
2						
3	END OF TESTPIT @ 3.0 m (desired depth)					10
4						
						15
5						16

eba A TETRA TECH COMPANY	LOGGED BY: JTP	COMPLETION DEPTH: 3m
	REVIEWED BY: CPC	COMPLETE: 9/11/2013
	DRAWING NO:	Page 1 of 1

Dry Stack Tailings Facility Phase II Expansion	CLIENT: Alexco Keno Hill Mining Corp	TESTPIT NO: W14103303-TP43
Keno Hill District Mill Site	EXCAVATOR: Hitachi 270 Excavator	PROJECT NO: W14103303-01
Keno City, YT	7086695N; 484241E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

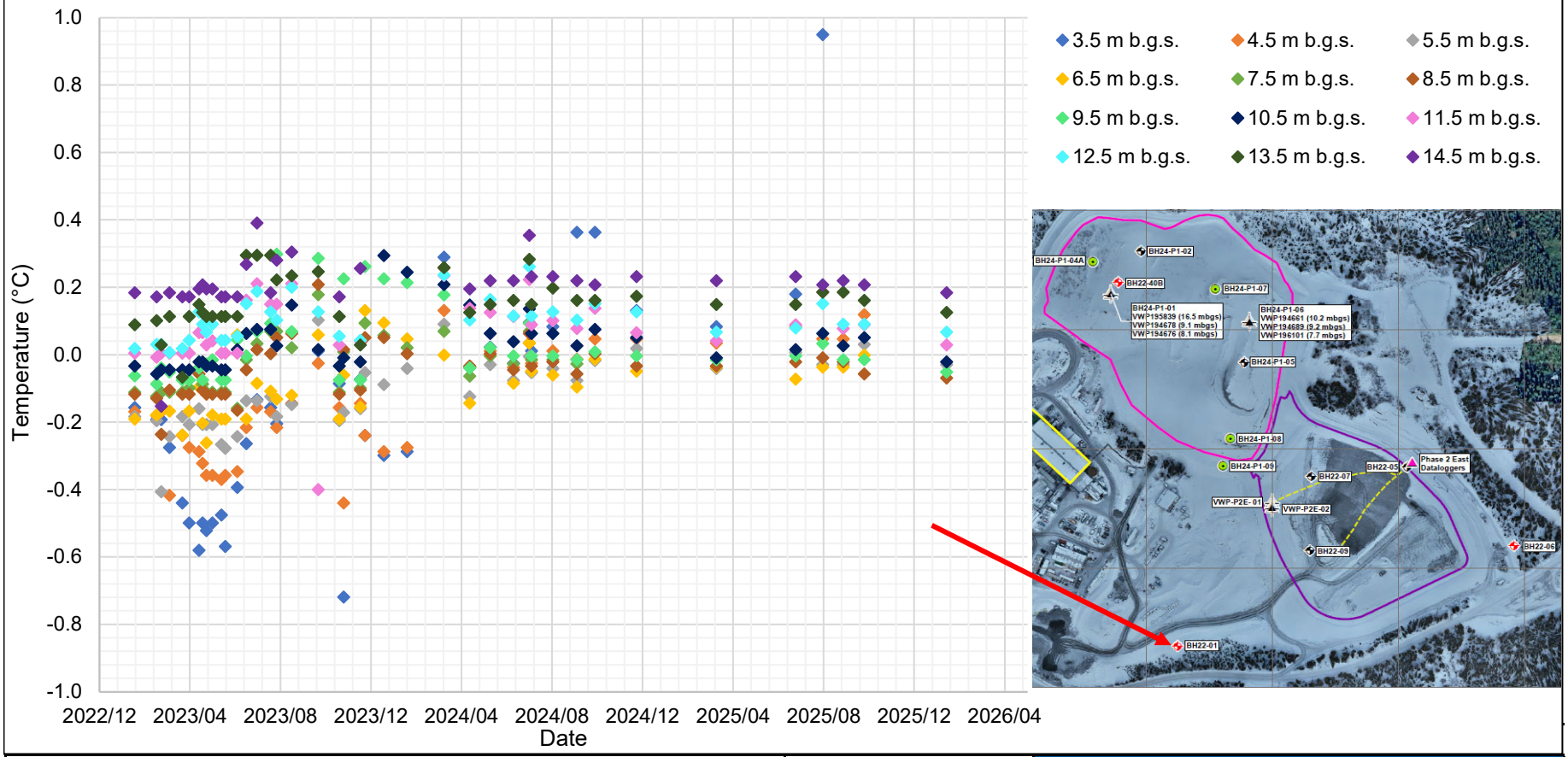
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC COVER						0
	SAND and GRAVEL - silty, well graded, medium grained, sub-rounded, compact (est.), damp, brown, cobbles throughout						
1							5
2			SA09		●		
3	END OF TESTPIT @ 3.0 m (desired depth)						10
4							15
5							16

eba A TETRA TECH COMPANY

LOGGED BY: JTP	COMPLETION DEPTH: 3m
REVIEWED BY: CPC	COMPLETE: 9/11/2013
DRAWING NO:	Page 1 of 1

APPENDIX C

GROUND TEMPERATURE CABLE DATA



NOTES:

Readings from 0.5, 1.5, 2.0, and 2.5 m b.g.s. not shown for plot clarity.

Selected readings between July 2023 and April 2024 removed due to questionable data quality.

CLIENT

Hecla MINING COMPANY

TETRA TECH

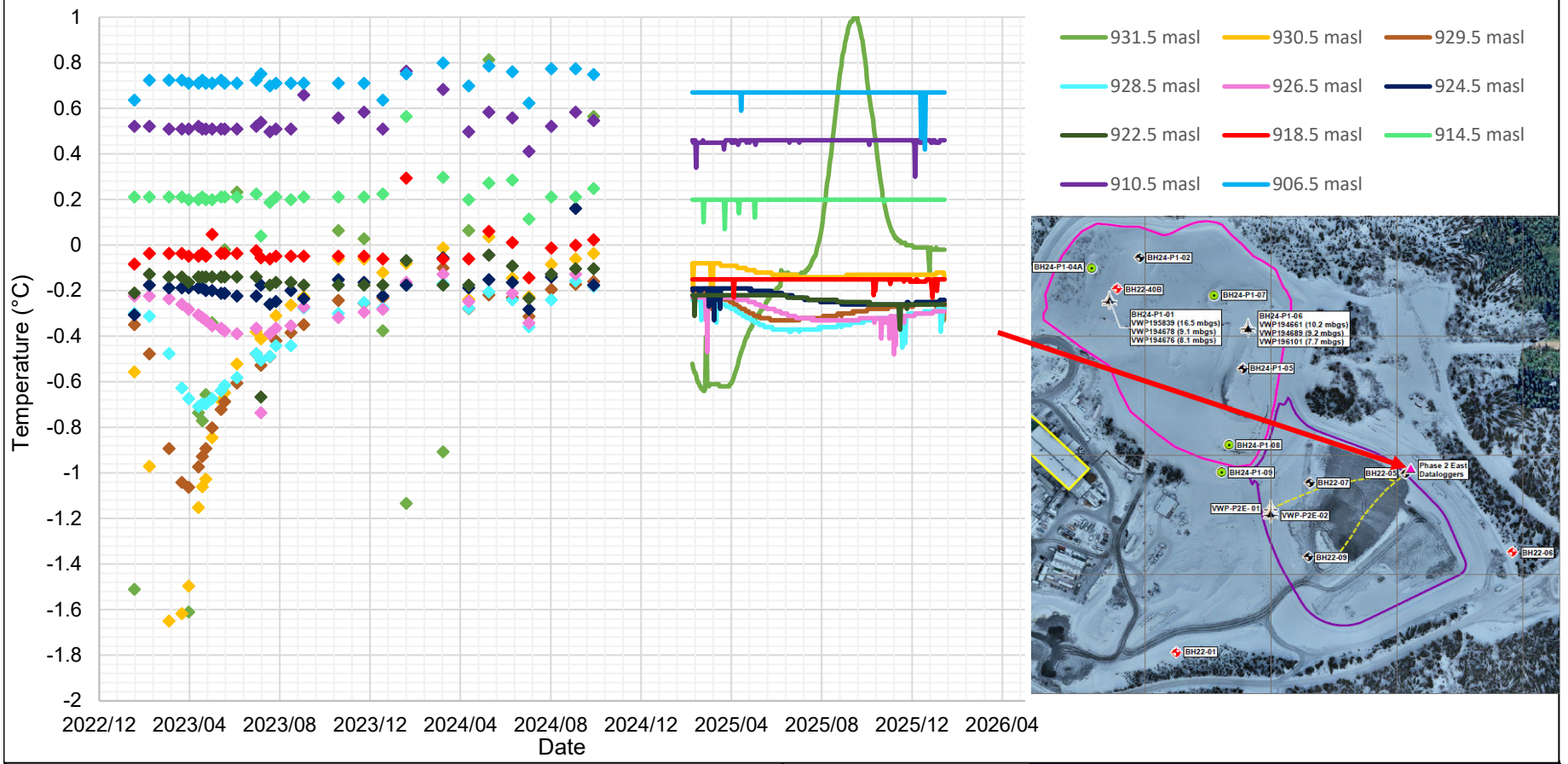
DSTF Instrumentation Montoring

BH22-01 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-1



NOTES:

Selected readings between July 2023 and July 2024 removed due to questionable data quality.

Ground surface on March 16, 2025 was approx. 934.2 masl

CLIENT

Hecla MINING COMPANY

TETRA TECH

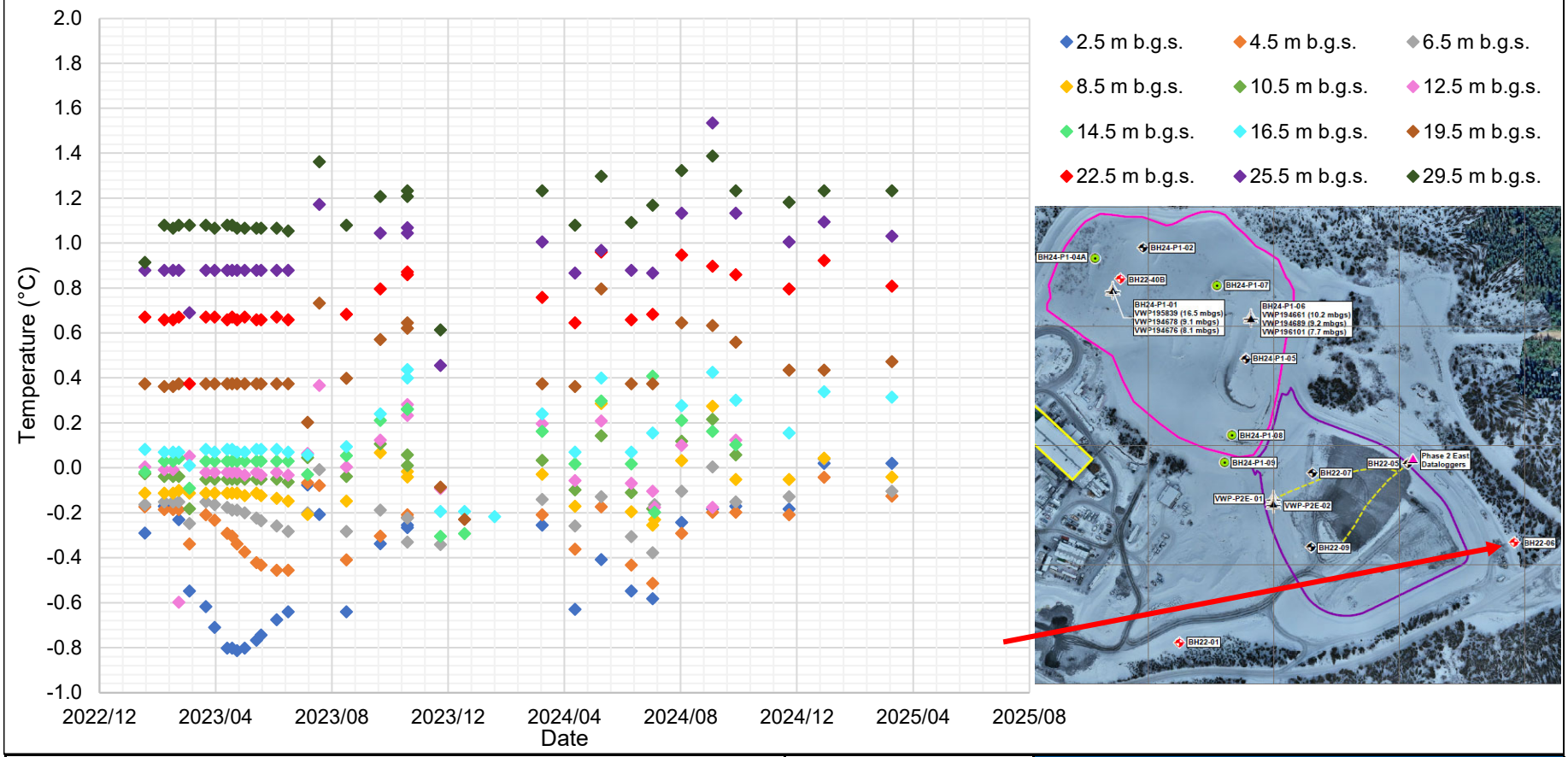
DSTF Instrumentation Montoring

BH22-05 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-2



NOTES:

Nodes at 0.5 and 1.5 m b.g.s. not shown for plot clarity.

Selected readings between March 2023 and July 2024 removed due to questionable data quality.

CLIENT

Hecla MINING COMPANY

TETRA TECH

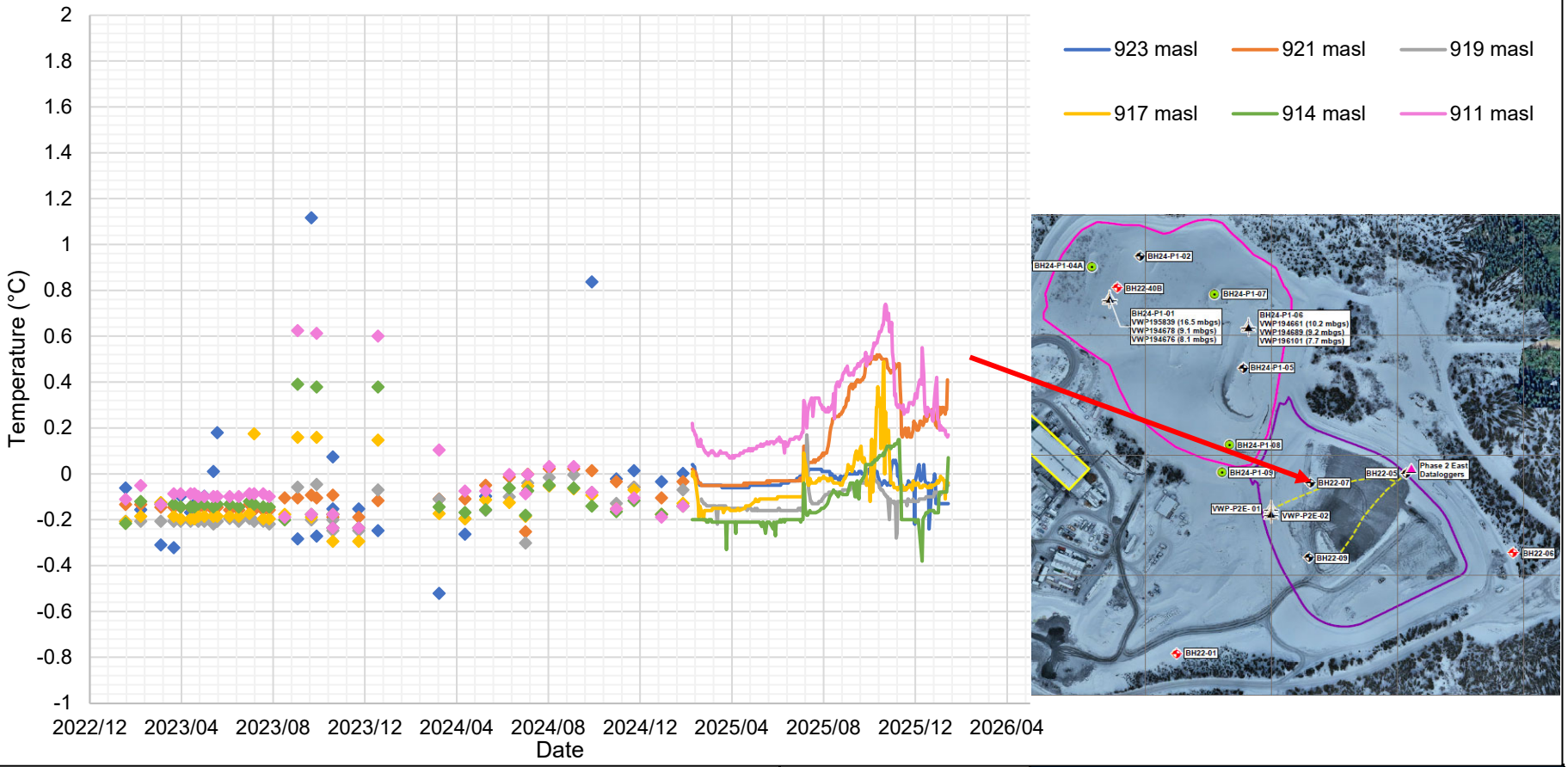
DSTF Instrumentation Montoring

BH22-06 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-3



NOTES:

Readings between September 2023 and March 2024 removed due to questionable data quality.

Occasional anomalous readings caused by cable extension removed.

Ground surface on March 16, 2025 was approx. 927.8 masl

CLIENT

Hecla MINING COMPANY

TETRA TECH

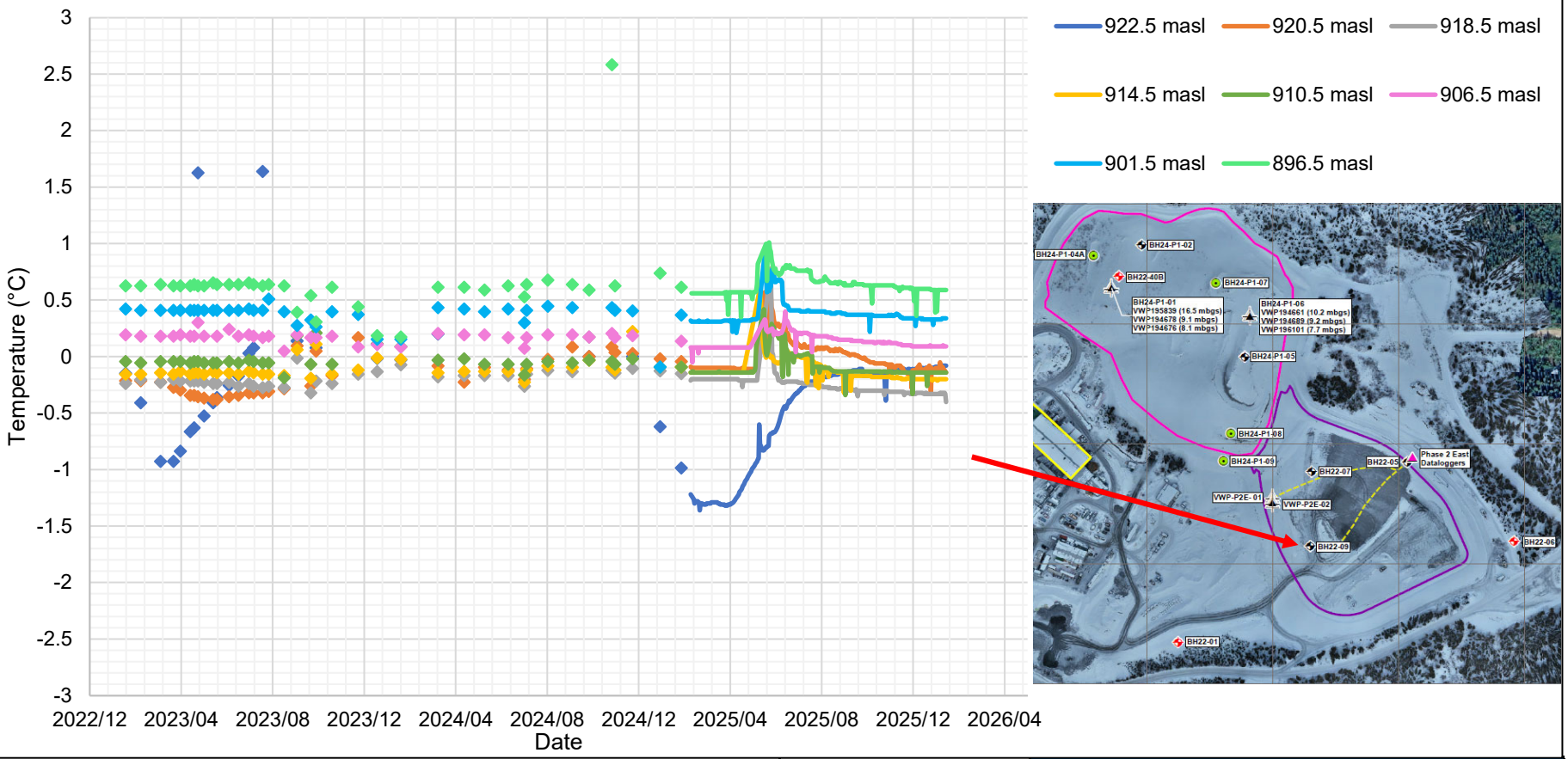
DSTF Instrumentation Montoring

BH22-07 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-4



NOTES:

Selected readings between September 2023 and November 2023 removed due to questionable data quality.

Ground surface on March 16, 2025 was approx. 926.9 masl

CLIENT

Hecla MINING COMPANY

TETRA TECH

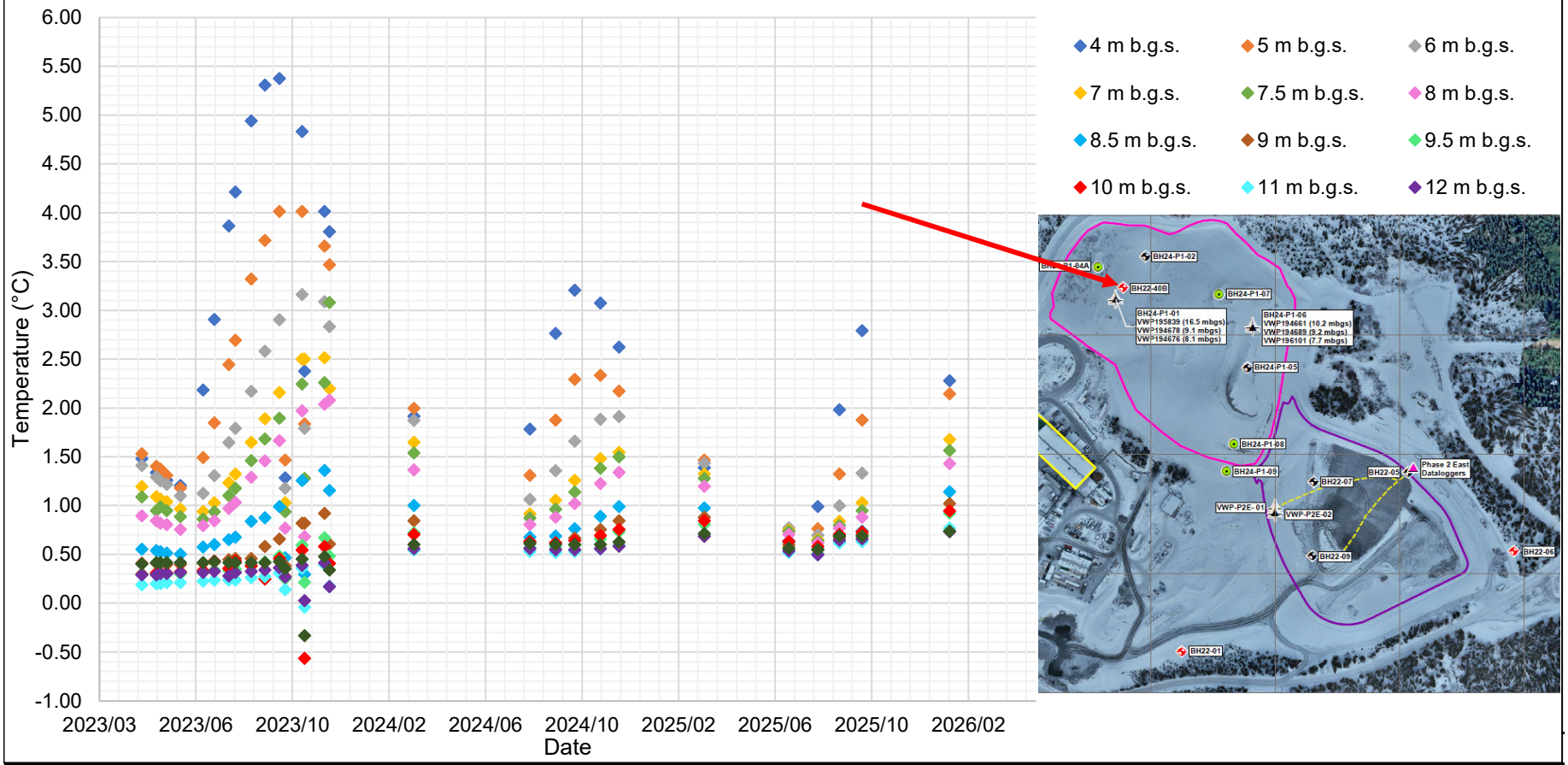
DSTF Instrumentation Montoring

BH22-09 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-5



NOTES:

Nodes at 1.0, 2.0, 3.0 m b.g.s. not shown for plot clarity.

Selected readings between September 2023 and November 2023 removed due to questionable data quality.

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TETRA TECH

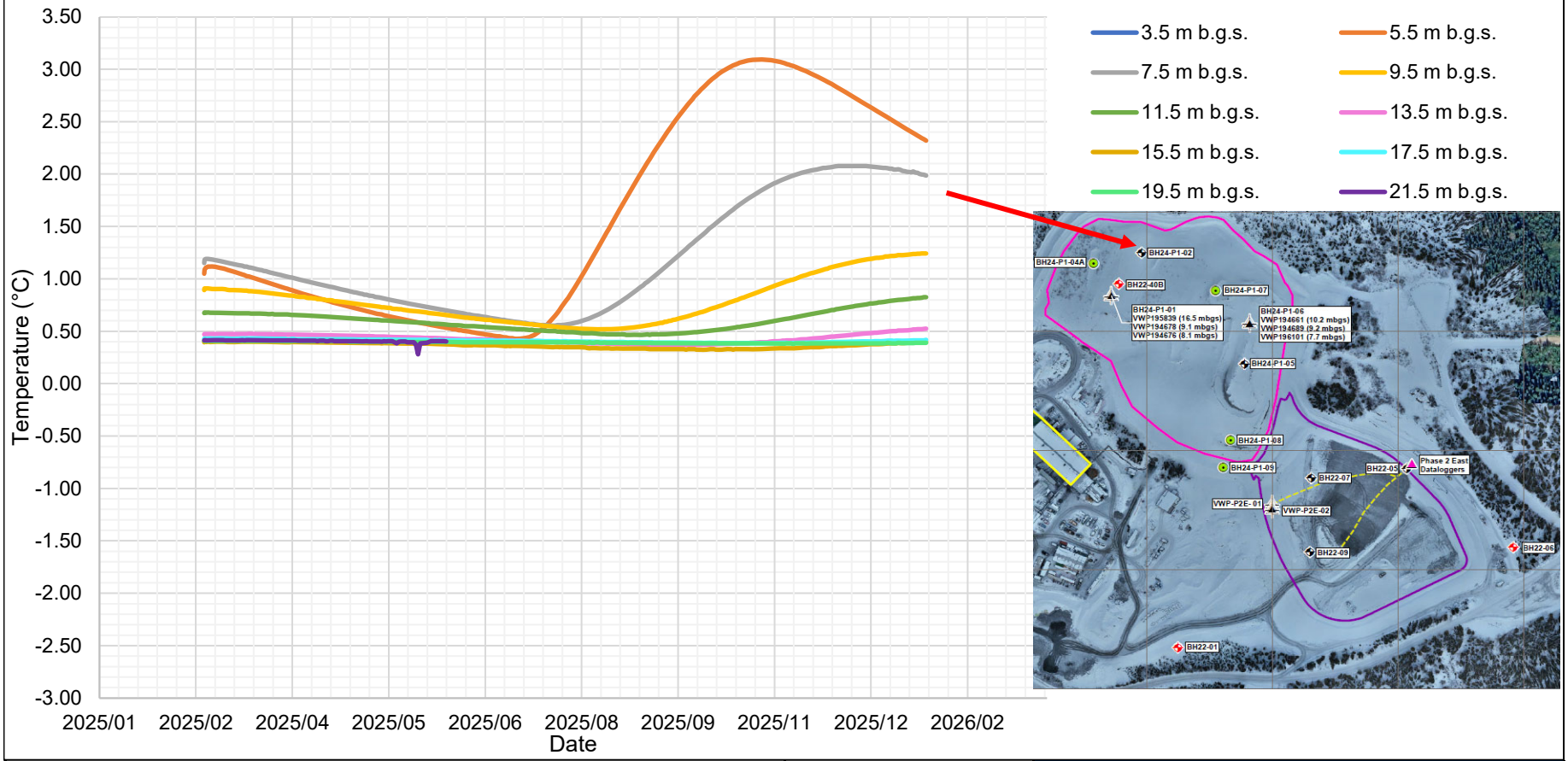
DSTF Instrumentation Montoring

BH22-40B Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-6



NOTES:

Node 10 at a depth of 21.5 m has been omitted due to erroneous data since 6/11/2025.

CLIENT

Hecla MINING COMPANY

TETRA TECH

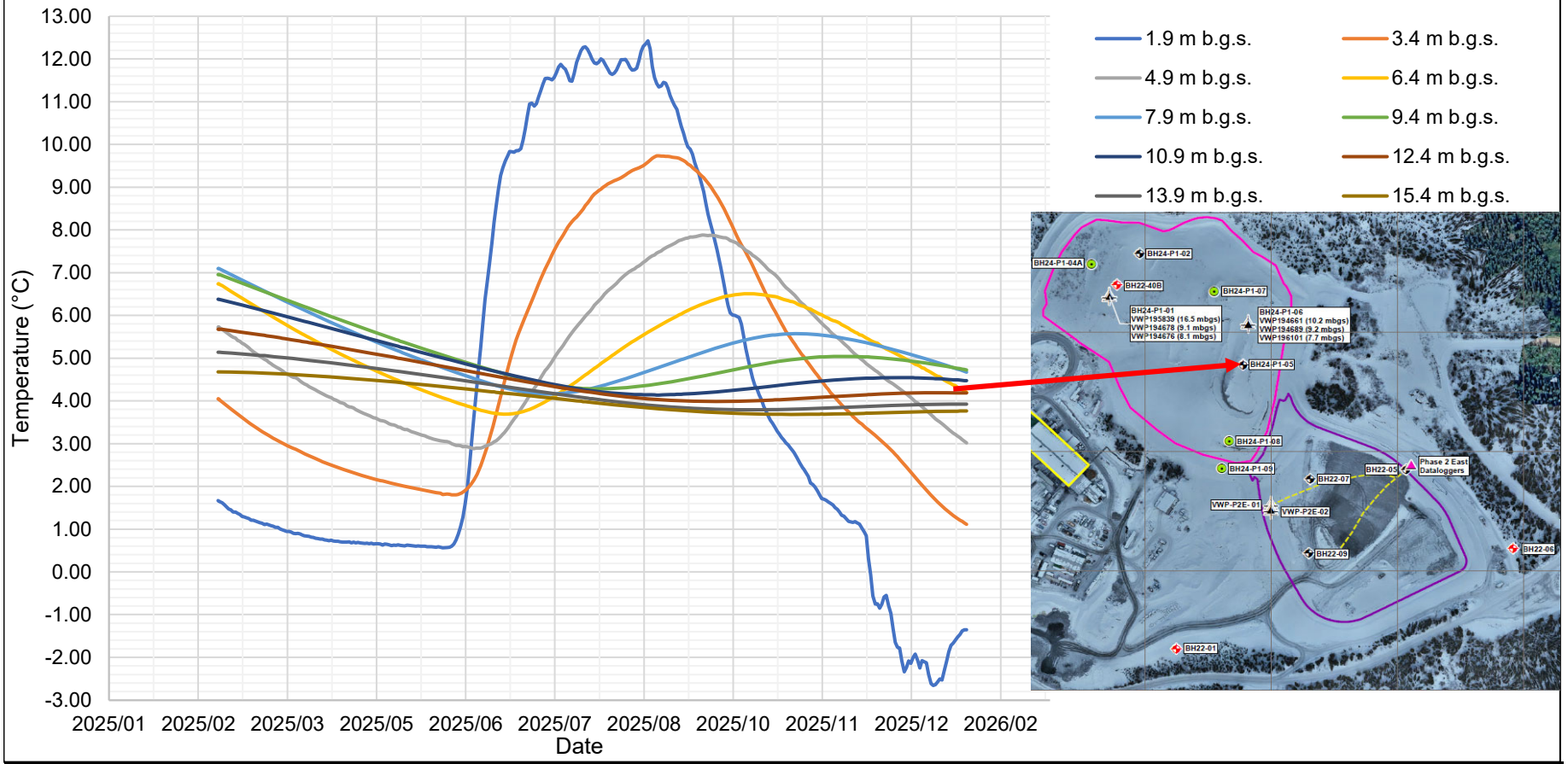
DSTF Instrumentation Montoring

BH24-P1-02 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-7



NOTES:

CLIENT

Hecla MINING COMPANY

TETRA TECH

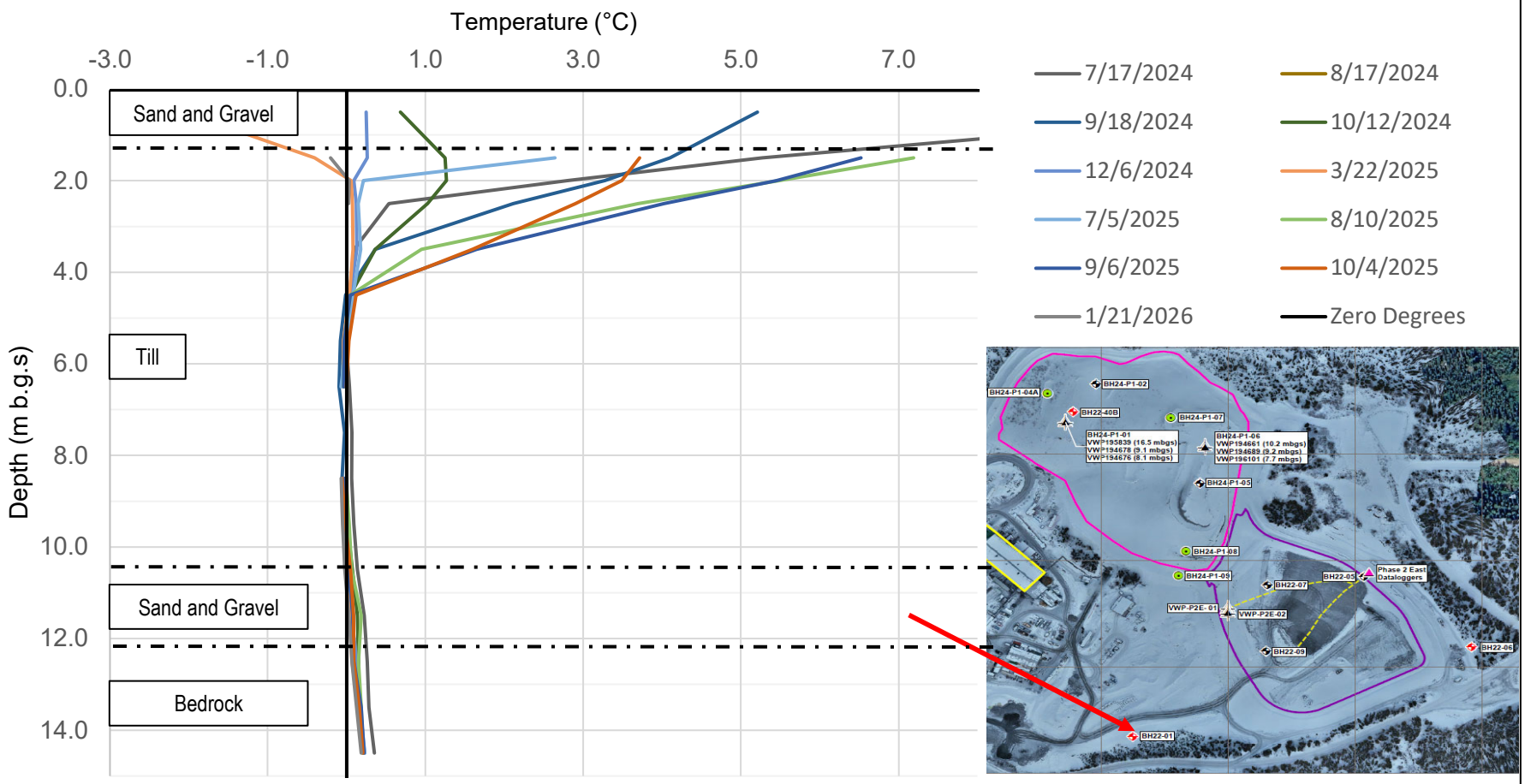
DSTF Instrumentation Montoring

BH24-P1-05 Ground Temperature Time Series

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Thursday, January 29, 2026	704-ENG.WARC04673-05

Figure B-8



NOTES:

Data is presented at nominal quarterly intervals until the most recent 12 months, during which monthly readings were included when available.

CLIENT

Hecla MINING COMPANY

TETRA TECH

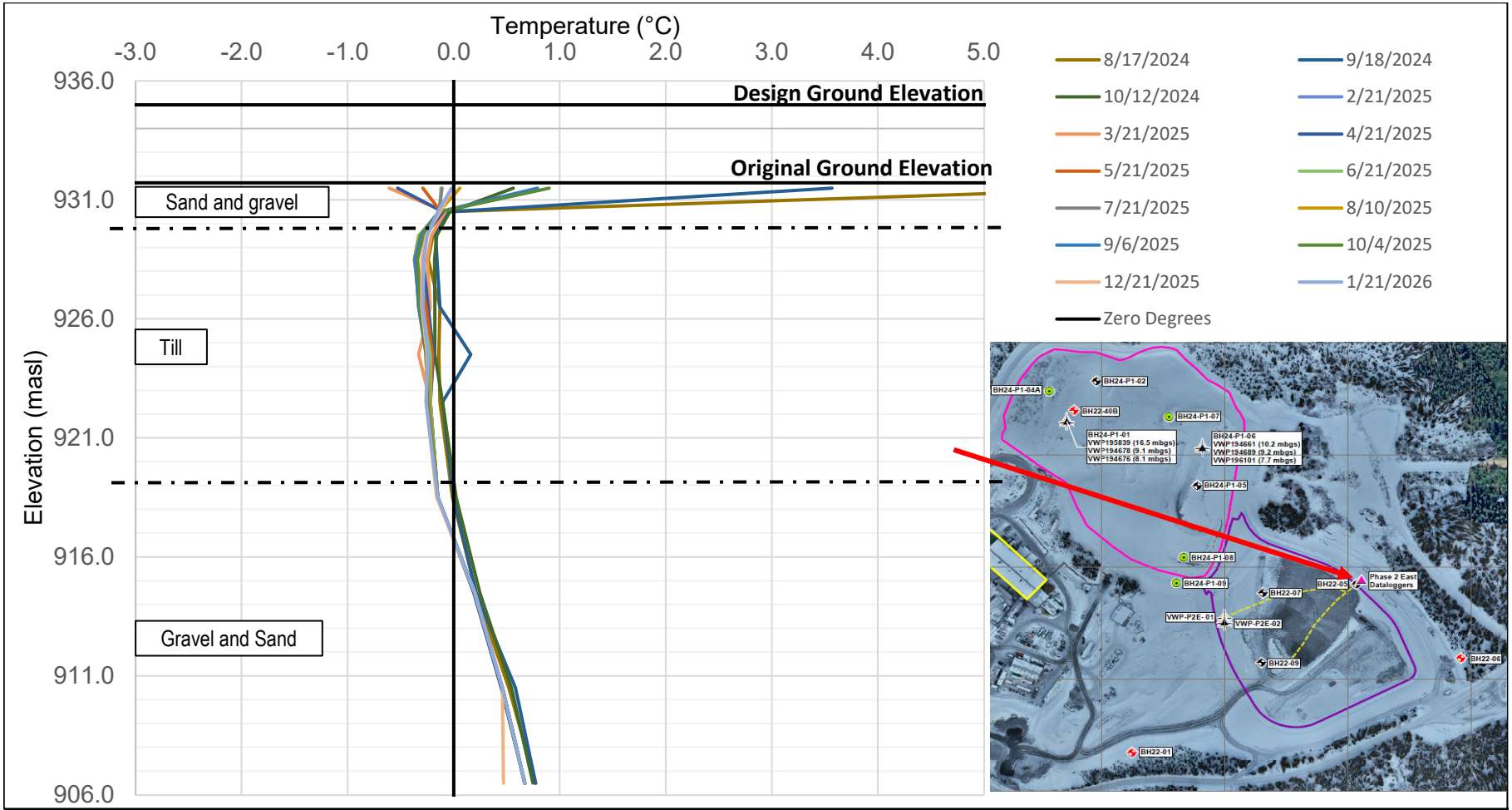
DSTF Instrumentation Montoring

BH22-01 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-9



NOTES:

Data is presented at nominal quarterly intervals until the most recent 12 months, during which monthly readings were included when available.

CLIENT

Hecla MINING COMPANY

TETRA TECH

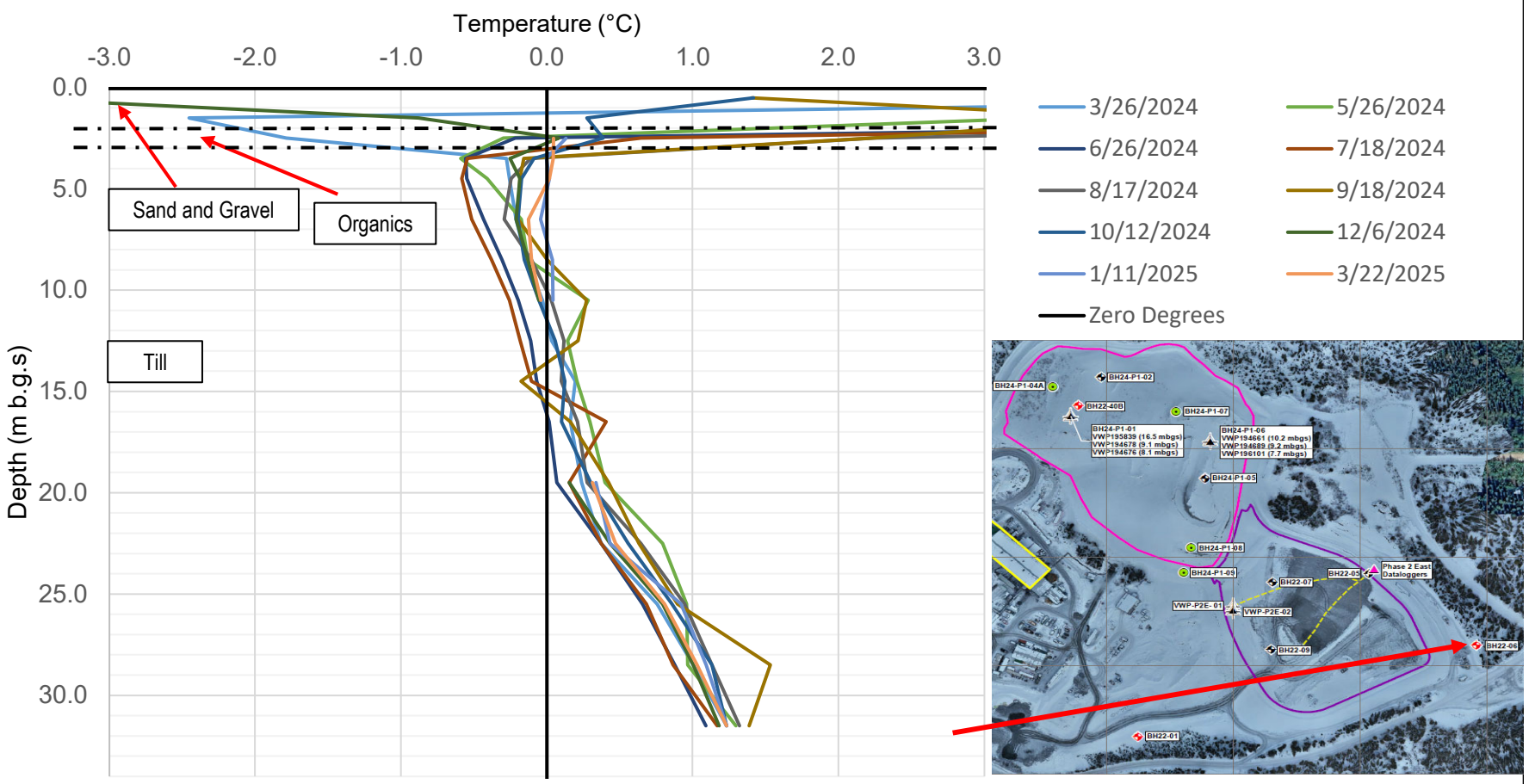
DSTF Instrumentation Montoring

BH22-05 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-10



NOTES:

Data is presented at nominal quarterly intervals until the most recent 12 months, during which monthly readings were included when available.

CLIENT

Hecla MINING COMPANY

TETRA TECH

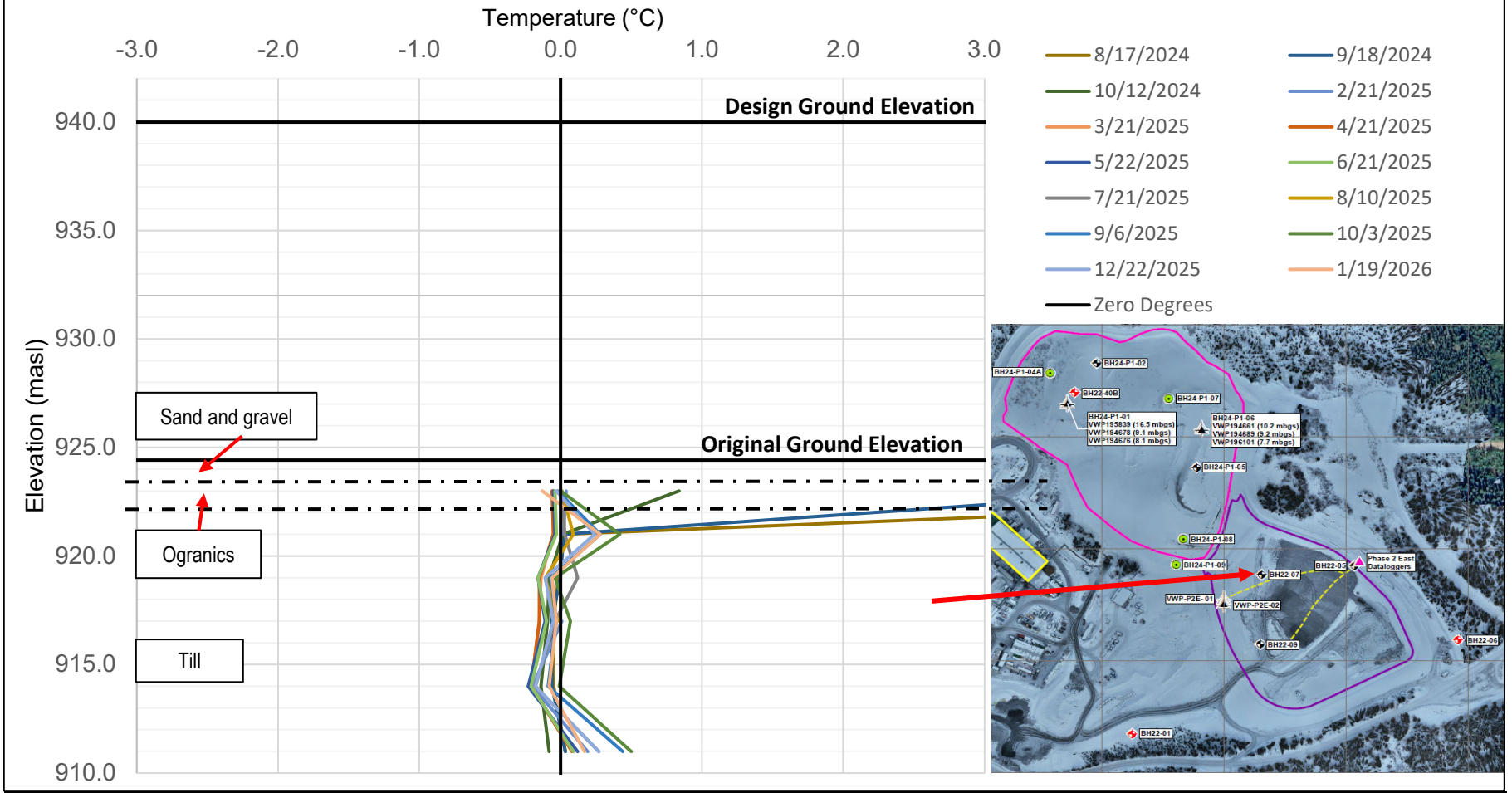
DSTF Instrumentation Montoring

BH22-06 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-11



NOTES:

Data is presented at nominal quarterly intervals until the most recent 12 months, during which monthly readings were included when available.

CLIENT

Hecla MINING COMPANY

TETRA TECH

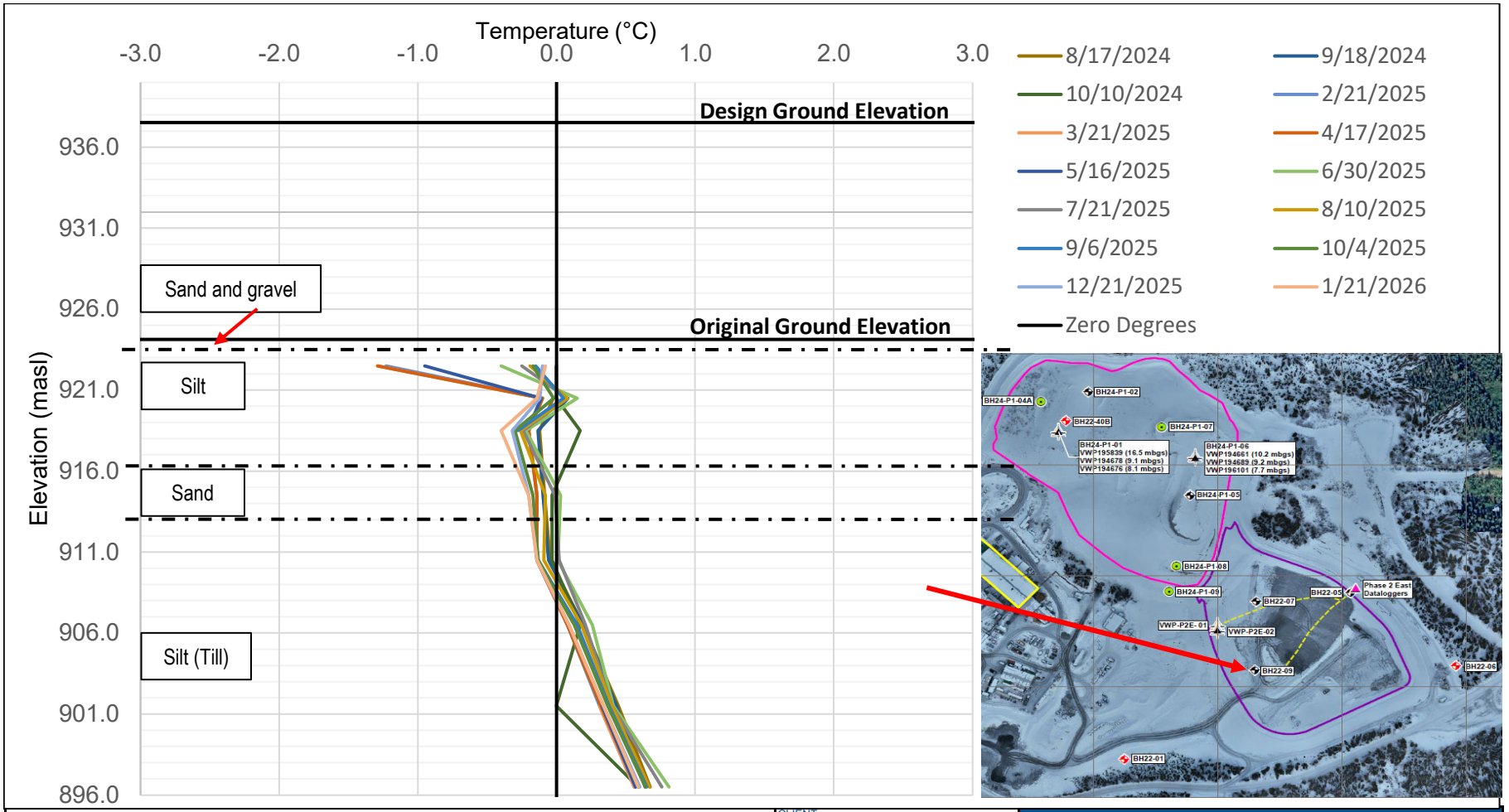
DSTF Instrumentation Montoring

BH22-07 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-12



NOTES:

Data is presented at nominal quarterly intervals until the most recent 12 months, during which monthly readings were included when available.

CLIENT

Hecla MINING COMPANY

TETRA TECH

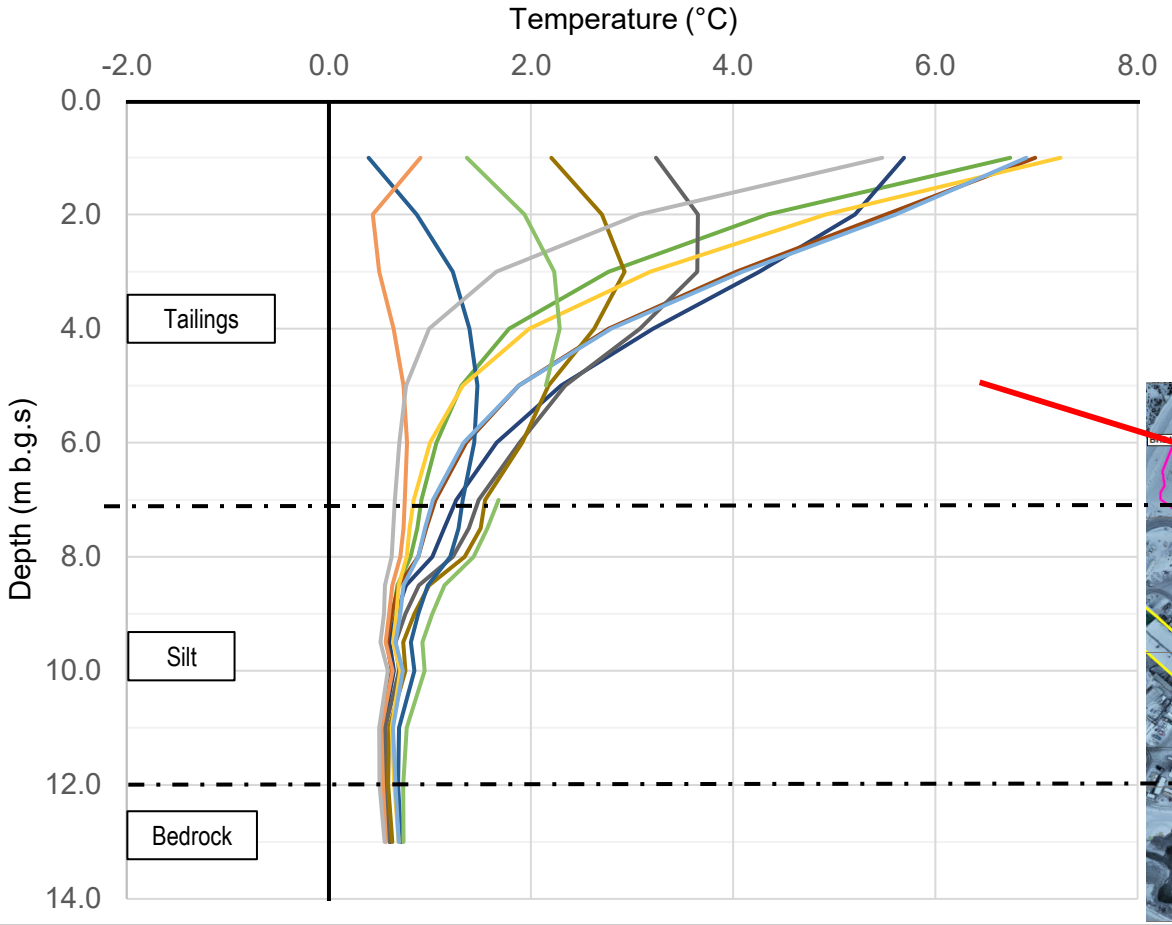
DSTF Instrumentation Montoring

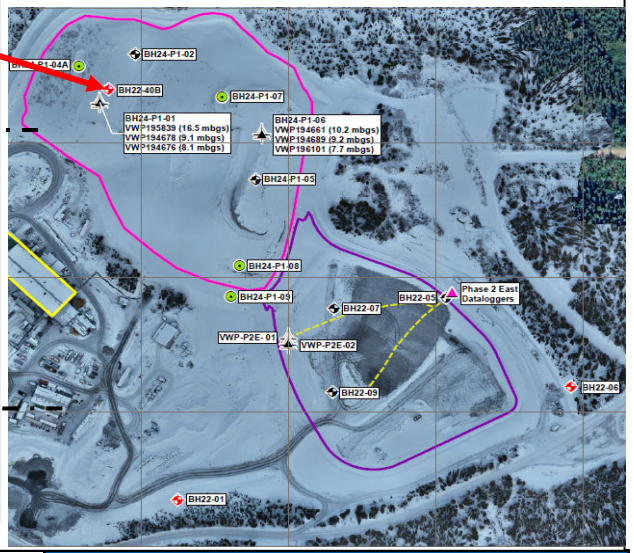
BH22-09 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-13





NOTES:

Data is presented at nominal quarterly intervals until the most recent 12 months, during which monthly readings were included when available.

CLIENT

Hecla MINING COMPANY

TETRA TECH

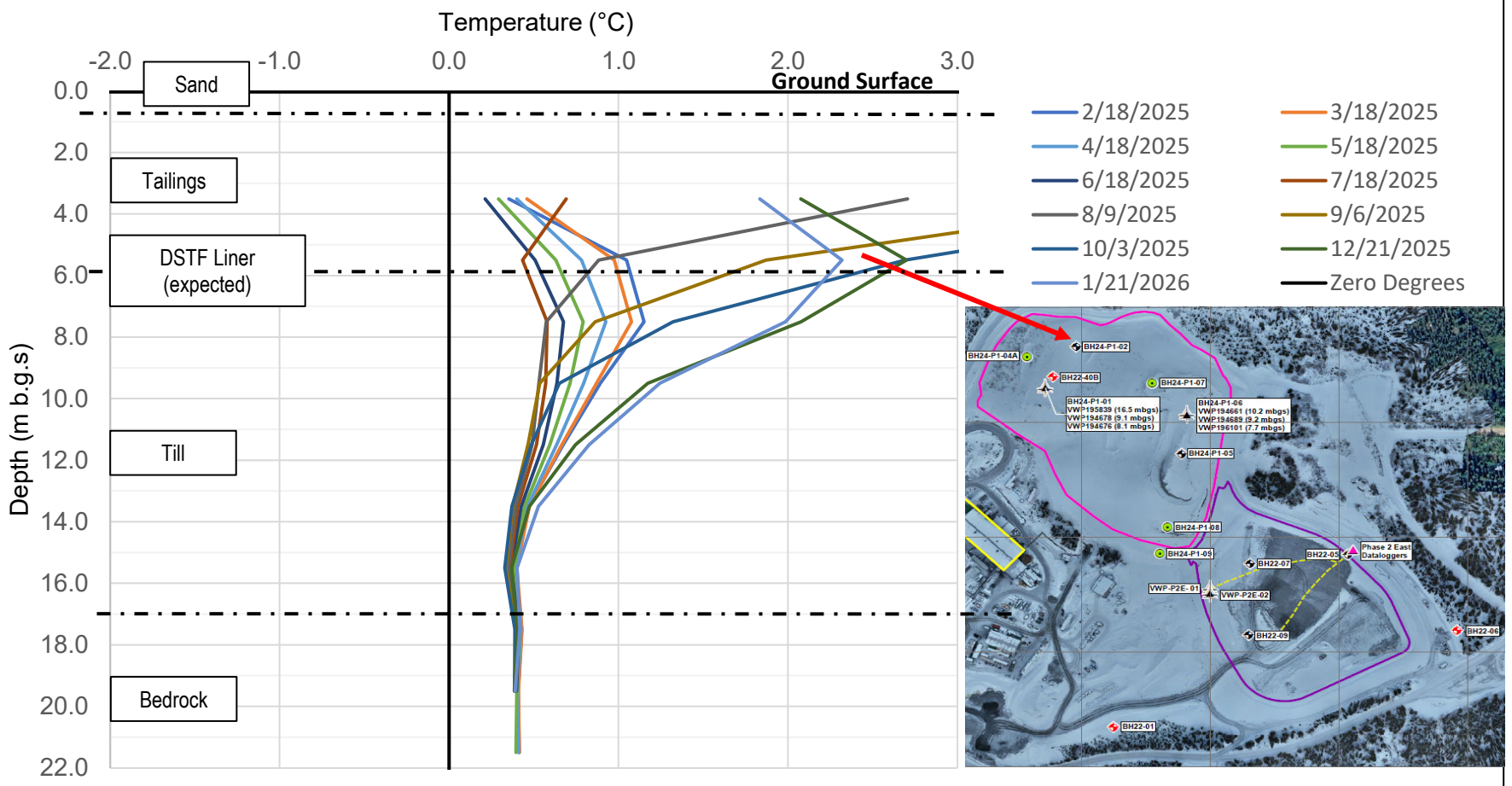
DSTF Instrumentation Montoring

BH22-40B Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-14



NOTES:

Node 10 at a depth of 21.5 m has been omitted due to erroneous data since 6/11/2025.

CLIENT

Hecla MINING COMPANY

TETRA TECH

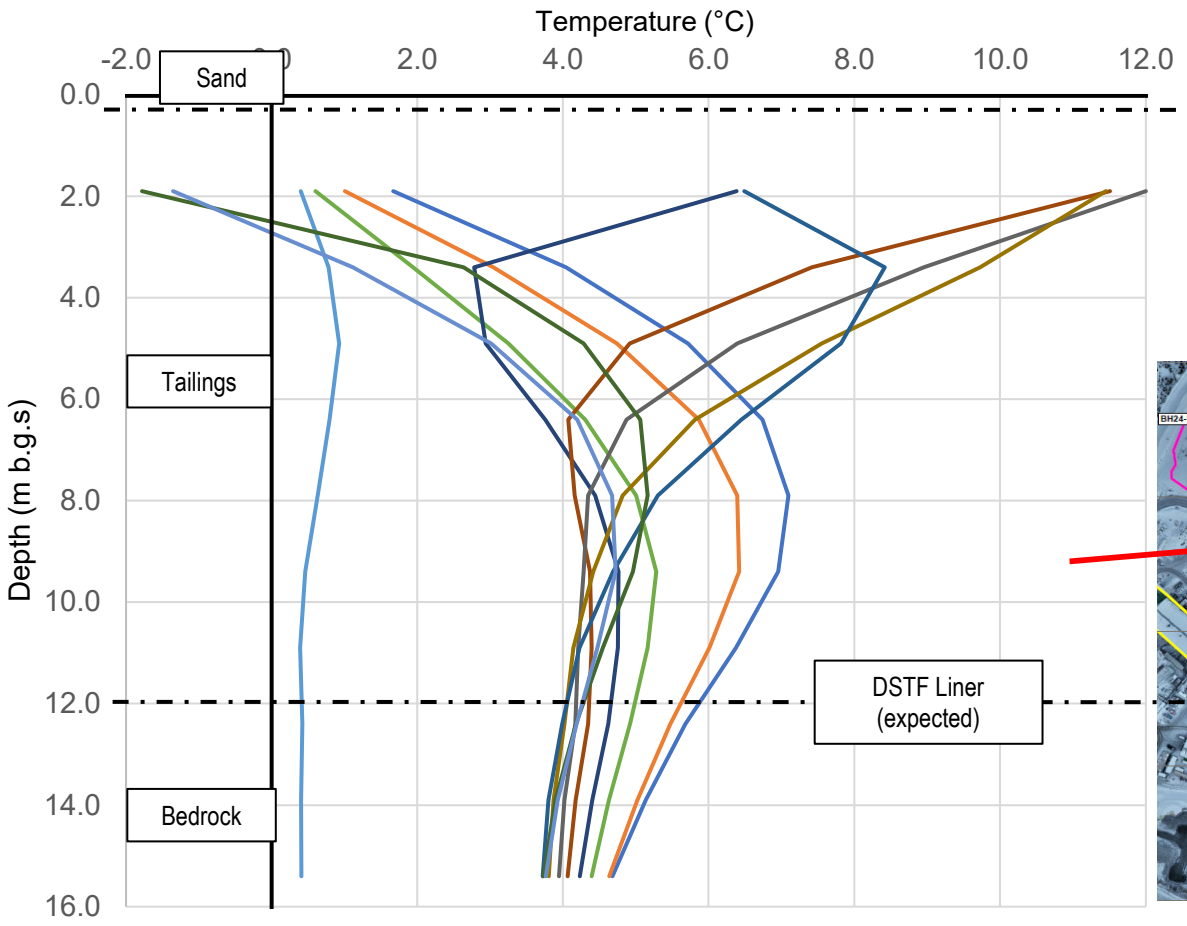
DSTF Instrumentation Montoring

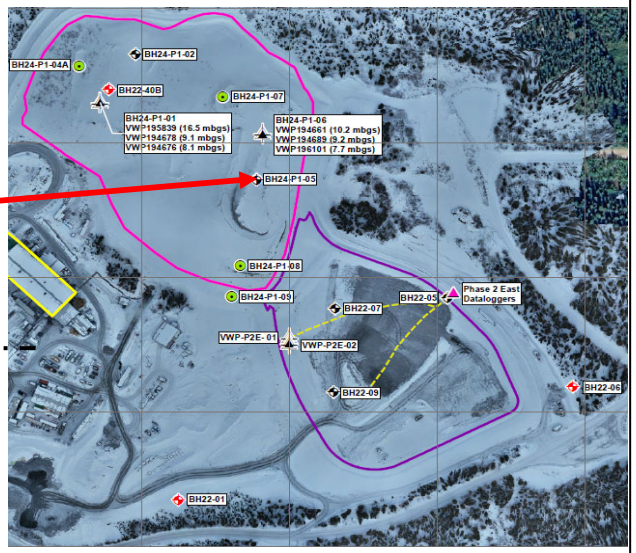
BH24-P1-02 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-15





NOTES:

CLIENT

Hecla MINING COMPANY

TETRA TECH

DSTF Instrumentation Montoring

BH24-P1-05 Ground Temperature Trumpet Curve

OFFICE	DWN	CKD	REV
EGI-WHSE	YL	IM	0

DATE	PROJECT NO.
Tuesday, October 21, 2025	704-ENG.WARC04673-05

Figure B-16

APPENDIX D

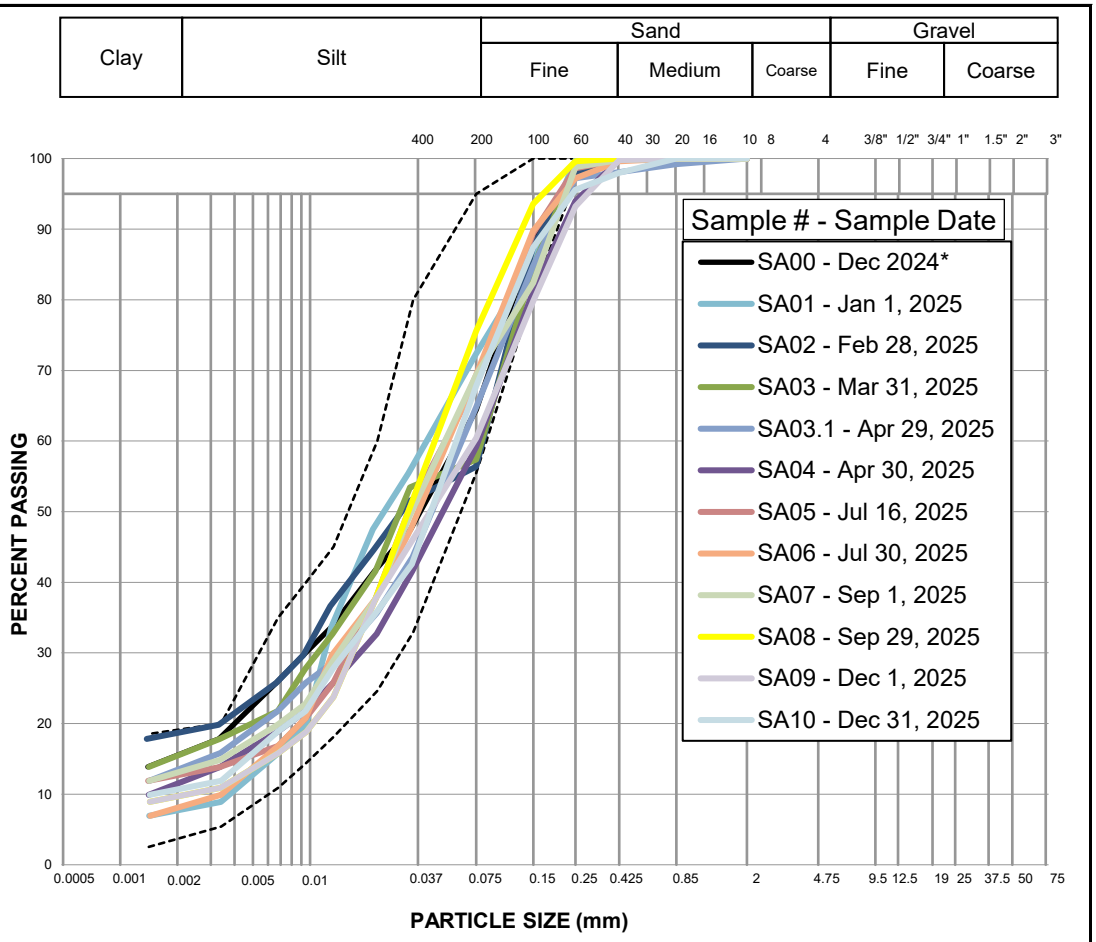
TAILINGS AND INTERFACE DIRECT SHEAR LABORATORY TEST DATA

PARTICLE SIZE ANALYSIS REPORT

ASTM D7928 & C136

Project:	AKHM DSTF EOR Services	Sample No.:	SA00 - SA10
Project No.:	ENG.WARC04673-05	Material Type:	Tailings
Site:	Keno Hill Mine, YT	Sample Loc.:	Flame and Moth Mill
Client:	AKHM	Sample Depth:	NA
Client Rep.:	Ryan Tilstra	Sampling Method:	Grab
Date Tested:	Varies By: CBC	Date Sampled:	Varies
Soil Description[2]:	SILT - sandy, trace clay	Sampled By:	AKHM
		USC Classification:	ML Cu:
Moisture Content:			Cc:

Particle Size (mm)	
75	
50	
38	
25	
19	
12.5	
10	
5	
2	
0.85	
0.425	
0.25	
0.15	
0.075	
0.0329	
0.0214	
0.0129	
0.0095	
0.0068	
0.0034	
0.0014	



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to Tetra Tech description protocols

Specification:

Remarks: *SA00 Hydrometer data was collected from another project Tetra Tech has executed for AKHM (WARC04673-03)

Reviewed By: _____ P.Eng.

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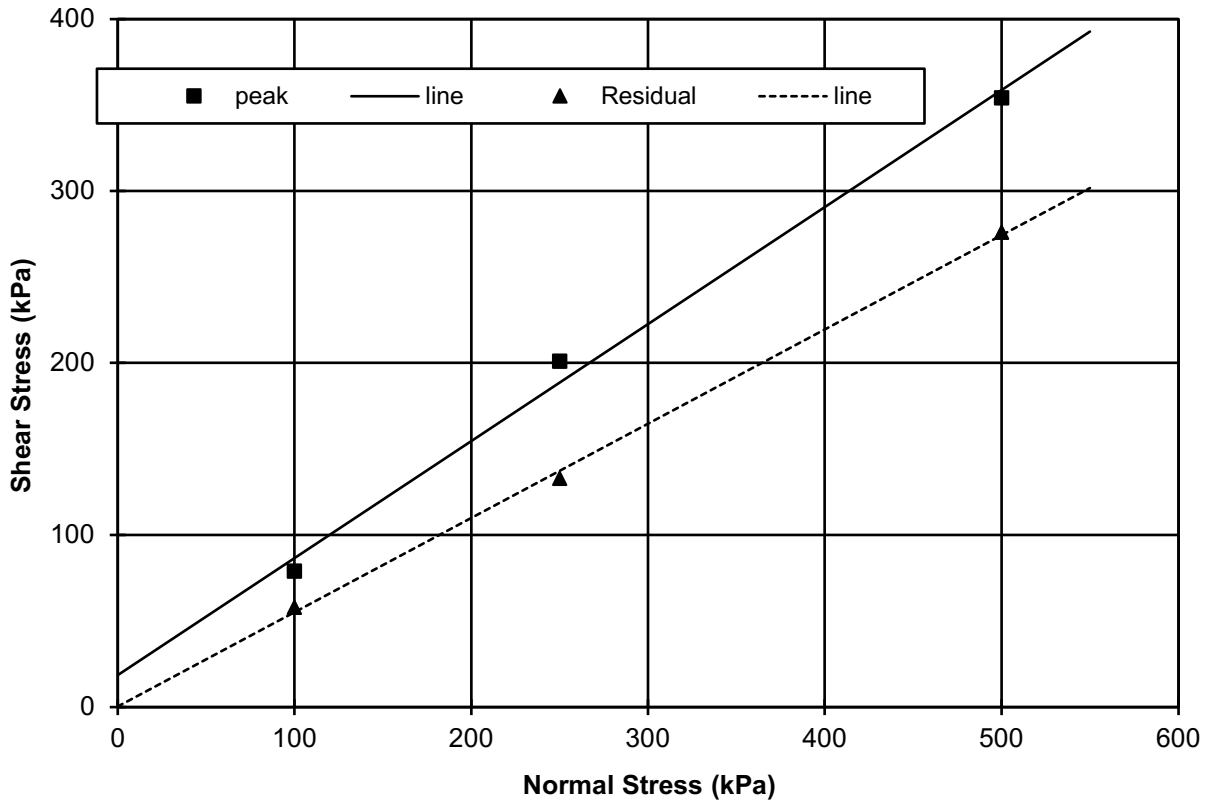
TETRA TECH

SUMMARY of DIRECT SHEAR TEST RESULTS

ASTM D3080

Project:	AKHM DSTF Tailings	Sample No.:	1054 (SA02)
Project No.:	ENG.WARC04673-05.003	Location:	Flame and Moth Hill
Client:	AKHM	Date:	April 22, 2025
Attention:	Ryan Tilstra	Tested By:	TD
Email:	rtilstra@hecla.com	Office:	Edmonton



Inferred Shear Strength Parameters :-

	Cohesion Intercept (kPa)	Inferred Angle of Shearing Resistance (Degrees)
Peak Strength:	**19**	**34.2**
Residual Strength:	**0**	**28.7**

Reviewed By: _____ P.Eng.

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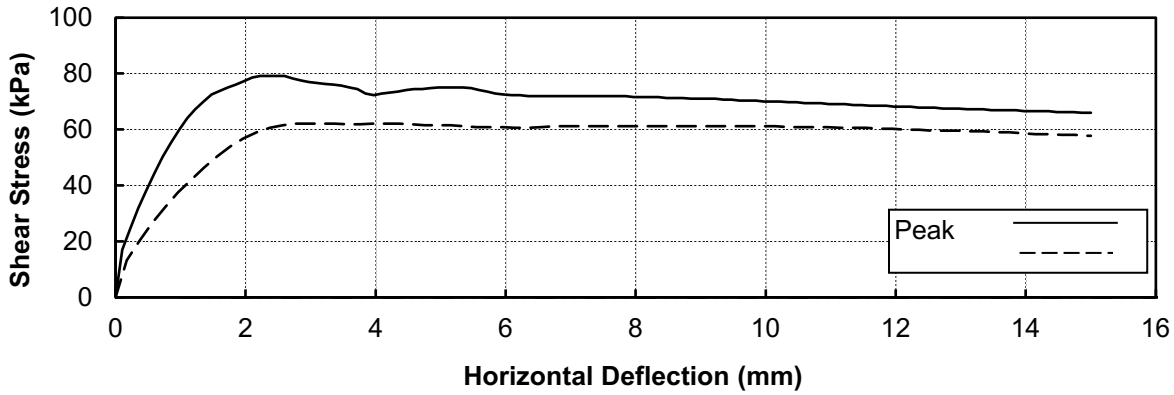
TETRA TECH

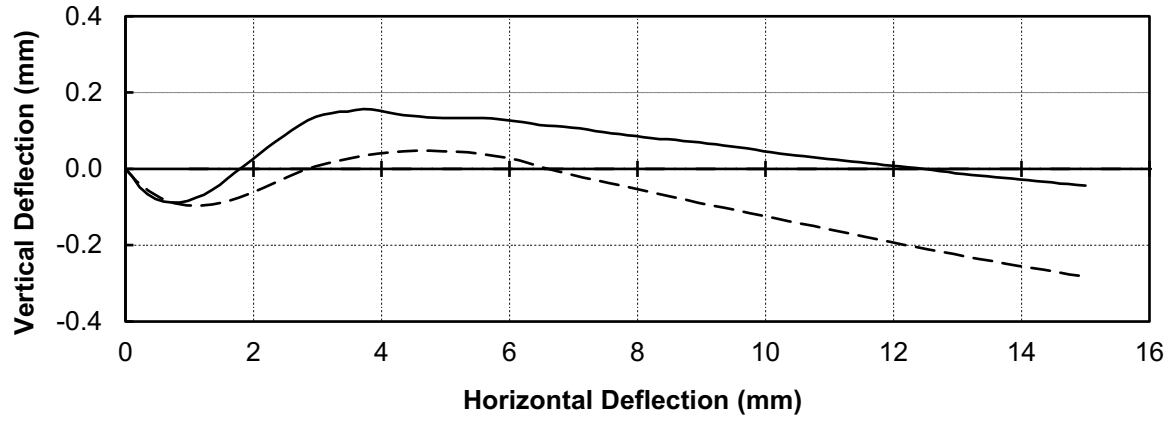
DIRECT SHEAR TEST

ASTM D3080

Project:	AKHM DSTF Tailings	Sample No.:	1054 (SA02)
Project No.:	ENG.WARC04673-05.003	Location:	Flame and Moth Hill
Client:	AKHM DSTF Tailings	Test No.:	DS-1
Date Tested:	April 15, 2025	Machine:	4
Description:	SILT, trace sand, bluish grey	Preparation:	Remolded

Normal Stress (kPa) =	100	Moisture Content (%)	15.6
Peak Stress (kPa) =	79	Wet Density (Mg/m^3)	2.111
Residual Stress (kPa) =	58	Dry Density (Mg/m^3)	1.826





Remarks:

Reviewed By: _____ P.Eng.

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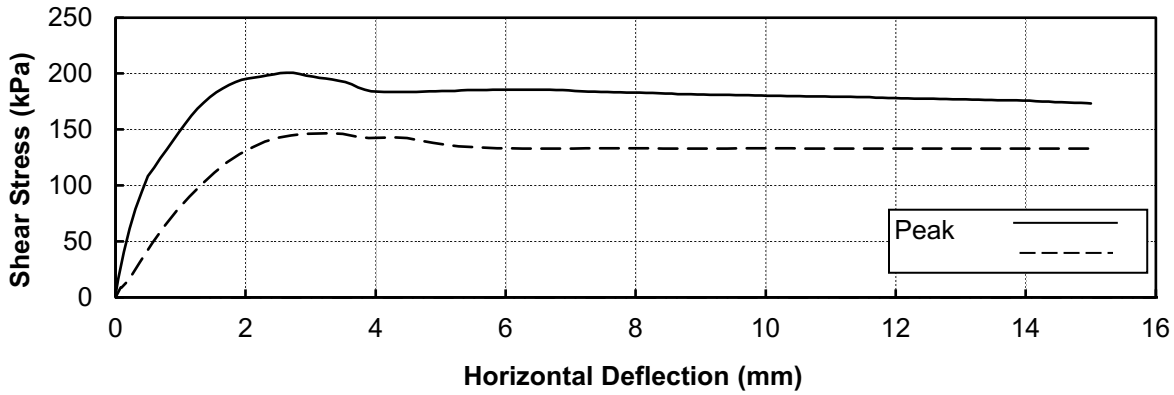
TETRA TECH

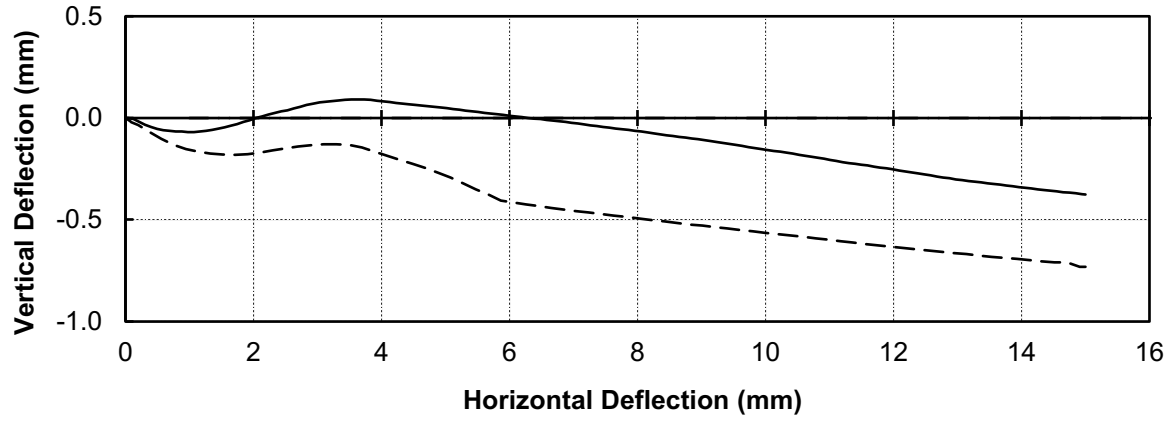
DIRECT SHEAR TEST

ASTM D3080

Project:	AKHM DSTF Tailings	Sample No.:	1054 (SA02)
Project No.:	ENG.WARC04673-05.003	Location:	Flame and Moth Hill
Client:	AKHM	Test No.:	DS-2
Date Tested:	April 15, 2025	Machine:	5
Description:	SILT, trace sand, bluish grey	Preparation:	Remolded

Normal Stress (kPa) =	250	Moisture Content (%)	15.8
Peak Stress (kPa) =	201	Wet Density (Mg/m^3)	2.111
Residual Stress (kPa) =	133	Dry Density (Mg/m^3)	1.823





Remarks:

Reviewed By: P.Eng.

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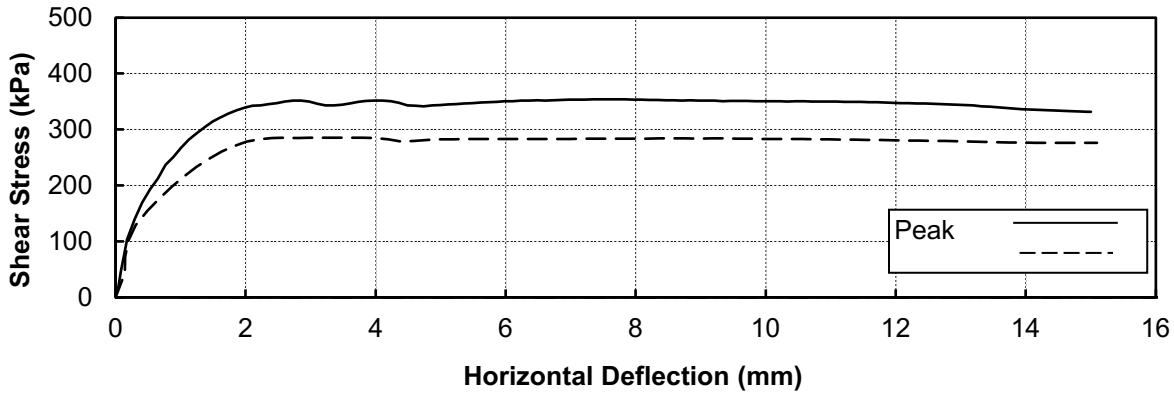
TETRA TECH

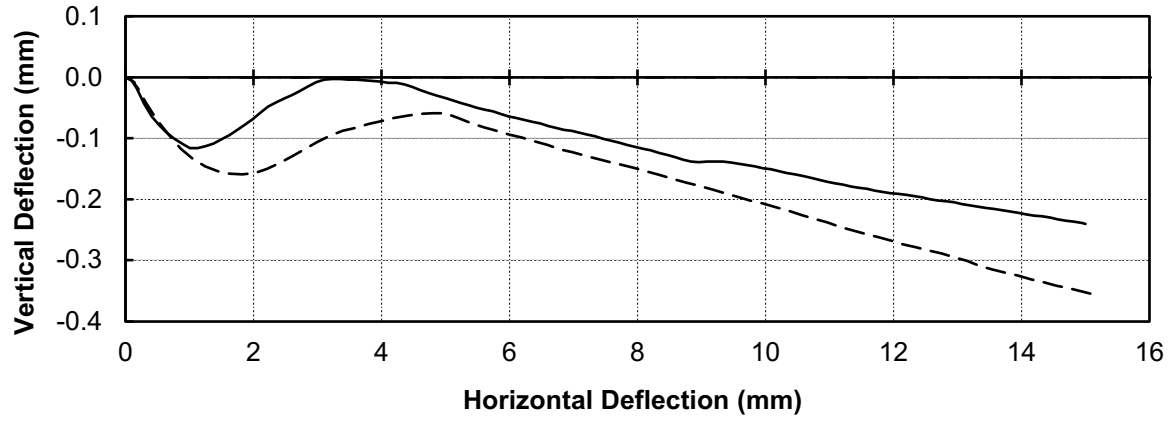
DIRECT SHEAR TEST

ASTM D3080

Project:	AKHM DSTF Tailings	Sample No.:	1054 (SA02)
Project No.:	ENG.WARC04673-05.003	Location:	Flame and Moth Hill
Client:	AKHM	Test No.:	DS-3
Date Tested:	April 15, 2025	Machine:	6
Description:	SILT, trace sand, bluish grey	Preparation:	Remolded

Normal Stress (kPa) =	500	Moisture Content (%)	15.7
Peak Stress (kPa) =	354	Wet Density (Mg/m^3)	2.111
Residual Stress (kPa) =	276	Dry Density (Mg/m^3)	1.825





Remarks:

Reviewed By: P.Eng.

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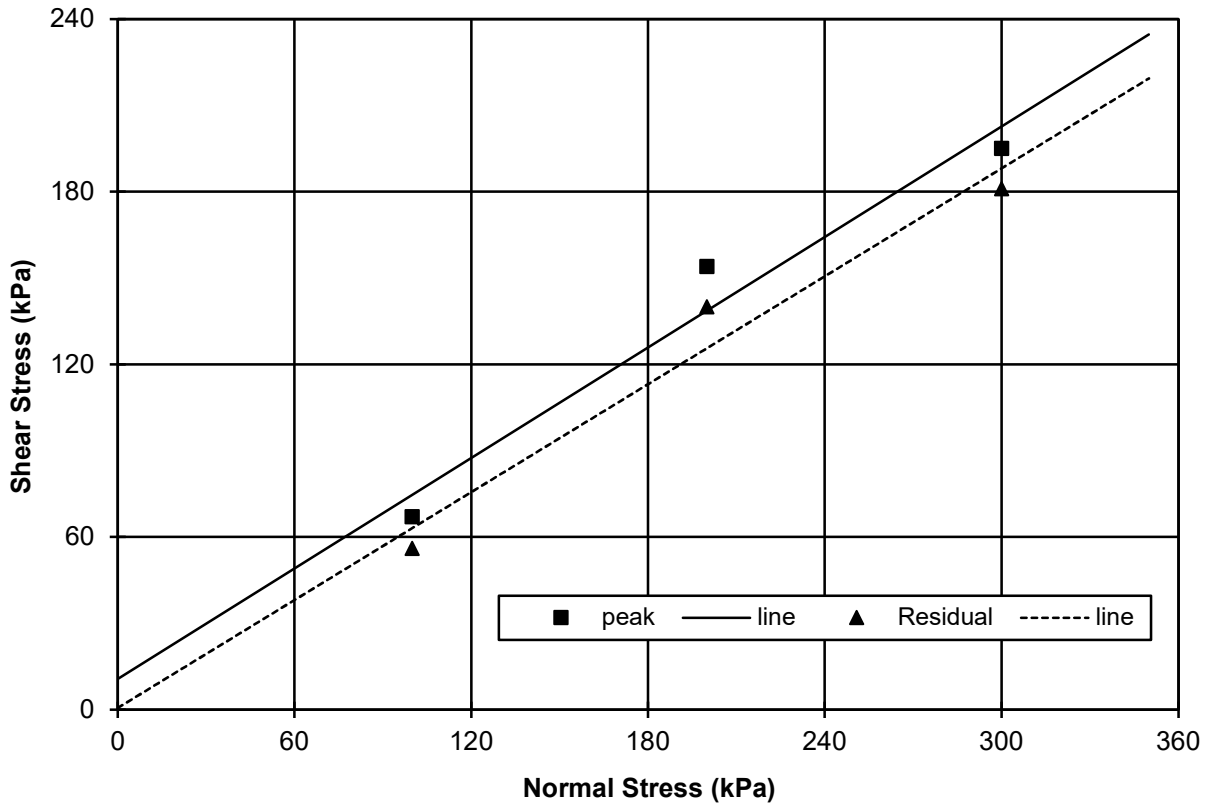
TETRA TECH

SUMMARY of DIRECT SHEAR TEST RESULTS

ASTM D3080

Project:	Keno Hill Mine Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Date:	October 26, 2023
Attention:	Joanne Huang	Tested By:	TD
Email:		Office:	Edmonton



Inferred Shear Strength Parameters :-

	Cohesion Intercept (kPa)	Inferred Angle of Shearing Resistance (Degrees)
Peak Strength:	**10.7**	**32.6**
Residual Strength:	**0.7**	**32.0**

Remarks: Remolded to 90%

Reviewed By: _____ P.Eng.

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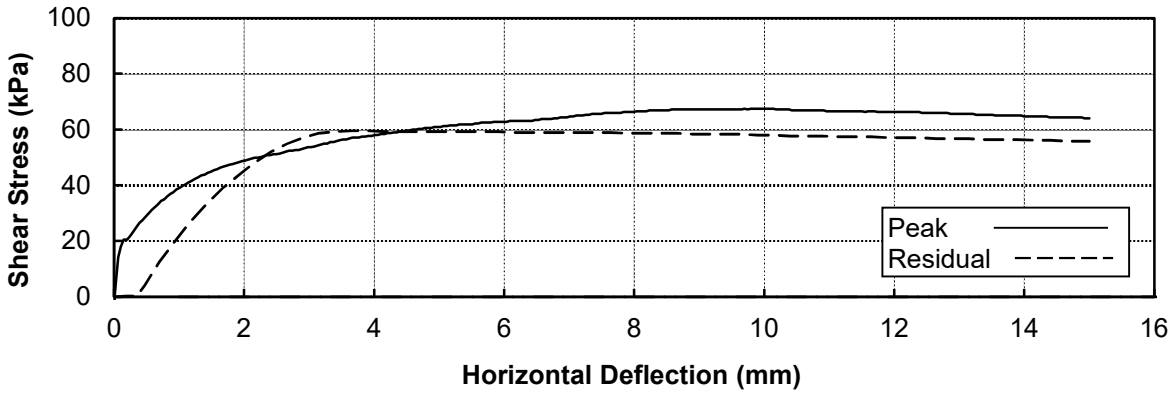
TETRA TECH

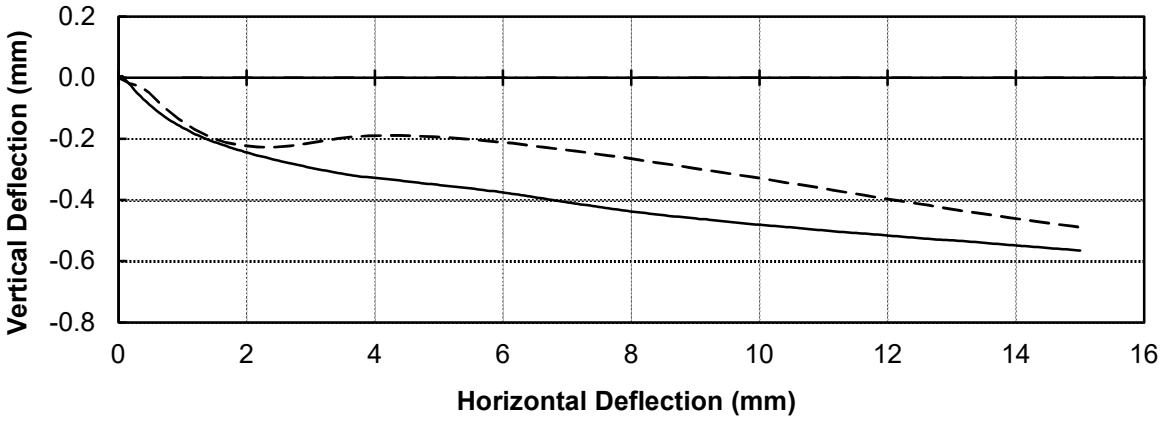
DIRECT SHEAR TEST

ASTM D3080

Project:	Keno Mine Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Test No.:	DS-1
Date Tested:	October 26, 2023	Machine:	4
Description:	Filtered Tailings	Preparation:	Remolded

Normal Stress (kPa) =	100	Moisture Content (%)	13.2
Peak Stress (kPa) =	67	Wet Density (Mg/m^3)	1.881
Residual Stress (kPa) =	56	Dry Density (Mg/m^3)	1.662





Remarks: Remolded to 90%

Reviewed By: IDR P.Eng.

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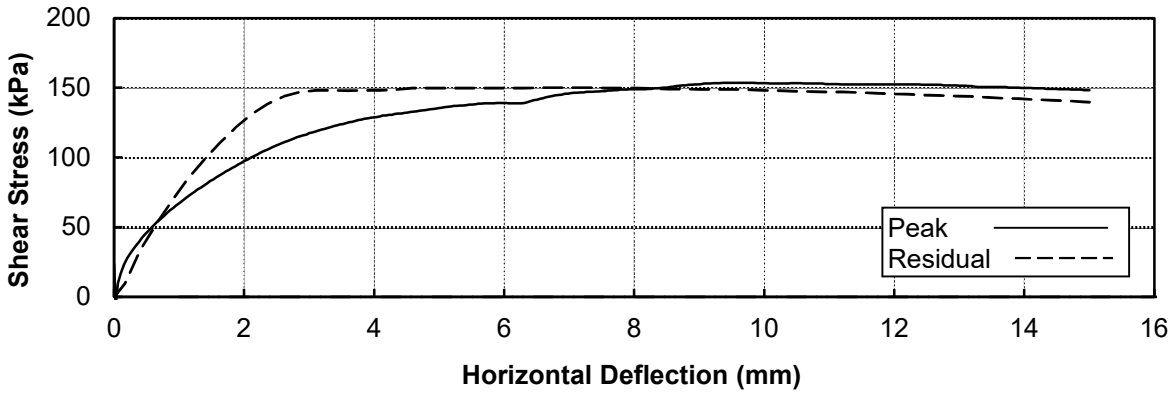
TETRA TECH

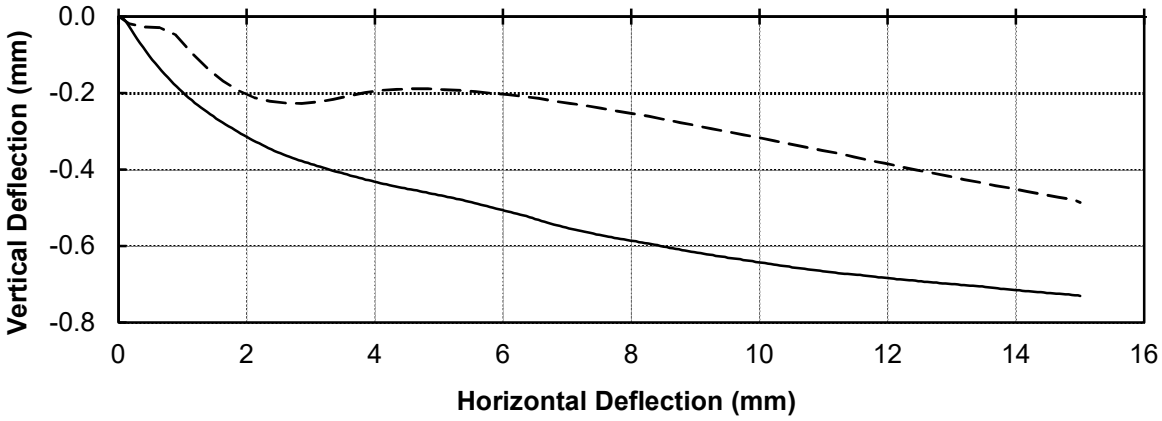
DIRECT SHEAR TEST

ASTM D3080

Project:	Keno Mine Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Test No.:	DS-2
Date Tested:	October 26, 2023	Machine:	5
Description:	Filtered Tailings	Preparation:	Remolded

Normal Stress (kPa) =	200	Moisture Content (%)	18.3
Peak Stress (kPa) =	154	Wet Density (Mg/m^3)	1.881
Residual Stress (kPa) =	140	Dry Density (Mg/m^3)	1.590





Remarks: Remolded to 90%

Reviewed By: _____ P.Eng.

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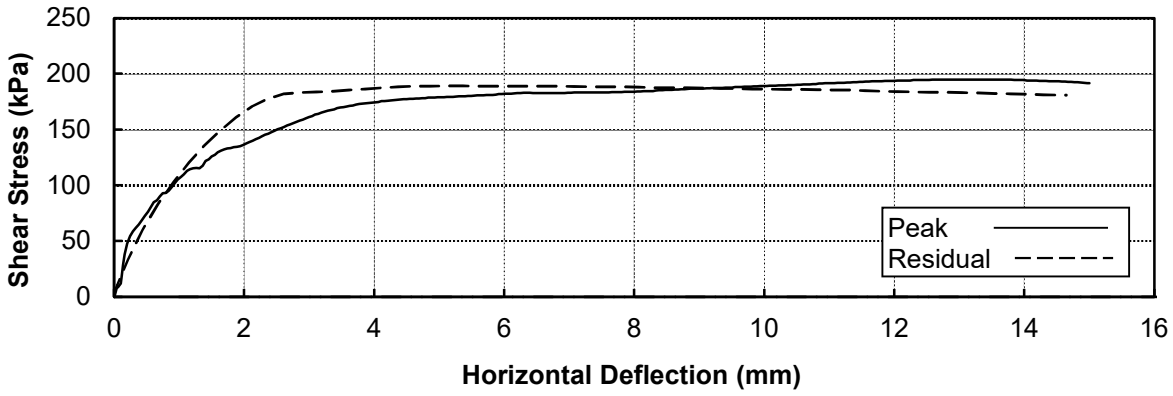
TETRA TECH

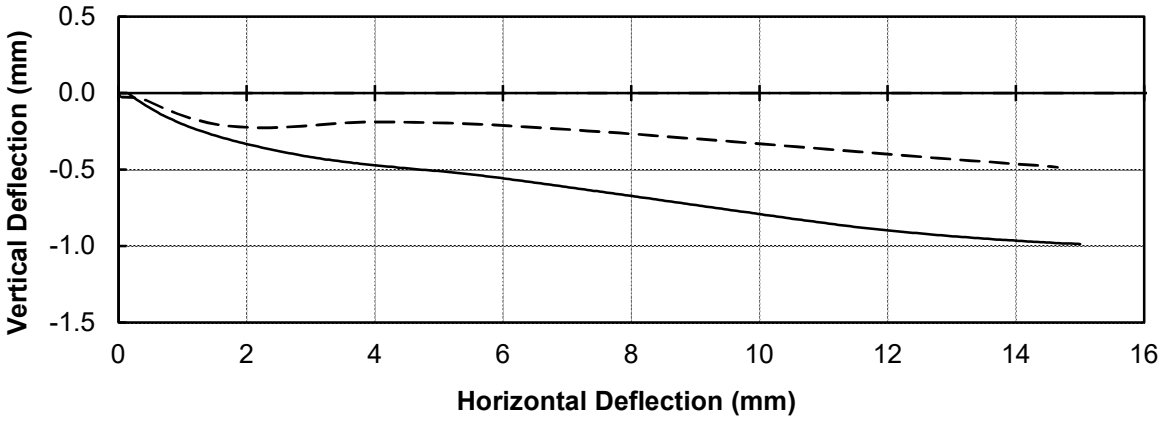
DIRECT SHEAR TEST

ASTM D3080

Project:	Keno Mine Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Test No.:	DS-3
Date Tested:	October 26, 2023	Machine:	6
Description:	Filtered Tailings	Preparation:	Remolded

Normal Stress (kPa) =	300	Moisture Content (%)	13.3
Peak Stress (kPa) =	195	Wet Density (Mg/m^3)	1.881
Residual Stress (kPa) =	181	Dry Density (Mg/m^3)	1.661





Remarks: Remolded to 90%

Reviewed By: _____ P.Eng.

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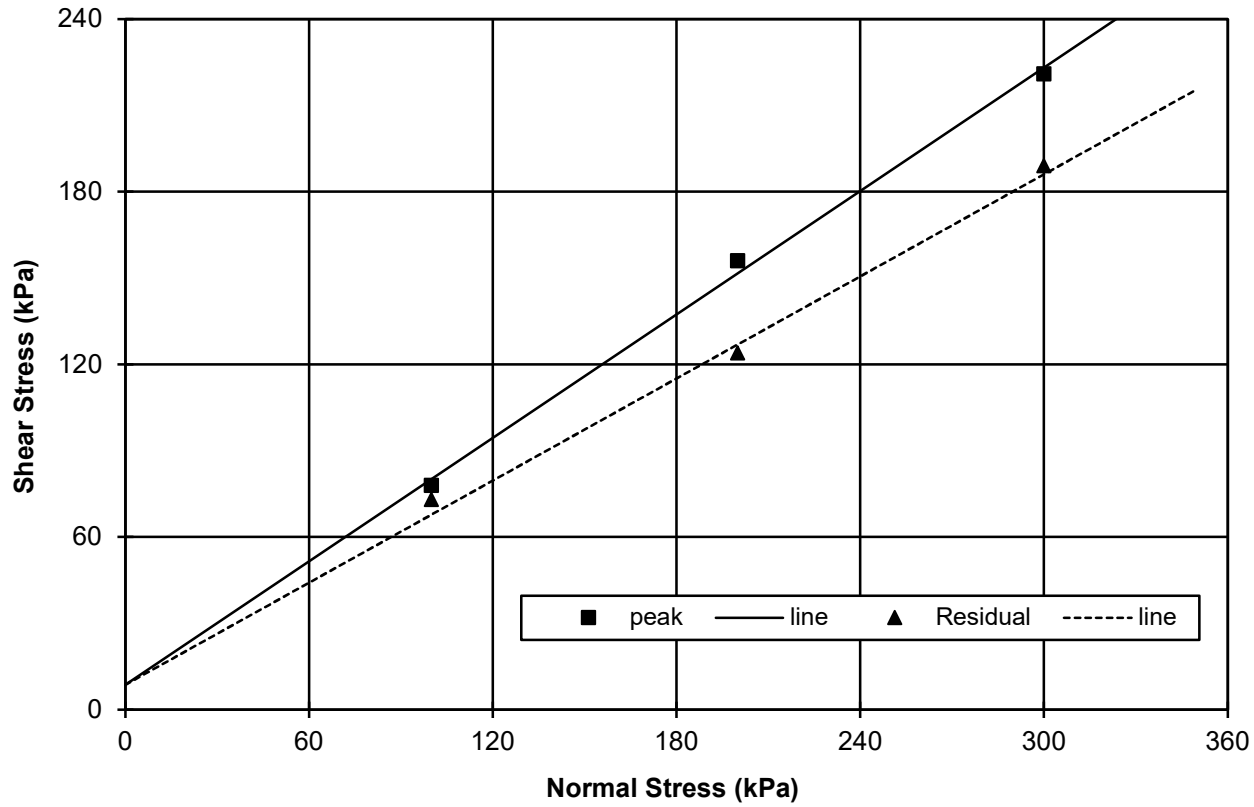
TETRA TECH

SUMMARY of DIRECT SHEAR TEST RESULTS

ASTM D3080

Project:	Keno Hill Mine Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Date:	October 26, 2023
Attention:	Joanne Huang	Tested By:	TD
Email:		Office:	Edmonton



Inferred Shear Strength Parameters :-

	Cohesion Intercept (kPa)	Inferred Angle of Shearing Resistance (Degrees)
Peak Strength:	**8.7**	**35.6**
Residual Strength:	**8.7**	**30.6**

Remarks: Remolded to 95%

Reviewed By: _____ P.Eng.

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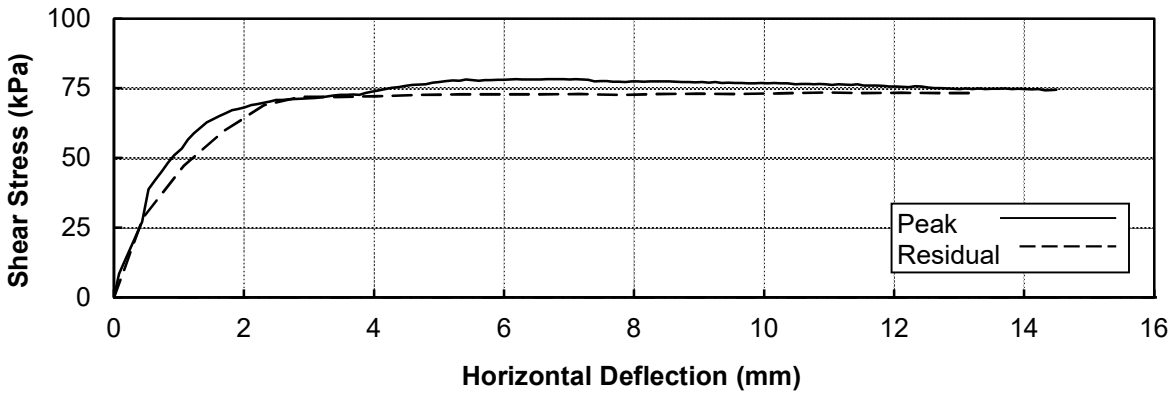
TETRA TECH

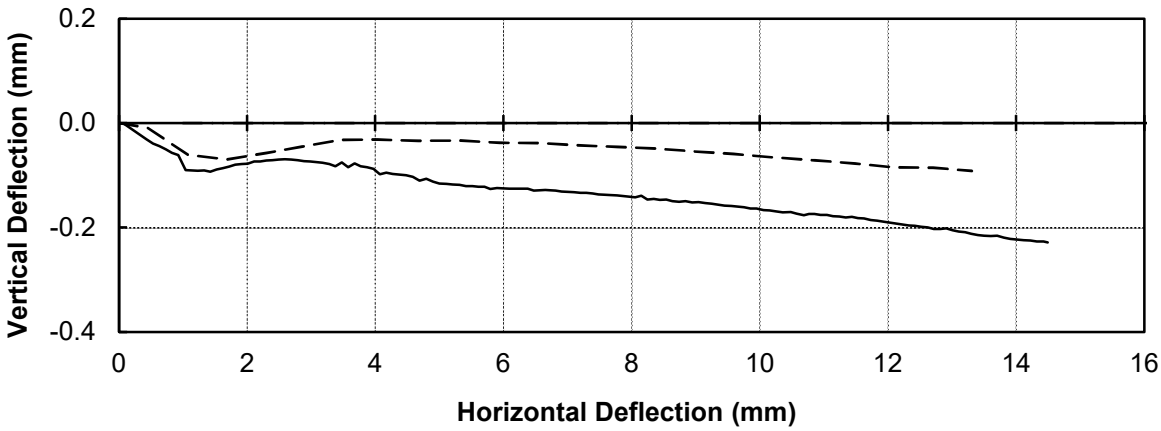
DIRECT SHEAR TEST

ASTM D3080

Project:	Keno Hill Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Test No.:	DS-4
Date Tested:	October 26, 2023	Machine:	1
Description:	Filtered Tailings	Preparation:	Remolded

			Initial
Normal Stress (kPa) =	100	Moisture Content (%)	13.1
Peak Stress (kPa) =	78	Wet Density (Mg/m^3)	1.986
Residual Stress (kPa) =	73	Dry Density (Mg/m^3)	1.756





Remarks: Remolded to 95%

Reviewed By: IDR P.Eng.

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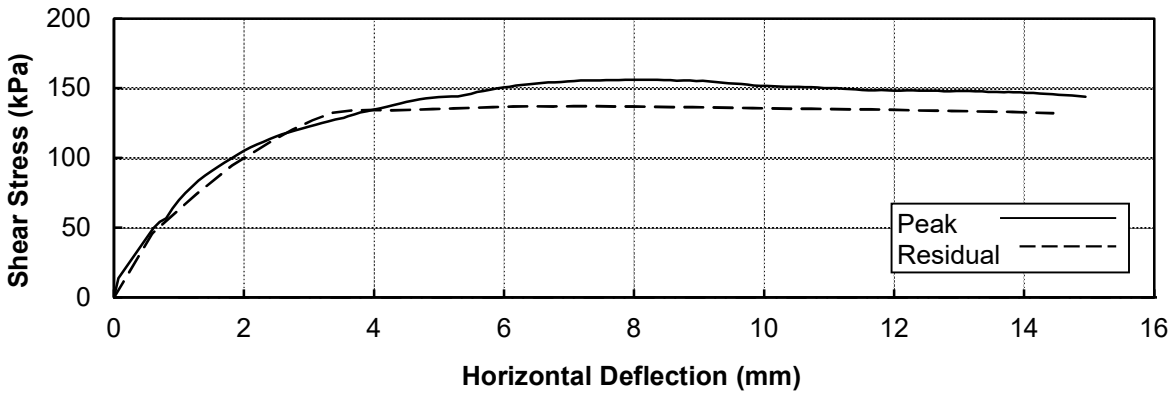
TETRA TECH

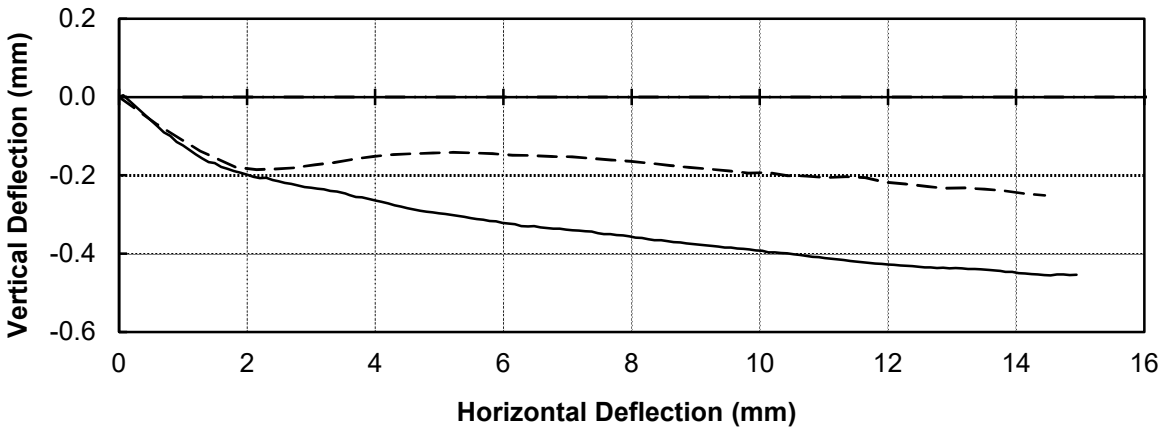
DIRECT SHEAR TEST

ASTM D3080

Project:	Keno Hill Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Test No.:	DS-5
Date Tested:	October 26, 2023	Machine:	2
Description:	Filtered Tailings	Preparation:	Remolded

			Initial
Normal Stress (kPa) =	200	Moisture Content (%)	13.1
Peak Stress (kPa) =	156	Wet Density (Mg/m^3)	1.986
Residual Stress (kPa) =	132	Dry Density (Mg/m^3)	1.756





Remarks: Remolded to 95%

Reviewed By: _____ P.Eng.

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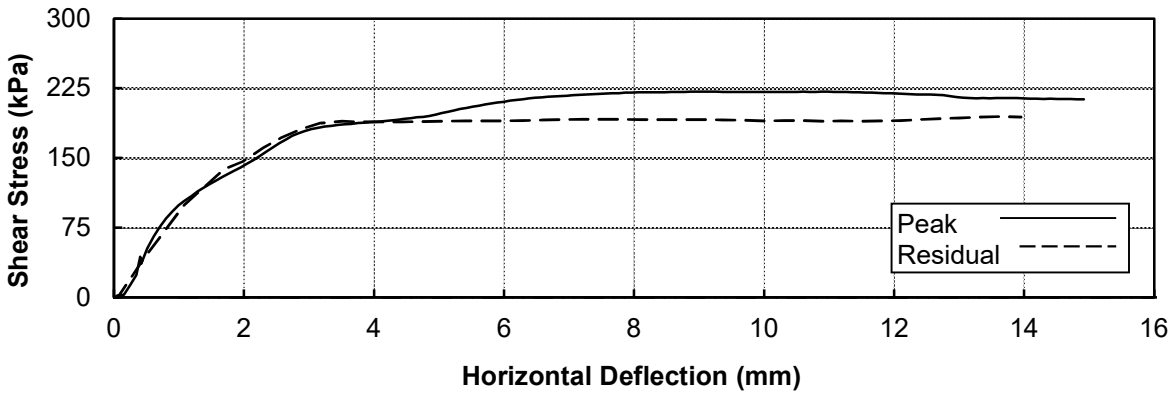
TETRA TECH

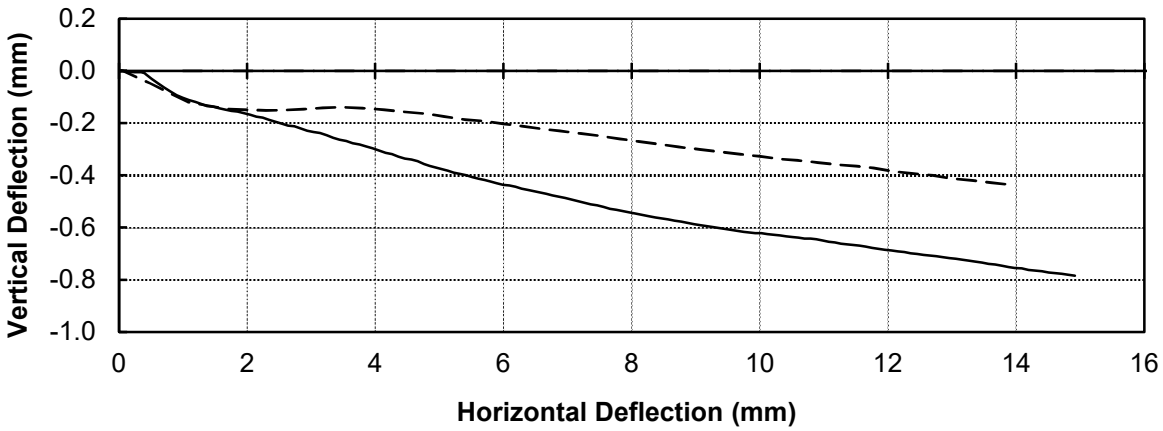
DIRECT SHEAR TEST

ASTM D3080

Project:	Keno Hill Tailings	Source:	Flame & Moth Mill
Project No.:	ENG.WARC04415-07	Location:	Tailings Discharge
Client:	NELPCo.	Test No.:	DS-6
Date Tested:	October 26, 2023	Machine:	3
Description:	Filtered Tailings	Preparation:	Remolded

			Initial
Normal Stress (kPa) =	300	Moisture Content (%)	13.2
Peak Stress (kPa) =	221	Wet Density (Mg/m^3)	1.986
Residual Stress (kPa) =	189	Dry Density (Mg/m^3)	1.754





Remarks: Remolded to 95%

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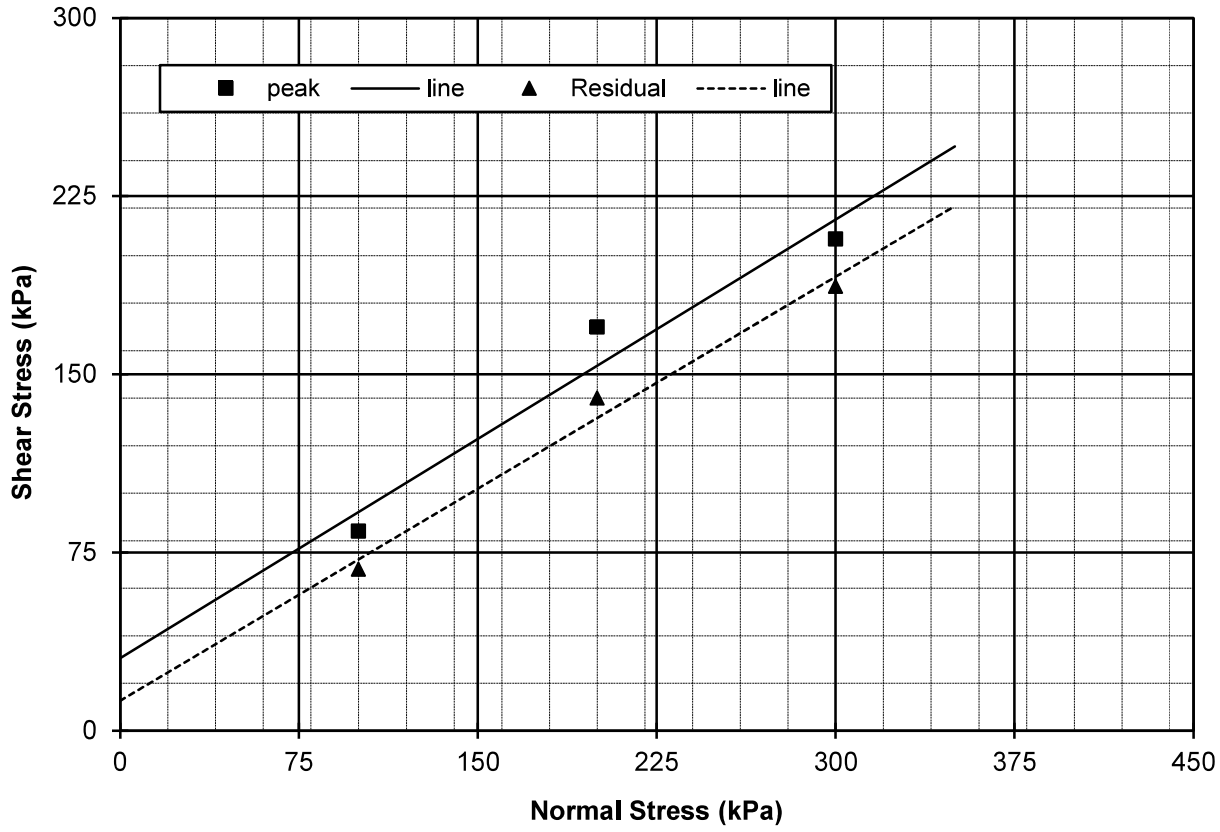
TETRA TECH

SUMMARY of DIRECT SHEAR TEST RESULTS

ASTM D3080

Project:	2022 Keno DSTF Tailings Characterization	Sample No.:	1948
Project No.:	ENG.WARC04181-01	Location:	Dry Stack Tailings Facility
Client:	Alexco Keno Mining Corp.	Date:	Apr 21, 2022
Attention:	Peter Johnson	Tested By:	TD
Email:		Office:	Edmonton



Inferred Shear Strength Parameters :-

	Cohesion Intercept (kPa)	Inferred Angle of Shearing Resistance (Degrees)
Peak Strength:	**30.7**	**31.6**
Residual Strength:	**12.7**	**30.8**

Reviewed By: JDR _____ P.Eng.

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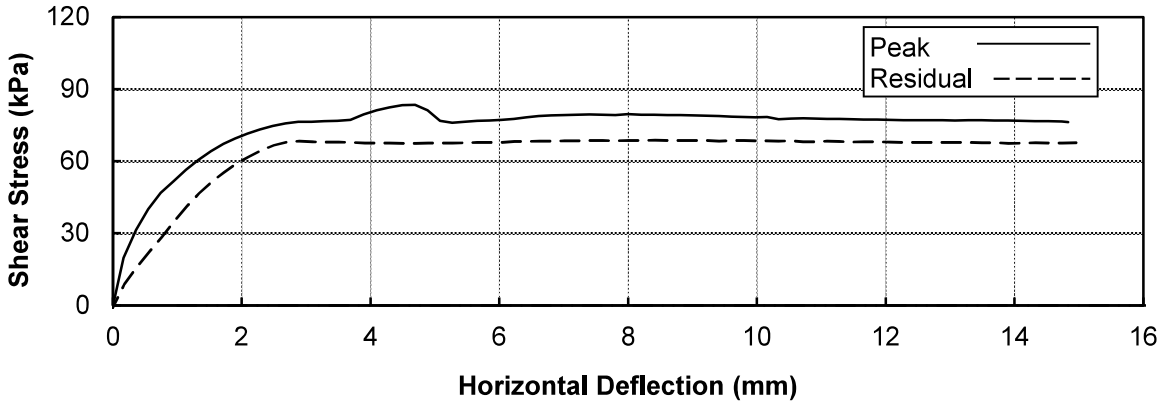
TETRA TECH

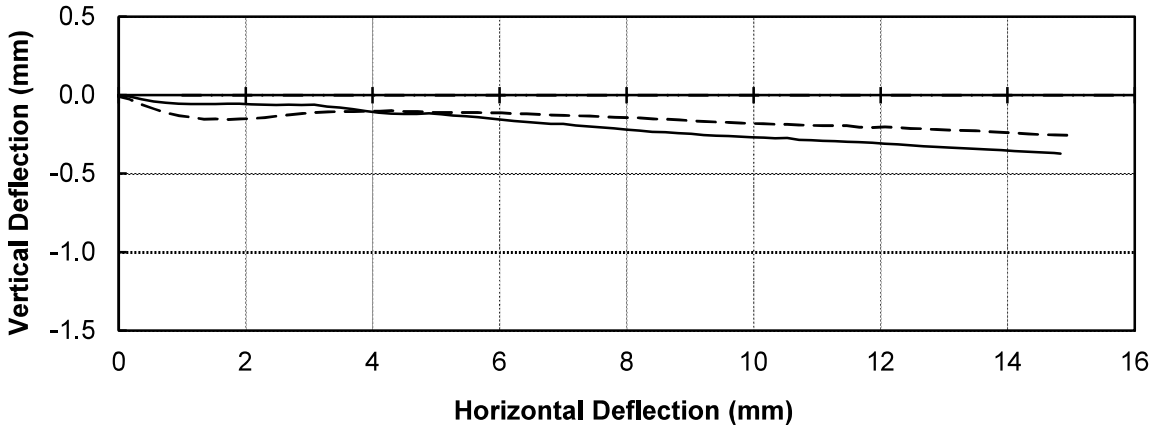
DIRECT SHEAR TEST

ASTM D3080

Project:	2022 Keno DSTF Tailings Characterization	Sample No.:	1948
Project No.:	ENG.WARC04181-01	Location:	Dry Stack Tailings Facility
Client:	Alexco Keno Mining Corp.	Test No.:	DS-4
Date Tested:	Apr 21, 2022	Machine:	3
Description:	SAND, silty, trace clay, grey	Preparation:	Remolded

			Initial	Final
Normal Stress (kPa) =	100	Moisture Content (%)	15.3	18.1
Peak Stress (kPa) =	84	Wet Density (Mg/m^3)	2.059	2.023
Residual Stress (kPa) =	68	Dry Density (Mg/m^3)	1.786	1.713





Remarks: Remolded sample

Reviewed By: _____ P.Eng.

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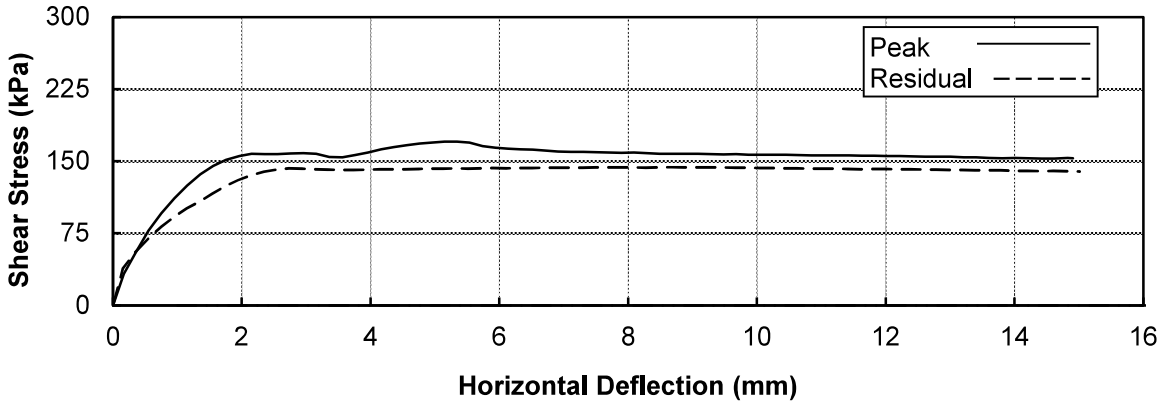
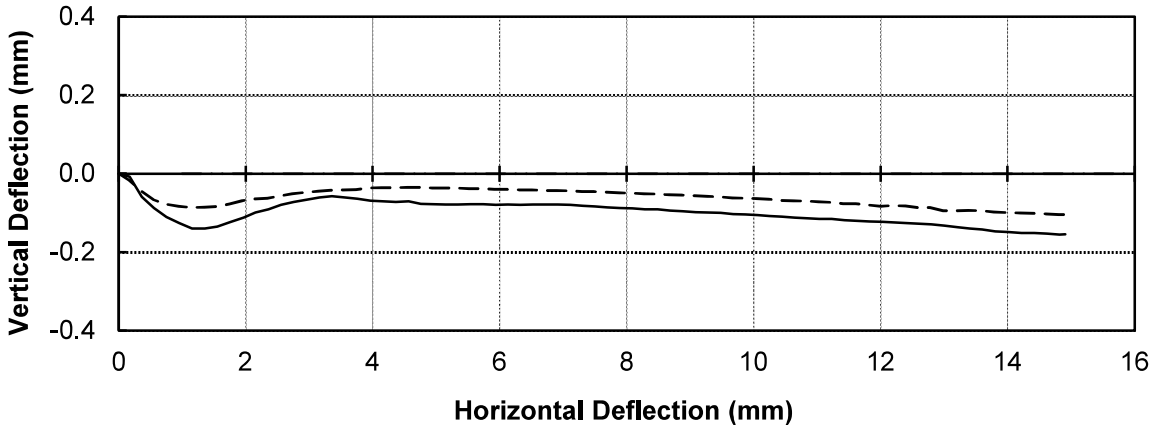
DIRECT SHEAR TEST

ASTM D3080

Project:	2022 Keno DSTF Tailings Characterization	Sample No.:	1948
Project No.:	ENG.WARC04181-01	Location:	Dry Stack Tailings Facility
Client:	Alexco Keno Mining Corp.	Test No.:	DS-5
Date Tested:	Apr 21, 2022	Machine:	2
Description:	SAND, silty, trace clay, grey	Preparation:	Remolded

			Initial	Final
Normal Stress (kPa) =	200	Moisture Content (%)	15.1	17.1
Peak Stress (kPa) =	170	Wet Density (Mg/m^3)	2.059	2.006
Residual Stress (kPa) =	140	Dry Density (Mg/m^3)	1.790	1.713





Remarks: Remolded sample

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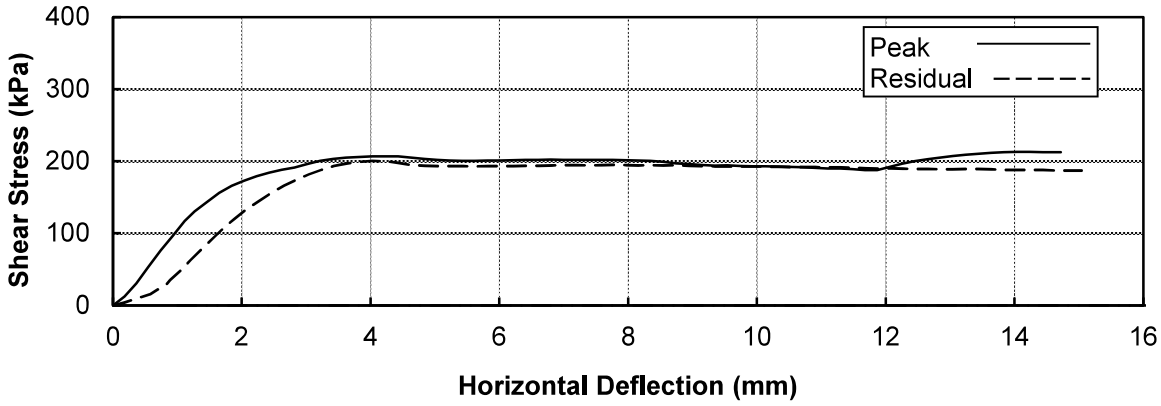
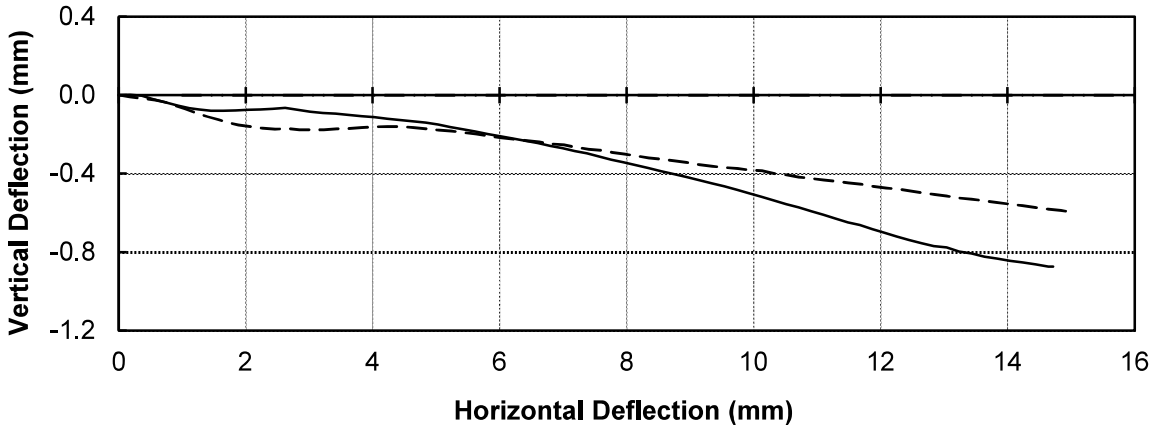
DIRECT SHEAR TEST

ASTM D3080

Project:	2022 Keno DSTF Tailings Characterization	Sample No.:	1948
Project No.:	ENG.WARC04181-01	Location:	Dry Stack Tailings Facility
Client:	Alexco Keno Mining Corp.	Test No.:	DS-6
Date Tested:	Apr 21, 2022	Machine:	1
Description:	SAND, silty, trace clay, grey	Preparation:	Remolded

			Initial	Final
Normal Stress (kPa) =	300	Moisture Content (%)	15.2	17.6
Peak Stress (kPa) =	213	Wet Density (Mg/m^3)	2.060	1.809
Residual Stress (kPa) =	187	Dry Density (Mg/m^3)	1.788	1.538





Remarks: Remolded sample

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TETRA TECH

ANALYSIS REPORT
SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 14, 2024
Report: 6710-001S-1A-en

IDENTIFICATION: Interface test #1: Tailings Vs GTX Non-woven
Project: 704-ENV.WARC 04415-09
Tailings received on January 03, 2024
Received: January 9, 2024

STANDARD:

TEST: Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear — ASTM D5321/D5321M-21

TEST CONDITIONS:
Shear surface 304 x 304 mm;
Data acquisition period (seconds): 6.00
Flat surfaces grips fixed with 4 bolts + rasp surface in lower box and upper box ;
Normal load: Micro-Stepper Motor
Rate of horizontal displacement(mm/min): 0.2
Tested in machine direction ;
Submerged interface ;
Thickness: 5 measurements per specimen according to ASTM D5199 (Non-woven Geotextile);
Mass per unit area: 1 measurement per specimen according to ASTM D5261 (Non-woven Geotextile);
Testing configuration - Upper box / Lower box: Tailings / Non-woven Geotextile
Date of test: between January 24 and February 6, 2024

RESULTS:

	Individual Data		
Normal Compressive Pressure (kPa):	102.4	201.7	400.4
GEOTEXTILE PROPERTIES	:		
Mass per unit area of the geosynthetic estimated basing on the weight of the specimen (g/m²):	302	293	279
Specimen thickness (mils):	76	70	70
PROPERTIES OF THE SOIL	:		
Water content of compaction (%):	15.5	15.1	15.3
Dry unit weight after compaction (kg/m³):	1860	1880	1870
Duration of the consolidation (hours):	16	16	16
TEST RESULTS	:		
Peak shear stress (kPa):	84.4	150.7	308.2

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 14, 2024

*** Any question regarding this report or its authenticity? Please contact Omar Kamla ****

The reports are identified by an alphanumeric code, the letter preceding "-en" refers to the revision number, emitted in ascending order. The electronic copy sent by CTT Group is the official report. The reported identification is based on what was observed on the received sample and/or information provided by the customer. The samples in relation to this report are retained for a period of 30 days following transmission of the report. The above reported results refer exclusively to the samples submitted for evaluation. This analysis report cannot be partly used or reproduced, unless in whole, without CTT Group prior written consent. ‡ The ISO/IEC 17025 Scope of Accreditation of CTT Group is available at www.gcttg.com. In this report, the tests which number is followed by the symbol ■ are not covered by this accreditation. For customer's complete address, please refer to the email.

ANALYSIS REPORT
SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 14, 2024
Report: 6710-001S-1A-en

IDENTIFICATION: Interface test #1: Tailings Vs GTX Non-woven
Project: 704-ENV.WARC 04415-09
Tailings received on January 03, 2024
Received: January 9, 2024

STANDARD:

TEST: Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear — ASTM D5321/D5321M-21

RESULTS (CONT):

		Individual Data	
Shear stress at large displacement (kPa):	64.1	108.7	241.2
Estimated peak angle of friction (°):	37		
Estimated peak adhesion (kPa):	3.4		
Estimated angle of friction at large displacement (°):	30		
Estimated adhesion at large displacement (kPa):	0.0		

REMARKS: -The thickness of the soil layer was reduced to 40 mm to facilitate consolidation and minimize experimental problems.

Consolidation:
- 100kPa: 1 hour at 10kPa, 1 hour at 50kPa, 16 hours at 100kPa.
- 200kPa: 1 hour at 10kPa, 1 hour at 50kPa, 1 hour at 100kPa, 16 hours at 200kPa.
- 400kPa: 1 hour at 10kPa, 1 hour at 50kPa, 1 hour at 100kPa, 1 hour at 200kPa, 16 hours at 400kPa.

- See graphs and pictures in appendix.

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 14, 2024

*** Any question regarding this report or its authenticity? Please contact Omar Kamla ***

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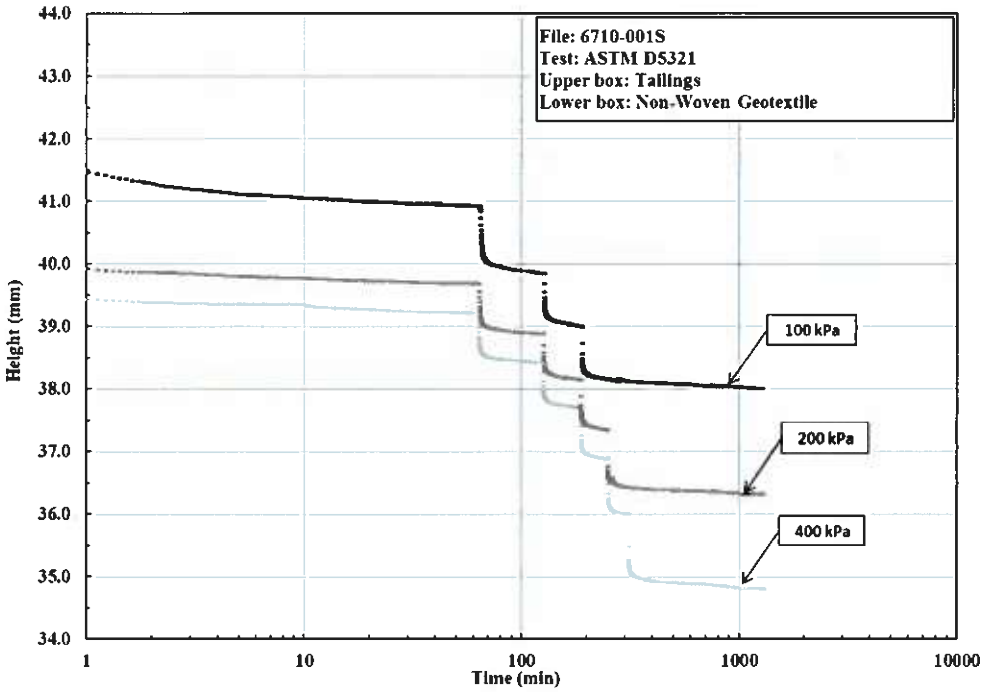
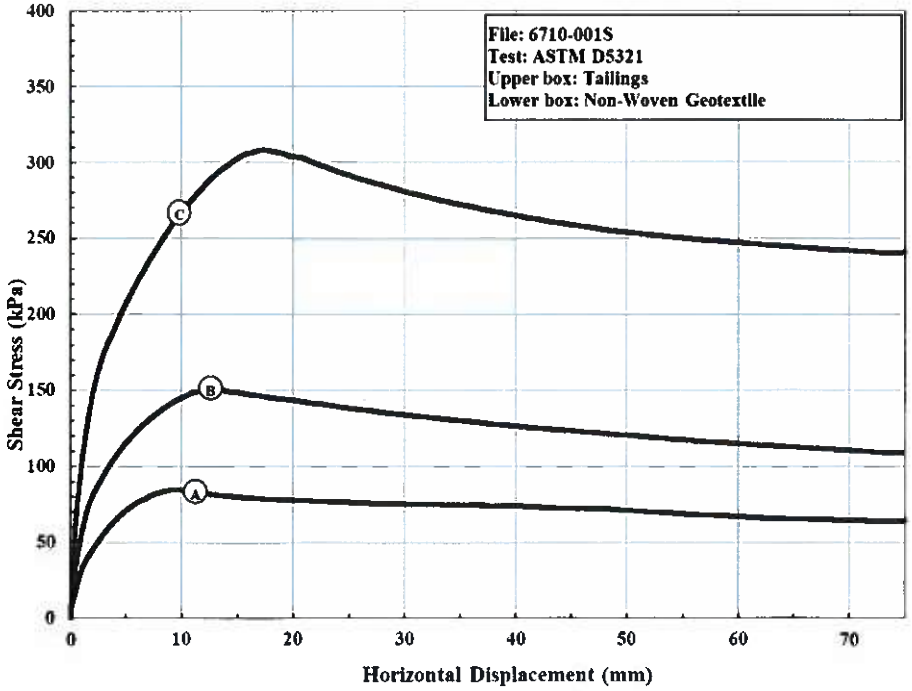
APPENDIX
Graphs

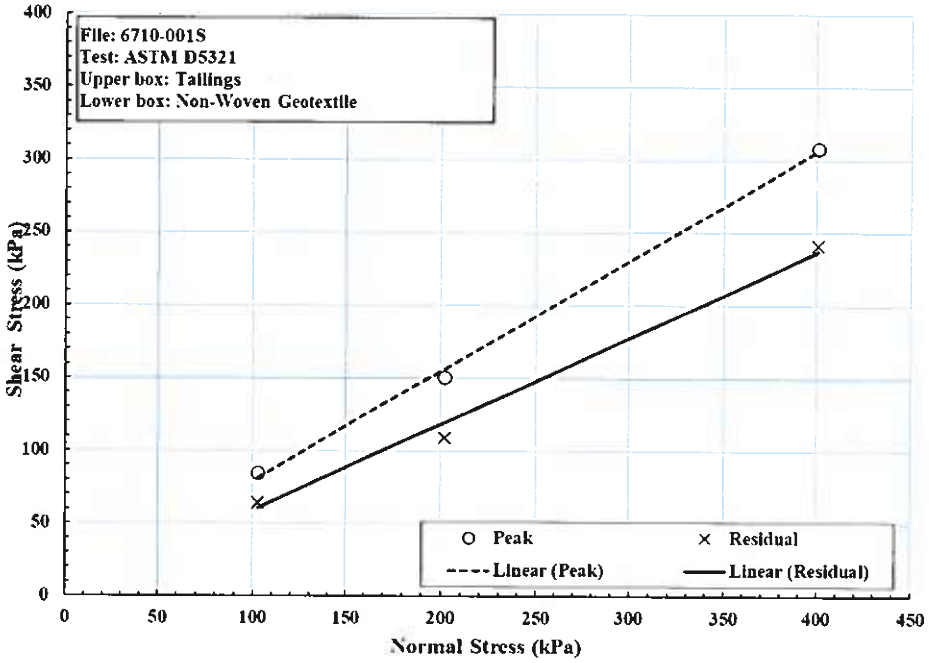


Consolidation curve



Shear Stress *vs* Horizontal Displacement

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378

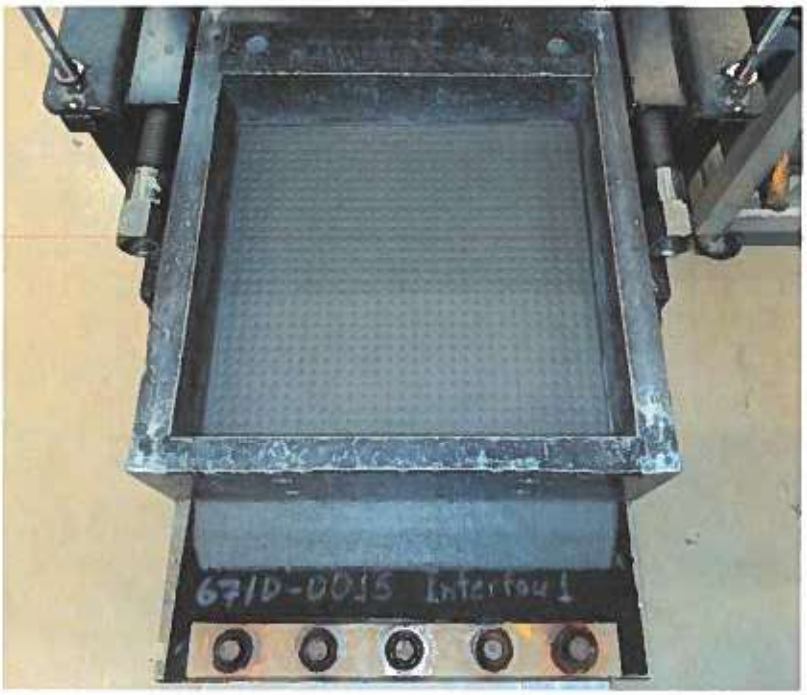


Shear Stress *vs* Normal Stress

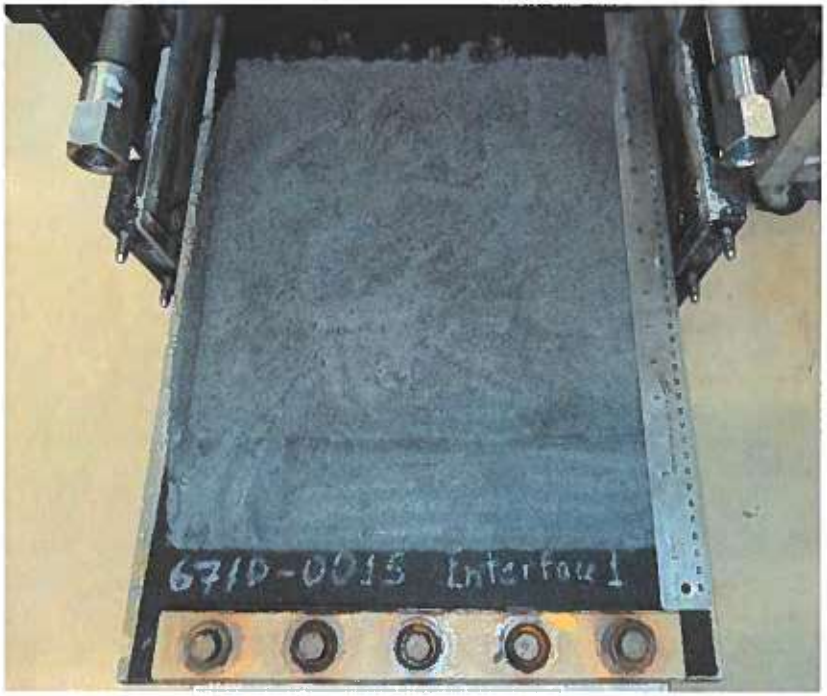
Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378

File: 6710-001S

Pictures

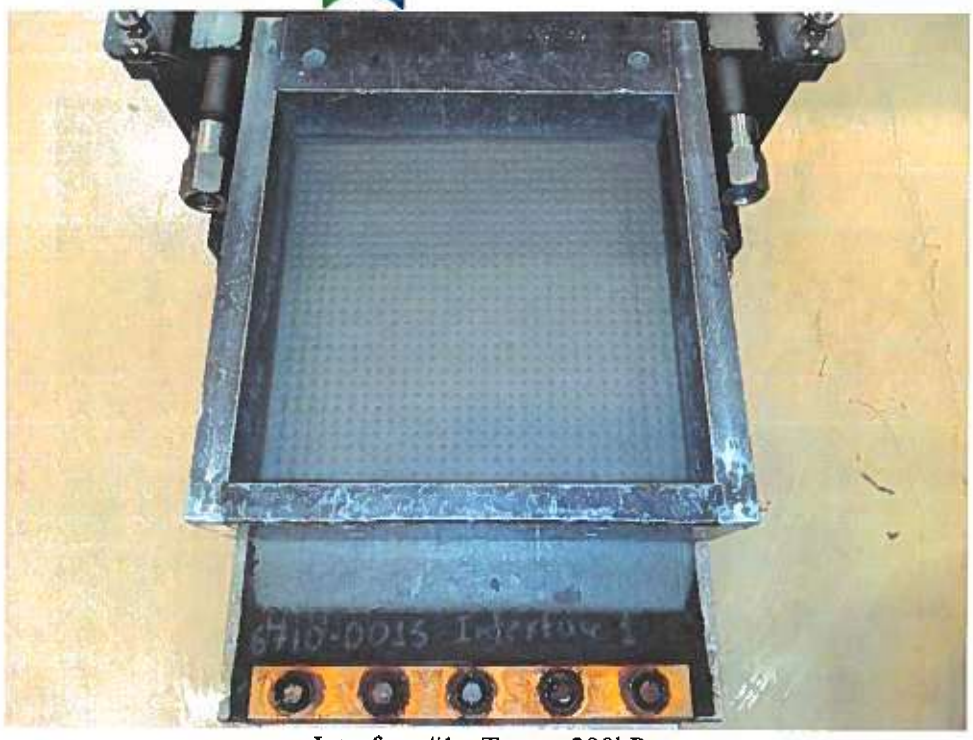


Interface #1 - Test at 100kPa

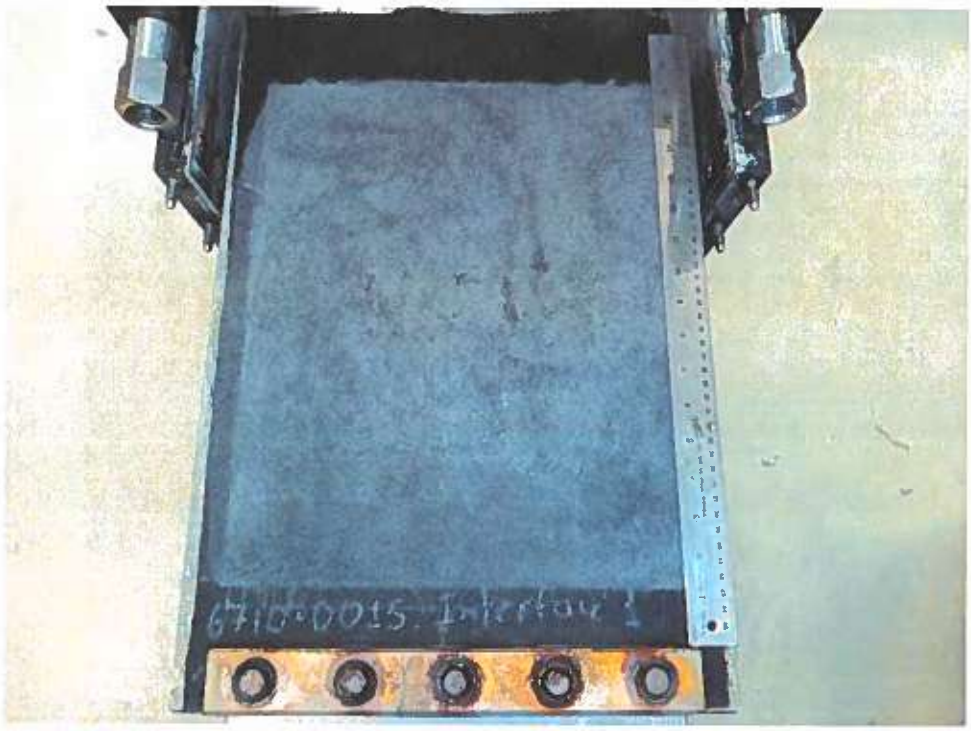


Non-woven Geotextile after the test – Test at 100kPa

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378



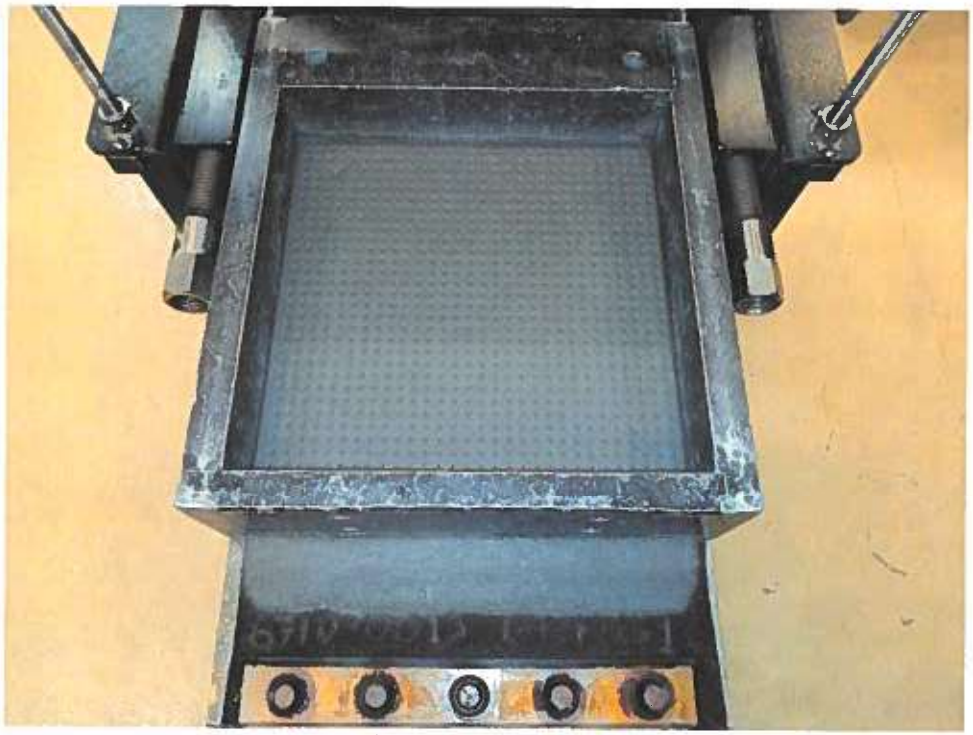
Interface #1 - Test at 200kPa



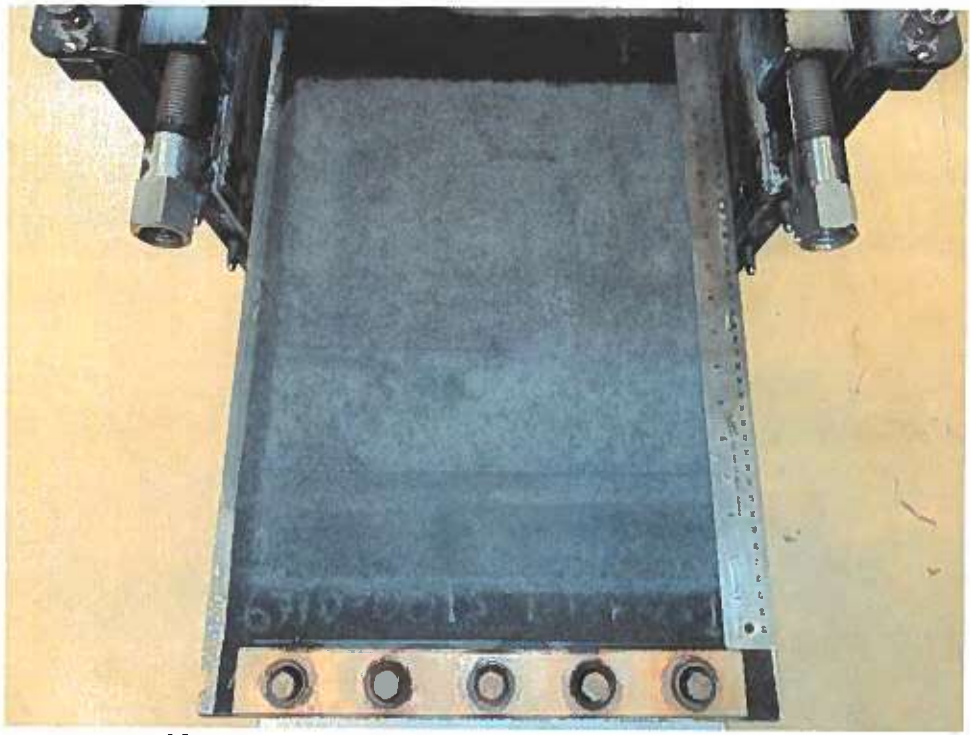
Non-woven Geotextile after the test – Test at 200kPa

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378

File: 6710-001S



Interface #1 - Test at 400kPa



Non-woven Geotextile after the test – Test at 400kPa

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378

ANALYSIS REPORT
SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 14, 2024
Report: 6710-001S-2A-en

IDENTIFICATION: Interface test #2: GTX Non-woven Vs Geonet Hydranet 220 # GN000131
Project: 704-ENV.WARC 04415-09
Received: January 9, 2024

STANDARD:

TEST: Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear — ASTM D5321/D5321M-21

TEST CONDITIONS:
Shear surface 304 x 304 mm;
Data acquisition period (seconds): 0.24
Flat surfaces grips fixed with 4 bolts + rasp surface in lower box and upper box ;
Normal load: Micro-Stepper Motor
Rate of horizontal displacement(mm/min); 5
Tested in machine direction ;
Submerged interface ;
Thickness: 5 measurements per specimen according to ASTM D5199 (Non-woven Geotextile and Geonet);
Mass per unit area: 1 measurement per specimen according to ASTM D5261 (Non-woven Geotextile);
Testing configuration - Upper box / Lower box: Non-woven Geotextile / Geonet
Date of test: January 19, 2024

RESULTS:

	Individual Data		
Normal Compressive Pressure (kPa):	101.9	198.9	397.6
GEOTEXTILE PROPERTIES	:		
Mass per unit area of the geosynthetic estimated basing on the weight of the specimen (g/m²):	261	293	301
Specimen thickness (mils):	71	73	74
GEONET PROPERTIES	:		
Specimen thickness (mils):	197	196	195
Duration of the consolidation (hours):	1	1	1
TEST RESULTS	:		
Peak shear stress (kPa):	31.2	65.3	154.6
Shear stress at large displacement (kPa):	23.5	49.8	92.1

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 14, 2024

*** Any question regarding this report or its authenticity? Please contact Omar Kamla ****

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ANALYSIS REPORT
SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 14, 2024
Report: 6710-001S-2A-en

IDENTIFICATION: Interface test #2: GTX Non-woven Vs Geonet Hydranet 220 # GN000131
Project: 704-ENV.WARC 04415-09
Received: January 9, 2024

STANDARD:

TEST: Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear — ASTM D5321/D5321M-21

RESULTS (CONT):

	Individual Data
Estimated peak angle of friction (°):	20
Estimated peak adhesion (kPa):	0.0
Estimated angle of friction at large displacement (°):	12
Estimated adhesion at large displacement (kPa):	1.8

REMARKS: - See graphs and pictures in Appendix.

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 14, 2024

*** Any question regarding this report or its authenticity? Please contact Omar Kamla ***

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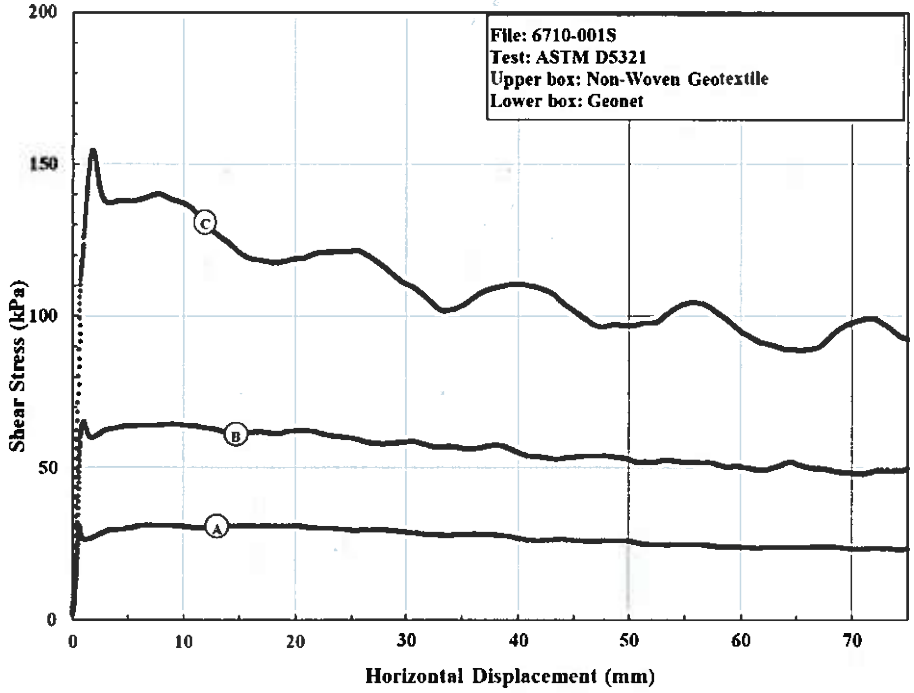
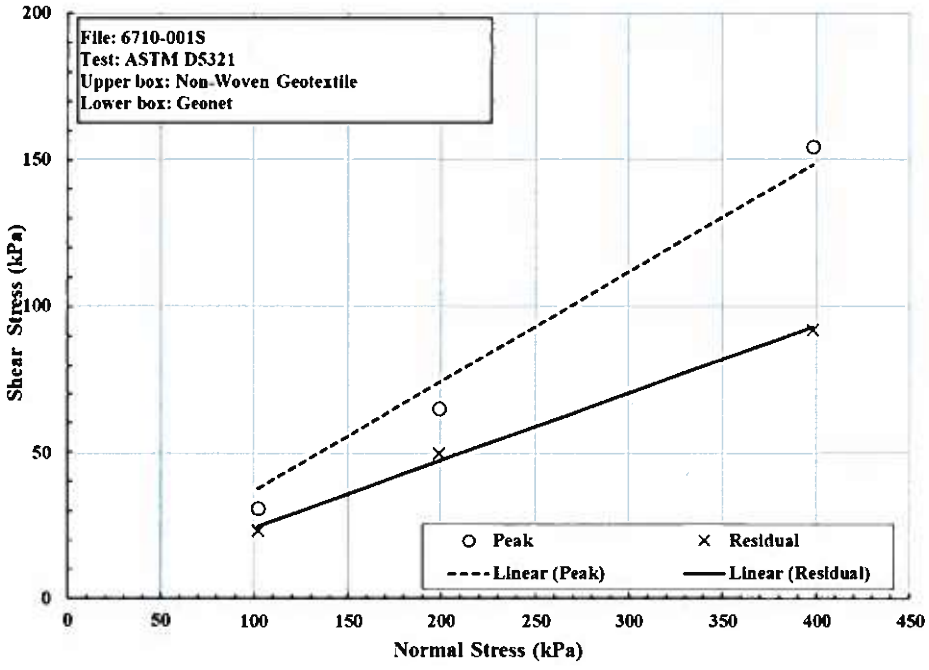
APPENDIX

Graphs



Shear Stress *vs* Horizontal Displacement



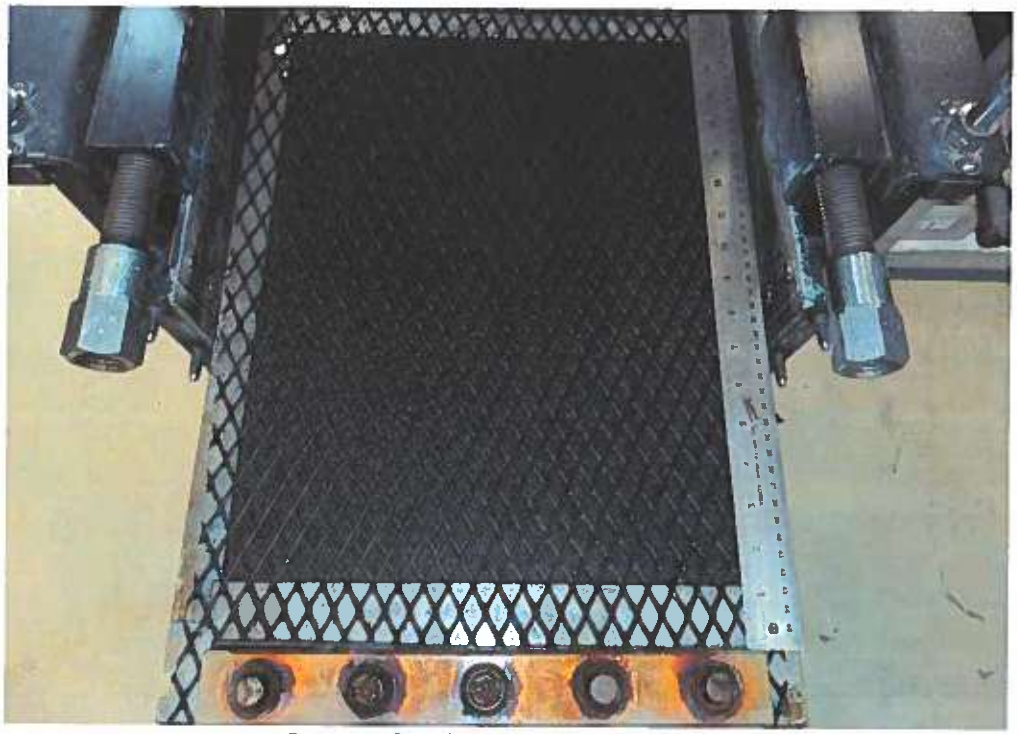
Shear Stress *vs* Normal Stress

File: 6710-001S

Pictures



Non-woven Geotextile after the test – Test at 100kPa



Geonet after the test – Test at 100kPa

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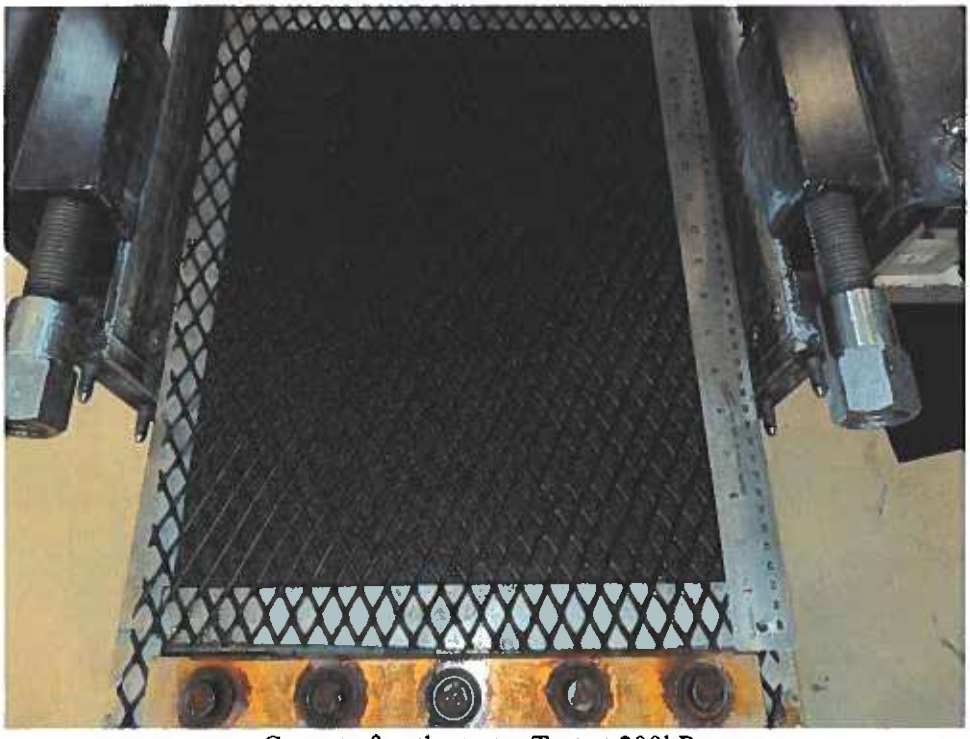
File: 6710-001S



Non-woven Geotextile after the test – Test at 200kPa



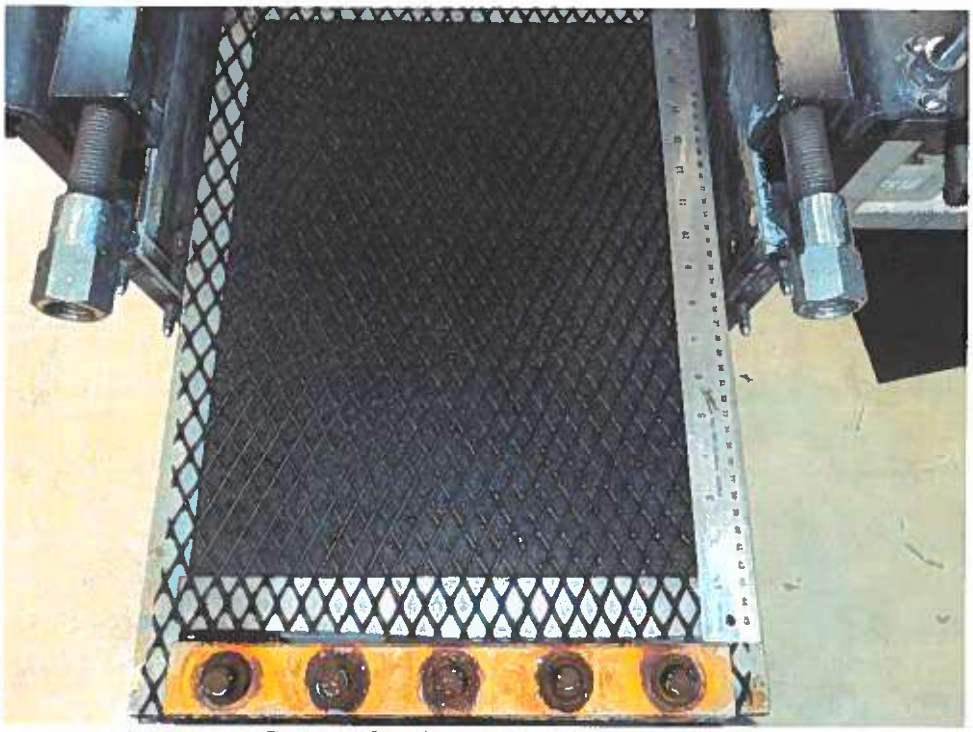
Geonet after the test – Test at 200kPa

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378

File: 6710-001S



Non-woven Geotextile after the test – Test at 400kPa



Geonet after the test – Test at 400kPa

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ANALYSIS REPORT

SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 14, 2024
Report: 6710-001S-3A-en

IDENTIFICATION: Interface test #3: Geonet Hydranet 220 # GN000131 Vs GCL Bentomat ST #10
Project: 704-ENV.WARC 04415-09
Geonet received on January 09, 2024
Received: January 19, 2024

STANDARD:

TEST: Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method — ASTM D6243/D6243M-20 Proc. B

TEST CONDITIONS:
Shear surface 304 x 304 mm;
Data acquisition period (seconds): 1 20
Hydratation of the GCL: 24 hours under 10 kPa, prior to consolidation ;
Flat surfaces grips fixed with 4 bolts + rasp surface in lower box and upper box ;
Normal load: Micro-stepper motor
Rate of horizontal displacement(mm/min): 1
Tested in machine direction ;
Submerged interface ;
Testing configuration - Upper box / Lower box: Geonet Hydranet 220 / GCL Bentomat ST#10 (Non-woven side)
Date of test: from February 7 to 13, 2024

RESULTS:	Individual Data			Avg.	S.D.	% CV
Normal Compressive Pressure (kPa):	101.5	200.8	399.5			
TESTS RESULTS	:					
Maximum Shear Stress (kPa):	41.9	77.0	180.5			
Residual Shear Stress (kPa):	39.9	72.9	137.0			
Estimated Maximum angle of friction (°):	23					
Estimated Maximum adhesion (kPa):	0.0					
Estimated Residual angle of friction (°):	18					
Estimated Residual adhesion (kPa):	7.1					

REMARKS: - See graphs and pictures in Appendix.

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 14, 2024

*** Any question regarding this report or its authenticity? Please contact Omar Kamla ****

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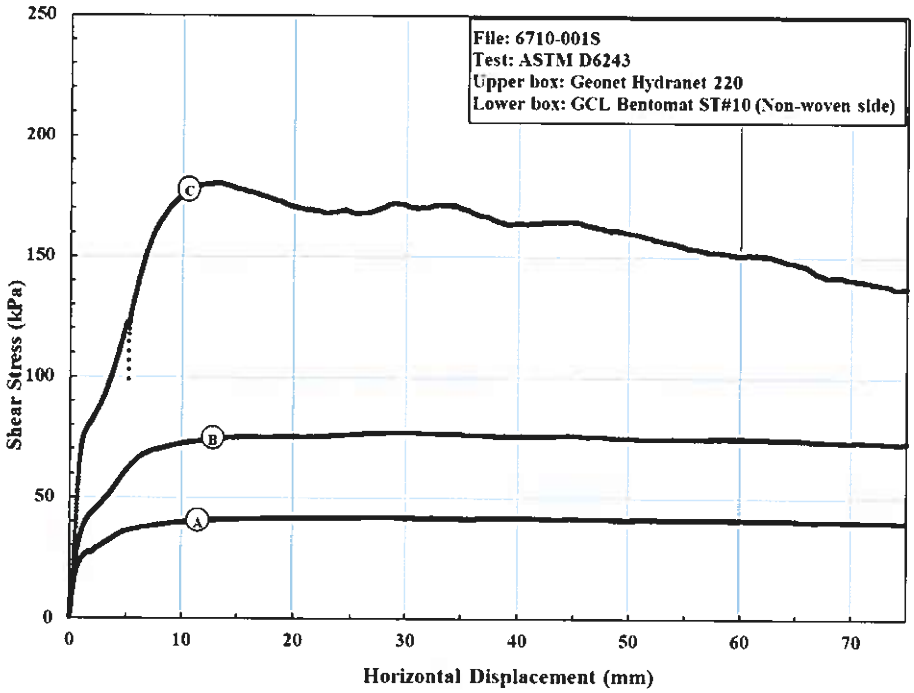
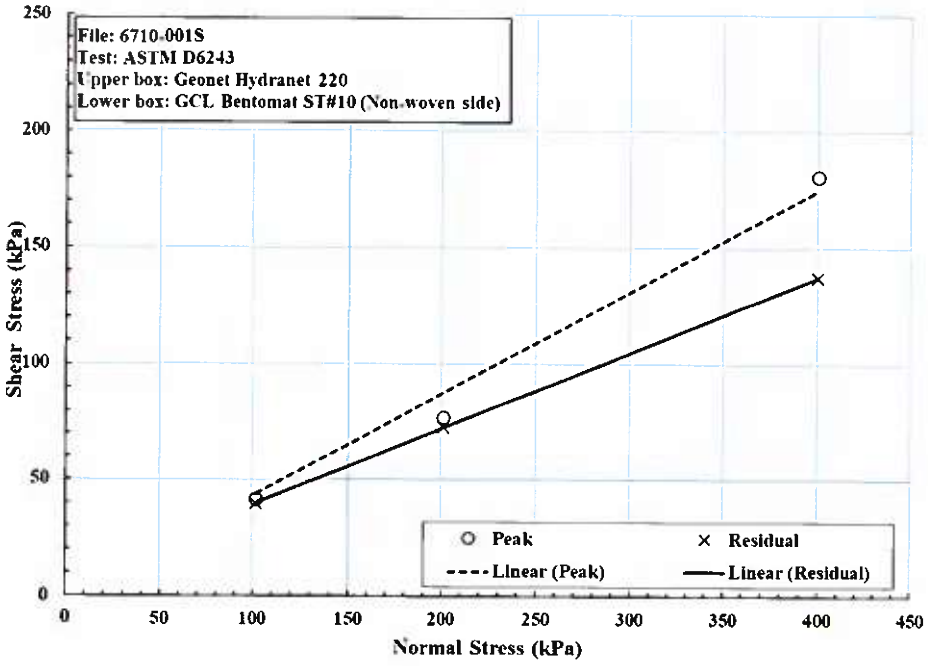
APPENDIX

Graphs



Shear Stress *vs* Horizontal Displacement



Shear Stress *vs* Normal Stress

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File: 6710-001S

Pictures



Geonet Hydranet 220 after the test - Test at 100kPa



GCL Bentomat ST#10 (non-woven side) after the test – Test at 100kPa

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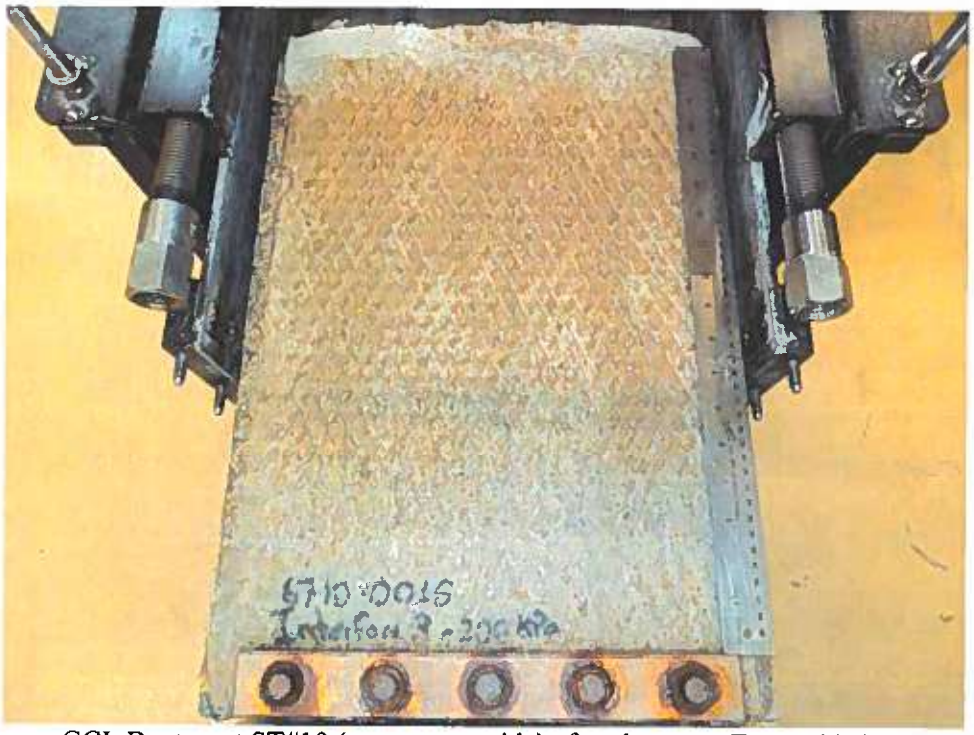
Geonet Hydranet 220 after the test - Test at 200kPa



GCL Bentomat ST#10 (non-woven side) after the test – Test at 200kPa

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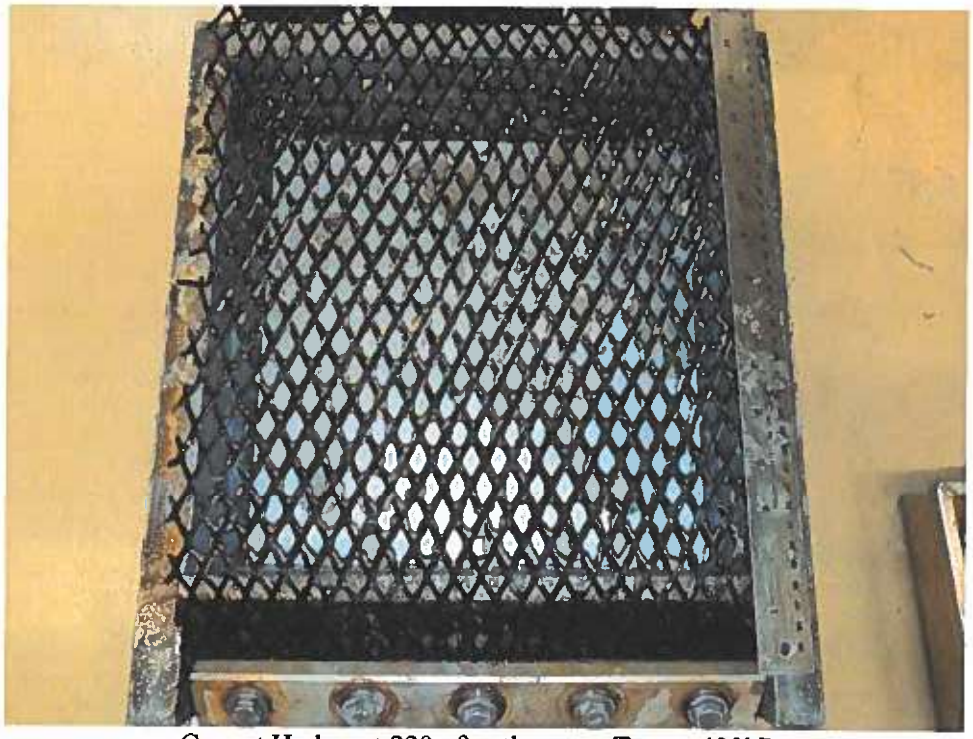
File: 6710-001S



Geonet Hydranet 220 after the test - Test at 400kPa



GCL Bentomat ST#10 (non-woven side) after the test – Test at 400kPa

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ANALYSIS REPORT

SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 19, 2024
Report: 6710-001S-4A-en

IDENTIFICATION: Interface test #4: GCL Bentomat ST #10 Vs Drainage blanket (Gravel, coarse soil "Dmax 16mm")
Project: 704-ENV.WARC 04415-09
Gravel received on January 03, 2024
Received: January 19, 2024

STANDARD:

TEST: Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method — ASTM D6243/D6243M-20 Proc. C

TEST CONDITIONS:
Shear surface 304 x 304 mm;
Data acquisition period (seconds): 1.20
Hydratation of the GCL: 24 hours under 10 kPa, prior to consolidation ;
Flat surfaces grips fixed with 4 bolts + rasp surface in lower box and upper box ;
Normal load: Micro-Stepper Motor
Rate of horizontal displacement(mm/min): 1
Tested in machine direction ;
Submerged interface ;
Testing configuration - Upper box / Lower box: Drainage Blanket (Gravel) / GCL Bentomat ST #10 (woven side)
Date of test: from February 14 to 16, 2024

RESULTS:	Individual Data			Avg.	S.D.	% CV
Normal Compressive Pressure (kPa):	102.5	203.7	402.3			
PROPERTIES OF THE SOIL	:					
Water content of compaction (%):	6.3	6.5	6.2			
Dry unit weight after compaction (kg/m³):	2050	2060	2050			
Duration of the consolidation (hours):	4	4	4			
TESTS RESULTS	:					
Maximum Shear Stress (kPa):	58.5	131.8	212.0			
Residual Shear Stress (kPa):	23.7	34.8	45.1			
Estimated Maximum angle of friction (°):	26					
Estimated Maximum adhesion (kPa):	16.7					
Estimated Residual angle of friction (°):	3					
Estimated Residual adhesion (kPa):	18.3					

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 19, 2024

*** Any question regarding this report or its authenticity? Please contact Omar Kamla ****

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ANALYSIS REPORT
SCC Accreditation No.: 40‡

Mr. Ian MacIntyre
Tetra Tech

Date: February 19, 2024
Report: 6710-001S-4A-en

REMARKS: - See graphs and pictures in Appendix.

- Consolidation:
100 kPa: 1 hour at 50 kPa, 4 hours at 100 kPa.
200 kPa: 1 hour at 50 kPa, 1 hour at 100 kPa, 4 hours at 200 kPa.
400 kPa: 1 hour at 50 kPa, 1 hour at 100 kPa, 1 hour at 200 kPa, 4 hours at 400 kPa.

Prepared by:
Marlon Bustos, M.Eng.
Technician

Approved by:
Omar Kamla, Eng.
Project Leader

Date: February 19, 2024

***** Any question regarding this report or its authenticity? Please contact Omar Kamla *****

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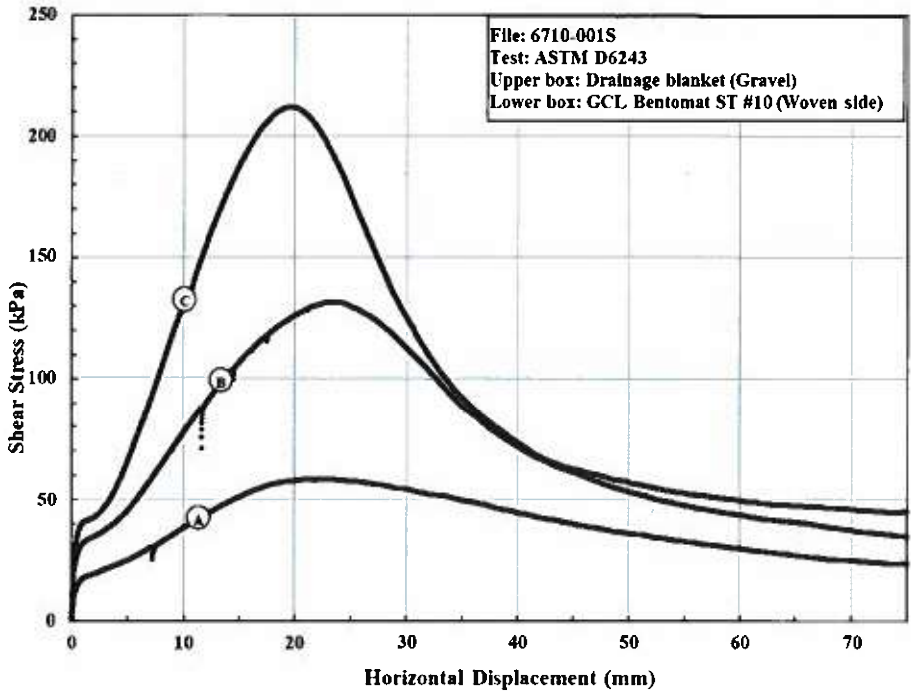
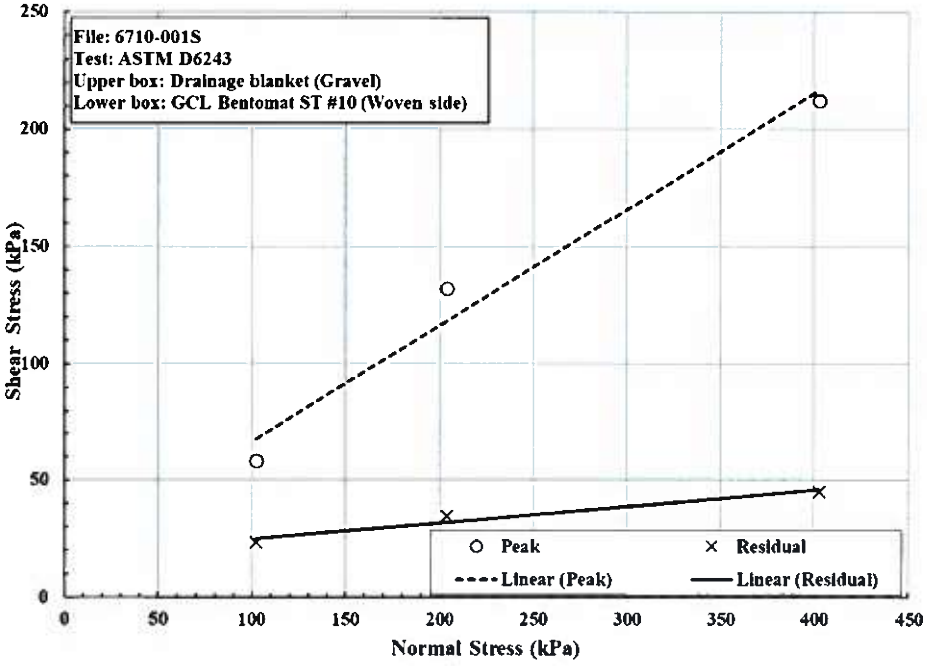
APPENDIX

Graphs



Shear Stress *vs* Horizontal Displacement



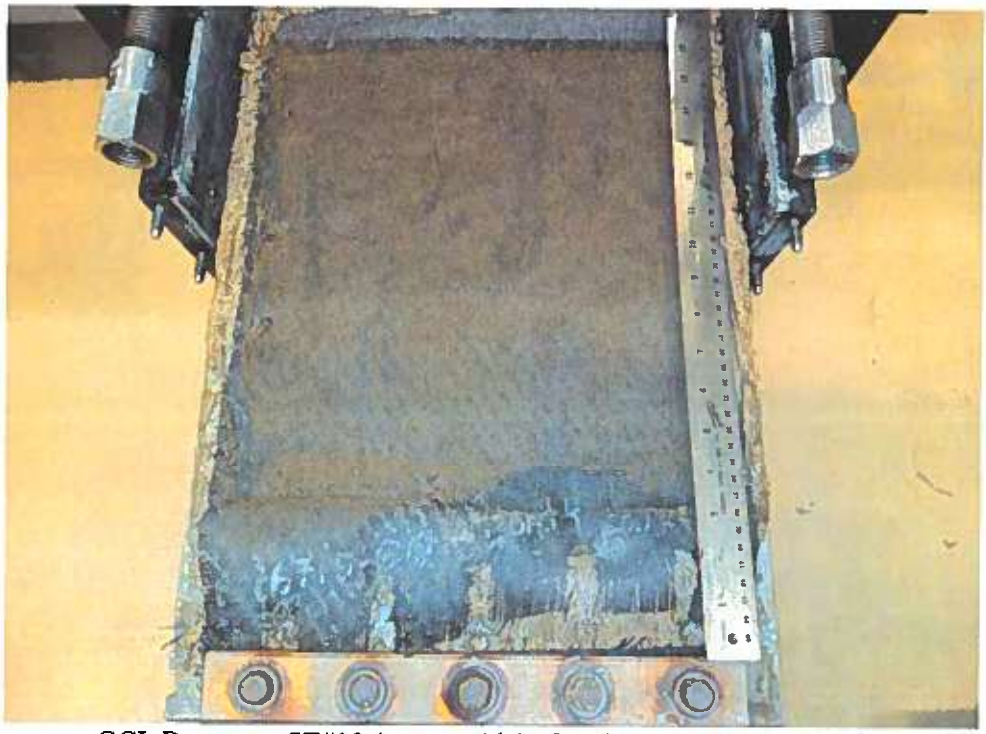
Shear Stress *vs* Normal Stress

File: 6710-001S

Pictures

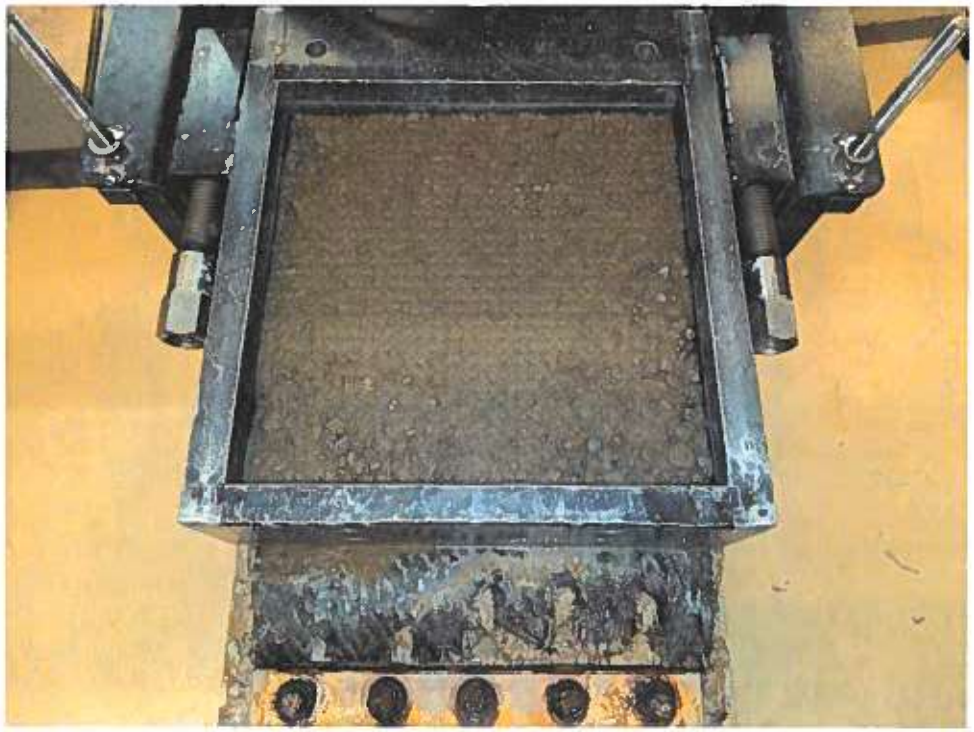


Interface #4 - Test at 100kPa

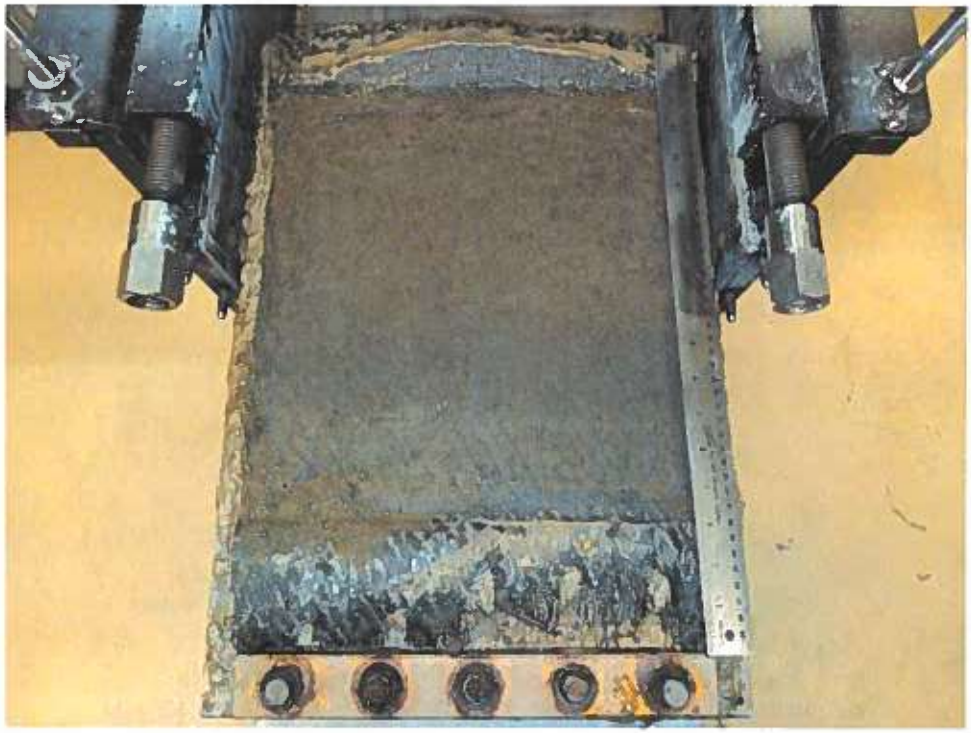


GCL Bentomat ST#10 (woven side) after the test – Test at 100kPa

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
T.:(+1) 877 288-8378



Interface #4 - Test at 200kPa



GCL Bentomat ST#10 (woven side) after the test – Test at 200kPa

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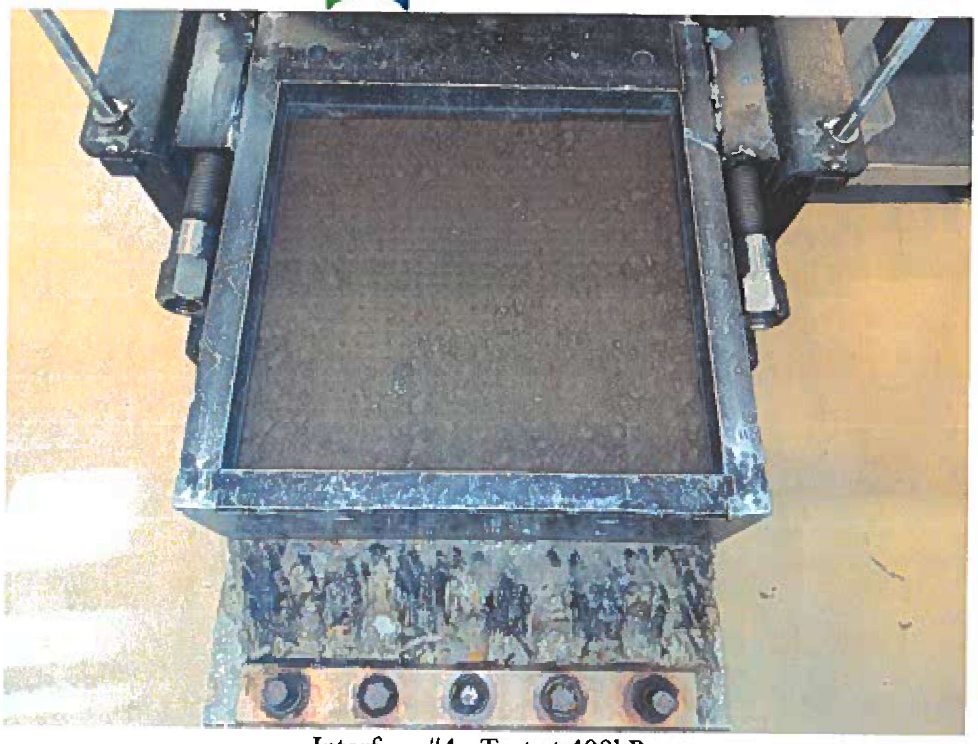
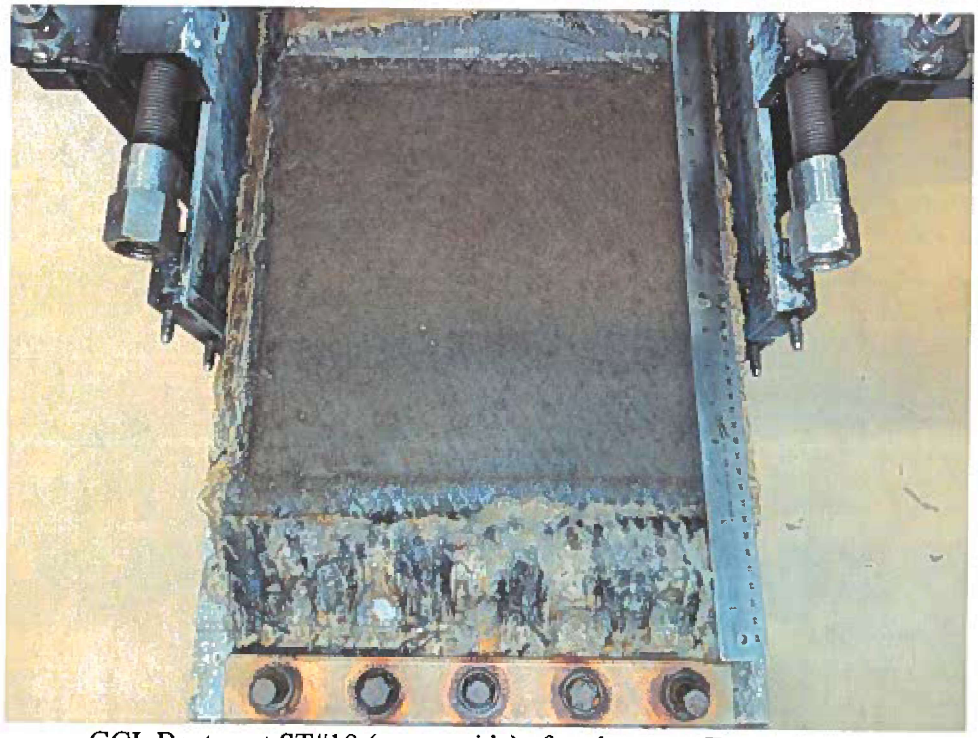
T.:(+1) 877 288-8378



Interface #4 - Test at 400kPa



GCL Bentomat ST#10 (woven side) after the test – Test at 400kPa

Groupe CTT Inc.
3000, avenue Boullé, St-Hyacinthe, QC, Canada, J2S 1H9
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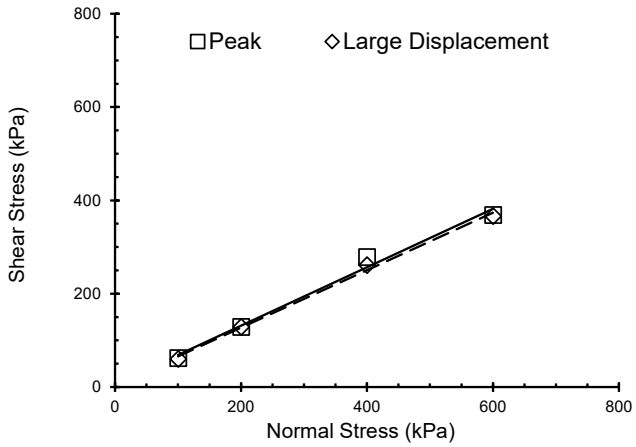
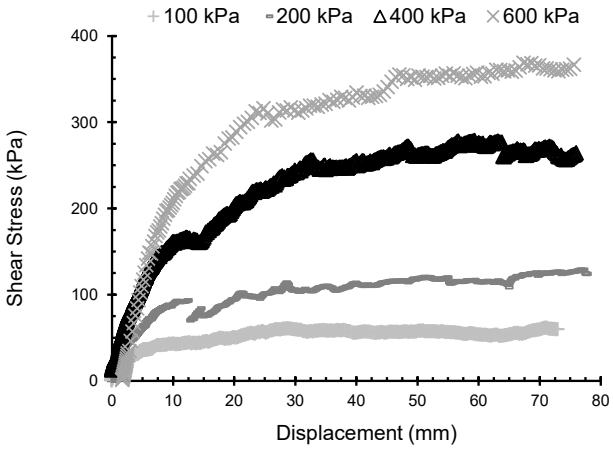
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Hecla Limited
Project: KH DSTF P2 West

TRI Log #: 25-00107-1
Richard S. Lacey, P.E. 2/5/2025
Analysis & Quality Review/Date

20 mm Bedding Material (P2W-20mm) vs. 80 mil Textured LLDPE GM (EL6280)





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	32.1	31.6
Y-intercept or Adhesion	kPa	6	4
Minimum Secant Angle	Degrees	31.6	30.9

Note - Large Displacement Values Reported for 76.2 mm of Displacement

Test Conditions		
Upper Box	20 mm Bedding Material (P2W-20mm) Tamped in place	
Lower Box	80 mil Textured LLDPE GM (EL6280)	
Conditioning	Wet - Loading applied and Interface flooded for a minimum of 15 minutes prior to shear.	
Shearing Rate	mm/minute	0.10

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		kPa	100	200	400	600
Box Edge Dimension		mm	305	305	305	305
Bearing Slide Resistance		N	124	212	388	565
Peak	Shear Stress	kPa	62	129	279	369
	Secant Angle	deg.	31.7	32.8	34.9	31.6
Large Displacement	Shear Stress	kPa	60	129	261	367
	Secant Angle	deg.	30.9	32.8	33.2	31.4
Asperity Height, Avg. of 5 Meas.		mm	0.650	0.675	0.625	0.650

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

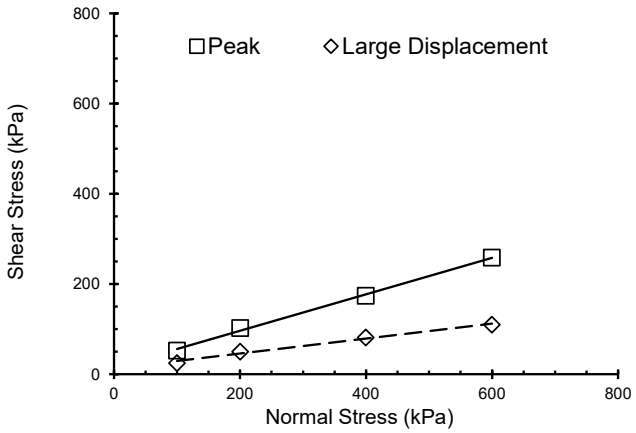
TRI Environmental, Inc.
9063 Bee Caves Rd. – Austin, TX 78733 – USA | Ph: 800.880.TEST or 512.263.2101

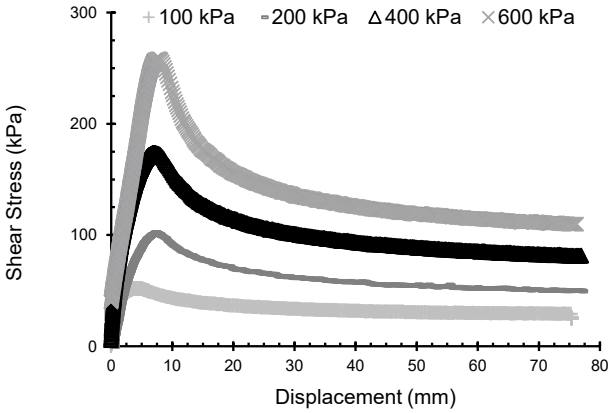
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Hecla Limited
Project: KH DSTF P2 West

TRI Log #: 25-00107-2
Richard S. Lacey, P.E. 2/4/2025
Analysis & Quality Review/Date

Non Woven Geotextile (LP8) vs. 80 mil Textured LLDPE GM (EL6280)





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	22.0	9.4
Y-intercept or Adhesion	kPa	15	13
Minimum Secant Angle	Degrees	23.3	10.4

Note - Large Displacement Values Reported for 76.2 mm of Displacement

Test Conditions		
Upper Box	Non Woven Geotextile (LP8)	
Lower Box	80 mil Textured LLDPE GM (EL6280)	
Conditioning	Wet - Interface soaked and loading applied for a minimum of 15 minutes prior to shear.	
Shearing Rate	mm/minute	0.10

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		kPa	100	200	400	600
Box Edge Dimension		mm	305	305	305	305
Bearing Slide Resistance		N	124	212	388	565
Peak	Shear Stress	kPa	52	102	174	259
	Secant Angle	deg.	27.6	27.0	23.5	23.3
Large Displacement	Shear Stress	kPa	25	50	81	110
	Secant Angle	deg.	14.0	14.1	11.5	10.4
Asperity Height, Avg. of 5 Meas.		mm	0.525	0.475	0.575	0.500

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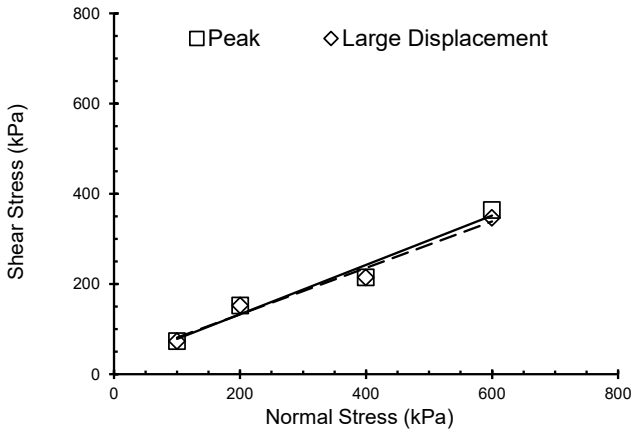
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

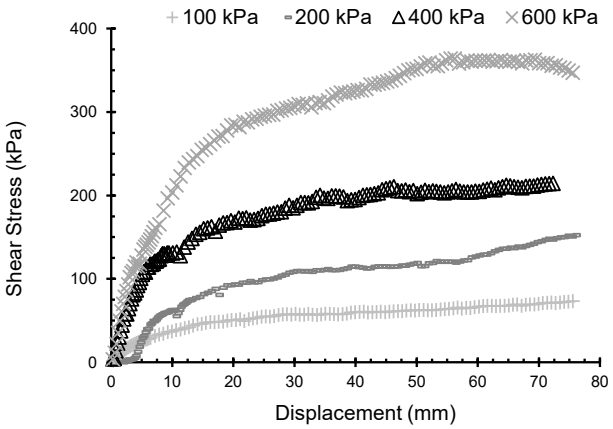
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Hecla Limited
Project: KH DSTF P2 West

TRI Log #: 25-00107-3
Richard S. Lacey, P.E. 2/4/2025
Analysis & Quality Review/Date

20 mm Bedding Material (P2W-20mm) vs. Non Woven Geotextile (LP8)





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	28.7	27.3
Y-intercept or Adhesion	kPa	23	30
Minimum Secant Angle	Degrees	28.2	28.2

Note - Large Displacement Values Reported for 76.2 mm of Displacement

Test Conditions		
Upper Box	20 mm Bedding Material (P2W-20mm) Tamped in place	
Lower Box	Non Woven Geotextile (LP8)	
Conditioning	Wet - Interface soaked and loading applied for a minimum of 15 minutes prior to shear.	
Shearing Rate	mm/minute	0.10

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		kPa	100	200	400	600
Box Edge Dimension		mm	305	305	305	305
Bearing Slide Resistance		N	124	212	388	565
Peak	Shear Stress	kPa	73	153	215	364
	Secant Angle	deg.	36.3	37.3	28.2	31.3
Large Displacement	Shear Stress	kPa	73	153	215	347
	Secant Angle	deg.	36.3	37.3	28.2	30.1

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

TRI Environmental, Inc.
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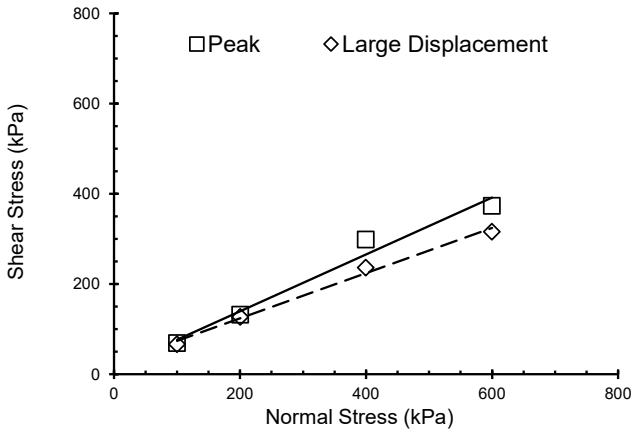
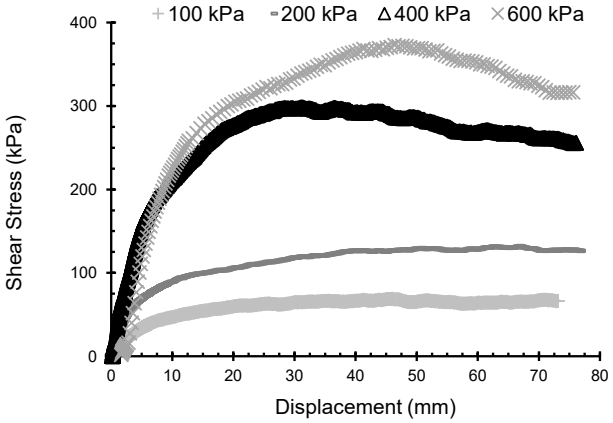
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Hecla Limited
Project: KH DSTF P2 West

TRI Log #: 25-00107-4
Richard S. Lacey, P.E. 2/4/2025
Analysis & Quality Review/Date

5 mm Bedding Material (P2W-5mm) vs. 80 mil Textured LLDPE GM (EL6280)





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	32.2	26.6
Y-intercept or Adhesion	kPa	13	24
Minimum Secant Angle	Degrees	31.9	27.8

Note - Large Displacement Values Reported for 76.2 mm of Displacement

Test Conditions		
Upper Box	5 mm Bedding Material (P2W-5mm) Tamped in place	
Lower Box	80 mil Textured LLDPE GM (EL6280)	
Conditioning	Wet - Interface soaked and loading applied for a minimum of 15 minutes prior to shear.	
Shearing Rate	mm/minute	0.10

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		kPa	100	200	400	600
Box Edge Dimension		mm	305	305	305	305
Bearing Slide Resistance		N	124	212	388	565
Peak	Shear Stress	kPa	69	132	299	373
	Secant Angle	deg.	34.6	33.4	36.8	31.9
Large Displacement	Shear Stress	kPa	66	127	236	316
	Secant Angle	deg.	33.6	32.4	30.6	27.8
Asperity Height, Avg. of 5 Meas.		mm	0.750	0.600	0.600	0.625

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WSP Canada Inc. - Burnaby Laboratory
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	**CID1**				
Sample No.	500 kPa				
Initial Dimensions					
H_o (cm)	15.67				
D_o (cm)	7.15				
Specific Gravity (Assumed)	2.75				
w (%)	11.2				
$\gamma_{o\ dry}$ (kN/m^3)	18.47				
Sat. (%)	67				
e_o	0.46				
B_{Value}	0.99				
Consolidation Results					
σ_{CELL} (kPa)	1184				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	498				
ΔV_c (cc)	-19.5				
t_{90} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	15.84				
D_c (cm)	7.30				
A_c (cm^2)	41.84				
V_c (cm^3)	662.7				
$\gamma_{c\ dry}$ (kN/m^3)	17.53				
e_c	0.54				
w (%)	19.6				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' **:**					
σ_1'-σ_3' (kPa)	1393				
$\varepsilon_{failure}$ (%)	15.63				
$\varepsilon_{volumetric}$ (%)	2.44				
σ_3' (kPa)	495				
σ_1' (kPa)	1887				

T. Madera	April 29, 2025	D. Lim	May 5, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
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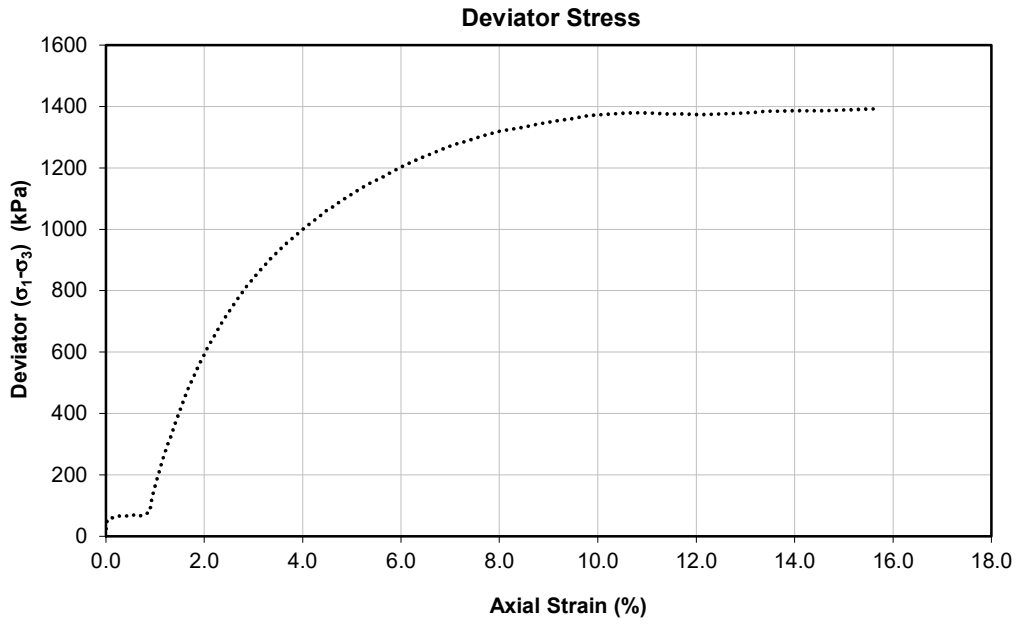
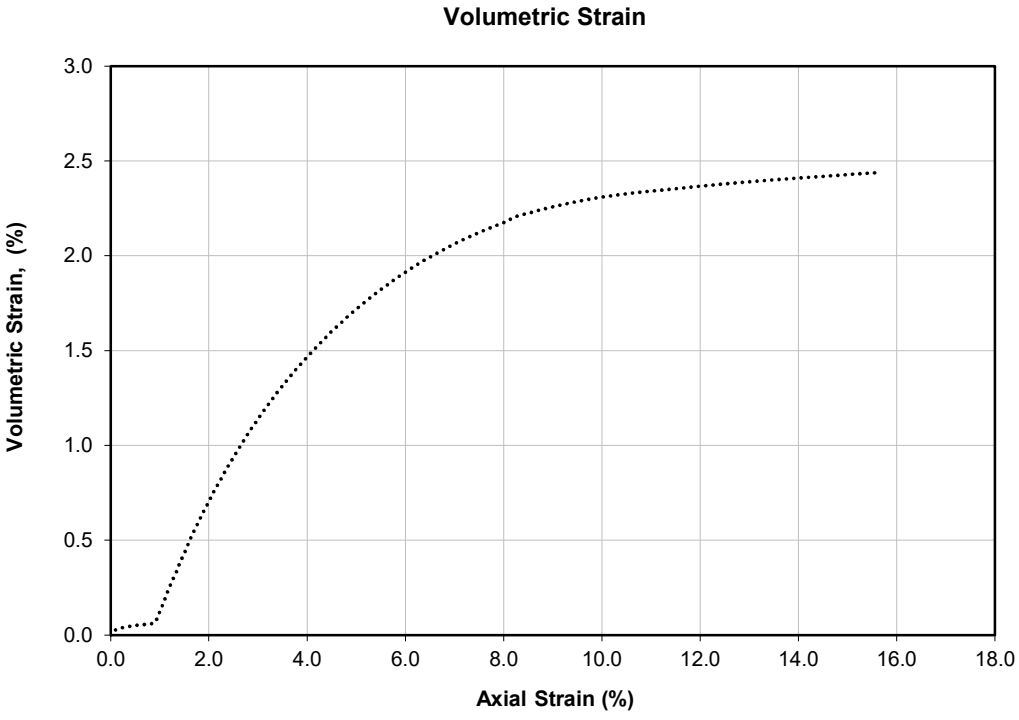
Consolidated Drained Triaxial Compression Test for Soils

Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





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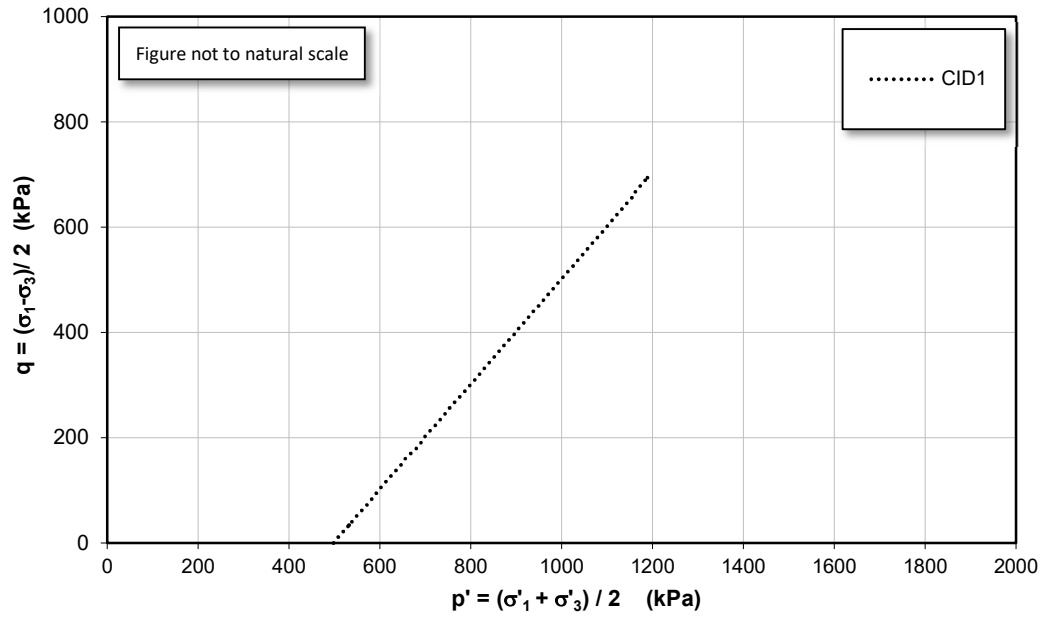
Consolidated Drained Triaxial Compression Test for Soils

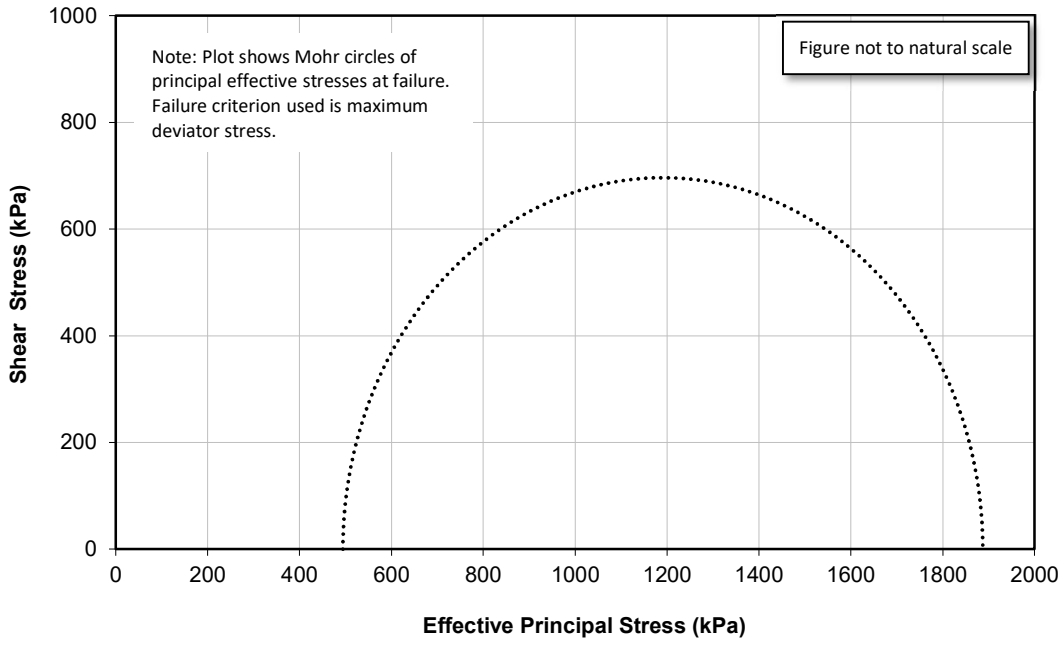
Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



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TESTED BY	DATE	CHECKED BY	DATE

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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

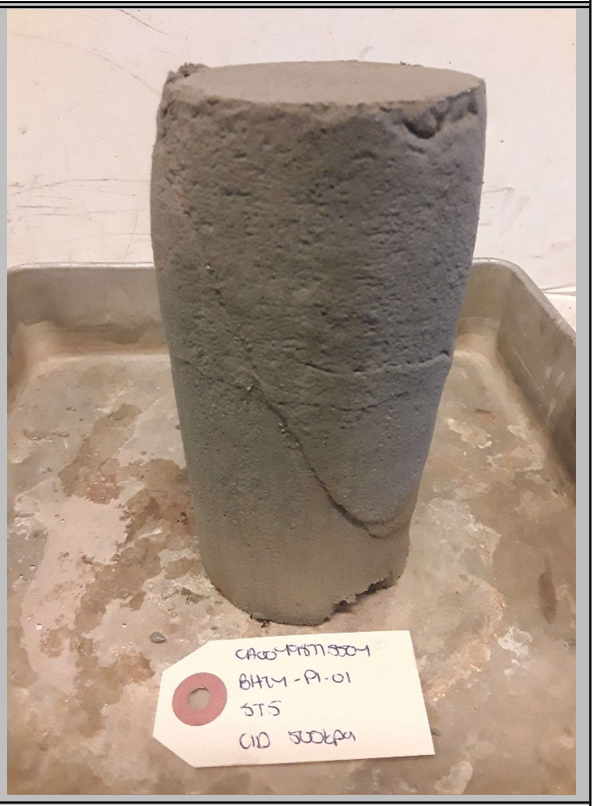
Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079
Type :	Undisturbed	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailings
Visual Description:	SILTY SAND grey, dense.		
Other Remarks:			

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	15.67	15.84
Diameter (cm):	7.15	7.30
Area (cm^2):	40.12	41.84
Volume (cm^3):	629	663
γ_{dry} (kN/m^3):	18.47	17.53
γ_{sat} (kN/m^3):	21.57	20.96
Water content, w (%):	11.2	19.6
Saturation (%):	67	100
Void ratio, e:	0.46	0.54
###	2.75	2.75

Equipment

Machine:	Truepath Load Frame - Stn. 6
Chamber:	KW
Load Cell:	729249
Axial DCDT:	LP-946
Cell Pressure:	PS5-184
Back Pressure:	PS3-243
Pore Pressure:	PS5-155
Feed Rate (%/hr):	2.00



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa)	498
σ_{pwp} (kPa):	686
B value:	0.99
Volume Change (cc):	-19.5
t_{90} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	1393
Strain, ε_f (%):	15.63
$\varepsilon_{volumetric}$ (%):	2.44
σ_1' (kPa):	1887
σ_3' (kPa):	495

T. Madera	April 29, 2025	D. Lim	May 5, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	**CID1**				
Sample No.	300 kPa				
Initial Dimensions					
H_o (cm)	14.94				
D_o (cm)	7.09				
Specific Gravity (Calculated)	3.11				
w (%)	11.3				
$\gamma_{o\ dry}$ (kN/m^3)	20.73				
Sat. (%)	74				
e_o	0.47				
B_{Value}	0.96				
Consolidation Results					
σ_{CELL} (kPa)	1266				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	299				
ΔV_c (cc)	-6.0				
t_{90} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	14.87				
D_c (cm)	7.03				
A_c (cm^2)	38.81				
V_c (cm^3)	577.2				
$\gamma_{c\ dry}$ (kN/m^3)	21.19				
e_c	0.44				
w (%)	14.1				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa)	6013				
$\varepsilon_{failure}$ (%)	4.41				
$\varepsilon_{volumetric}$ (%)	-0.68				
σ_3' (kPa)	300				
σ_1' (kPa)	6313				

T. Madera	July 4, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
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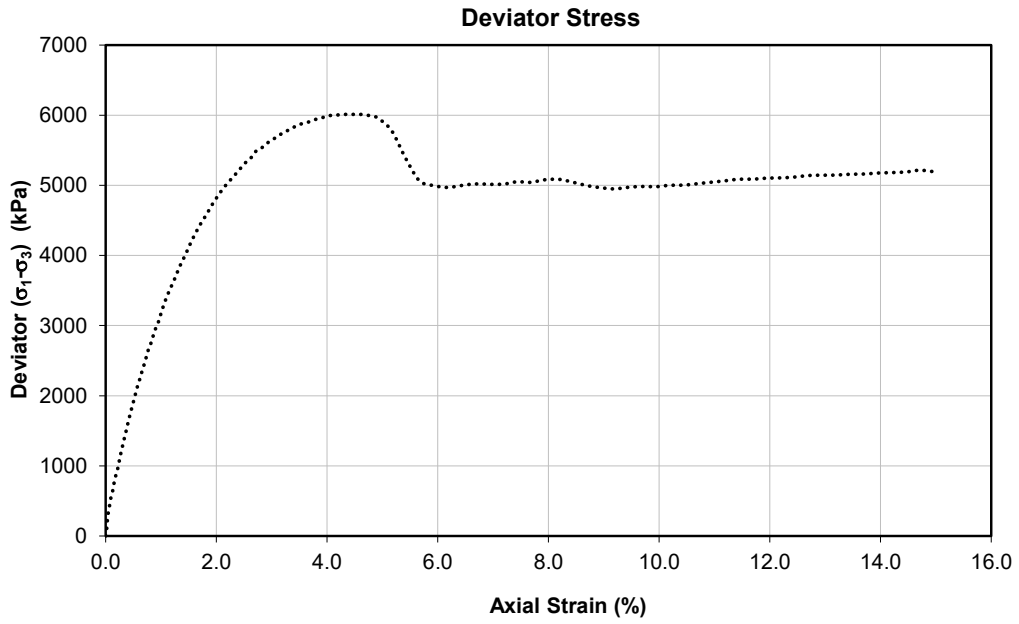
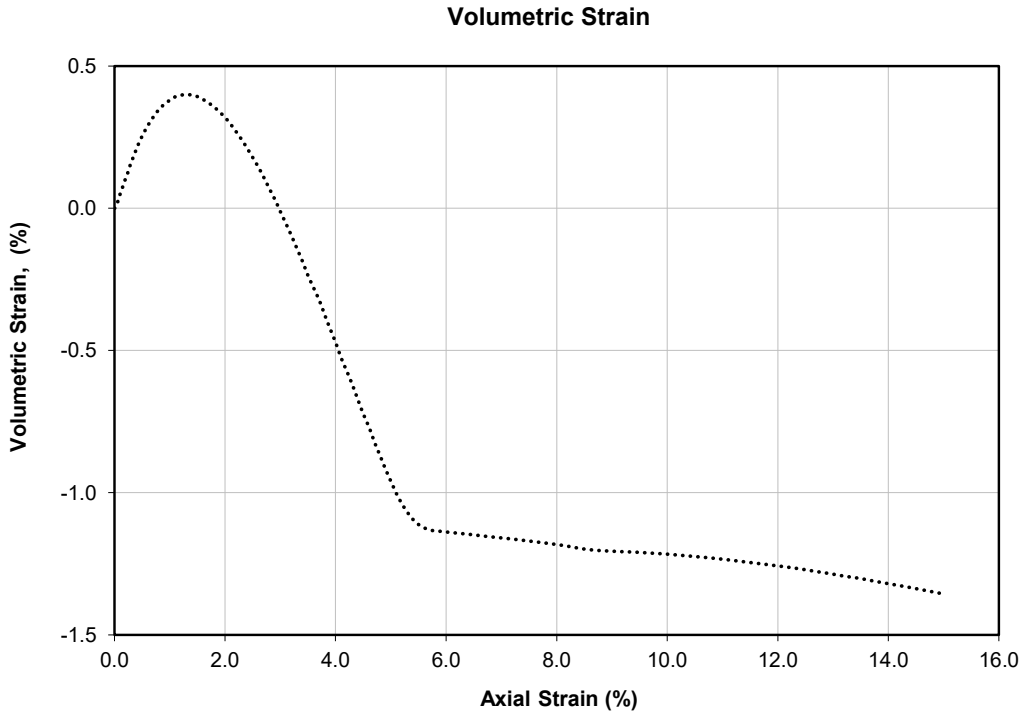
Consolidated Drained Triaxial Compression Test for Soils

Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





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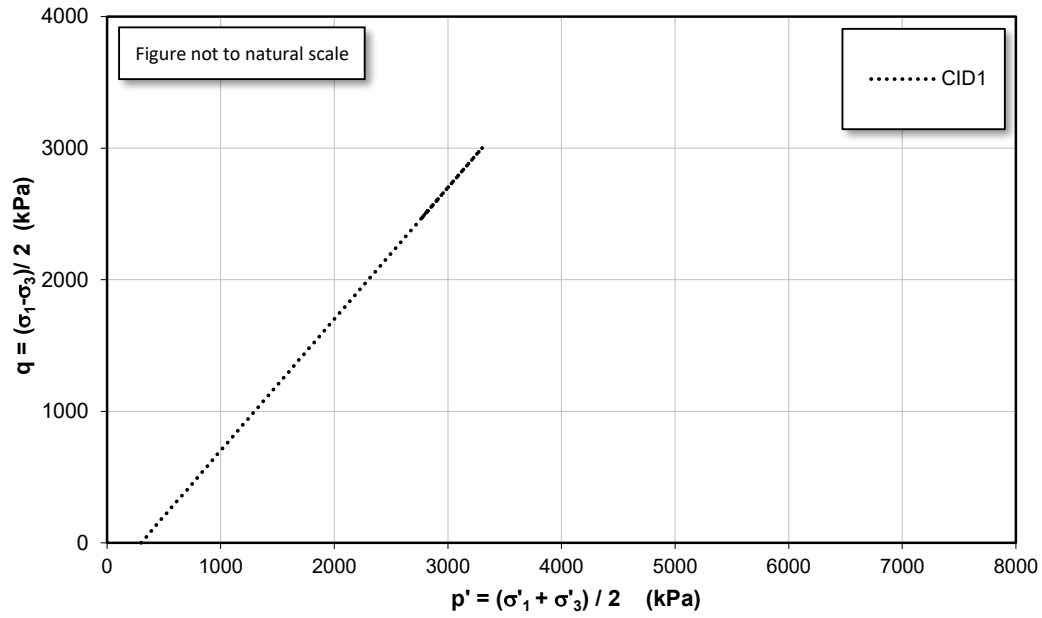
Consolidated Drained Triaxial Compression Test for Soils

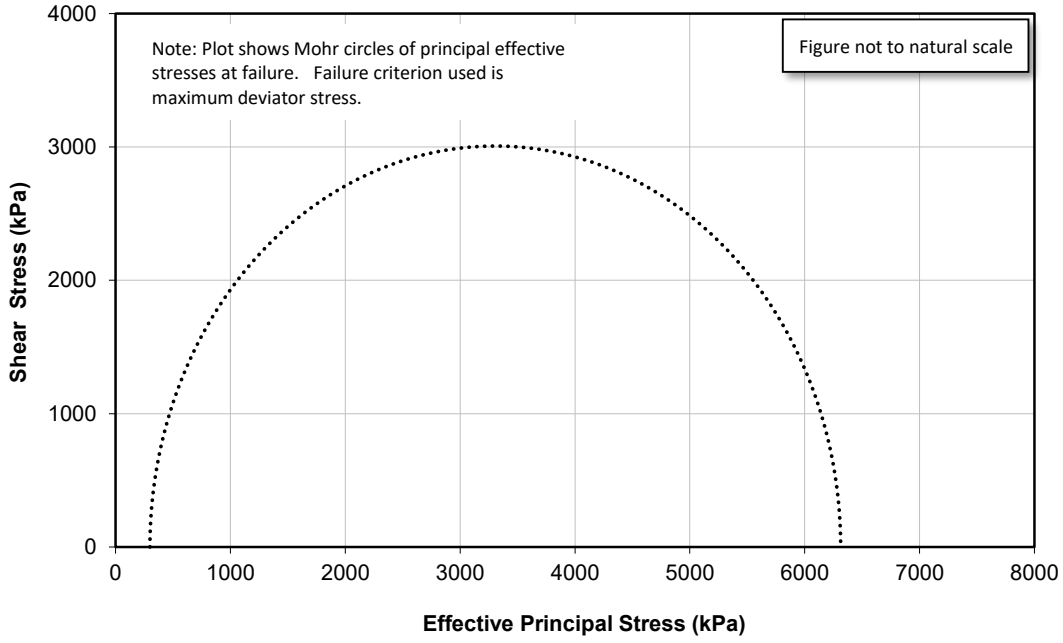
Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample No.:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079
Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailings
Visual Description:	SILTY SAND grey, dense		
Other Remarks:	Reconstitute sample prepared to void ratio of 0.60 at 11.5% moisture content		

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	14.94	14.87
Diameter (cm):	7.09	7.03
Area (cm^2):	39.50	38.81
Volume (cm^3):	590	577
γ_{dry} (kN/m^3):	20.73	21.19
γ_{sat} (kN/m^3):	23.87	24.19
Water content, w (%):	11.3	14.1
Saturation (%):	74	100
Void ratio, e:	0.47	0.44
###	3.11	3.11

Equipment

Machine:	Truepath Load Frame - Stn. 6
Chamber:	KW
Load Cell:	1143627
Axial DCDT:	LP-946
Cell Pressure:	PS5-184
Back Pressure:	PS3-243
Pore Pressure:	PS5-155
Feed Rate (%/hr):	1.00



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa)	299
σ_{pwp} (kPa):	966
B value:	0.96
Volume Change (cc):	-6.0
t_{90} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	6013
Strain, ε_f (%):	4.41
$\varepsilon_{volumetric}$ (%):	-0.68
σ_1' (kPa):	6313
σ_3' (kPa):	300

T. Madera	July 4, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample No.:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	**CID1**				
Sample No.	700 kPa				
Initial Dimensions					
H_o (cm)	14.88				
D_o (cm)	7.09				
Specific Gravity (Calculated)	3.12				
w (%)	11.3				
$\gamma_{o\ dry}$ (kN/m^3)	20.89				
Sat. (%)	76				
e_o	0.46				
B_{Value}	0.95				
Consolidation Results					
σ_{CELL} (kPa)	1727				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	699				
ΔV_c (cc)	-9.8				
t_{90} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	14.79				
D_c (cm)	7.01				
A_c (cm^2)	38.55				
V_c (cm^3)	570.0				
$\gamma_{c\ dry}$ (kN/m^3)	21.55				
e_c	0.42				
w (%)	13.5				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa)	2808				
$\varepsilon_{failure}$ (%)	6.24				
$\varepsilon_{volumetric}$ (%)	-0.11				
σ_3' (kPa)	699				
σ_1' (kPa)	3507				

T. Madera	July 10, 2025	D. Lim	July 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

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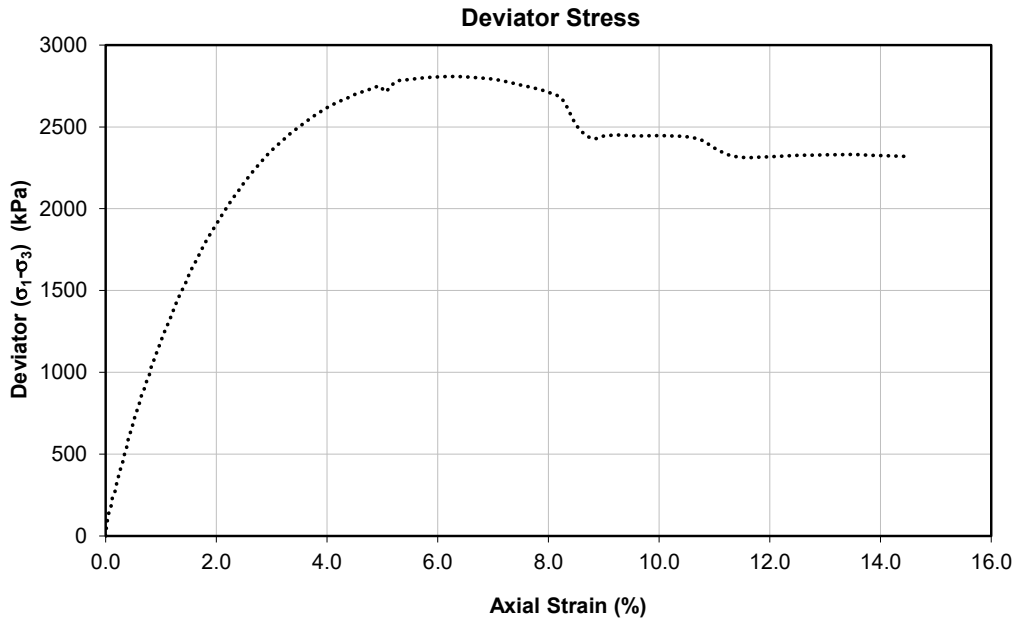
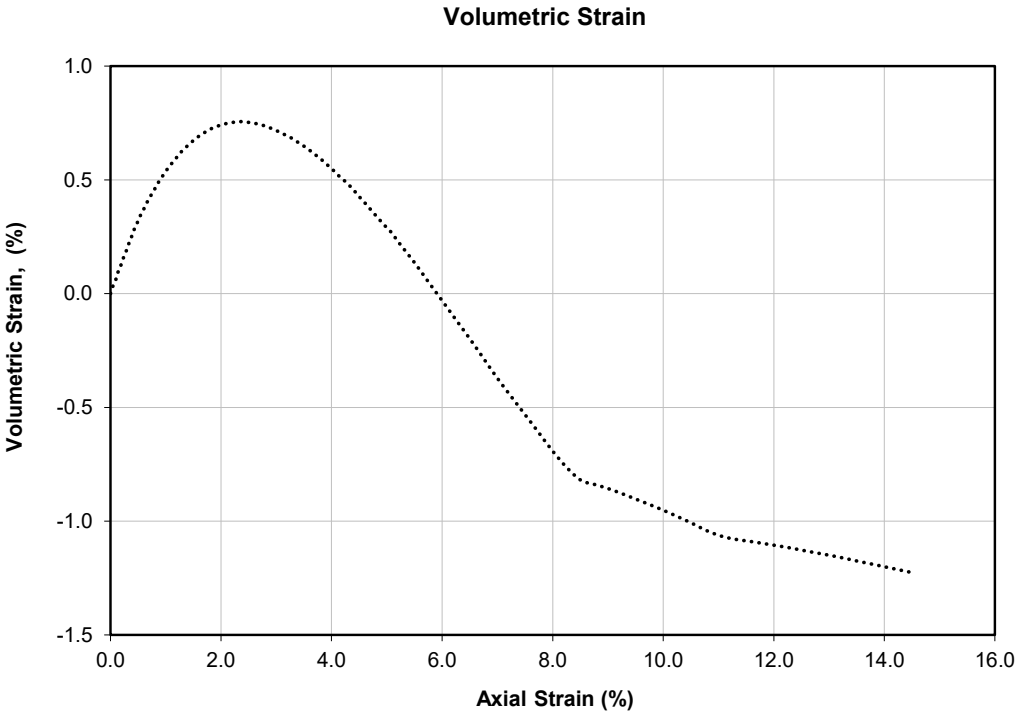
Consolidated Drained Triaxial Compression Test for Soils

Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample No.:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





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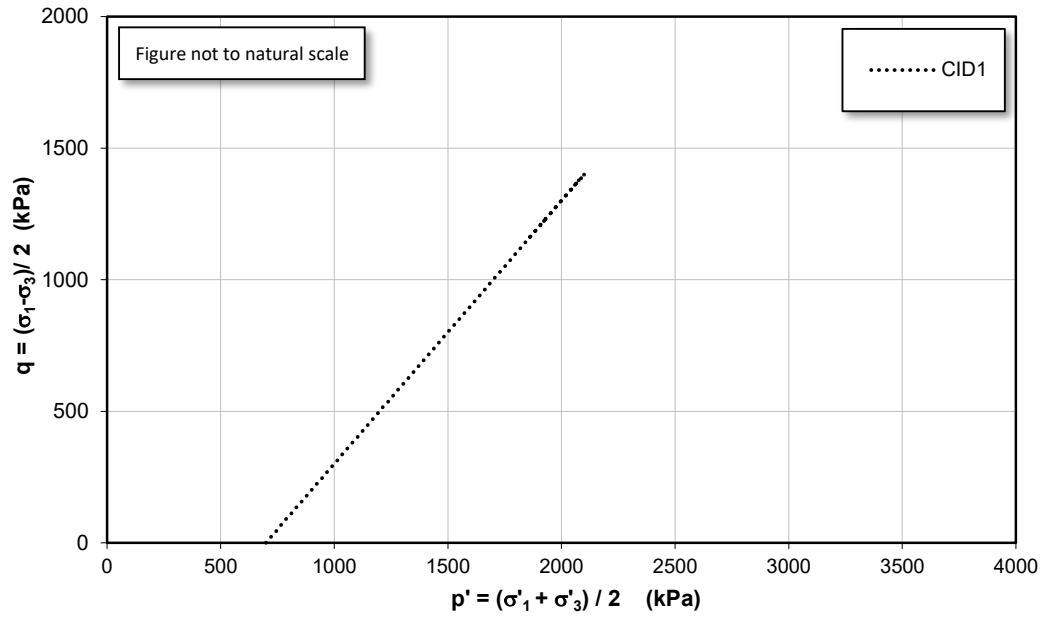
Consolidated Drained Triaxial Compression Test for Soils

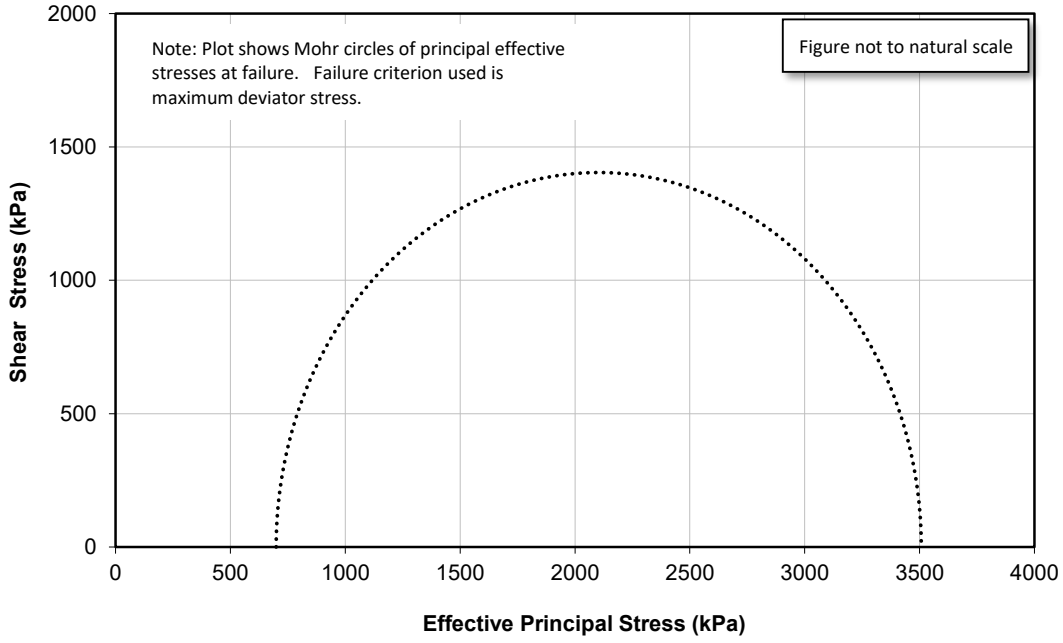
Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample No.:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample No.:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079
Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailings
Visual Description:	SILTY SAND grey, dense		
Other Remarks:	Reconstitute sample prepared to void ratio of 0.60 at 11.5% moisture content		

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	14.88	14.79
Diameter (cm):	7.09	7.01
Area (cm^2):	39.53	38.55
Volume (cm^3):	588	570
γ_{dry} (kN/m^3):	20.89	21.55
γ_{sat} (kN/m^3):	24.01	24.46
Water content, w (%):	11.3	13.5
Saturation (%):	76	100
Void ratio, e:	0.46	0.42
###	3.12	3.12

Equipment

Machine:	Truepath Load Frame - Stn. 1
Chamber:	KW
Load Cell:	118534
Axial DCDT:	LP-1215
Cell Pressure:	PS3-265
Back Pressure:	PS3-264
Pore Pressure:	PS3-134
Feed Rate (%/hr):	1.00



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa)	699
σ_{pwp} (kPa):	1028
B value:	0.95
Volume Change (cc):	-9.8
t_{90} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	2808
Strain, ε_f (%):	6.24
$\varepsilon_{volumetric}$ (%):	-0.11
σ_1' (kPa):	3507
σ_3' (kPa):	699

T. Madera	July 10, 2025	D. Lim	July 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	**CID1**				
Sample No.	250 kPa				
Initial Dimensions					
H_o (cm)	16.09				
D_o (cm)	7.08				
Specific Gravity (Assumed)	2.85				
w (%)	11.5				
$\gamma_{o\ dry}$ (kN/m^3)	21.07				
Sat. (%)	100				
e_o	0.33				
B_{Value}	1.00				
Consolidation Results					
σ_{CELL} (kPa)	755				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	234				
ΔV_c (cc)	-8.9				
t_{90} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	16.26				
D_c (cm)	7.23				
A_c (cm^2)	41.03				
V_c (cm^3)	667.1				
$\gamma_{c\ dry}$ (kN/m^3)	20.00				
e_c	0.40				
w (%)	15.5				
Sat (%)	111				
Failure At Maximum Deviator Stress σ_1'-σ_3' **:**					
σ_1'-σ_3' (kPa)	1155				
$\varepsilon_{failure}$ (%)	5.68				
$\varepsilon_{volumetric}$ (%)	-1.50				
σ_3' (kPa)	240				
σ_1' (kPa)	1395				

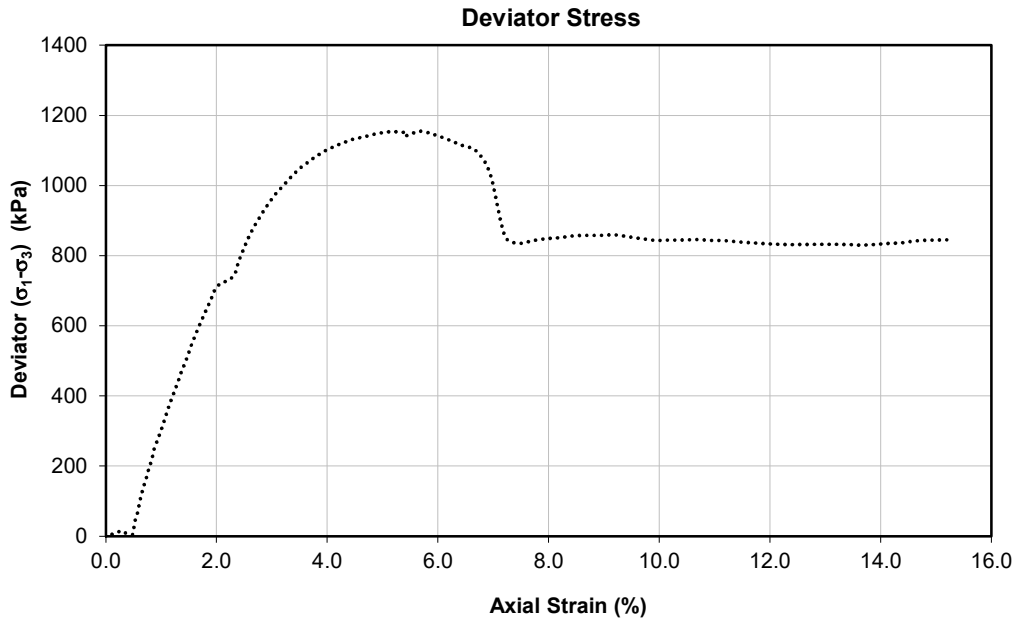
T. Madera	May 2, 2025	D. Lim	May 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

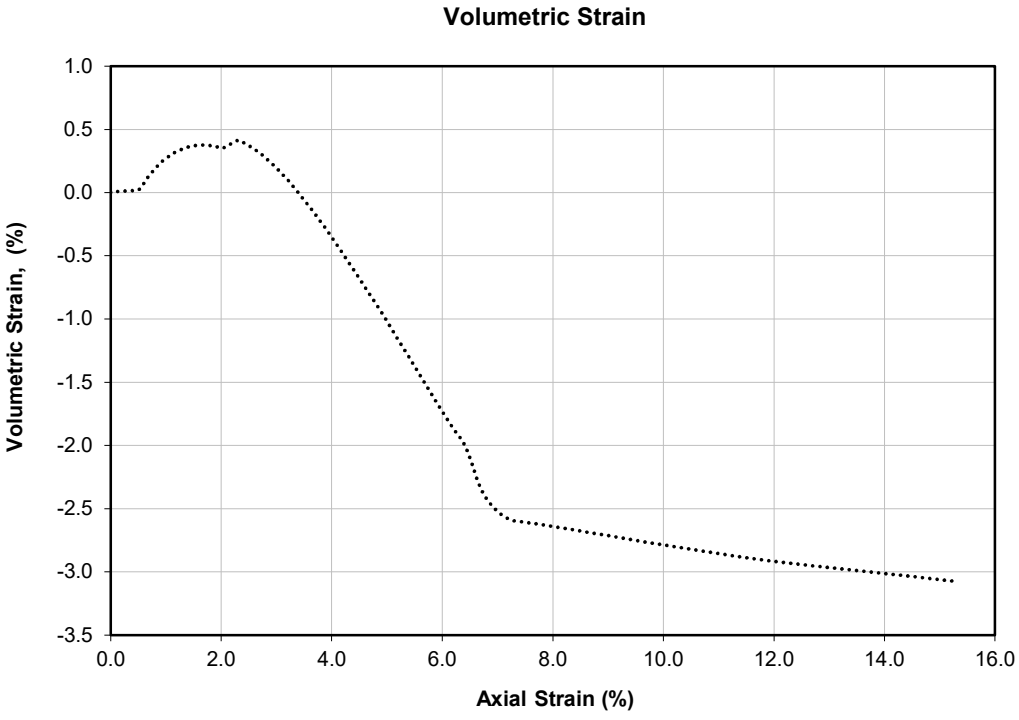
WSP Canada Inc. - Burnaby Laboratory
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Drained Triaxial Compression Test for Soils

Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





T. Madera	May 2, 2025	D. Lim	May 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

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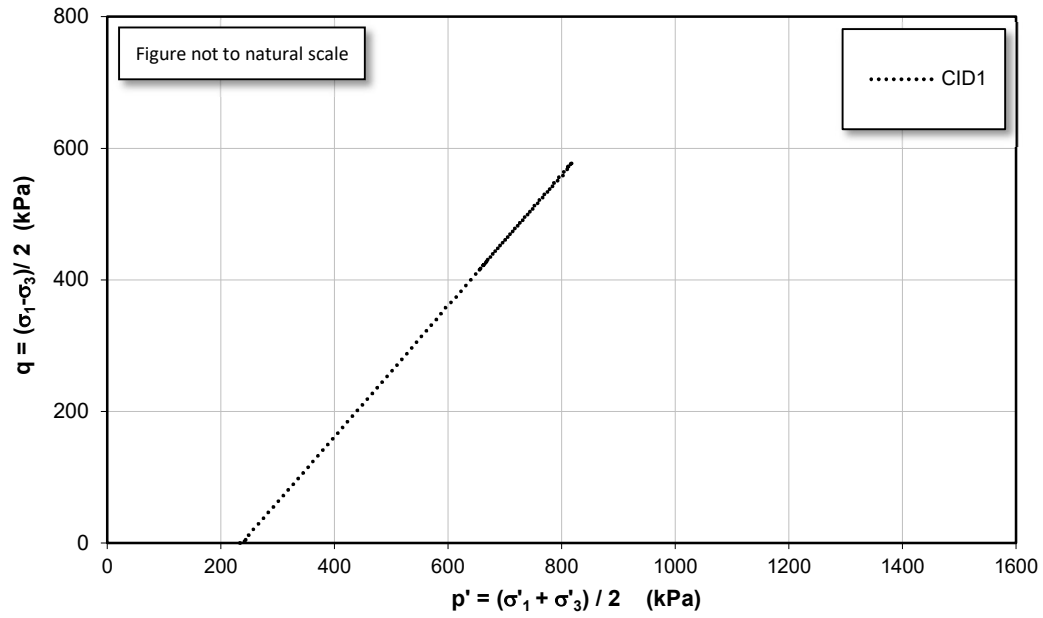
Consolidated Drained Triaxial Compression Test for Soils

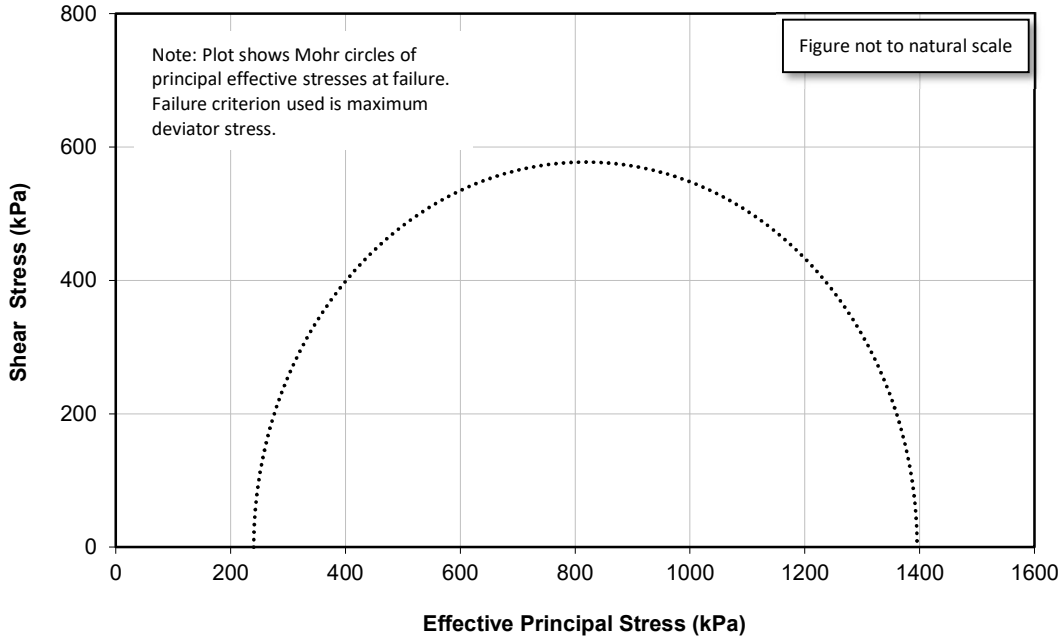
Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



T. Madera	May 2, 2025	D. Lim	May 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

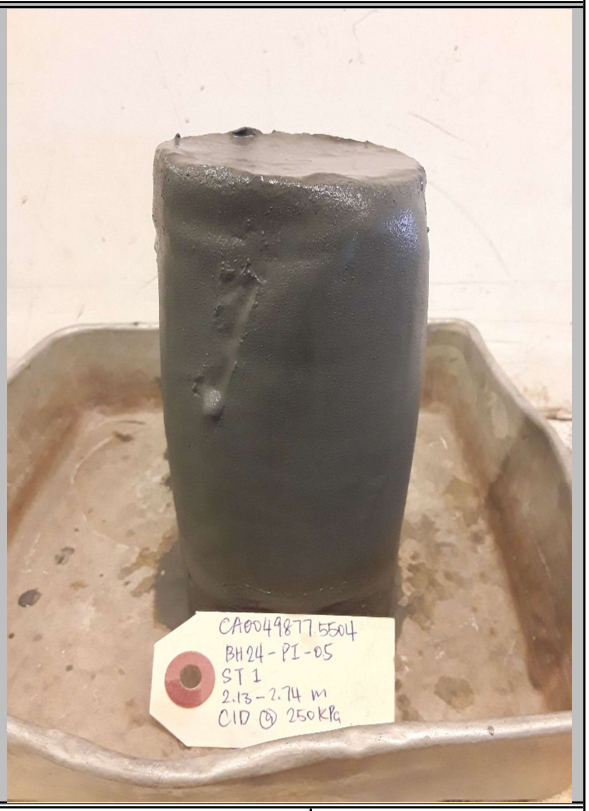
Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079
Type :	Intact	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Soil
Visual Description:	SILT, some sand, grey, w > PL, dense.		
Other Remarks:			

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	16.09	16.26
Diameter (cm):	7.08	7.23
Area (cm^2):	39.36	41.03
Volume (cm^3):	633	667
γ_{dry} (kN/m^3):	21.07	20.00
γ_{sat} (kN/m^3):	23.49	22.79
Water content, w (%):	11.5	15.5
Saturation (%):	100	111
Void ratio, e:	0.33	0.40
###	2.85	2.85

Equipment

Machine:	Truepath Load Frame - Stn. 6
Chamber:	KW
Load Cell:	729249
Axial DCDT:	LP-946
Cell Pressure:	PS5-184
Back Pressure:	PS3-243
Pore Pressure:	PS5-155
Feed Rate (%/hr):	2.00



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa)	234
σ_{pwp} (kPa):	521
B value:	1.00
Volume Change (cc):	-8.9
t_{90} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	1155
Strain, ε_f (%):	5.68
$\varepsilon_{volumetric}$ (%):	-1.50
σ_1' (kPa):	1395
σ_3' (kPa):	240

T. Madera	May 2, 2025	D. Lim	May 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	**CID1**				
Sample No.	50 kPa				
Initial Dimensions					
H_o (cm)	14.85				
D_o (cm)	7.07				
Specific Gravity (Calculated)	2.86				
w (%)	11.5				
$\gamma_{o\ dry}$ (kN/m^3)	18.15				
Sat. (%)	60				
e_o	0.55				
B_{Value}	0.97				
Consolidation Results					
σ_{CELL} (kPa)	1289				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	48				
ΔV_c (cc)	-3.0				
t_{90} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	14.82				
D_c (cm)	7.04				
A_c (cm^2)	38.89				
V_c (cm^3)	576.5				
$\gamma_{c\ dry}$ (kN/m^3)	18.34				
e_c	0.53				
w (%)	18.5				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' **:**					
σ_1'-σ_3' (kPa)	183				
$\varepsilon_{failure}$ (%)	3.62				
$\varepsilon_{volumetric}$ (%)	0.41				
σ_3' (kPa)	48				
σ_1' (kPa)	231				

T. Madera	June 27, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
#300 - 3811 North Fraser Way
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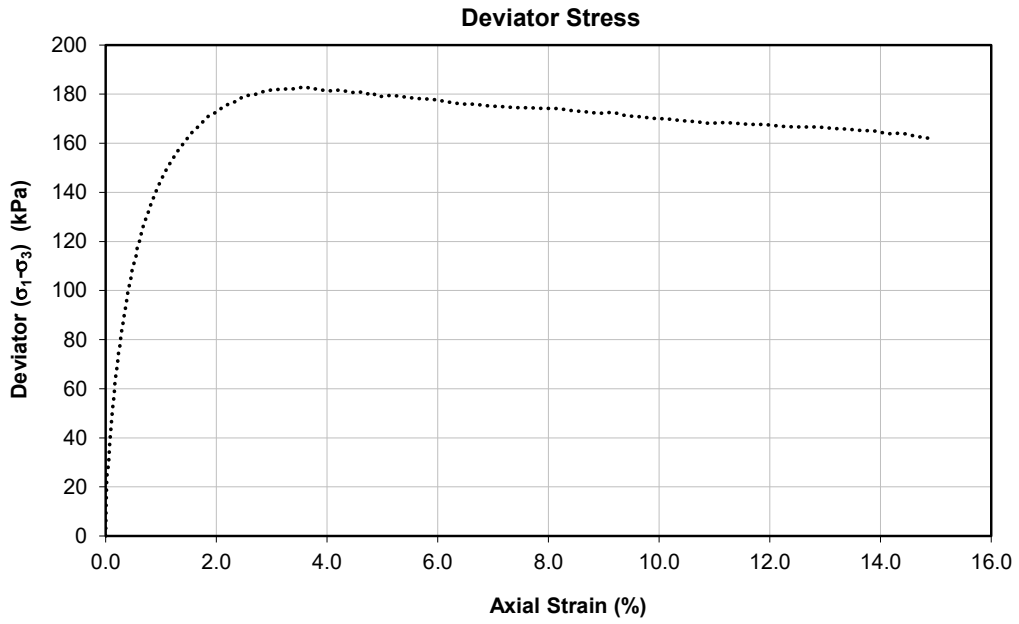
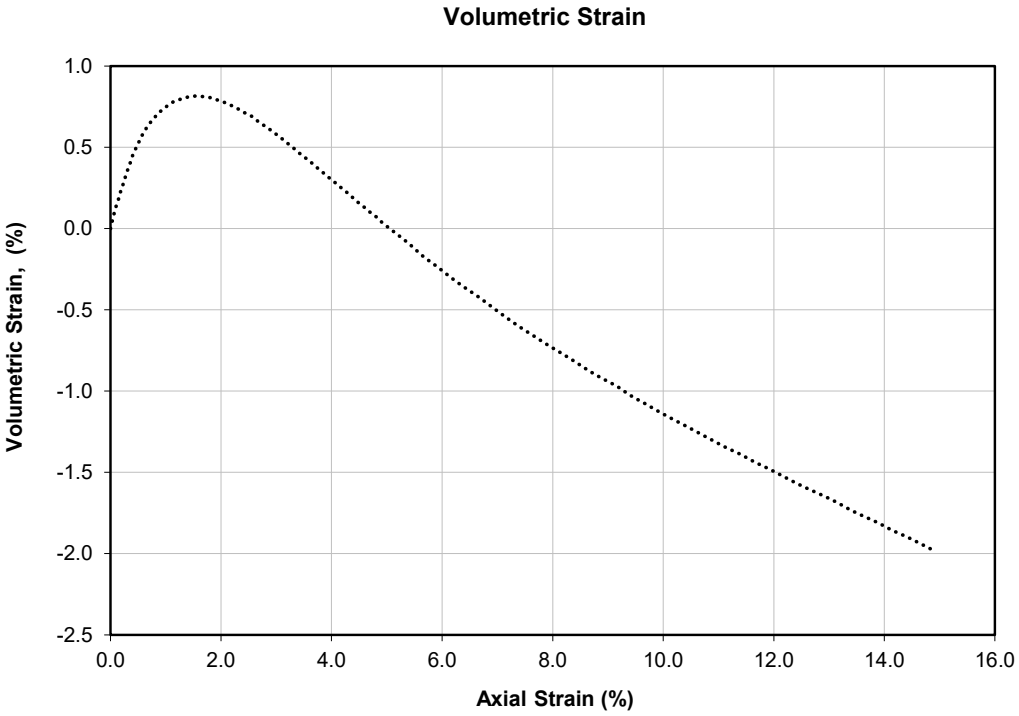
Consolidated Drained Triaxial Compression Test for Soils

Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





T. Madera	June 27, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

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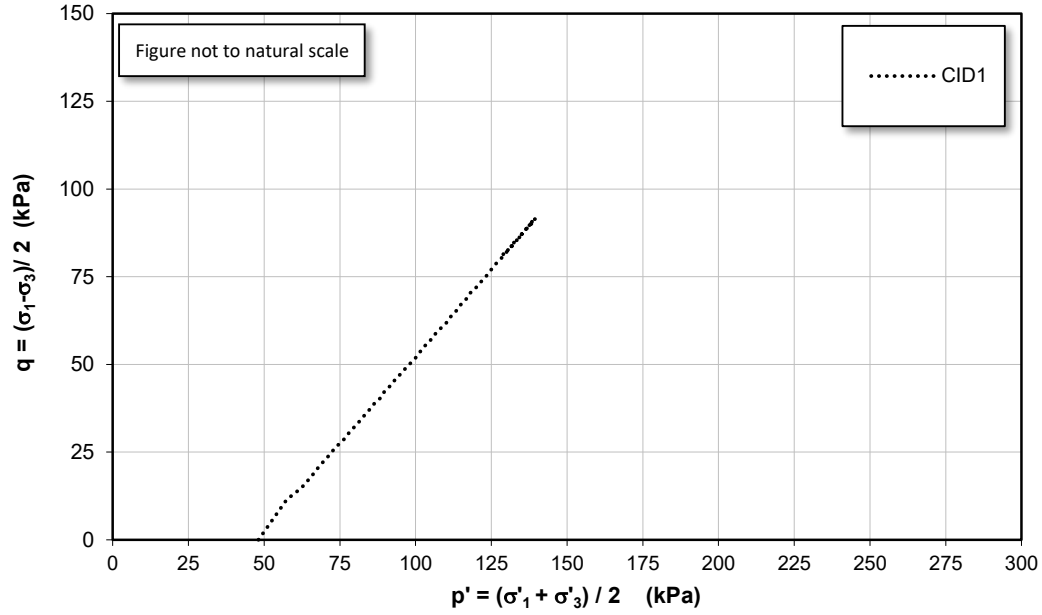
Consolidated Drained Triaxial Compression Test for Soils

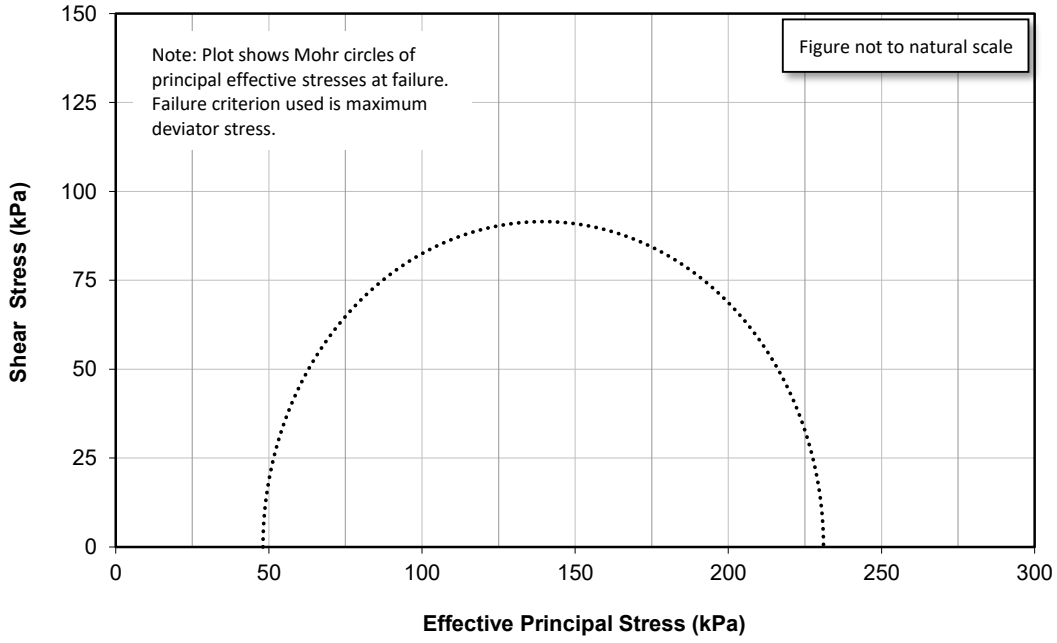
Reference
ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



T. Madera	June 27, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Consolidated Drained Triaxial Compression Test for Soils

Reference ASTM D7181

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample No.:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079
Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailings
Visual Description:	SILTY SAND, grey, dense		
Other Remarks:	Reconstitute sample and prepared to void ratio of 0.58 at 11.5 moisture content		

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	14.85	14.82
Diameter (cm):	7.07	7.04
Area (cm^2):	39.22	38.89
Volume (cm^3):	583	576
γ_{dry} (kN/m^3):	18.15	18.34
γ_{sat} (kN/m^3):	21.61	21.74
Water content, w (%):	11.5	18.5
Saturation (%):	60	100
Void ratio, e:	0.55	0.53
###	2.86	2.86

Equipment

Machine:	Truepath Load Frame - Stn. 2
Chamber:	KW
Load Cell:	205859
Axial DCDT:	LP-175
Cell Pressure:	PS-2234
Back Pressure:	PS2-467
Pore Pressure:	PS2-184
Feed Rate (%/hr):	2.00



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa)	48
σ_{pwp} (kPa):	1241
B value:	0.97
Volume Change (cc):	-3.0
t_{90} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	183
Strain, ε_f (%):	3.62
$\varepsilon_{volumetric}$ (%):	0.41
σ_1' (kPa):	231
σ_3' (kPa):	48

T. Madera	June 27, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	CIU-1				
Sample	200 kPa				
Initial Dimensions					
H_o (cm)	15.03				
D_o (cm)	7.11				
Gs (assumed)	2.75				
w (%)	11.6				
$\gamma_{o\ dry}$ (kN/m^3)	19.14				
Sat. (%)	78				
e_o	0.41				
B_{Value}	1.00				
Consolidation Results					
σ_{CELL} (kPa)	886				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	188				
ΔV_c (cc)	-8.0				
t_{50} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	15.24				
D_c (cm)	7.31				
A_c (cm^2)	41.93				
V_c (cm^3)	639.1				
$\gamma_{c\ dry}$ (kN/m^3)	17.87				
e_c	0.51				
w (%)	18.5				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa) :	940				
ε_f (%)	10.27				
u (kPa)	-106				
σ_3' (kPa)	295				
σ_1' (kPa)	1235				

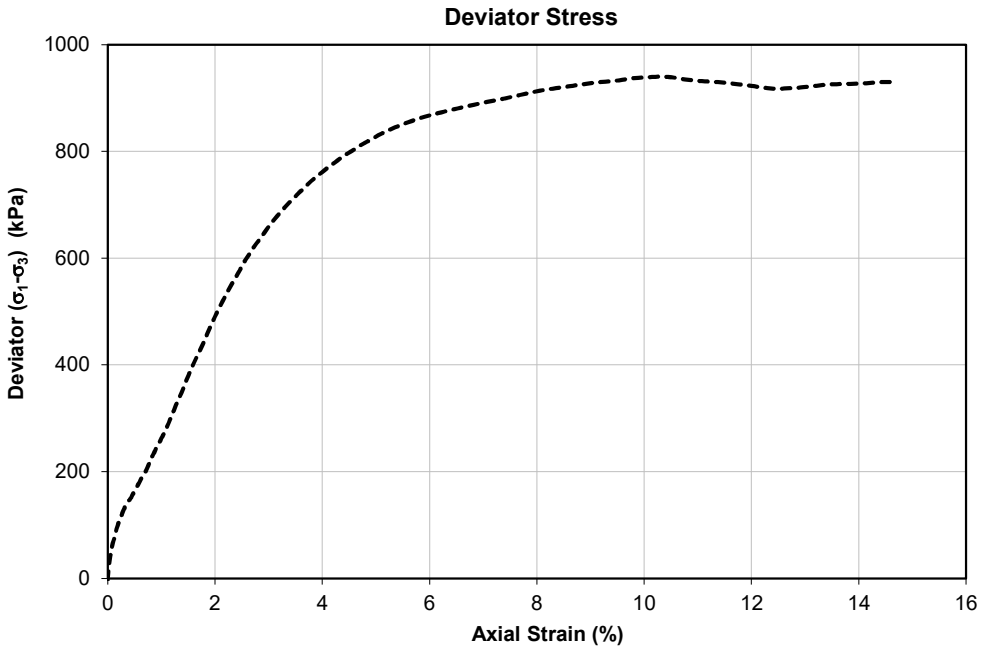
T. Madera	April 29, 2025	D. Lim	May 5, 2025
TESTED BY	DATE	CHECKED BY	DATE

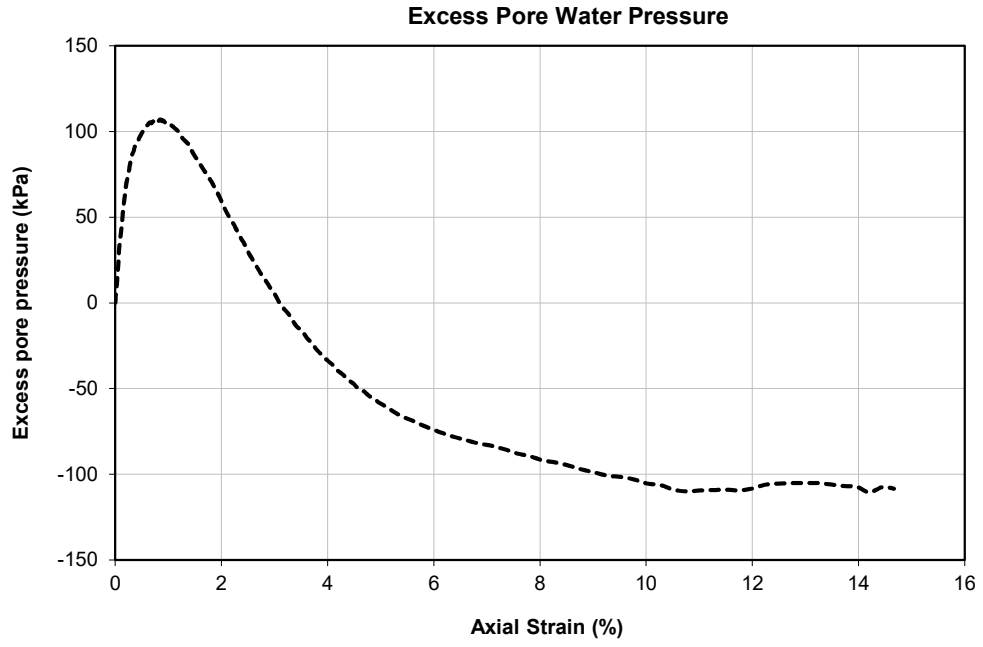
WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





T. Madera	April 29, 2025	D. Lim	May 5, 2025
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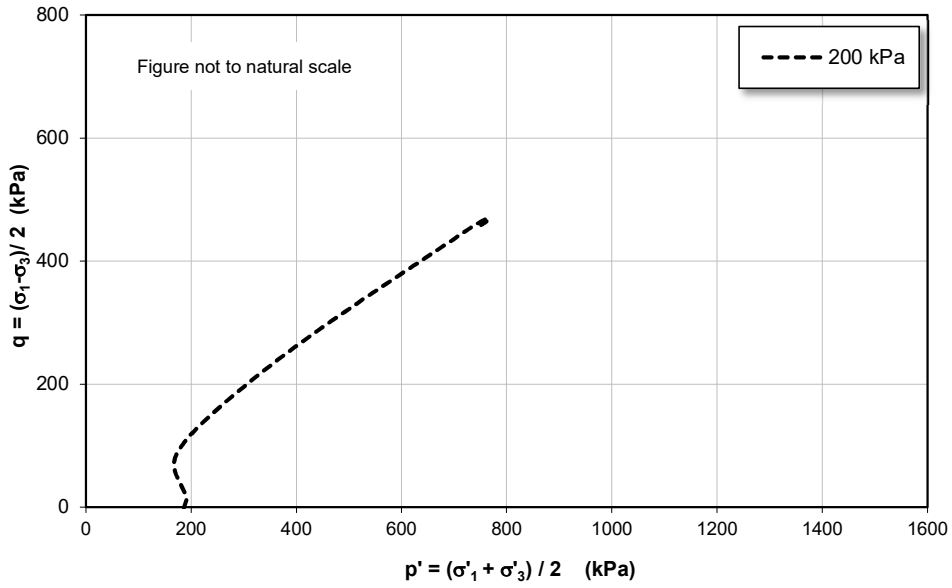
Consolidated Undrained Triaxial Compression Test for Soils

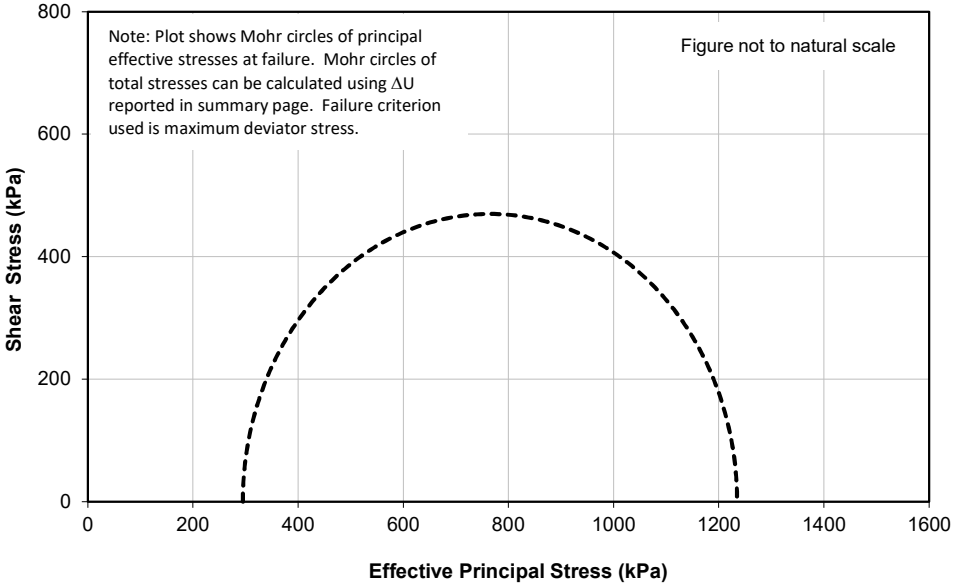
Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



T. Madera	April 29, 2025	D. Lim	May 5, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST5
Location:	Yukon	**Depth (m):**	4.50 - 5.20
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Type :	Intact	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailings
Visual Description:	SILTY SAND, grey, dense		
Other Remarks:			

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	15.03	15.24
Diameter (cm):	7.11	7.31
Area (cm^2):	39.70	41.93
Volume (cm^3):	597	639
γ_{dry} (kN/m^3):	19.14	17.87
γ_{sat} (kN/m^3):	21.36	21.18
Water content, w (%):	11.6	18.5
Saturation (%):	78	100
Void ratio, e:	0.41	0.51
Gs (assumed):	2.75	2.75

Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	188
σ_{pwp} (kPa):	698
B value:	1.00
Volume Change (cc):	-8.0
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	940
Strain, ε_f:	10.27
u (kPa):	-106
σ_1' (kPa):	1235
σ_3' (kPa):	295

Equipment

Machine:	Truepath Load Frame - Stn.4
Chamber:	KW
Load Cell:	281451
Axial DCDT:	LP-174
Cell Pressure:	PS3-650
Back Pressure:	PS-3278
Pore Pressure:	PS3-190
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST



T. Madera	April 29, 2025	D. Lim	May 5, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
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Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	CIU-1				
Sample	150 kPa				
Initial Dimensions					
H_o (cm)	14.91				
D_o (cm)	7.10				
Gs (measured)	3.11				
w (%)	11.3				
$\gamma_{o\ dry}$ (kN/m^3)	20.75				
Sat. (%)	75				
e_o	0.47				
B_{Value}	1.00				
Consolidation Results					
σ_{CELL} (kPa)	1291				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	35				
ΔV_c (cc)	-1.6				
t_{50} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	14.87				
D_c (cm)	7.06				
A_c (cm^2)	39.15				
V_c (cm^3)	582.1				
$\gamma_{c\ dry}$ (kN/m^3)	21.06				
e_c	0.45				
w (%)	14.4				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa) :	1967				
ε_f (%)	11.32				
u (kPa)	-578				
σ_3' (kPa)	613				
σ_1' (kPa)	2580				

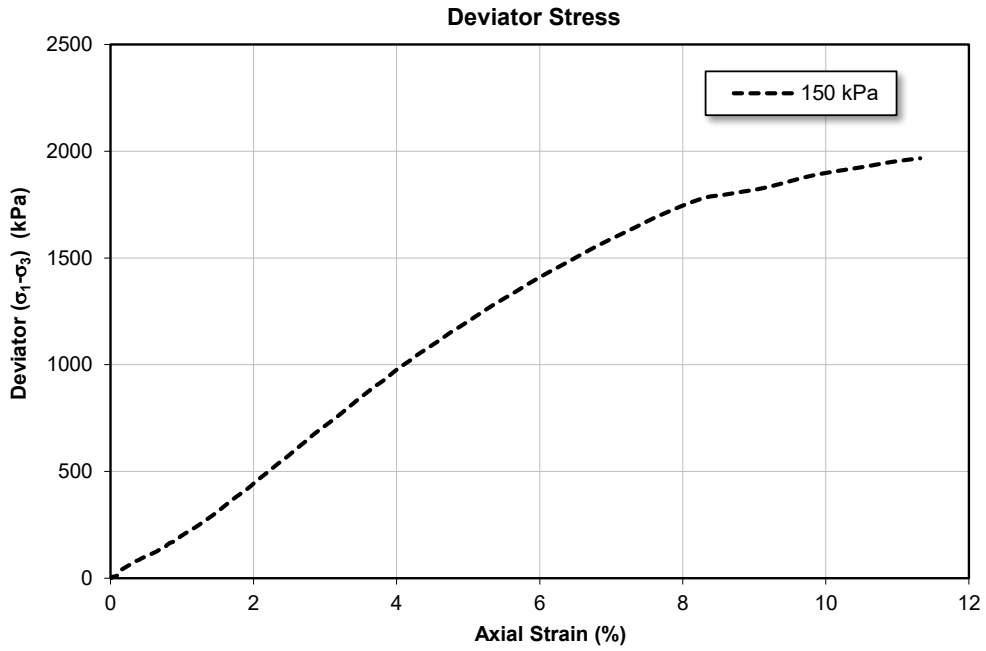
T. Madera	July 3, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

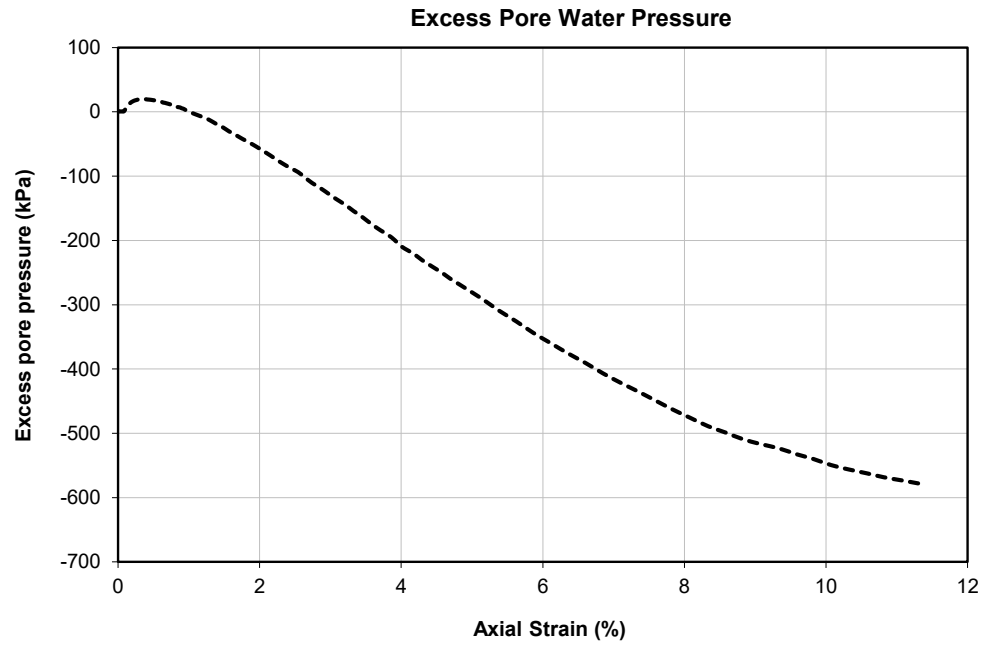
WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





T. Madera	July 3, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

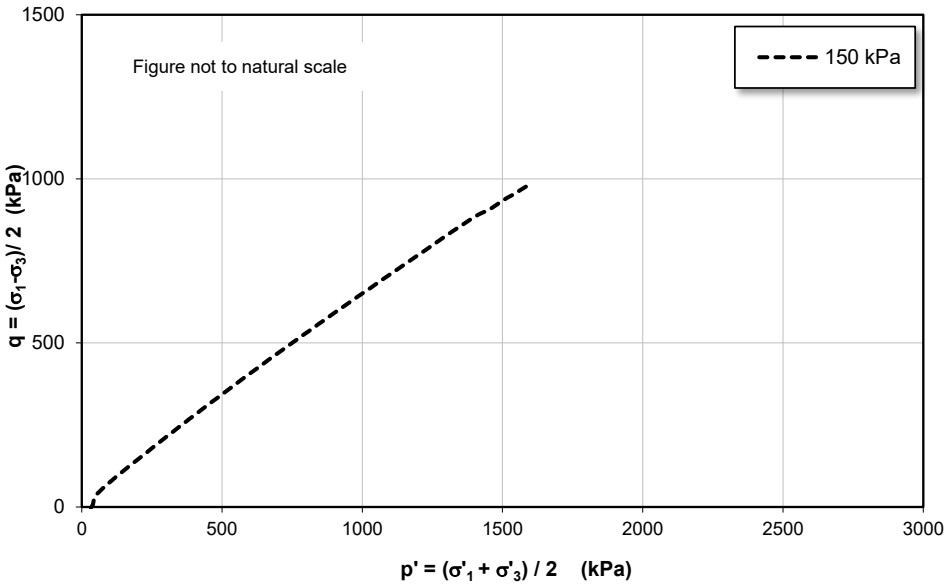
WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

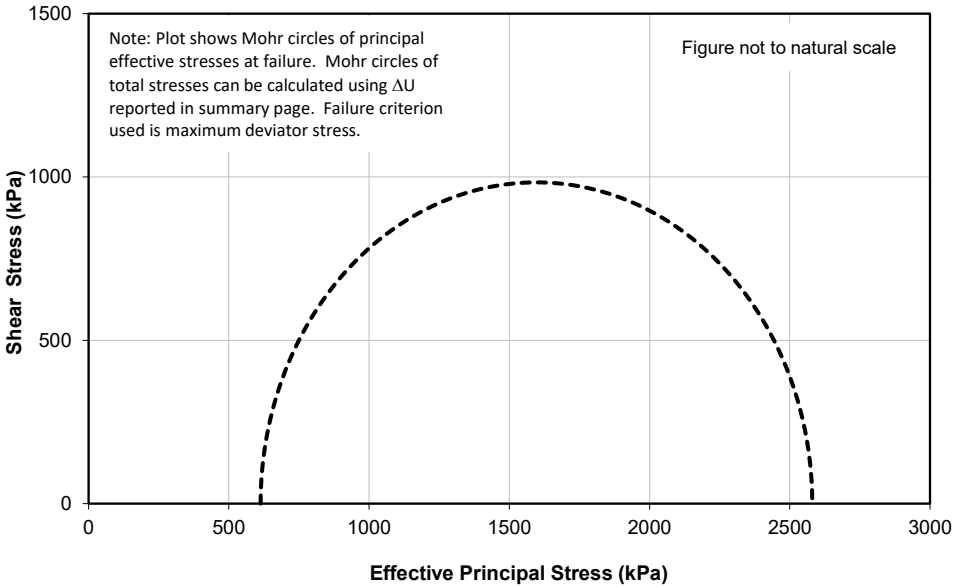
Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



T. Madera	July 3, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-01
Project:	Keno Hill District Mill Site	**Sample:**	ST7
Location:	Yukon	**Depth (m):**	6.00 - 6.70
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailing
Visual Description:	SILTY SAND, grey, dense		
Other Remarks:	Reconstitute sample prepared to void ratio of 0.60 at 11.5% moisture content		

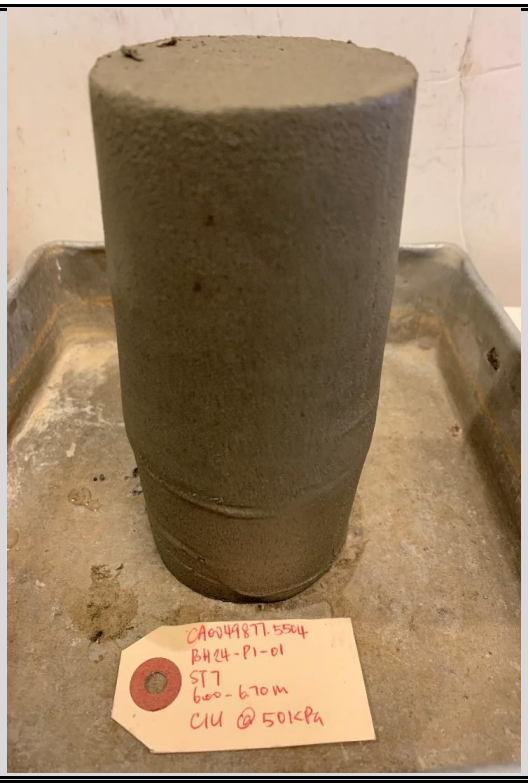
Sample Data

	Before Consolidation	After Consolidation
Height (cm):	14.91	14.87
Diameter (cm):	7.10	7.06
Area (cm^2):	39.61	39.15
Volume (cm^3):	591	582
γ_{dry} (kN/m^3):	20.75	21.06
γ_{sat} (kN/m^3):	23.09	24.09
Water content, w (%):	11.3	14.4
Saturation (%):	75	100
Void ratio, e:	0.47	0.45
Gs (measured):	3.11	3.11

Equipment

Machine:	Truepath Load Frame - Stn.4
Chamber:	KW
Load Cell:	281451
Axial DCDT:	LP-174
Cell Pressure:	PS3-650
Back Pressure:	PS-3278
Pore Pressure:	PS3-190
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	35
σ_{pwp} (kPa):	1256
B value:	1.00
Volume Change (cc):	-1.6
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	1967
Strain, ε_f:	11.32
u (kPa):	-578
σ_1' (kPa):	2580
σ_3' (kPa):	613

T. Madera	July 3, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
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Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	CIU-1				
Sample	30 kPa				
Initial Dimensions					
H_o (cm)	14.83				
D_o (cm)	7.07				
Gs (measured)	3.12				
w (%)	11.1				
$\gamma_{o\ dry}$ (kN/m^3)	20.78				
Sat. (%)	73				
e_o	0.47				
B_{Value}	0.98				
Consolidation Results					
σ_{CELL} (kPa)	858				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	20				
ΔV_c (cc)	-0.7				
t_{50} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	14.83				
D_c (cm)	7.07				
A_c (cm^2)	39.20				
V_c (cm^3)	581.5				
$\gamma_{c\ dry}$ (kN/m^3)	20.79				
e_c	0.47				
w (%)	15.1				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa) :	1873				
ε_f (%)	16.24				
u (kPa)	-571				
σ_3' (kPa)	591				
σ_1' (kPa)	2465				

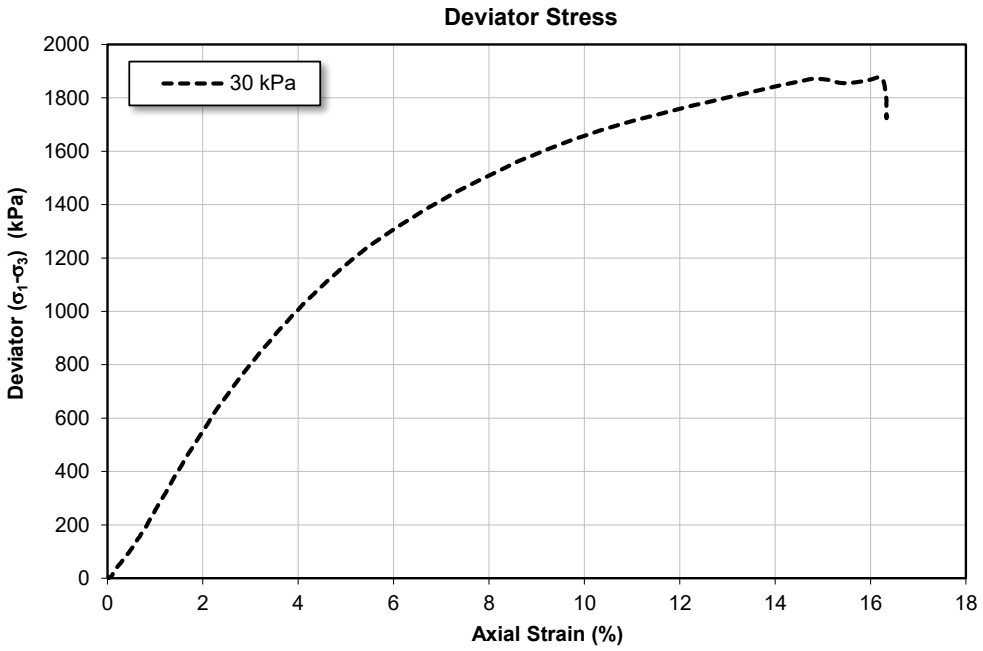
T. Madera	July 9, 2025	D. Lim	July 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

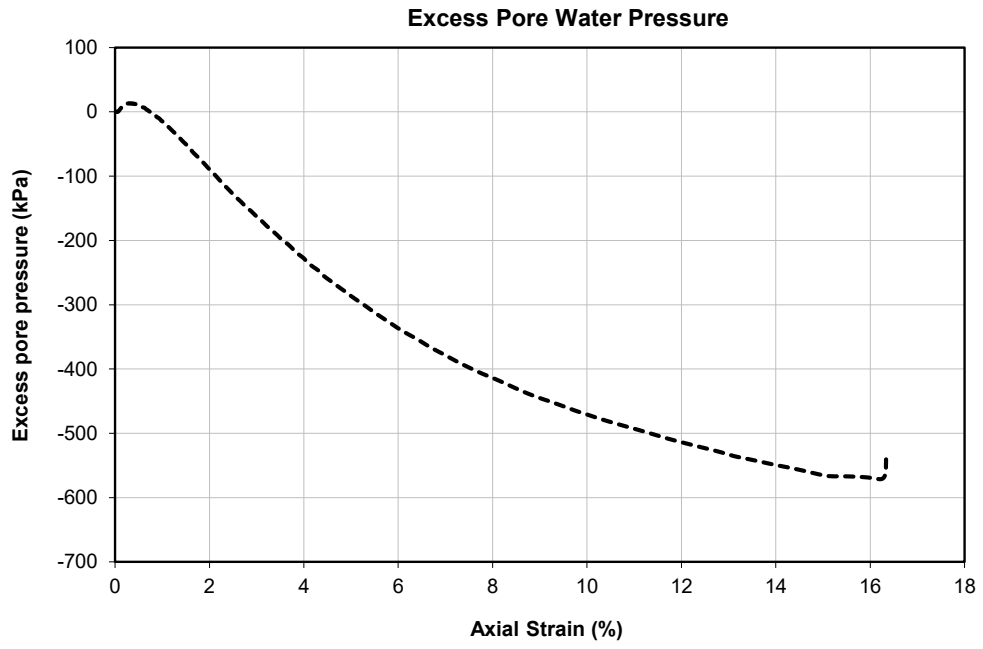
WSP Canada Inc. - Burnaby Laboratory
Unit 300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





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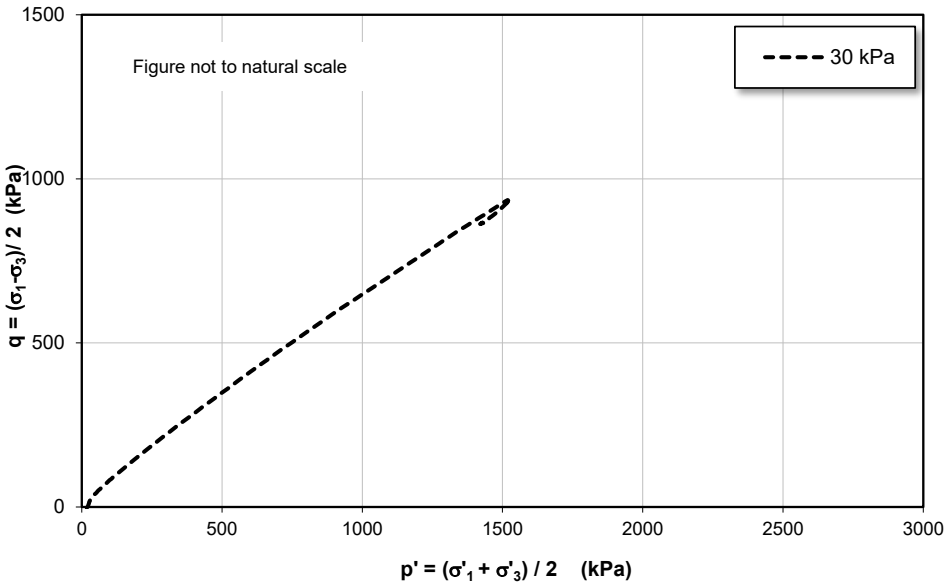
Consolidated Undrained Triaxial Compression Test for Soils

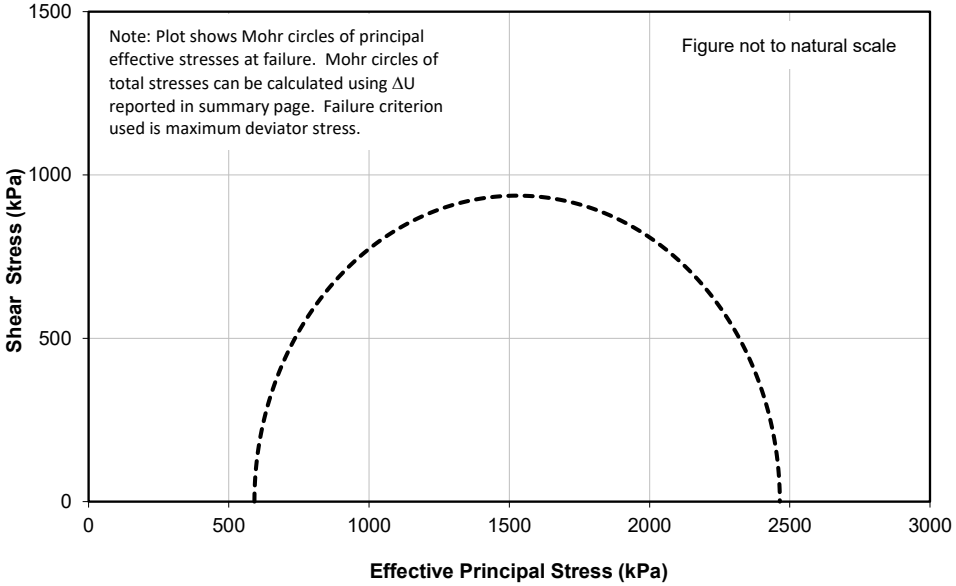
Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



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Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-04
Project:	Keno Hill District Mill Site	**Sample:**	ST3
Location:	Yukon	**Depth (m):**	2.29 - 2.90
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailing
Visual Description:	SILTY SAND, grey, dense		
Other Remarks:	Reconstitute sample prepared to void ratio of 0.62 at 11.0% moisture content		

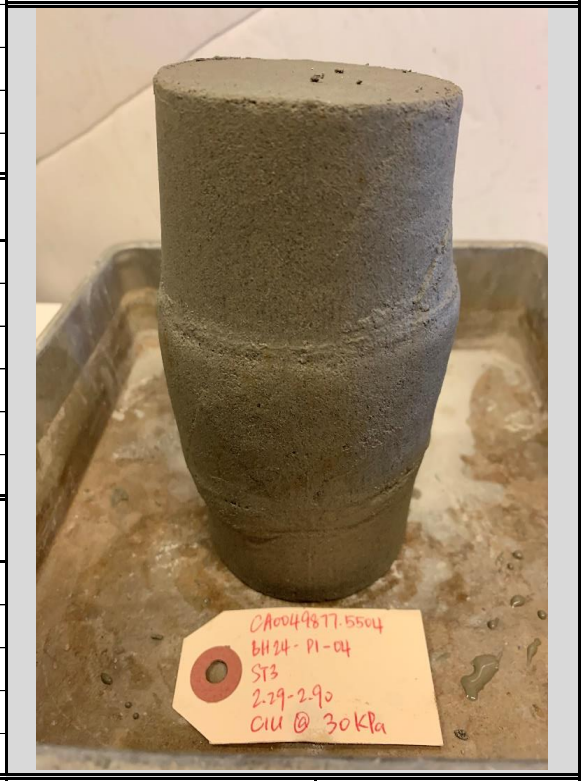
Sample Data

	Before Consolidation	After Consolidation
Height (cm):	14.83	14.83
Diameter (cm):	7.07	7.07
Area (cm^2):	39.22	39.20
Volume (cm^3):	582	581
γ_{dry} (kN/m^3):	20.78	20.79
γ_{sat} (kN/m^3):	23.09	23.94
Water content, w (%):	11.1	15.1
Saturation (%):	73	100
Void ratio, e:	0.47	0.47
Gs (measured):	3.12	3.12

Equipment

Machine:	Truepath Load Frame - Stn.4
Chamber:	KW
Load Cell:	281451
Axial DCDT:	LP-174
Cell Pressure:	PS3-650
Back Pressure:	PS-3278
Pore Pressure:	PS3-190
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	20
σ_{pwp} (kPa):	838
B value:	0.98
Volume Change (cc):	-0.7
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	1873
Strain, ε_f:	16.24
u (kPa):	-571
σ_1' (kPa):	2465
σ_3' (kPa):	591

T. Madera	July 9, 2025	D. Lim	July 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	CIU-1				
Sample	100 kPa				
Initial Dimensions					
H_o (cm)	15.91				
D_o (cm)	7.17				
Gs (assumed)	2.85				
w (%)	13.6				
$\gamma_{o\ dry}$ (kN/m^3)	20.04				
Sat. (%)	98				
e_o	0.40				
B_{Value}	0.96				
Consolidation Results					
σ_{CELL} (kPa)	788				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	104				
ΔV_c (cc)	-3.5				
t_{50} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	15.97				
D_c (cm)	7.22				
A_c (cm^2)	40.97				
V_c (cm^3)	654.4				
$\gamma_{c\ dry}$ (kN/m^3)	19.64				
e_c	0.42				
w (%)	14.9				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa) :	1575				
ε_f (%)	14.76				
u (kPa)	-470				
σ_3' (kPa)	575				
σ_1' (kPa)	2151				

T. Madera	May 2, 2025	D. Lim	May 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
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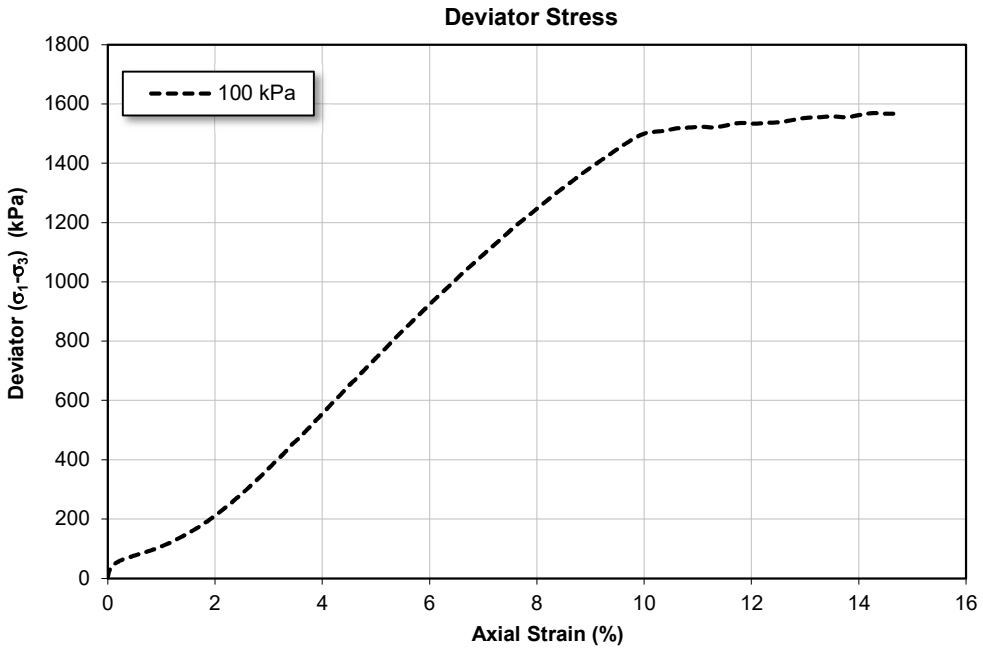
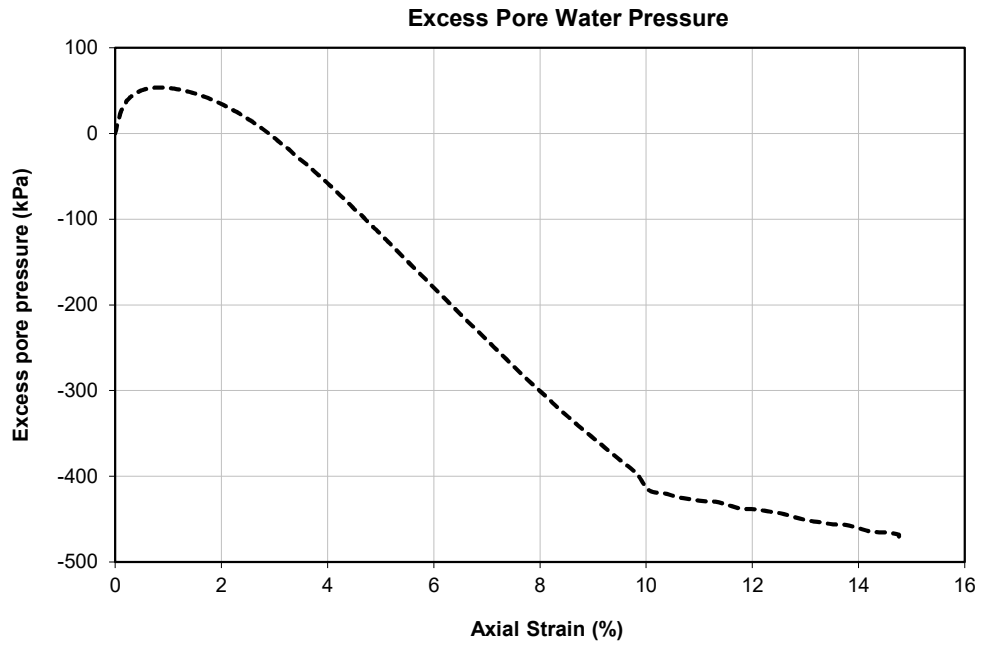
Consolidated Undrained Triaxial Compression Test for Soils

Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





T. Madera	May 2, 2025	D. Lim	May 21, 2025
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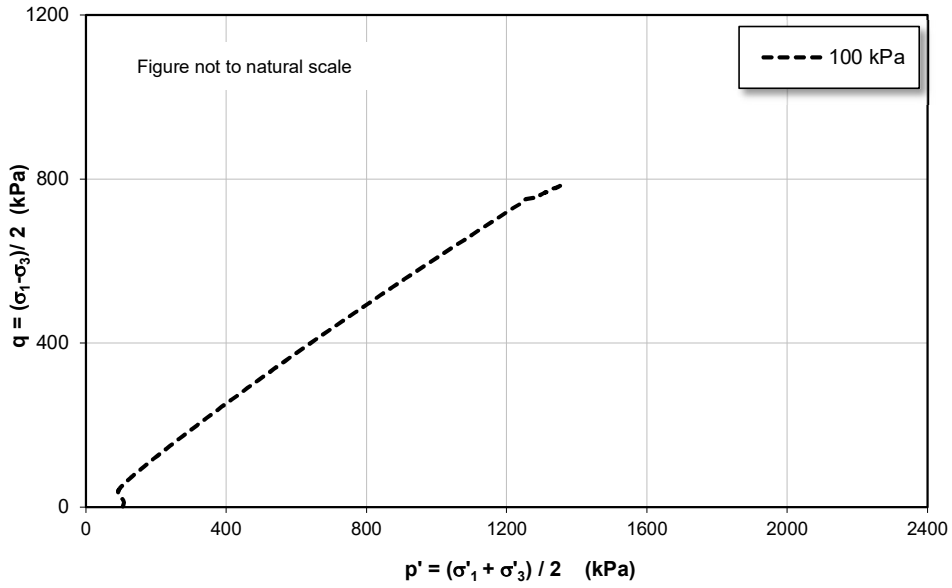
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

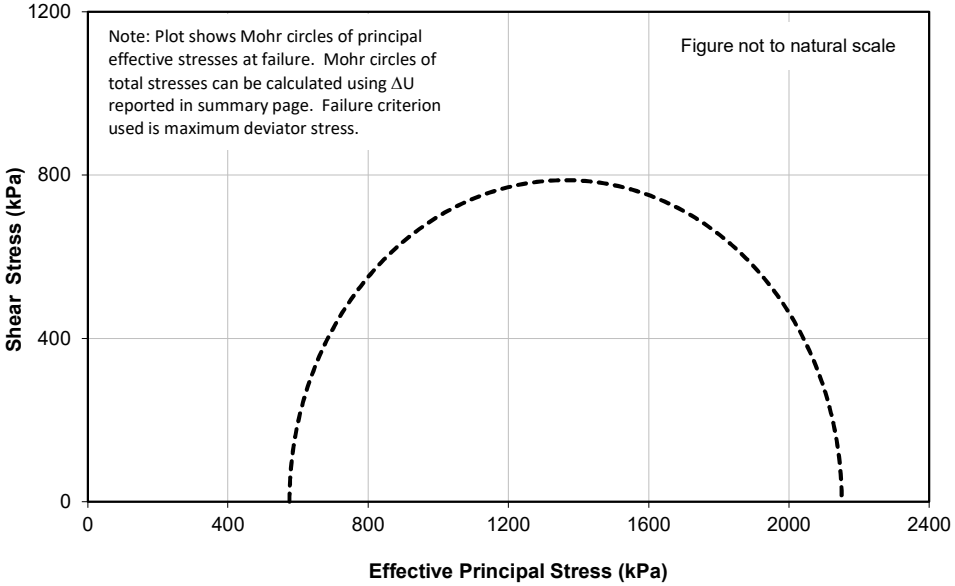
Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



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WSP Canada Inc. - Burnaby Laboratory
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Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST1
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Soil

Visual Description: SILT, some sand, grey, w > PL, dense.

Other Remarks: Piston leak at 10.25%, repaired and restarted test.

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	15.91	15.97
Diameter (cm):	7.17	7.22
Area (cm^2):	40.32	40.97
Volume (cm^3):	641	654
γ_{dry} (kN/m^3):	20.04	19.64
γ_{sat} (kN/m^3):	22.78	22.56
Water content, w (%):	13.6	14.9
Saturation (%):	98	100
Void ratio, e:	0.40	0.42
Gs (assumed):	2.85	2.85

Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	104
σ_{pwp} (kPa):	684
B value:	0.96
Volume Change (cc):	-3.5
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	1575
Strain, ε_f:	14.76
u (kPa):	-470
σ_1' (kPa):	2151
σ_3' (kPa):	575

Equipment

Machine:	Truepath Load Frame - Stn.5
Chamber:	KW
Load Cell:	706444
Axial DCDT:	LP-949
Cell Pressure:	PS5-156
Back Pressure:	PS3-146
Pore Pressure:	PS-3328
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST



T. Madera	May 2, 2025	D. Lim	May 21, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc. - Burnaby Laboratory
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Consolidated Undrained Triaxial Compression Test for Soils

Reference ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Test	CIU-1				
Sample	100 kPa				
Initial Dimensions					
H_o (cm)	14.98				
D_o (cm)	7.06				
Gs (measured)	2.86				
w (%)	11.7				
$\gamma_{o\ dry}$ (kN/m^3)	19.55				
Sat. (%)	77				
e_o	0.44				
B_{Value}	0.97				
Consolidation Results					
σ_{CELL} (kPa)	1271				
OCR	n/a				
$\sigma_{3c'}$ (kPa)	94				
ΔV_c (cc)	-2.9				
t_{50} (min)	N/A				
After Consolidation Dimensions					
H_c (cm)	14.97				
D_c (cm)	7.06				
A_c (cm^2)	39.14				
V_c (cm^3)	586.0				
$\gamma_{c\ dry}$ (kN/m^3)	19.56				
e_c	0.43				
w (%)	15.2				
Sat (%)	100				
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa) :	1968				
ε_f (%)	8.97				
u (kPa)	-558				
σ_3' (kPa)	653				
σ_1' (kPa)	2621				

T. Madera	July 4, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

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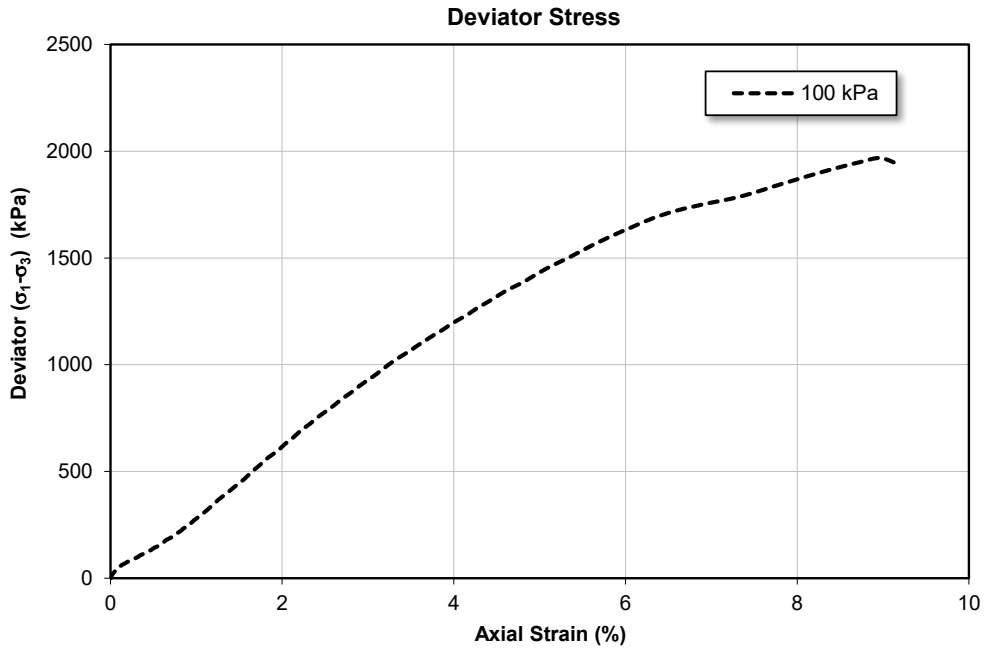
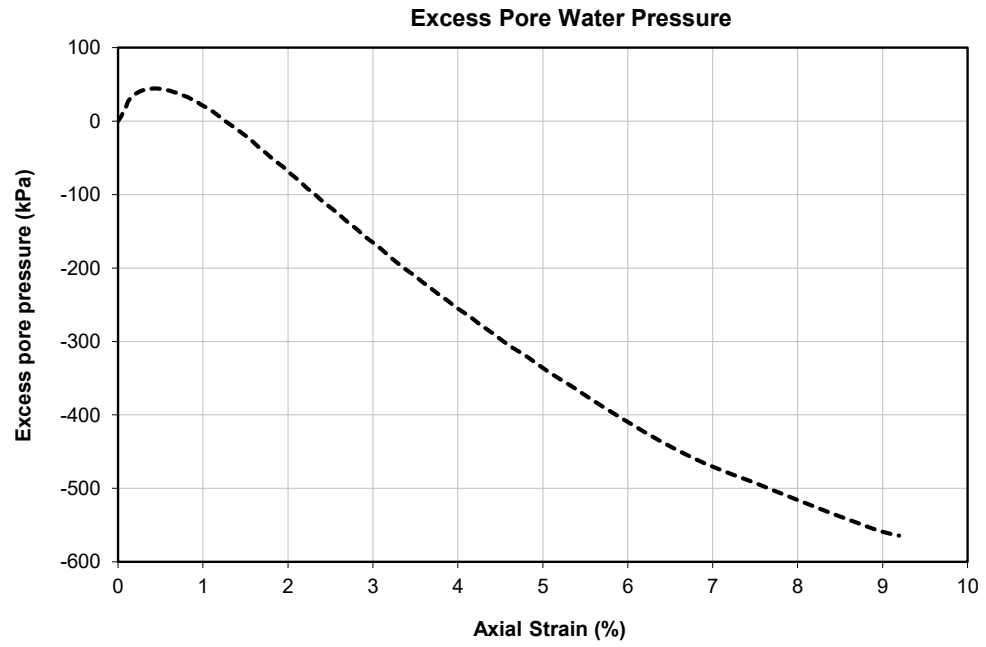
Burnaby, B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079





T. Madera	July 4, 2025	D. Lim	July 14, 2025
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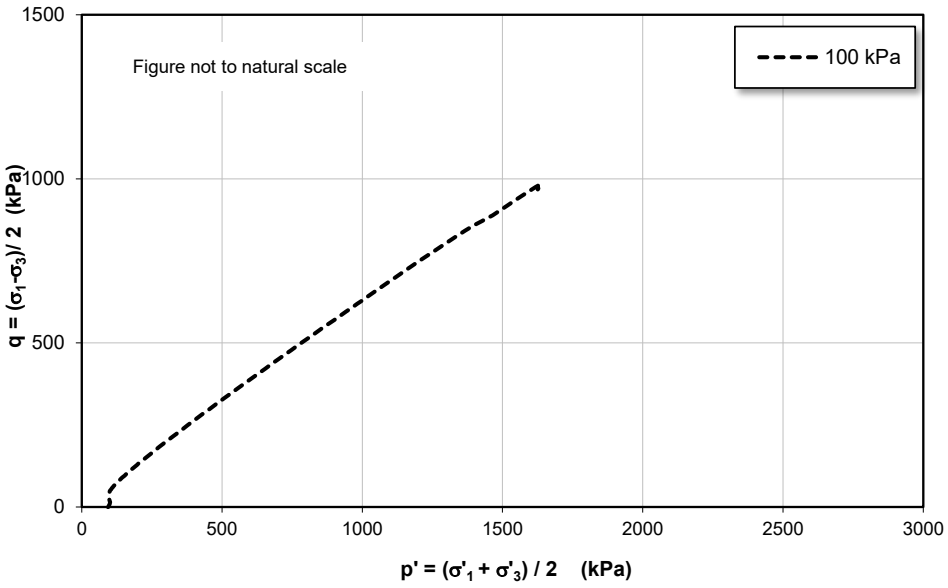
Consolidated Undrained Triaxial Compression Test for Soils

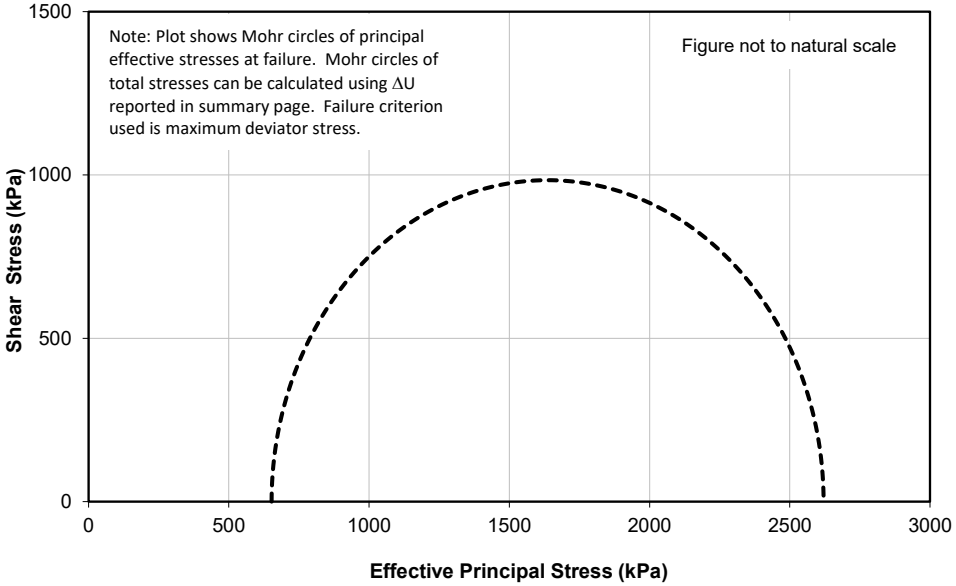
Reference
ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Stress Paths



Mohr Circles Deviator Stress



T. Madera	July 4, 2025	D. Lim	July 14, 2025
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Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Tetra Tech	**Borehole:**	BH24-P1-05
Project:	Keno Hill District Mill Site	**Sample:**	ST9
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Project No.:	CA0049877.5504	**Lab ID No:**	B25-079

Type :	Reconstituted	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type:**	Tailings
Visual Description:	SILTY SAND, grey, dense		
Other Remarks:	Reconstitute sample and prepared to void ratio of 0.58		

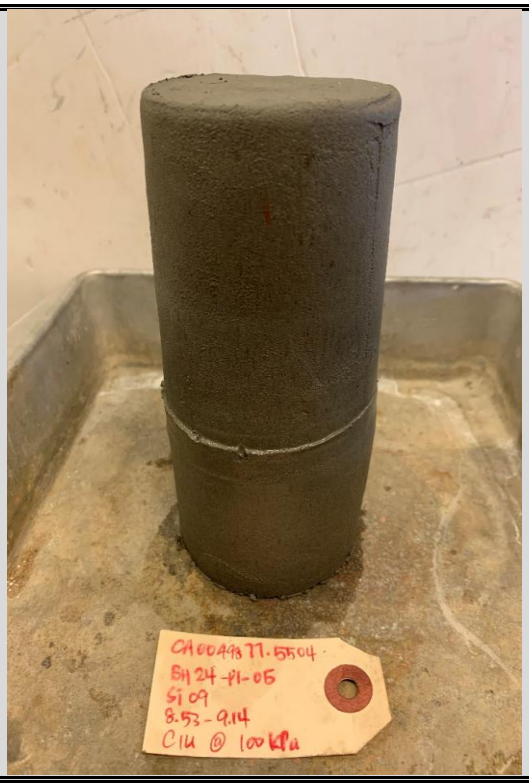
Sample Data

	Before Consolidation	After Consolidation
Height (cm):	14.98	14.97
Diameter (cm):	7.06	7.06
Area (cm^2):	39.16	39.14
Volume (cm^3):	586	586
γ_{dry} (kN/m^3):	19.55	19.56
γ_{sat} (kN/m^3):	21.84	22.53
Water content, w (%):	11.7	15.2
Saturation (%):	77	100
Void ratio, e:	0.44	0.43
Gs (measured):	2.86	2.86

Equipment

Machine:	Truepath Load Frame - Stn.1
Chamber:	KW
Load Cell:	685511
Axial DCDT:	LP-1215
Cell Pressure:	PS3-265
Back Pressure:	PS3-264
Pore Pressure:	PS3-134
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST



Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	94
σ_{pwp} (kPa):	1177
B value:	0.97
Volume Change (cc):	-2.9
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	1968
Strain, ε_f:	8.97
u (kPa):	-558
σ_1' (kPa):	2621
σ_3' (kPa):	653

T. Madera	July 4, 2025	D. Lim	July 14, 2025
TESTED BY	DATE	CHECKED BY	DATE

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~500ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 1

Vertical LVDT	Serial No.:	113179
Vertical Load Cell	Serial No.:	89612
Shear Load Cell	Serial No.:	30465

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.44
Diameter (mm)	70.38
Area (cm^2)	38.90
Volume (cm^3)	95.08
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, trace gravel, brown, w > PL, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	228.10	Initial Water Content (%)	9.89
Dry Mass (g)	207.57	Initial Saturation (%)	79.82
Initial Wet Unit Weight (kN/m^3)	23.53	Final Water Content (%)	14.01
Initial Dry Unit Weight (kN/m^3)	21.42	Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A	Max. Axial Strain %	7.95
Max Applied Vertical Stress (kPa)	100.25	Axial Strain at end of Consol. %	7.95
Vertical Stress at end of Consol (kPa)	99.99	Change in Height ΔH_c (mm)	1.94
Laboratory OCR	N/A		

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	100.25	Peak Shear Strength (kPa)	228.05
Initial Shear Stress (kPa)	0.18	Excess Pore Pressure at Peak (kPa)	-229.80
Applied Shear Bias (kPa)	0.00	Ratio of Peak / σ'_v	2.27
Rate of Shearing (%/hr)	4.98	Maximum Shear Strain γ_{MAX} (%)	19.91
Test Condition	Undrained	Shear Strength at γ_{MAX} (kPa)	228.00

Comments / Special Instructions

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

T. Madera	April 29, 2025	M. Badanagki	May 6, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

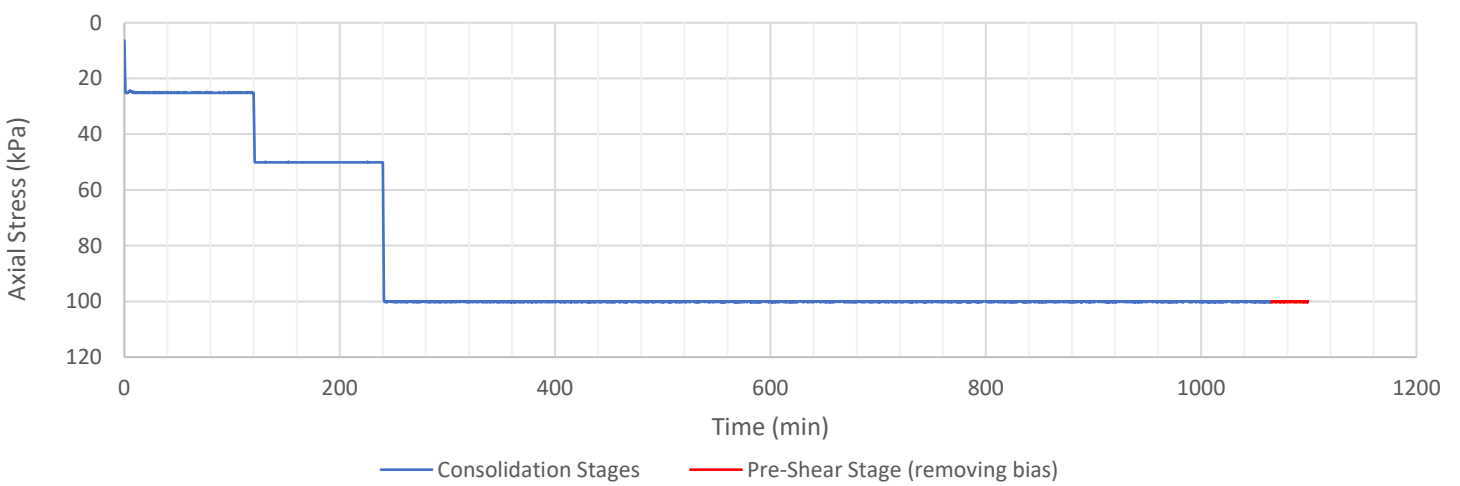
Consolidation Summary

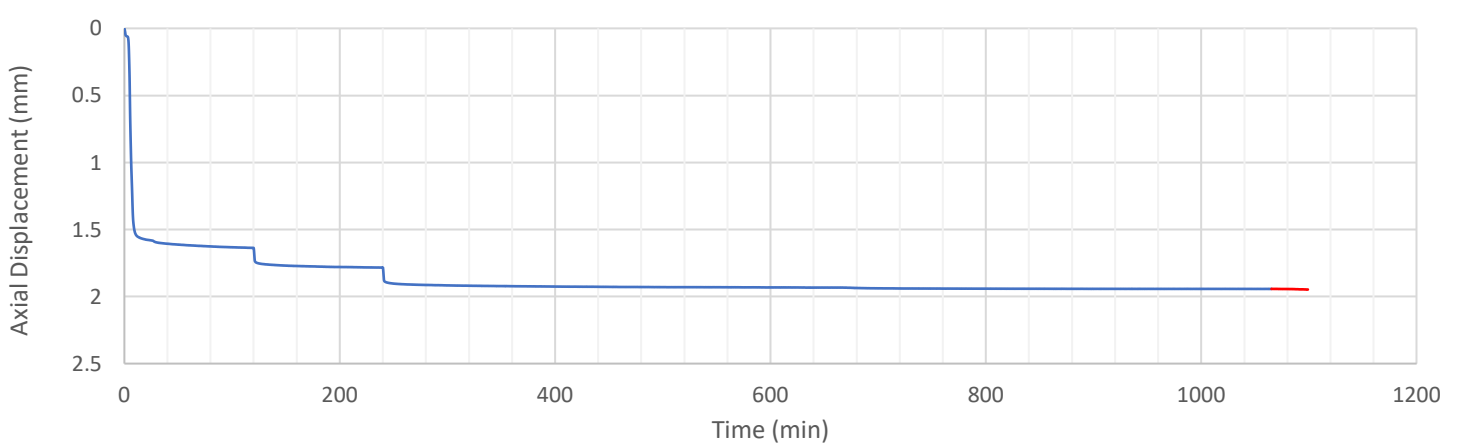
Stress at end of Consolidation (kPa)	99.99
Axial Strain at end of Consolidation (%)	7.95
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.94

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100								
Load (kN)	0.098	0.195	0.39								
Duration (min)	120	120	825								
Axial Strain (%)	6.70	7.30	7.95								





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NORSOK G-001

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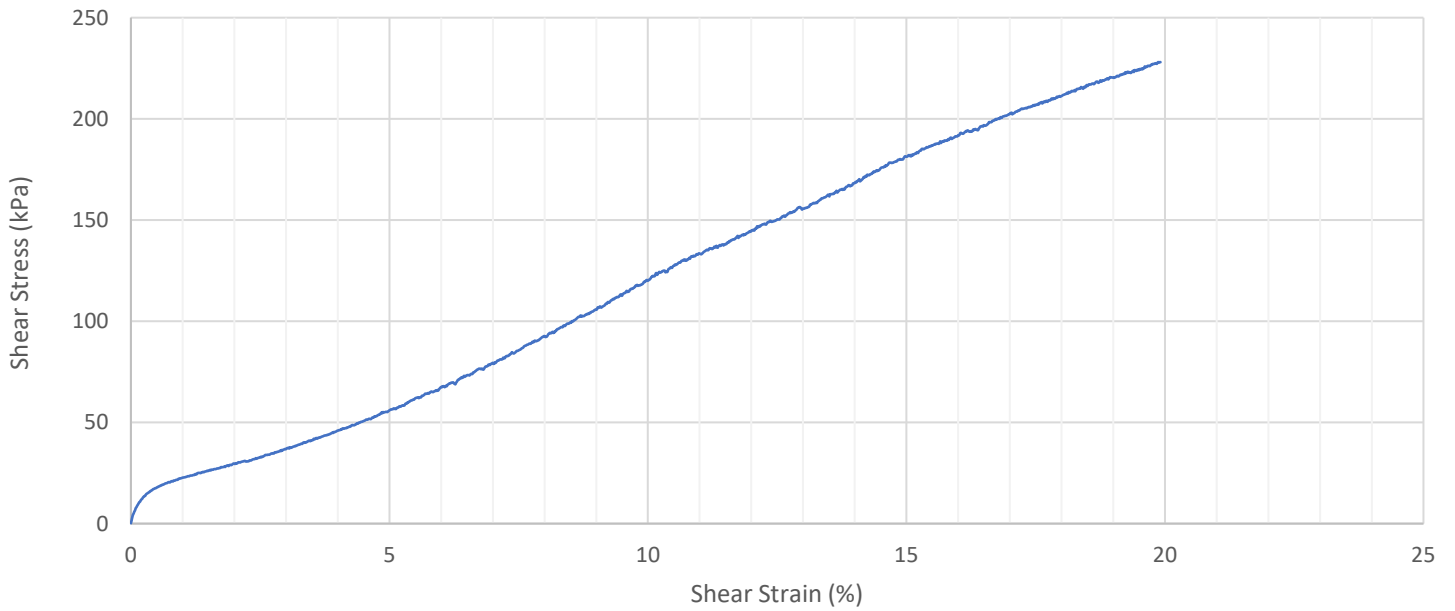
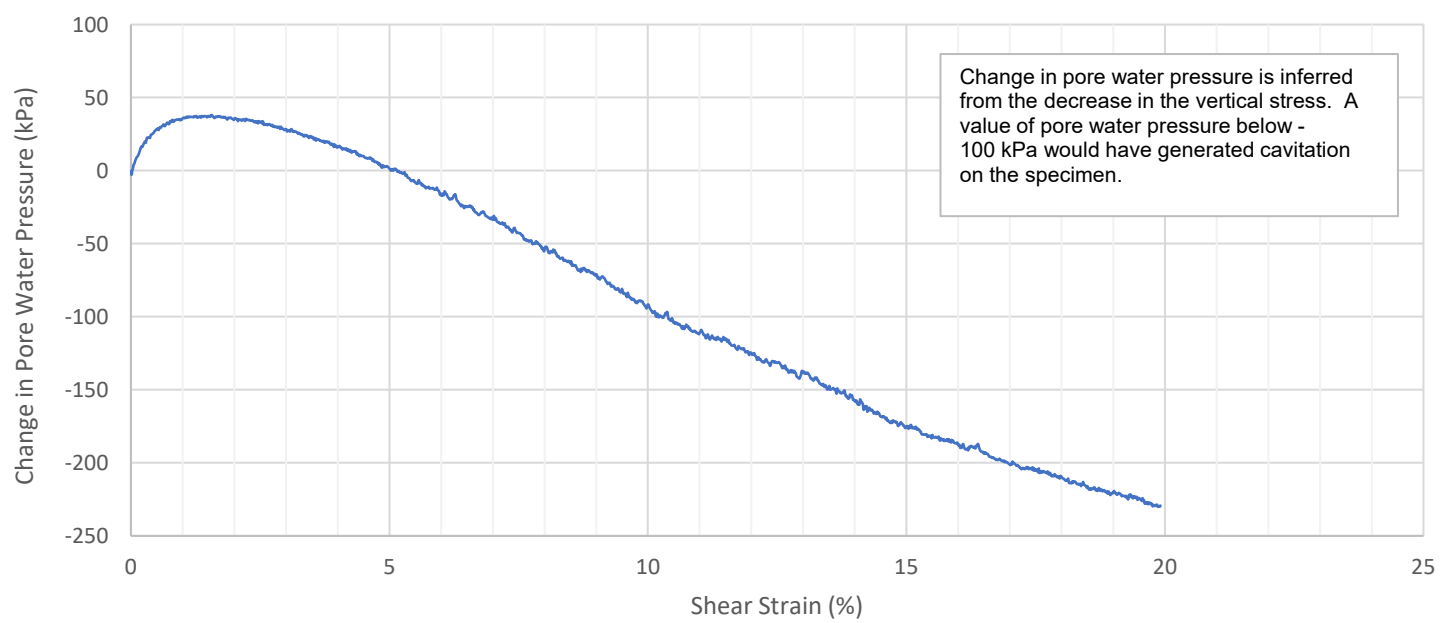
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079





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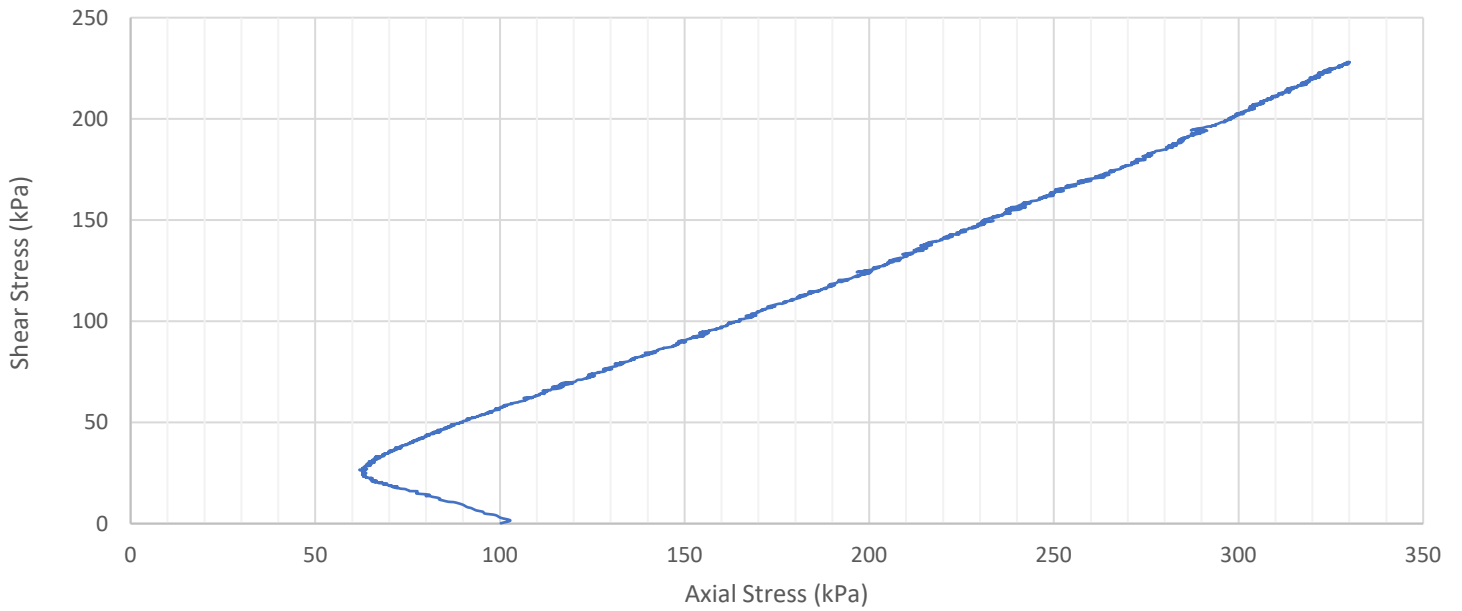
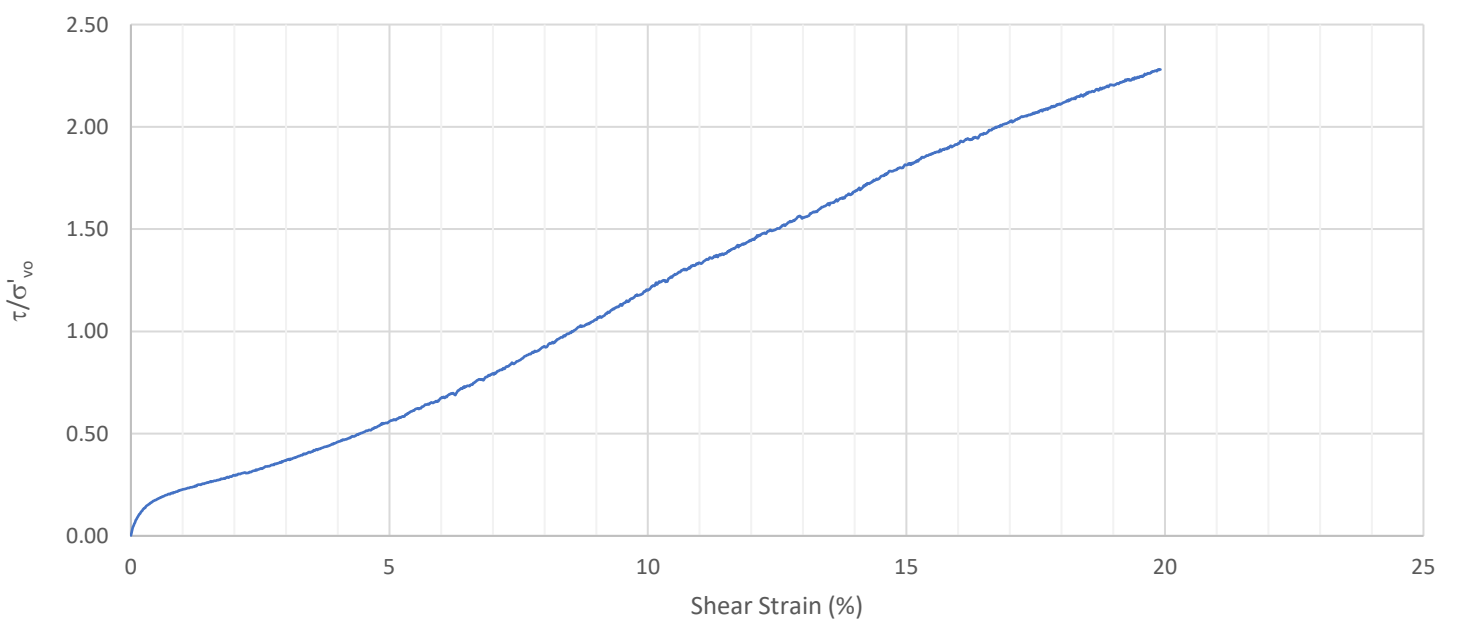
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079





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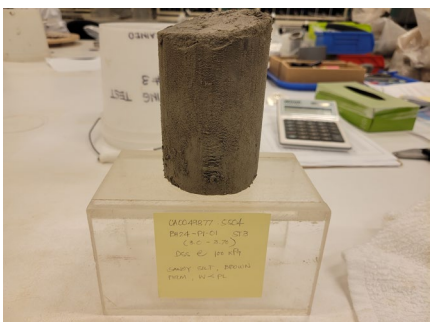
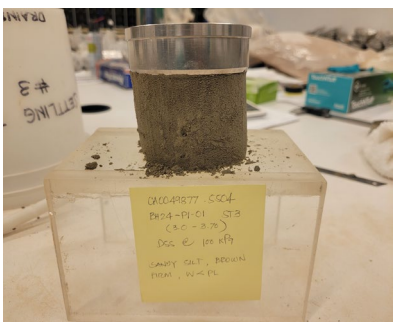
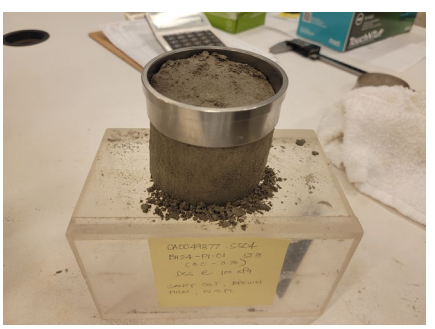
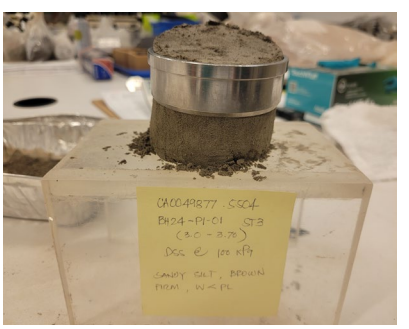
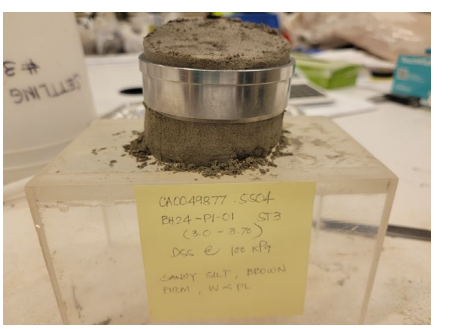
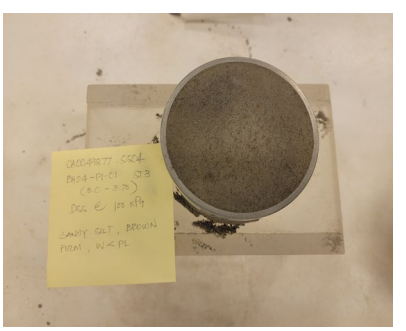
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

Minimal water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.95
Diameter (mm)	70.78
Area (cm^2)	39.35
Volume (cm^3)	94.24
Specific Gravity (assumed)	3.00

Visual Description	SILTY SAND, brown, moist, dense		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	207.13
Dry Mass (g)	187.70
Initial Wet Unit Weight (kN/m^3)	21.56
Initial Dry Unit Weight (kN/m^3)	19.54

Initial Water Content (%)	10.35
Initial Saturation (%)	61.68
Final Water Content (%)	16.64
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	201.24
Vertical Stress at end of Consol (kPa)	200.60
Laboratory OCR	N/A

Max. Axial Strain %	4.21
Axial Strain at end of Consol. %	4.21
Change in Height ΔH_c (mm)	1.01

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	200.52
Initial Shear Stress (kPa)	-0.18
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.00
Test Condition	Undrained

Peak Shear Strength (kPa)	57.11
Excess Pore Pressure at Peak (kPa)	105.75
Ratio of Peak / σ'_v	0.28
Maximum Shear Strain γ_{MAX} (%)	20.01
Shear Strength at γ_{MAX} (kPa)	55.20

Comments / Special Instructions

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Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

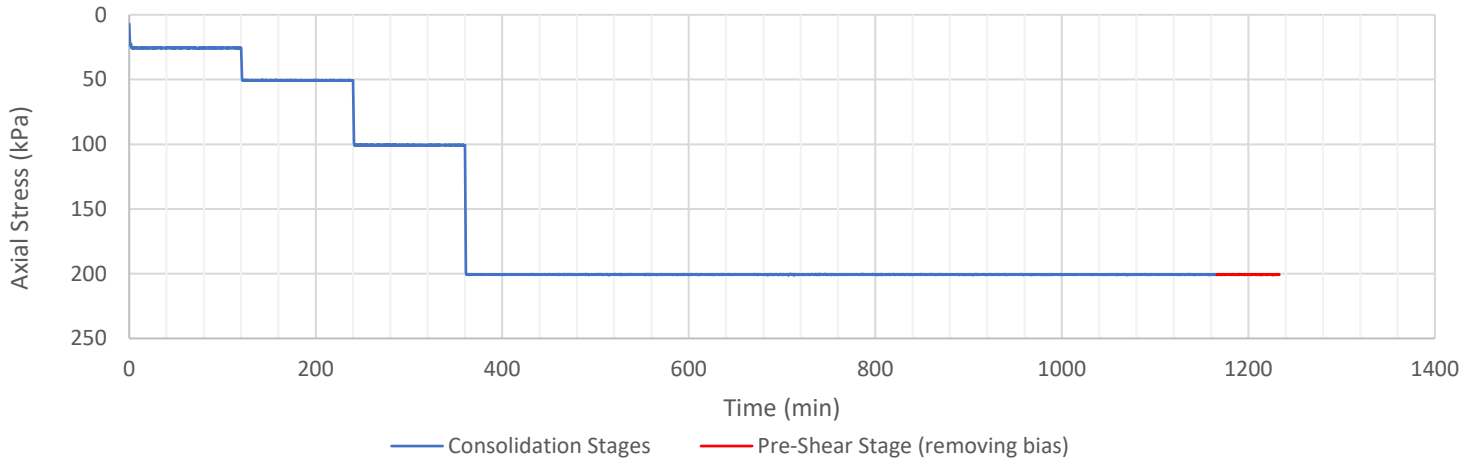
Consolidation Summary

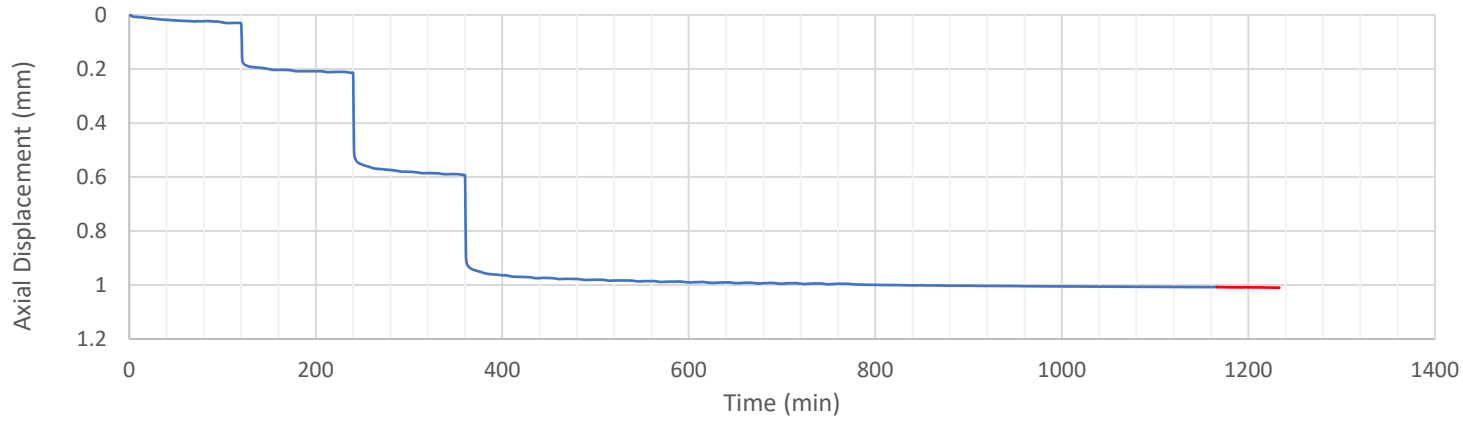
Stress at end of Consolidation (kPa)	200.60
Axial Strain at end of Consolidation (%)	4.21
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.01

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200							
Load (kN)	0.1022	0.2006	0.3974	0.7918							
Duration (min)	120	120	120	806							
Axial Strain (%)	0.13	0.89	2.47	4.21							





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NORSOK G-001

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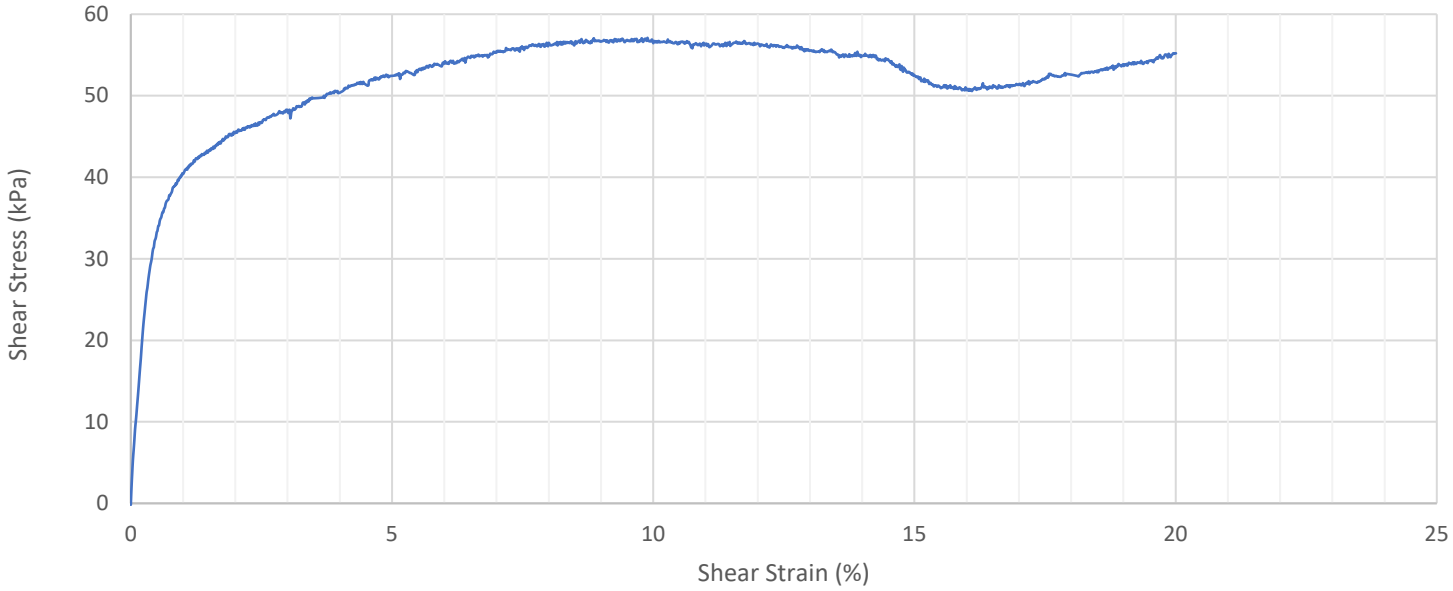
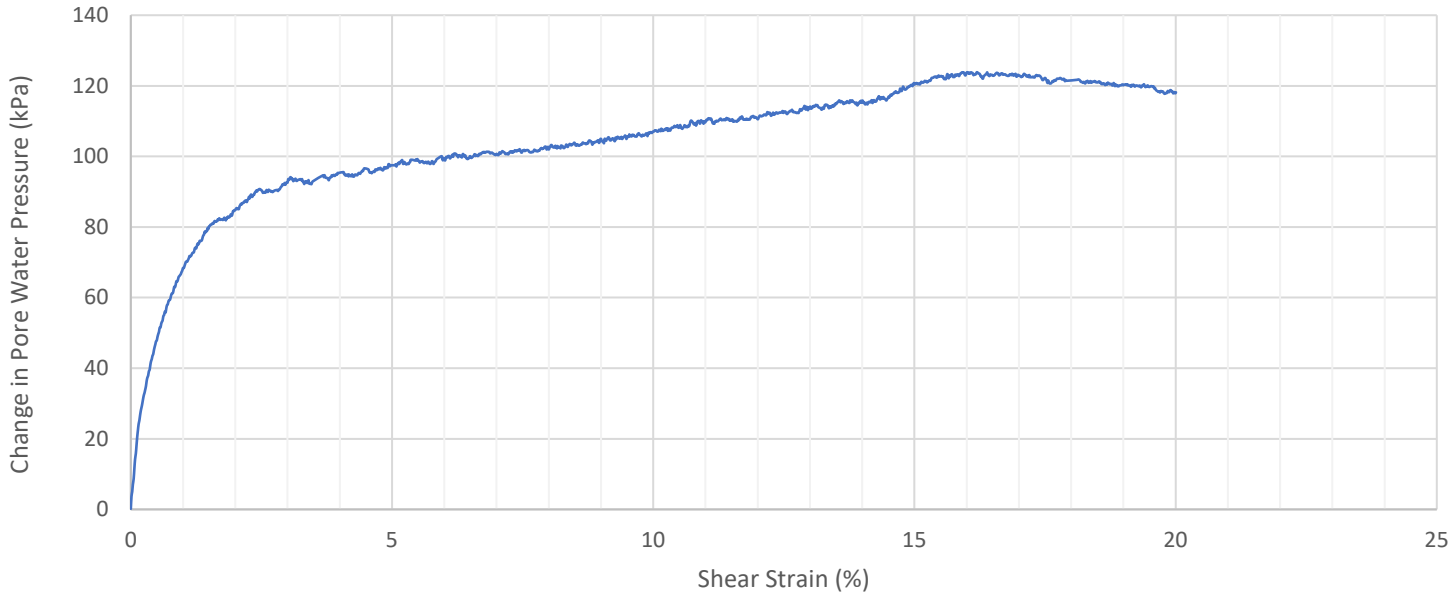
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079





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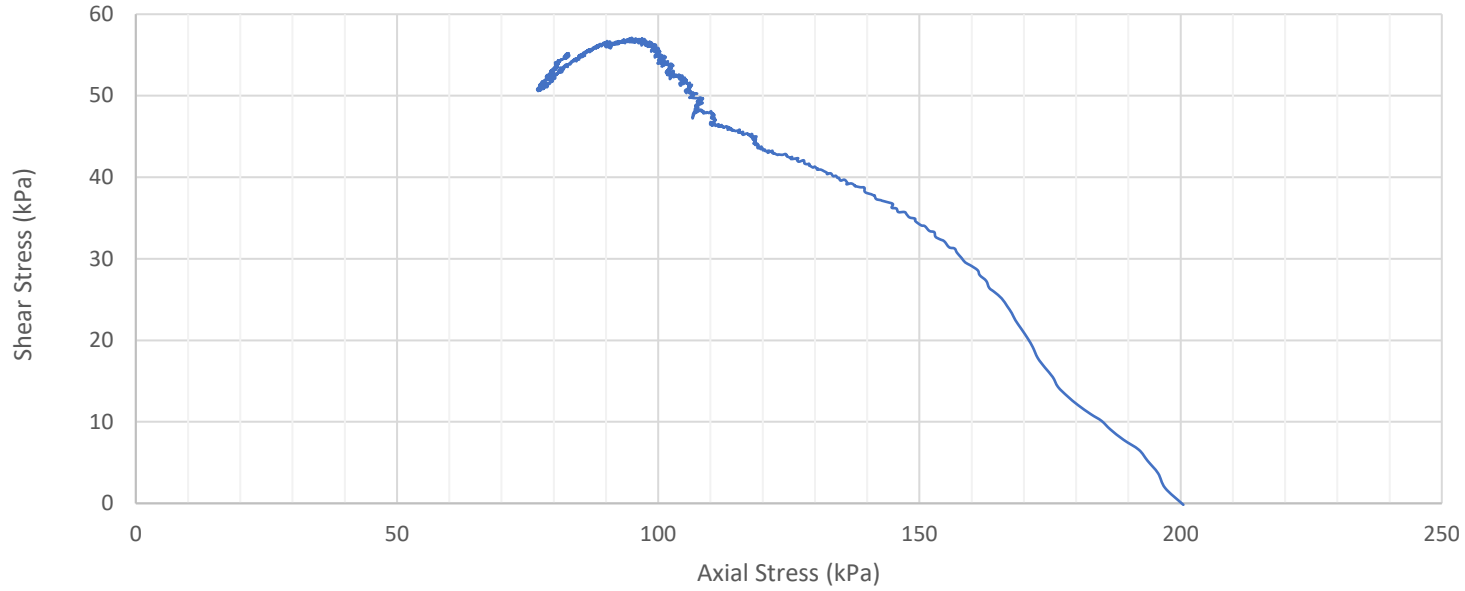
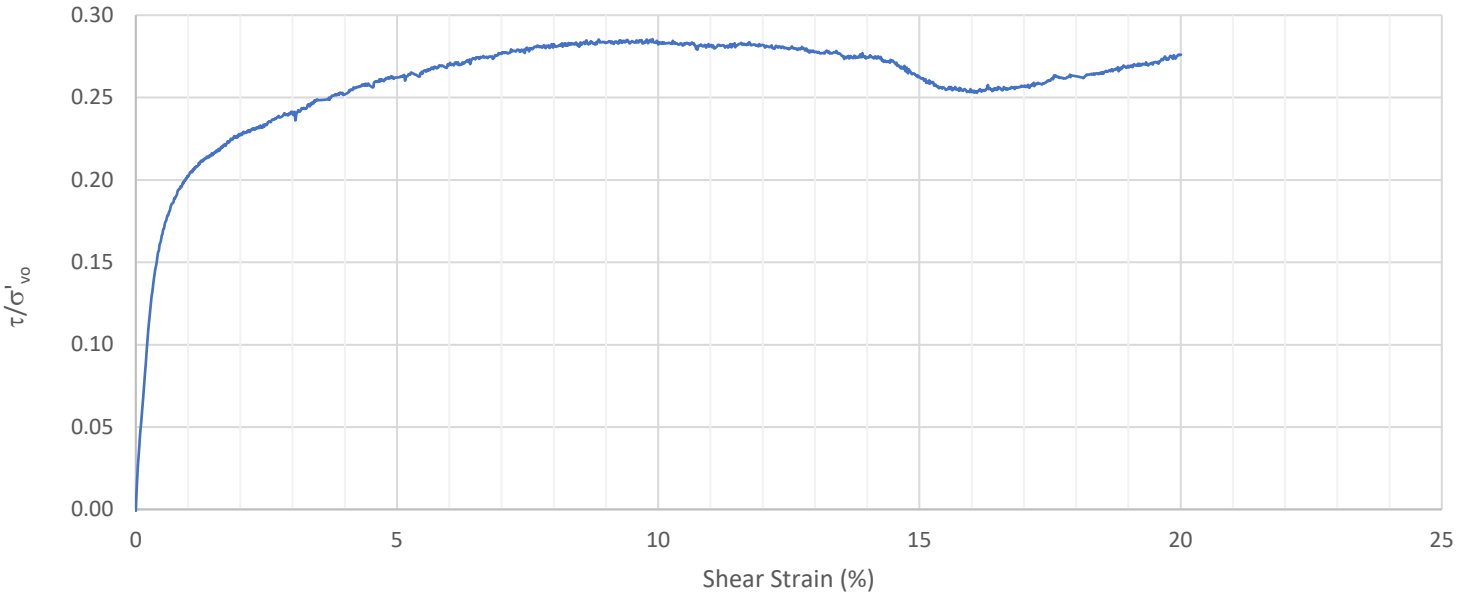
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079





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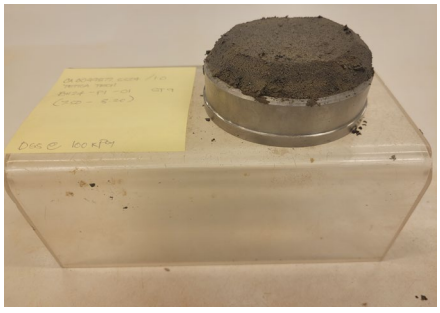
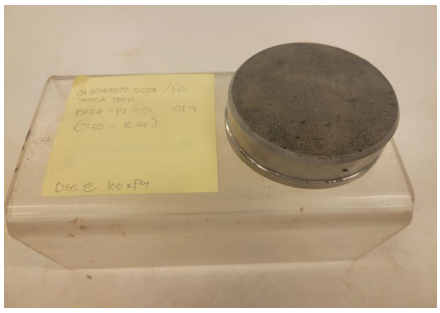
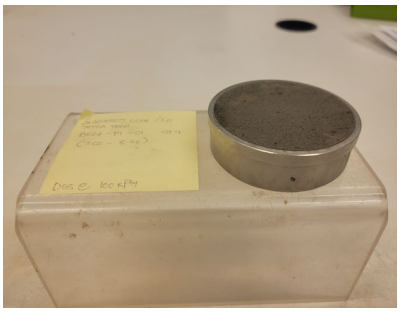
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079







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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~250ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.28
Diameter (mm)	70.42
Area (cm^2)	38.95
Volume (cm^3)	94.57
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, trace gravel, brown, w > PL, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	229.39	Initial Water Content (%)	9.74
Dry Mass (g)	209.03	Initial Saturation (%)	82.37
Initial Wet Unit Weight (kN/m^3)	23.80	Final Water Content (%)	12.60
Initial Dry Unit Weight (kN/m^3)	21.68	Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A	Max. Axial Strain %	8.87
Max Applied Vertical Stress (kPa)	400.54	Axial Strain at end of Consol. %	8.87
Vertical Stress at end of Consol (kPa)	400.20	Change in Height ΔH_c (mm)	2.16
Laboratory OCR	N/A		

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	409.42	Peak Shear Strength (kPa)	655.11
Initial Shear Stress (kPa)	-0.36	Excess Pore Pressure at Peak (kPa)	-565.25
Applied Shear Bias (kPa)	0.00	Ratio of Peak / σ'_v	1.64
Rate of Shearing (%/hr)	4.98	Maximum Shear Strain γ_{MAX} (%)	19.93
Test Condition	Undrained	Shear Strength at γ_{MAX} (kPa)	655.11

Comments / Special Instructions

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Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079

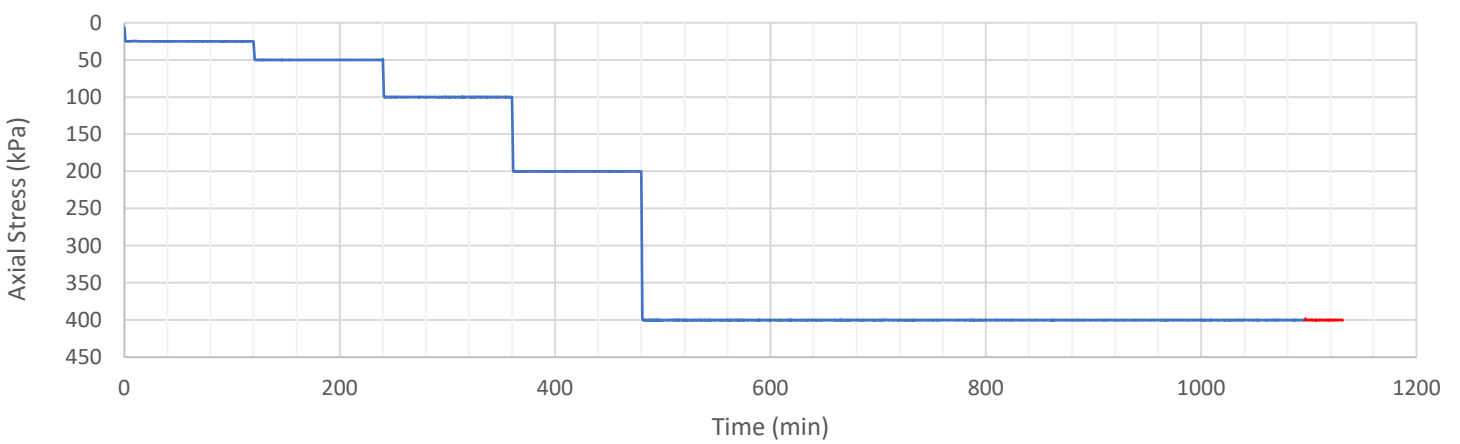
Consolidation Summary

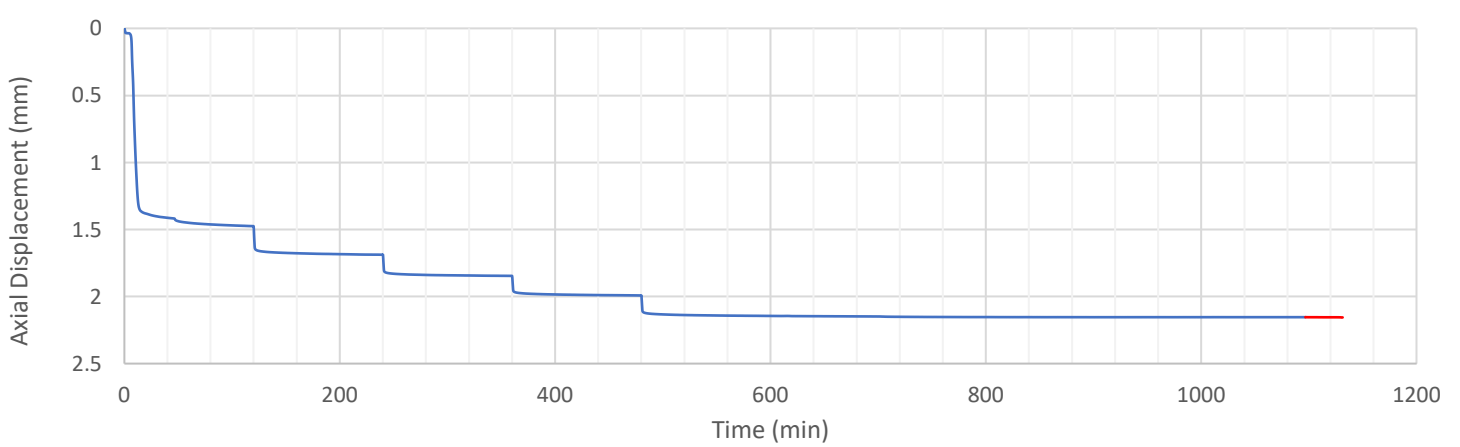
Stress at end of Consolidation (kPa)	400.20
Axial Strain at end of Consolidation (%)	8.87
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	2.16

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400						
Load (kN)	0.0987	0.1961	0.3911	0.7803	1.56						
Duration (min)	120	120	120	120	617						
Axial Strain (%)	6.07	6.95	7.60	8.20	8.87						





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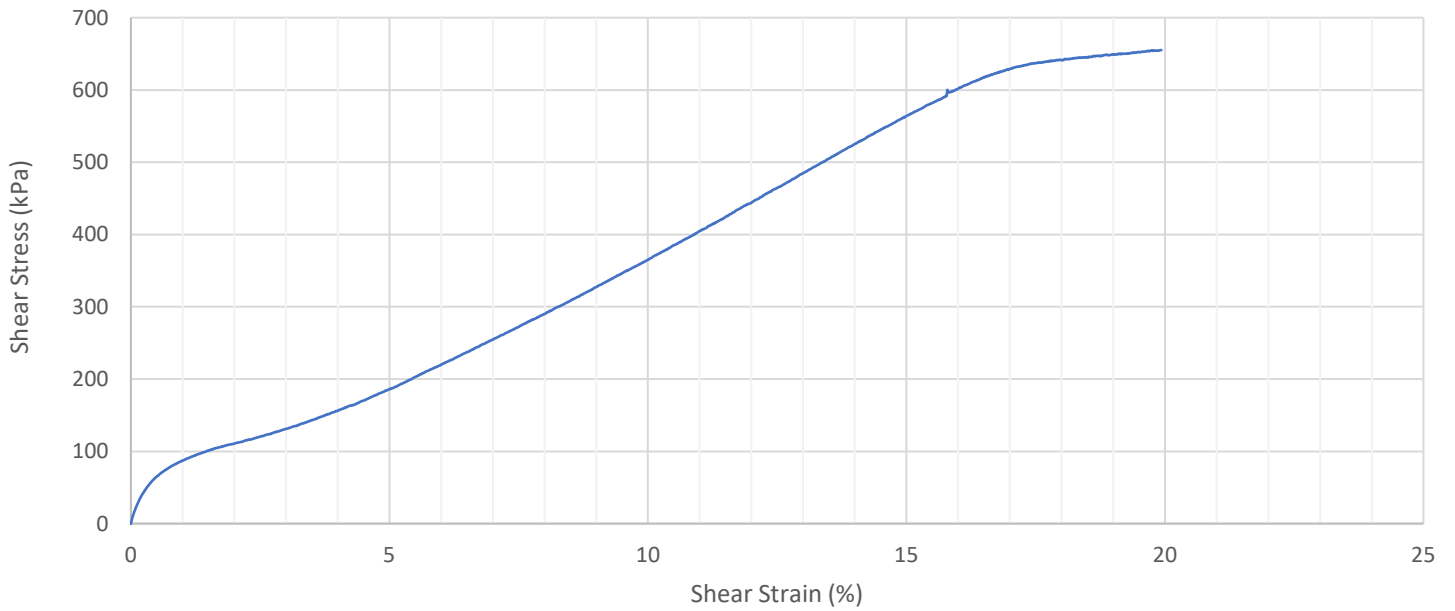
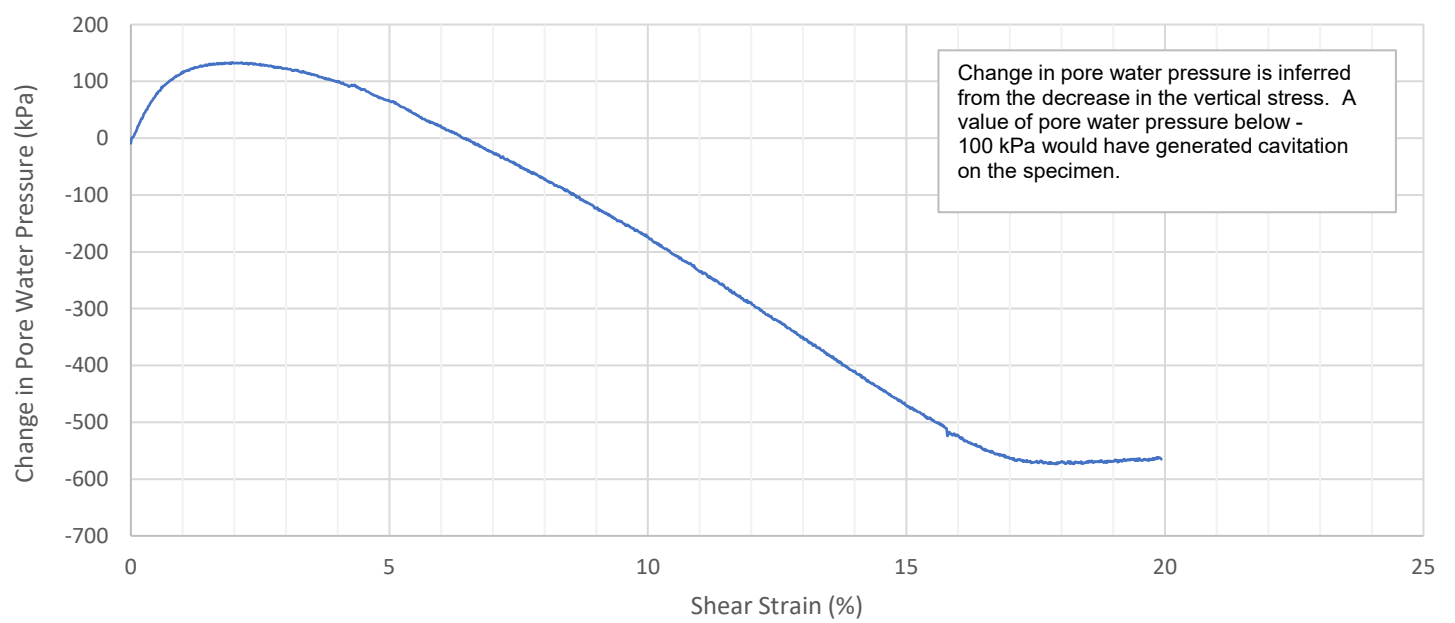
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079





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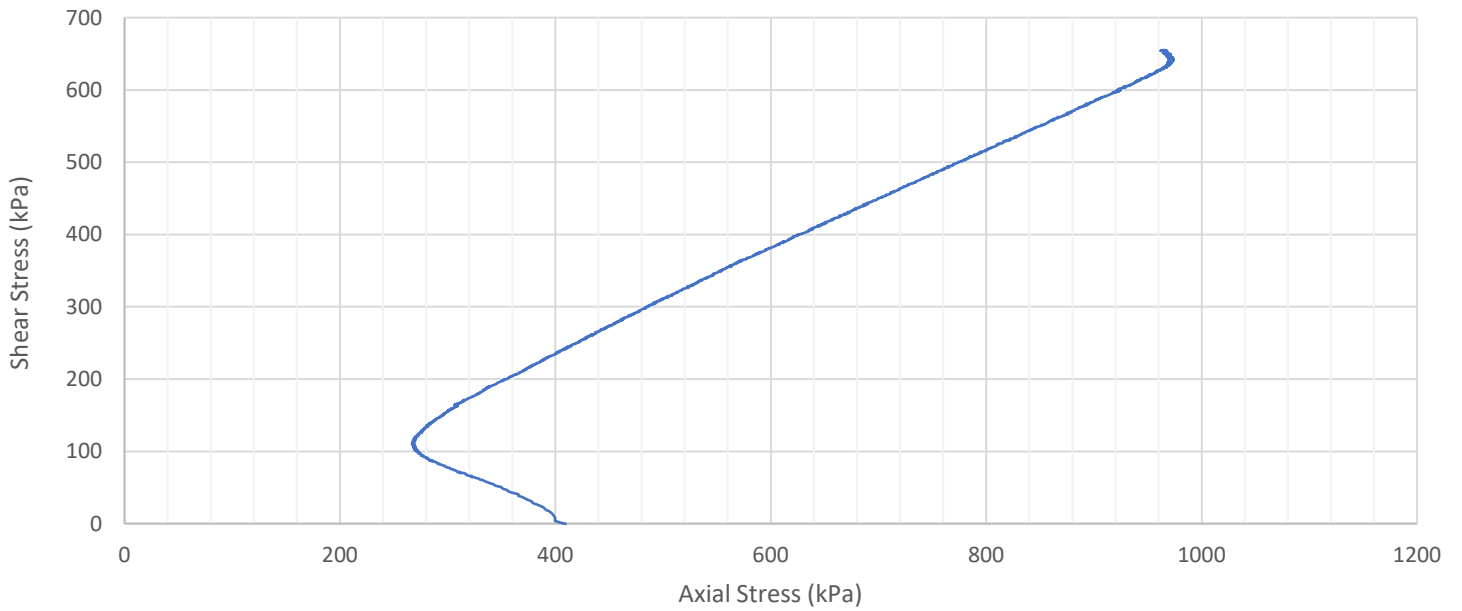
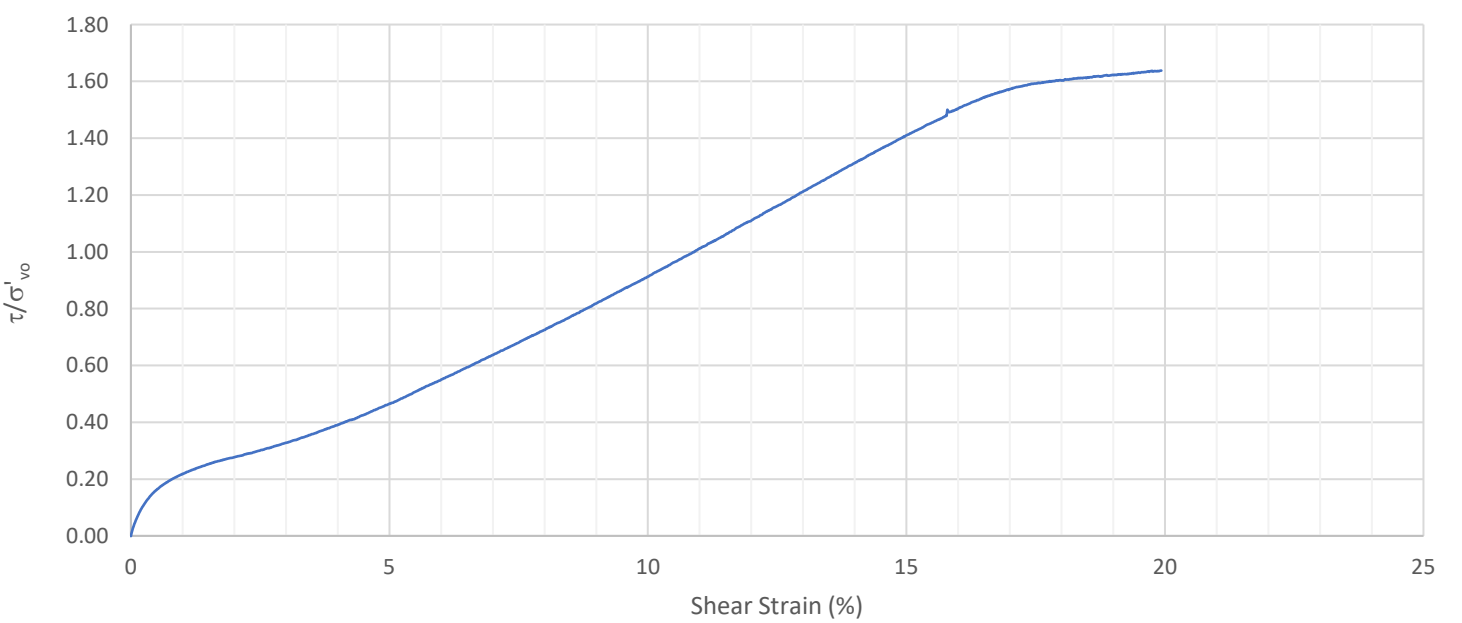
300, 3811 North Fraser Way, Burnaby, British Columbia, Canada V5J 5J2
Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079





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T. Madera	April 29, 2025	M. Badanagki	May 6, 2025
TESTED BY	DATE	CHECKED BY	DATE

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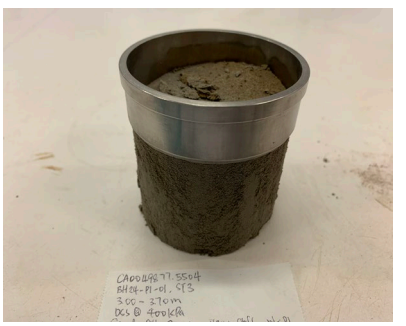
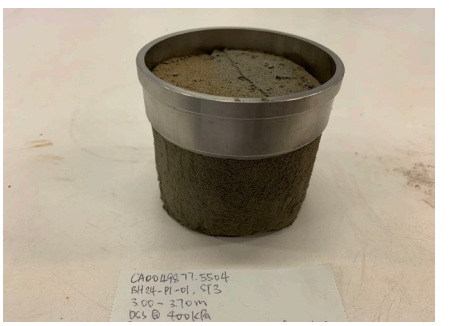
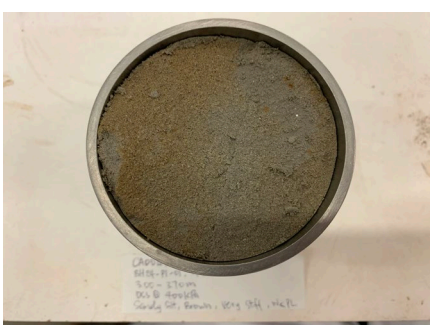
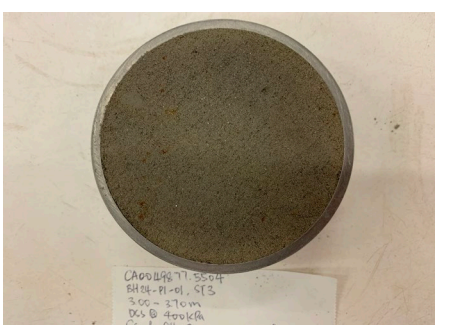
Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

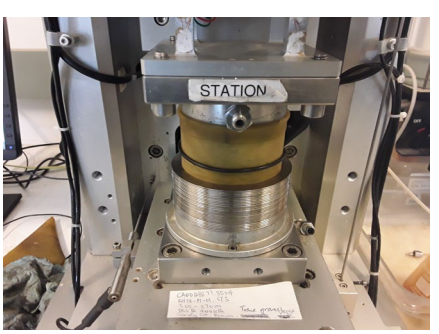
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST3
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.0 - 3.7
Client:	Tetra Tech	**Lab ID No:**	B25-079







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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~500ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.15
Diameter (mm)	70.36
Area (cm^2)	38.88
Volume (cm^3)	93.90
Specific Gravity (assumed)	3.00

Visual Description	SILTY SAND, light grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	221.69
Dry Mass (g)	190.81
Initial Wet Unit Weight (kN/m^3)	23.16
Initial Dry Unit Weight (kN/m^3)	19.93

Initial Water Content (%)	16.18
Initial Saturation (%)	>100
Final Water Content (%)	17.86
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	100.36
Vertical Stress at end of Consol (kPa)	100.10
Laboratory OCR	N/A

Max. Axial Strain %	2.08
Axial Strain at end of Consol. %	2.08
Change in Height ΔH_c (mm)	0.50

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	102.39
Initial Shear Stress (kPa)	-0.15
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.00
Test Condition	Undrained

Peak Shear Strength (kPa)	124.35
Excess Pore Pressure at Peak (kPa)	-95.68
Ratio of Peak / σ'_v	1.24
Maximum Shear Strain γ_{MAX} (%)	20.01
Shear Strength at γ_{MAX} (kPa)	124.15

Comments / Special Instructions

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

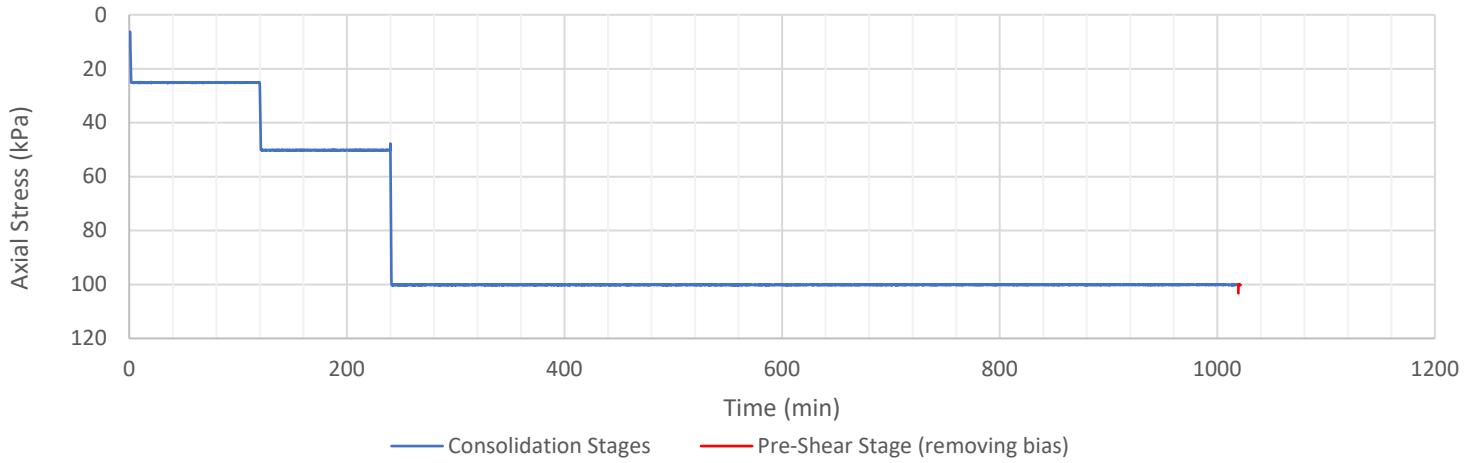
Consolidation Summary

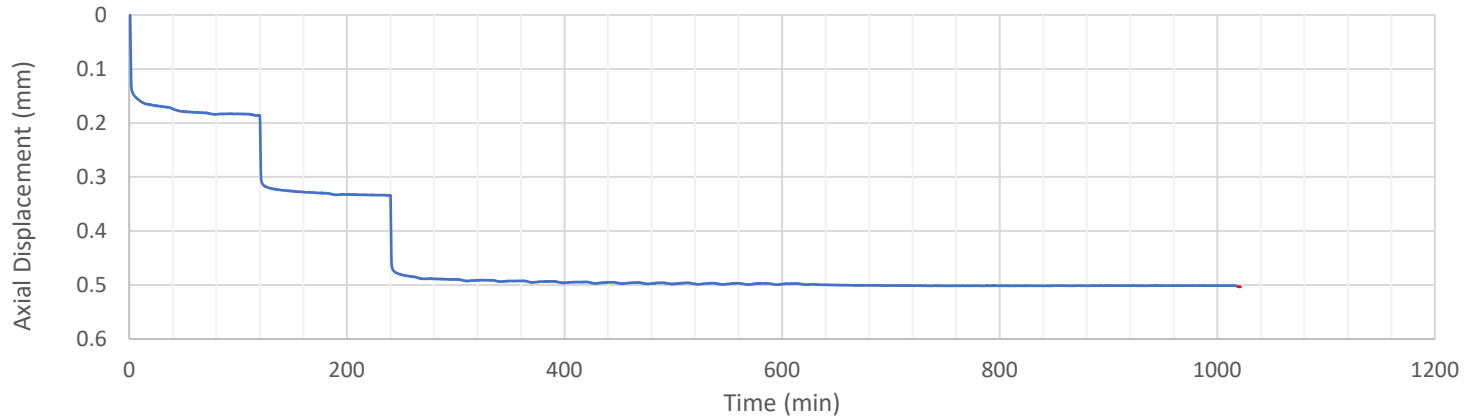
Stress at end of Consolidation (kPa)	100.10
Axial Strain at end of Consolidation (%)	2.08
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.50

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100								
Load (kN)	0.0985	0.1956	0.3902								
Duration (min)	120	120	779								
Axial Strain (%)	0.77	1.38	2.08								





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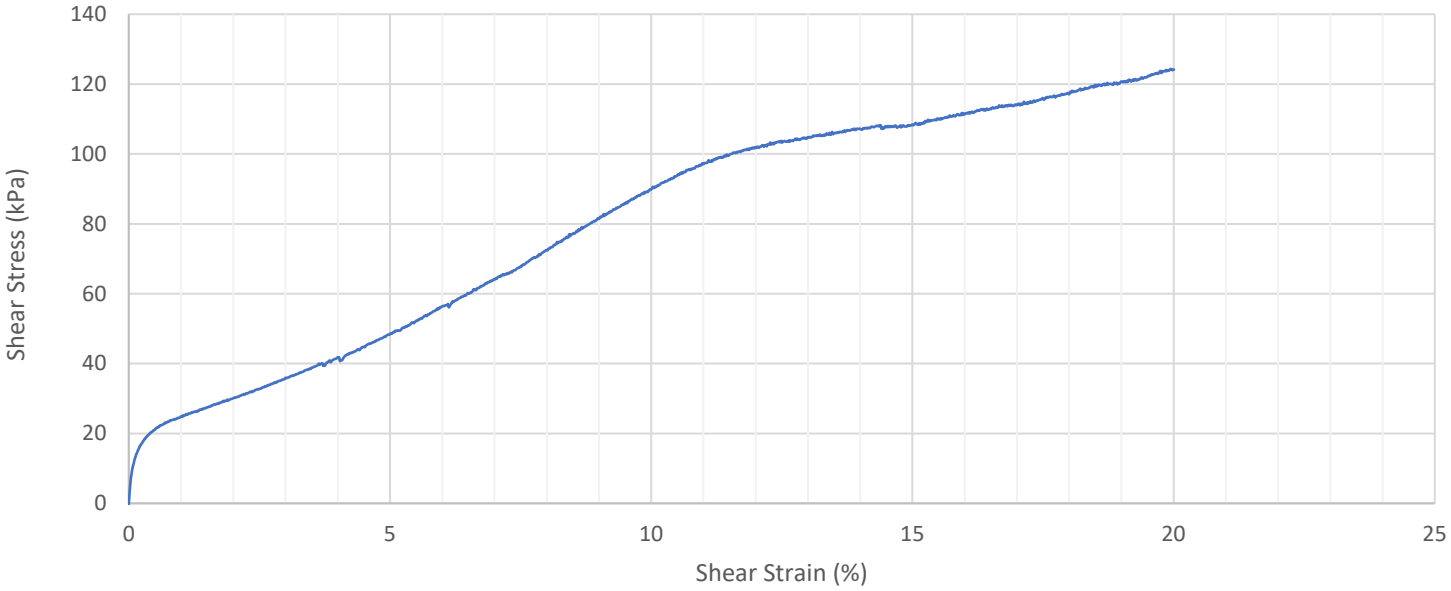
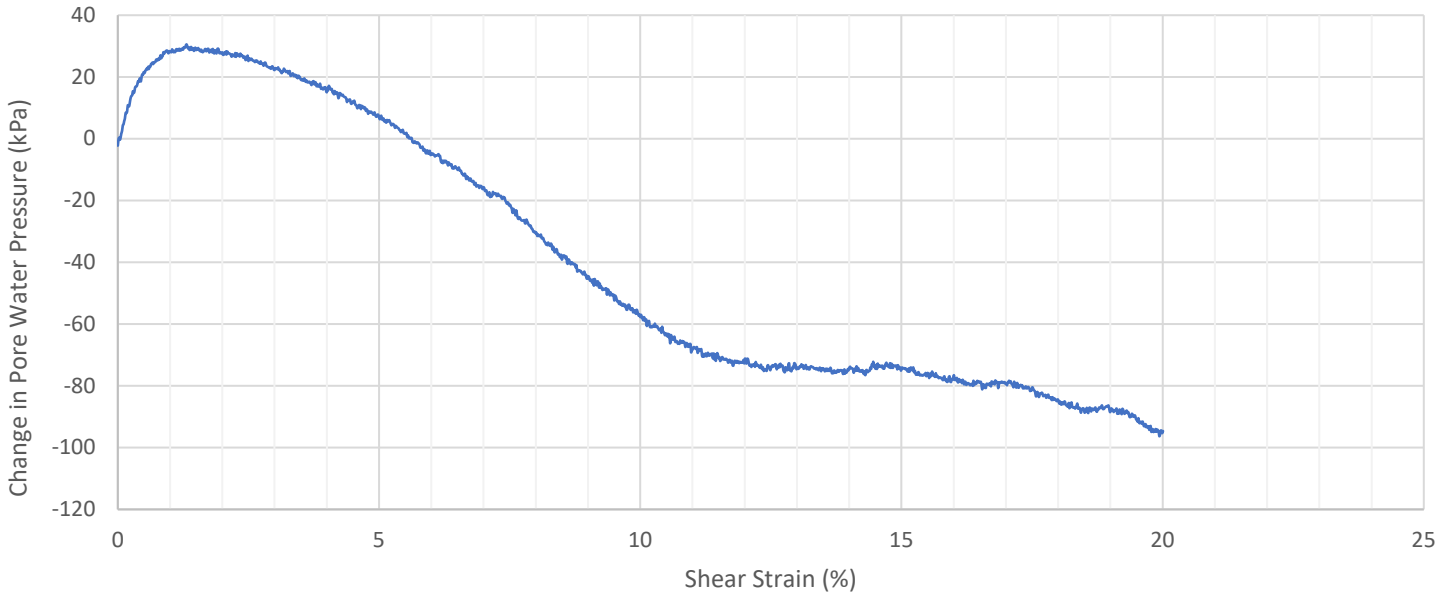
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079





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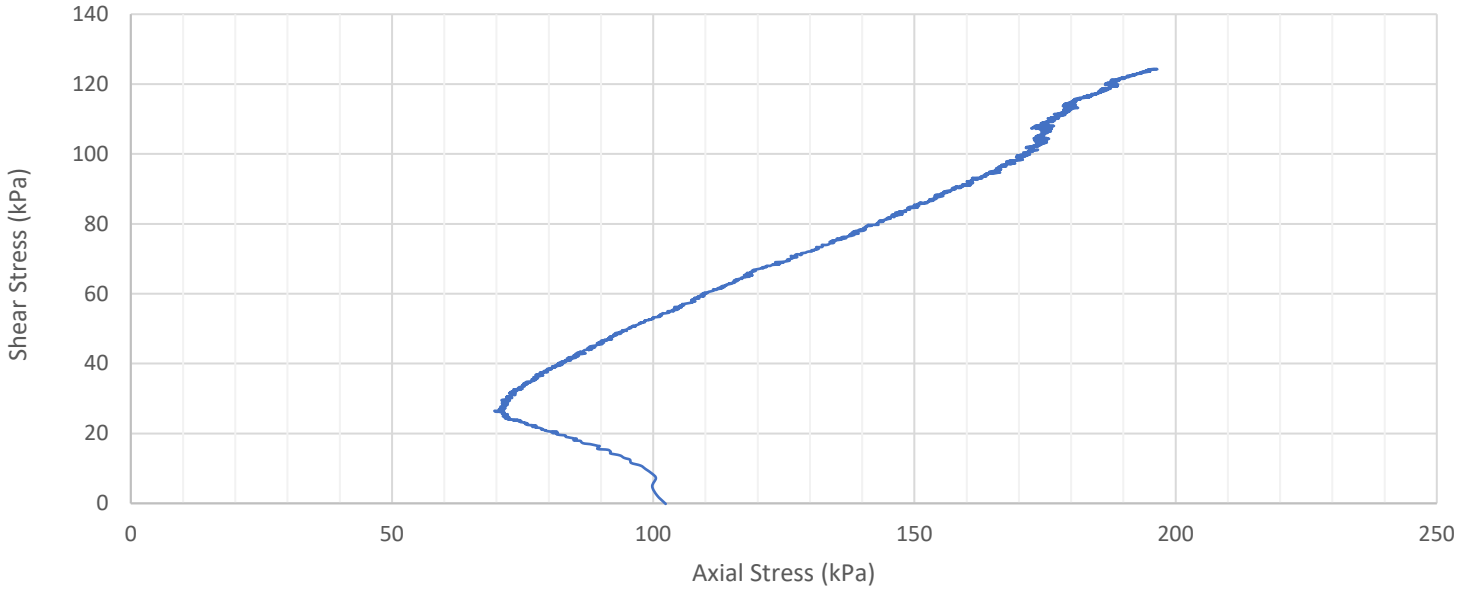
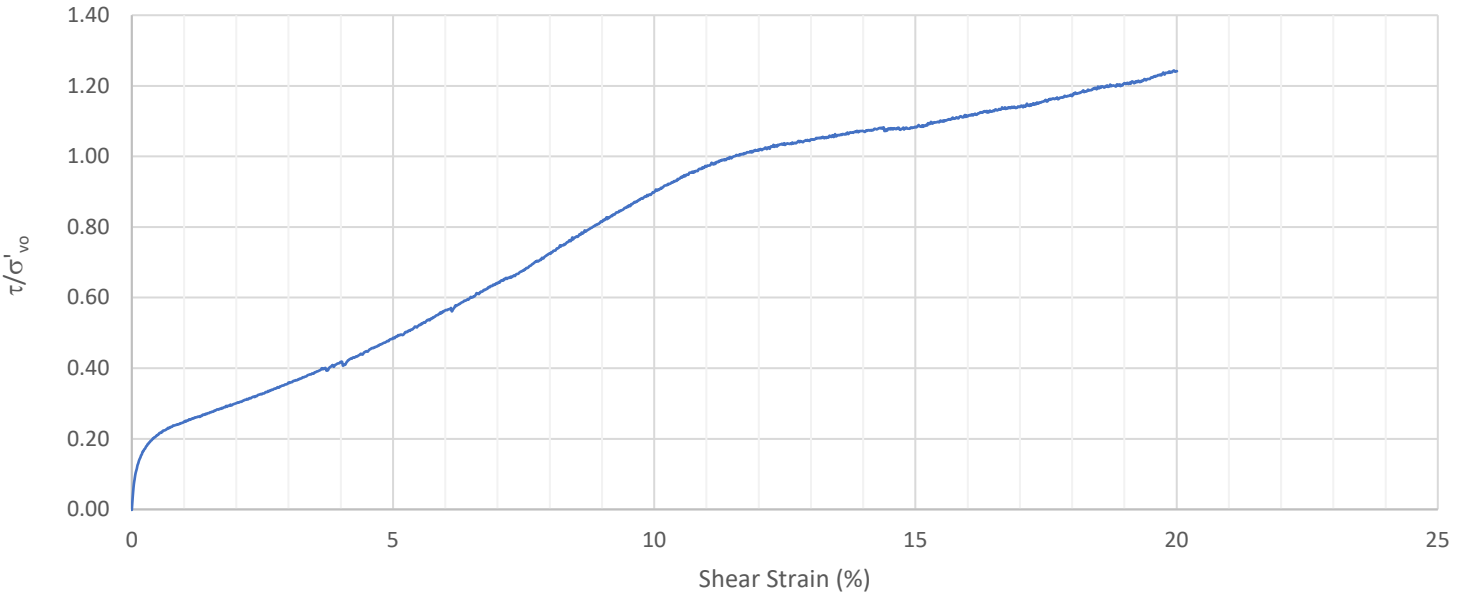
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079





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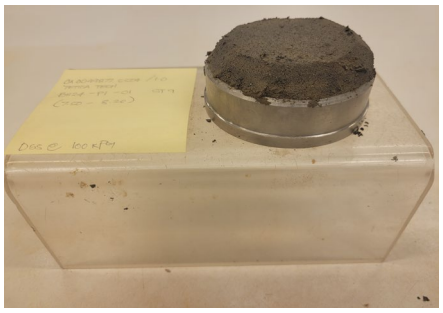
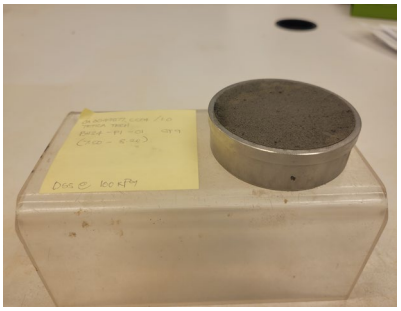
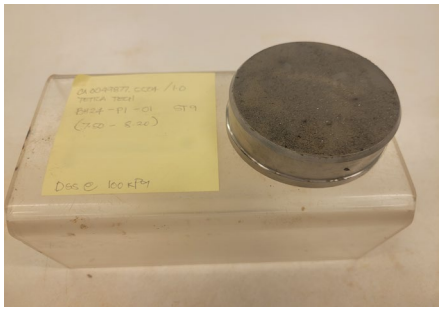
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

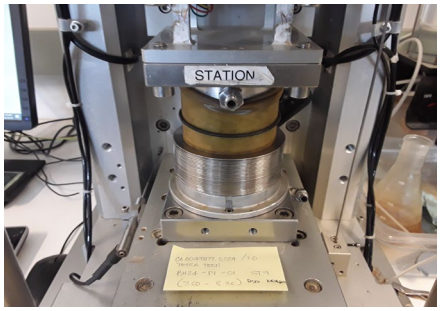








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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~150ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.01
Diameter (mm)	69.97
Area (cm^2)	38.45
Volume (cm^3)	92.32
Specific Gravity (assumed)	3.00

Visual Description	SILTY SAND, light grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	218.46
Dry Mass (g)	188.30
Initial Wet Unit Weight (kN/m^3)	23.21
Initial Dry Unit Weight (kN/m^3)	20.01

Initial Water Content (%)	16.02
Initial Saturation (%)	>100
Final Water Content (%)	17.19
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	200.46
Vertical Stress at end of Consol (kPa)	200.10
Laboratory OCR	N/A

Max. Axial Strain %	2.68
Axial Strain at end of Consol. %	2.68
Change in Height ΔH_c (mm)	0.64

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	198.38
Initial Shear Stress (kPa)	-0.36
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.00
Test Condition	Undrained

Peak Shear Strength (kPa)	167.15
Excess Pore Pressure at Peak (kPa)	-71.91
Ratio of Peak / σ'_v	0.84
Maximum Shear Strain γ_{MAX} (%)	19.99
Shear Strength at γ_{MAX} (kPa)	166.99

Comments / Special Instructions

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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

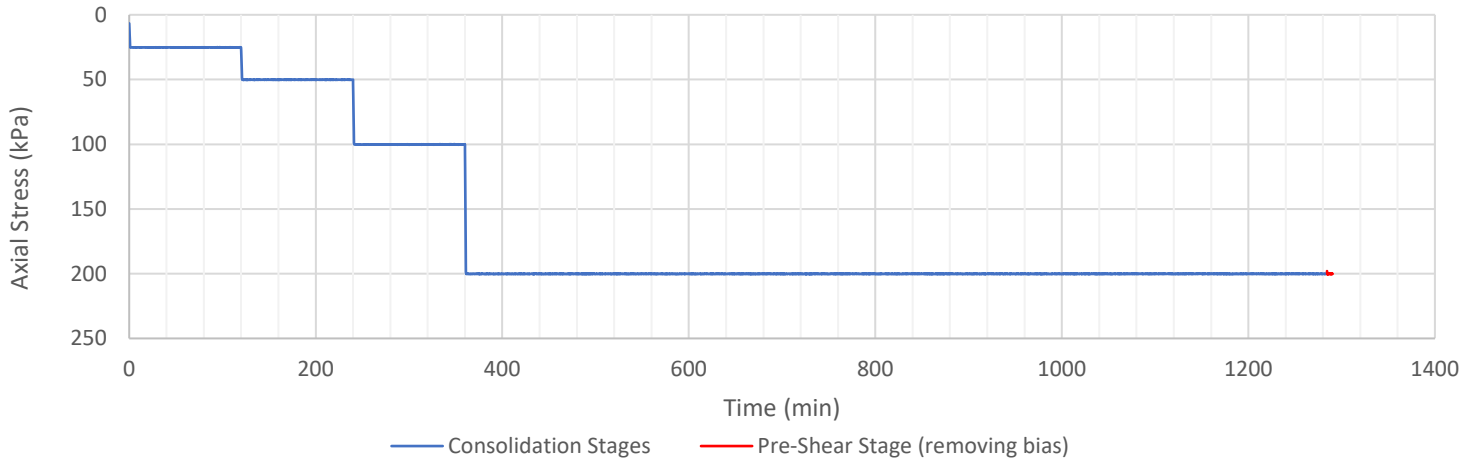
Consolidation Summary

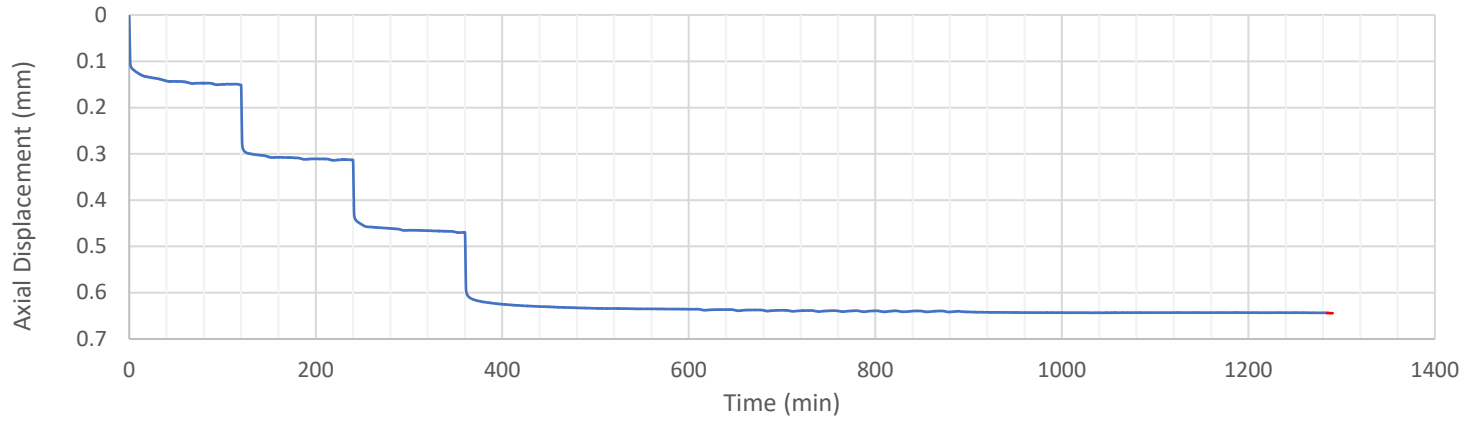
Stress at end of Consolidation (kPa)	200.10
Axial Strain at end of Consolidation (%)	2.68
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.64

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200							
Load (kN)	0.0978	0.1936	0.3863	0.7708							
Duration (min)	120	120	120	924							
Axial Strain (%)	0.63	1.31	1.96	2.68							





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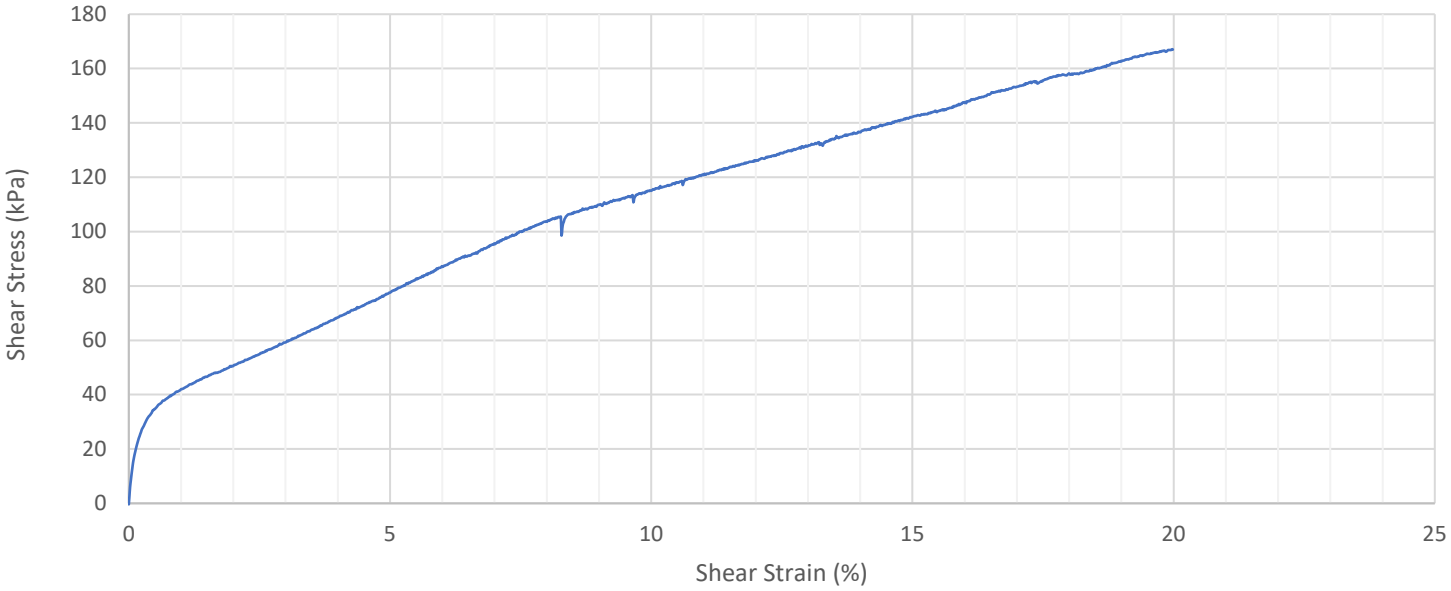
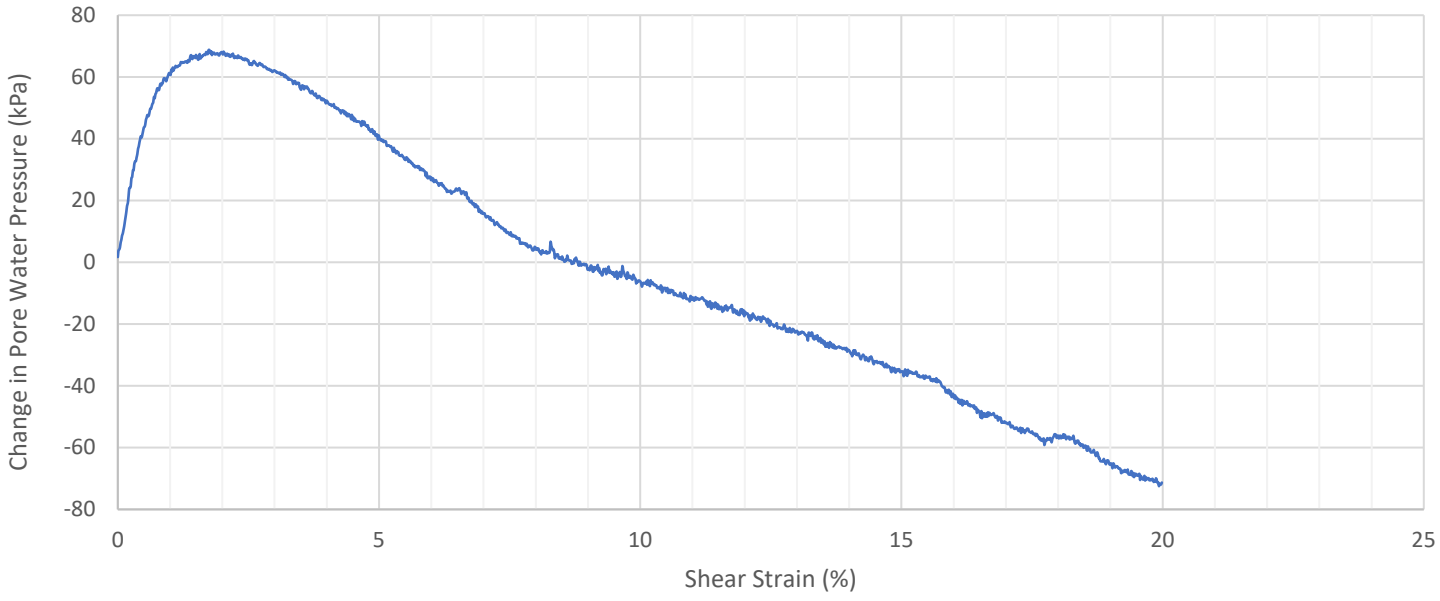
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079





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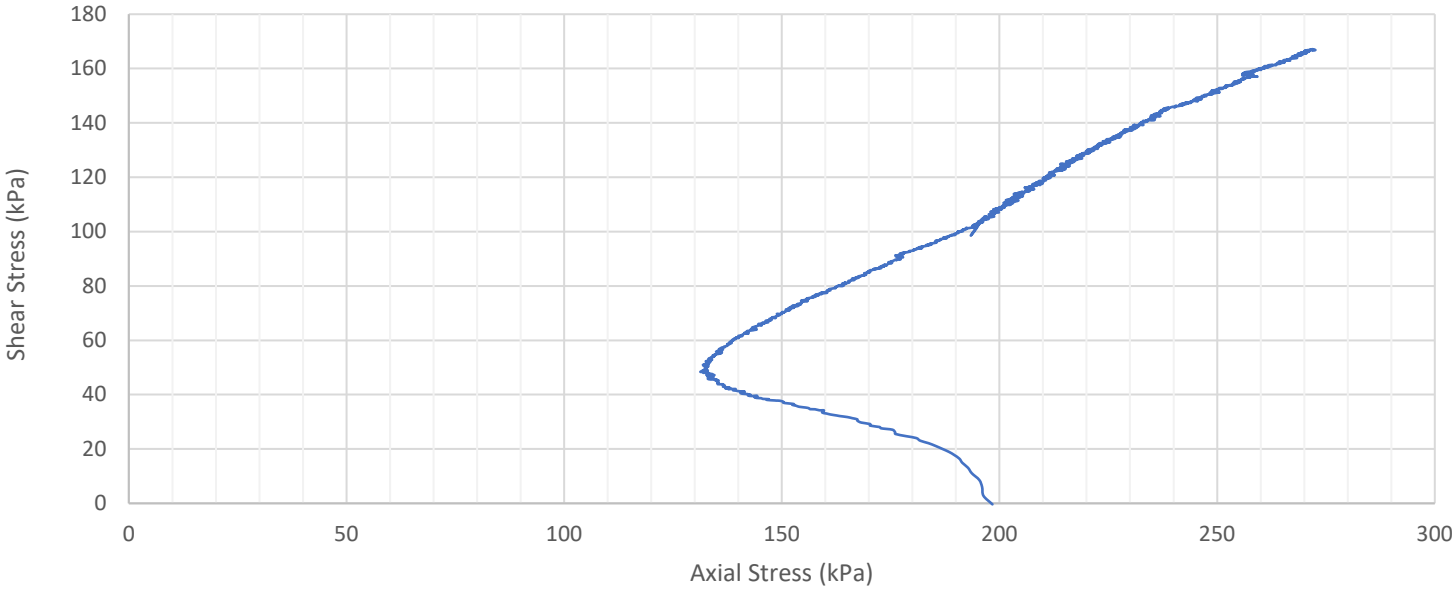

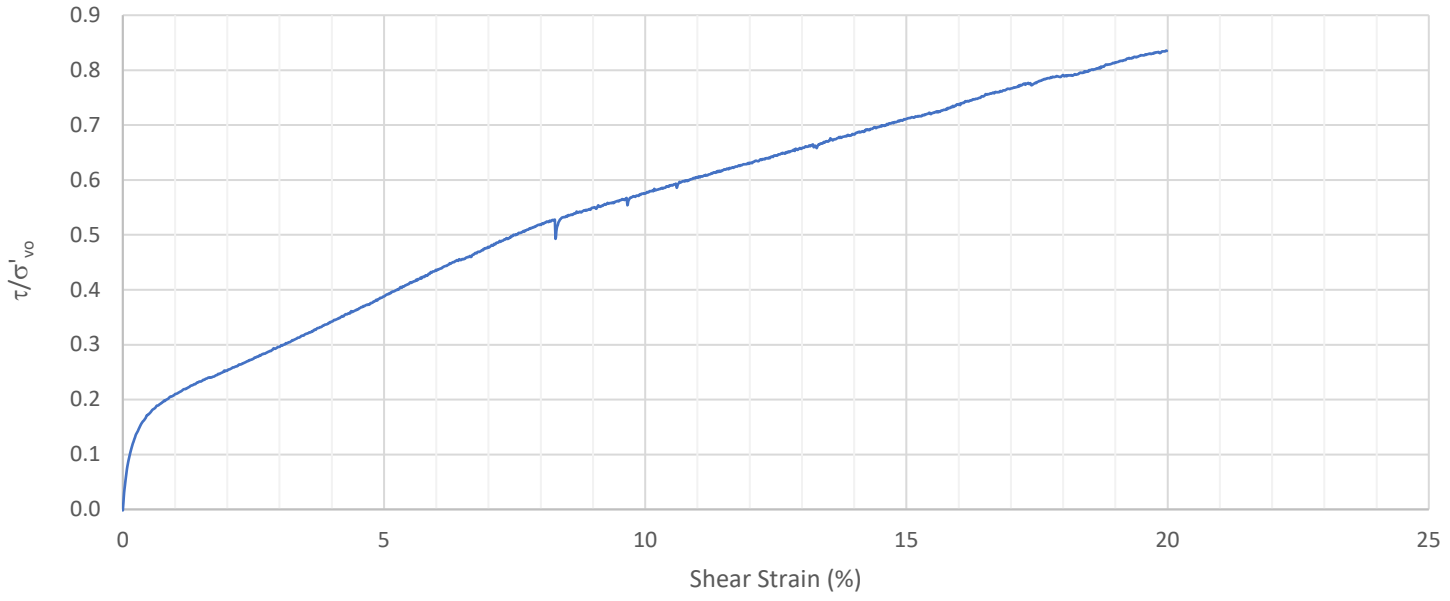

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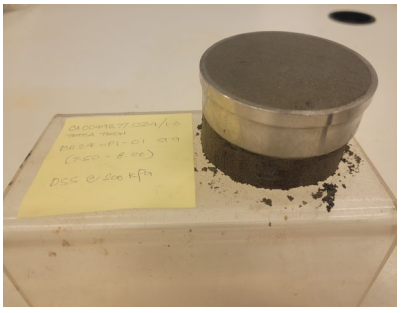
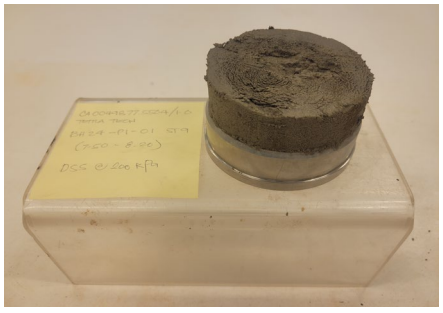
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079



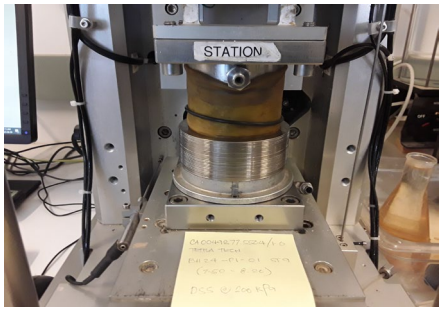








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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~300ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.13
Diameter (mm)	69.93
Area (cm^2)	38.41
Volume (cm^3)	92.68
Specific Gravity (assumed)	3.00

Visual Description	SILTY SAND, light grey, moist, dense. This point is wetter than the others		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	222.60
Dry Mass (g)	191.59
Initial Wet Unit Weight (kN/m^3)	23.56
Initial Dry Unit Weight (kN/m^3)	20.28

Initial Water Content (%)	16.19
Initial Saturation (%)	>100
Final Water Content (%)	16.35
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	401.15
Vertical Stress at end of Consol (kPa)	400.60
Laboratory OCR	N/A

Max. Axial Strain %	6.16
Axial Strain at end of Consol. %	6.14
Change in Height ΔH_c (mm)	1.48

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	400.55
Initial Shear Stress (kPa)	-0.13
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	4.90
Test Condition	Undrained

Peak Shear Strength (kPa)	237.53
Excess Pore Pressure at Peak (kPa)	25.41
Ratio of Peak / σ'_v	0.59
Maximum Shear Strain γ_{MAX} (%)	19.61
Shear Strength at γ_{MAX} (kPa)	237.25

Comments / Special Instructions

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G. Patton	June 9, 2025	M. Badanagki	June 16, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079

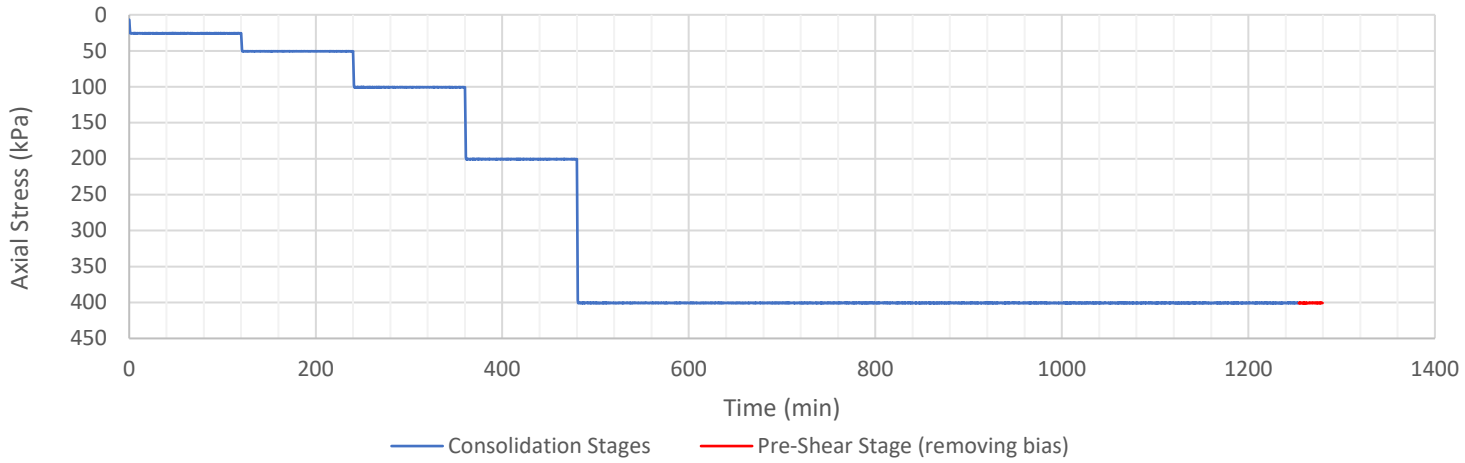
Consolidation Summary

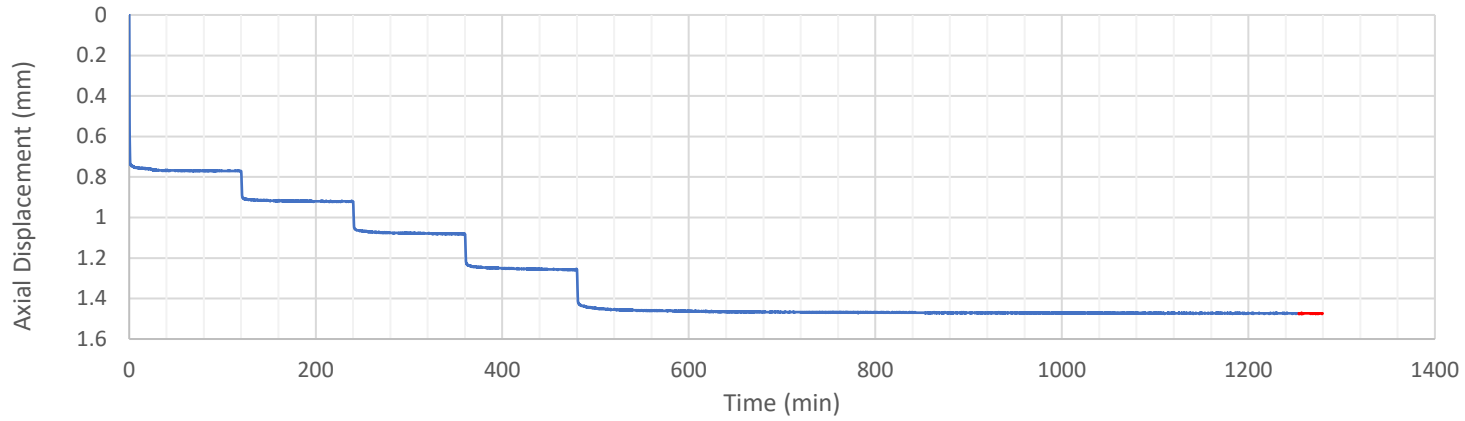
Stress at end of Consolidation (kPa)	400.60
Axial Strain at end of Consolidation (%)	6.14
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.48

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400						
Load (kN)	0.0999	0.1955	0.3878	0.7716	1.5407						
Duration (min)	120	120	120	120	774						
Axial Strain (%)	3.24	3.86	4.52	5.26	6.16						





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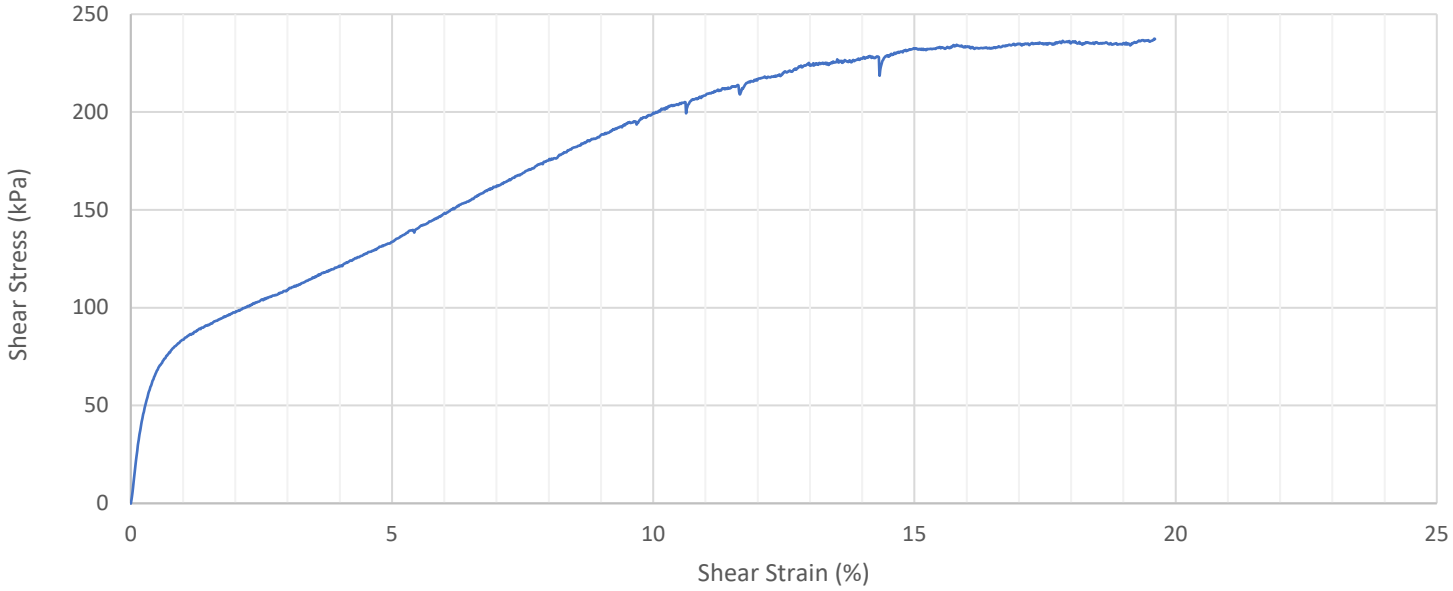
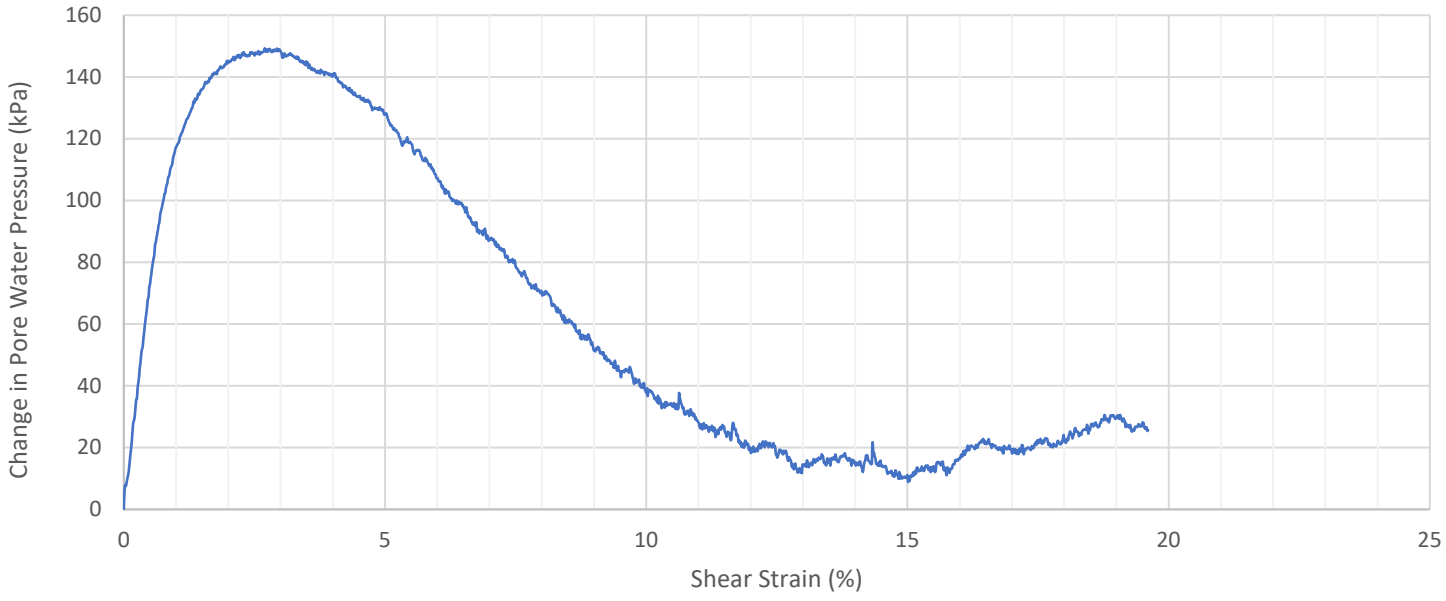
Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079





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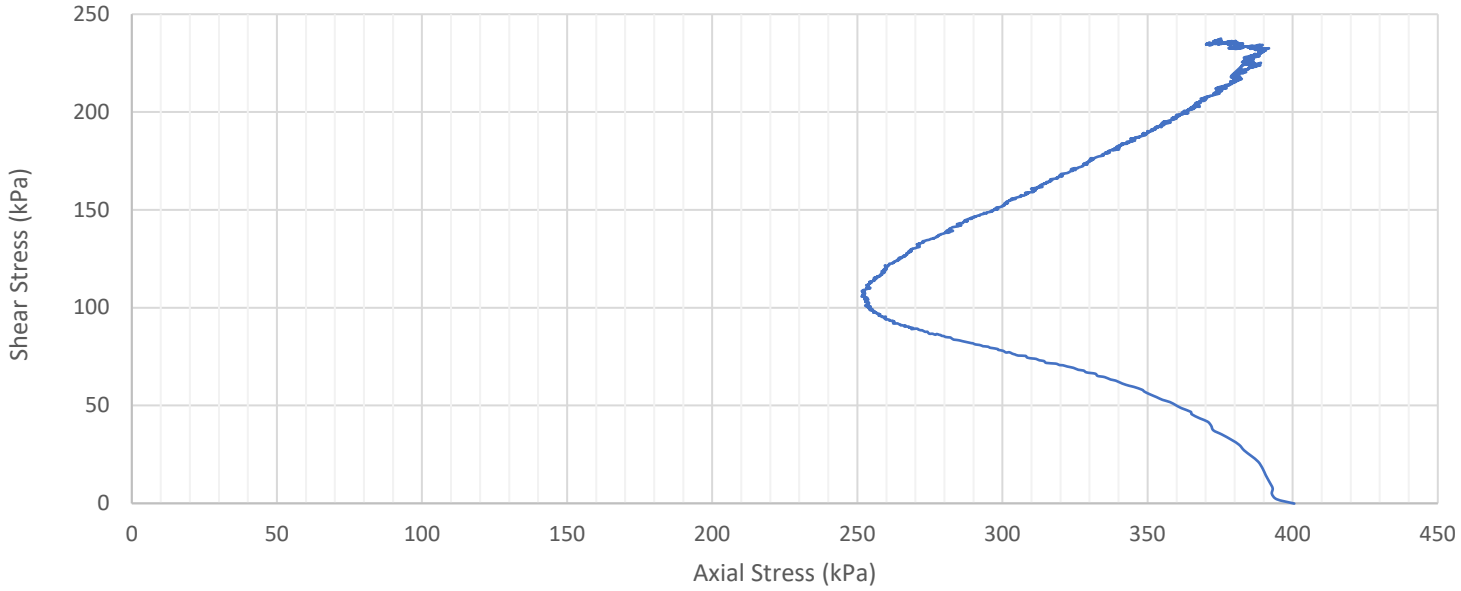
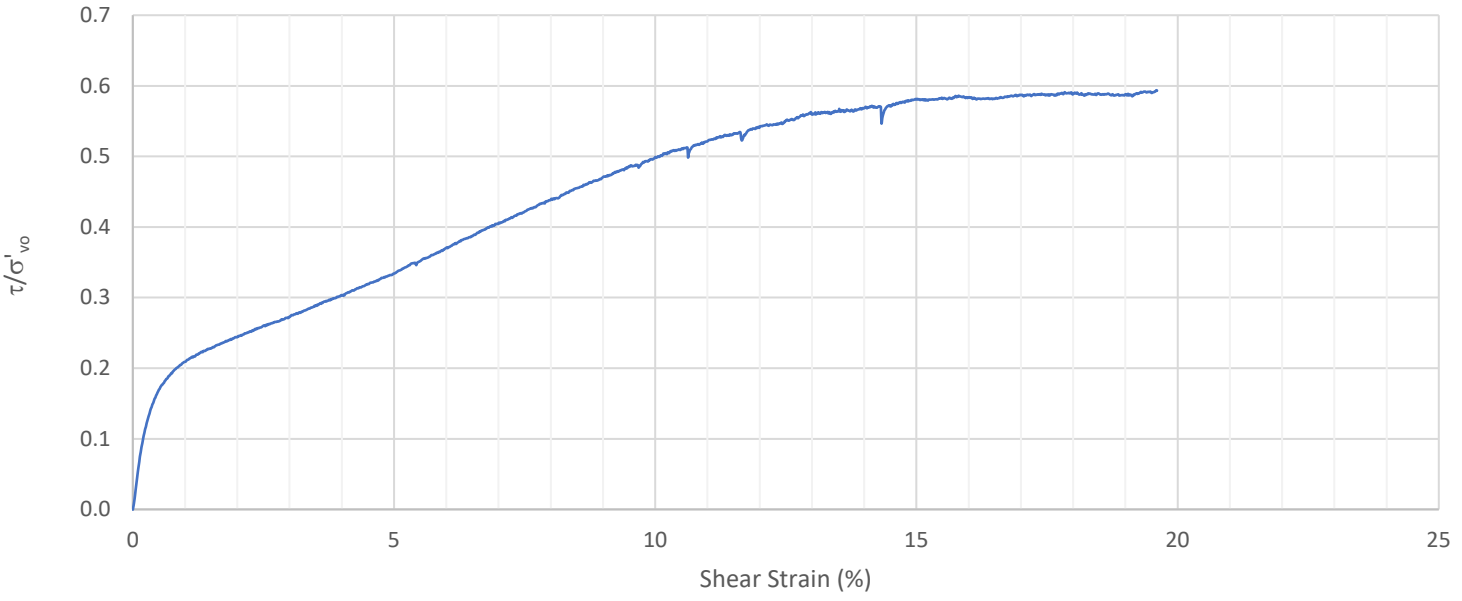
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-01 ST9
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079





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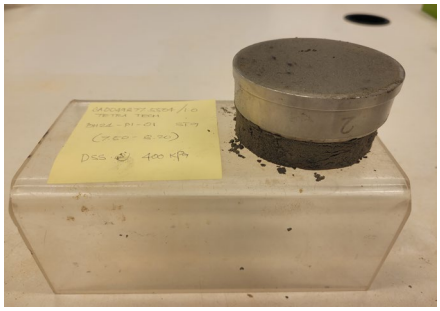
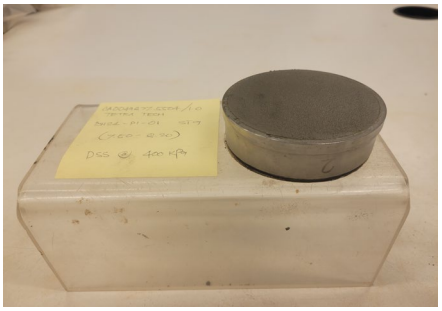
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	7.50 - 8.20
Client:	Tetra Tech	**Lab ID No:**	B25-079



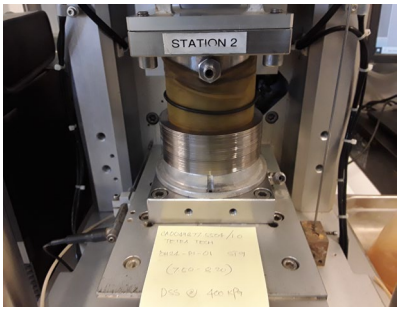













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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~275ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.83
Diameter (mm)	70.61
Area (cm^2)	39.16
Volume (cm^3)	93.31
Specific Gravity (assumed)	3.00

Visual Description			
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	217.56	Initial Water Content (%)	13.07
Dry Mass (g)	192.41	Initial Saturation (%)	86.69
Initial Wet Unit Weight (kN/m^3)	22.87	Final Water Content (%)	16.52
Initial Dry Unit Weight (kN/m^3)	20.23	Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A	Max. Axial Strain %	5.08
Max Applied Vertical Stress (kPa)	101.08	Axial Strain at end of Consol. %	5.08
Vertical Stress at end of Consol (kPa)	100.90	Change in Height ΔH_c (mm)	1.21
Laboratory OCR	N/A		

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	100.80	Peak Shear Strength (kPa)	150.67
Initial Shear Stress (kPa)	-0.54	Excess Pore Pressure at Peak (kPa)	-136.42
Applied Shear Bias (kPa)	0.00	Ratio of Peak / σ'_v	1.50
Rate of Shearing (%/hr)	4.96	Maximum Shear Strain γ_{MAX} (%)	19.85
Test Condition	Undrained	Shear Strength at γ_{MAX} (kPa)	150.42

Comments / Special Instructions

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079

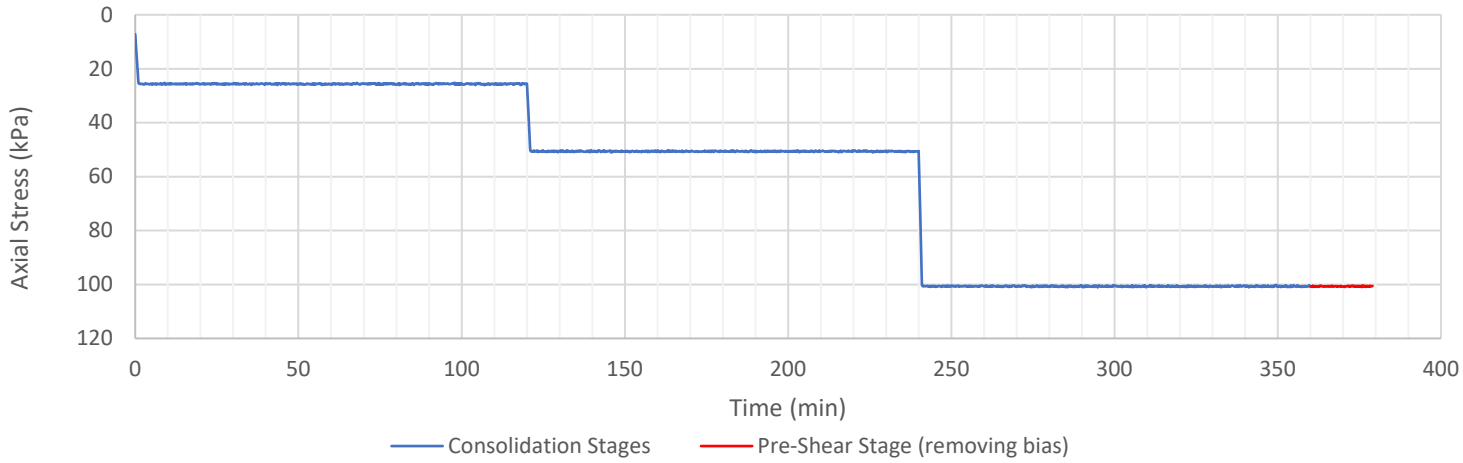
Consolidation Summary

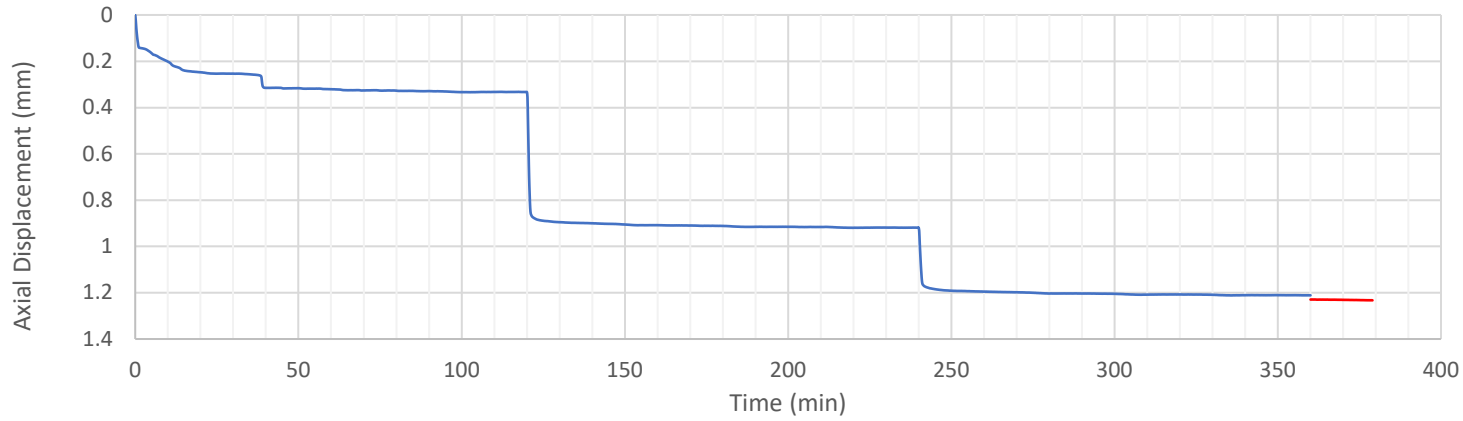
Stress at end of Consolidation (kPa)	100.90
Axial Strain at end of Consolidation (%)	5.08
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.21

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100								
Load (kN)	0.1022	0.1999	0.3958								
Duration (min)	120	120	120								
Axial Strain (%)	1.40	3.86	5.08								





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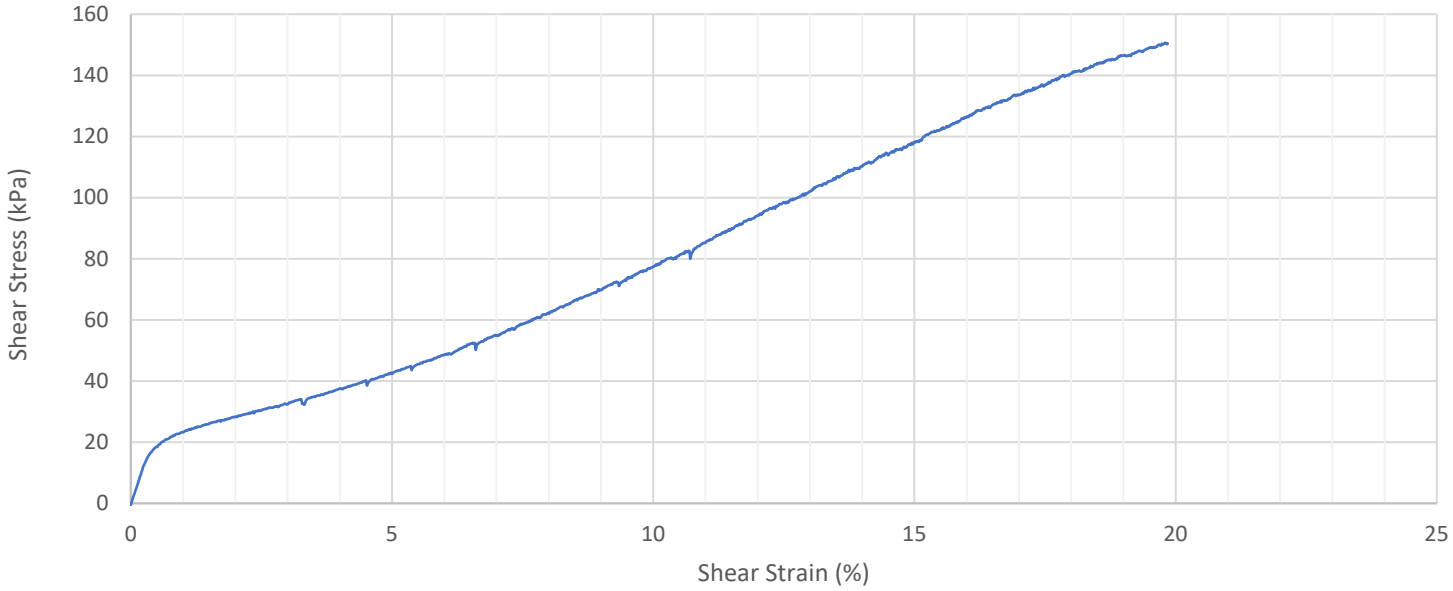
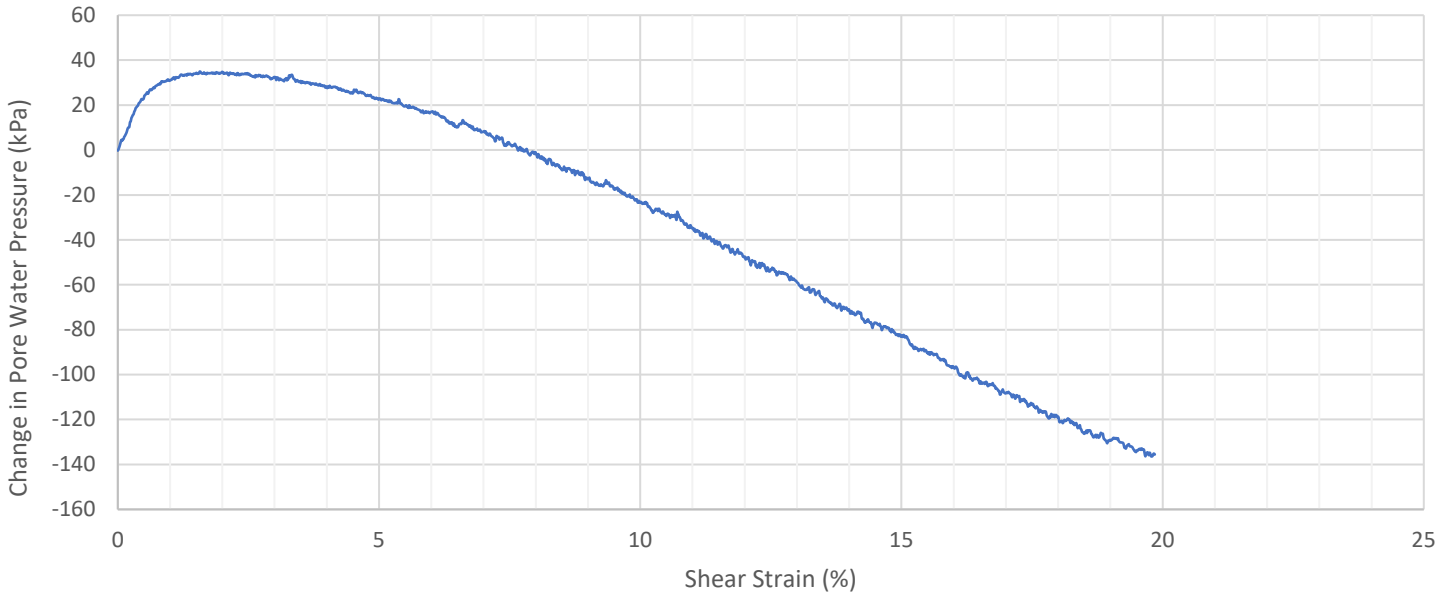
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079





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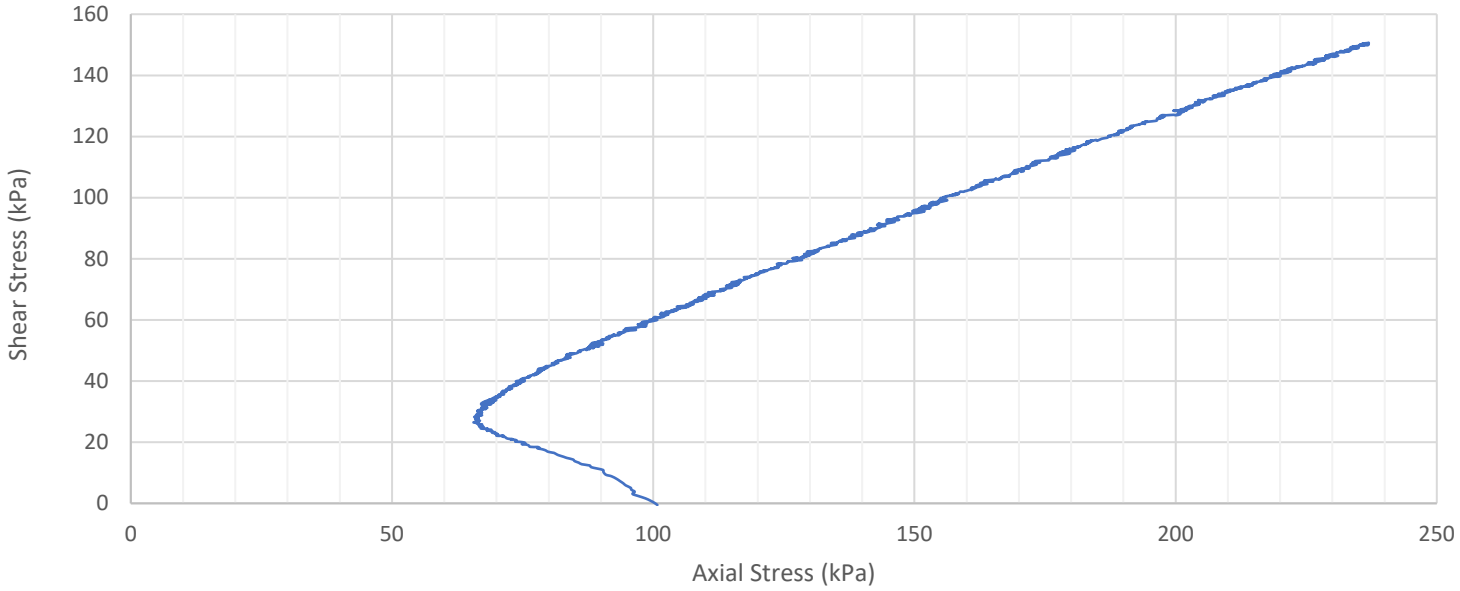
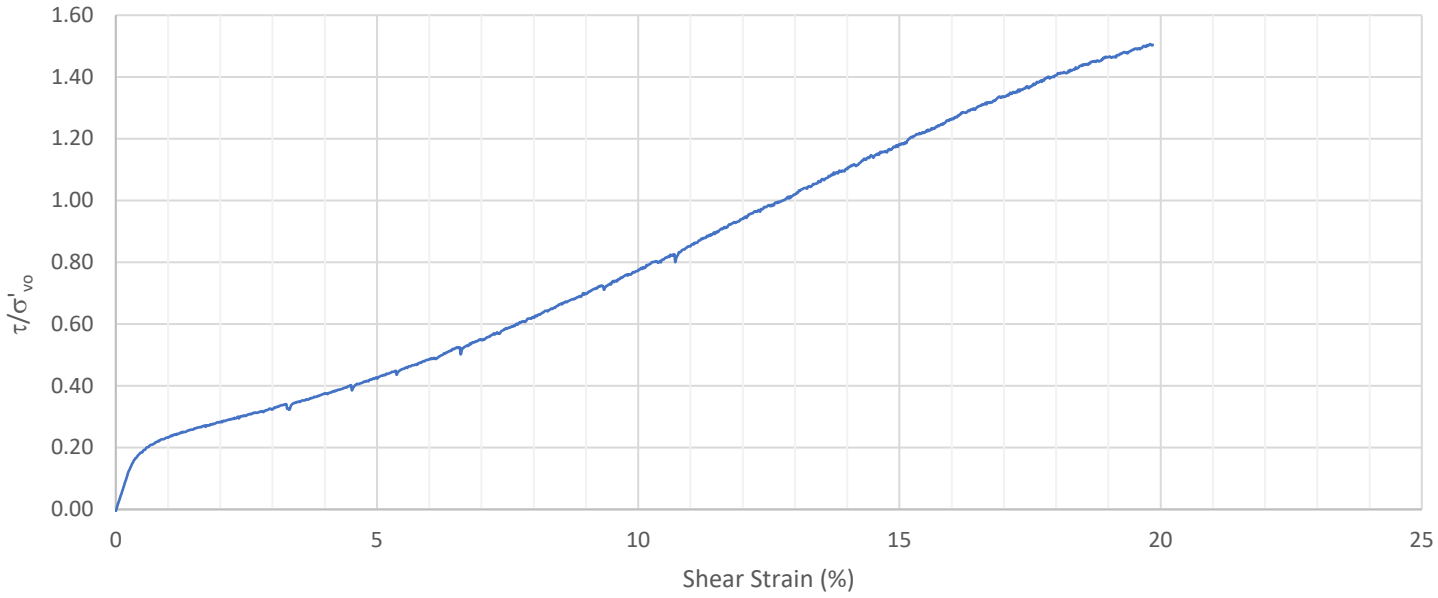
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079





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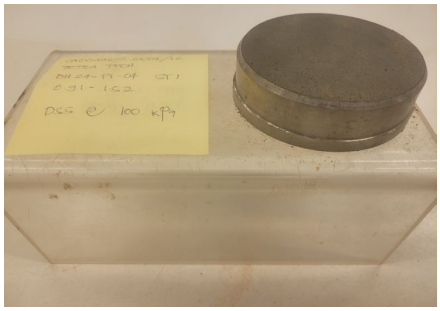
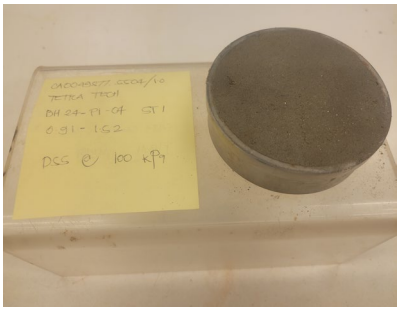
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	100kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079









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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

Minimal water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.10
Diameter (mm)	70.40
Area (cm^2)	38.93
Volume (cm^3)	93.81
Specific Gravity (assumed)	3.00

Visual Description			
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	219.04	Initial Water Content (%)	34.78
Dry Mass (g)	162.52	Initial Saturation (%)	>100
Initial Wet Unit Weight (kN/m^3)	22.91	Final Water Content (%)	38.49
Initial Dry Unit Weight (kN/m^3)	17.00	Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A	Max. Axial Strain %	7.95
Max Applied Vertical Stress (kPa)	200.13	Axial Strain at end of Consol. %	7.95
Vertical Stress at end of Consol (kPa)	200.13	Change in Height ΔH_c (mm)	1.92
Laboratory OCR	N/A		

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	200.13	Peak Shear Strength (kPa)	257.49
Initial Shear Stress (kPa)	0.18	Excess Pore Pressure at Peak (kPa)	-212.97
Applied Shear Bias (kPa)	0.00	Ratio of Peak / σ'_v	1.29
Rate of Shearing (%/hr)	4.99	Maximum Shear Strain γ_{MAX} (%)	19.96
Test Condition	Undrained	Shear Strength at γ_{MAX} (kPa)	257.31

Comments / Special Instructions

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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079

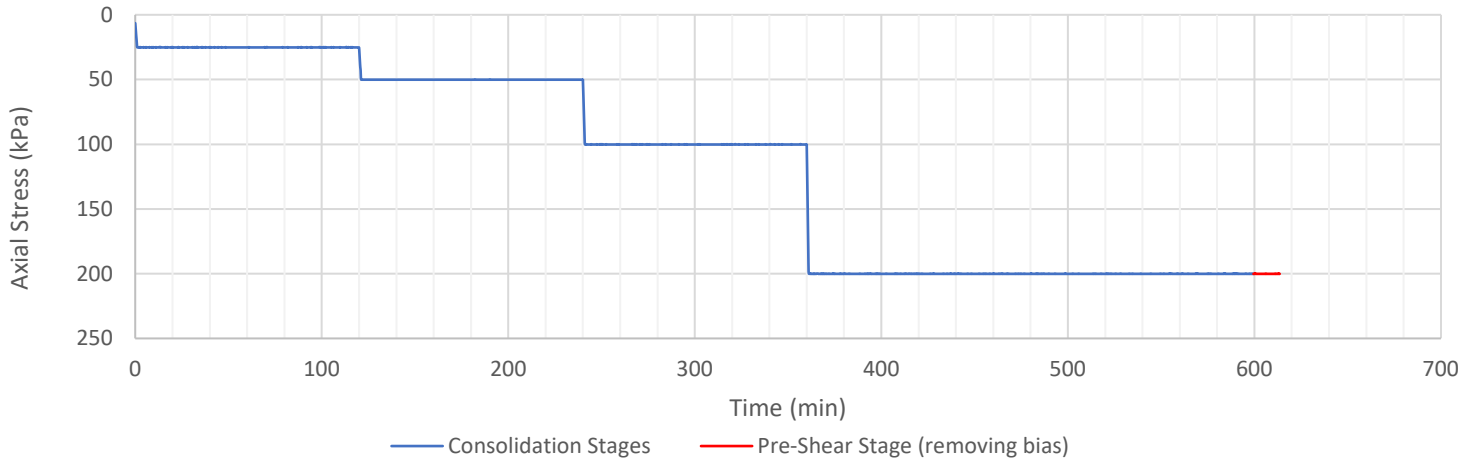
Consolidation Summary

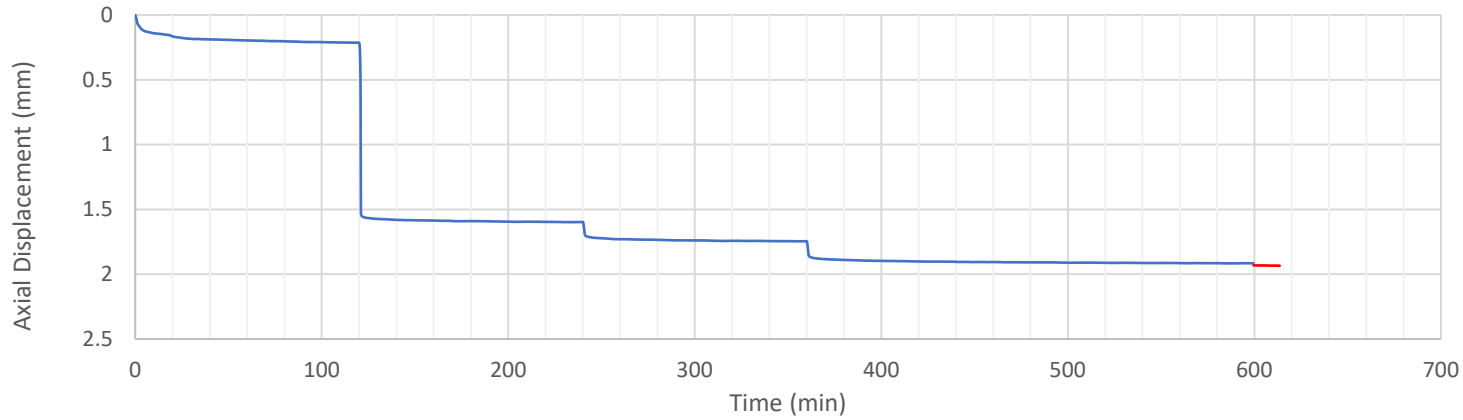
Stress at end of Consolidation (kPa)	200.13
Axial Strain at end of Consolidation (%)	7.95
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.92

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200							
Load (kN)	0.098	0.195	0.39	0.779							
Duration (min)	120	120	120	240							
Axial Strain (%)	0.89	6.63	7.25	7.95							





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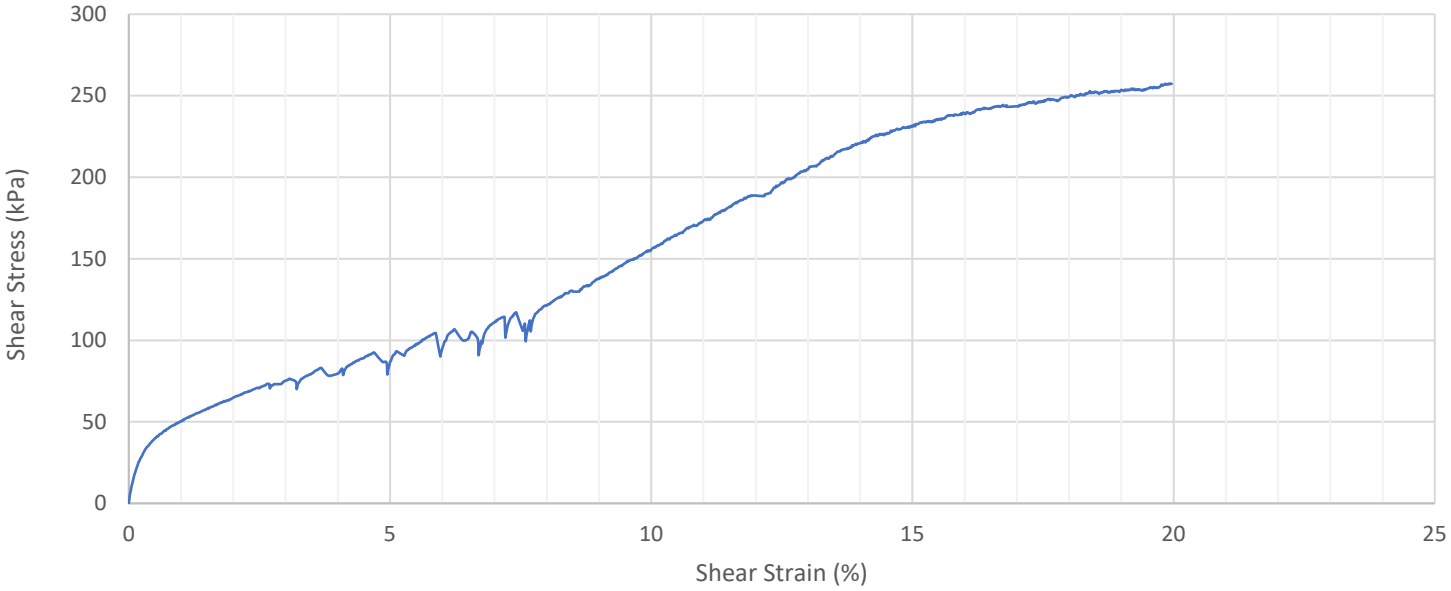
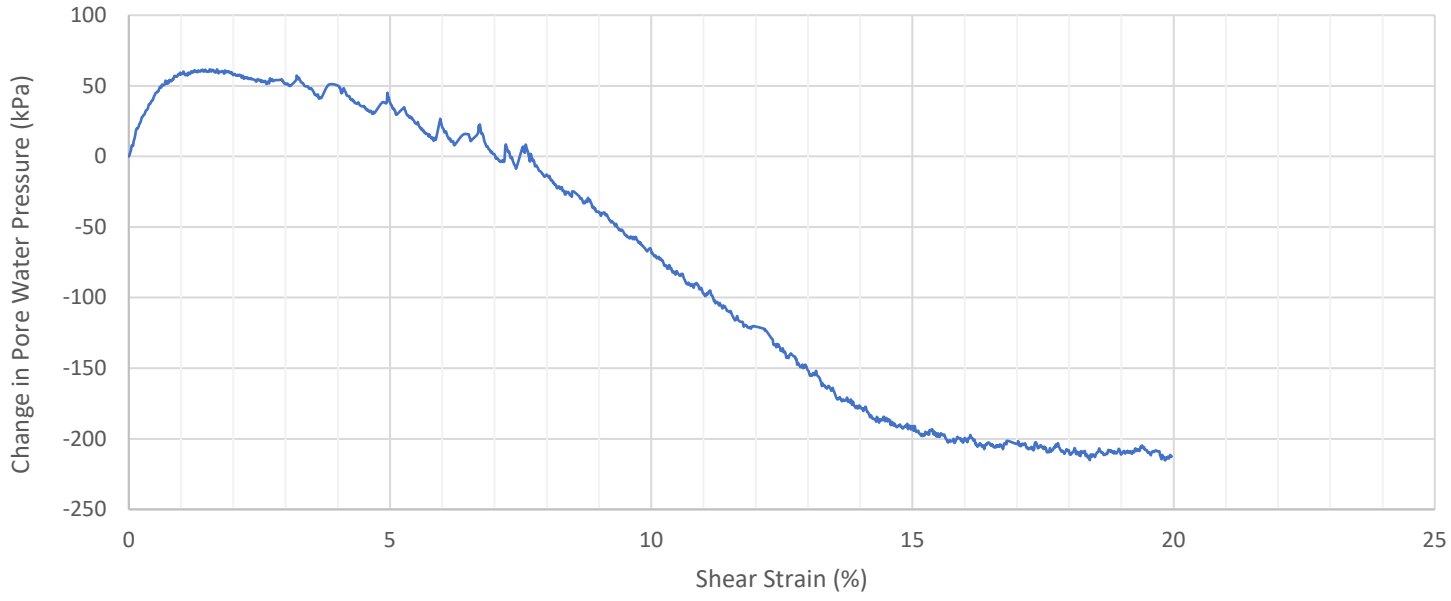
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079





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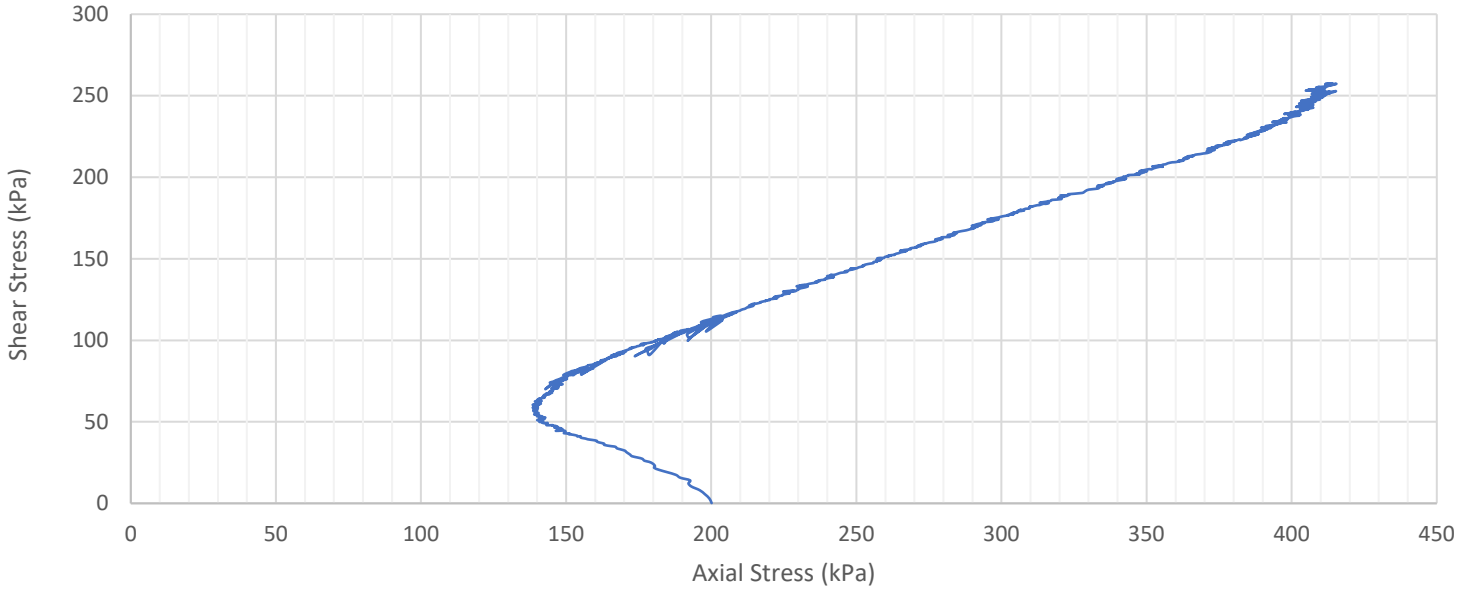
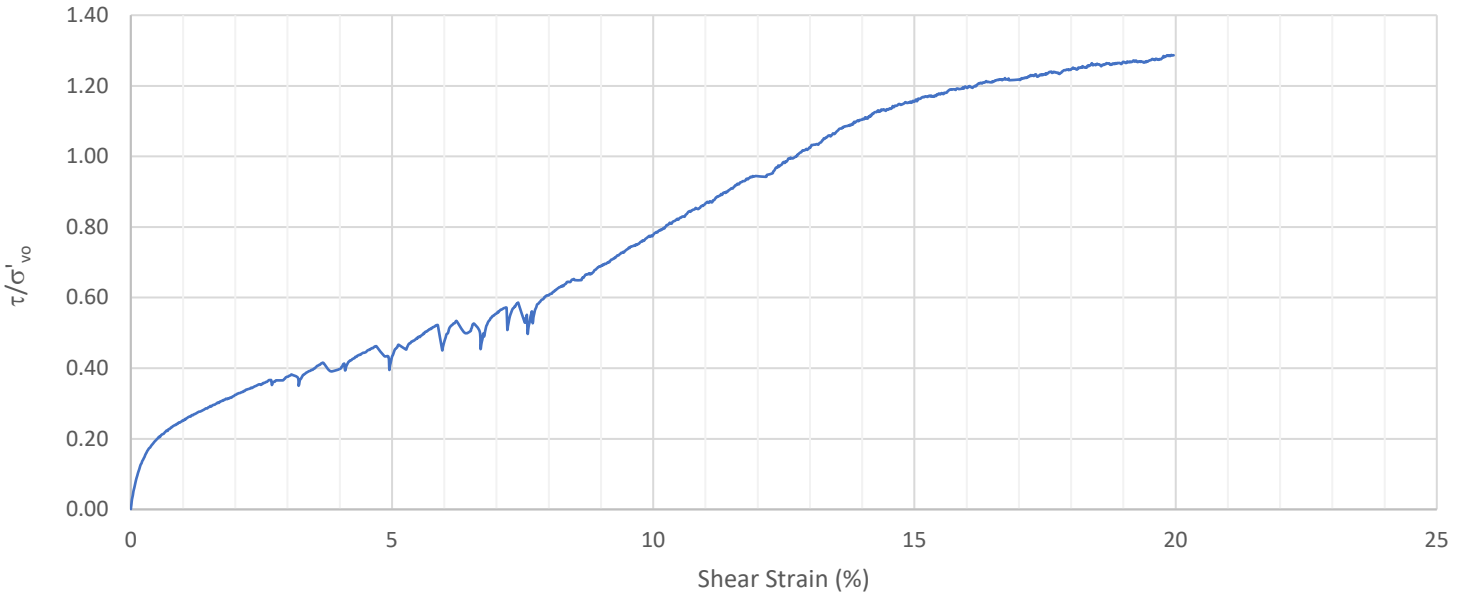
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079





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TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc.
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Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079



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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~100ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.79
Diameter (mm)	70.28
Area (cm^2)	38.79
Volume (cm^3)	92.29
Specific Gravity (assumed)	3.00

Visual Description	SILTY SAND, grey, moist, grey.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	216.59
Dry Mass (g)	191.96
Initial Wet Unit Weight (kN/m^3)	23.02
Initial Dry Unit Weight (kN/m^3)	20.40

Initial Water Content (%)	12.83
Initial Saturation (%)	87.54
Final Water Content (%)	14.81
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	400.69
Vertical Stress at end of Consol (kPa)	400.15
Laboratory OCR	N/A

Max. Axial Strain %	5.45
Axial Strain at end of Consol. %	5.45
Change in Height ΔH_c (mm)	1.30

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	403.04
Initial Shear Stress (kPa)	-0.52
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.00
Test Condition	Undrained

Peak Shear Strength (kPa)	317.79
Excess Pore Pressure at Peak (kPa)	-105.46
Ratio of Peak / σ'_v	0.79
Maximum Shear Strain γ_{MAX} (%)	20.00
Shear Strength at γ_{MAX} (kPa)	317.38

Comments / Special Instructions

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079

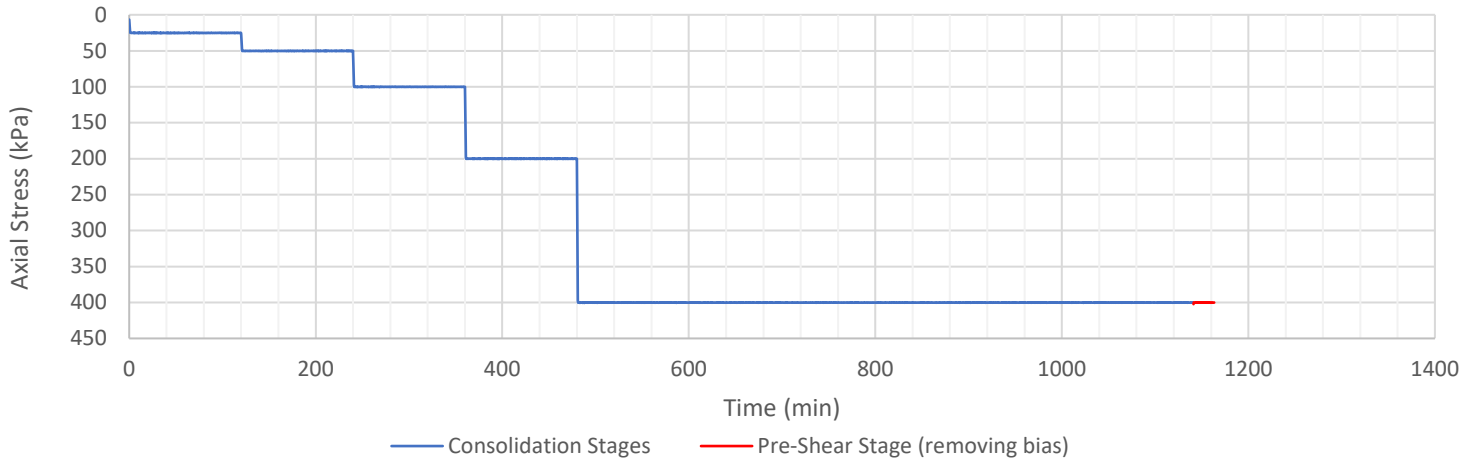
Consolidation Summary

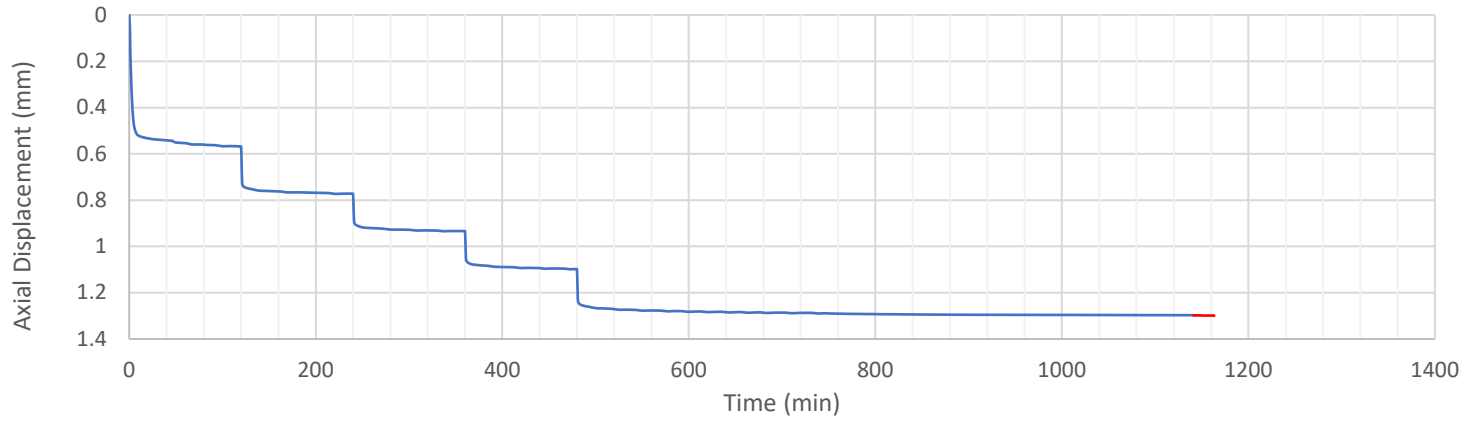
Stress at end of Consolidation (kPa)	400.15
Axial Strain at end of Consolidation (%)	5.45
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.30

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400						
Load (kN)	0.0985	0.1954	0.3892	0.7776	1.5544						
Duration (min)	120	120	120	120	661						
Axial Strain (%)	2.39	3.25	3.93	4.62	5.45						





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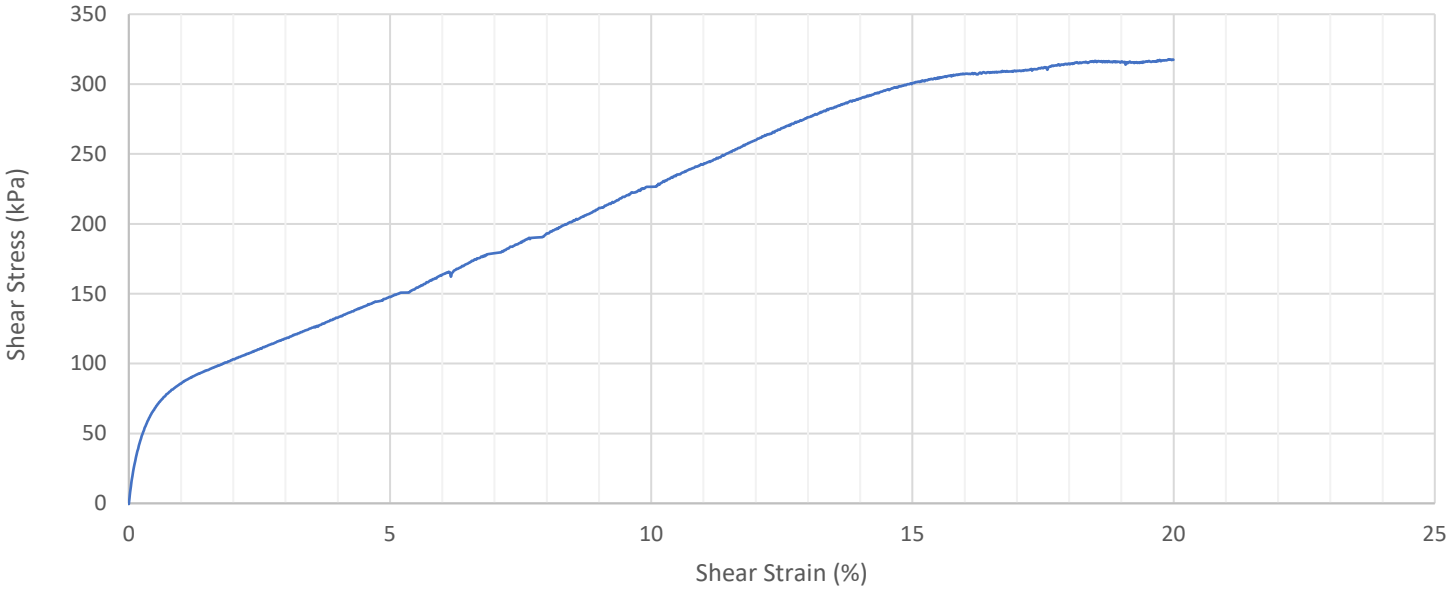
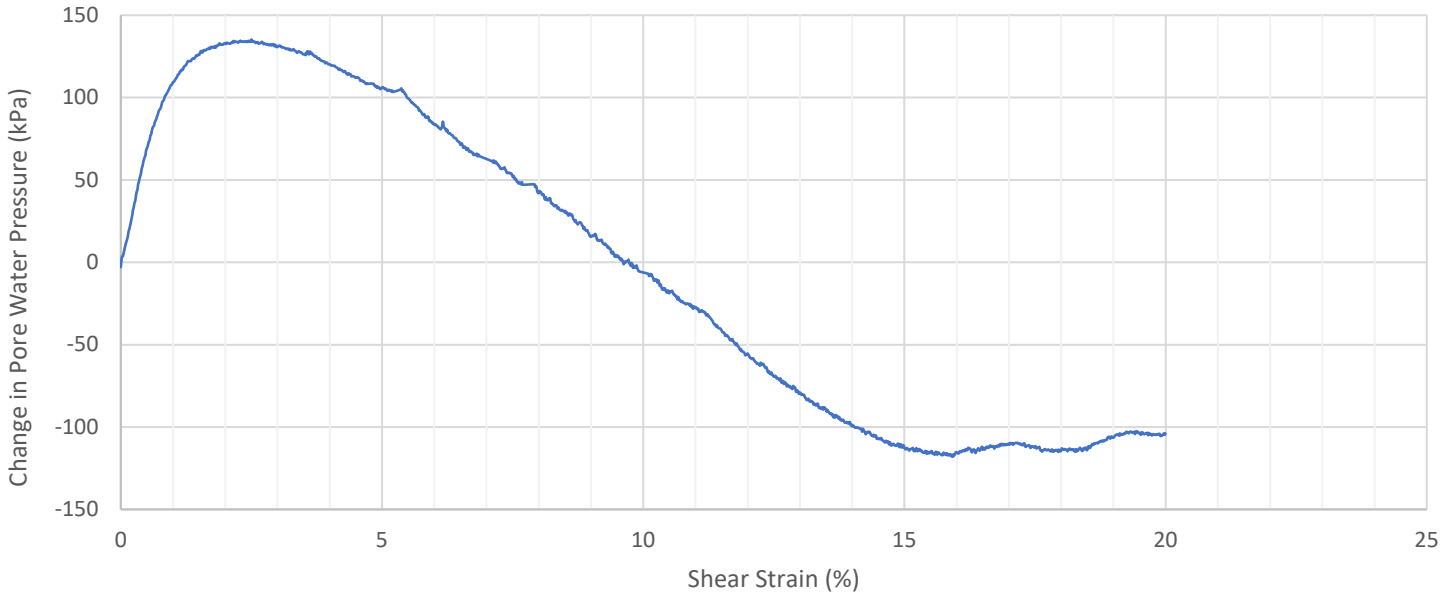
Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079





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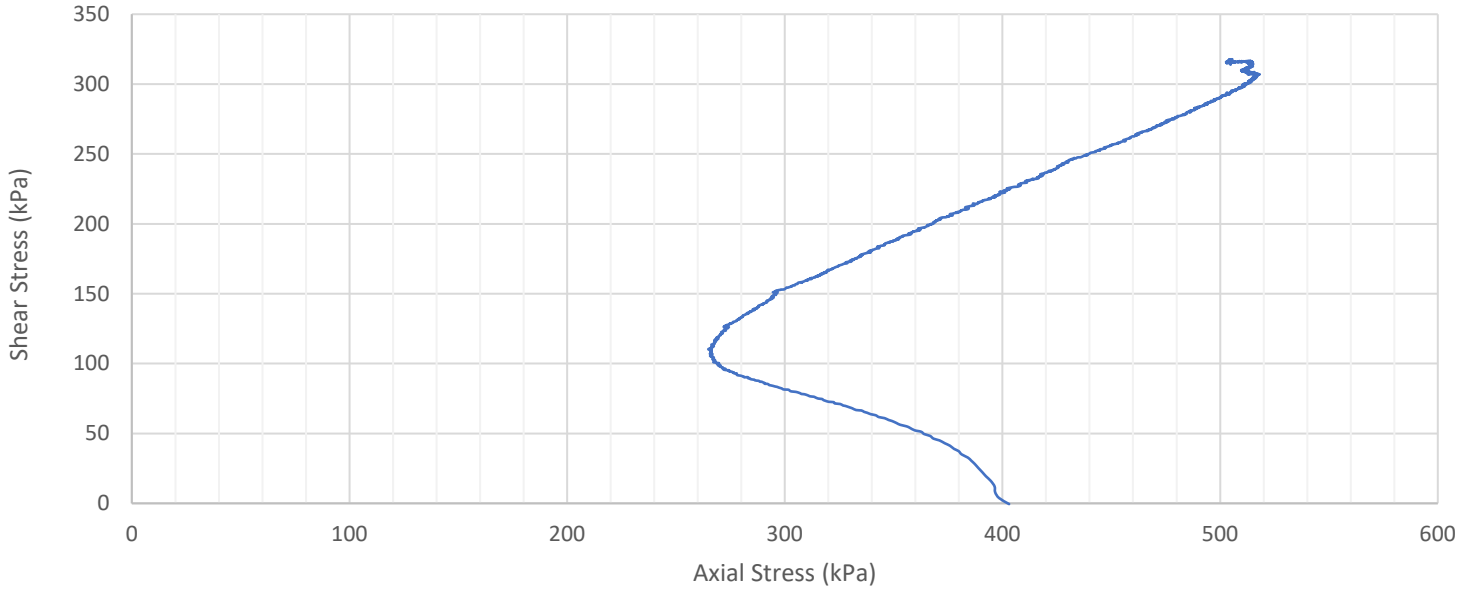
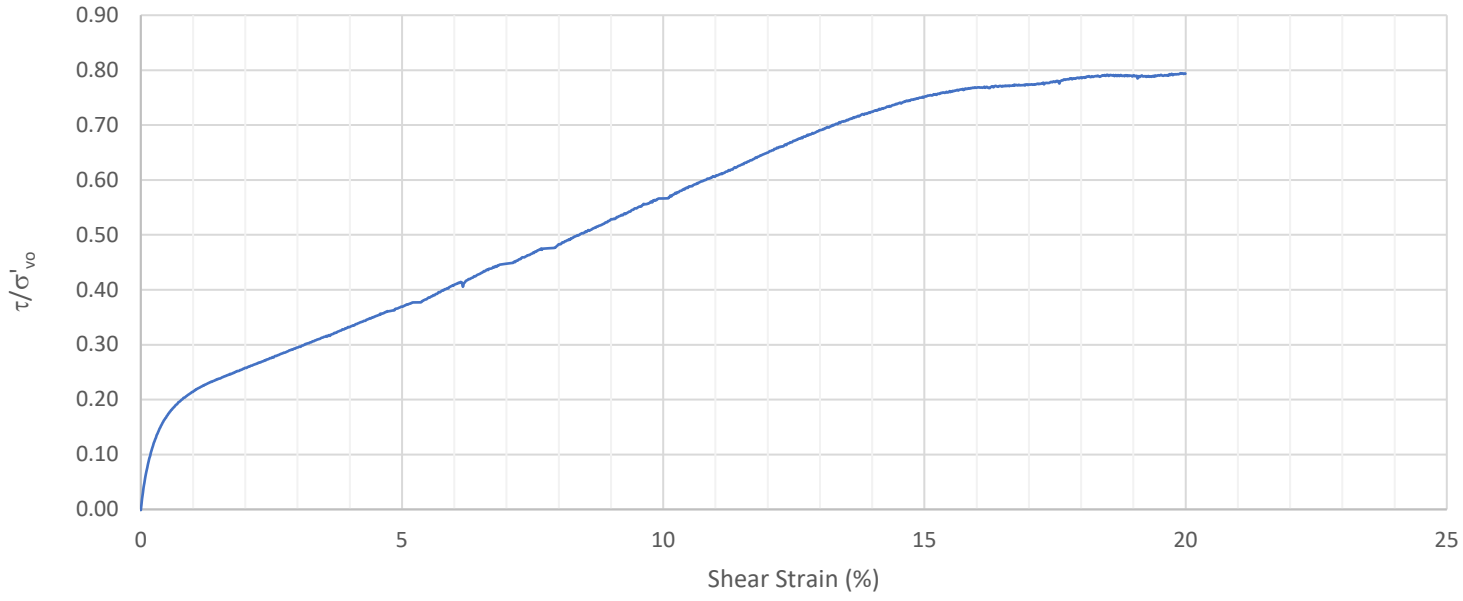
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-04 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079





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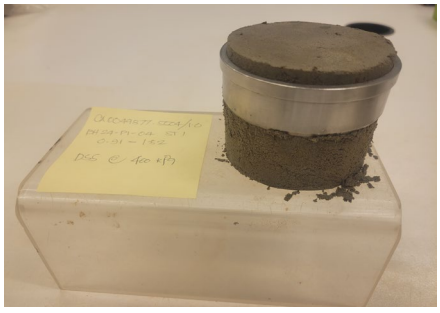
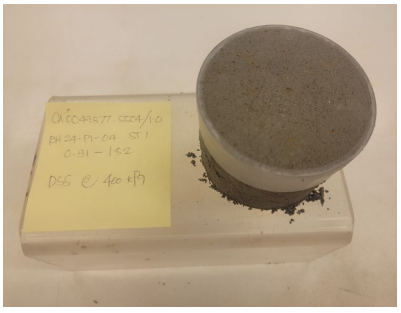
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	0.91 - 1.52
Client:	Tetra Tech	**Lab ID No:**	B25-079









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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~350ml of water passed through sample during consolidation
Target dry density = 1,710kg/m³, Achieved dry density = 1707kg/m³
Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 1

Vertical LVDT	Serial No.:	113179
Vertical Load Cell	Serial No.:	89612
Shear Load Cell	Serial No.:	30465

Sample Properties

Preparation Method	Moist Tamping
Height (mm)	23.73
Diameter (mm)	71.85
Area (cm^2)	40.55
Volume (cm^3)	96.21
Specific Gravity (assumed)	2.85

Visual Description	SILT, some sand, grey, w > PL, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	181.71
Dry Mass (g)	164.24
Initial Wet Unit Weight (kN/m^3)	18.53
Initial Dry Unit Weight (kN/m^3)	16.75

Initial Water Content (%)	10.64
Initial Saturation (%)	45.48
Final Water Content (%)	20.67
Final Saturation (%)	91.78

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	200.49
Vertical Stress at end of Consol (kPa)	199.97
Laboratory OCR	N/A

Max. Axial Strain %	1.50
Axial Strain at end of Consol. %	1.49
Change in Height ΔH_c (mm)	0.35

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	201.16
Initial Shear Stress (kPa)	-2.71
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.00
Test Condition	Undrained

Peak Shear Strength (kPa)	59.51
Excess Pore Pressure at Peak (kPa)	47.92
Ratio of Peak / σ'_v	0.30
Maximum Shear Strain γ_{MAX} (%)	20.01
Shear Strength at γ_{MAX} (kPa)	46.44

Comments / Special Instructions

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079

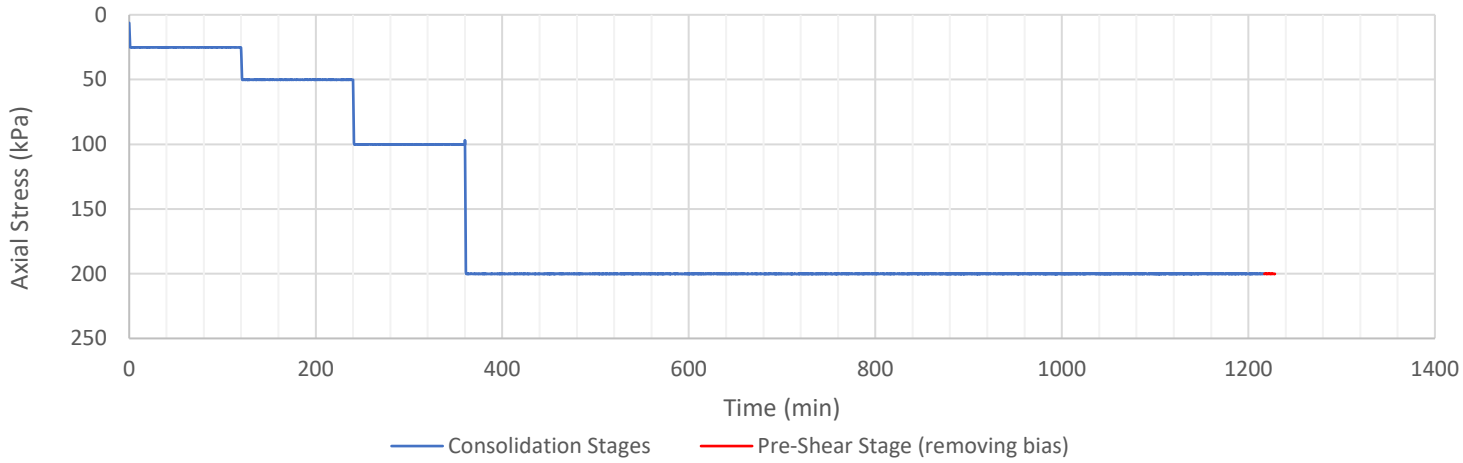
Consolidation Summary

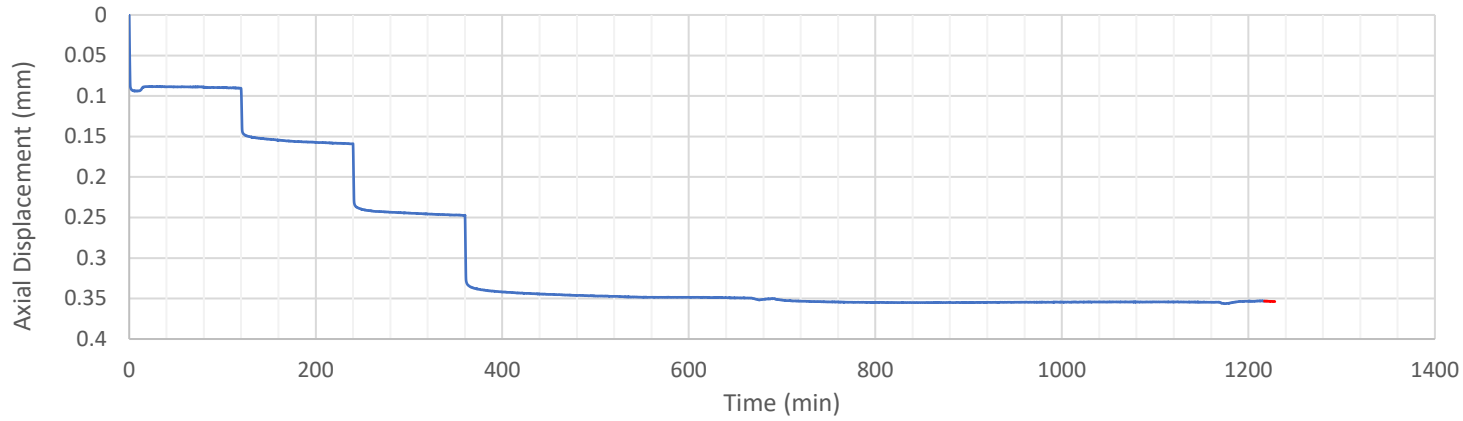
Stress at end of Consolidation (kPa)	199.97
Axial Strain at end of Consolidation (%)	1.49
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.35

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200							
Load (kN)	0.1028	0.204	0.407	0.8129							
Duration (min)	120	120	120	857							
Axial Strain (%)	0.40	0.67	1.04	1.50							





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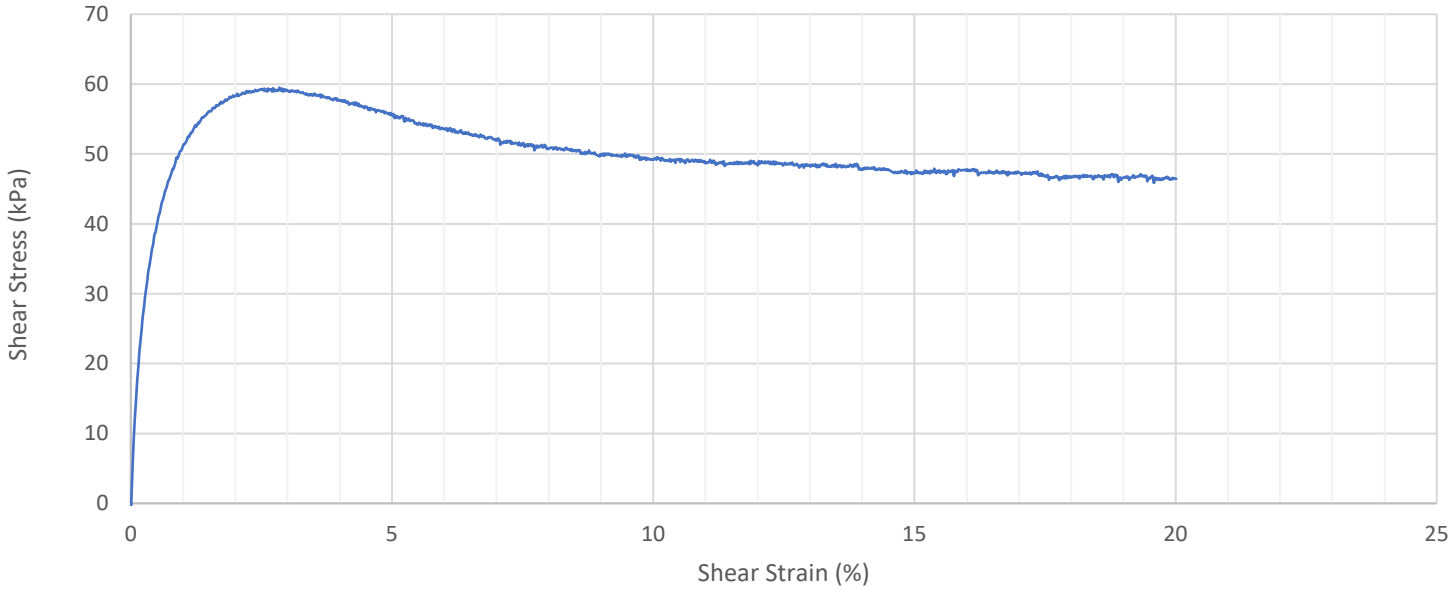
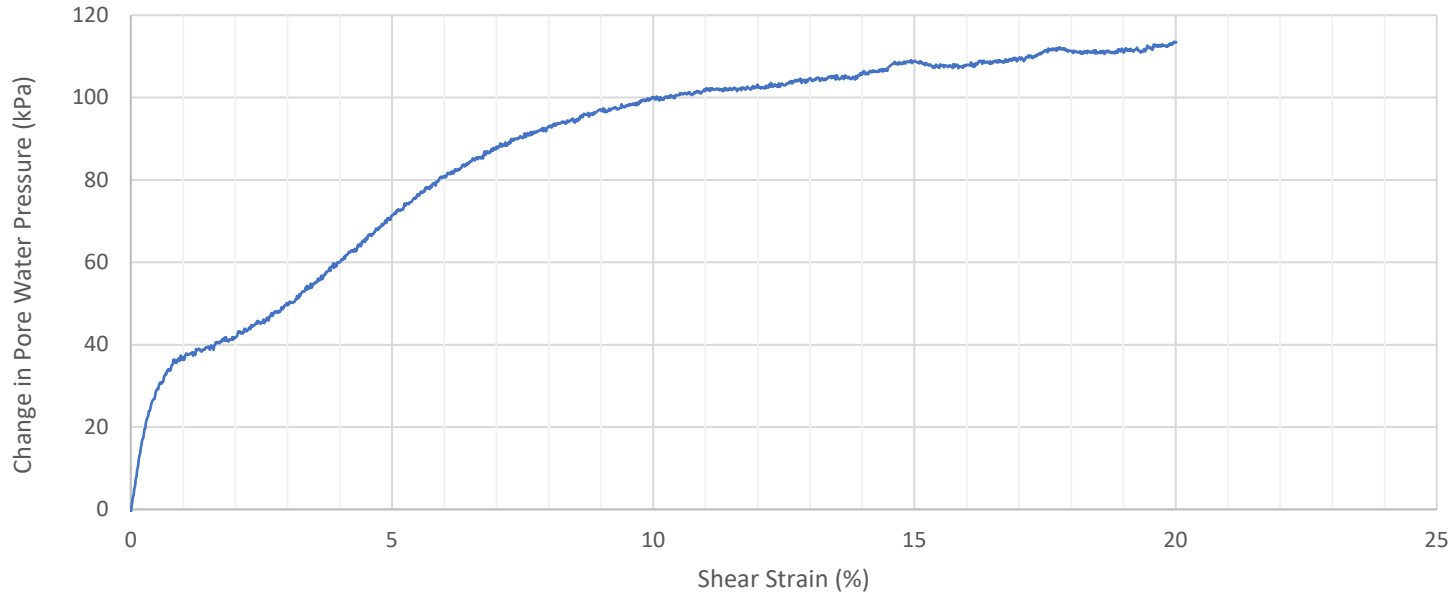
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079





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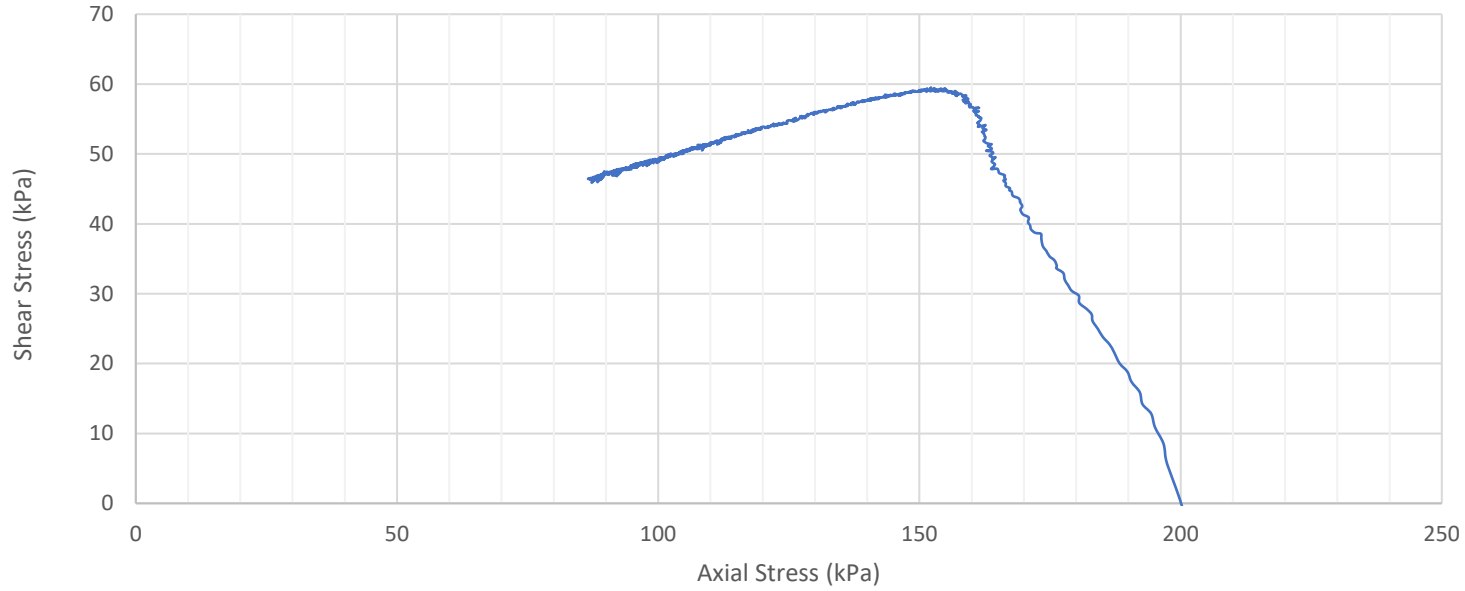
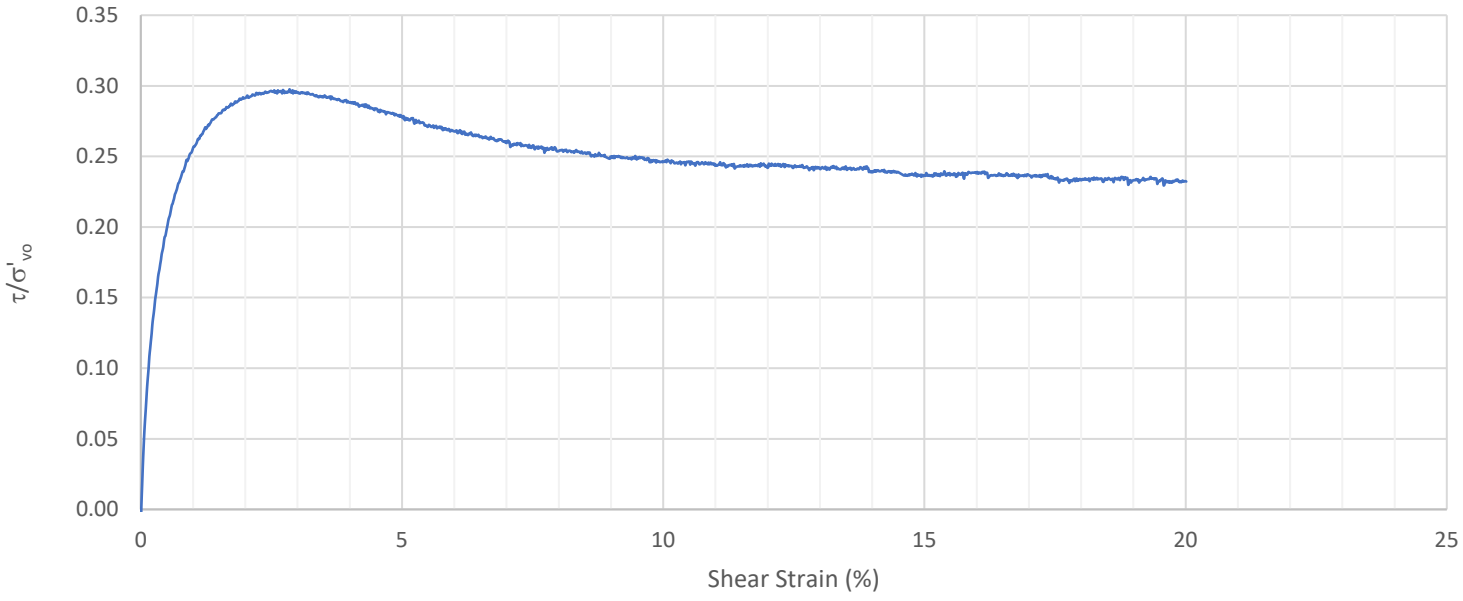
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079





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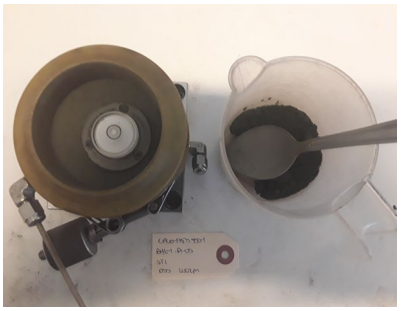
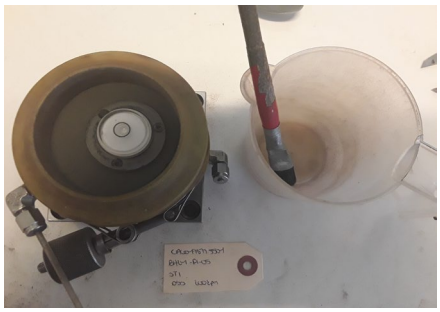
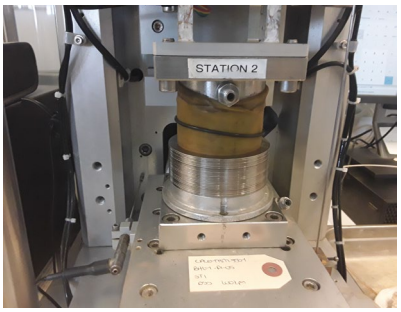
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079







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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

Minimal water passed through sample during consolidation
Target dry density = 1,710kg/m³, Achieved dry density = 1705kg/m³
Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 1

Vertical LVDT	Serial No.:	113179
Vertical Load Cell	Serial No.:	89612
Shear Load Cell	Serial No.:	30465

Sample Properties

Preparation Method	Moist Tamping
Height (mm)	23.74
Diameter (mm)	71.92
Area (cm^2)	40.62
Volume (cm^3)	96.44
Specific Gravity (assumed)	2.85

Visual Description	SILT, some sand, grey, w > PL, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	181.87
Dry Mass (g)	164.39
Initial Wet Unit Weight (kN/m^3)	18.50
Initial Dry Unit Weight (kN/m^3)	16.72

Initial Water Content (%)	10.63
Initial Saturation (%)	45.30
Final Water Content (%)	19.04
Final Saturation (%)	84.12

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	400.25
Vertical Stress at end of Consol (kPa)	400.00
Laboratory OCR	N/A

Max. Axial Strain %	1.40
Axial Strain at end of Consol. %	1.38
Change in Height ΔH_c (mm)	0.33

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	400.00
Initial Shear Stress (kPa)	0.17
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.04
Test Condition	Undrained

Peak Shear Strength (kPa)	91.18
Excess Pore Pressure at Peak (kPa)	150.40
Ratio of Peak / σ'_v	0.23
Maximum Shear Strain γ_{MAX} (%)	20.17
Shear Strength at γ_{MAX} (kPa)	71.85

Comments / Special Instructions

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Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079

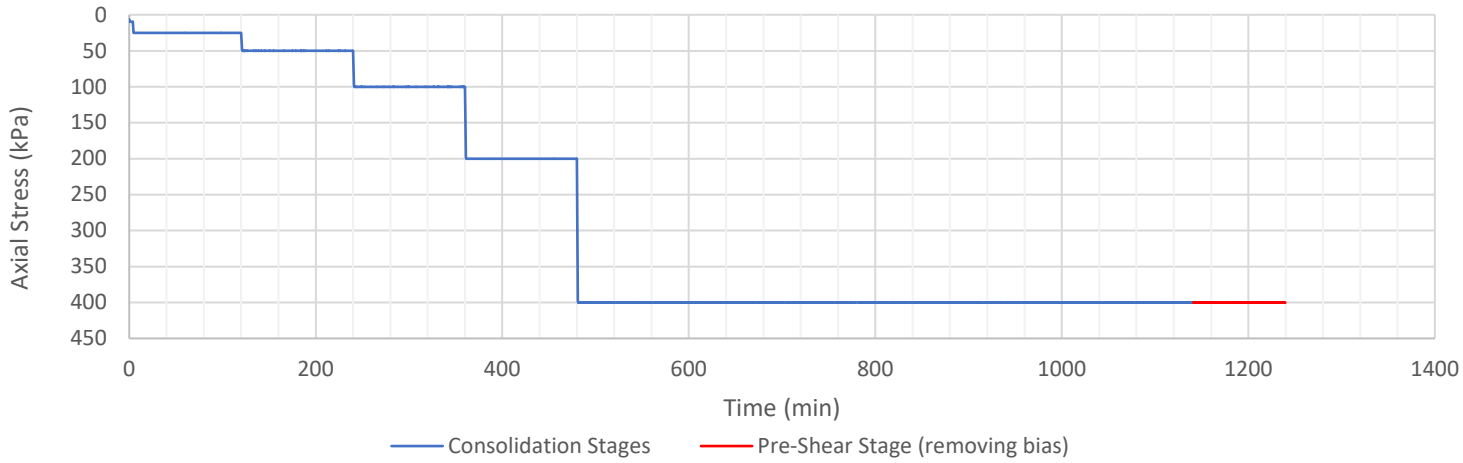
Consolidation Summary

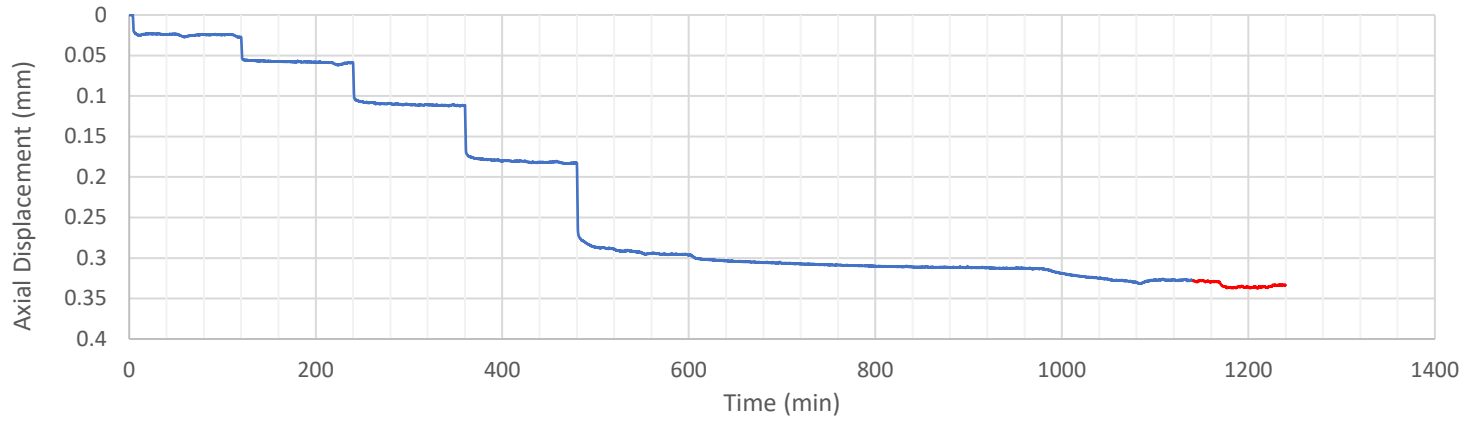
Stress at end of Consolidation (kPa)	400.00
Axial Strain at end of Consolidation (%)	1.38
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.33

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400						
Load (kN)	0.102	0.204	0.407	0.813	1.626						
Duration (min)	120	120	120	120	661						
Axial Strain (%)	0.12	0.26	0.47	0.77	1.40						





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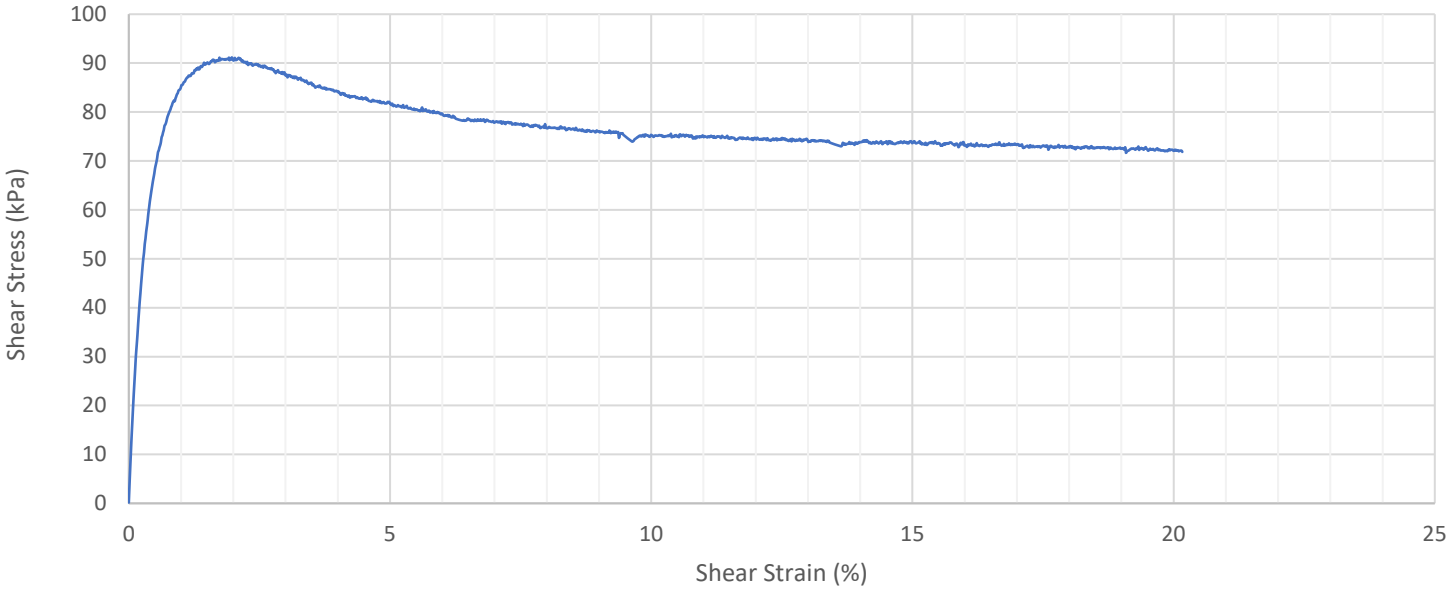
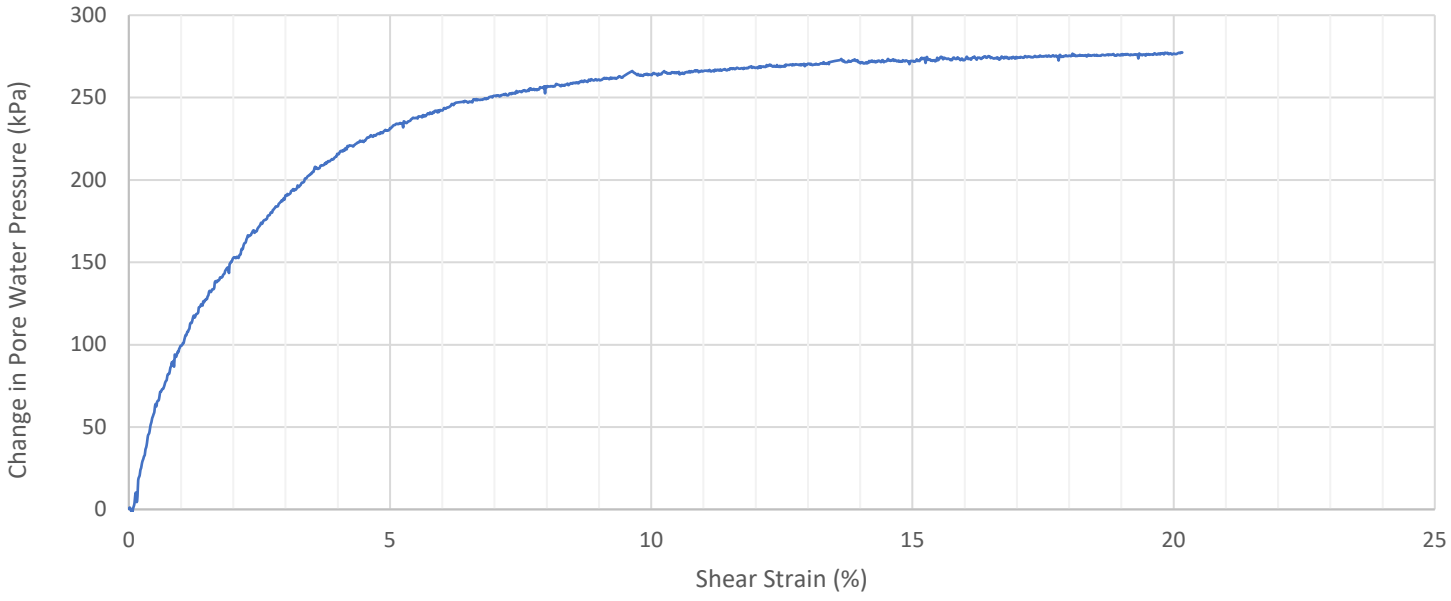
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079





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T. Madera	July 3, 2025	M. Badanagki	July 11, 2025
TESTED BY	DATE	CHECKED BY	DATE

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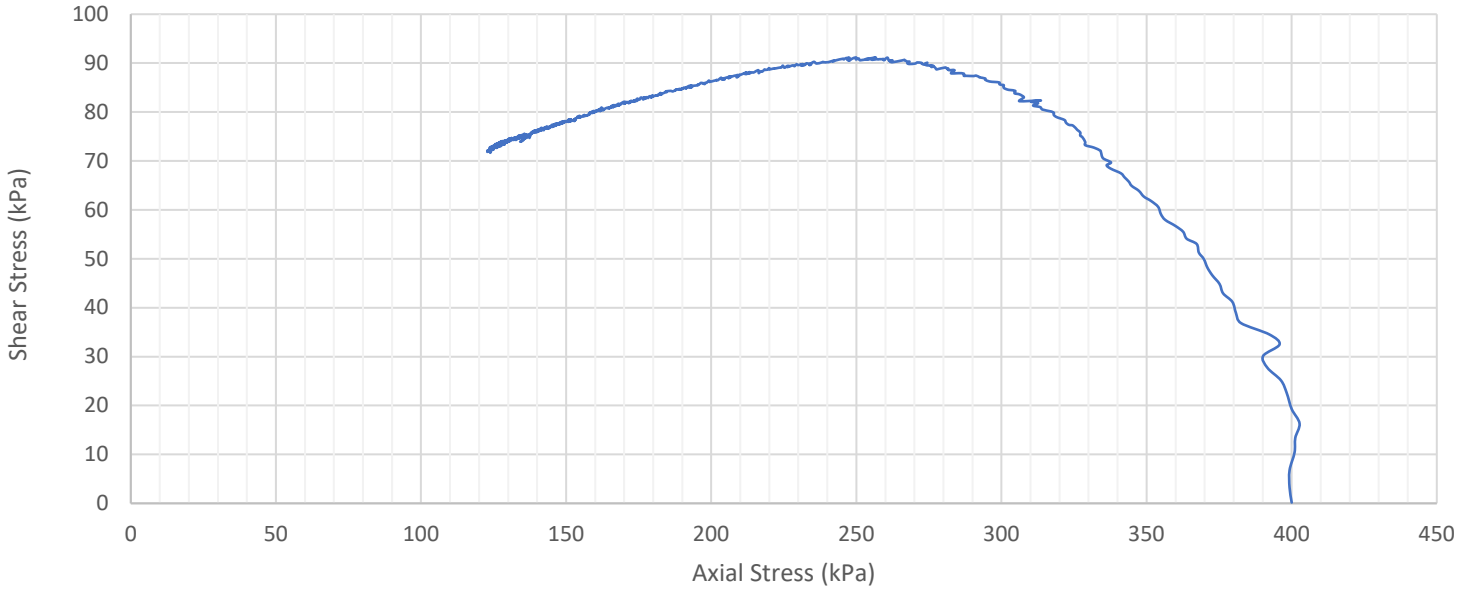
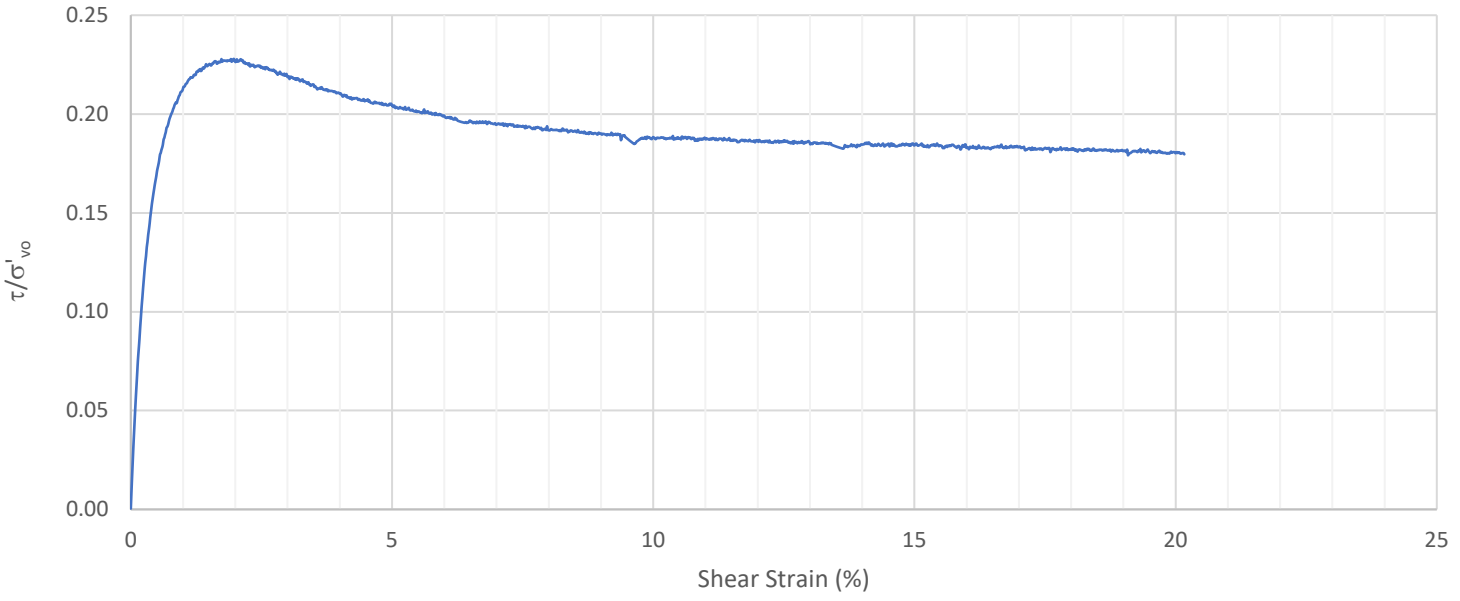
Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079





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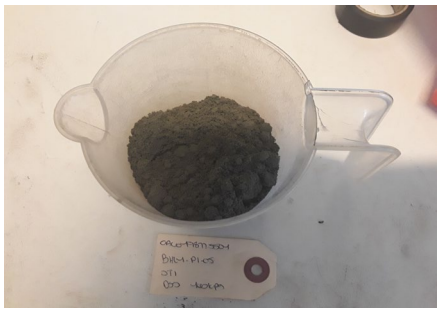





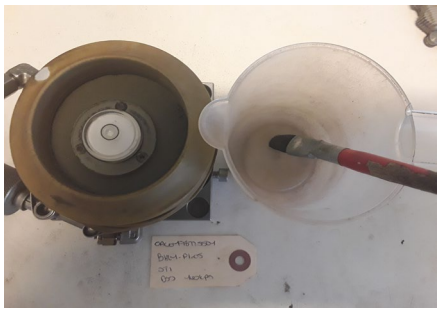


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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~150ml of water passed through sample during consolidation
Target dry density = 1,710kg/m³, Achieved dry density = 1709kg/m³
Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.74
Diameter (mm)	71.85
Area (cm^2)	40.55
Volume (cm^3)	96.26
Specific Gravity (assumed)	2.85

Visual Description	SILT, some sand, grey, w > PL, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	181.64	Initial Water Content (%)	10.45
Dry Mass (g)	164.46	Initial Saturation (%)	44.77
Initial Wet Unit Weight (kN/m^3)	18.51	Final Water Content (%)	19.77
Initial Dry Unit Weight (kN/m^3)	16.76	Final Saturation (%)	93.83

Consolidation

Effective Overburden Pressure (kPa)	N/A	Max. Axial Strain %	3.88
Max Applied Vertical Stress (kPa)	800.46	Axial Strain at end of Consol. %	3.88
Vertical Stress at end of Consol (kPa)	799.77	Change in Height ΔH_c (mm)	0.92
Laboratory OCR	N/A		

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	802.31	Peak Shear Strength (kPa)	132.47
Initial Shear Stress (kPa)	-0.30	Excess Pore Pressure at Peak (kPa)	357.06
Applied Shear Bias (kPa)	0.00	Ratio of Peak / σ'_v	0.17
Rate of Shearing (%/hr)	4.99	Maximum Shear Strain γ_{MAX} (%)	19.97
Test Condition	Undrained	Shear Strength at γ_{MAX} (kPa)	109.28

Comments / Special Instructions

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Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST1
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079

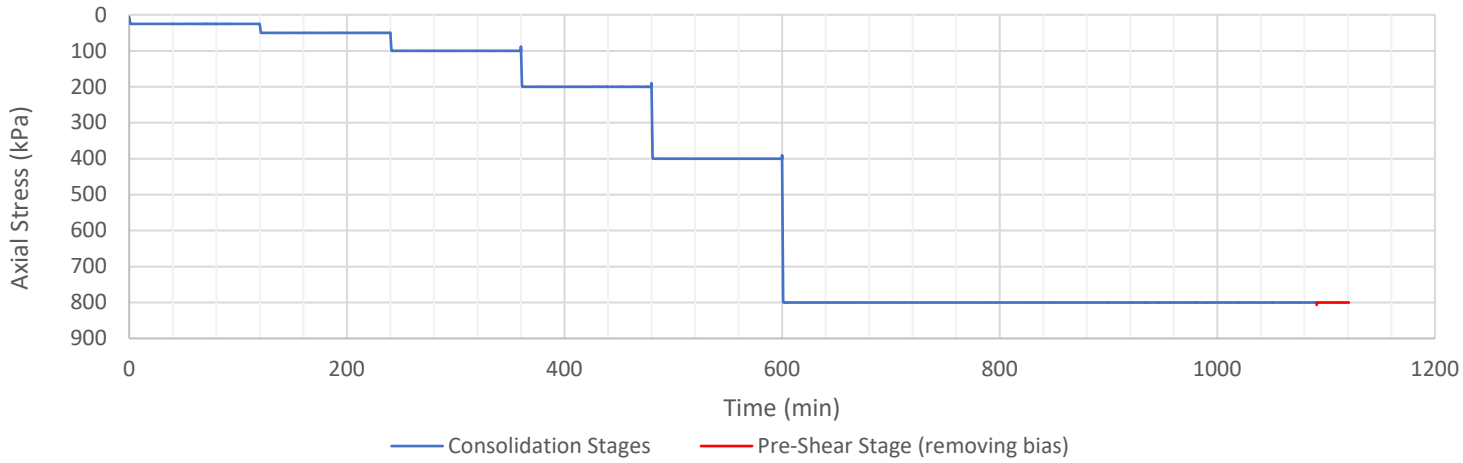
Consolidation Summary

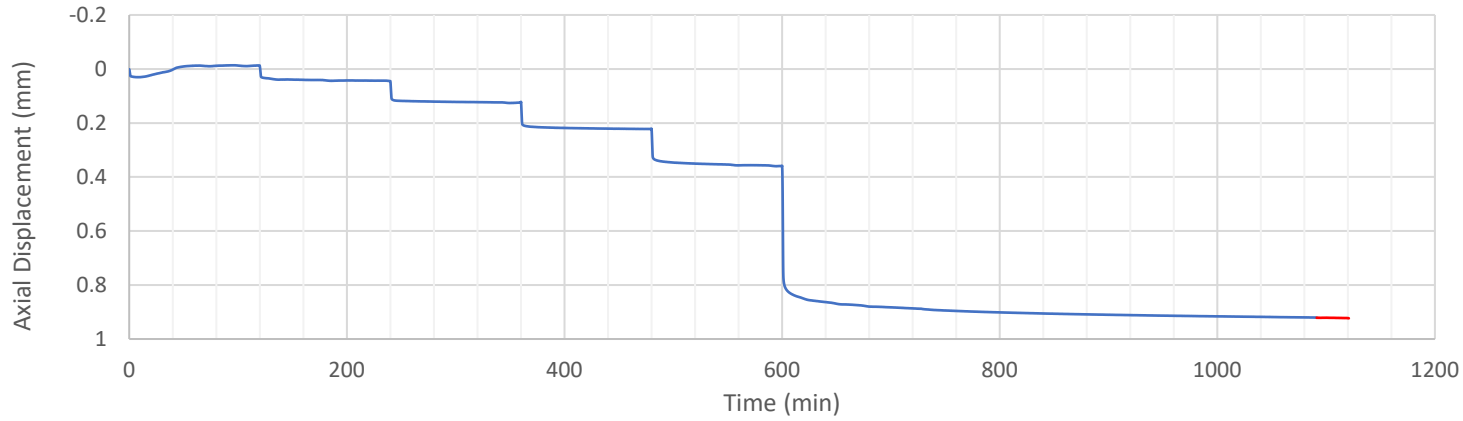
Stress at end of Consolidation (kPa)	799.77
Axial Strain at end of Consolidation (%)	3.88
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.92

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400	800					
Load (kN)	0.103	0.2045	0.407	0.8129	1.6235	3.2455					
Duration (min)	120	120	120	120	120	491					
Axial Strain (%)	0.13	0.19	0.53	0.94	1.52	3.88					





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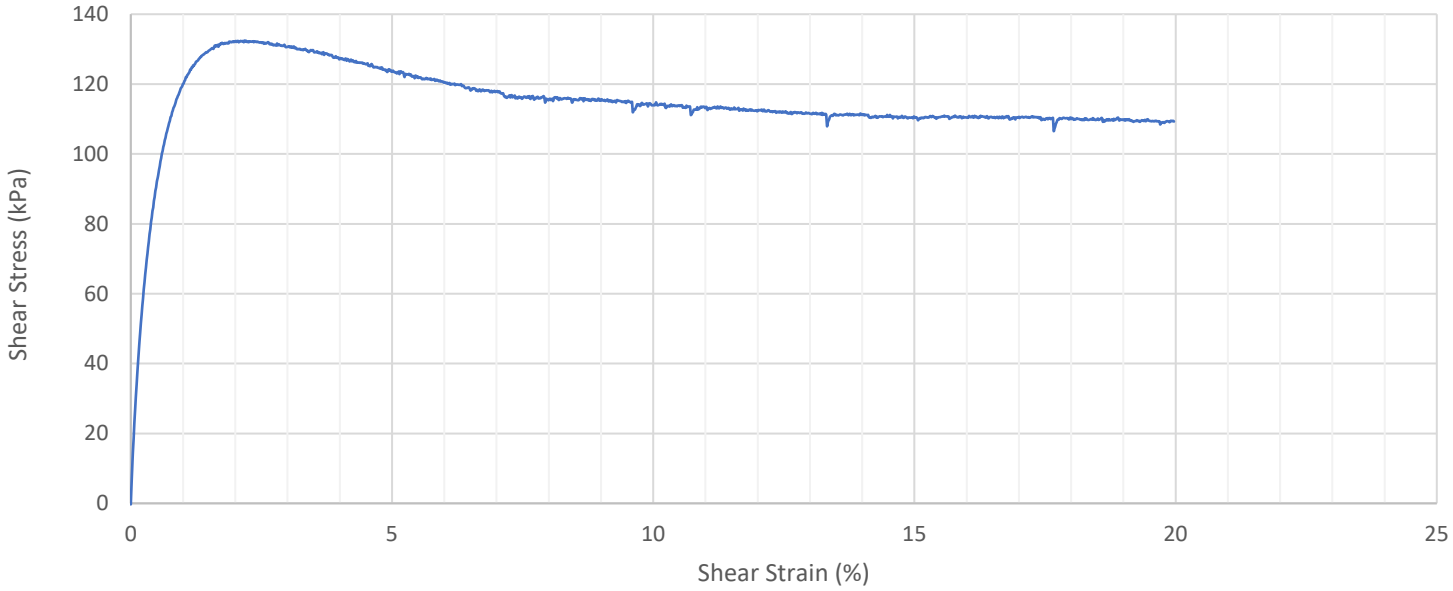
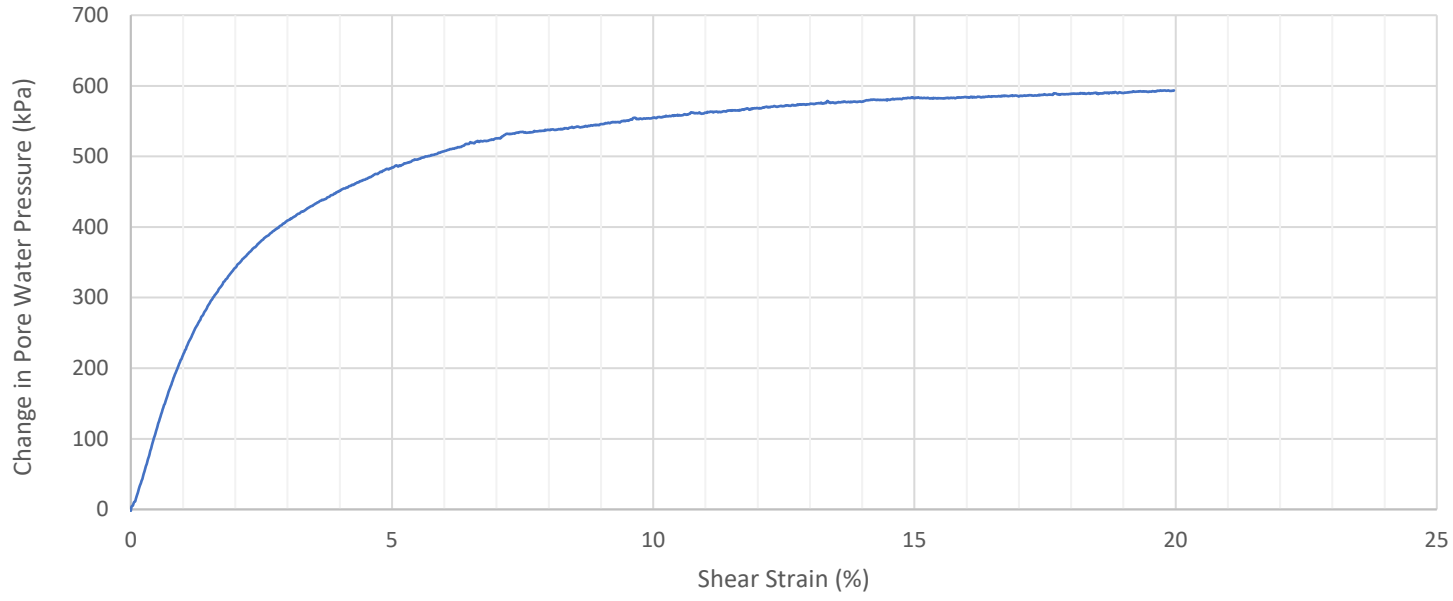
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079





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Location:	Yukon	**Depth (m):**	2.13 - 2.74
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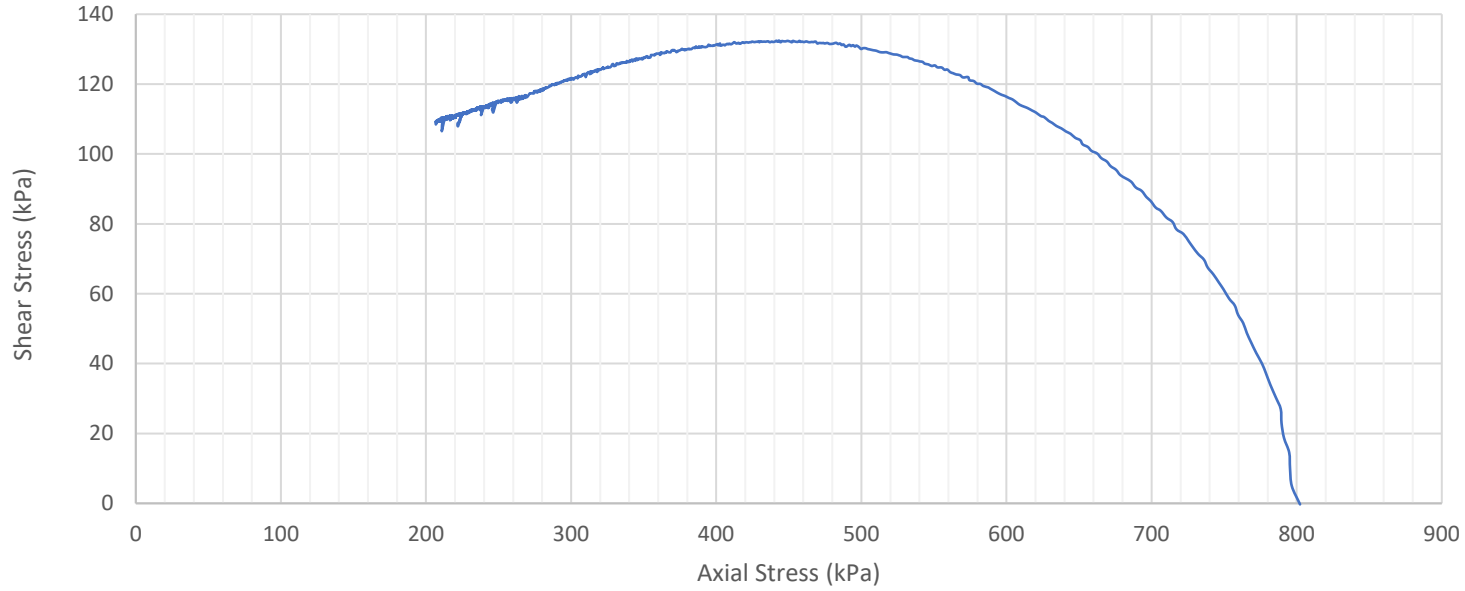

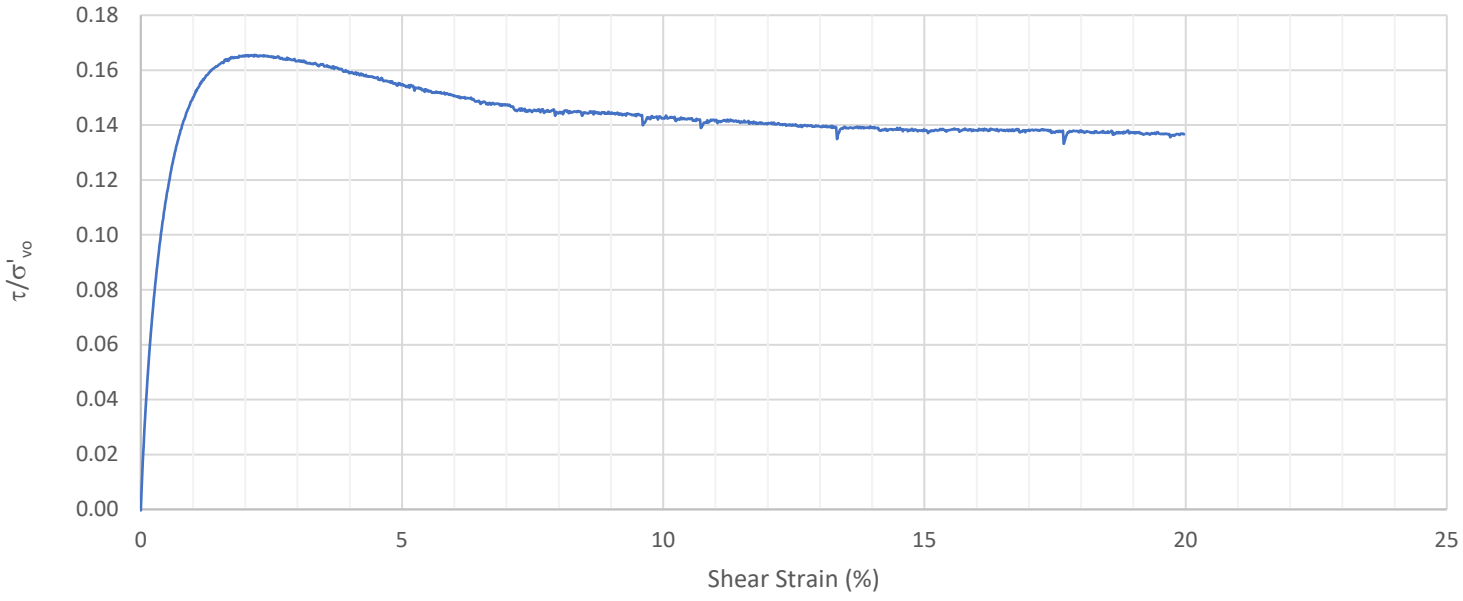

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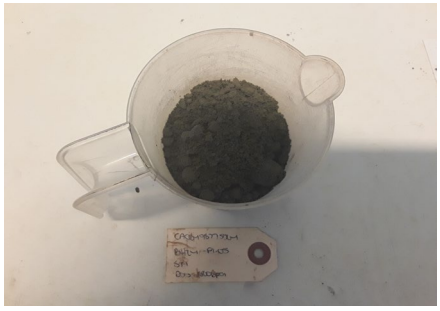
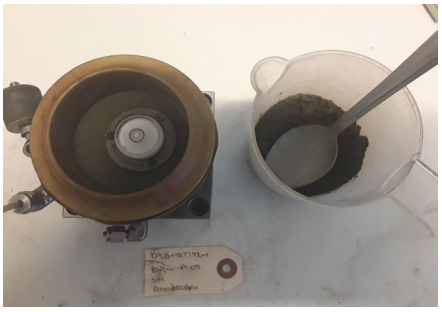
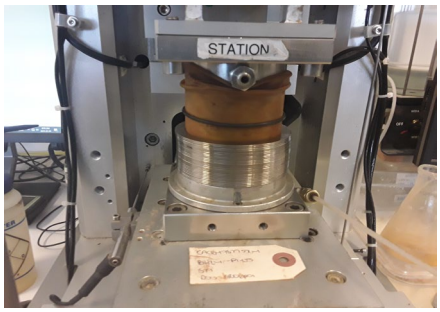
Location:	Yukon	**Depth (m):**	2.13 - 2.74
Client:	Tetra Tech	**Lab ID No:**	B25-079









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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~100ml of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.24
Diameter (mm)	70.59
Area (cm^2)	39.14
Volume (cm^3)	94.87
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	213.51
Dry Mass (g)	183.95
Initial Wet Unit Weight (kN/m^3)	22.08
Initial Dry Unit Weight (kN/m^3)	19.02

Initial Water Content (%)	16.07
Initial Saturation (%)	88.56
Final Water Content (%)	17.76
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	201.20
Vertical Stress at end of Consol (kPa)	200.61
Laboratory OCR	N/A

Max. Axial Strain %	3.90
Axial Strain at end of Consol. %	3.90
Change in Height ΔH_c (mm)	0.95

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	200.74
Initial Shear Stress (kPa)	-0.13
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.01
Test Condition	Undrained

Peak Shear Strength (kPa)	271.34
Excess Pore Pressure at Peak (kPa)	-237.68
Ratio of Peak / σ'_v	1.35
Maximum Shear Strain γ_{MAX} (%)	20.06
Shear Strength at γ_{MAX} (kPa)	270.93

Comments / Special Instructions

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Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

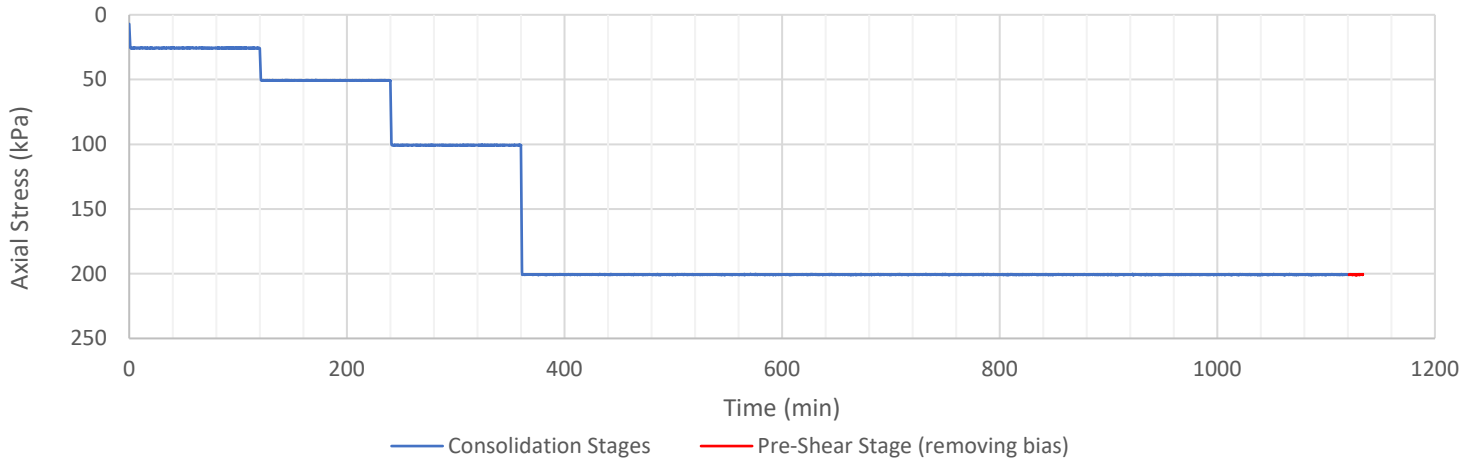
Consolidation Summary

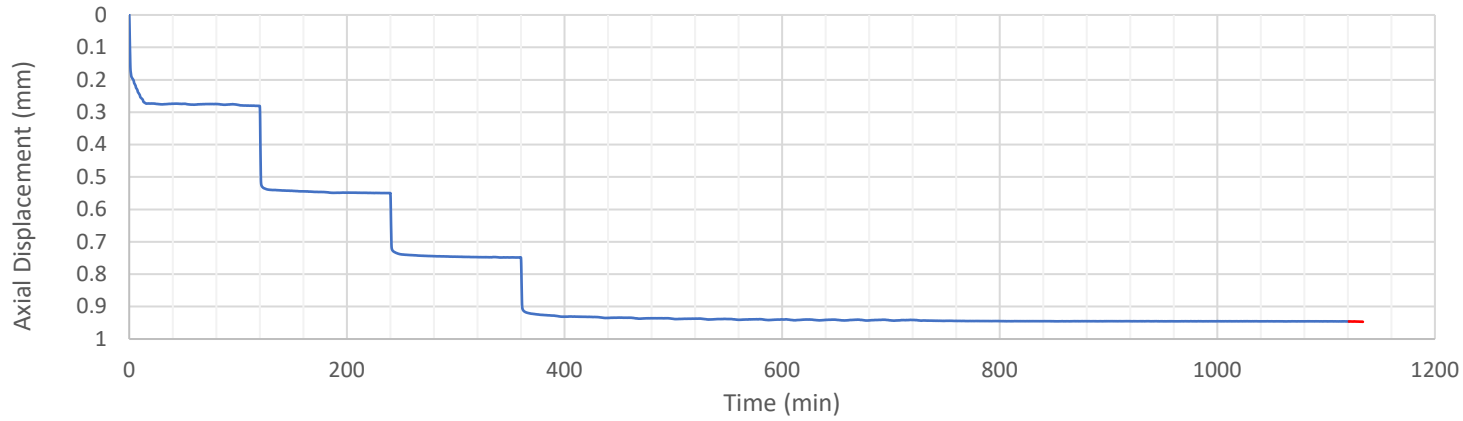
Stress at end of Consolidation (kPa)	200.61
Axial Strain at end of Consolidation (%)	3.90
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.95

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200							
Load (kN)	0.1018	0.1994	0.3951	0.7874							
Duration (min)	120	120	120	761							
Axial Strain (%)	1.16	2.27	3.09	3.90							





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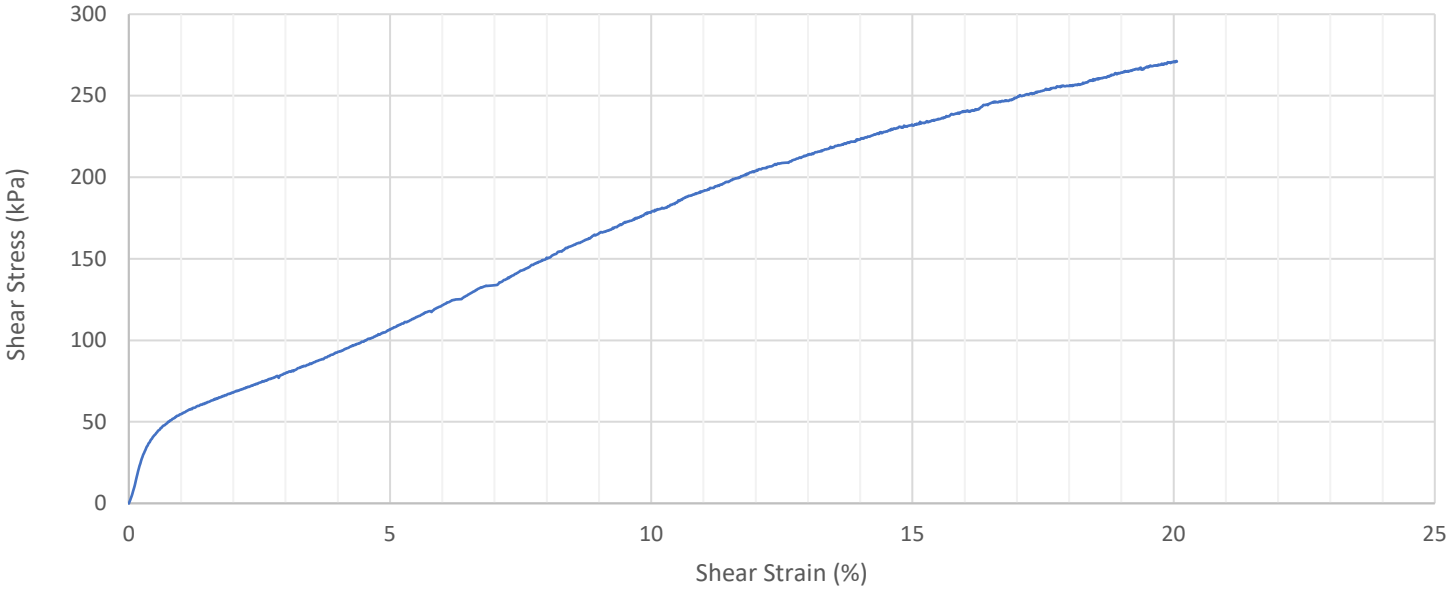

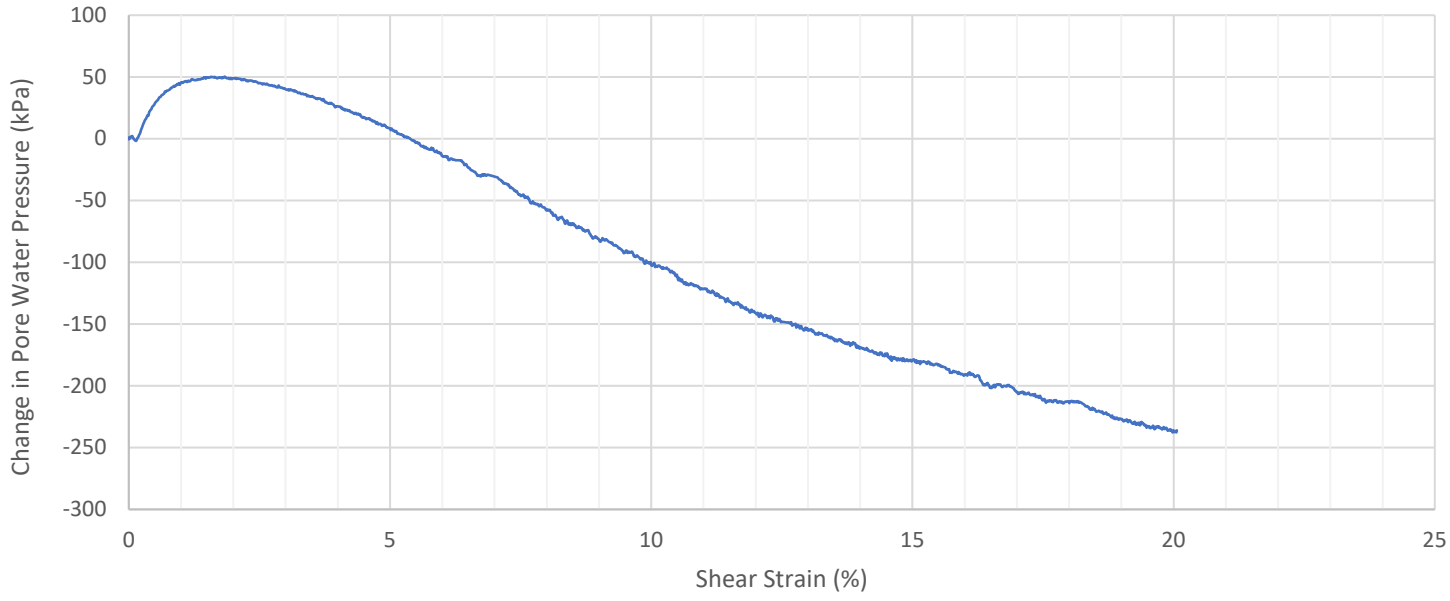

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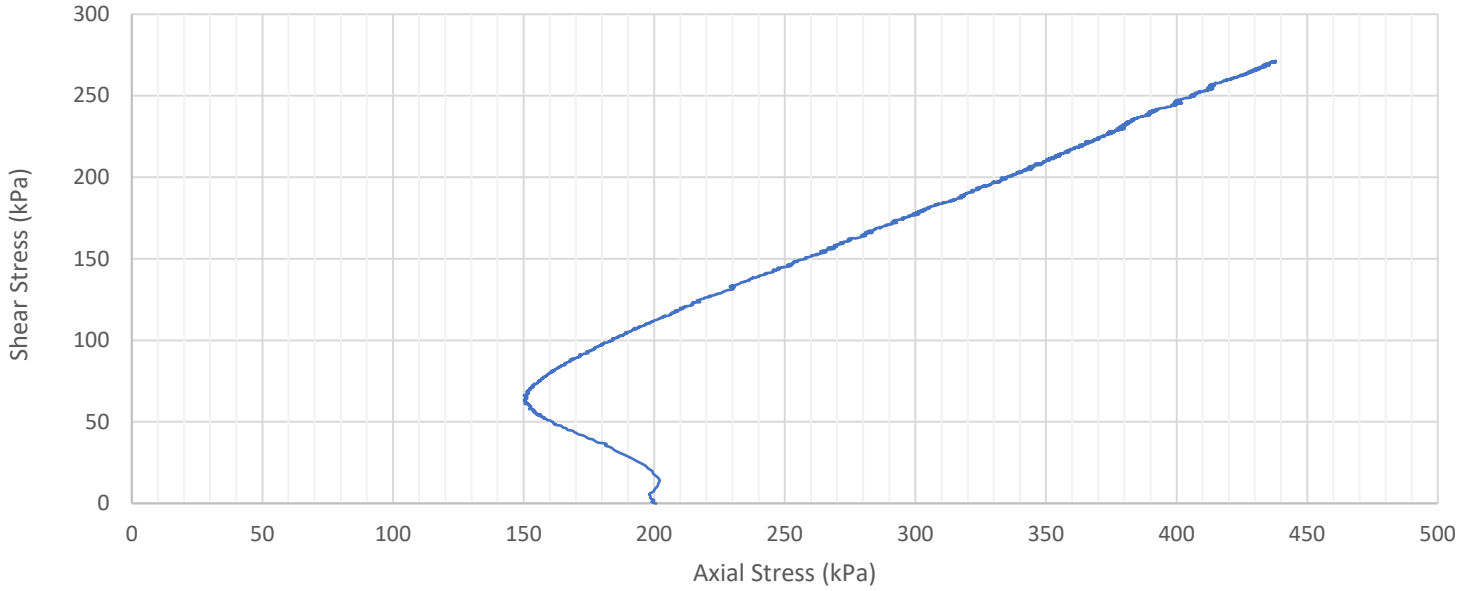

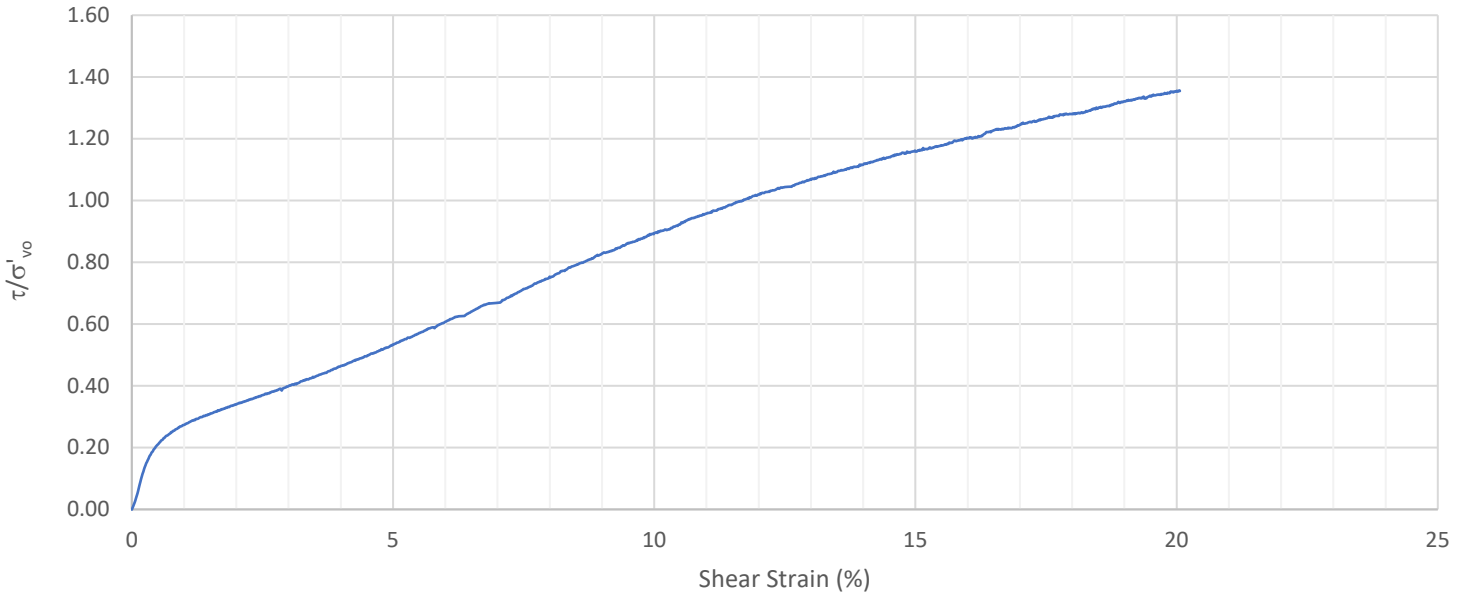

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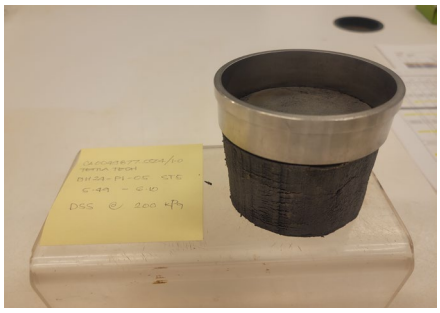
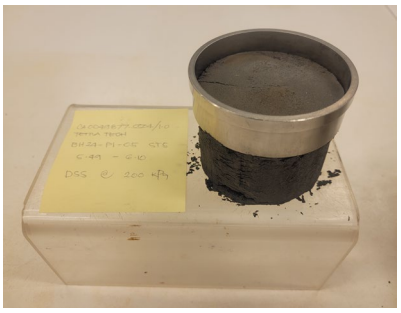
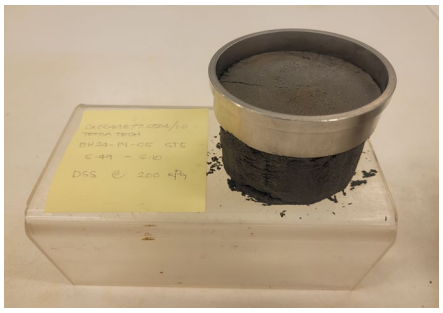
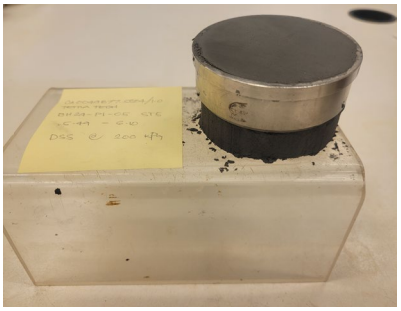
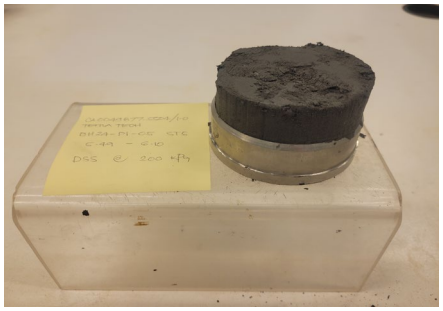
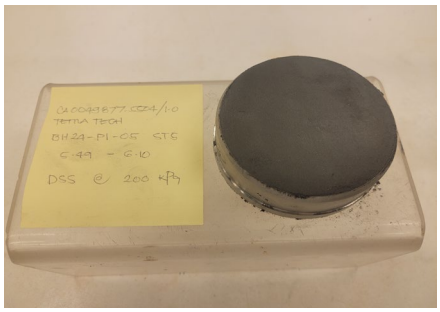
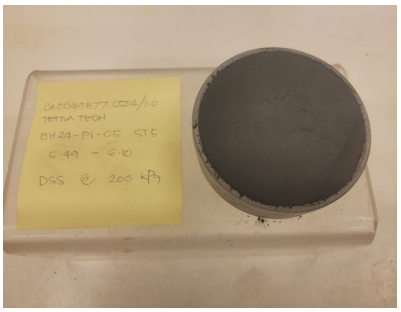
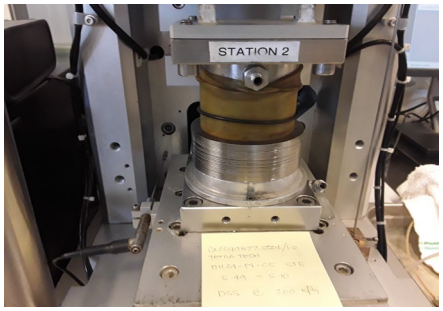
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079





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T. Madera	June 10, 2025	M. Badanagki	June 13, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc.
300, 3811 North Fraser Way, Burnaby, British Columbia, Canada V5J 5J2
Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

Minimal water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.88
Diameter (mm)	70.05
Area (cm^2)	38.54
Volume (cm^3)	92.03
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	210.50
Dry Mass (g)	182.87
Initial Wet Unit Weight (kN/m^3)	22.44
Initial Dry Unit Weight (kN/m^3)	19.49

Initial Water Content (%)	15.11
Initial Saturation (%)	89.39
Final Water Content (%)	16.86
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	400.60
Vertical Stress at end of Consol (kPa)	400.24
Laboratory OCR	N/A

Max. Axial Strain %	3.59
Axial Strain at end of Consol. %	3.59
Change in Height ΔH_c (mm)	0.85

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	401.48
Initial Shear Stress (kPa)	-0.42
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	4.99
Test Condition	Undrained

Peak Shear Strength (kPa)	329.04
Excess Pore Pressure at Peak (kPa)	-127.04
Ratio of Peak / σ'_v	0.82
Maximum Shear Strain γ_{MAX} (%)	19.98
Shear Strength at γ_{MAX} (kPa)	329.04

Comments / Special Instructions

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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

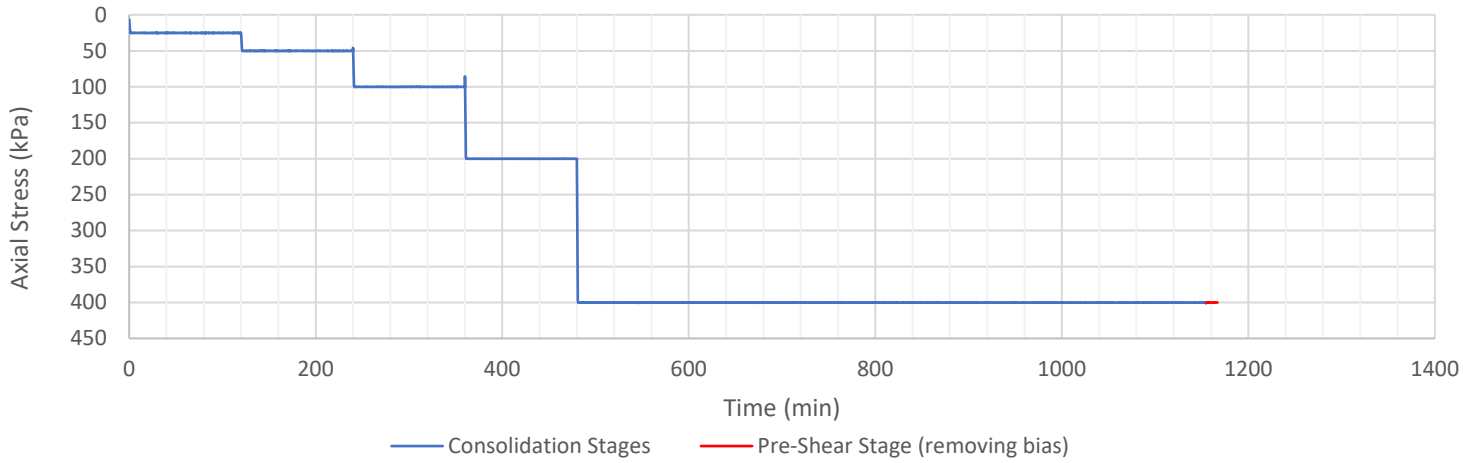
Consolidation Summary

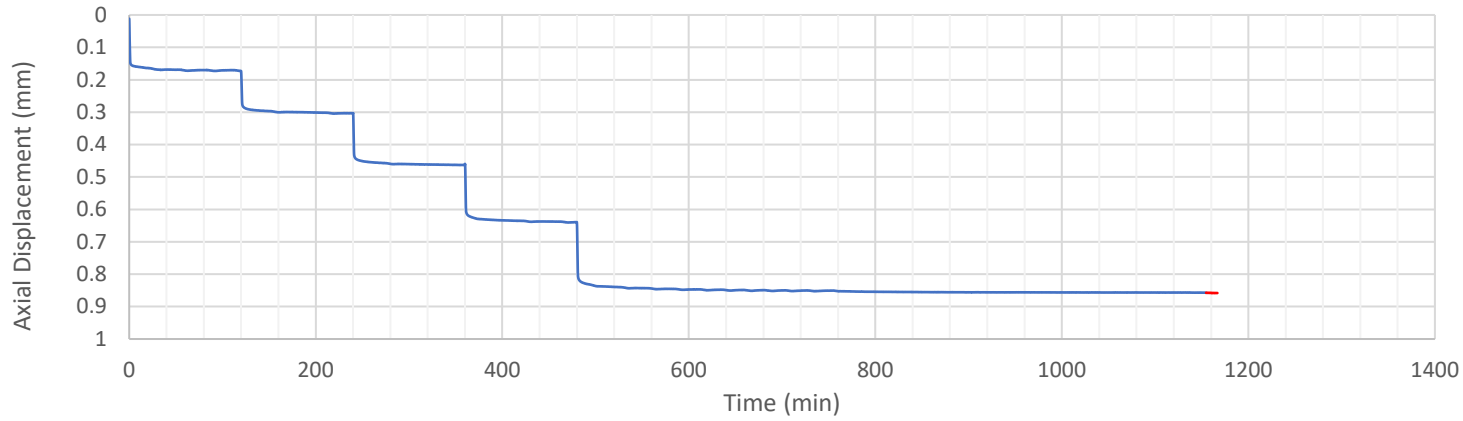
Stress at end of Consolidation (kPa)	400.24
Axial Strain at end of Consolidation (%)	3.59
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.85

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400						
Load (kN)	0.098	0.1947	0.3867	0.7719	1.5439						
Duration (min)	120	120	120	120	675						
Axial Strain (%)	0.72	1.27	1.94	2.68	3.59						





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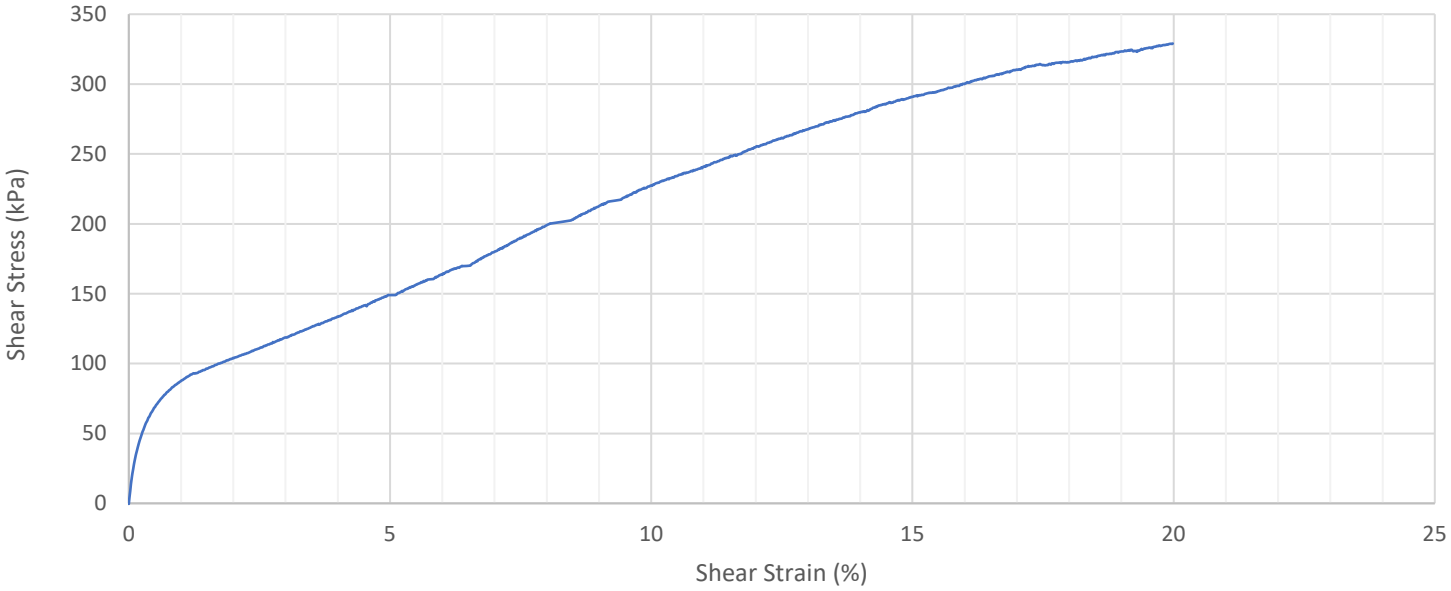
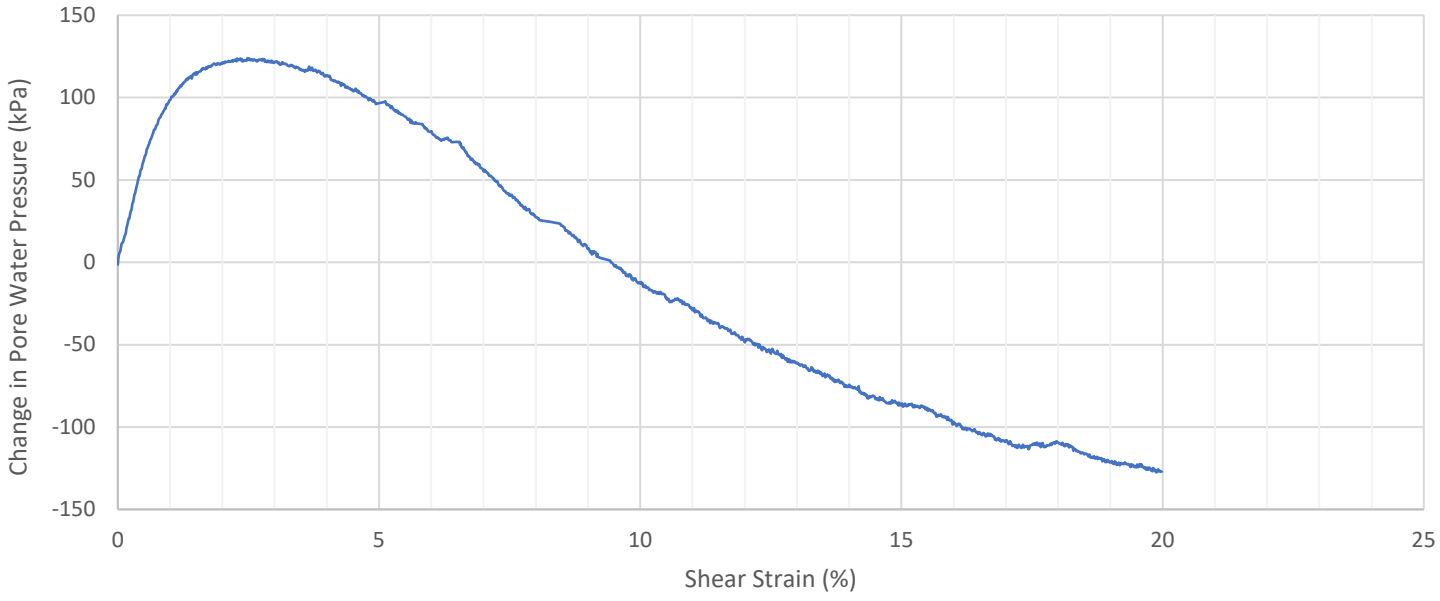
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079





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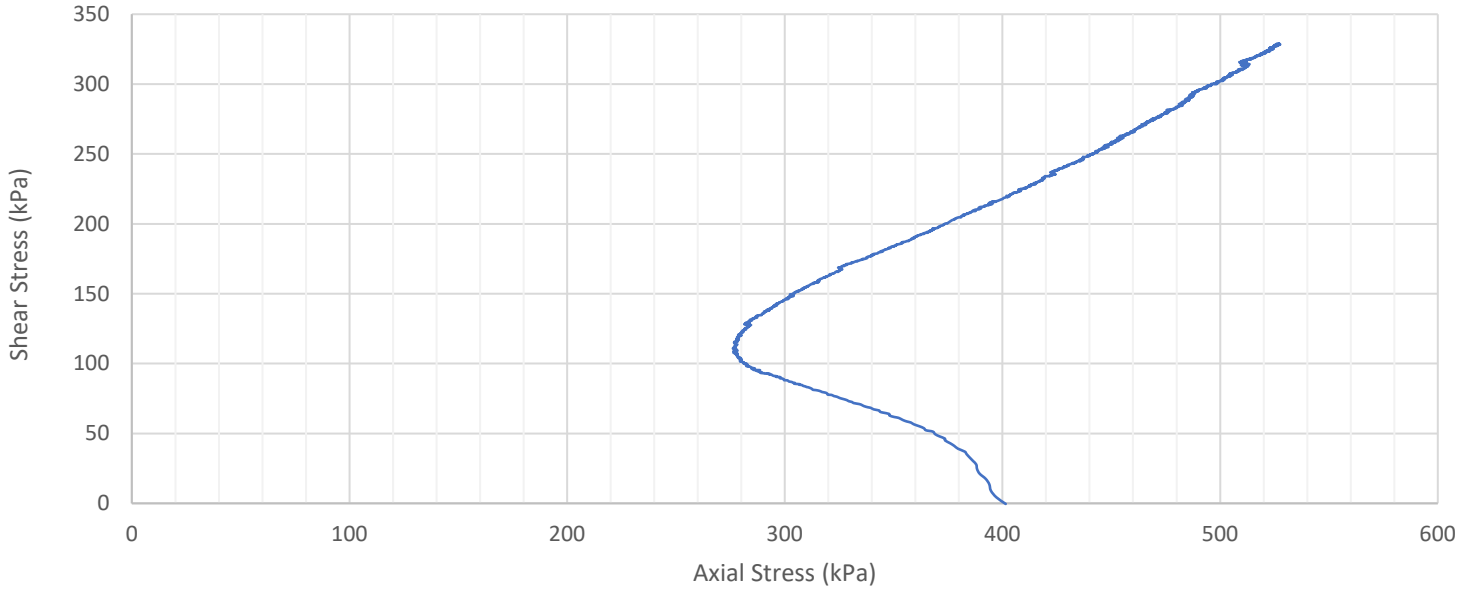
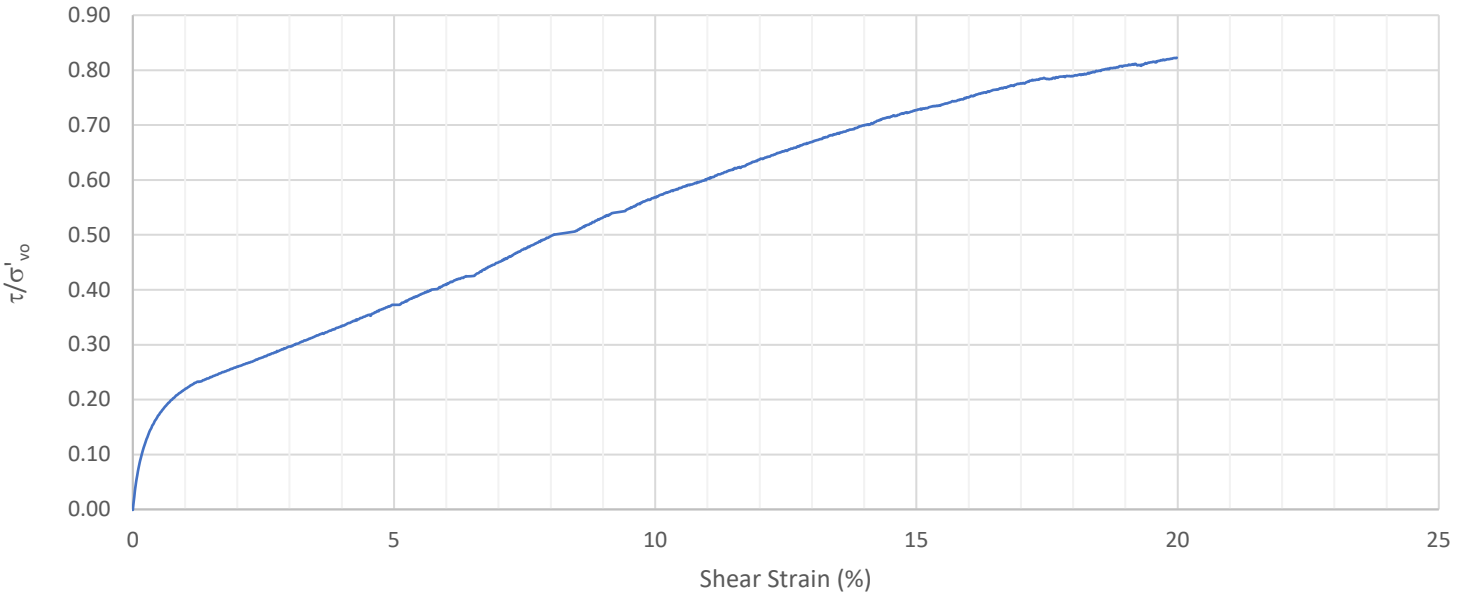
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079





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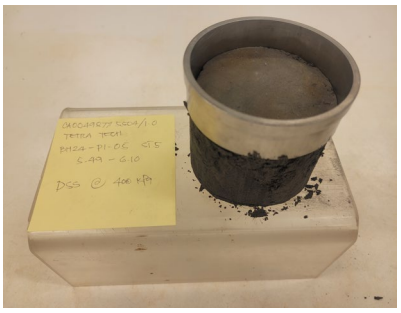
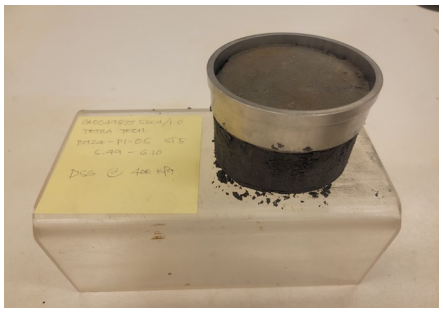
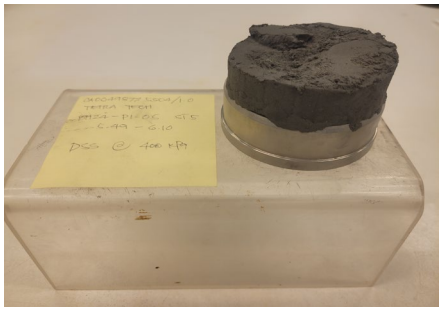
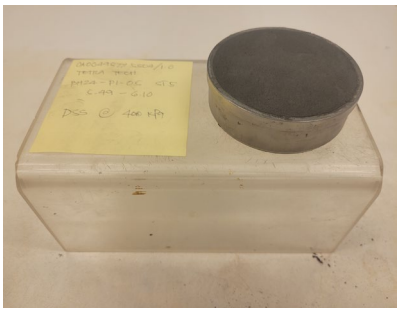
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

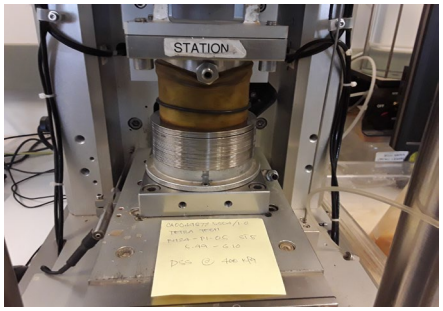










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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~25mL of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 1

Vertical LVDT	Serial No.:	113179
Vertical Load Cell	Serial No.:	89612
Shear Load Cell	Serial No.:	30465

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.89
Diameter (mm)	70.25
Area (cm^2)	38.76
Volume (cm^3)	92.60
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	208.42
Dry Mass (g)	179.97
Initial Wet Unit Weight (kN/m^3)	22.08
Initial Dry Unit Weight (kN/m^3)	19.07

Initial Water Content (%)	15.81
Initial Saturation (%)	87.70
Final Water Content (%)	16.86
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	800.31
Vertical Stress at end of Consol (kPa)	800.05
Laboratory OCR	N/A

Max. Axial Strain %	5.60
Axial Strain at end of Consol. %	5.60
Change in Height ΔH_c (mm)	1.34

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	800.05
Initial Shear Stress (kPa)	0.18
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	4.44
Test Condition	Undrained

Peak Shear Strength (kPa)	333.95
Excess Pore Pressure at Peak (kPa)	214.40
Ratio of Peak / σ'_v	0.42
Maximum Shear Strain γ_{MAX} (%)	17.75
Shear Strength at γ_{MAX} (kPa)	333.88

Comments / Special Instructions

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

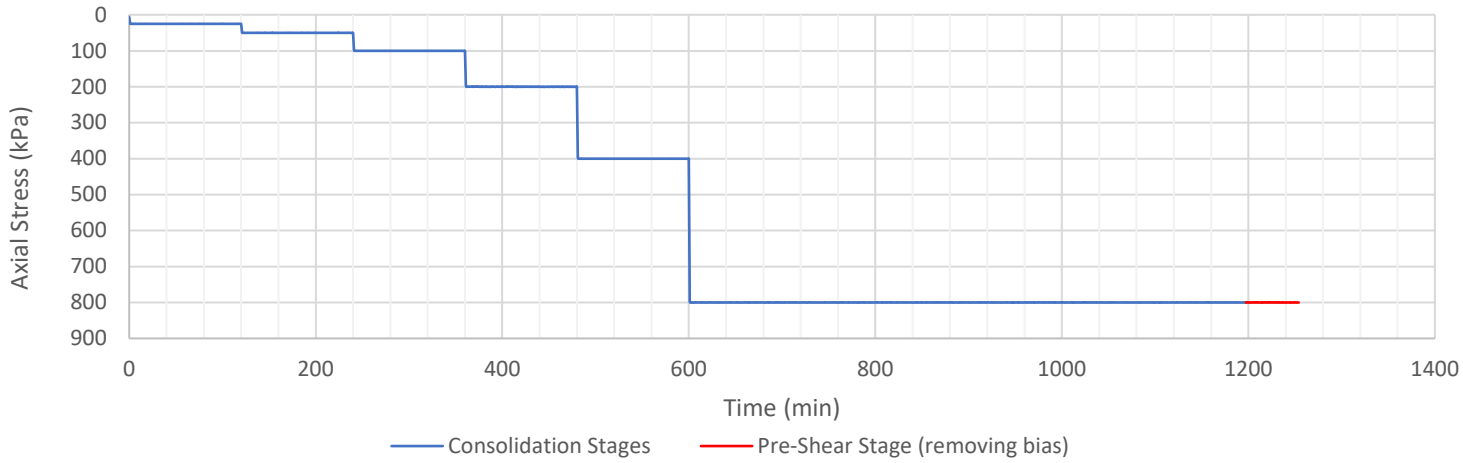
Consolidation Summary

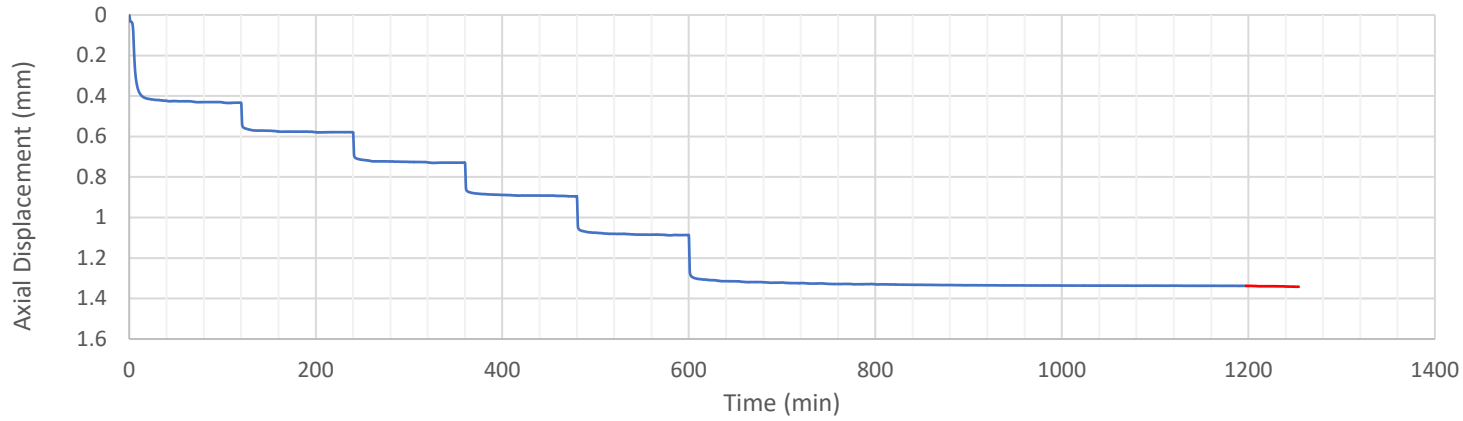
Stress at end of Consolidation (kPa)	800.05
Axial Strain at end of Consolidation (%)	5.60
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.34

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400	800					
Load (kN)	0.098	0.195	0.388	0.776	1.551	3.102					
Duration (min)	120	120	120	120	120	597					
Axial Strain (%)	1.82	2.43	3.06	3.75	4.55	5.60					





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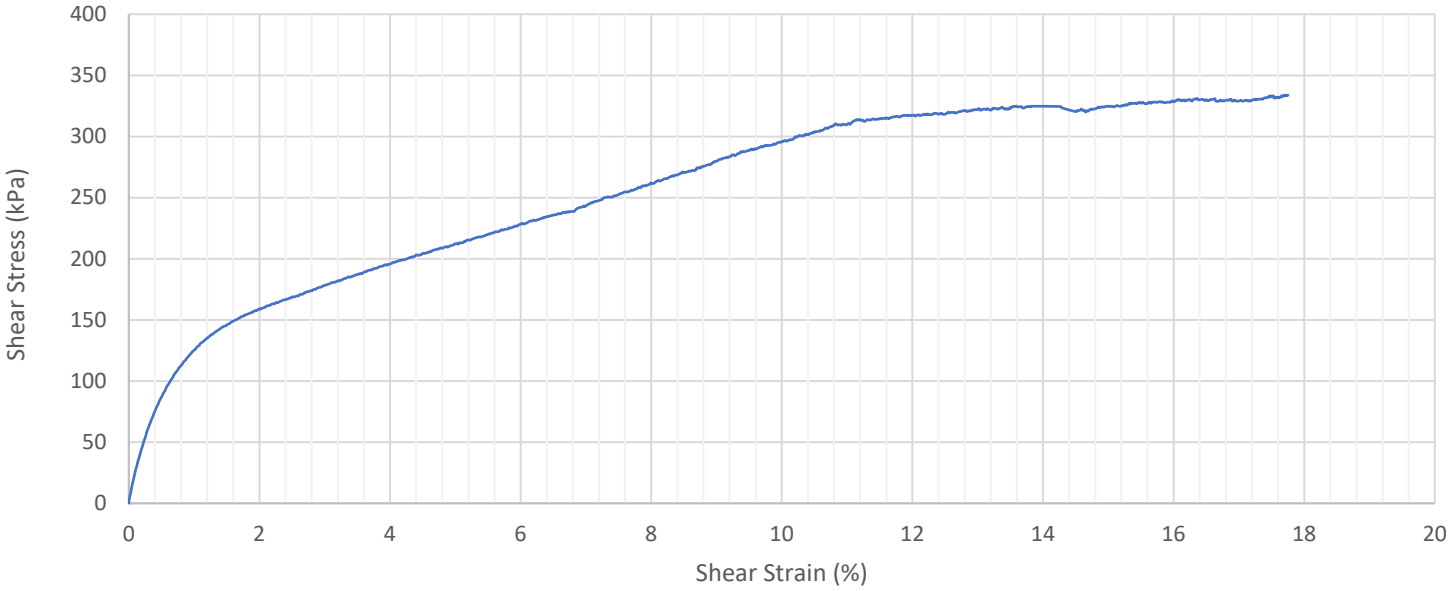
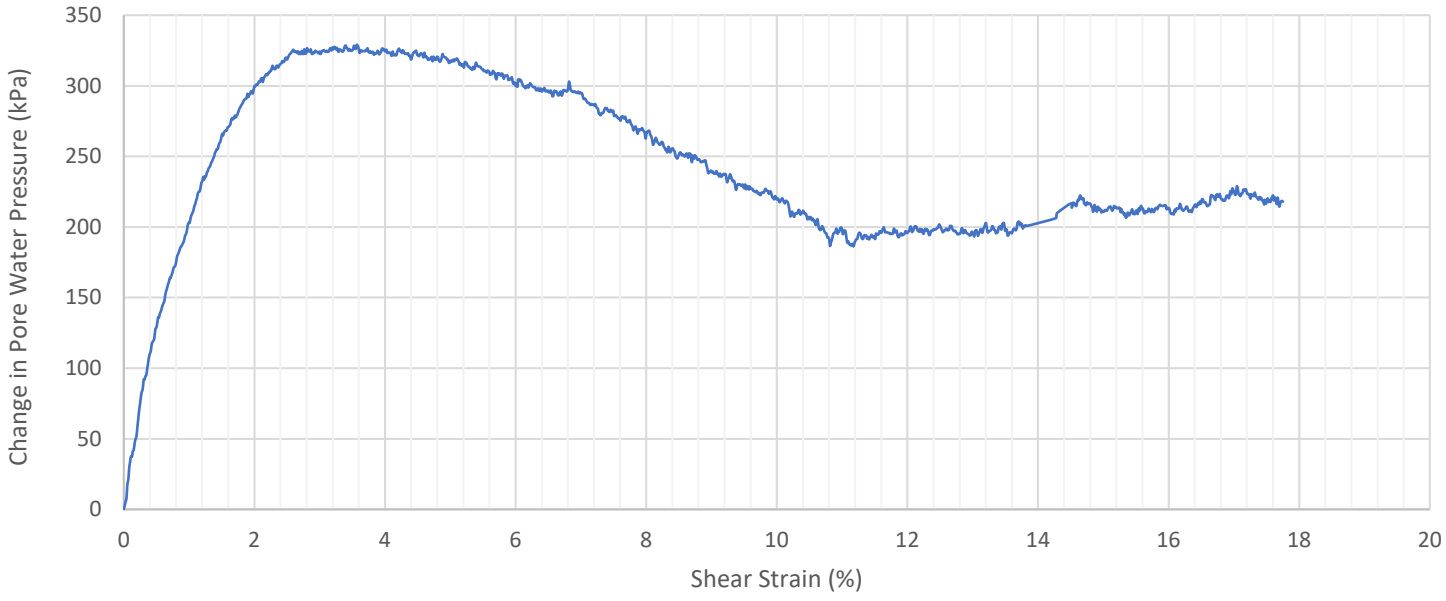
NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079





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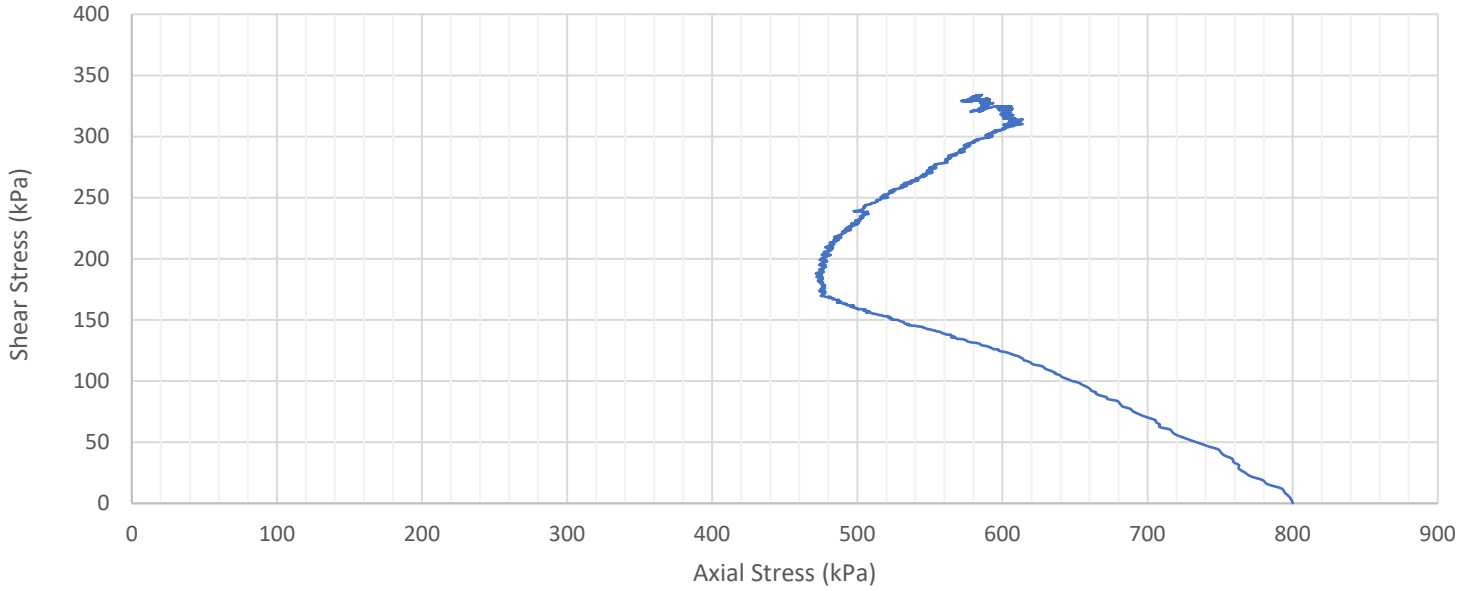
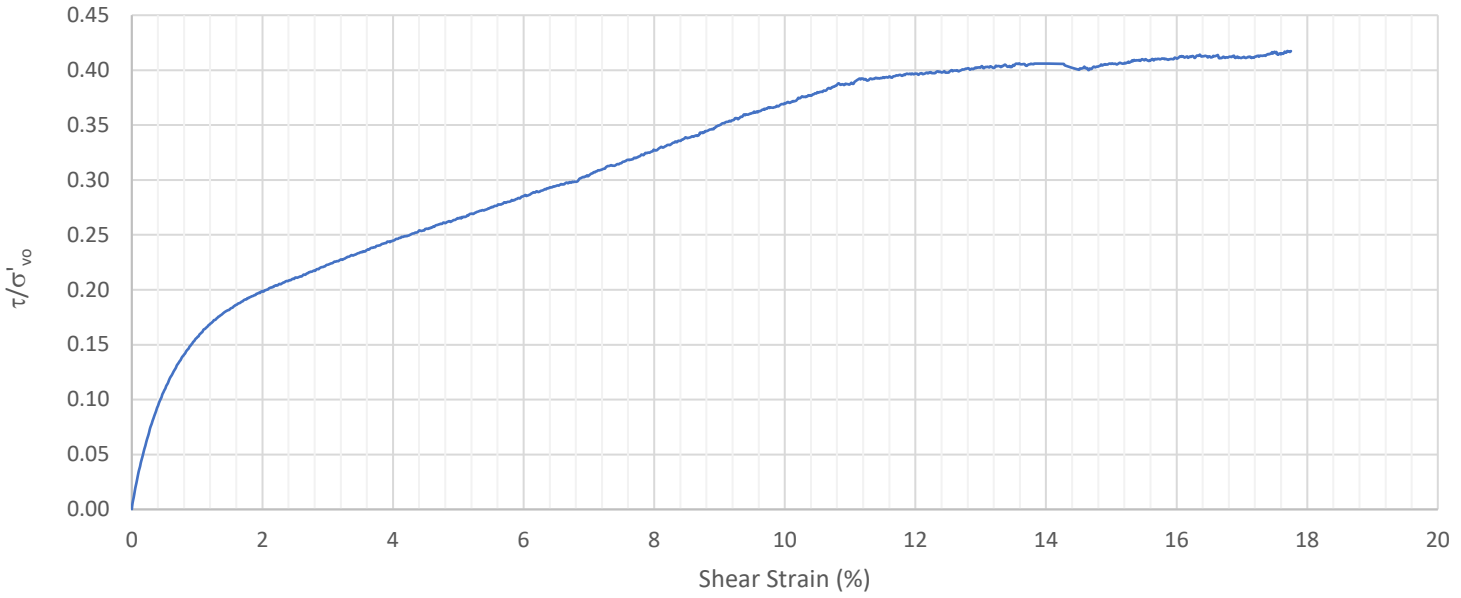
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079





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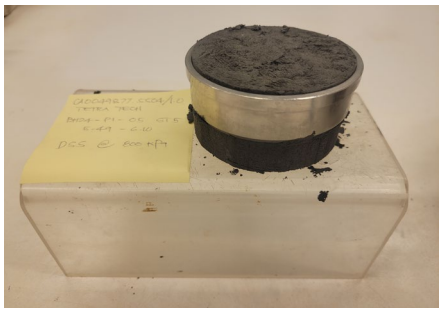
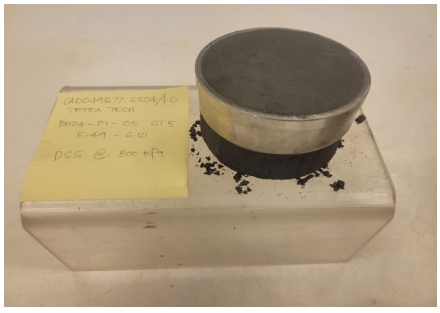
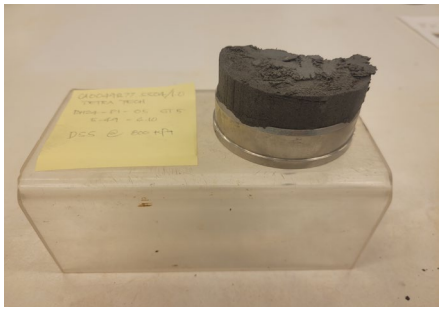
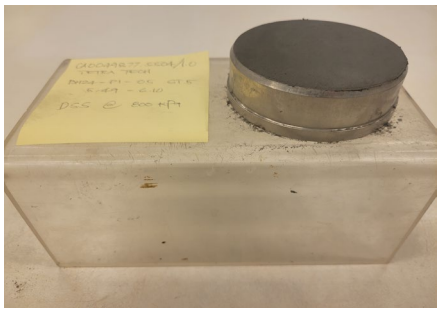
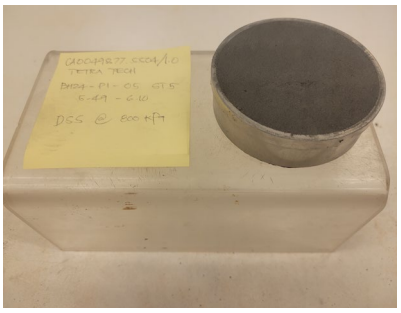
Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-05 ST5
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	5.49 - 6.10
Client:	Tetra Tech	**Lab ID No:**	B25-079

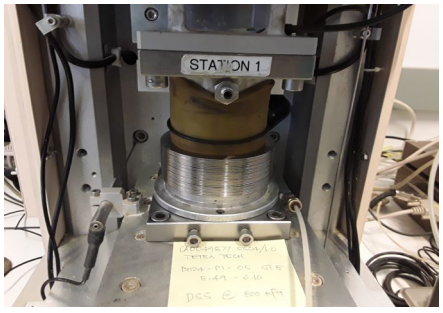






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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

Minimal water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.67
Diameter (mm)	70.21
Area (cm^2)	38.72
Volume (cm^3)	91.64
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	174.08
Dry Mass (g)	157.24
Initial Wet Unit Weight (kN/m^3)	18.64
Initial Dry Unit Weight (kN/m^3)	16.83

Initial Water Content (%)	10.71
Initial Saturation (%)	43.11
Final Water Content (%)	26.46
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	201.21
Vertical Stress at end of Consol (kPa)	200.67
Laboratory OCR	N/A

Max. Axial Strain %	3.78
Axial Strain at end of Consol. %	3.78
Change in Height ΔH_c (mm)	0.90

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	200.95
Initial Shear Stress (kPa)	-0.18
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.01
Test Condition	Undrained

Peak Shear Strength (kPa)	36.65
Excess Pore Pressure at Peak (kPa)	84.64
Ratio of Peak / σ'_v	0.18
Maximum Shear Strain γ_{MAX} (%)	20.02
Shear Strength at γ_{MAX} (kPa)	19.53

Comments / Special Instructions

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T. Madera	June 19, 2025	M. Badanagki	June 30, 2025
TESTED BY	DATE	CHECKED BY	DATE

WSP Canada Inc.
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Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

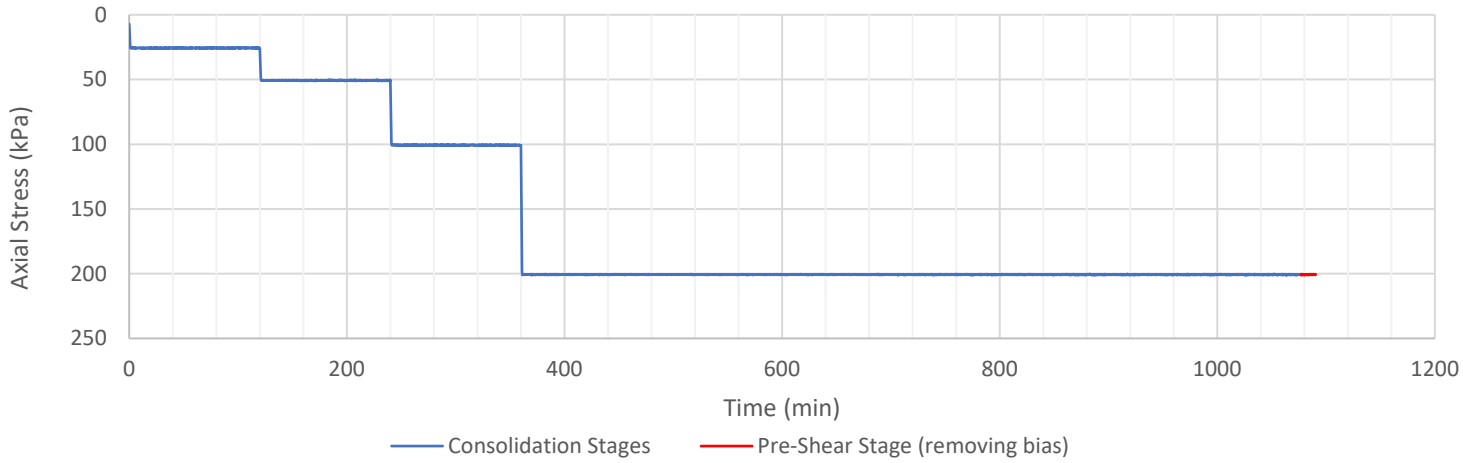
Consolidation Summary

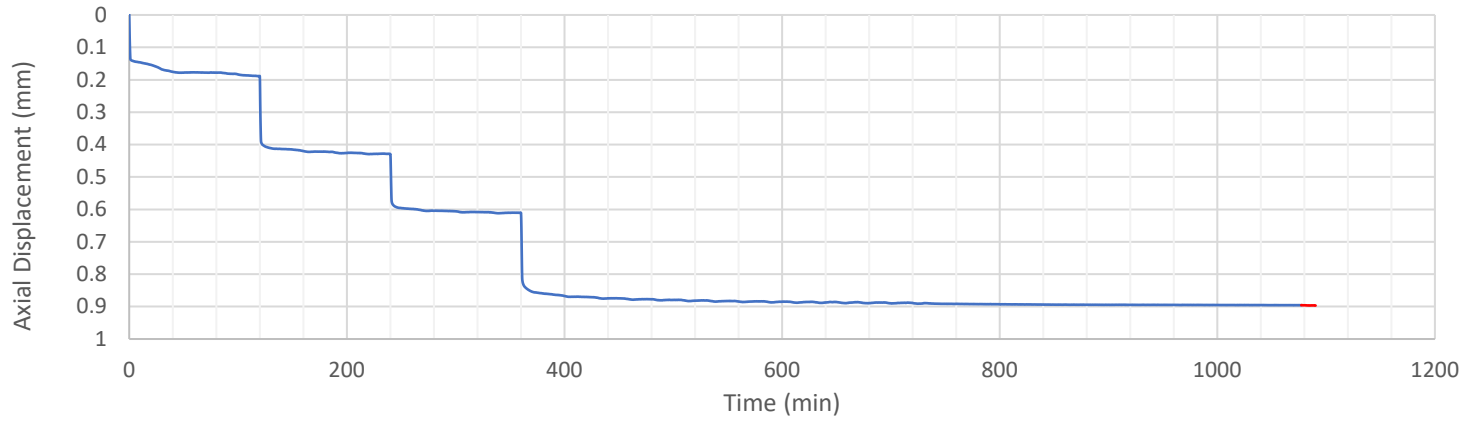
Stress at end of Consolidation (kPa)	200.67
Axial Strain at end of Consolidation (%)	3.78
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	0.90

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200							
Load (kN)	0.1009	0.1985	0.3912	0.779							
Duration (min)	120	120	120	717							
Axial Strain (%)	0.80	1.81	2.58	3.78							





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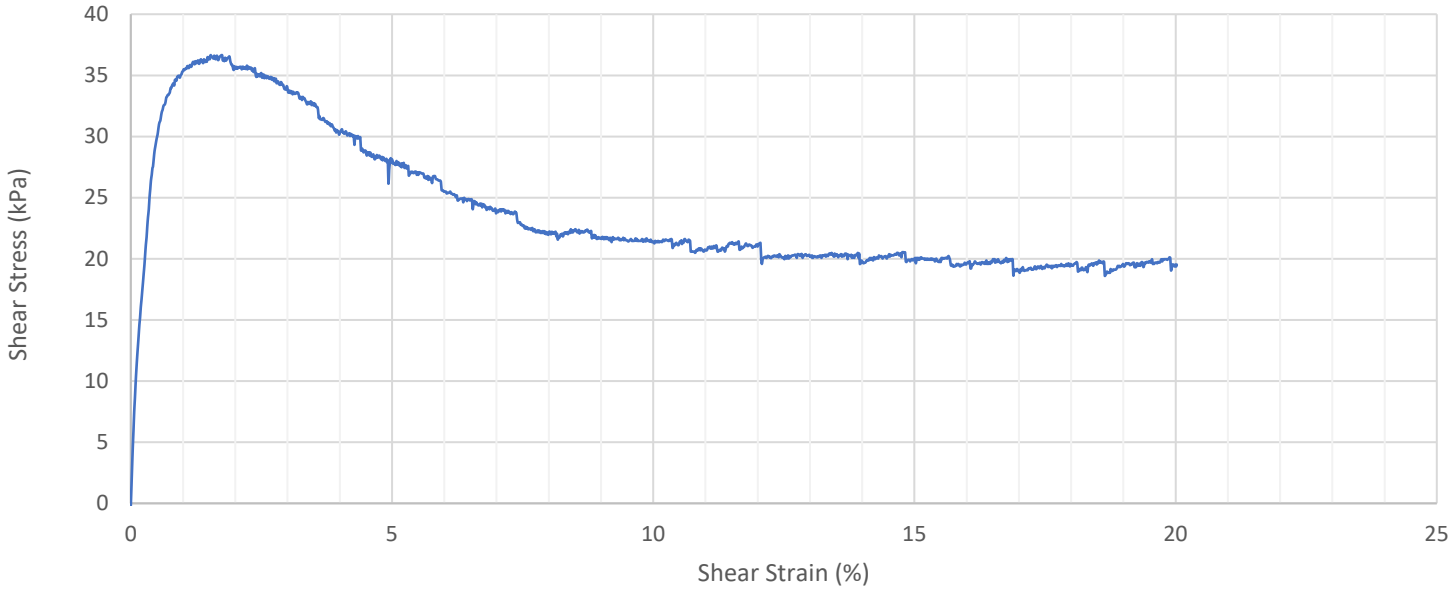
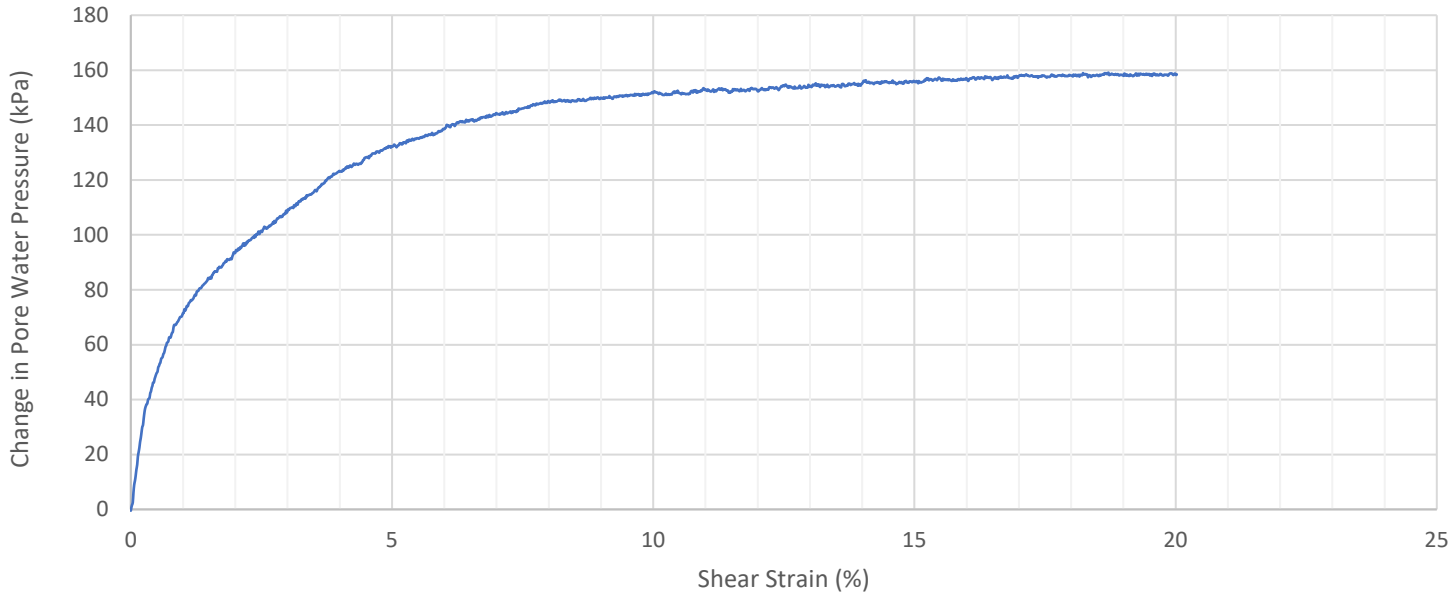
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079





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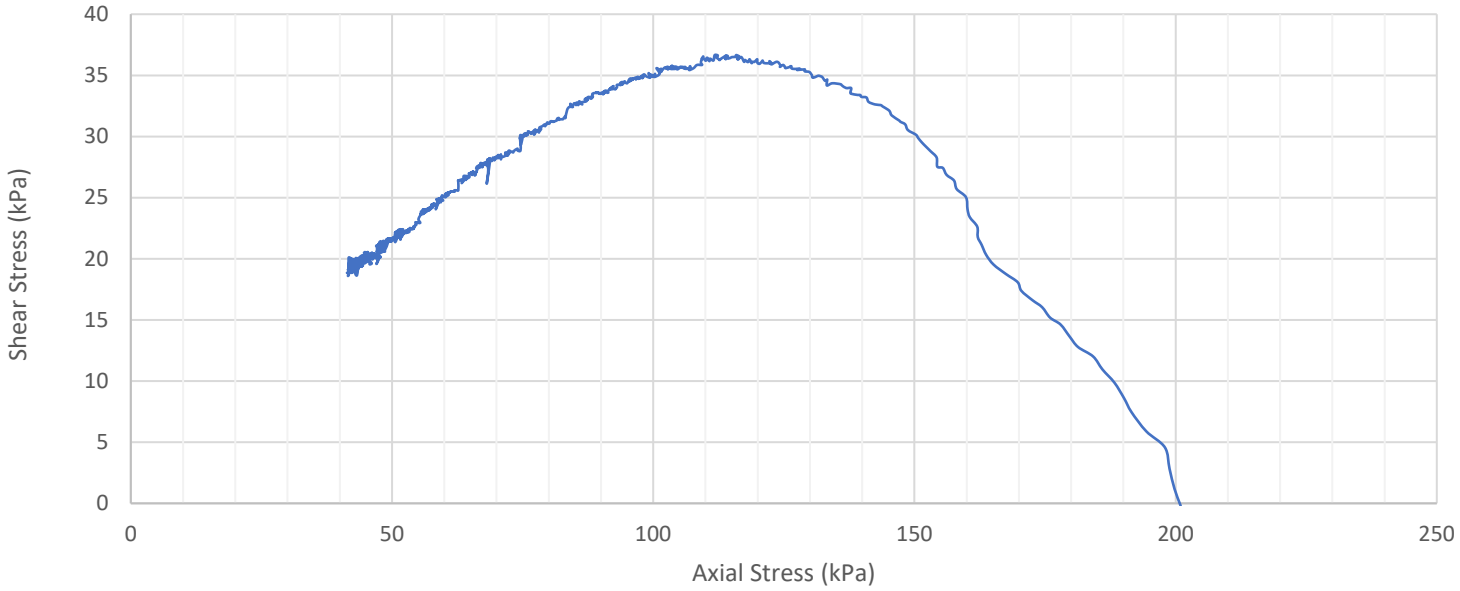
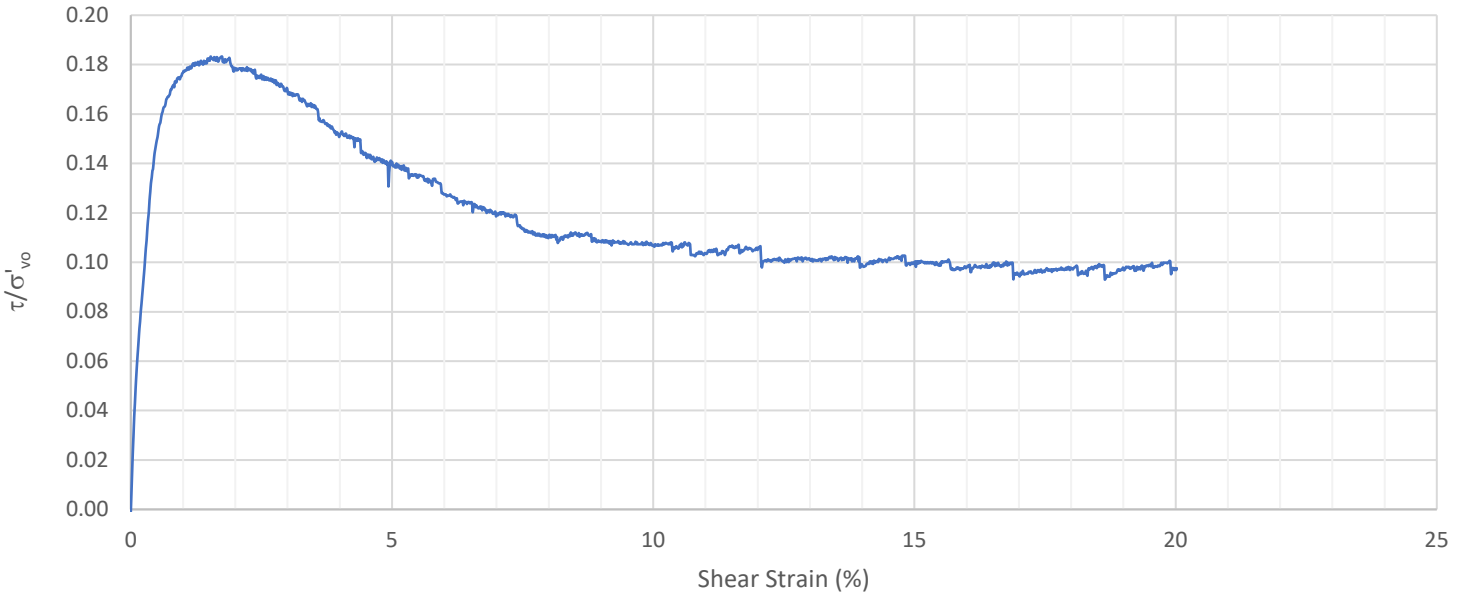
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079





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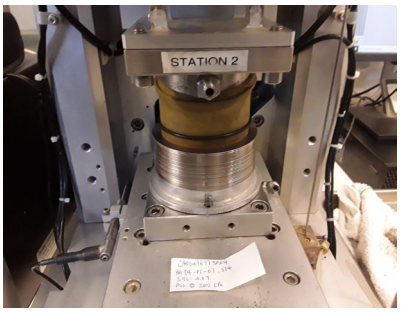
Project:	Keno Hill District Mill Site	**Test ID:**	200kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079







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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~400mL of water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 1

Vertical LVDT	Serial No.:	113179
Vertical Load Cell	Serial No.:	89612
Shear Load Cell	Serial No.:	30465

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.65
Diameter (mm)	70.38
Area (cm^2)	38.90
Volume (cm^3)	92.01
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	174.02
Dry Mass (g)	156.77
Initial Wet Unit Weight (kN/m^3)	18.55
Initial Dry Unit Weight (kN/m^3)	16.72

Initial Water Content (%)	11.00
Initial Saturation (%)	43.58
Final Water Content (%)	24.48
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	400.22
Vertical Stress at end of Consol (kPa)	400.22
Laboratory OCR	N/A

Max. Axial Strain %	6.17
Axial Strain at end of Consol. %	6.16
Change in Height ΔH_c (mm)	1.46

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	399.96
Initial Shear Stress (kPa)	0.13
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	4.99
Test Condition	Undrained

Peak Shear Strength (kPa)	68.63
Excess Pore Pressure at Peak (kPa)	190.47
Ratio of Peak / σ'_v	0.17
Maximum Shear Strain γ_{MAX} (%)	19.99
Shear Strength at γ_{MAX} (kPa)	48.27

Comments / Special Instructions

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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

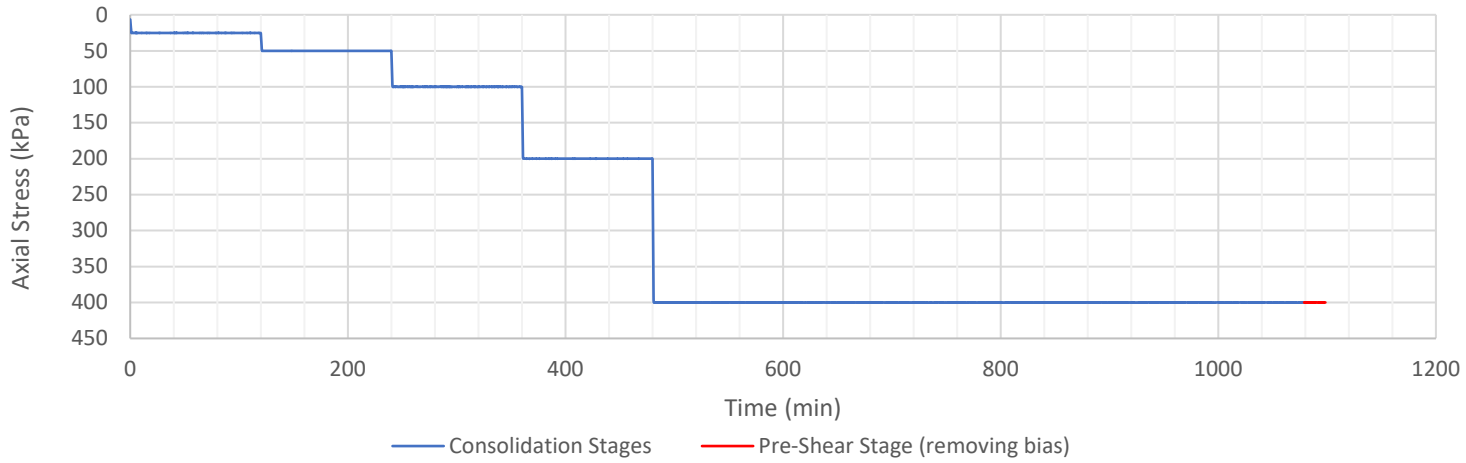
Consolidation Summary

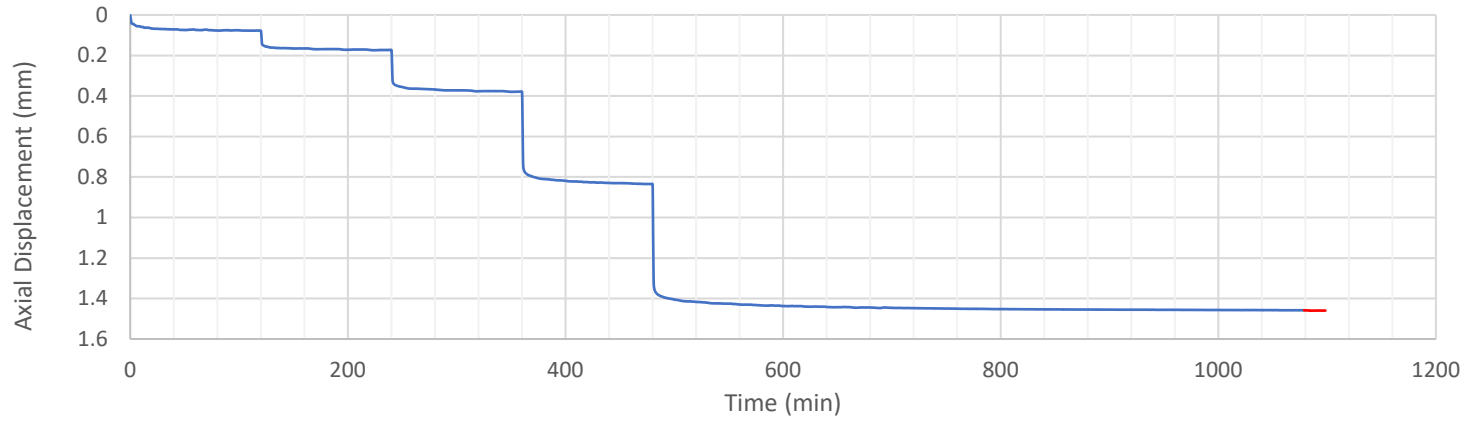
Stress at end of Consolidation (kPa)	400.22
Axial Strain at end of Consolidation (%)	6.16
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.46

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400						
Load (kN)	0.098	0.195	0.39	0.779	1.557						
Duration (min)	120	120	120	120	599						
Axial Strain (%)	0.33	0.74	1.60	3.53	6.17						





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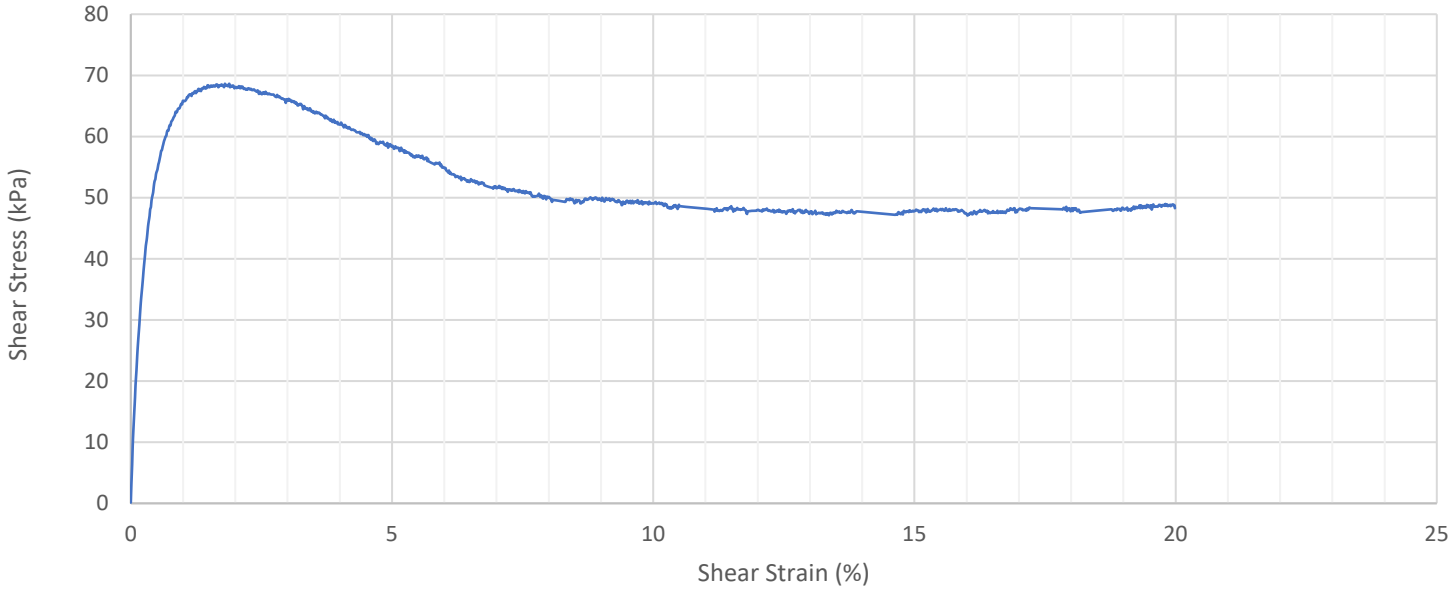

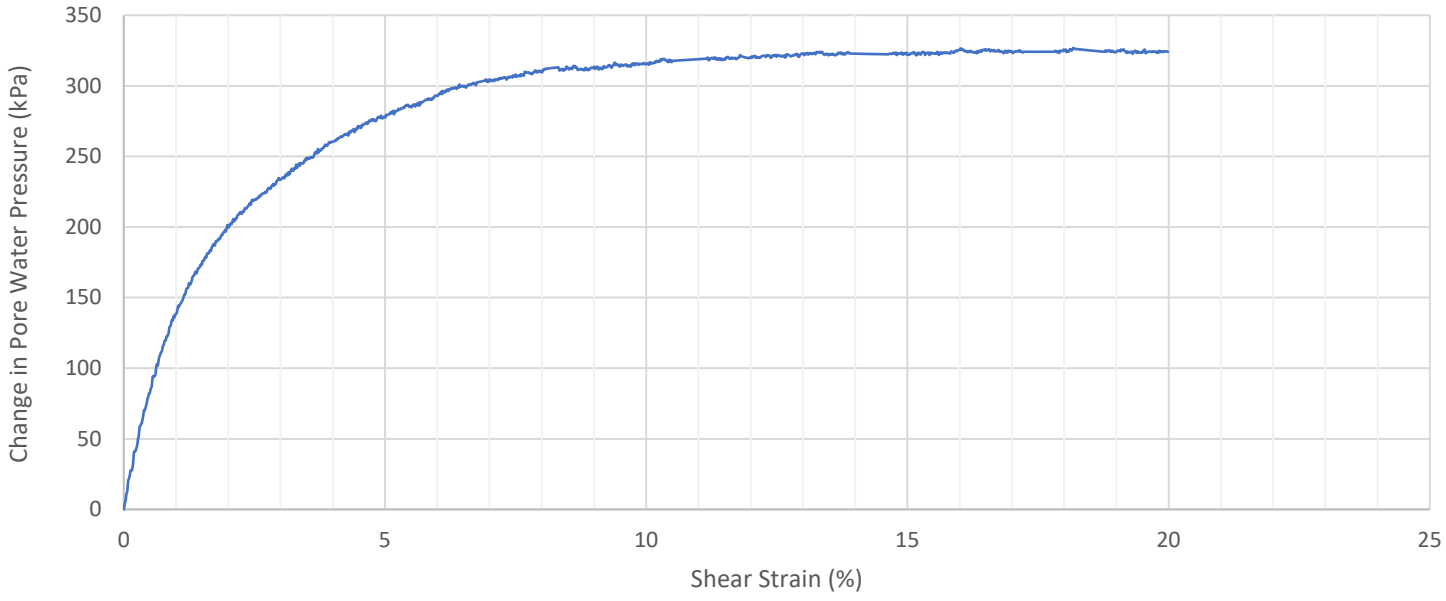

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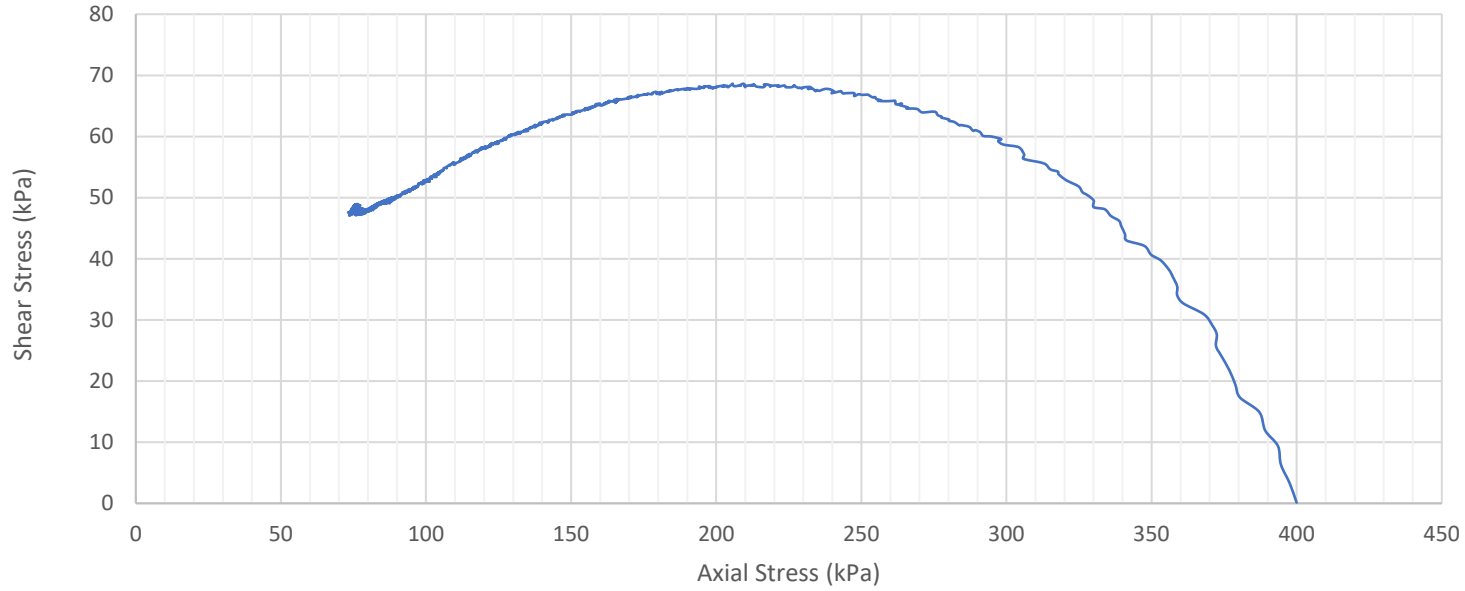
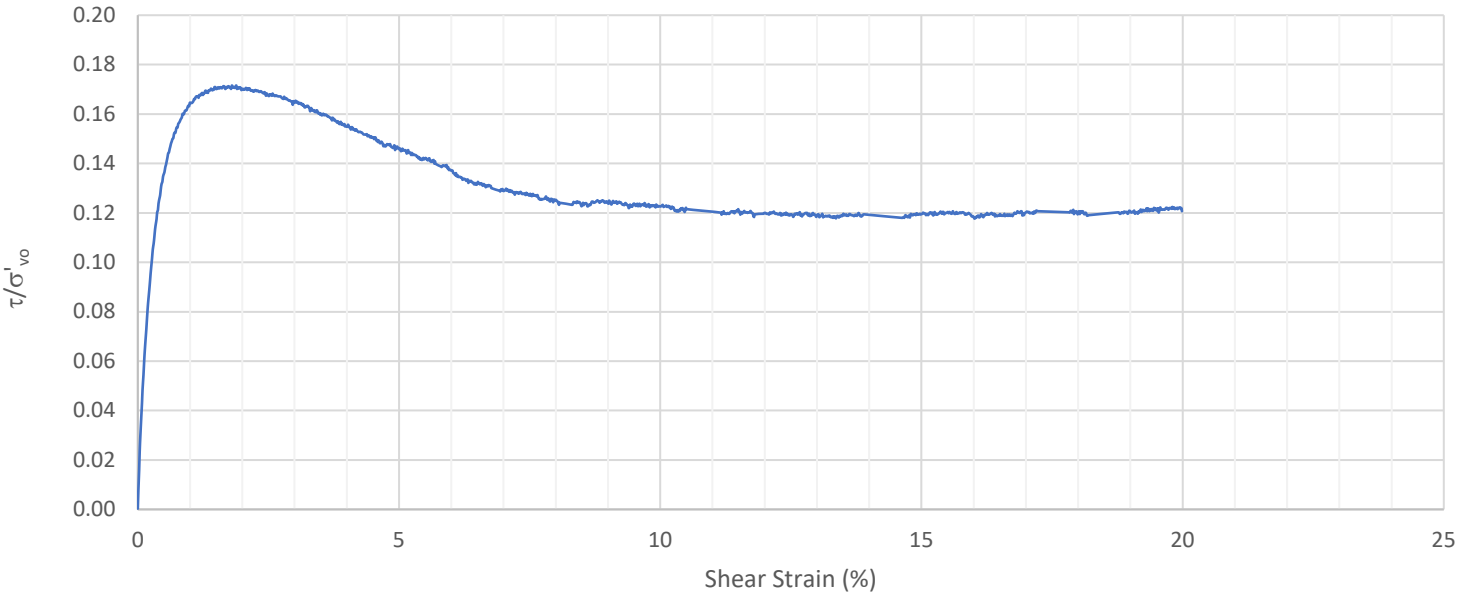
Client:	Tetra Tech	**Lab ID No:**	B25-079





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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	400kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079















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Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

Minimal water passed through sample during consolidation

Sample flushed with CO2 prior to sataturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.92
Diameter (mm)	70.33
Area (cm^2)	38.85
Volume (cm^3)	92.92
Specific Gravity (assumed)	3.00

Visual Description	SANDY SILT, grey, moist, dense.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	173.95
Dry Mass (g)	156.88
Initial Wet Unit Weight (kN/m^3)	18.36
Initial Dry Unit Weight (kN/m^3)	16.56

Initial Water Content (%)	10.88
Initial Saturation (%)	42.18
Final Water Content (%)	22.20
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	800.71
Vertical Stress at end of Consol (kPa)	800.17
Laboratory OCR	N/A

Max. Axial Strain %	7.69
Axial Strain at end of Consol. %	7.69
Change in Height ΔH_c (mm)	1.84

Direct Simple Shear Test Results

Initial Vertical Stress (kPa)	802.79
Initial Shear Stress (kPa)	-0.10
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.01
Test Condition	Undrained

Peak Shear Strength (kPa)	152.93
Excess Pore Pressure at Peak (kPa)	361.74
Ratio of Peak / σ'_v	0.19
Maximum Shear Strain γ_{MAX} (%)	20.03
Shear Strength at γ_{MAX} (kPa)	116.81

Comments / Special Instructions

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Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

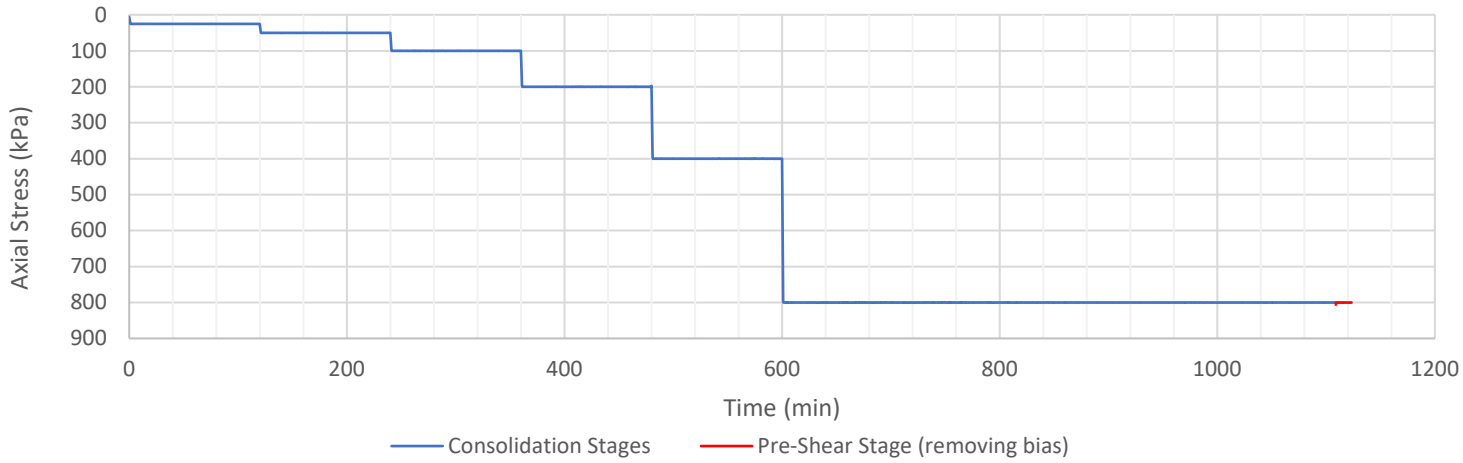
Consolidation Summary

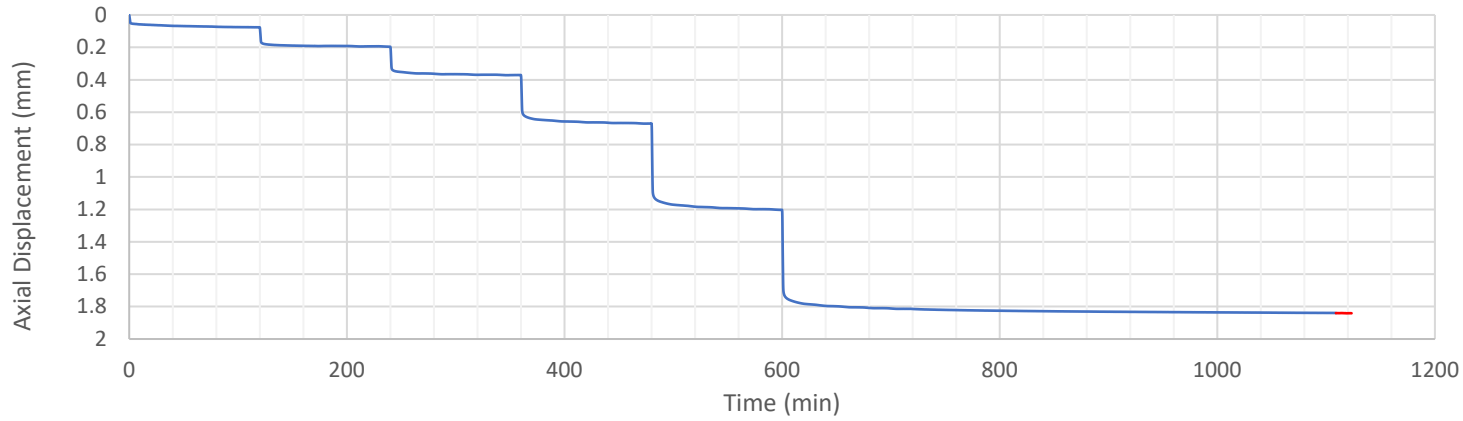
Stress at end of Consolidation (kPa)	800.17
Axial Strain at end of Consolidation (%)	7.69
Laboratory Induced OCR	N/A
Change in Height ΔH_c (mm)	1.84

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	100	200	400	800					
Load (kN)	0.0983	0.1959	0.3902	0.7788	1.5562	3.1106					
Duration (min)	120	120	120	120	120	509					
Axial Strain (%)	0.32	0.82	1.55	2.80	5.03	7.69					





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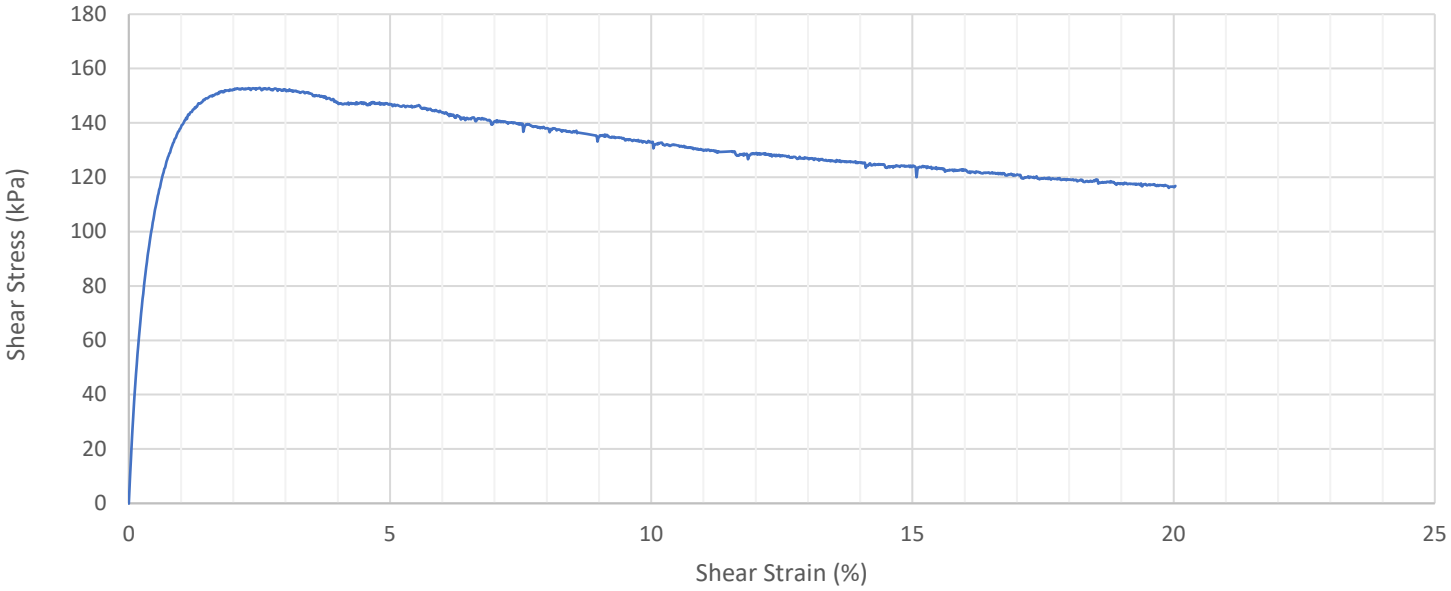
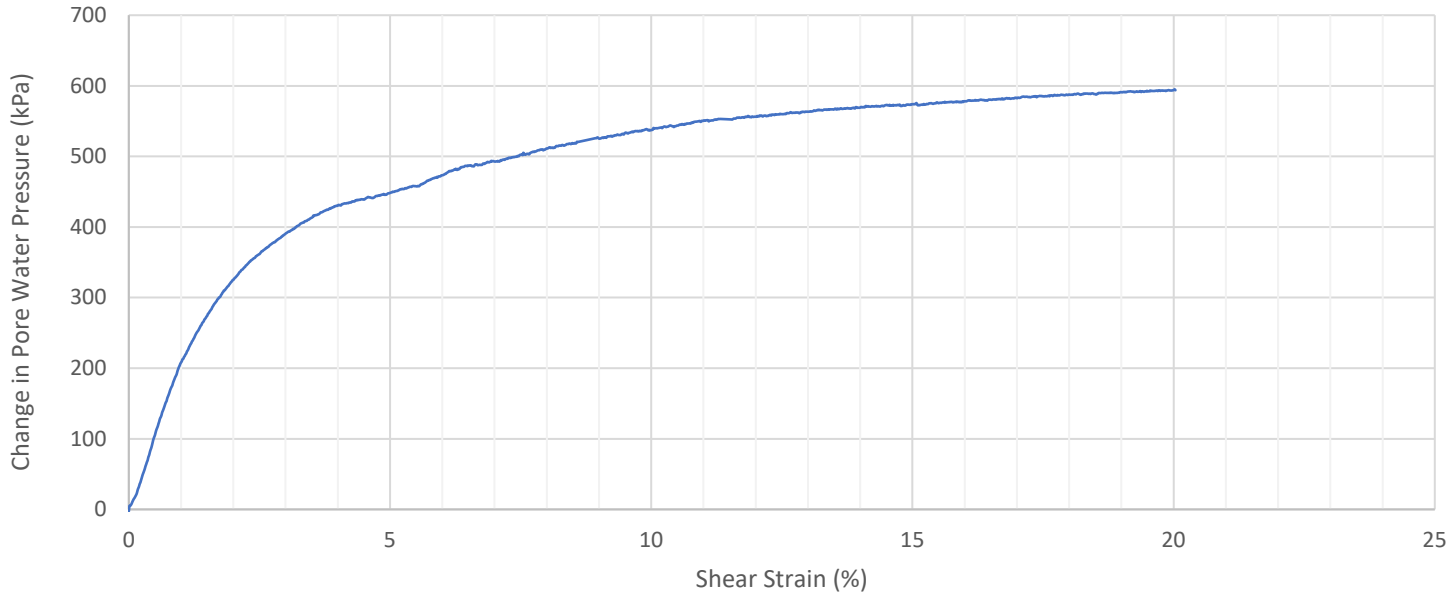
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079





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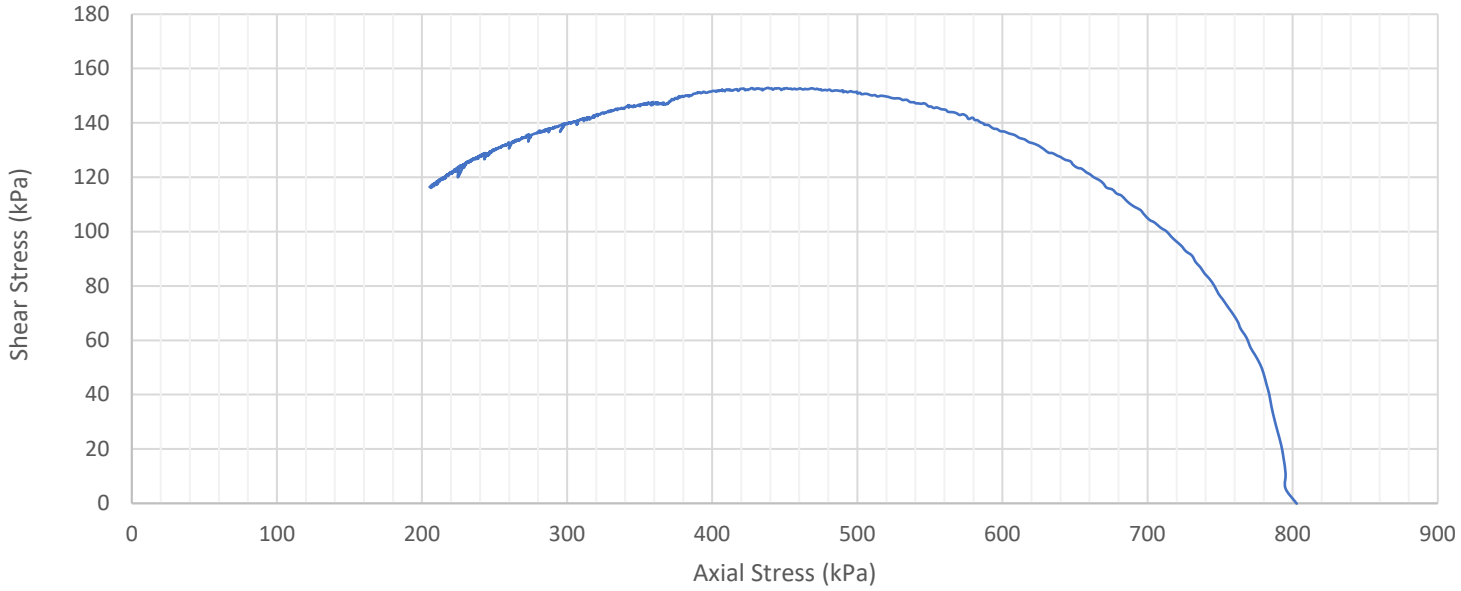
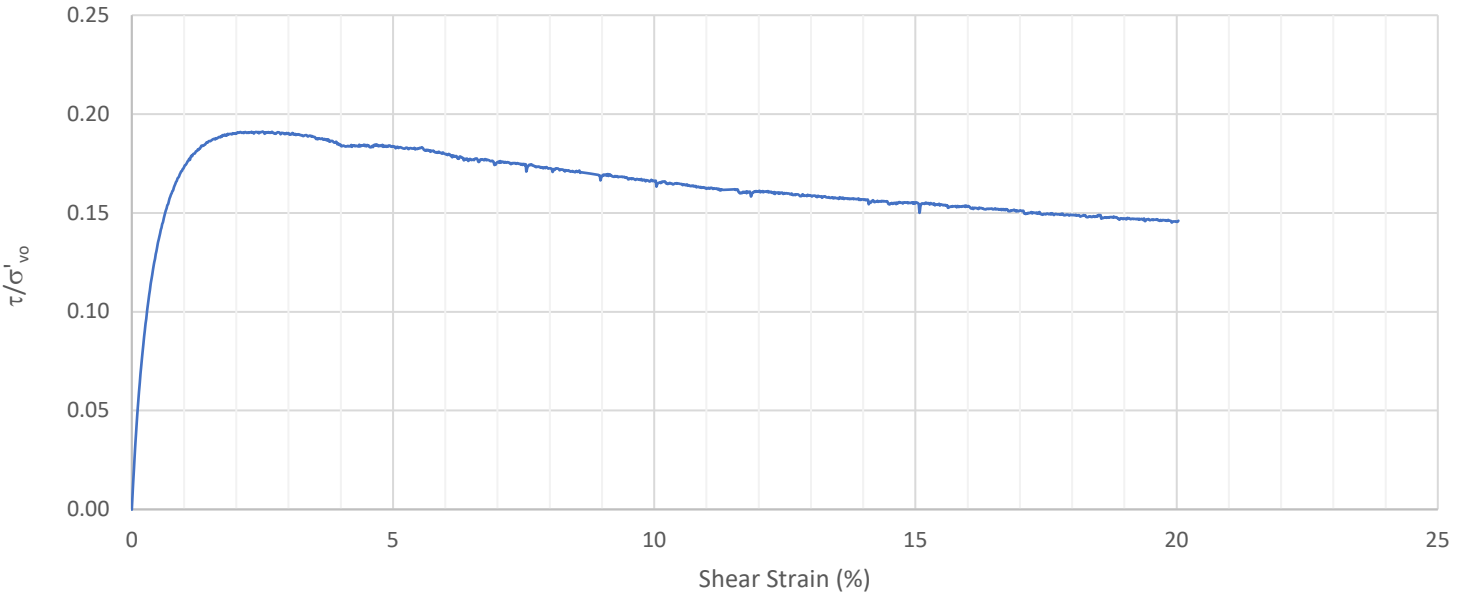
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079





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Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST4
Project:	Keno Hill District Mill Site	**Test ID:**	800kPa DSS
Location:	Yukon	**Depth (m):**	3.96 - 4.57
Client:	Tetra Tech	**Lab ID No:**	B25-079

















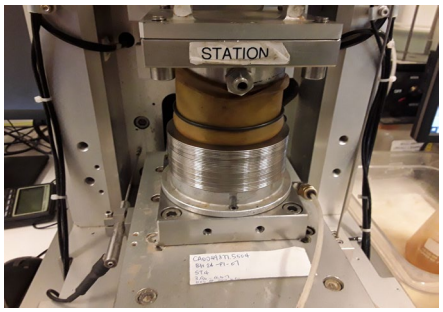

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Cyclic Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST08
Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.20CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~250 ml of water passed through sample during consolidation

Achieved dry density = 1930kg/m³

Sample flushed with CO2 prior to saturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	23.80
Diameter (mm)	69.92
Area (cm^2)	38.40
Volume (cm^3)	91.38
Specific Gravity (assumed)	2.90

Visual Description	SAND, some silt, brown, wet, dense. Sample is dilatant.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	204.34
Dry Mass (g)	176.39
Initial Wet Unit Weight (kN/m^3)	21.94
Initial Dry Unit Weight (kN/m^3)	18.94

Initial Water Content (%)	15.85
Initial Saturation (%)	91.95
Final Water Content (%)	17.86
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	91.08
Vertical Stress at end of Consol (kPa)	90.56
Laboratory OCR	N/A

Max. Axial Strain %	2.85
Axial Strain at end of Consol. %	2.85
Change in Height ΔH_c (mm)	0.68

Cyclic Test Results

Frequency (Hz)	1.00
CSR	0.67
Cycles to 3.75% Shear Strain	9
Initial Vertical Stress (kPa)	90.74
Max Abs. Cyclic Shear Stress (kPa)	61.05
Max. Shear Strain at N=9 (zero load)	1.79
Min. Shear Strain at N=9 (zero load)	-3.06
Max. u at N=9 (zero load)	62.99
Min. u at N=9 (zero load)	60.87

Post Cyclic Monotonic Test Results

Initial Vertical Stress (kPa)	32.35
Initial Shear Stress (kPa)	-0.91
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.00
Peak Shear Strength (kPa)	92.33
Excess Pore Pressure at Peak (kPa)	-51.02
Ratio of Peak / σ'_v	1.02
Maximum Shear Strain γ_{MAX} (%)	20.02
Shear Strength at γ_{MAX} (kPa)	92.12

Comments / Special Instructions

*Target CSR = 0.20, as the sample liquified equipment was unable to maintain target

Comments / Special Instructions

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T. Madera	July 16, 2025	M. Badanagki	July 28, 2025
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Cyclic Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST08
Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.20CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

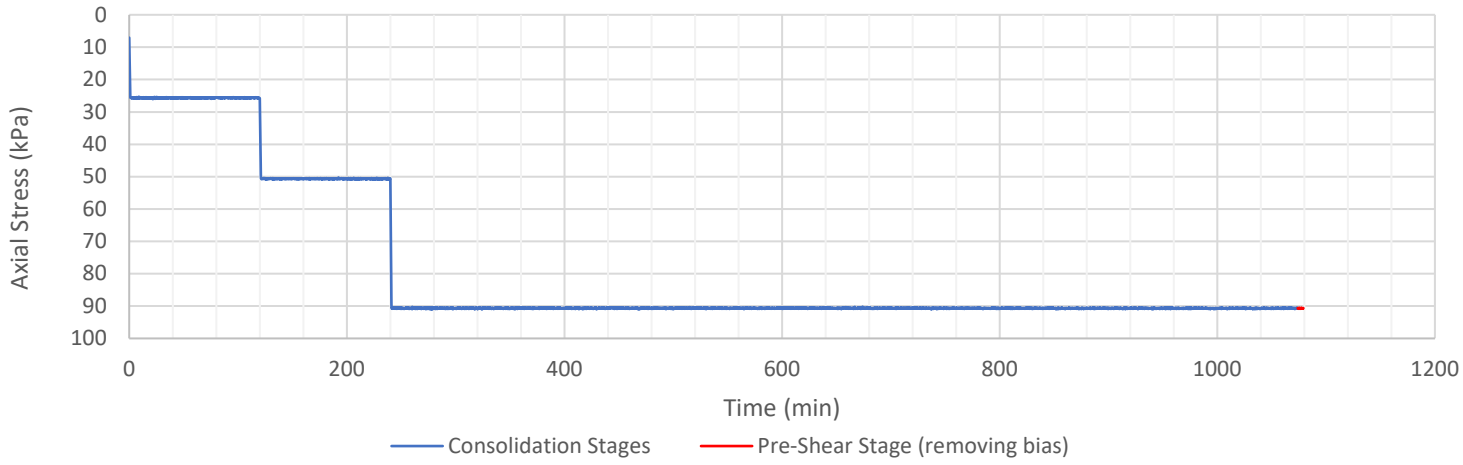
Consolidation Summary

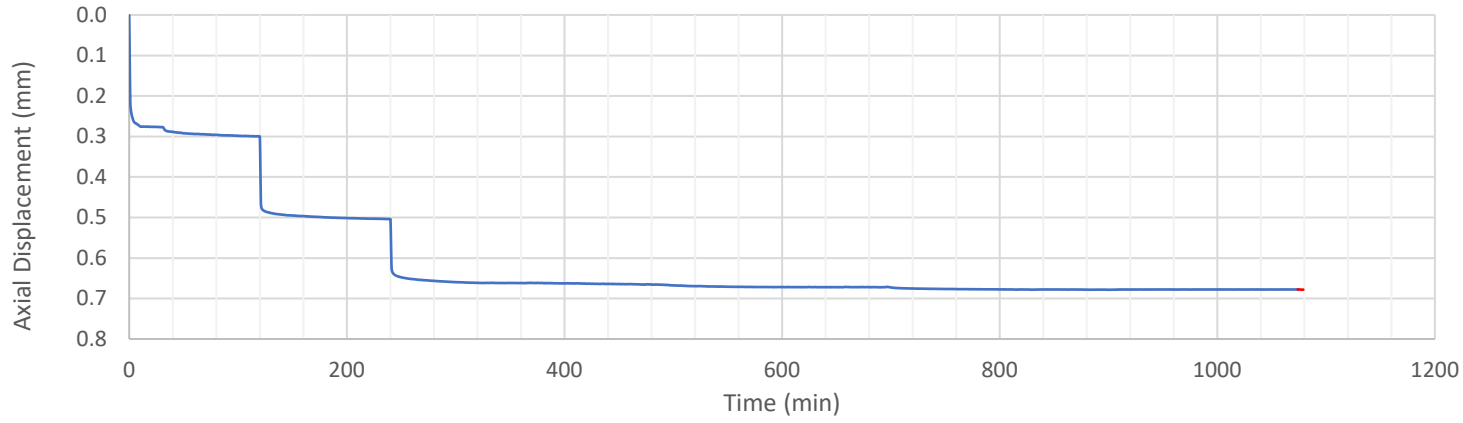
Stress at end of Consolidation (kPa)	90.56
Axial Strain at end of Consolidation (%)	2.85
Laboratory Induced OCR	N/A
Change in Height DH_c (mm)	0.68

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	90								
Load (kN)	0.0999	0.1955	0.3497								
Duration (min)	120	120	834								
Axial Strain (%)	1.26	2.12	2.85								





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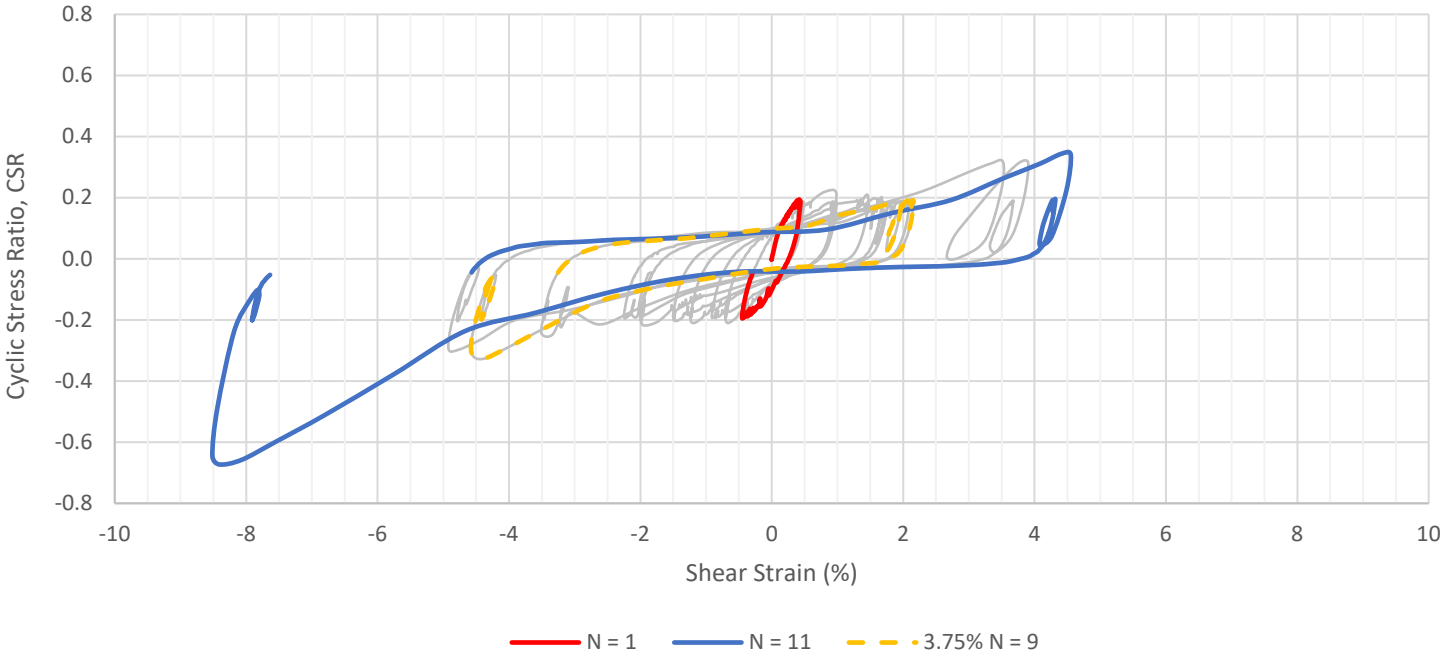

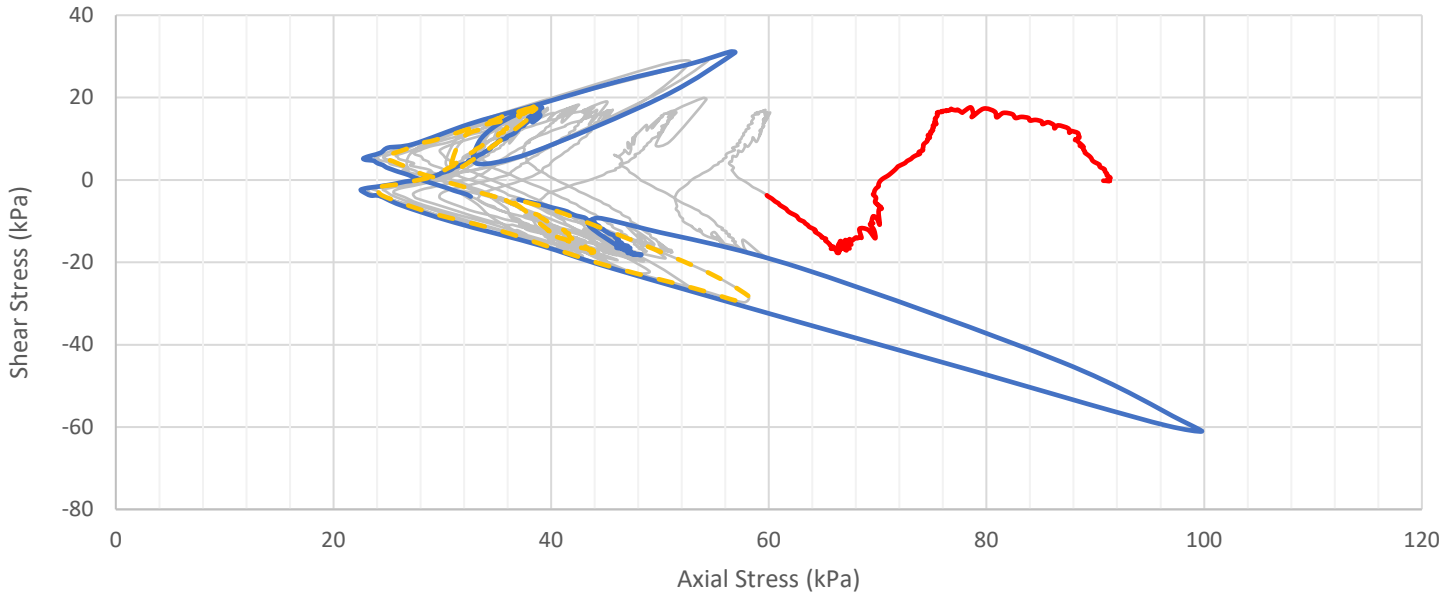

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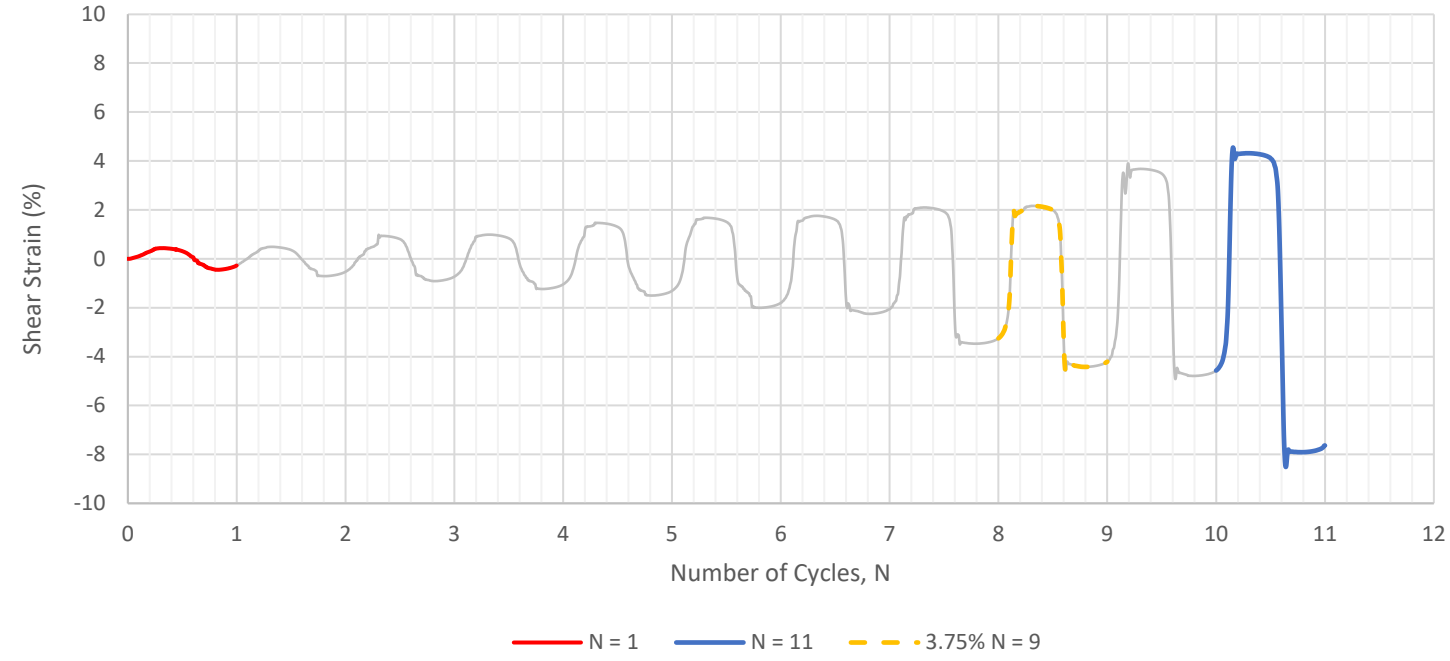

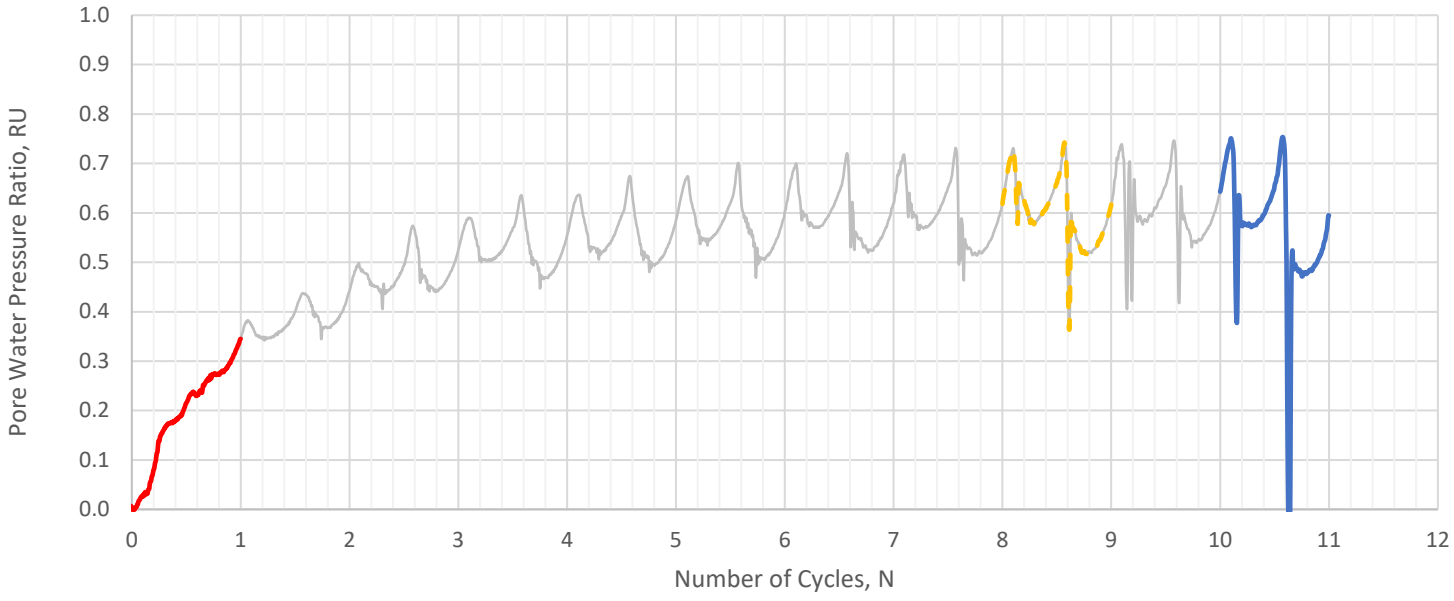

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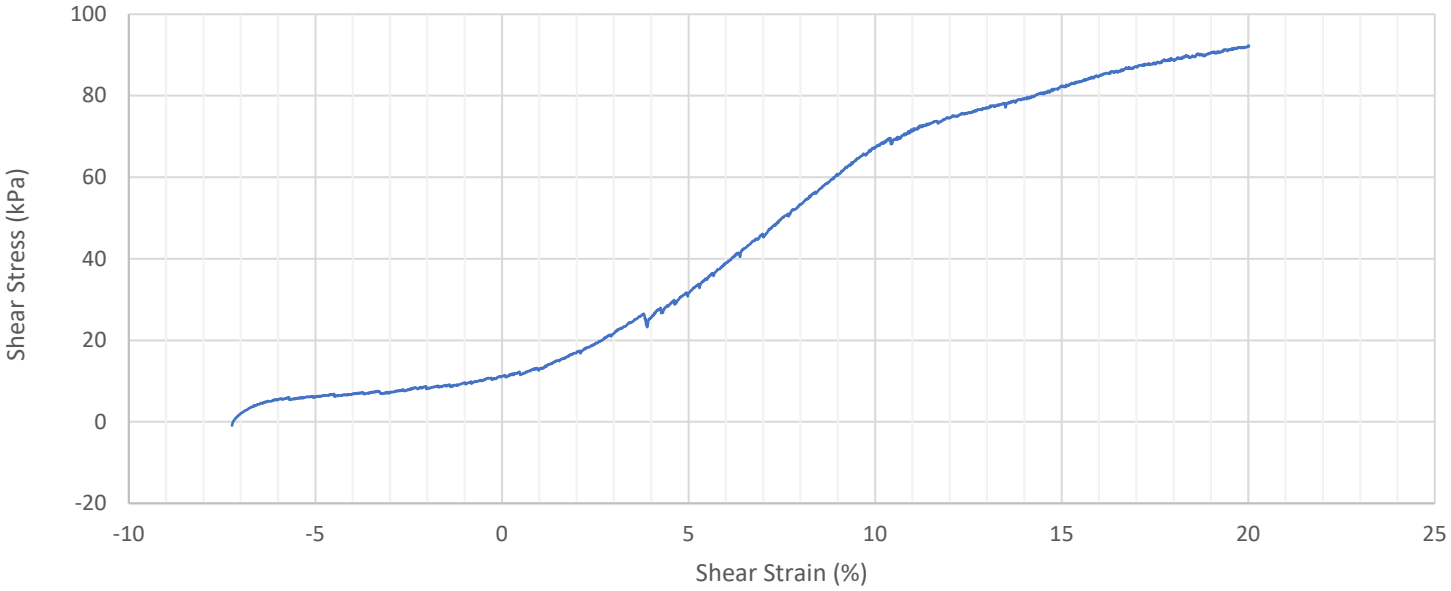

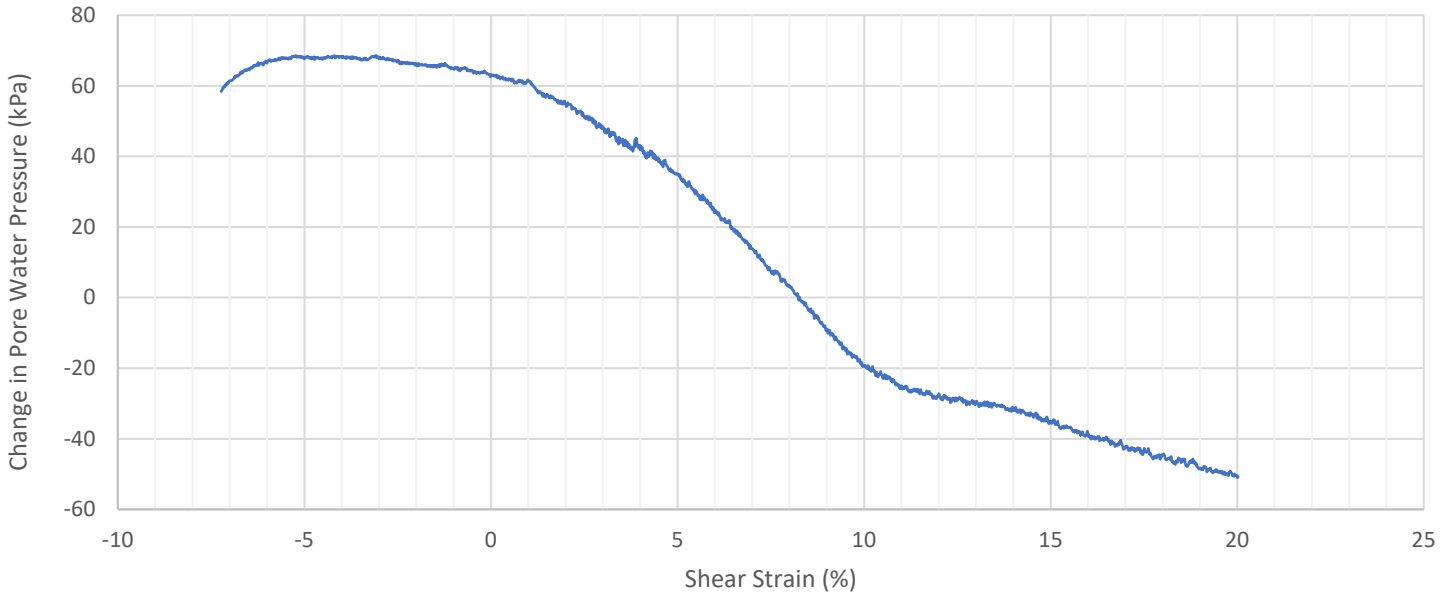

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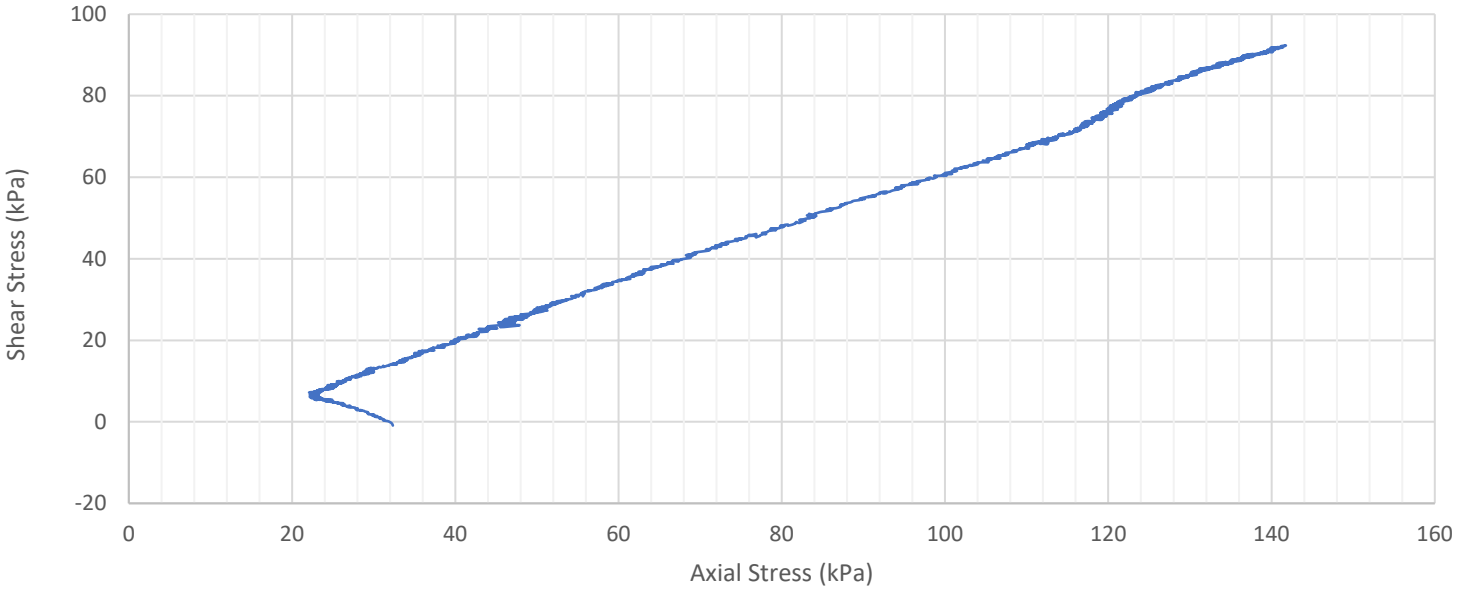

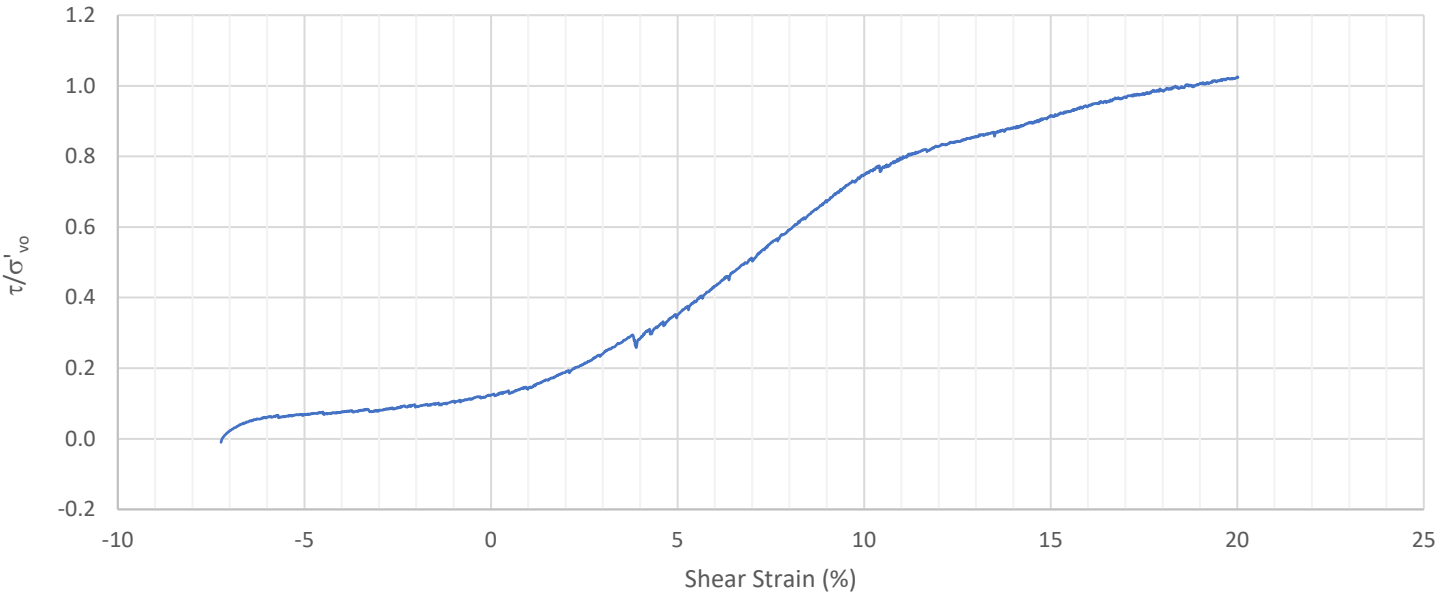

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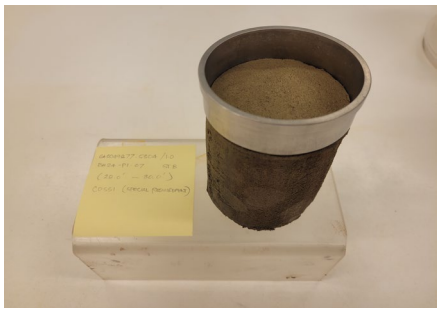
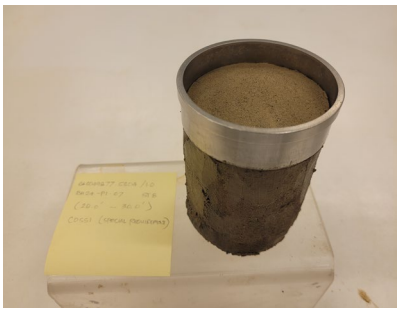
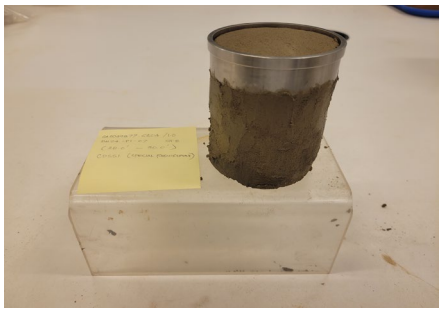
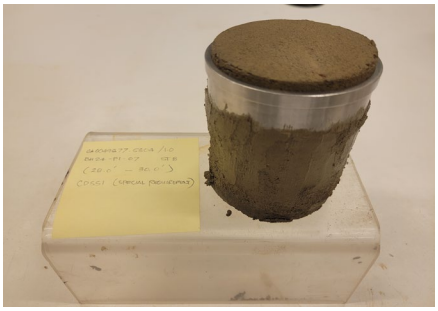

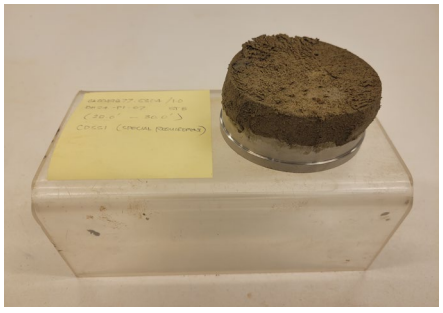
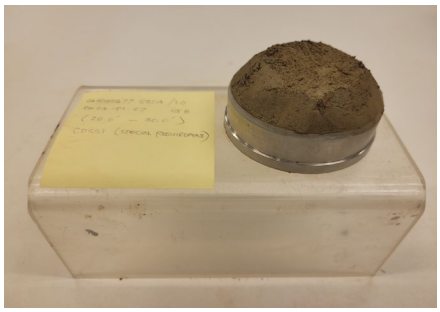







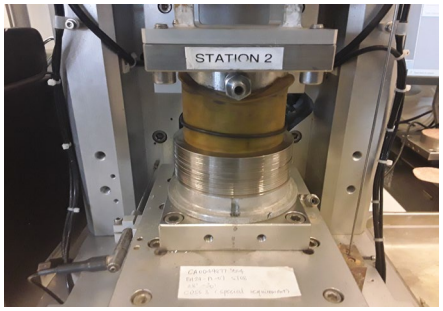

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NORSOK G-001

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Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.10CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~80 ml of water passed through sample during consolidation

Achieved dry density = 1925kg/m³

Sample flushed with CO2 prior to saturation

Equipment Description: GDS - Station 2

Vertical LVDT	Serial No.:	11897
Vertical Load Cell	Serial No.:	38408
Shear Load Cell	Serial No.:	158877

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.32
Diameter (mm)	70.10
Area (cm^2)	38.59
Volume (cm^3)	93.86
Specific Gravity (assumed)	2.90

Visual Description	SAND, some silt, brown, wet, dense. Sample is dilatant.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	209.70
Dry Mass (g)	180.69
Initial Wet Unit Weight (kN/m^3)	21.92
Initial Dry Unit Weight (kN/m^3)	18.88

Initial Water Content (%)	16.06
Initial Saturation (%)	92.43
Final Water Content (%)	16.88
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	91.20
Vertical Stress at end of Consol (kPa)	90.56
Laboratory OCR	N/A

Max. Axial Strain %	1.64
Axial Strain at end of Consol. %	1.64
Change in Height ΔH_c (mm)	0.40

Cyclic Test Results

Frequency (Hz)	1.00
CSR	0.36
Cycles to 3.75% Shear Strain	85
Initial Vertical Stress (kPa)	90.74
Max Abs. Cyclic Shear Stress (kPa)	32.98
Max. Shear Strain at N=85 (zero load)	0.43
Min. Shear Strain at N=85 (zero load)	-3.53
Max. u at N=85 (zero load)	76.34
Min. u at N=85 (zero load)	69.49

Post Cyclic Monotonic Test Results

Initial Vertical Stress (kPa)	19.85
Initial Shear Stress (kPa)	-0.39
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	5.02
Peak Shear Strength (kPa)	105.56
Excess Pore Pressure at Peak (kPa)	-74.05
Ratio of Peak / σ'_v	1.16
Maximum Shear Strain γ_{MAX} (%)	19.98
Shear Strength at γ_{MAX} (kPa)	104.91

Comments / Special Instructions

*Target CSR = 0.10, as the sample liquified equipment was unable to maintain target

Comments / Special Instructions

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NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST08
Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.10CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

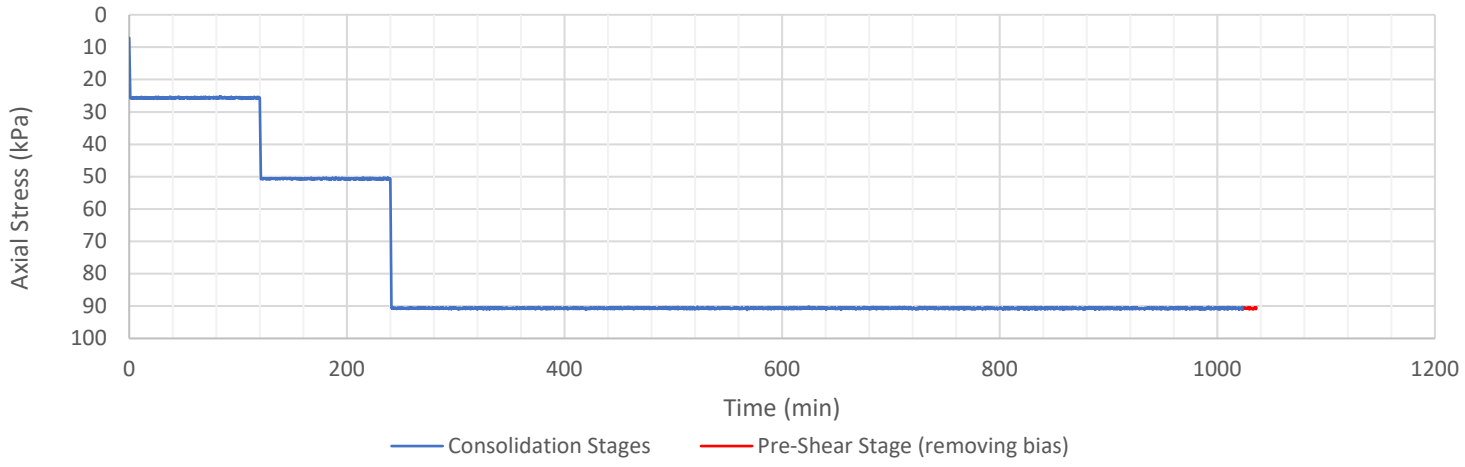
Consolidation Summary

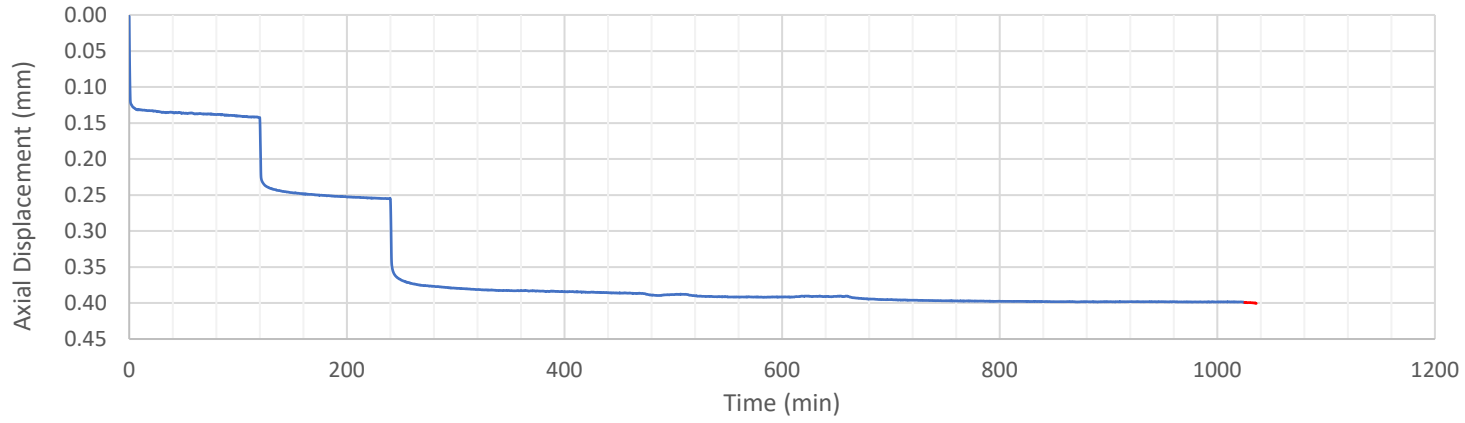
Stress at end of Consolidation (kPa)	90.56
Axial Strain at end of Consolidation (%)	1.64
Laboratory Induced OCR	N/A
Change in Height DH_c (mm)	0.40

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	90								
Load (kN)	0.1004	0.1969	0.352								
Duration (min)	120	120	785								
Axial Strain (%)	0.59	1.05	1.64								





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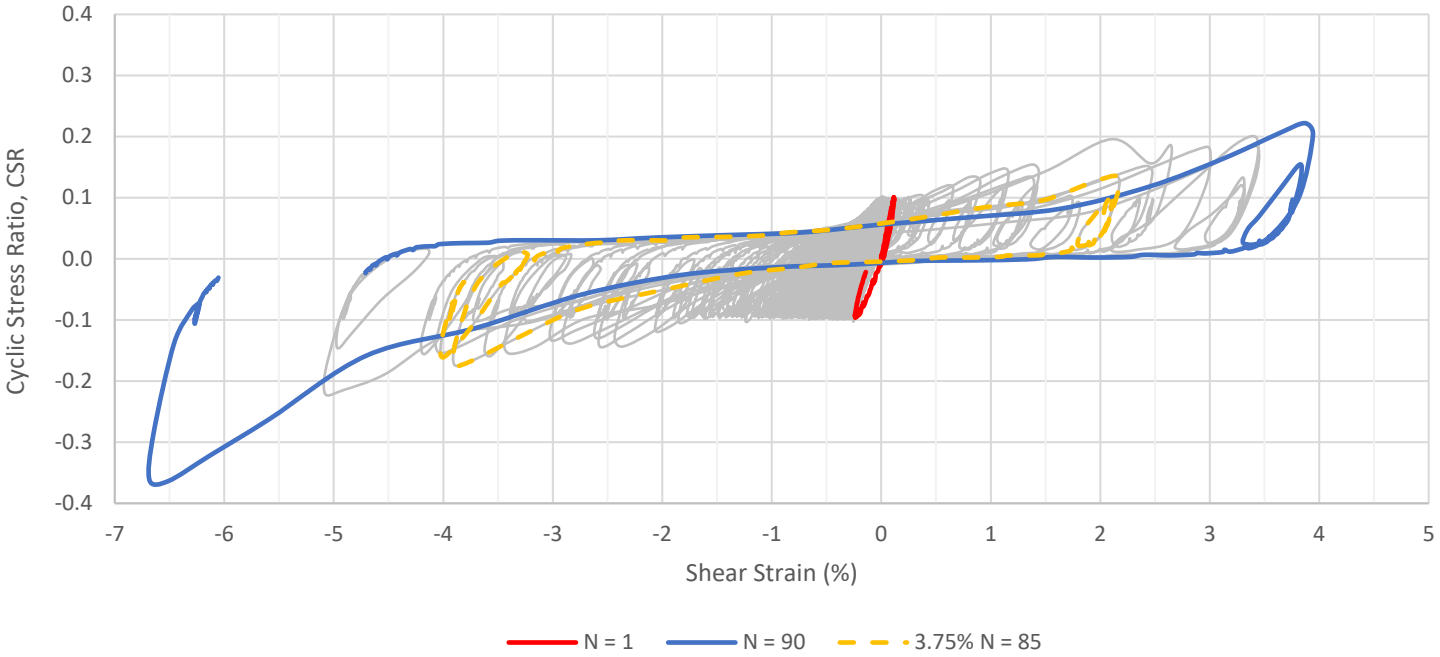

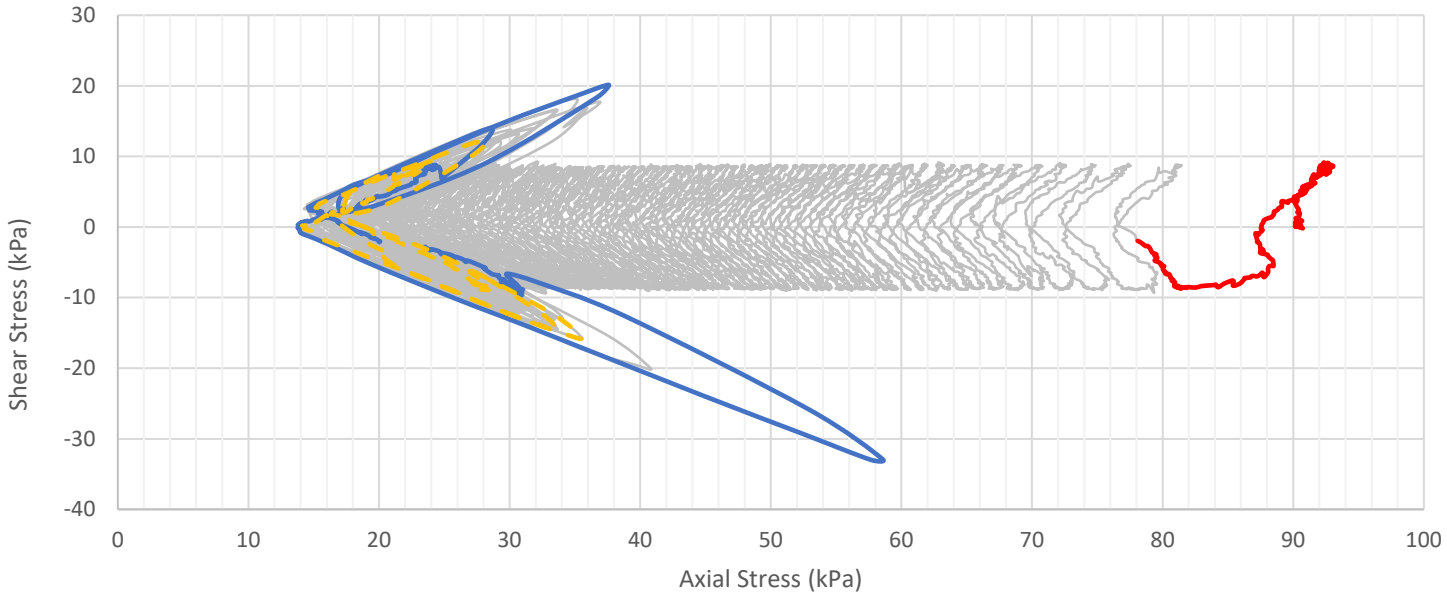

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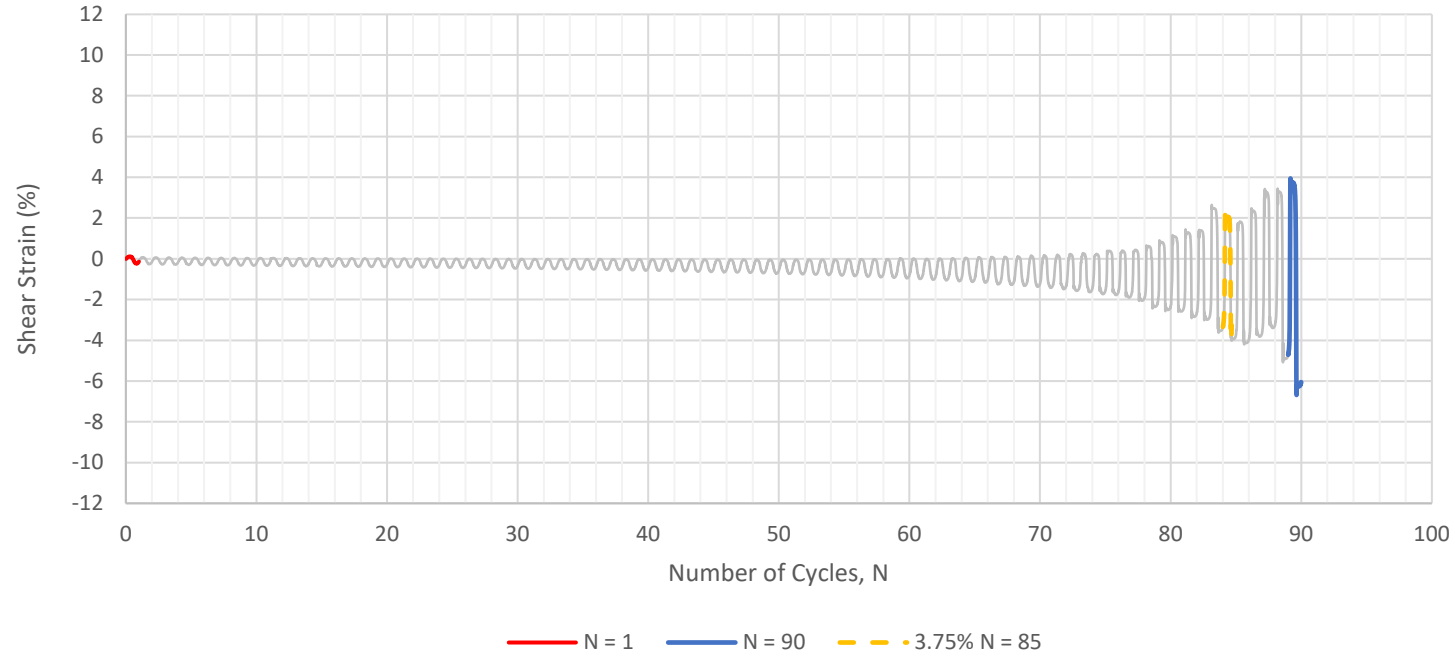

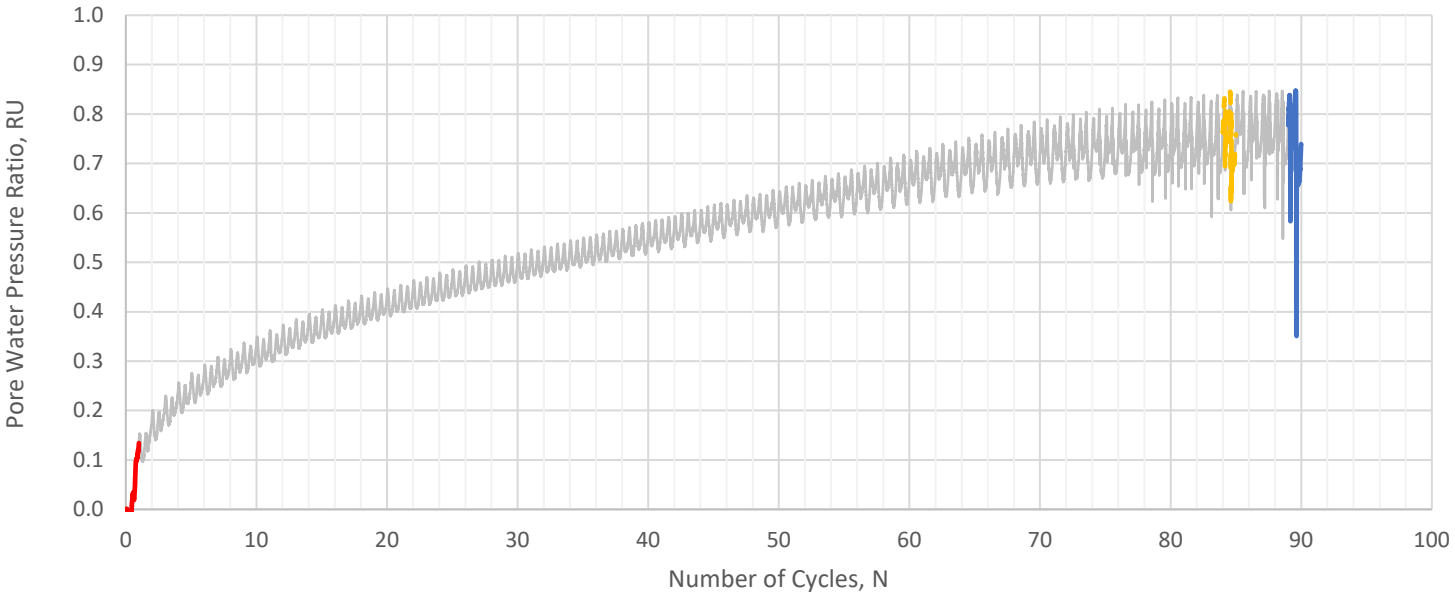

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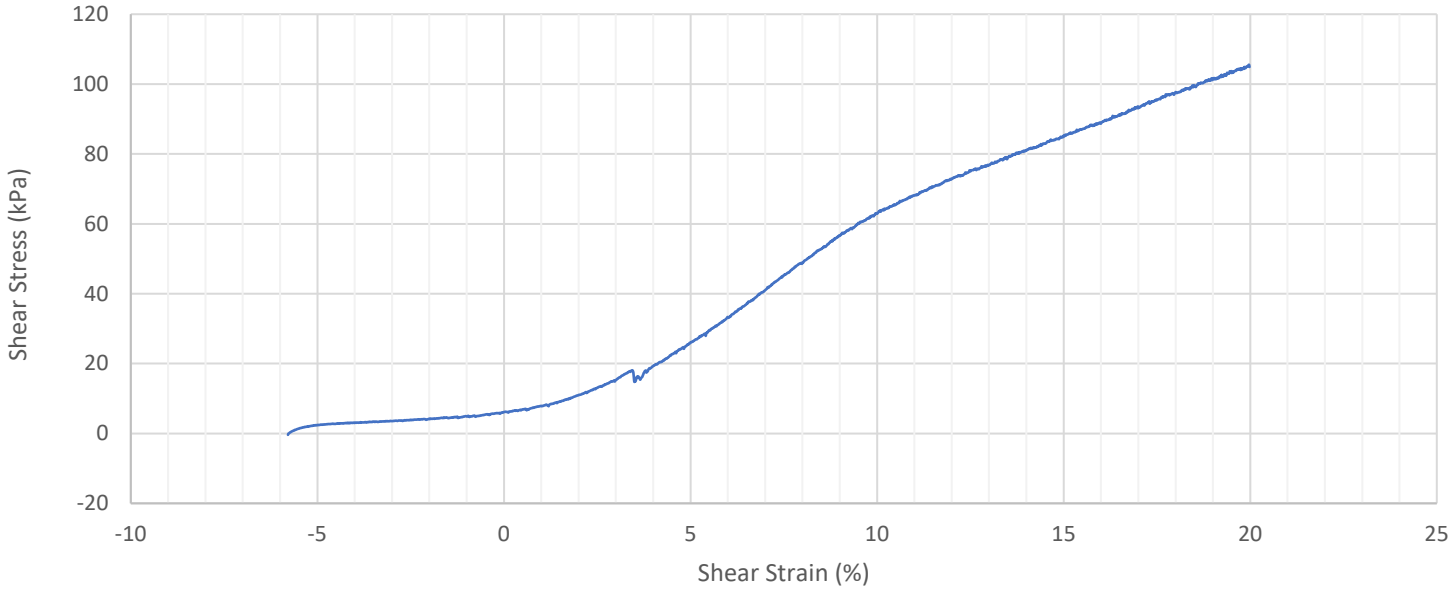

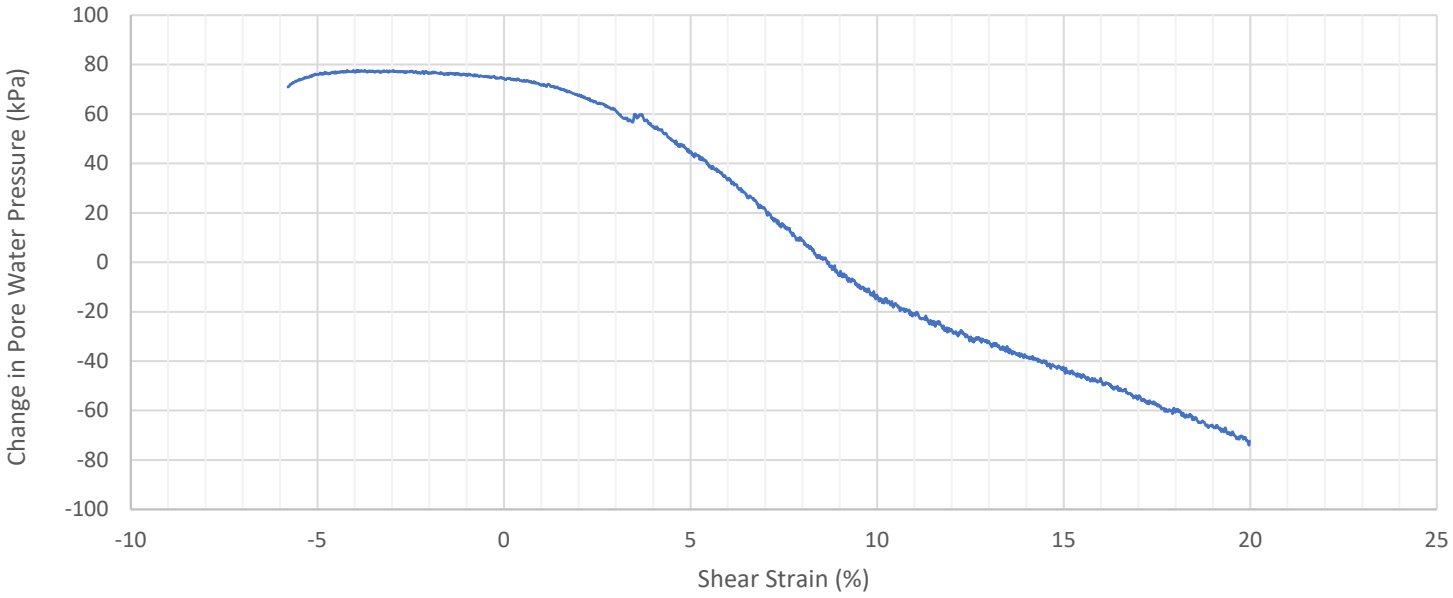

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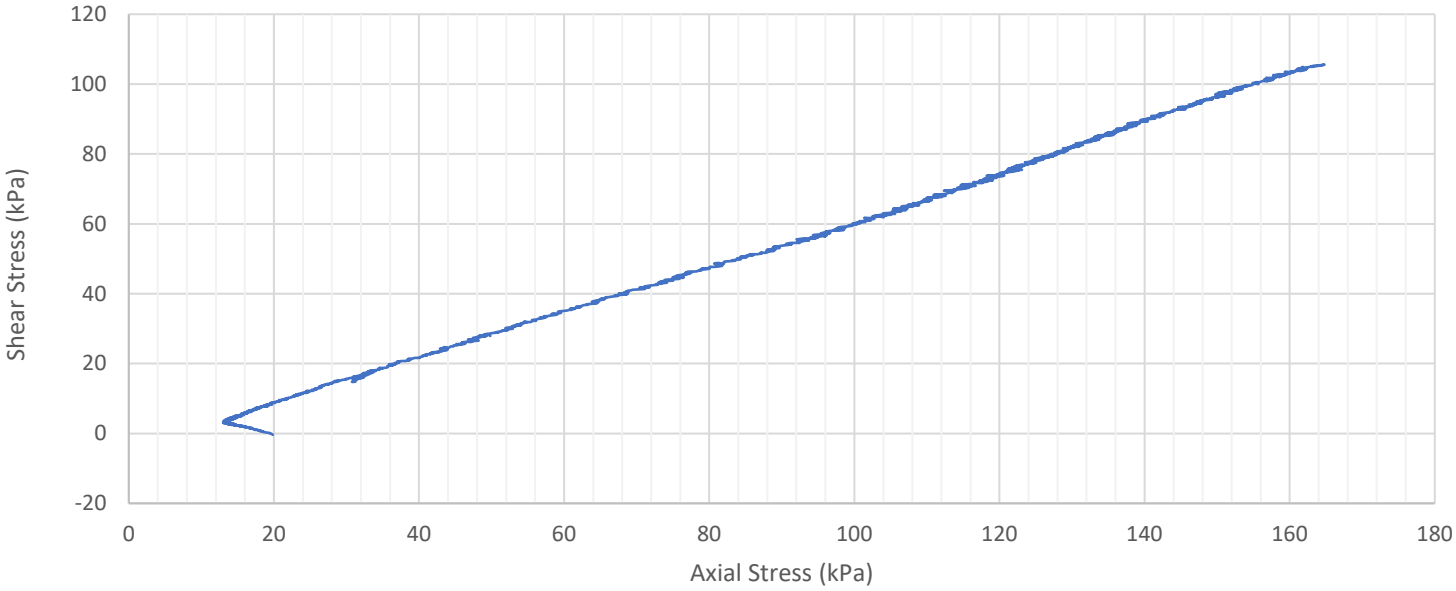

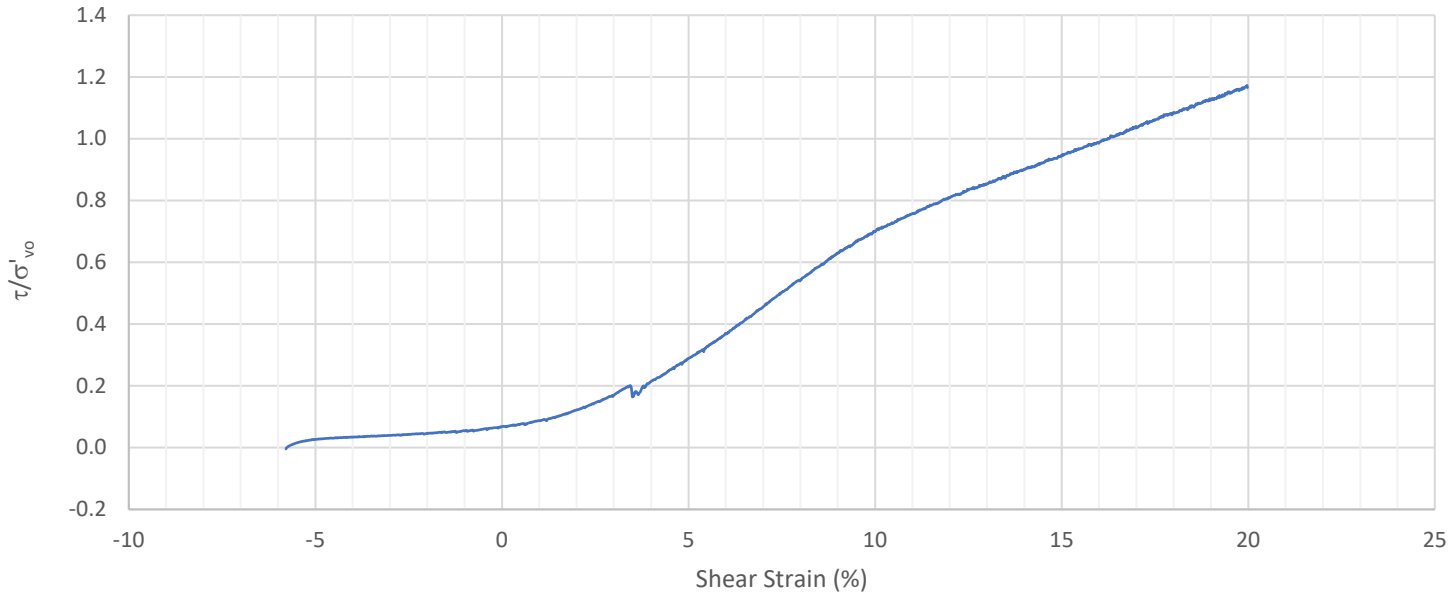

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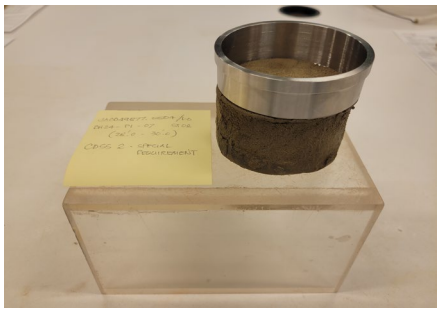
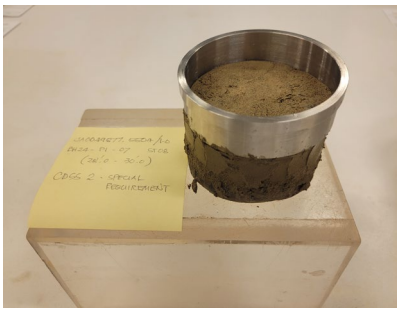
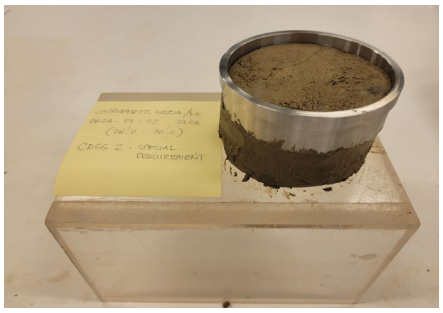
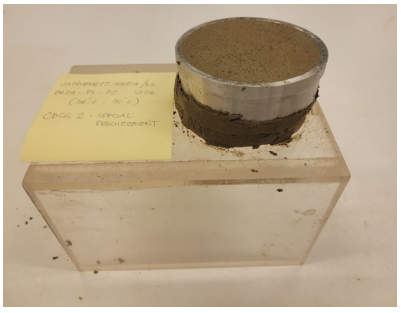
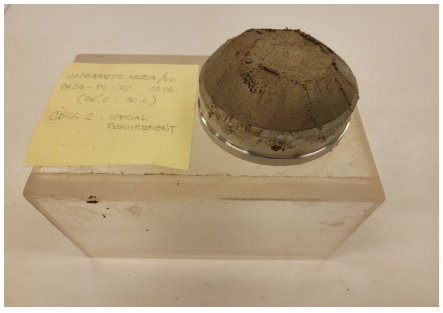
Tel: 604-412-6899 Fax: 604-412-6816 www.wsp.com

Cyclic Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST08
Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.10CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

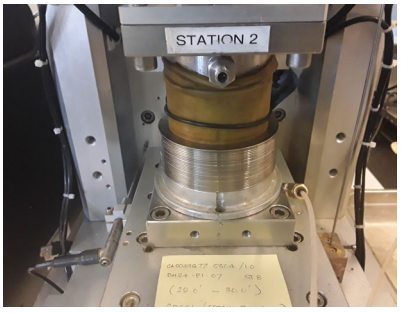












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T. Madera	July 15, 2025	M. Badanagki	July 28, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Cyclic Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST08
Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.15CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

General Remarks

~100 ml of water passed through sample during consolidation

Achieved dry density = 1988kg/m³

Sample flushed with CO2 prior to saturation

Equipment Description: GDS - Station 3

Vertical LVDT	Serial No.:	11894
Vertical Load Cell	Serial No.:	38407
Shear Load Cell	Serial No.:	158879

Sample Properties

Preparation Method	Trim from Undisturbed
Height (mm)	24.19
Diameter (mm)	69.56
Area (cm^2)	38.00
Volume (cm^3)	91.93
Specific Gravity (assumed)	2.90

Visual Description	SAND, some silt, brown, wet, dense. Sample is dilatant.		
Coarse Fraction (%)	N/A	Liquid Limit	N/A
Fine Fraction (%)	N/A	Plastic Limit	N/A
Shear Strength est. (kPa)		N/A	
Sensitivity		N/A	

Weight Volume Relationships

Initial Wet Mass (g)	209.47
Dry Mass (g)	182.71
Initial Wet Unit Weight (kN/m^3)	22.35
Initial Dry Unit Weight (kN/m^3)	19.50

Initial Water Content (%)	14.65
Initial Saturation (%)	93.05
Final Water Content (%)	16.31
Final Saturation (%)	>100

Consolidation

Effective Overburden Pressure (kPa)	N/A
Max Applied Vertical Stress (kPa)	90.39
Vertical Stress at end of Consol (kPa)	90.10
Laboratory OCR	N/A

Max. Axial Strain %	3.36
Axial Strain at end of Consol. %	3.35
Change in Height ΔH_c (mm)	0.81

Cyclic Test Results

Frequency (Hz)	1.00
CSR	0.57
Cycles to 3.75% Shear Strain	10
Initial Vertical Stress (kPa)	89.86
Max Abs. Cyclic Shear Stress (kPa)	51.08
Max. Shear Strain at N=10 (zero load)	3.90
Min. Shear Strain at N=10 (zero load)	-1.85
Max. u at N=10 (zero load)	81.65
Min. u at N=10 (zero load)	79.40

Post Cyclic Monotonic Test Results

Initial Vertical Stress (kPa)	11.37
Initial Shear Stress (kPa)	-1.84
Applied Shear Bias (kPa)	0.00
Rate of Shearing (%/hr)	4.88
Peak Shear Strength (kPa)	55.10
Excess Pore Pressure at Peak (kPa)	11.45
Ratio of Peak / σ'_v	0.61
Maximum Shear Strain γ_{MAX} (%)	19.39
Shear Strength at γ_{MAX} (kPa)	55.05

Comments / Special Instructions

*Target CSR = 0.15, as the sample liquified equipment was unable to maintain target

Comments / Special Instructions

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T. Madera	July 17, 2025	M. Badanagki	July 28, 2025
TESTED BY	DATE	CHECKED BY	DATE

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Cyclic Direct Simple Shear Testing of Soils Under Consolidated Constant-Volume Conditions

NORSOK G-001

Project No.:	CA0049877.5504	**Sample Number:**	BH24-P1-07 ST08
Project:	Keno Hill District Mill Site	**Test ID:**	90 kPa 0.15CSR
Location:	Yukon	**Depth (m):**	8.53 - 9.14
Client:	Tetra Tech	**Lab ID No:**	B25-079

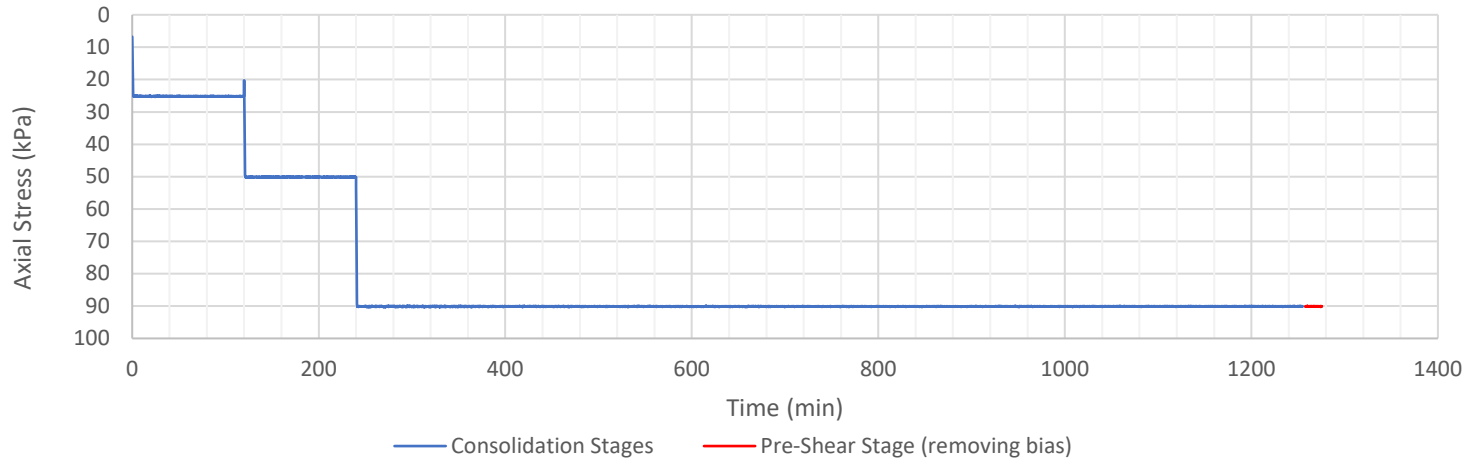
Consolidation Summary

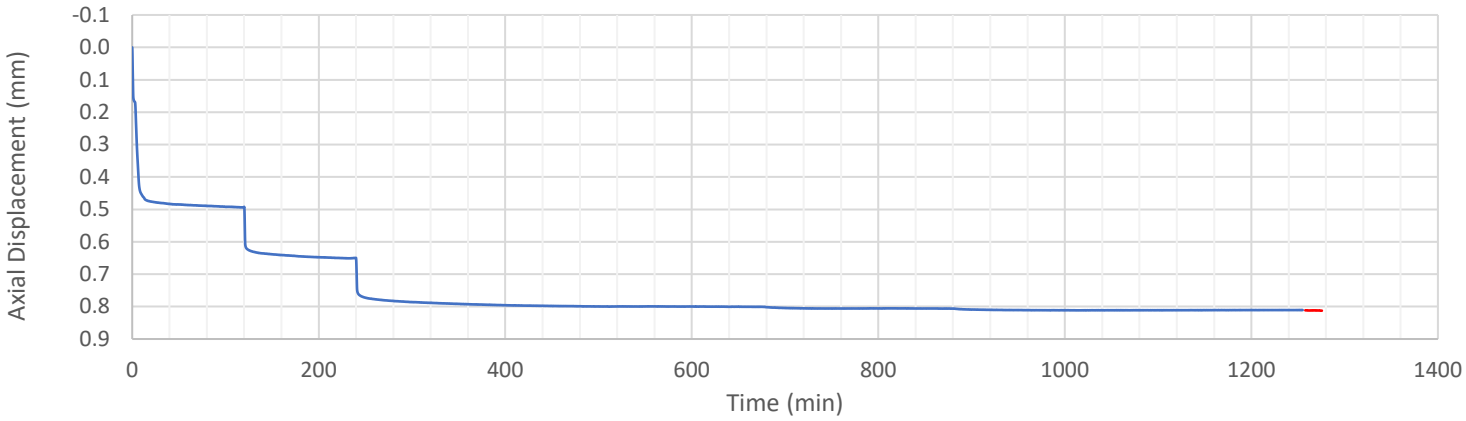
Stress at end of Consolidation (kPa)	90.10
Axial Strain at end of Consolidation (%)	3.35
Laboratory Induced OCR	N/A
Change in Height DH_c (mm)	0.81

Comments

Volumetric strains during consolidation may not be comparable to those measured in an oedometer test due to seating of the platens and possible lateral sample deformation during loading.

Increment (kPa)	25	50	90								
Load (kN)	0.0964	0.1913	0.3435								
Duration (min)	120	120	1015								
Axial Strain (%)	2.04	2.69	3.36								





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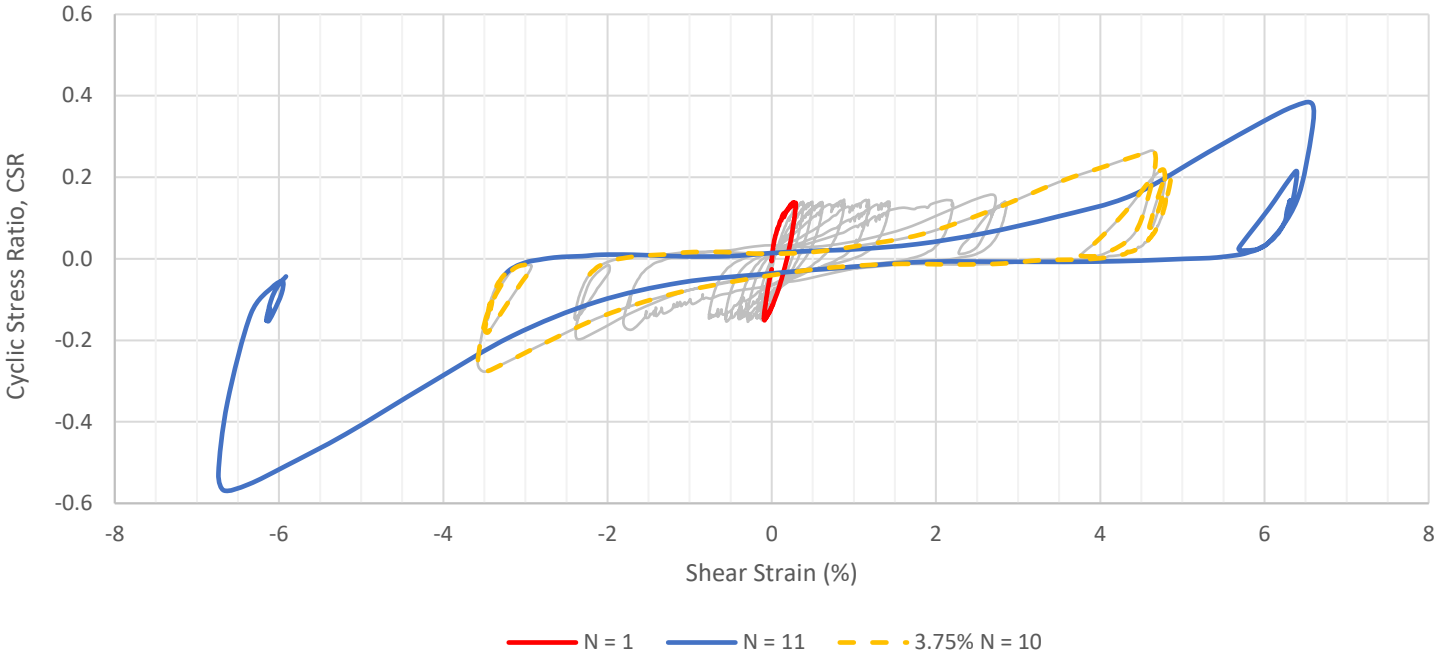

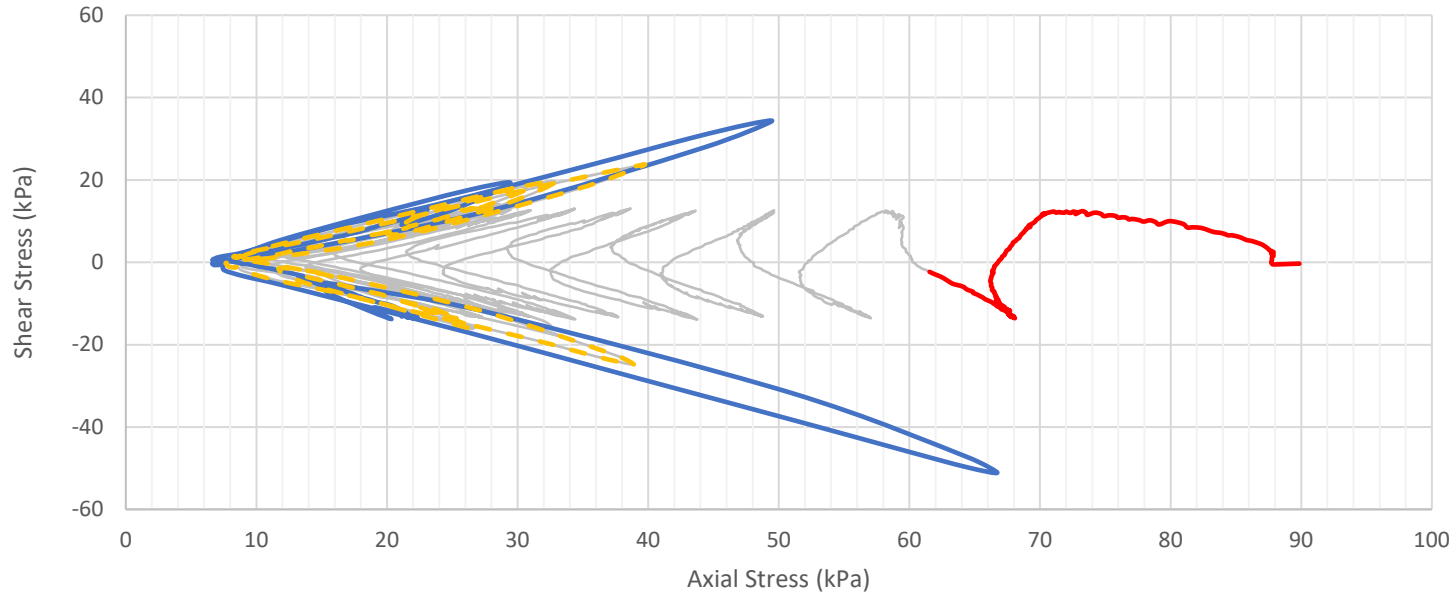

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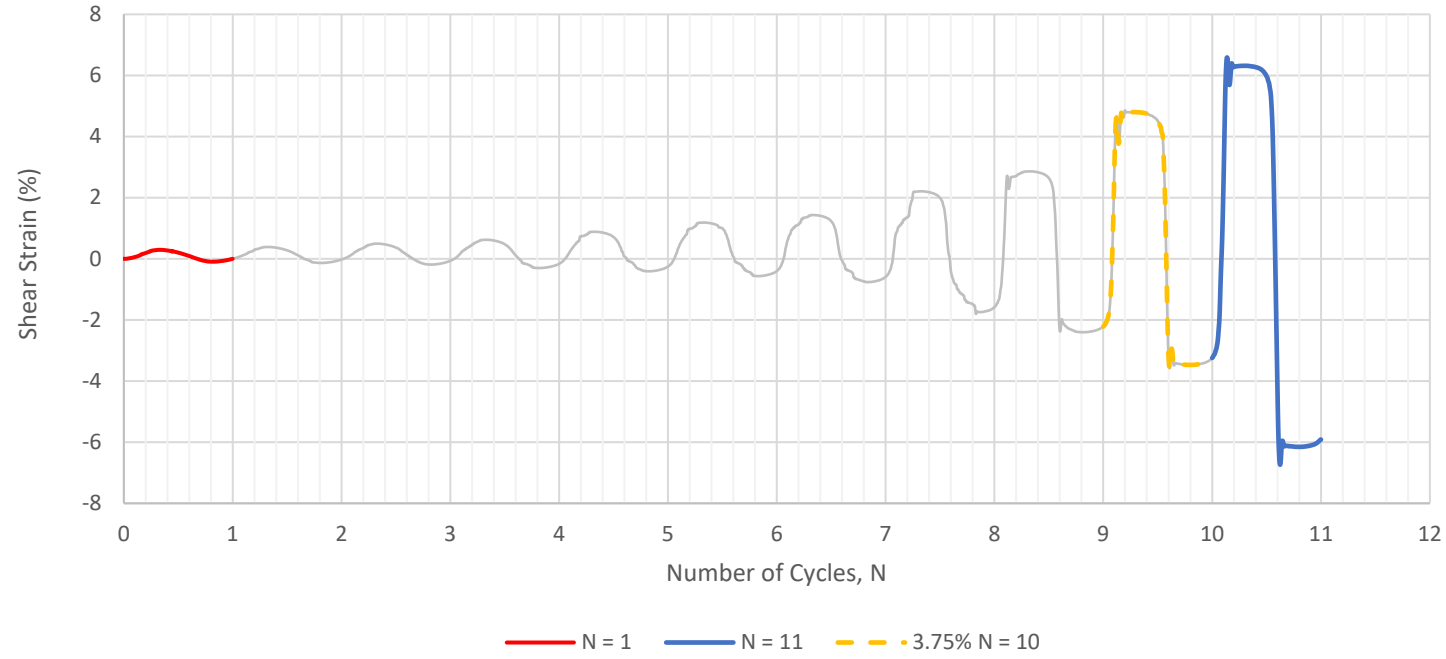

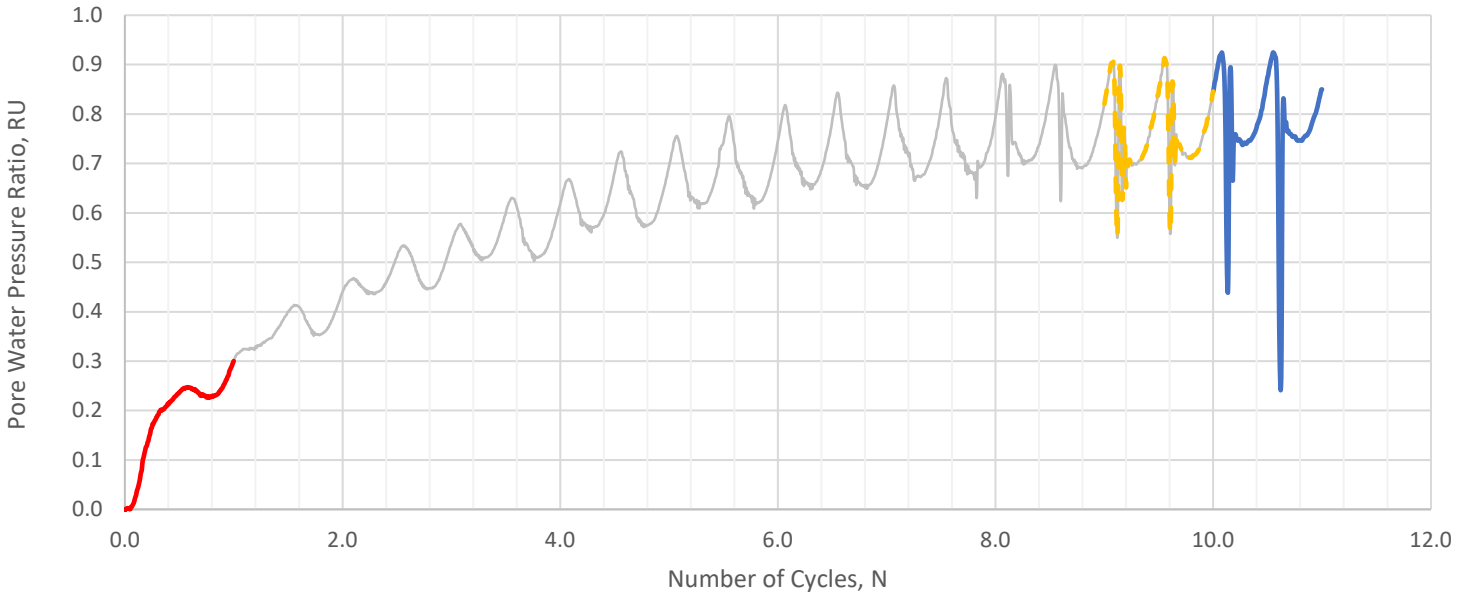

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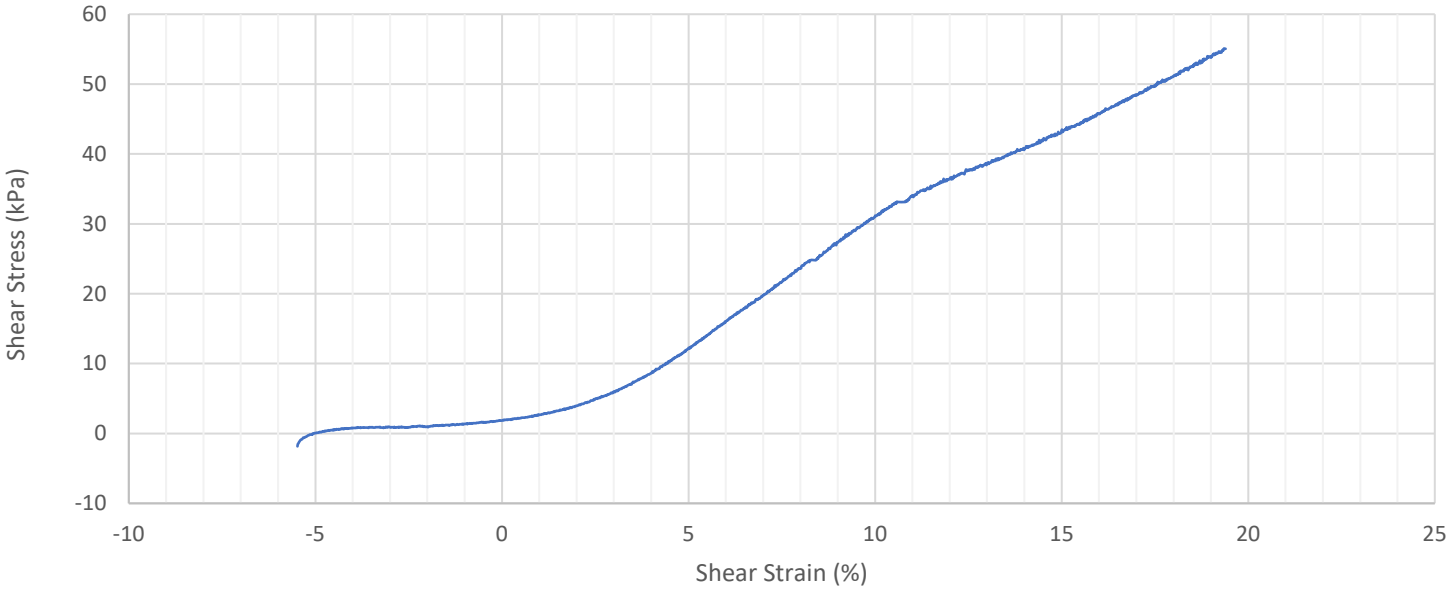

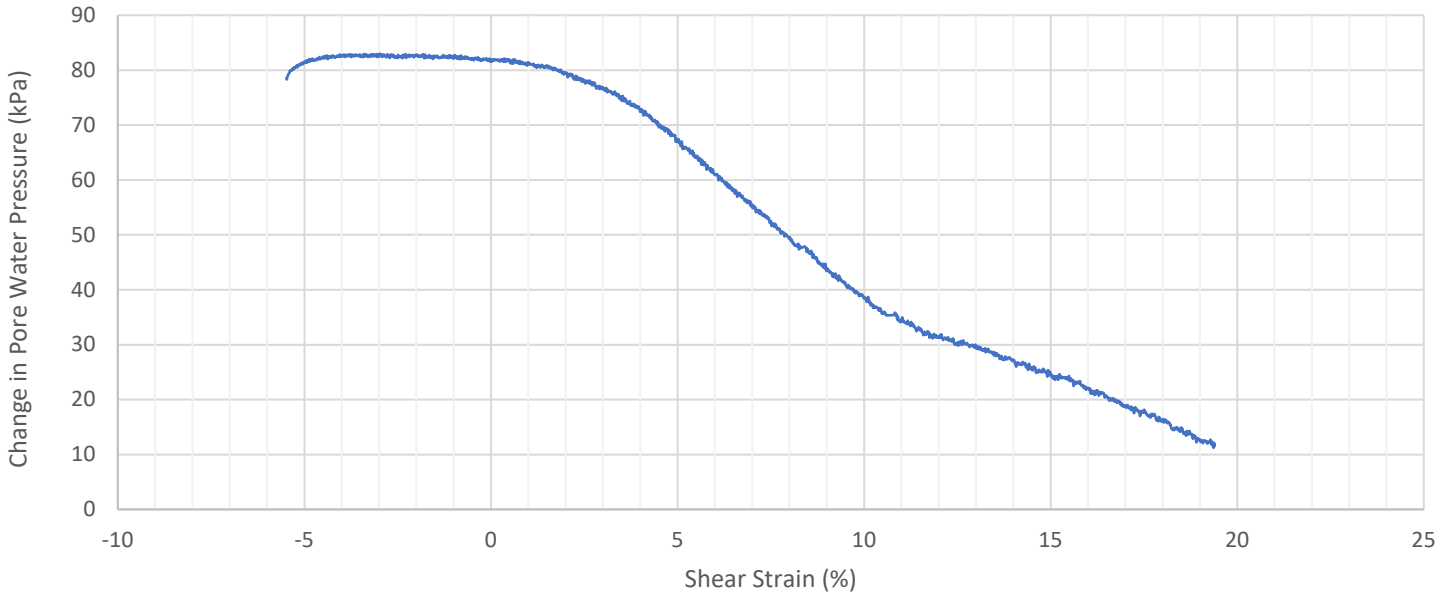

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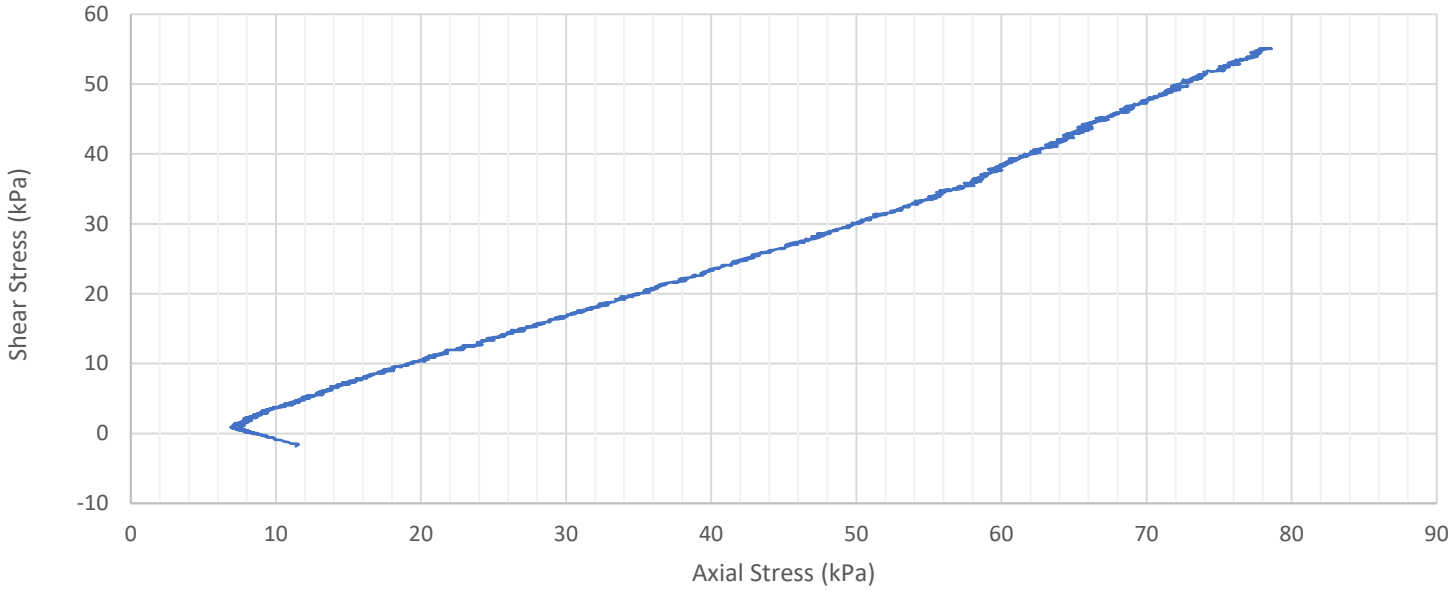

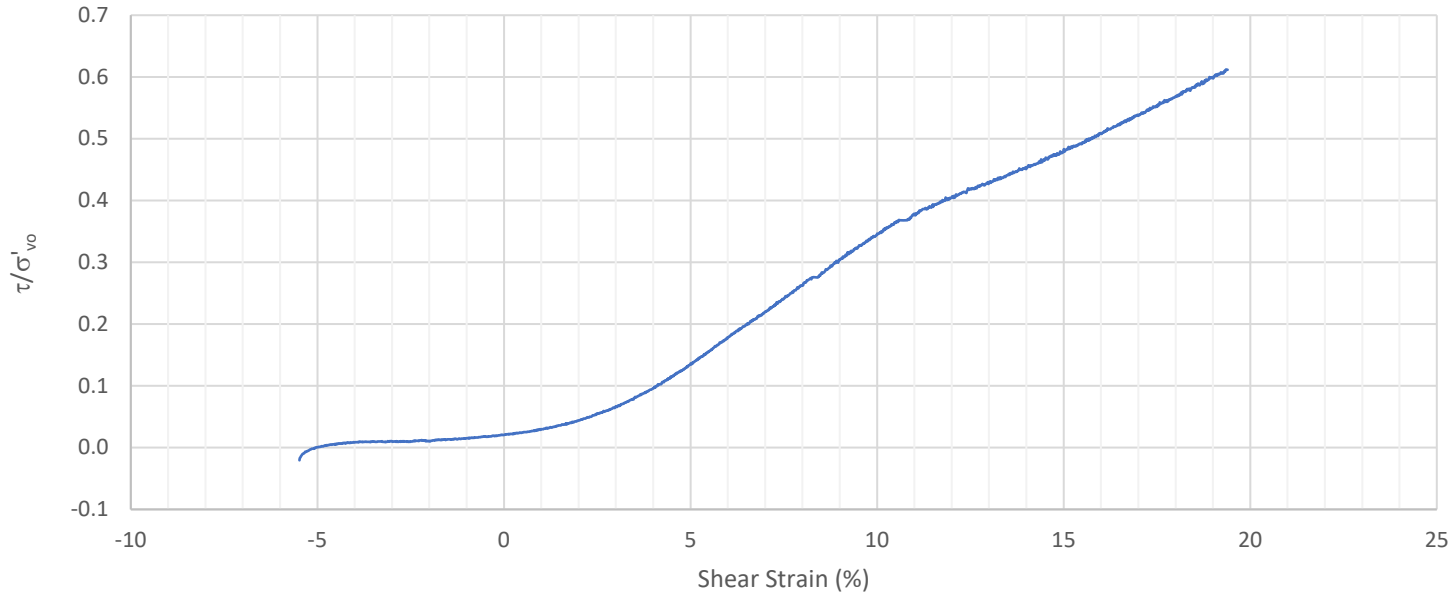

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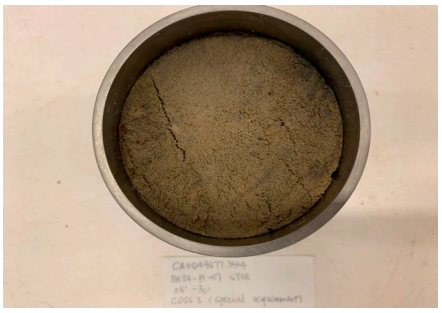
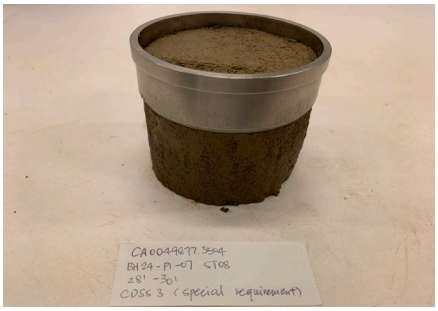
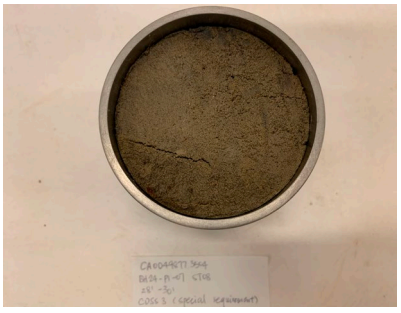
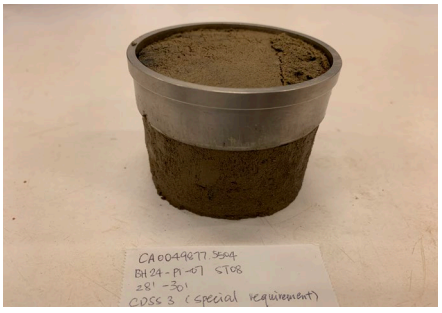

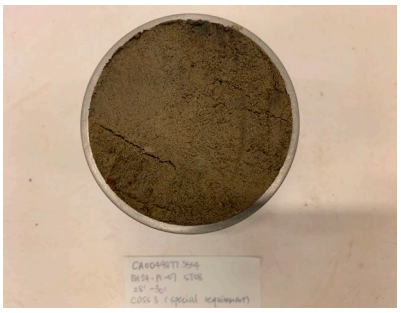








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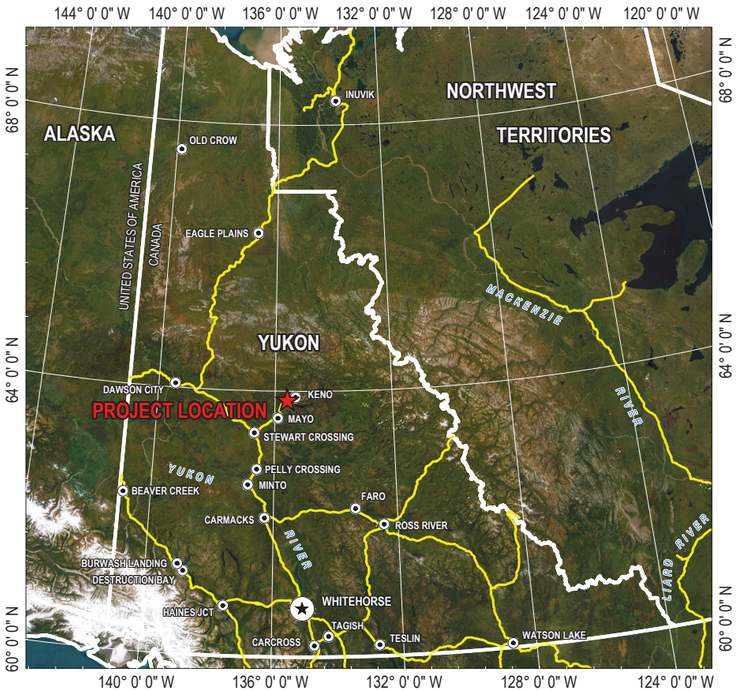
APPENDIX E

P2W DSTF 95% ISSUED FOR PERMITTING DRAWIGN PACKAGE

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

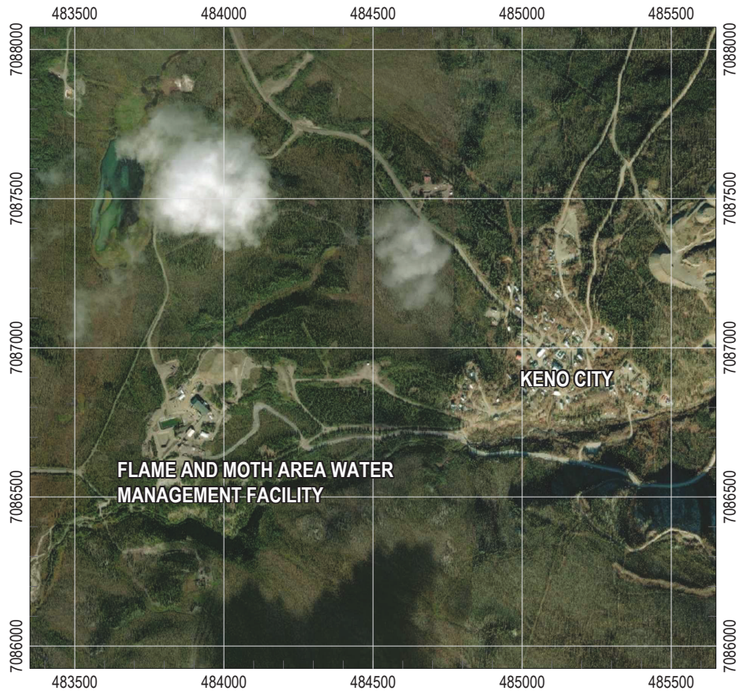
PREPARED FOR

Hecla MINING COMPANY



GENERAL LOCATION MAP OF THE YUKON TERRITORY

SCALE = 1:10,000,000



SITE PLAN

SCALE = 1:20,000

SHEET	TITLE
C100	COVER SHEET
C101	SITE PLAN
C500	PHASE 2 WEST DSTF PRE-CONSTRUCTION PLAN VIEW
C501	PHASE 2 WEST DSTF FINAL TAILINGS CONFIGURATION
C502	PHASE 2 WEST DSTF FINAL TAILINGS CONFIGURATION CROSS-SECTIONS
C503	PHASE 2 WEST DSTF SITE PREPARATION AND SUBEXCAVATION
C504	PHASE 2 WEST DSTF CONTACT WATER SEEPAGE, COLLECTION, AND CONVEYANCE
C505	PHASE 2 WEST DSTF POST CONSTRUCTION PLAN VIEW
C506	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE PROFILE
C507	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE SECTIONS STATION 0+030 TO 0+180
C508	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE SECTIONS STATION 0+190 TO 0+240
C509	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE CROSS-SECTIONS C-C' AND D-D'
C510	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE CROSS-SECTION E-E'
C511	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE NON-CONTACT WATER SYSTEM
C512	PHASE 2 WEST DSTF CONTAINED TAILINGS TOE STRUCTURE CONCEPTUAL ABUTMENT TIE-IN
C513	CONTACT SEEPAGE COLLECTION AND UNDER TAILINGS DRAINAGE PIPE EXTENSION PROFILE
C514	PHASE 2 WEST DSTF HAUL ROAD PLAN AND PROFILE
C515	PHASE 2 WEST DSTF HAUL ROAD SECTIONS STATION 0+010 TO 0+120
C516	PHASE 2 WEST DSTF HAUL ROAD SECTIONS STATION 0+130 TO 0+190
C517	PHASE 2 WEST DSTF TYPICAL DETAILS (1 of 3)
C518	PHASE 2 WEST DSTF TYPICAL DETAILS (2 of 3)
C519	PHASE 2 WEST DSTF TYPICAL DETAILS (3 of 4)
C520	PHASE 2 WEST DSTF TYPICAL DETAILS (4 of 4)

95% DRAWINGS - ISSUED FOR PERMITTING

TETRA TECH

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C100 SERIES - GENERAL\ENG.WARC04673-04_GENERAL_DSTF-C100.dwg February 20, 2026 (BY: LEE, ELVIN)



NOTES:
1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. IMAGE FROM PROPELLER, DATED SEPTEMBER 7, 2025.

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
YUKON TERRITORY
M. ESTRADA
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

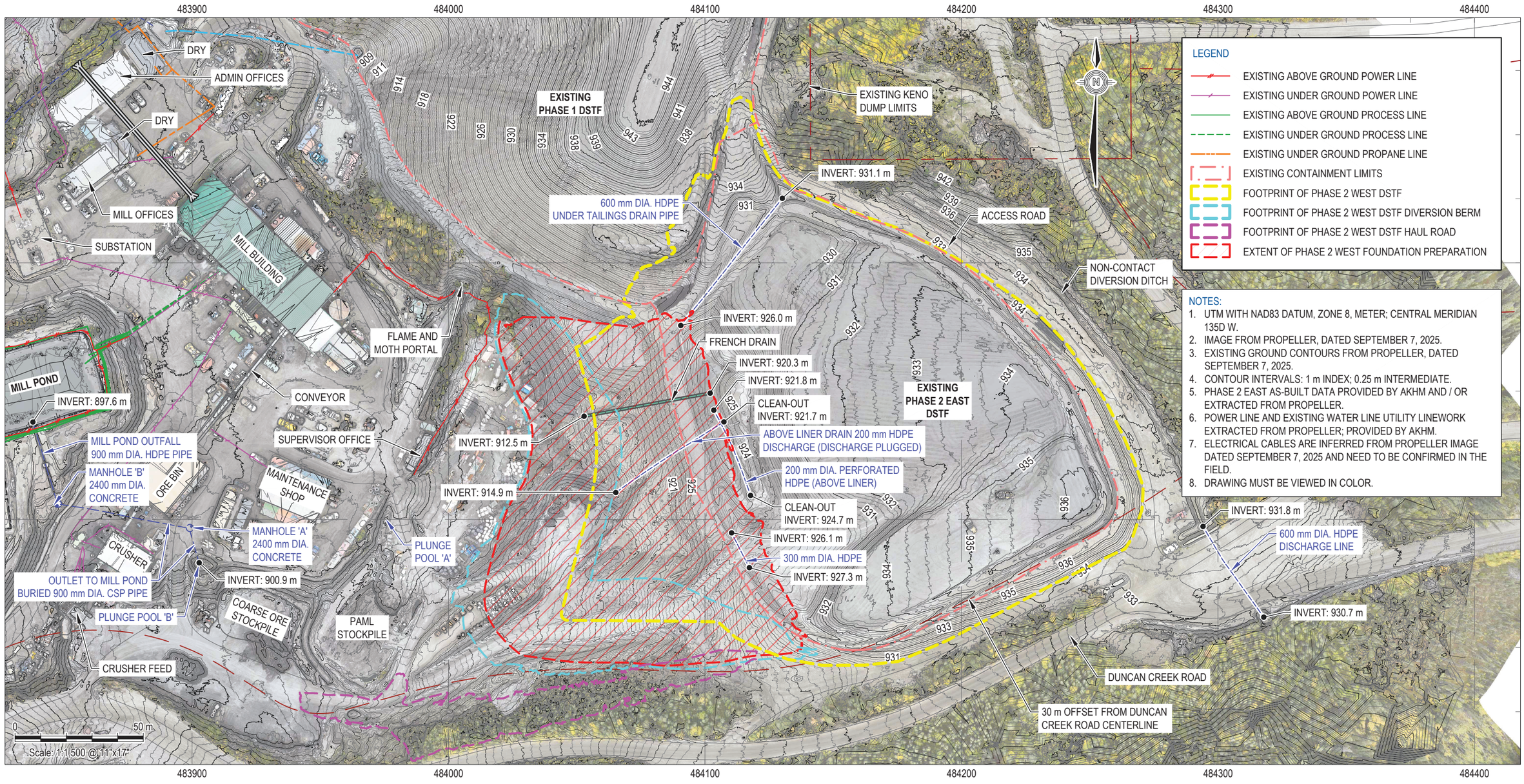
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

SITE PLAN

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C101
DATE:	SHEET No.	DWN	APP	STATUS	
FEBRUARY 20, 2026	2 of 23	EL	GK	C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C500.dwg [C500] February 20, 2026 - 7:27:23 pm (BY: LEE, ELVIN)



LEGEND

- EXISTING ABOVE GROUND POWER LINE
- EXISTING UNDER GROUND POWER LINE
- EXISTING ABOVE GROUND PROCESS LINE
- EXISTING UNDER GROUND PROCESS LINE
- EXISTING UNDER GROUND PROPANE LINE
- EXISTING CONTAINMENT LIMITS
- FOOTPRINT OF PHASE 2 WEST DSTF
- FOOTPRINT OF PHASE 2 WEST DSTF DIVERSION BERM
- FOOTPRINT OF PHASE 2 WEST DSTF HAUL ROAD
- EXTENT OF PHASE 2 WEST FOUNDATION PREPARATION

NOTES:

1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. IMAGE FROM PROPELLER, DATED SEPTEMBER 7, 2025.
3. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
4. CONTOUR INTERVALS: 1 m INDEX; 0.25 m INTERMEDIATE.
5. PHASE 2 EAST AS-BUILT DATA PROVIDED BY AKHM AND / OR EXTRACTED FROM PROPELLER.
6. POWER LINE AND EXISTING WATER LINE UTILITY LINEWORK EXTRACTED FROM PROPELLER; PROVIDED BY AKHM.
7. ELECTRICAL CABLES ARE INFERRED FROM PROPELLER IMAGE DATED SEPTEMBER 7, 2025 AND NEED TO BE CONFIRMED IN THE FIELD.
8. DRAWING MUST BE VIEWED IN COLOR.

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C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
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PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
YUKON TERRITORY
M. ESTRADA
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
PRE-CONSTRUCTION PLAN VIEW

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C500
DATE: FEBRUARY 20, 2026	SHEET No. 3 of 23	DWN EL	APP GK	STATUS C	

LEGEND

- EXISTING ABOVE GROUND POWER LINE
- EXISTING UNDER GROUND POWER LINE
- INSTALLED PHASE 2 WEST CONVEYANCE PIPES
- CONTACT WATER RUNOFF

NOTES:

1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
3. CONTOUR INTERVALS: 1 m INDEX; 0.25 m INTERMEDIATE.
4. PHASE 2 EAST AS-BUILT DATA PROVIDED BY AKHM AND / OR EXTRACTED FROM PROPELLER.
5. POWER LINE AND EXISTING WATER LINE UTILITY LINEWORK EXTRACTED FROM PROPELLER; PROVIDED BY AKHM.
6. ELECTRICAL CABLES ARE INFERRED FROM PROPELLER IMAGE DATED SEPTEMBER 7, 2025 AND NEED TO BE CONFIRMED IN THE FIELD.
7. DRAWING MUST BE VIEWED IN COLOR.

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON TERRITORY M. ESTRADA Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

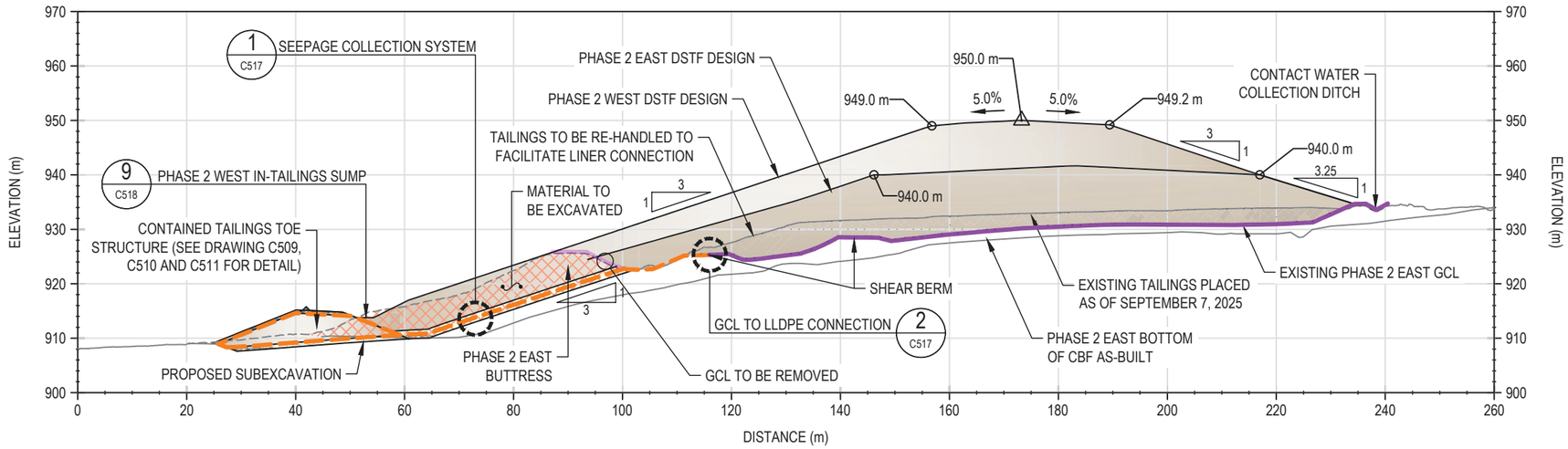
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

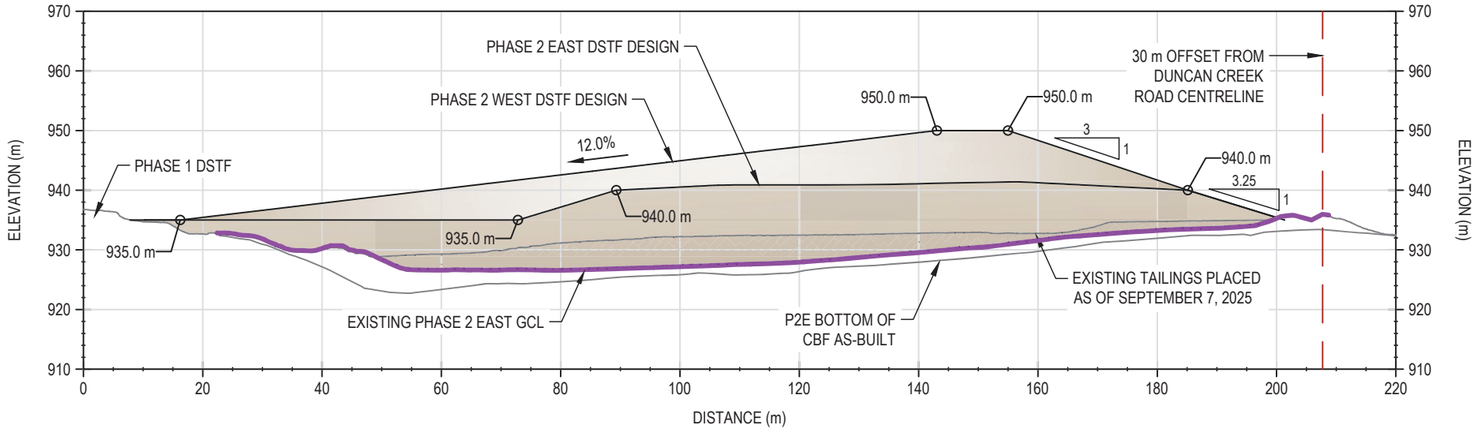
PHASE 2 WEST DSTF
FINAL TAILINGS CONFIGURATION

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C501
DATE: FEBRUARY 20, 2026	SHEET No. 4 of 23	DWN EL	APP GK	STATUS C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C501_C502.dwg [C501] February 20, 2026 - 7:29:21 pm (BY: LEE, ELVIN)



A C501 CROSS-SECTION
SCALE: 1:1000



B C501 CROSS-SECTION
SCALE: 1:1000

LEGEND

- 80 mil TEXTURED LLDPE
- EXISTING PHASE 2 EAST GCL
- EXISTING PHASE 2 EAST GCL TO BE REMOVED
- CONTAINED TAILINGS TOE STRUCTURE
- PHASE 2 WEST DESIGN PLACEMENT
- PHASE 2 EAST DESIGN PLACEMENT
- EXISTING TAILINGS PLACED AS OF SEPTEMBER 7, 2025
- MATERIAL TO BE EXCAVATED AS PART OF PHASE 2 WEST SUBEXCAVATION

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
FINAL TAILINGS CONFIGURATION
CROSS-SECTIONS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C502
DATE: FEBRUARY 20, 2026	SHEET No. 5 of 23	DWN EL	APP GK	STATUS C	

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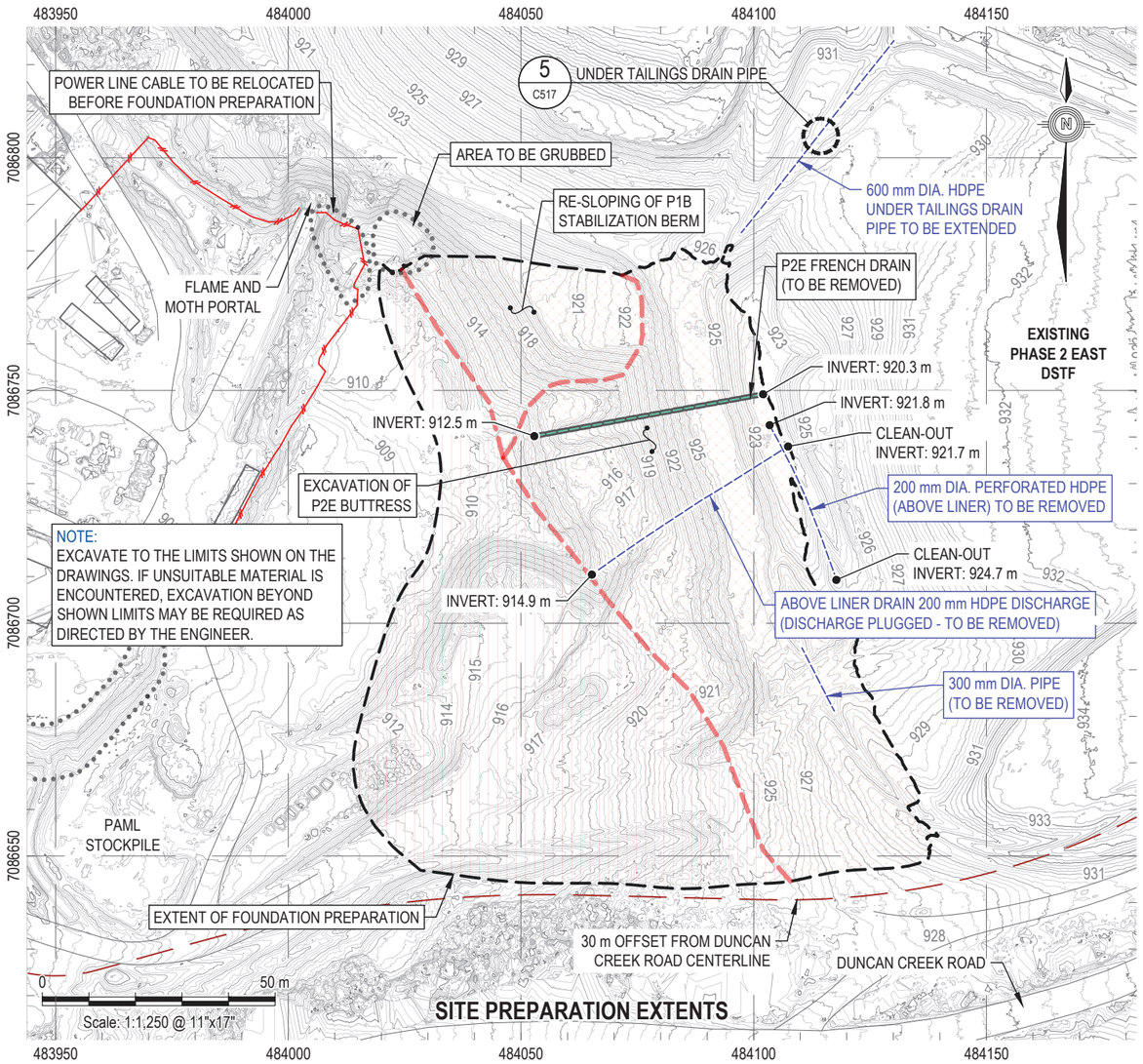

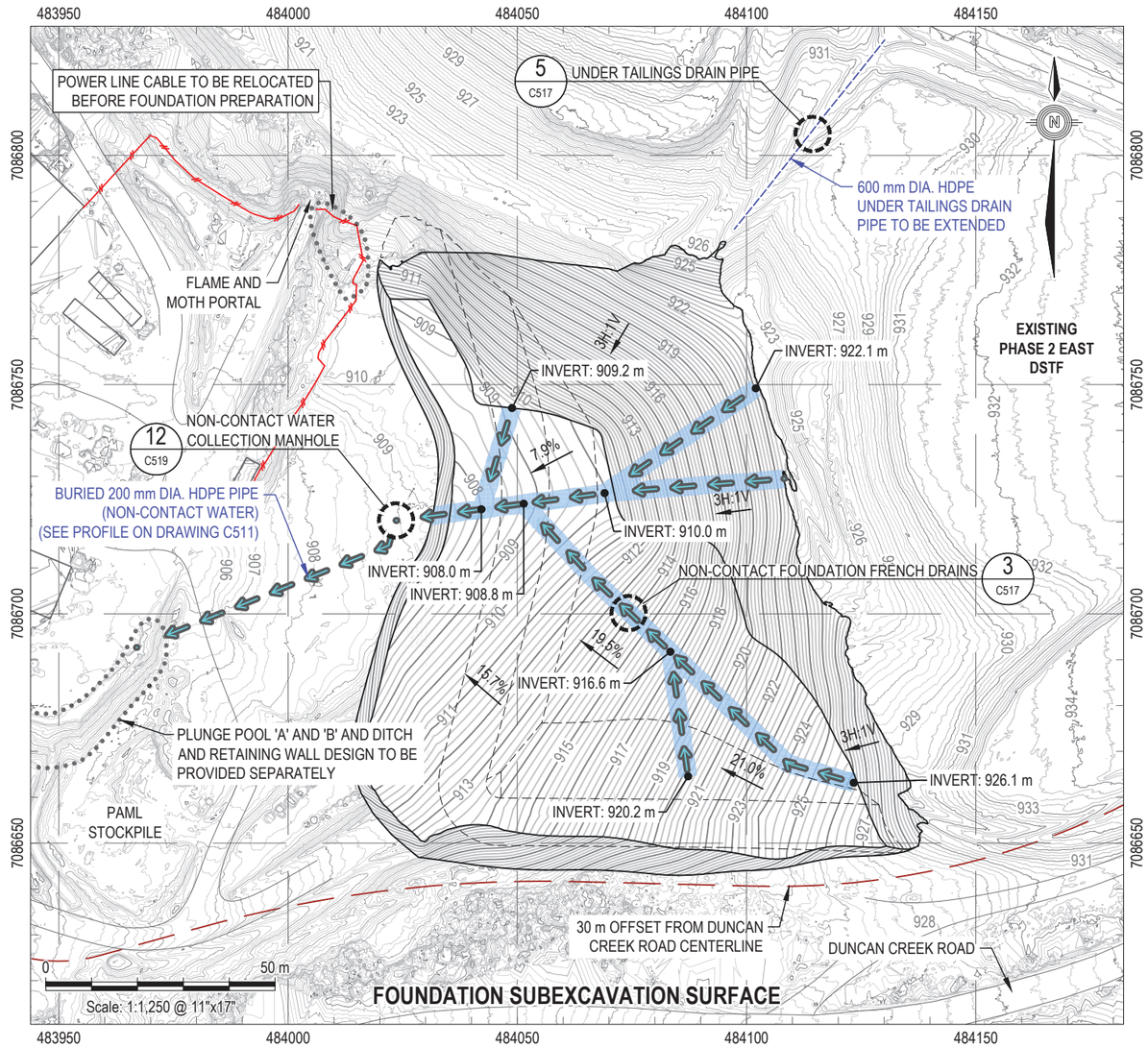

LEGEND

- EXISTING ABOVE GROUND POWER LINE
- EXTENT OF FOUNDATION PREPARATION
- EXISTING P1B STABILIZATION BERM AND P2E BUTTRESS EXCAVATION
- SUBEXCAVATION
- INSTALLED PHASE 2 EAST CONVEYANCE PIPE
- PROPOSED FRENCH DRAIN FLOW PATH
- UNDERLINER FRENCH DRAIN ROCK FOOTPRINT

NOTES:

1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
3. CONTOUR INTERVALS: 1 m INDEX; 0.25 m INTERMEDIATE.
4. PHASE 2 EAST AS-BUILT DATA PROVIDED BY AKHM AND / OR EXTRACTED FROM PROPELLER.
5. POWER LINE AND EXISTING WATER LINE UTILITY LINEWORK EXTRACTED FROM PROPELLOR; PROVIDED BY AKHM.
6. ELECTRICAL CABLES ARE INFERRED FROM PROPELLER SATELLITE IMAGE DATED SEPTEMBER 7, 2025 AND NEED TO BE CONFIRMED IN THE FIELD.
7. DRAWING MUST BE VIEWED IN COLOR.
8. FRENCH DRAIN INVERTS AND ALIGNMENTS TO BE CONFIRMED POST-EXCAVATION.

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON TERRITORY M. ESTRADA Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
SITE PREPARATION AND SUBEXCAVATION

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C503
DATE: FEBRUARY 20, 2026	SHEET No. 6 of 23	DWN EL	APP GK	STATUS C	

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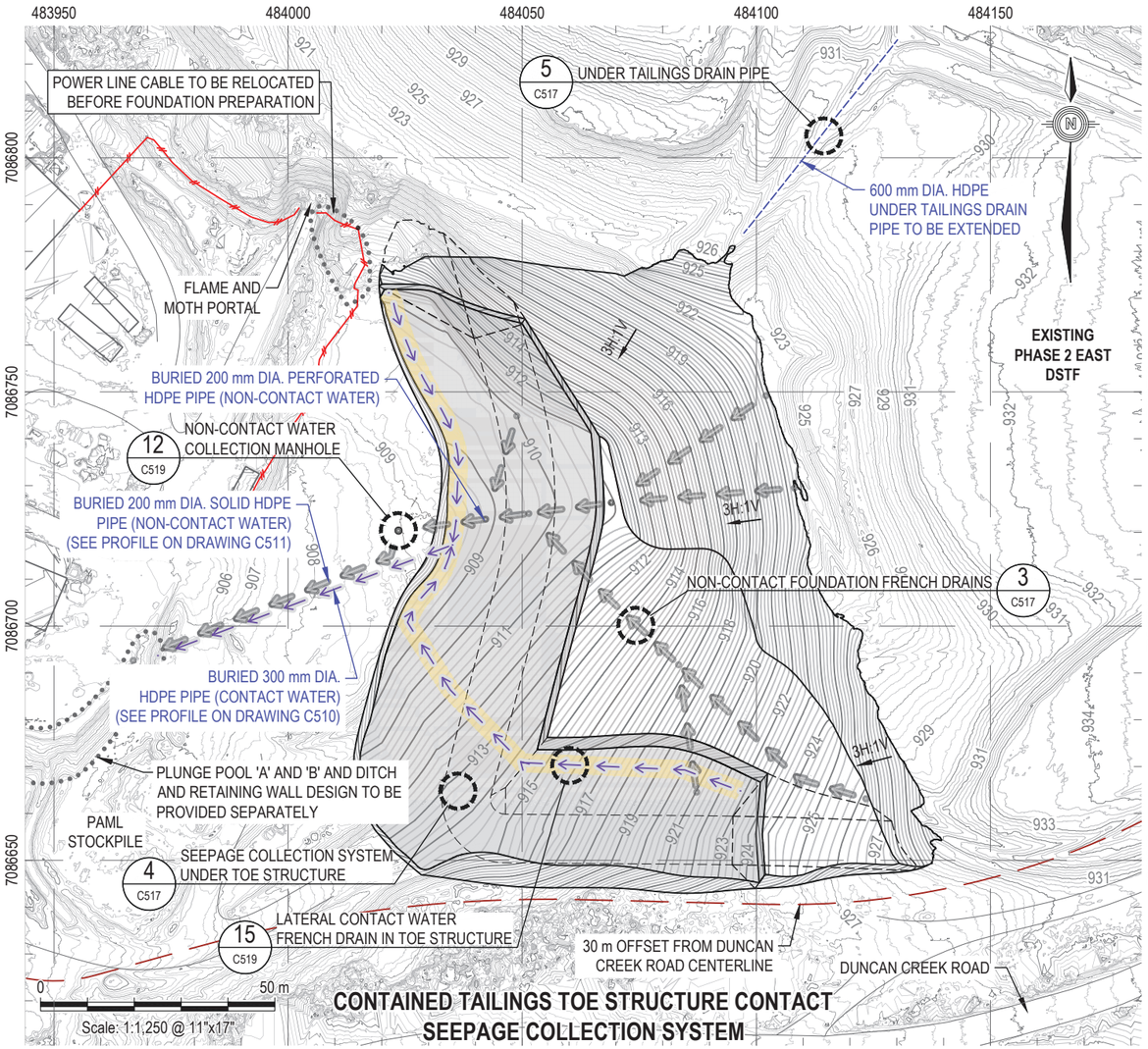
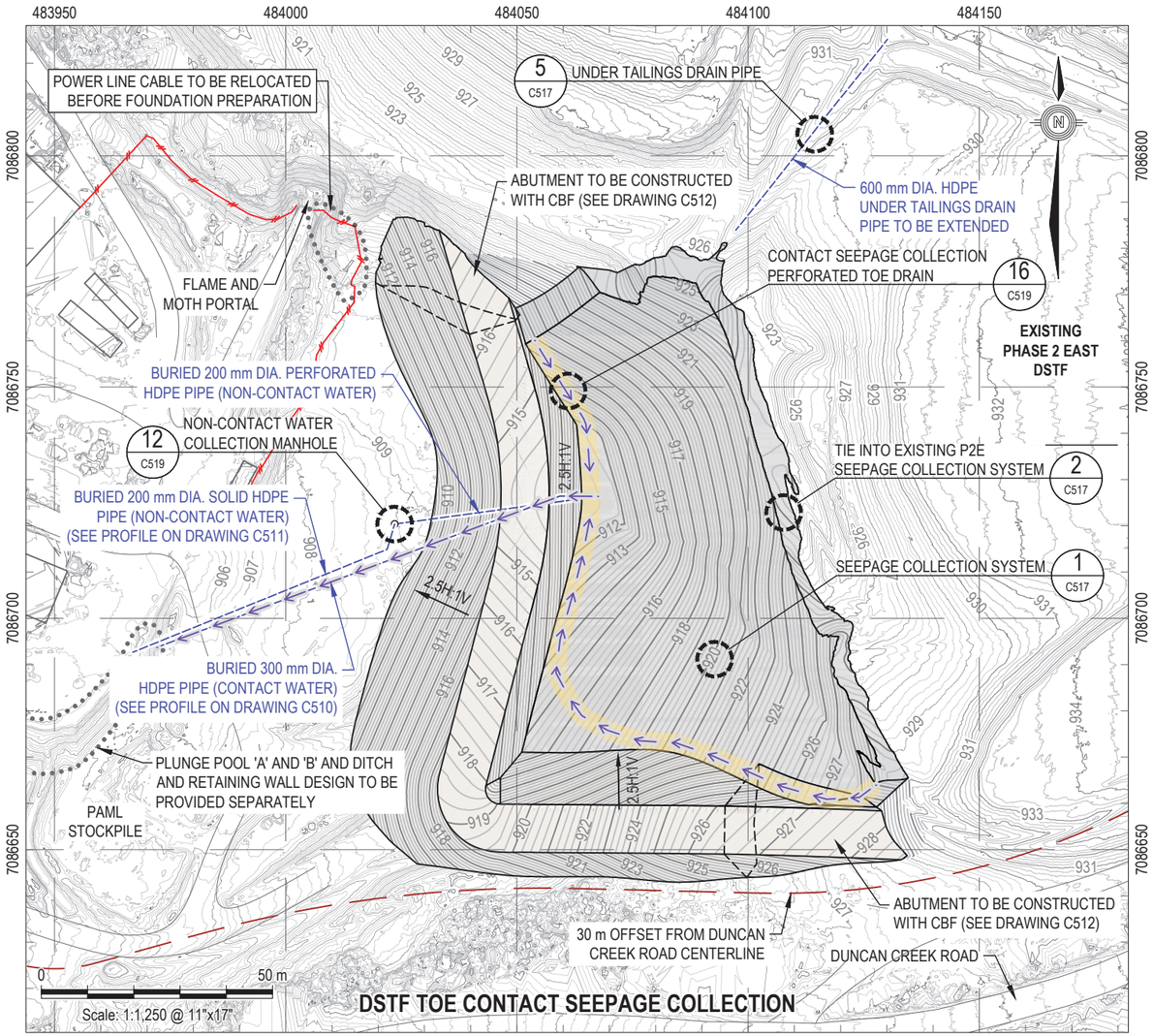




LEGEND

- EXISTING ABOVE GROUND POWER LINE
- NON-CONTACT WATER FRENCH DRAIN
- CONTACT WATER TOE DRAIN
- INSTALLED PHASE 2 WEST CONVEYANCE PIPE

NOTES:

1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
3. CONTOUR INTERVALS: 1 m INDEX; 0.25 m INTERMEDIATE.
4. PHASE 2 EAST AS-BUILT DATA PROVIDED BY AKHM AND / OR EXTRACTED FROM PROPELLER.
5. POWER LINE AND EXISTING WATER LINE UTILITY LINEWORK EXTRACTED FROM PROPELLOR; PROVIDED BY AKHM.
6. ELECTRICAL CABLES ARE INFERRED FROM PROPELLER SATELLITE IMAGE DATED SEPTEMBER 7, 2025 AND NEED TO BE CONFIRMED IN THE FIELD.
7. CONTACT WATER CONVEYANCE PIPE INVERTS AND ALIGNMENTS TO BE CONFIRMED IN THE FIELD.
8. DRAWING MUST BE VIEWED IN COLOR.

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

CLIENT

Hecla MINING COMPANY

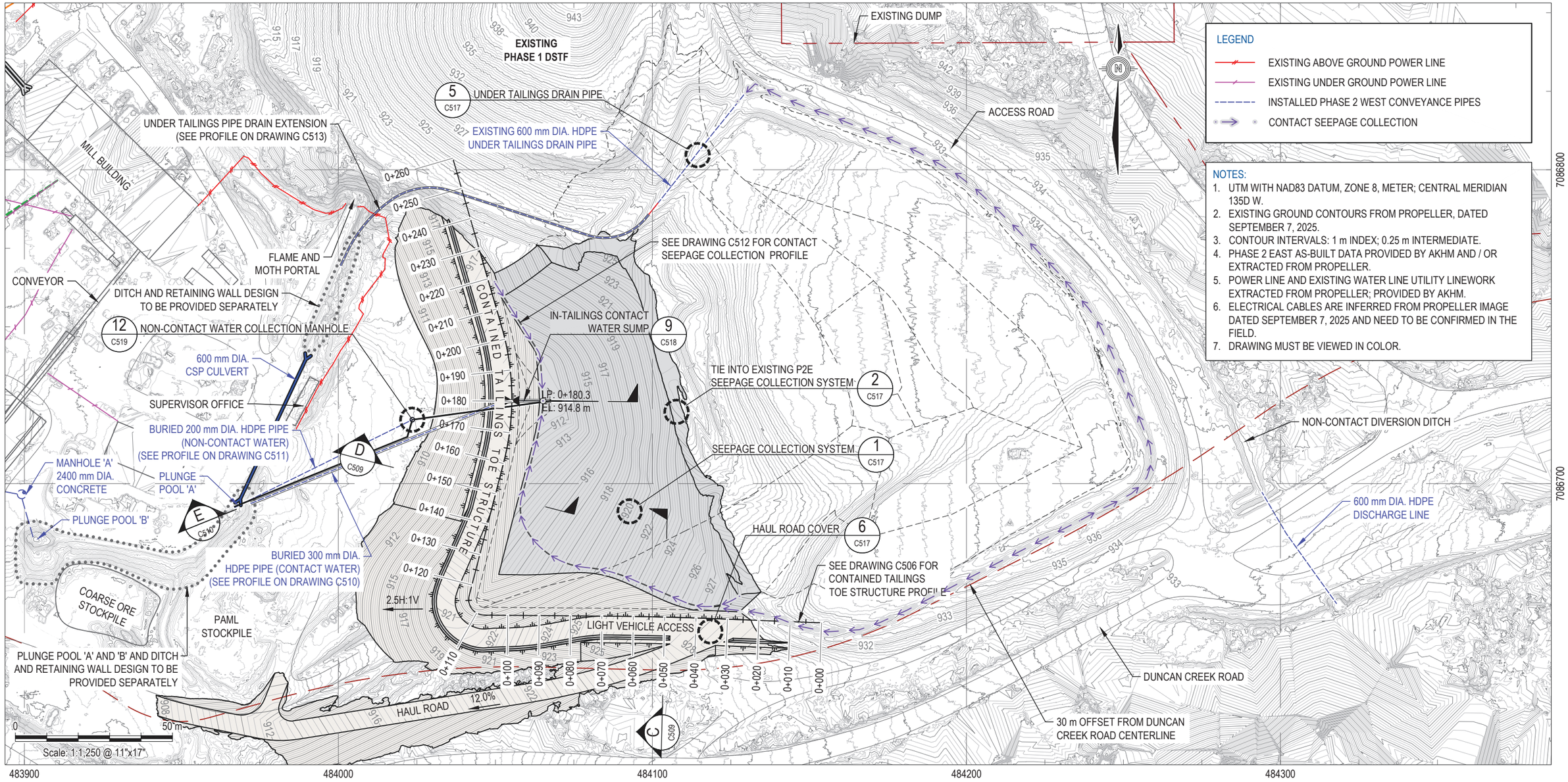
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF CONTACT WATER SEEPAGE, COLLECTION, AND CONVEYANCE

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C504
DATE: FEBRUARY 20, 2026	SHEET No. 7 of 23	DWN EL	APP GK	STATUS C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C504.dwg [C504] February 20, 2026 - 7:32:55 pm (BY: LEE, ELVIN)



LEGEND

- EXISTING ABOVE GROUND POWER LINE
- EXISTING UNDER GROUND POWER LINE
- INSTALLED PHASE 2 WEST CONVEYANCE PIPES
- CONTACT SEEPAGE COLLECTION

NOTES:

1. UTM WITH NAD83 DATUM, ZONE 8, METER; CENTRAL MERIDIAN 135D W.
2. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
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B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

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TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

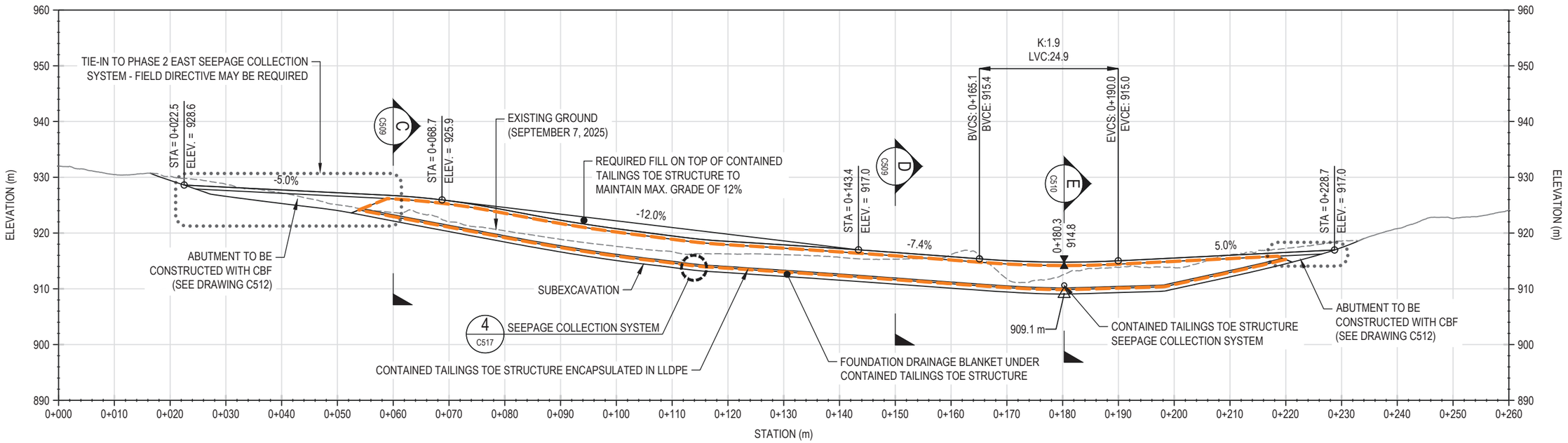
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
POST CONSTRUCTION PLAN VIEW

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C505
DATE: FEBRUARY 20, 2026	SHEET No. 8 of 23	DWN EL	APP GK	STATUS C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C505-C513.dwg



CONTAINED TAILINGS TOE STRUCTURE PROFILE

SCALE = 1:750

LEGEND

- CONTAINED TAILINGS TOE STRUCTURE ENCAPSULATED IN 80 mil TEXTURED LLDPE
- EXISTING GROUND
- EXISTING GROUND TO BE EXCAVATED

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PROFESSIONAL SEAL

PROFESSIONAL ENGINEER YUKON TERRITORY M. ESTRADA Feb. 20 2026

CLIENT

Hecla MINING COMPANY

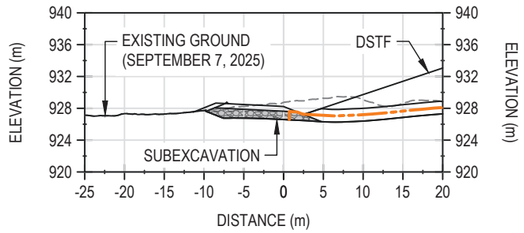
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE PROFILE

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C506
DATE: FEBRUARY 20, 2026	SHEET No. 9 of 23	DWN EL	APP GK	STATUS C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C505-C513.dwg



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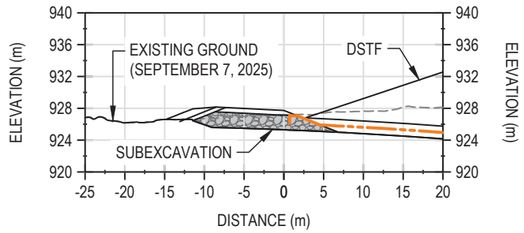

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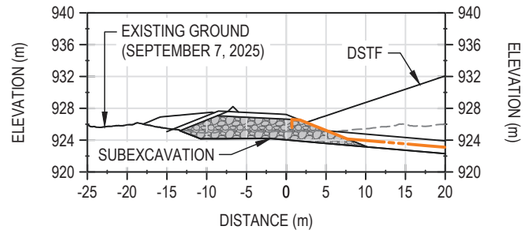

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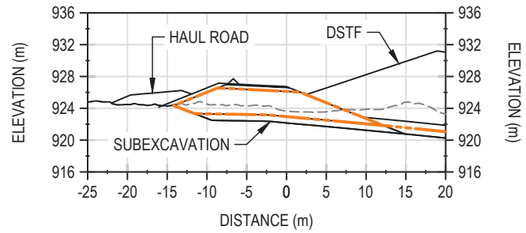

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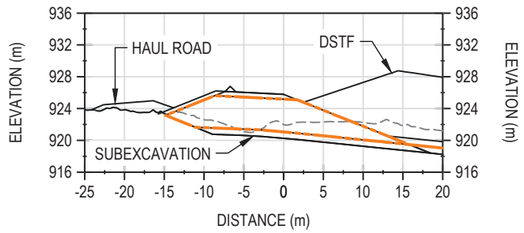

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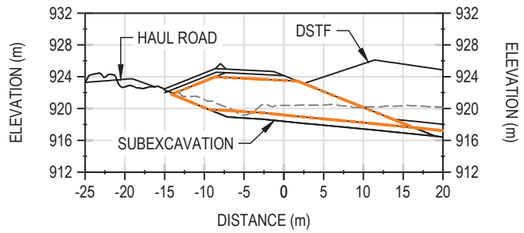

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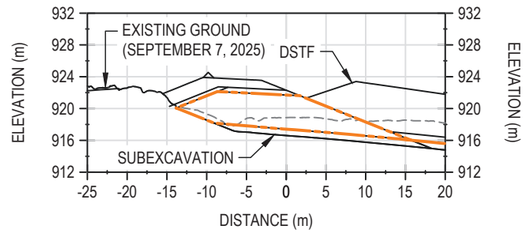

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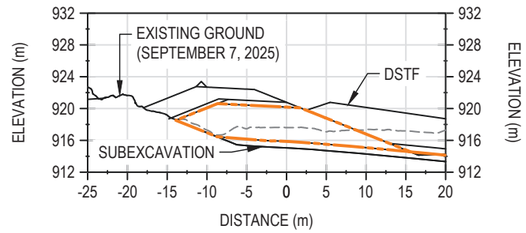

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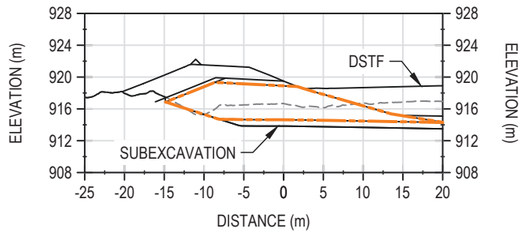

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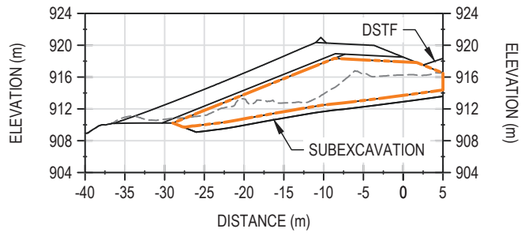

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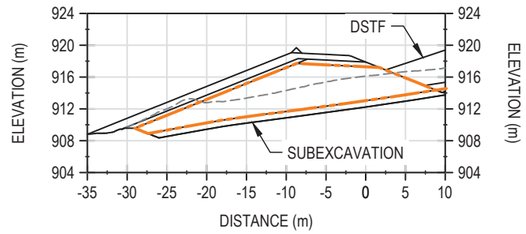

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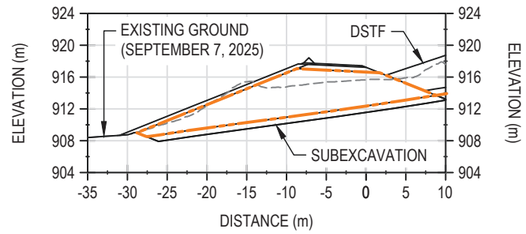

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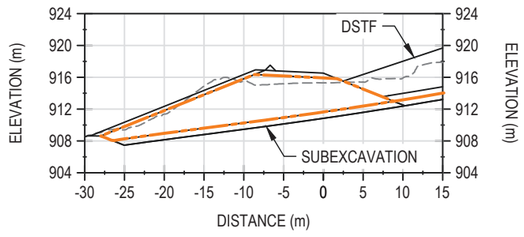

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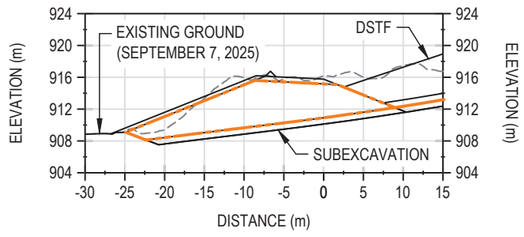

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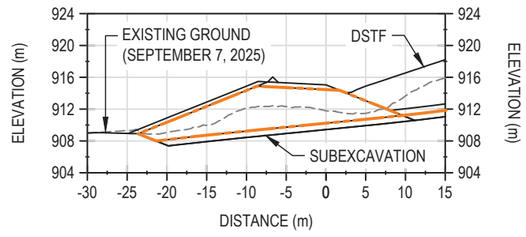

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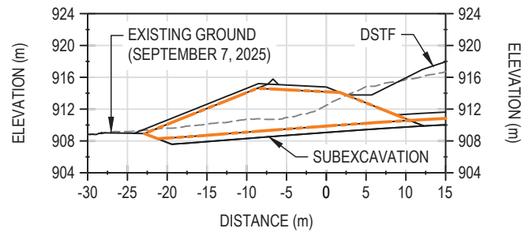


STATION 0+180

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
YUKON TERRITORY
M. ESTRADA
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

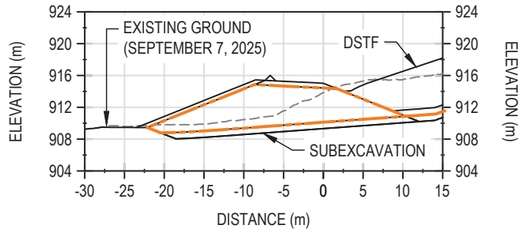
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE
SECTIONS STATION 0+030 TO 0+180

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C507
DATE: FEBRUARY 20, 2026	SHEET No. 10 of 23	DWN EL	APP GK	STATUS C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C505-C513.dwg



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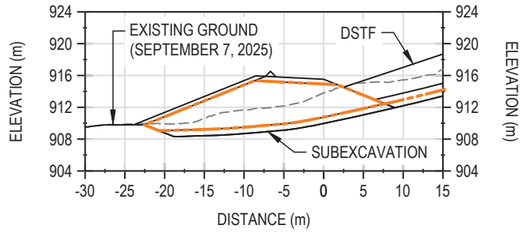
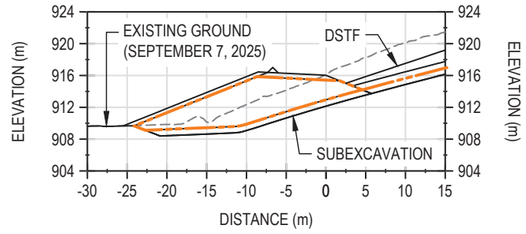


STATION 0+200



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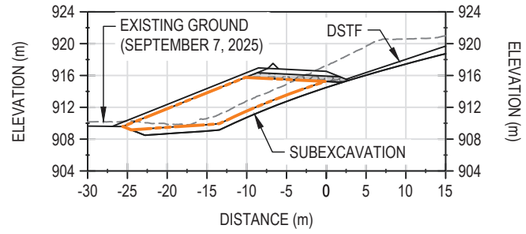

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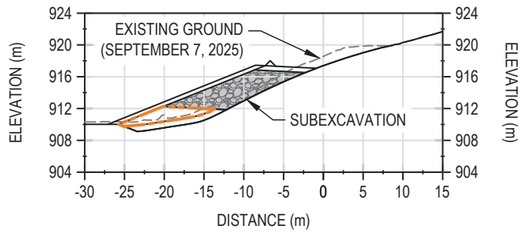

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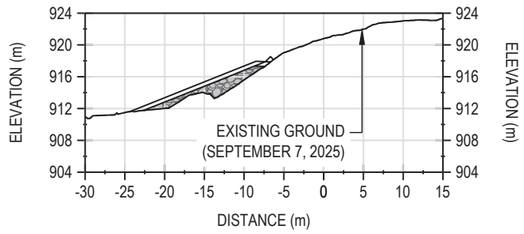

STATION 0+240

LEGEND (APPLIES TO DRAWINGS C507 AND C508)

- CONTAINED TAILINGS TOE STRUCTURE ENCAPSULATED IN 80 mil TEXTURED LLDPE
- EXISTING GROUND TO BE EXCAVATED
- COARSE BULK FILL

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
YUKON
M. ESTRADA
TERRITORY
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE
SECTIONS STATION 0+190 TO 0+240

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C508
DATE: FEBRUARY 20, 2026	SHEET No. 11 of 23	DWN EL	APP GK	STATUS C	

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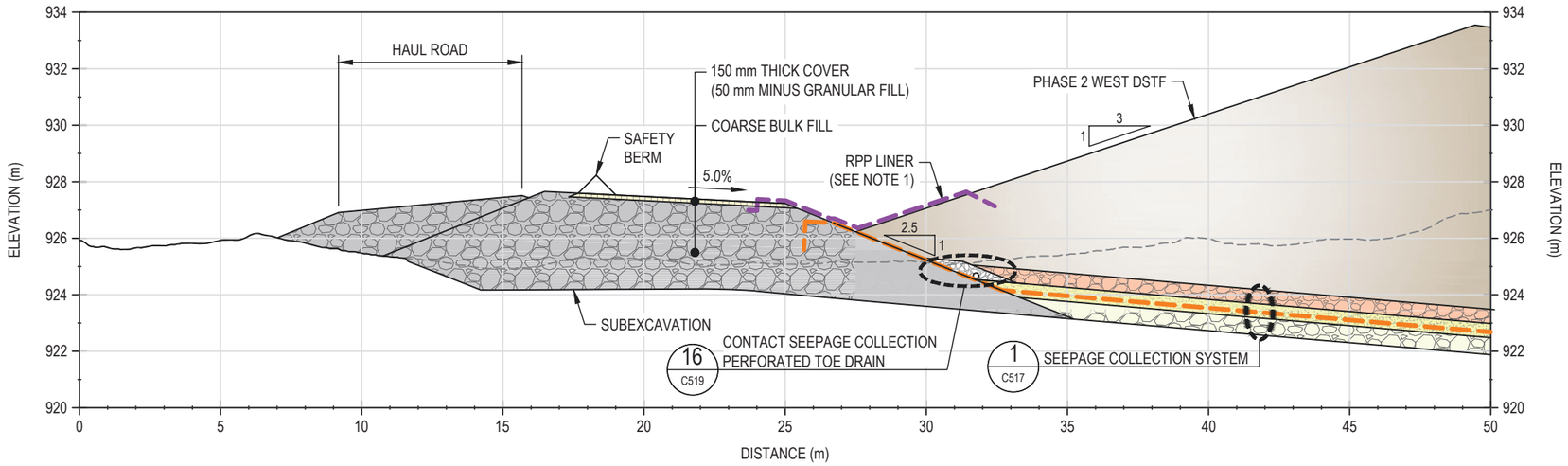
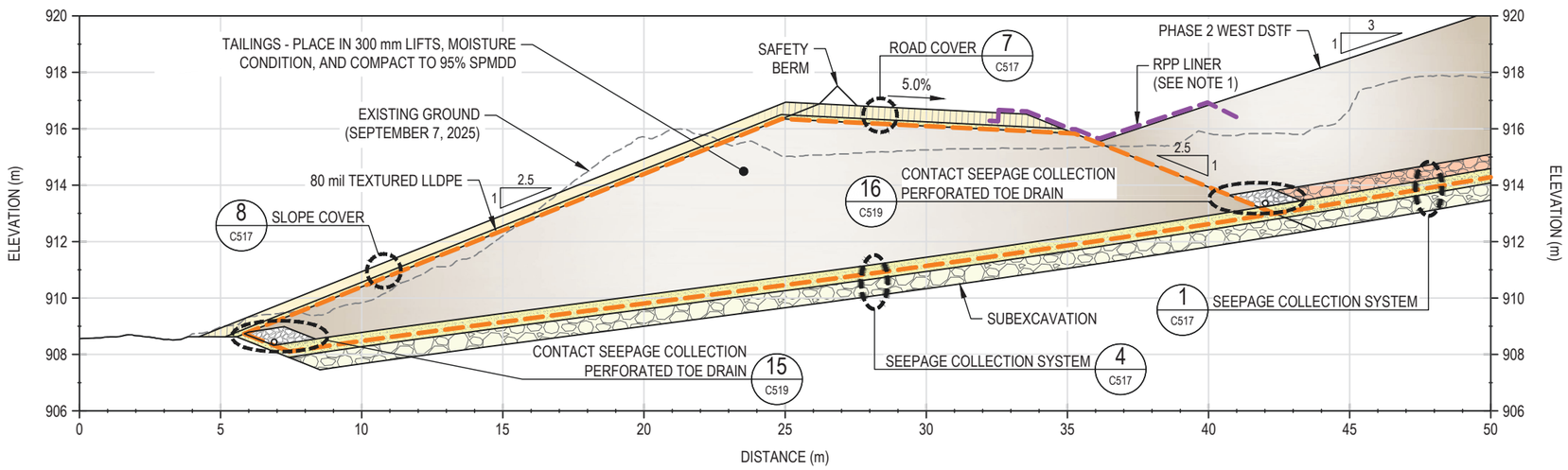


C TYPICAL CROSS-SECTION (COARSE BULK FILL TOE STRUCTURE)

C505
C506

SCALE: 1:200



D TYPICAL CROSS-SECTION (CONTAINED TAILINGS TOE STRUCTURE)

C505
C506

SCALE: 1:200

NOTES:
1. RPP LINER TO BE INSTALLED AFTER FINAL TAILINGS CONFIGURATION.

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C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
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A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

REVISIONS

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TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE
CROSS-SECTIONS C-C' AND D-D'

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C509
DATE: FEBRUARY 20, 2026	SHEET No. 12 of 23	DWN EL	APP GK	STATUS C	

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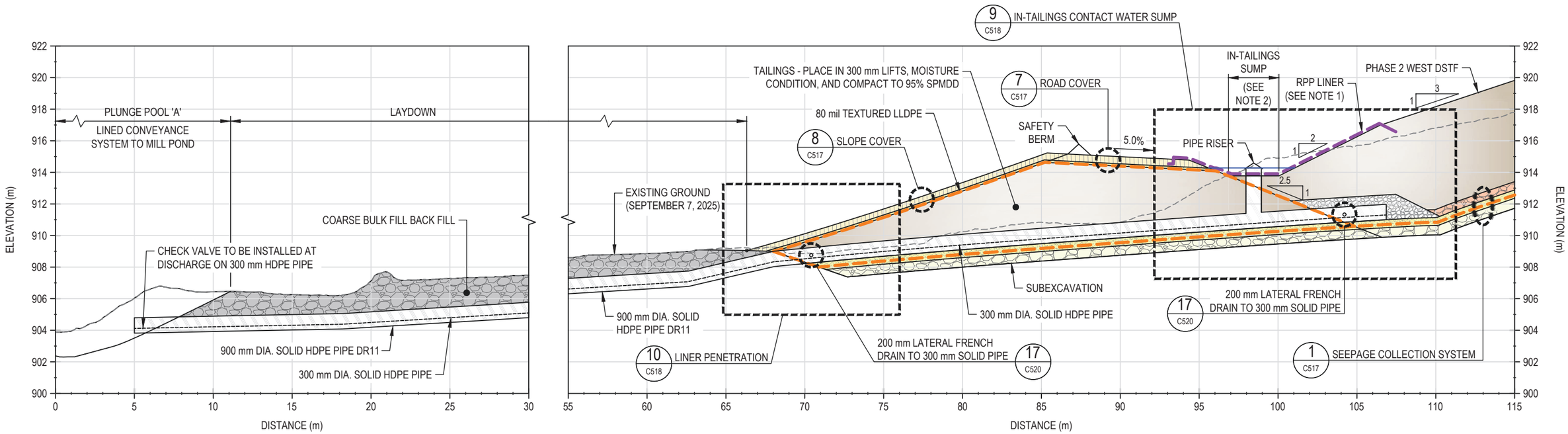

E CONTACT WATER COLLECTION SYSTEM PROFILE AND IN-TAILINGS SUMP

C505 C506 SCALE: 1:250

NOTES:
1. RPP LINER TO BE INSTALLED AFTER FINAL TAILINGS CONFIGURATION.
2. PIPE RISER WON'T BE ACTIVATED UNTIL FINAL TAILINGS CONFIGURATION. PERFORATED DRAIN AT SUMP LOCATION TO BE LEFT EXPOSED AND USED FOR RUNOFF COLLECTION IN THE INTERIM.

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C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
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A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

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TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE
CROSS-SECTION E-E'

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C510
DATE: FEBRUARY 20, 2026	SHEET No. 13 of 23	DWN EL	APP GK	STATUS C	

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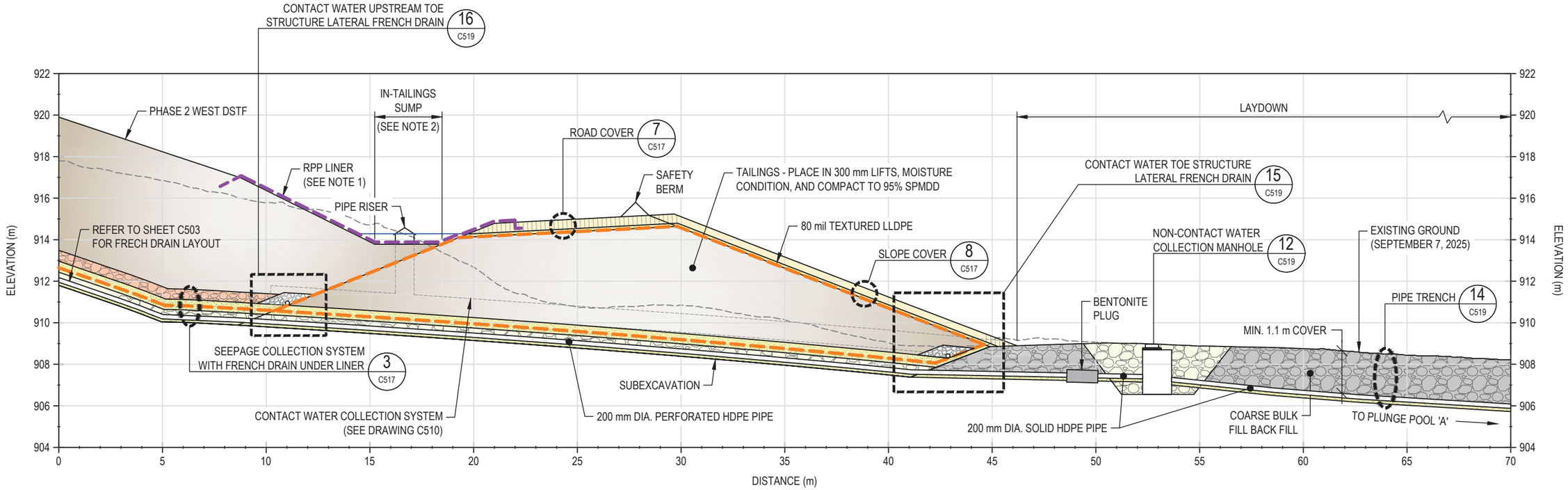

NON-CONTACT WATER COLLECTION SYSTEM

SCALE = 1:200

NOTES:
1. RPP LINER TO BE INSTALLED AFTER FINAL TAILINGS CONFIGURATION.
2. PIPE RISER WON'T BE ACTIVATED UNTIL FINAL TAILINGS CONFIGURATION. 900 mm HDPE PIPE TO BE LEFT EXPOSED AND USED FOR RUNOFF COLLECTION IN THE INTERIM. 900 mm HDPE PIPE WILL BE CAPPED AND COVERED PRIOR TO THE PIPE RISER BEING ACTIVATED.

NUM	DATE	APR	DESCRIPTION
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A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE
NON-CONTACT WATER SYSTEM

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C511
DATE: FEBRUARY 20, 2026	SHEET No. 14 of 23	DWN EL	APP GK	STATUS C	

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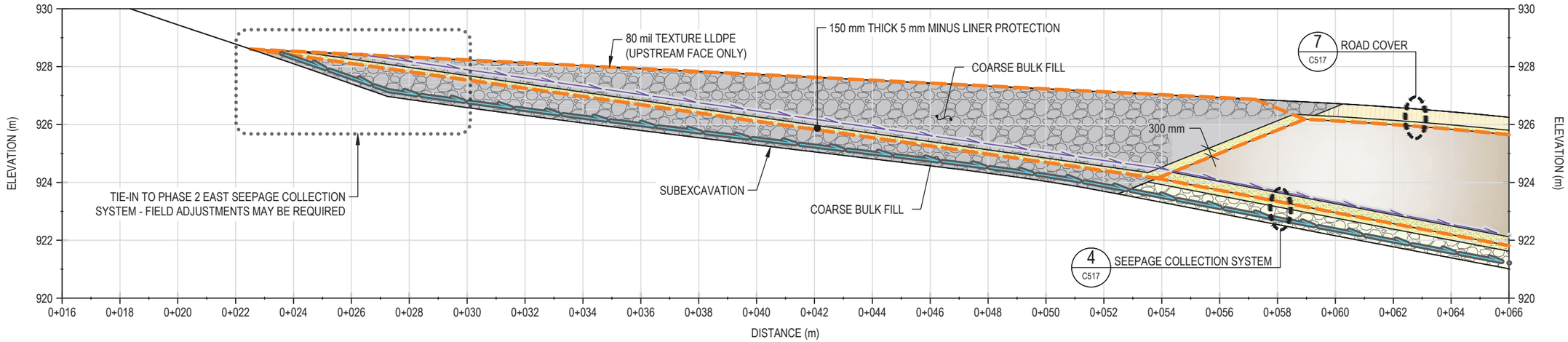
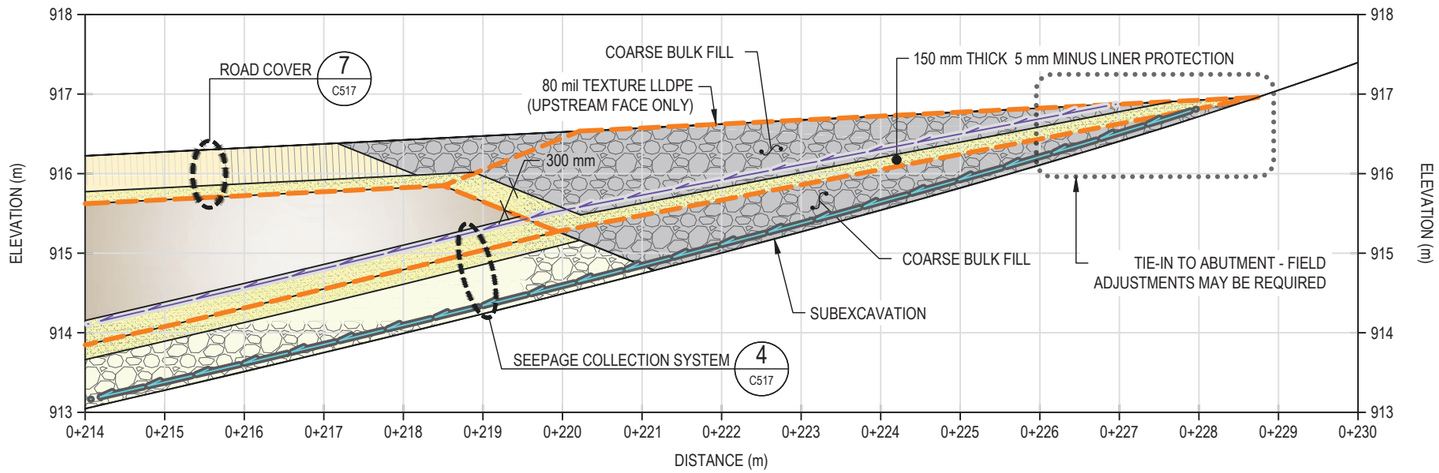


CONTAINED TAILINGS TOE STRUCTURE PHASE 2 EAST ABUTMENT TIE-IN

SCALE = 1:150



LEGEND

- CONTACT WATER FLOW
- NON-CONTACT WATER FLOW
- 80 mil TEXTURED LLDPE LINER

CONTAINED TAILINGS TOE STRUCTURE NORTH ABUTMENT TIE-IN

SCALE = 1:75

NOTES:

1. STATIONING AND ELEVATIONS SHOWN FOR REFERENCE. TIE-IN CONDITIONS WILL NEED TO BE CONFIRMED IN THE FIELD. FIELD ADJUSTMENTS MAY BE REQUIRED.

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DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

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PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
CONTAINED TAILINGS TOE STRUCTURE
ABUTMENT TIE-IN

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C512
DATE: FEBRUARY 20, 2026	SHEET No. 15 of 23	DWN EL	APP GK	STATUS C	

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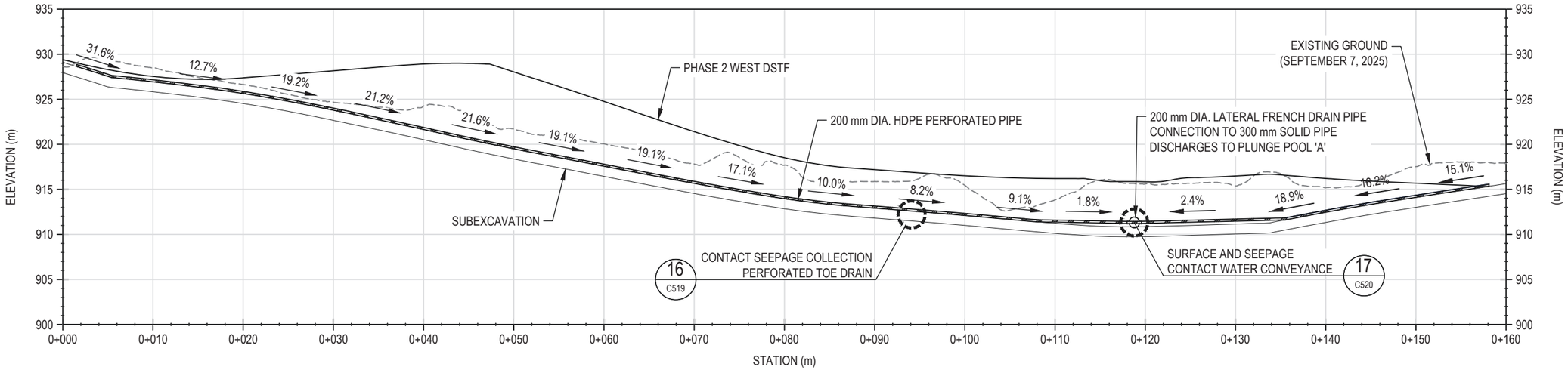
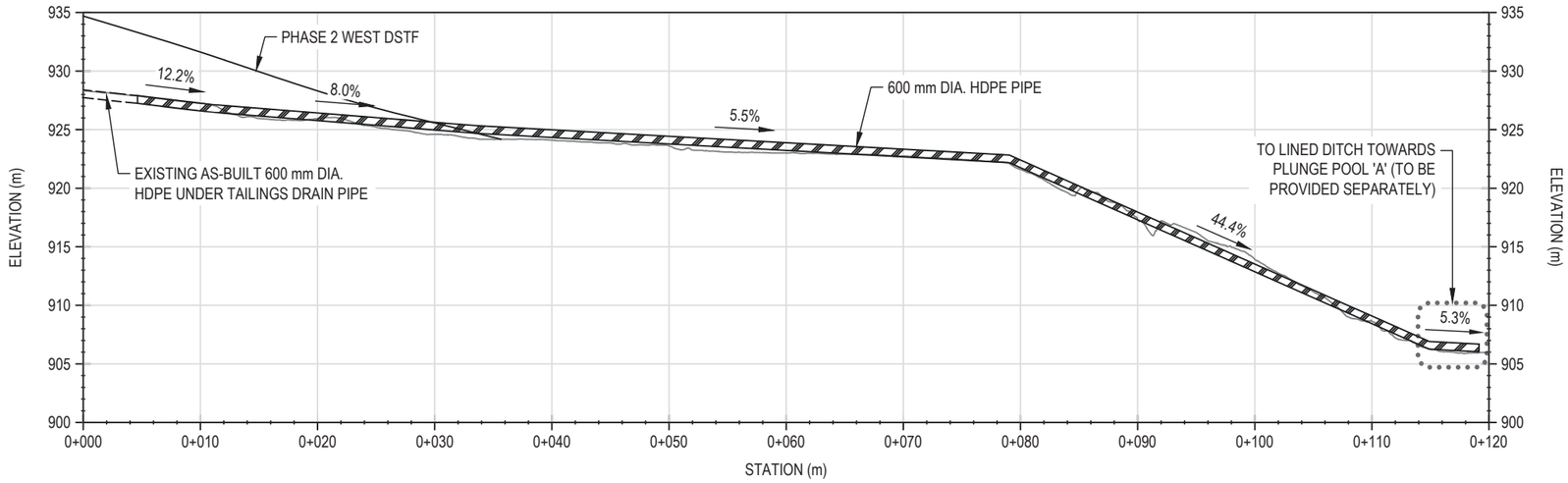


CONTACT SEEPAGE COLLECTION PROFILE

SCALE = 1:500



UNDER TAILINGS DRAINAGE PIPE EXTENSION PROFILE

SCALE = 1:500

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
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A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

REVISIONS

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TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
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Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
YUKON
M. ESTRADA
TERRITORY
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

CONTACT SEEPAGE COLLECTION AND UNDER TAILINGS DRAINAGE PIPE EXTENSION PROFILE

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C513
DATE: FEBRUARY 20, 2026	SHEET No. 16 of 23	DWN EL	APP GK	STATUS C	

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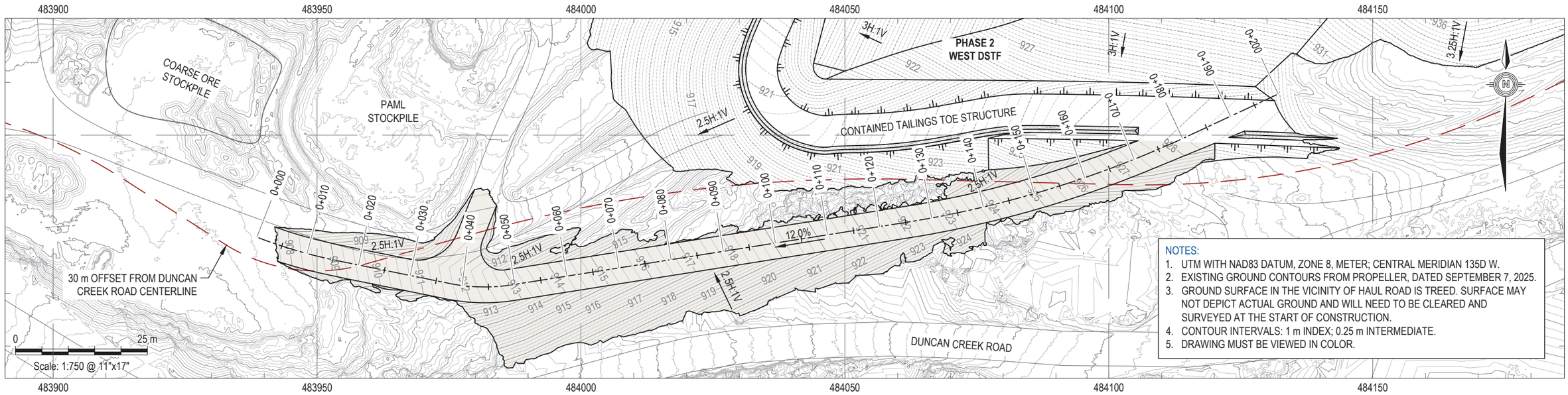
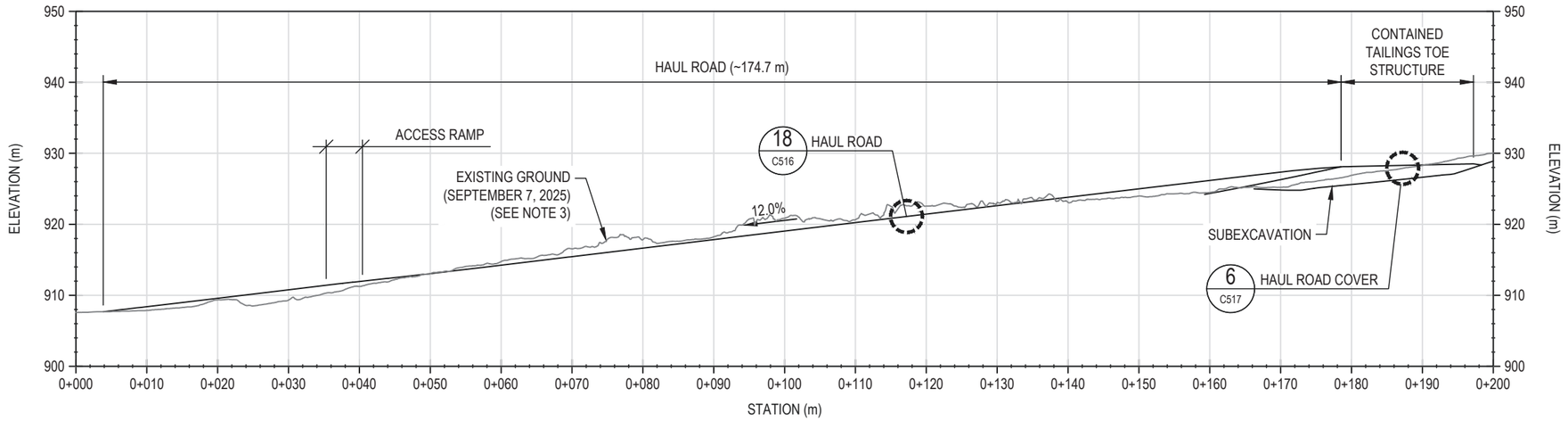


HAUL ROAD - PLAN VIEW

SCALE = 1:750



HAUL ROAD - PROFILE

SCALE = 1:750

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
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DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

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TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

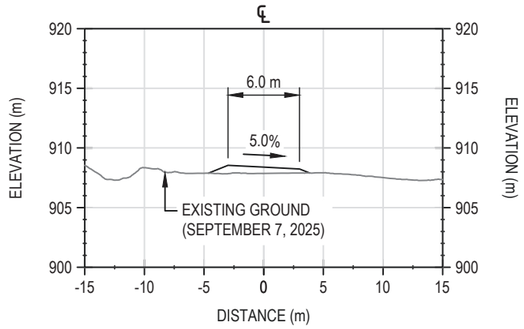
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

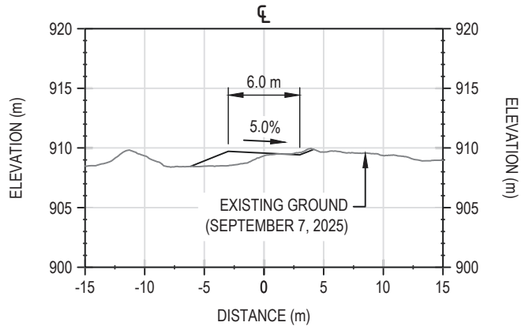
PHASE 2 WEST DSTF HAUL ROAD
PLAN AND PROFILE

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C514
DATE: FEBRUARY 20, 2026	SHEET No. 17 of 23	DWN EL	APP GK	STATUS C	

C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C514-C516.dwg [C514] February 20, 2026 - 7:35:51 pm (BY: LEE, ELVIN)



STATION 0+010



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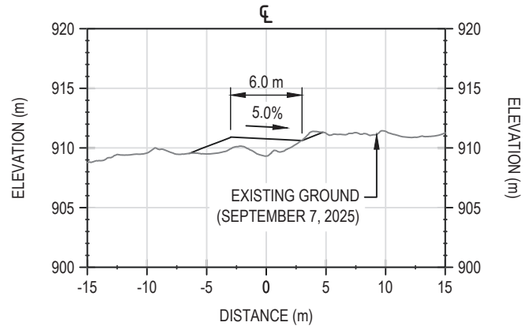

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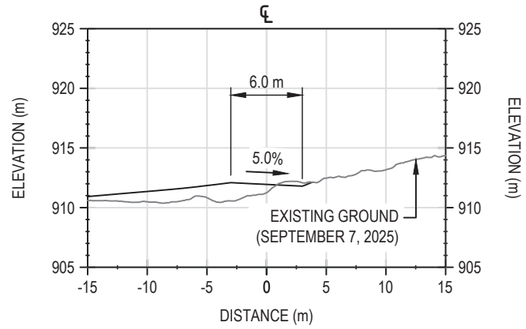

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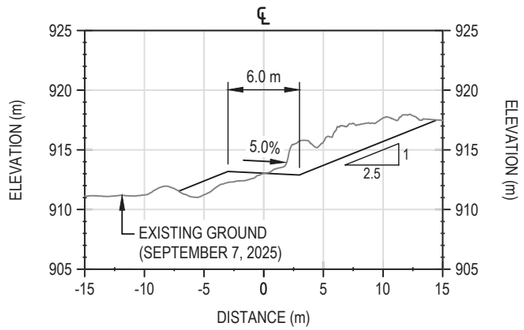

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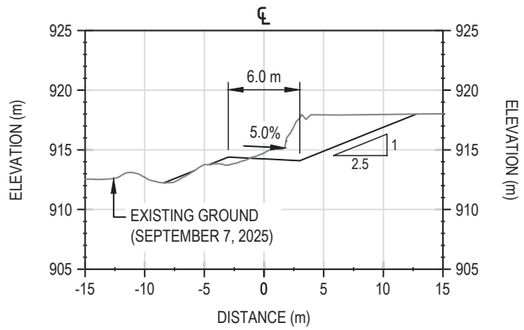

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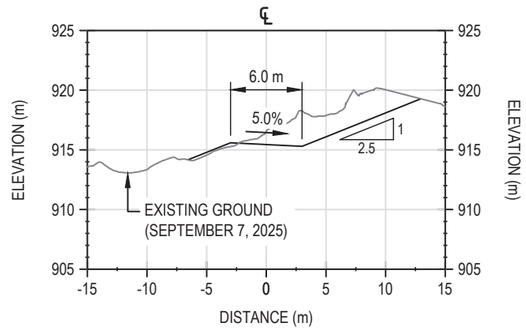
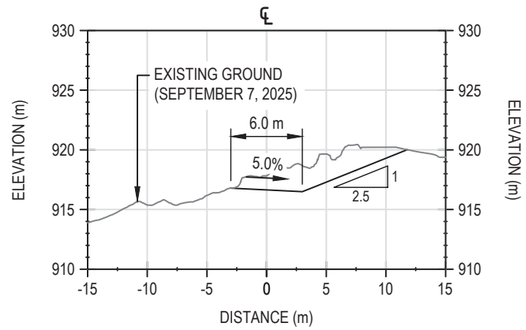


STATION 0+070



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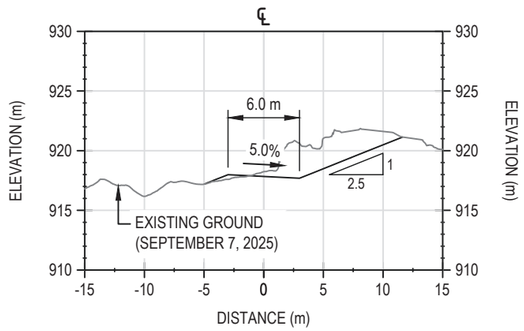

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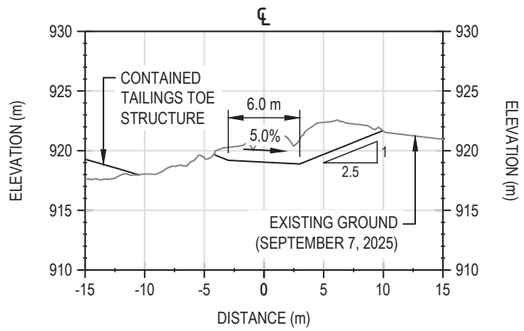

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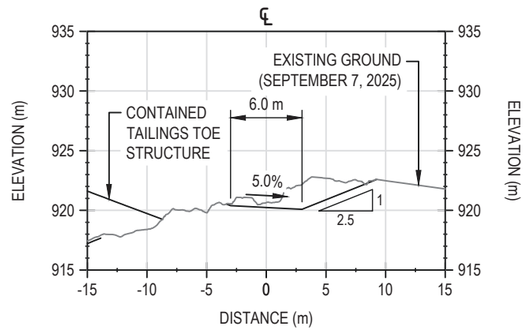

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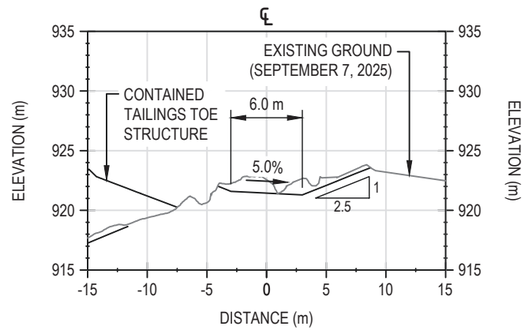

STATION 0+120

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

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TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
PROFESSIONAL
YUKON
M. ESTRADA
TERRITORY
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
HAUL ROAD SECTIONS STATION
0+010 TO 0+120

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C515
DATE: FEBRUARY 20, 2026	SHEET No. 18 of 23	DWN EL	APP GK	STATUS C	

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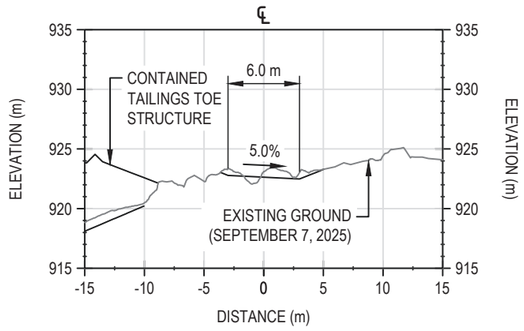

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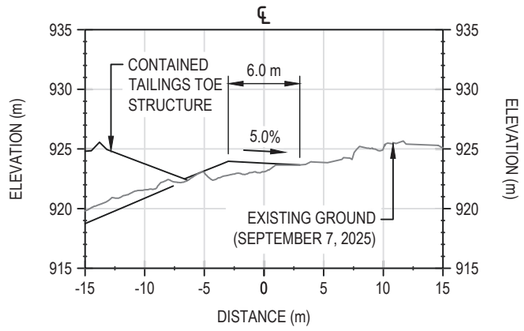
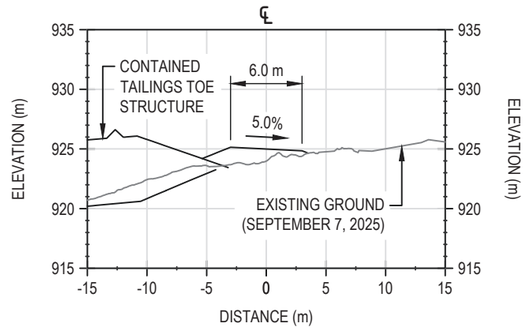


STATION 0+140



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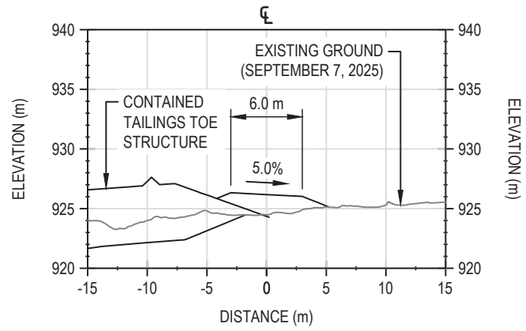

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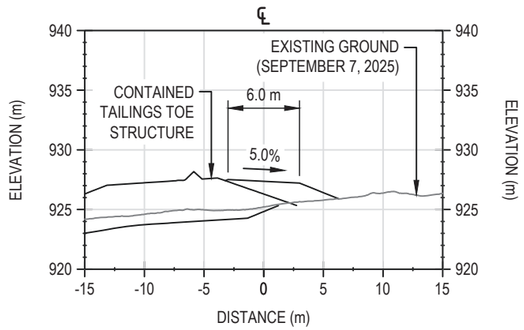

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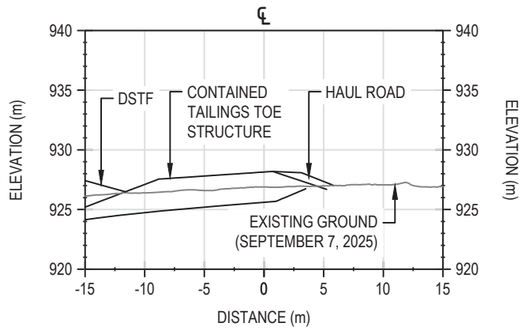
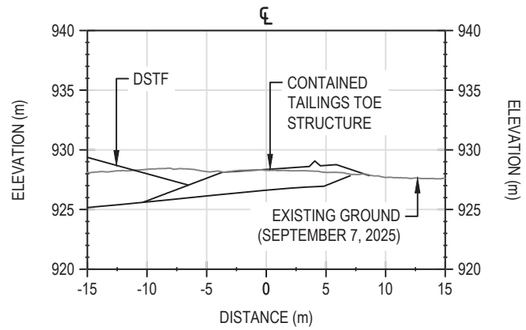
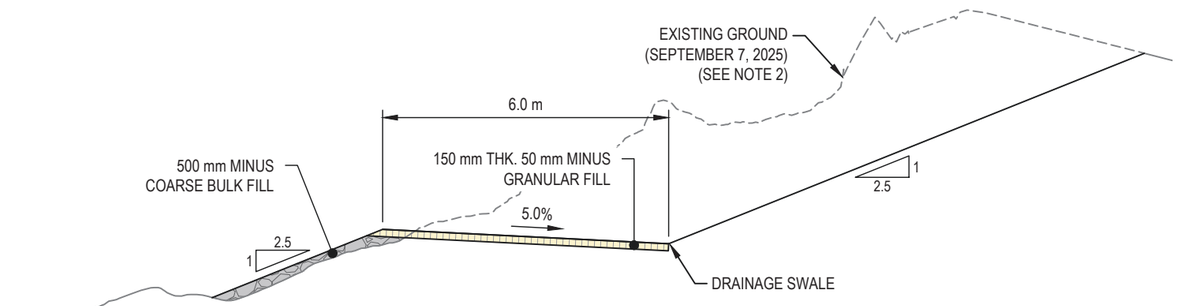


STATION 0+180



STATION 0+190

NOTES:
1. EXISTING GROUND CONTOURS FROM PROPELLER, DATED SEPTEMBER 7, 2025.
2. GROUND SURFACE IN THE VICINITY OF HAUL ROAD IS TREED. SURFACE MAY NOT DEPICT ACTUAL GROUND AND WILL NEED TO BE CLEARED AND SURVEYED AT THE START OF CONSTRUCTION.



18 C514 TYPICAL HAUL ROAD
SCALE: NTS

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

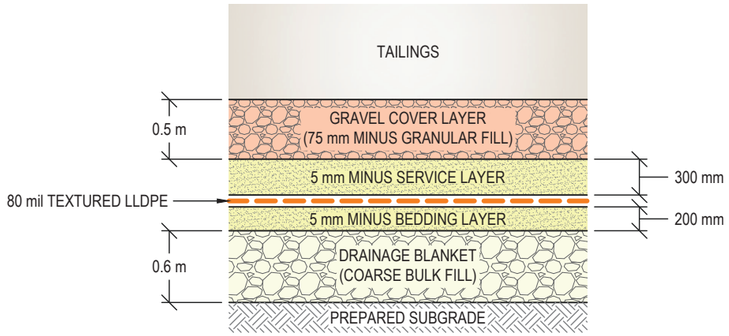
TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
HAUL ROAD SECTIONS STATION
0+130 TO 0+190

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C516
DATE: FEBRUARY 20, 2026	SHEET No. 19 of 23	DWN EL	APP GK	STATUS C	

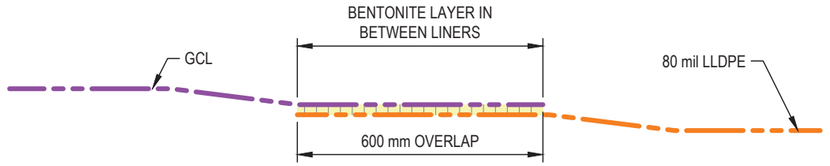
C:\Users\elvin.lee\OneDrive - Tetra Tech, Inc\HECLA - Keno Hill_Elsa - CAD\Production Drawings\C500 SERIES - PHASE 2 WEST DSTF\ENG.WARC04673-04_DSTF PHASE 2 WEST-C514-C516.dwg [C516] February 20, 2026 - 7:36:03 pm (BY: LEE, ELVIN)



1 TYPICAL SEEPAGE COLLECTION SYSTEM UNDER PHASE 2 WEST DRY STACK TAILINGS

C502 C504 C505 C509 C510

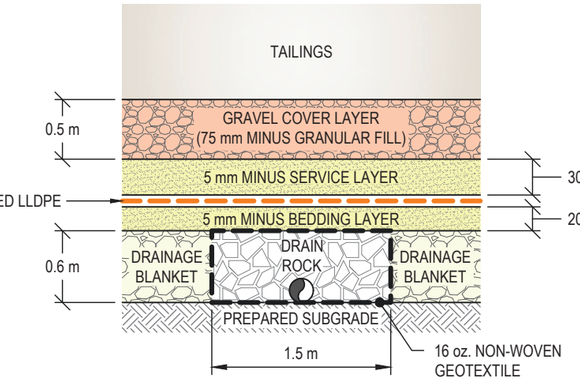
SCALE: NTS



2 TYPICAL GCL TO LLDPE LINER CONNECTION DETAIL

C502 C504 C505

SCALE: NTS

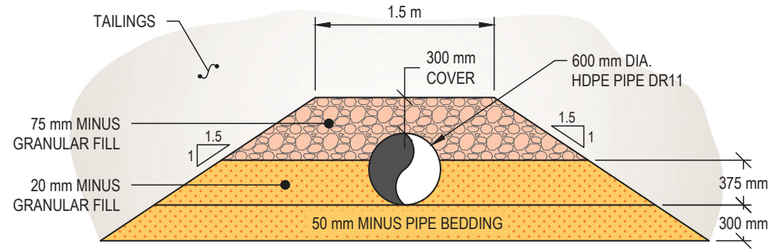


TYPICAL FRENCH DRAIN UNDER LINER WITH PERFORATED PIPE

3

C503 C504 C511

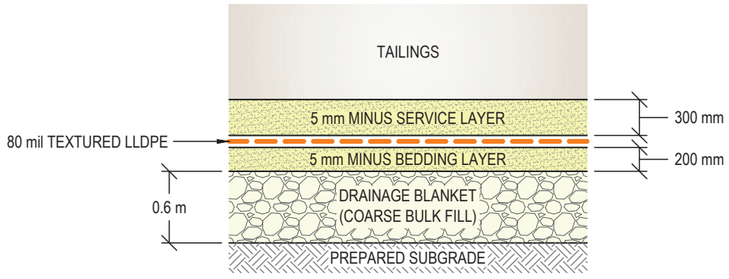
SCALE: NTS



5 TYPICAL UNDER TAILINGS DRAIN PIPE

C501 C503 C504 C505

SCALE: NTS

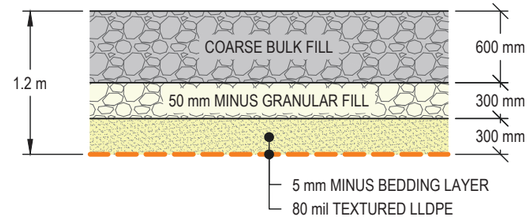


TYPICAL SEEPAGE COLLECTION SYSTEM UNDER CONTAINED TAILINGS TOE STRUCTURE

4

C504 C506 C512

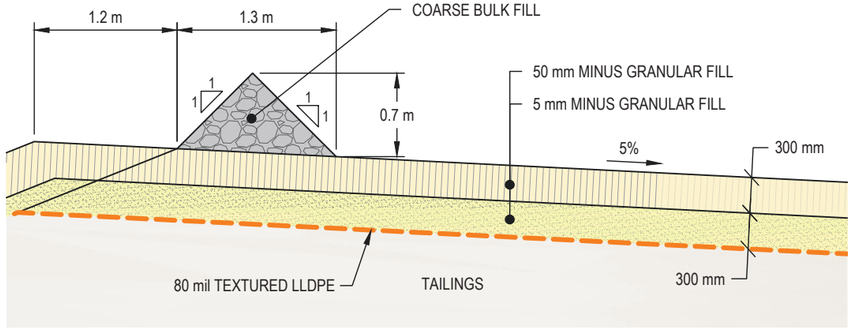
SCALE: NTS



6 TYPICAL HAUL ROAD LINER COVER THICKNESS

C501 C505 C514

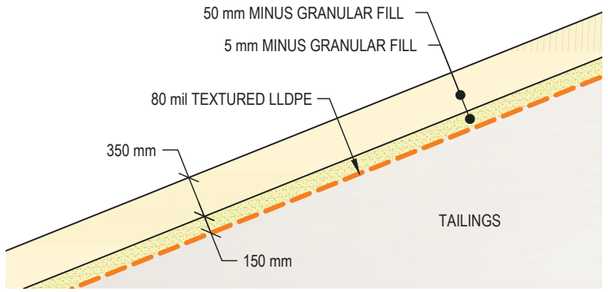
SCALE: NTS



7 TYPICAL ROAD COVER AND SAFETY BERM

C509 C510 C511 C512

SCALE: NTS



8 TYPICAL SLOPE COVER

C509 C510 C511

SCALE: NTS

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER
YUKON TERRITORY
M. ESTRADA
Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

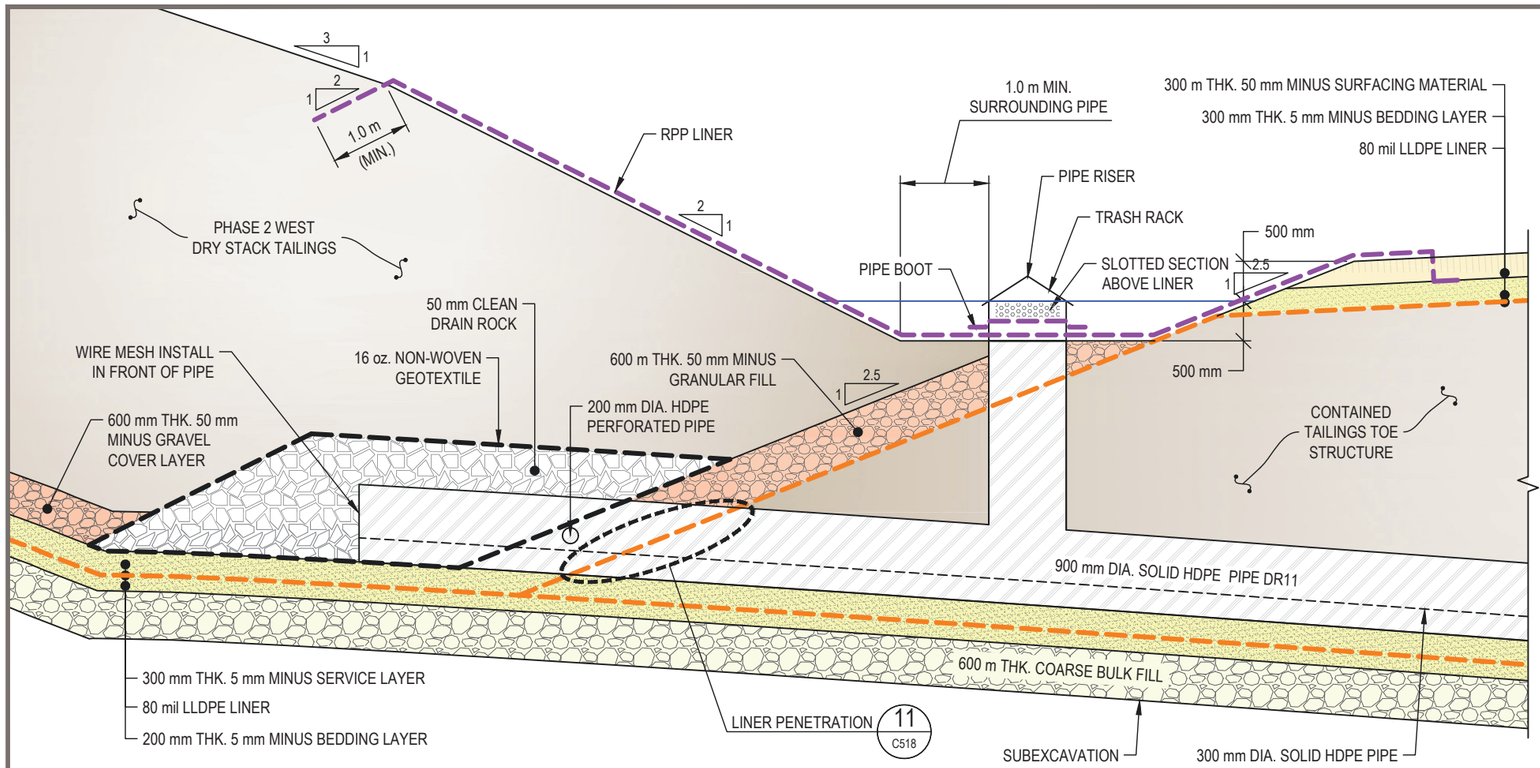
Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

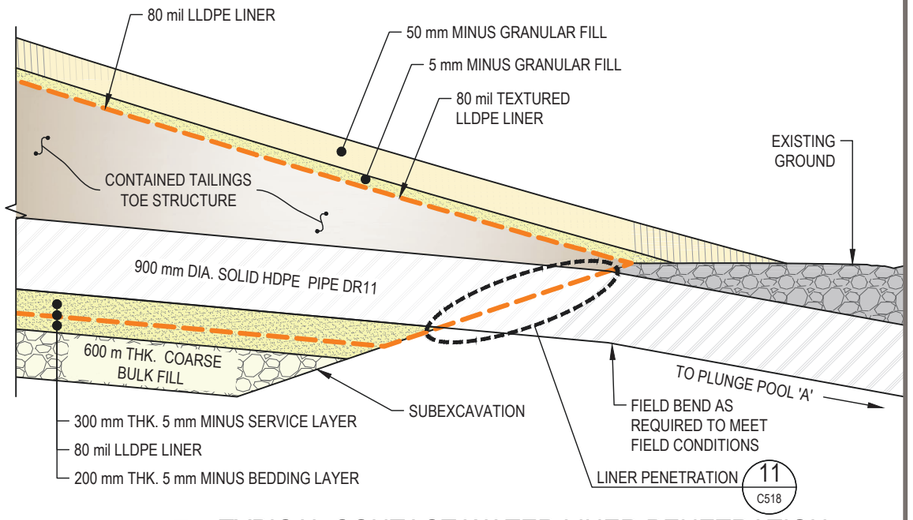
PHASE 2 WEST DSTF
TYPICAL DETAILS
(1 OF 3)

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C517
DATE: FEBRUARY 20, 2026	SHEET No. 20 of 23	DWN EL	APP GK	STATUS C	



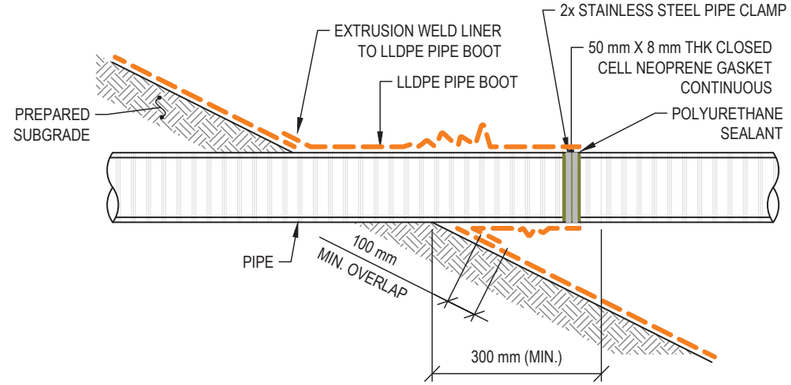
9 C501 C502 C505 **IN-TAILINGS SUMP (FULL PHASE 2 WEST DRY STACK BUILD OUT)**

SCALE: NTS



10 C510 **TYPICAL CONTACT WATER LINER PENETRATION**

SCALE: NTS



11 C518 **TYPICAL LINER PENETRATION**

SCALE: NTS

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

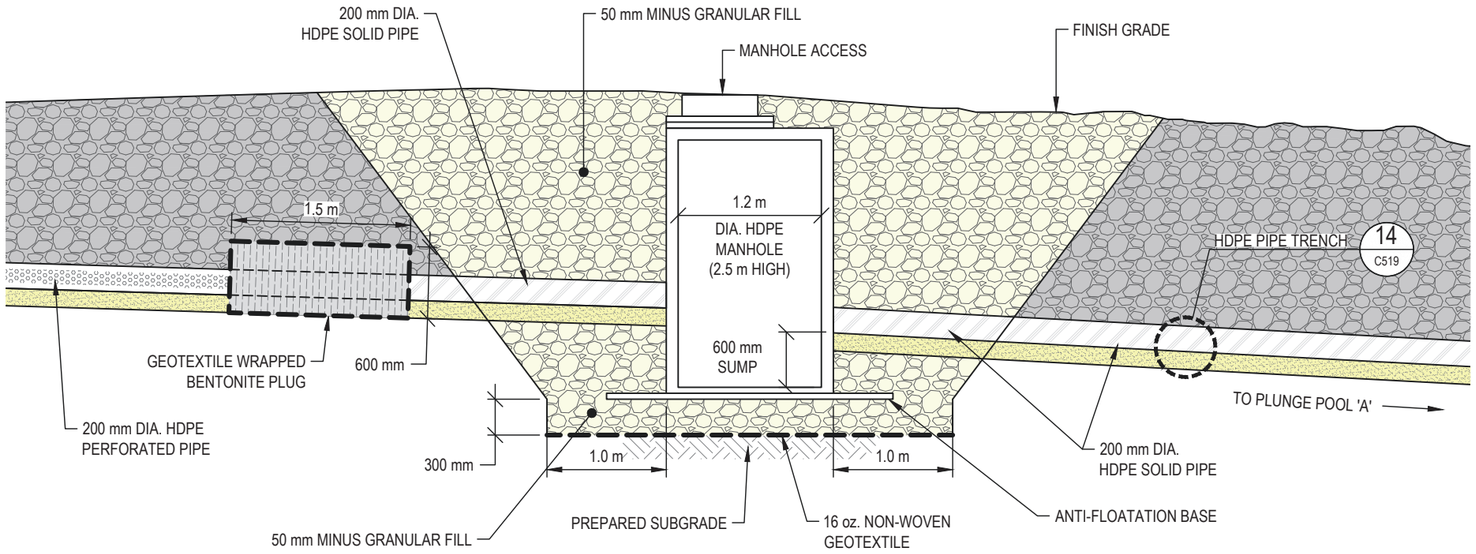
Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

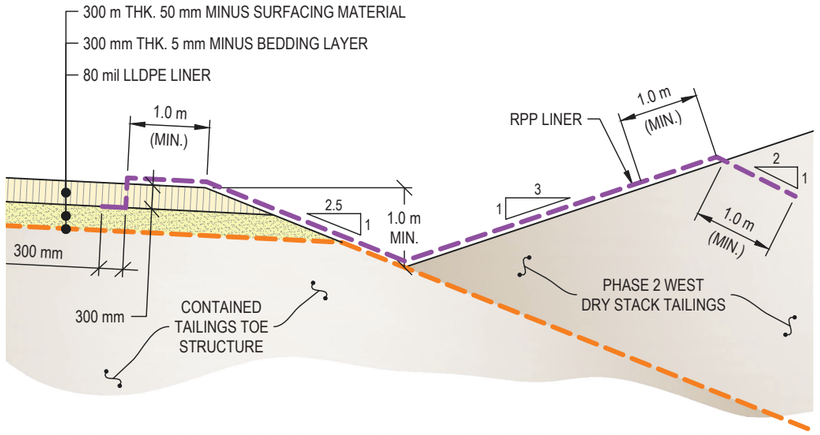
PHASE 2 WEST DSTF
TYPICAL DETAILS
(2 OF 3)

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C518
DATE: FEBRUARY 20, 2026	SHEET No. 21 of 23	DWN EL	APP GK	STATUS C	



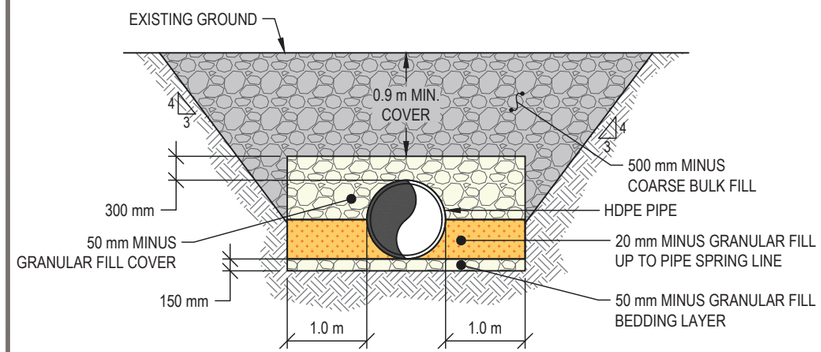
12 NON-CONTACT WATER MANHOLE DETAIL

C501 C503 C504 C505 C511 SCALE: NTS



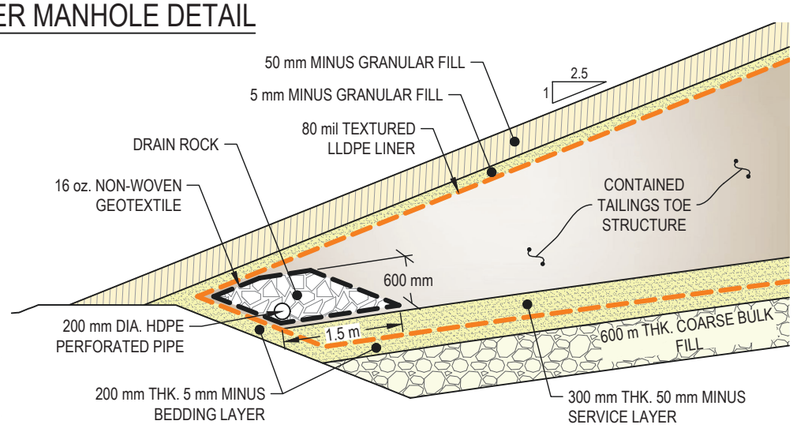
TYPICAL COLLECTION DITCH LINER TIE-IN TO TOP OF TOE STRUCTURE AND TAILINGS (FINAL TAILINGS CONFIGURATION)

13 C501 SCALE: NTS



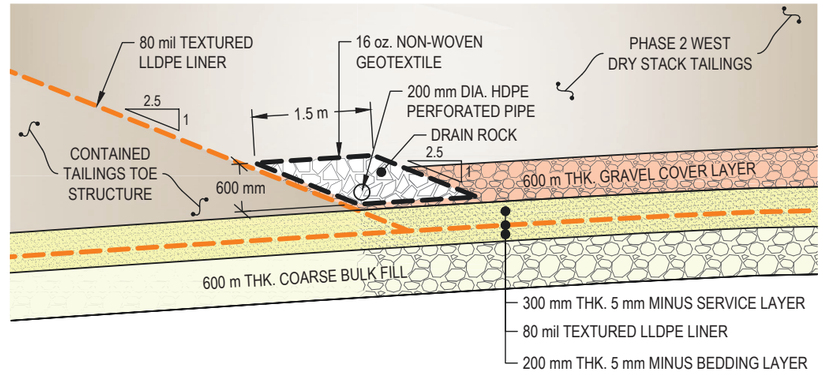
14 TYPICAL HDPE PIPE TRENCH

C519 SCALE: NTS



TYPICAL CONTACT WATER TOE STRUCTURE LATERAL FRENCH DRAIN WITH PERFORATED PIPE

15 C504 SCALE: NTS



TYPICAL CONTACT WATER UPSTREAM TOE STRUCTURE LATERAL FRENCH DRAIN WITH PERFORATED PIPE

16 C504 C513 SCALE: NTS

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date 2026-02-20
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

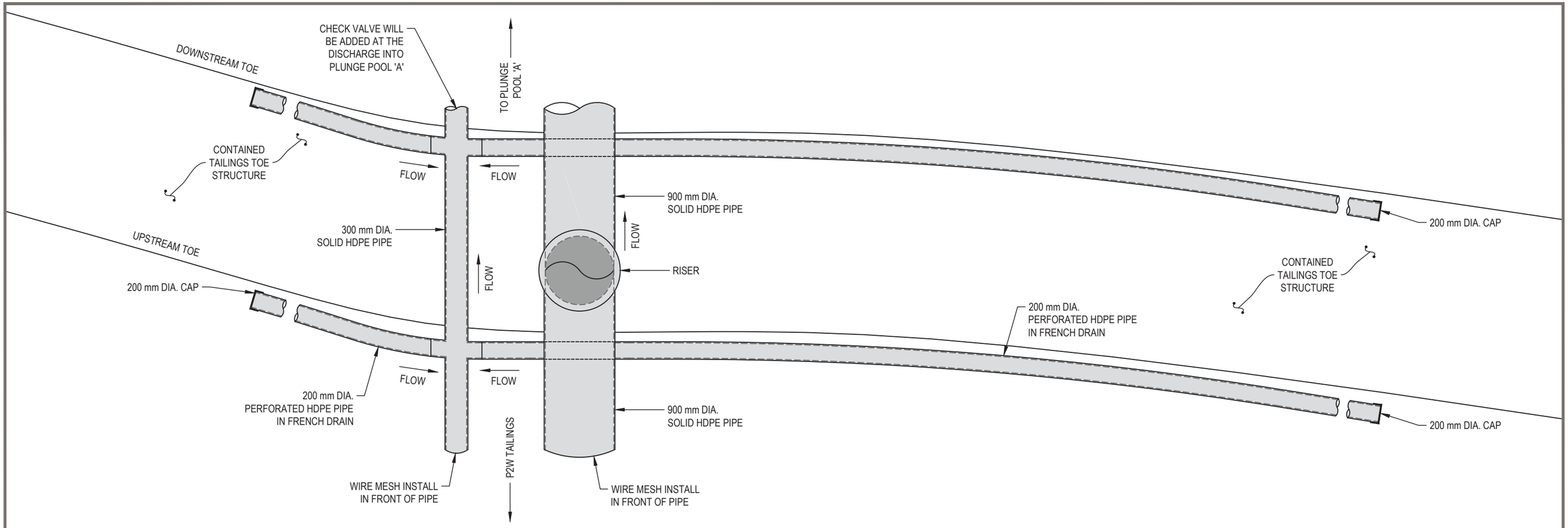
Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
TYPICAL DETAILS
(3 OF 4)

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	C519
DATE: FEBRUARY 20, 2026	SHEET No. 22 of 23	DWN EL	APP GK	STATUS C	



17 C513 SURFACE AND SEEPAGE CONTACT WATER CONVEYANCE

SCALE: NTS

NUM	DATE	APR	DESCRIPTION
C	20-FEB-26	ME / IM / GK	ISSUED FOR PERMITTING
B	30-JAN-26	IM / GK	ISSUED FOR 95% DESIGN REVIEW
A	17-OCT-25	IM / GK	ISSUED FOR 50% DESIGN REVIEW

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION

REVISIONS

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
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Association of Professional Engineers of Yukon

PERMIT

PROFESSIONAL ENGINEER YUKON M. ESTRADA TERRITORY Feb. 20 2026

PROFESSIONAL SEAL

CLIENT

Hecla MINING COMPANY

TETRA TECH

FLAME AND MOTH DSTF PHASE 2 WEST
KENO HILL DISTRICT MILL SITE, YUKON

PHASE 2 WEST DSTF
TYPICAL DETAILS
(4 OF 4)

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
ENG.WARC04673-04	EDMONTON	ME/DH	IM	-	**C520**
DATE: FEBRUARY 20, 2026	SHEET No. 23 of 23	DWN EL	APP GK	STATUS C	