Appendix 1.0-H SRK, Field Reports for 2018, 2019, and 2021 and Piteau Engineering Geology and Geotechnical Assessment, Tenas Pit and Waste Dumps

TELKWA COAL
LIMITED

Tenas Project – Factual Data Report for 2018 Geotechnical Investigation

Prepared for

Telkwa Coal Ltd.

Prepared by

SRK Consulting (Canada) Inc.
2CT025.002
August 2018

Tenas Project – Factual Data Report for 2018 Geotechnical Investigation

August 2018

Prepared for

Telkwa Coal Ltd.
1415 Hankin Avenue
Telkwa, BC V0J 2X0

Tel: +1 778 643 2843
Web: www.allegiancecoal.com.au

Prepared by

SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2
Canada

Tel: +1 604 681 4196
Web: www.srk.com

Project No: 2CT025.002

File Name: Telkwa_Tenas Geotech_Report_2CT025.002_20180827.docx

Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

SRK Consulting (Canada) Inc. (SRK) is pleased to provide Telkwa Coal Ltd. (Telkwa) with this factual data report for the 2018 Geotechnical Investigations undertaken at the Tenas Coal Project, British Columbia. Soil investigations were carried out to examine foundation materials below proposed waste rock dumps and sediment ponds, and rock geotechnical investigations for proposed pit slopes. This work was carried out in accordance with the SRK proposal, referenced 2CS000.P27, and dated August 3, 2017.

This report provides a description of the geotechnical field investigations, and the results of the factual data collected in February 2018. In addition, downhole televiewer survey and laboratory testing performed by others are included as they support the geotechnical data presented in this report.

2 Scope of Work

2.1 Supervision of Geotechnical Field Investigations

The geotechnical field investigation supervision included the following activities:

- Geotechnical logging, sampling and point load testing of rock core recovered from diamond drillholes; and
- Supervision, geotechnical logging, consistency testing and sampling of soil from sonic drillholes and test pit excavations.

2.2 Data Analyses and Factual Reporting

This task included data processing and preparation of this factual report based on the data collected during the field investigation. The following activities were carried out, and are included in this report:

- QA/QC of geotechnical core and soil logs;
- Descriptions of the materials encountered in the sonic drillholes and test pits, and determined from the results of the laboratory testing.
- Rock mass classification using Bieniawski's Rock Mass Rating (RMR_{89}) system;
- Preparation of downhole plots using the logged geotechnical parameters;
- Preparation of stereographic projections showing the structural data collected from televiewer surveys; and
- Compilation of the laboratory testing results.

3 Site Conditions

3.1 Site Location

The Tenas Project is located in central British Columbia approximately 15 km south of Smithers and 2 km southwest of Telkwa, as shown on Figure 3-1. The project site is located south of the Telkwa River.

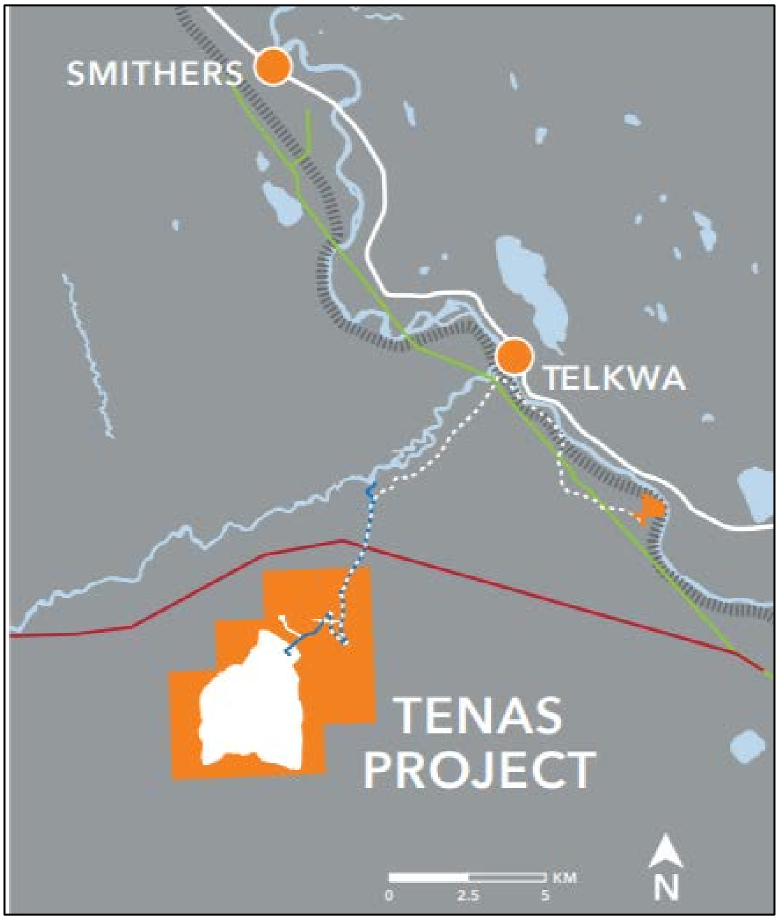


Figure 3-1: Tenas Project Location Map (Source: http://www.allegiancecoal.com.au)

3.2 Geomorphology and Surficial Soils

The Tenas site is located within the foothills of British Columbia, between the Bulkley Mountain Range to the north and west, and the low-lying gently sloping relief of the Nechako Plateau. Bedrock is typically covered by Quaternary soils, except for rocky outcrops along deeply eroded sections in adjacent river and stream valleys. Elevation across the site ranges generally from 600 to 900 m, with maximum elevations along the east side of the property (Levson et al, 1997).

The regional surficial soils have been studied by Levson et al, 1997. Two soil units are characterized regionally, and include:

- A widespread, massive unit, interpreted as a till, is located at or near the ground surface elevation. The till is described as diamicton, with particle sizes ranging from clay to boulders within a fine grained or sandy matrix. No thickness information was provided by Levson et al.
- In some areas, the till is underlain by both glaciofluvial stratified sands and gravels, and horizontally bedded sand, silt and clay sequences interpreted to be advanced-phase glacio-lacustrine sediments. These soils were not encountered in the sonic drillholes or test pits completed as part of the 2018 investigations.

The results of the soil geotechnical investigations are summarised in Section 6. The surficial soils below the proposed waste rock dumps and sediment ponds are mostly described as a sandy lean clay till (CL). The clay till typically contains silt and fine sand with some gravel, is commonly stiff to hard in consistency, has low to medium plasticity, and is well graded. These materials are generally comparable to the till unit described by Levson et al.

3.3 Bedrock Geology

The coal that is to be mined from the Tenas Pit is located within the sedimentary sequences of the early Cretaceous-aged Skeena Group. The Skeena Group consists of mudstones, siltstones, sandstones and conglomerates with inter-bedded, bituminous coal seams. The Skeena Group has been historically divided into four units (Palsgrove, 1991), of which two units are economically coal-bearing (Figure 3-2).

Of relevance to this study at Tenas is Unit 1 described by Palsgrove. A geological map of the Tenas Pit area with the Unit 1 outcrops is shown in Figure 3-3. Unit 1 comprises a 50 to 120 m thick sedimentary sequence interbedded with Coal Seam 1 (Seams 1A to 1F). The individual coal seams vary from less than 1 m to 3 m in thickness, and can be laterally discontinuous (Palsgrove, 1991).

The Skeena Group unconformably overlies the Hazelton Volcanic Group rocks. Additionally, the project geology map indicates the intrusive unit is in contact with the Skeena Group in all directions outside of the proposed pit footprint (Figure 3-3). However, the Hazelton Volcanic Group was not intercepted in vertical diamond drillholes that extended below the lower-most coal plys at Tenas or the inclined diamond drillholes that were drilled though the east-limb of the Tenas syncline (i.e. proposed east wall) along the east side of the deposit.

As discussed, the Skeena Group rock have been folded into a syncline at Tenas. On the west side the rocks are shallow, west dipping and gently folded along a west-limb. Toward the east, the bedding dips increase at the axis of the fold, and the rocks are moderately dipping to the east along the east-limb.

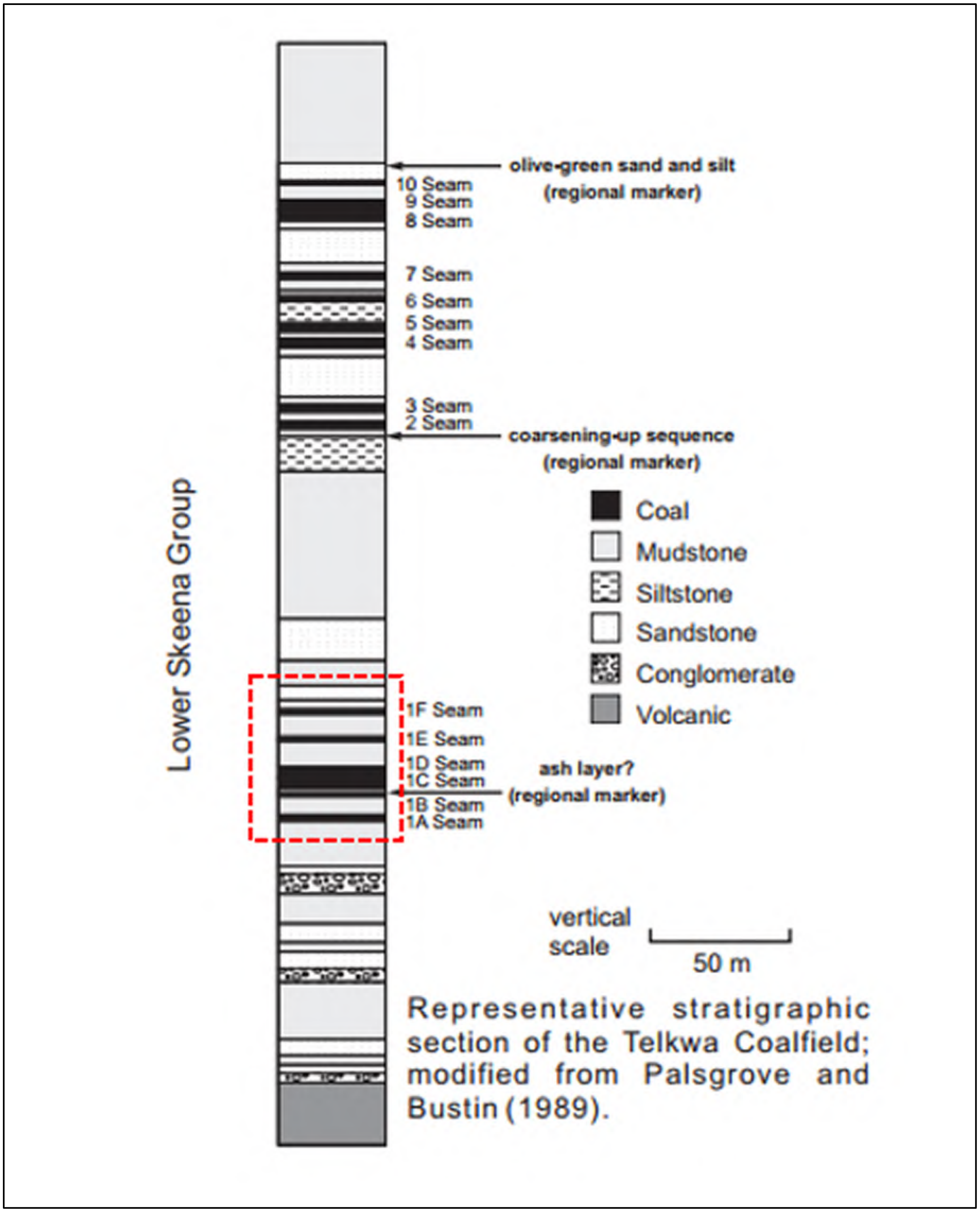


Figure 3-2: Representative Stratigraphy of the Skeena Group (Palsgrove, 1991). Unit 1 shown in Red Dashed Box.

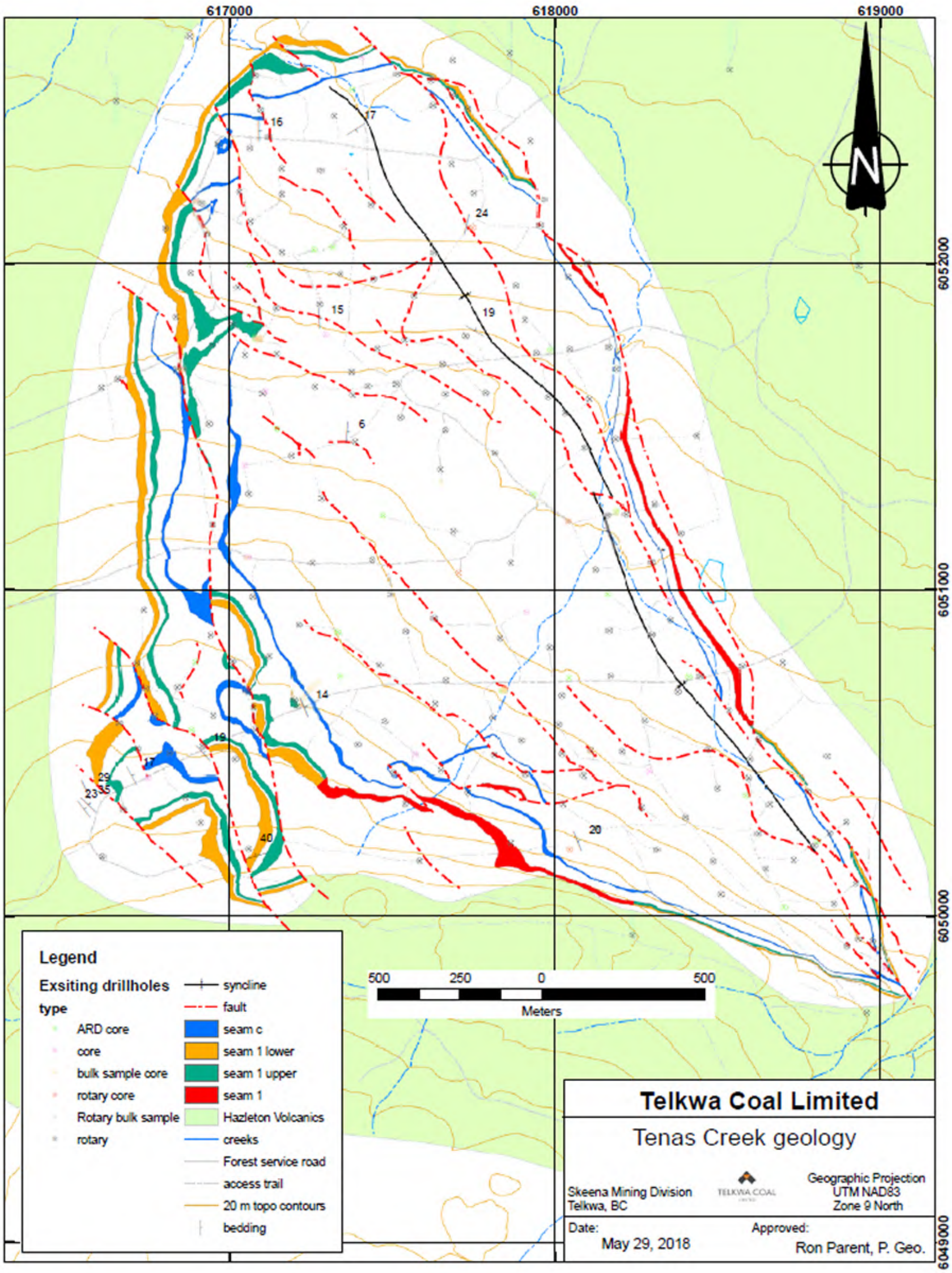


Figure 3-3: Tenas Geology Map (Telkwa, 2018)

3.4 Seismicity

The 2015 National Building Code Seismic Hazard Map (NRC, 2015) indicates that the Telkwa Coal project site is located in a relatively stable seismic area. The peak ground acceleration (PGA) for a two percent probability of exceedance in a 50-year period, i.e. once in 2,475 years, is 0.049 g.

4 Previous Geotechnical and Hydrogeological Investigations

Five previous geotechnical and hydrogeological investigation programs have been completed in the Telkwa area, as summarised in Table 4-1. These include investigations for the Tenas, Goathorn and Telkwa North deposits. The 1997 Piteau Engineering Ltd. (Piteau) report is most relevant to the 2018 geotechnical investigations, and the data from these historical investigations has been compiled and compared in this current report.

Table 4-1: Summary of Previous Geotechnical and Hydrogeological Investigations in the Telkwa Area

Consultant	Report Title	Year of Report	Pit Area
Klohn Leonoff	Stage II Geotechnical, Hydrological, and Hydrogeological Design report.	1985	Goathorn
Piteau Engineering Ltd.	Engineering Geology and Geotechnical Assessment for the Pit 7 and Pit 8 Areas.	1994	Telkwa North
Piteau Engineering Ltd.	Water Management of Tailings Pond and Pits 7 and 8.	1994	Telkwa North
Piteau Engineering Ltd.	Engineering Geology and Geotechnical Assessment for the Tenas Pit and Waste Dumps.	1997	Tenas
Piteau Engineering Ltd.	Geotechnical Assessment for the Coal Haul Roads, Tailings Pond and Plant Site.	1998	All pits

5 2018 Geotechnical Field Investigations

The 2018 geotechnical field investigations have been divided into soil (sonic drilling and testing pitting) and rock (diamond drilling and televiewer surveying) components. Laboratory testing was conducted on both soil and rock samples collected during the investigations. The summary of the program is presented in the following subsections. A map of the geotechnical investigation area, with all sonic drillholes, test pits and diamond drillholes, is shown in Figure 5-1.

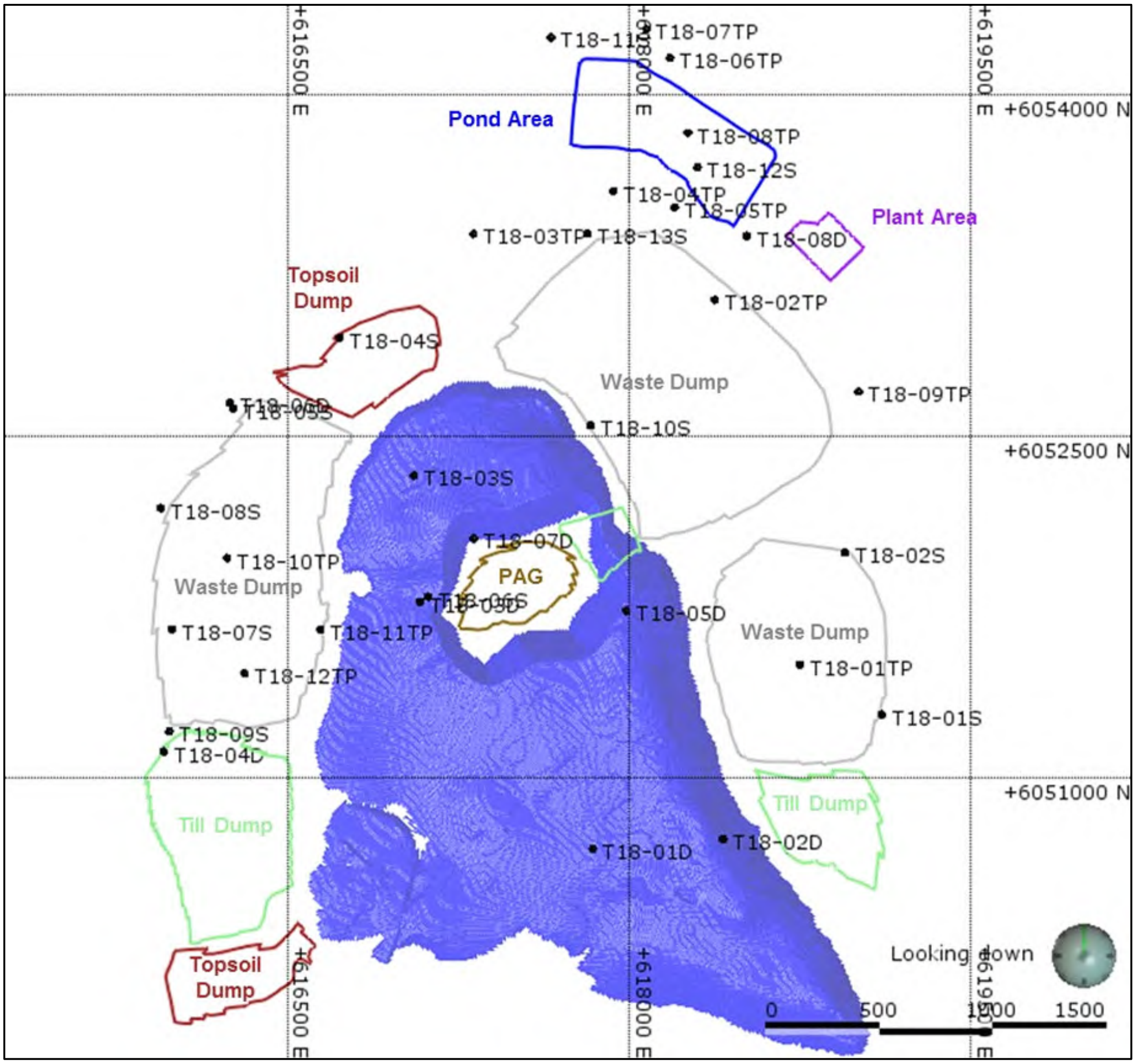


Figure 5-1: 2018 Geotechnical Investigation Area with Sonic Drillholes, Test Pits, and Diamond Drillholes[1]

5.1 Sonic Drilling

The sonic drill program was completed using a LS250 Minisonic rig by Boart Longyear. The program consisted of 13 geotechnical sonic drillholes as detailed in Table 5-1. The geotechnical sonic holes investigated soil foundations below proposed waste rock dumps and sediment ponds. The drillholes were drilled vertically and were terminated at depths between 9.0 m and 30.8 m upon reaching bedrock or sufficiently high soil consistency/density. One of the sonic drill holes, Drillhole T18-06S, was advanced under the direction of Telkwa site management personnel to collect a bulk coal sample within the proposed pit boundaries. For these reasons, the drillhole

[1] Note: *Pit, Pond Area, Plant Area, and dump locations extracted from SRK, 2017*

was not geotechnically logged or sampled. Four standpipe piezometers were installed in completed drillholes to measure standing groundwater levels.

Table 5-1: Sonic Drillhole Program Summary

Drillhole ID	Planned ID	Final Depth (m)	Easting[1] (m)	Northing[1] (m)	Elevation[1] (masl)	Date Completed	Geotech Logging	Screened Depth of Installed Well
T18-01S	Geo12	9.0	619132	6051278	863	2/1/2018	Yes	
T18-02S	Geo11	19.5	618921	6051995	836	2/2/2018	Yes	11.0-14.0 m
T18-03S	Geo03	15.0	617071	6052362	852	2/3/2018	Yes	
T18-04S	Geo09	20.0	616709	6052775	834	2/4/2018	Yes	
T18-05S	Geo08	14.0	616249	6052648	852	2/5/2018	Yes	
T18-06S	ARD01	NA	617081	6051775	904	2/6/2018	No	
T18-07S	Geo02	27.9	616004	6051665	908	2/8/2018	Yes	
T18-08S	Geo07	15.5	616018	6052169	885	2/9/2018	Yes	
T18-09S	Geo06	13.5	615957	6051117	939	2/10/2018	Yes	10.1-13.1 m
T18-10S	Geo10	14.0	617817	6052528	838	2/12/2018	Yes	
T18-11S	Geo22	19.5	617697	6054253	791	2/13/2018	Yes	7.5-10.5 m
T18-12S	Geo15	30.8	618296	6053689	801	2/16/2018	Yes	
T18-13S	Geo13	18.4	617809	6053408	815	2/17/2018	Yes	14.9-17.9 m

[1]: Datum: UTM NAD83, Zone 9 North. Coordinates and elevation surveyed after completion of program and provided by Telkwa. Values rounded to nearest metre.

Geotechnical soil logs describing the encountered materials are presented in Appendix A. The logs include the following:

- Soil layer descriptions, including Unified Soil Classification System (USCS) classification/soil type, particle size and shape, plasticity, color and odor, fabric and structure, moisture, consistency or relative density, and inferred soil unit;
- Samples and pocket penetrometer testing;
- Standard penetration test (SPT) results; and,
- Drill performance indicators of subsurface condition (i.e., drilling resistance)

5.2 Test Pit Investigations

A total of 12 test pits were excavated to investigate shallow foundation materials below the proposed waste rock dumps and sediment ponds. The test pits were excavated to maximum depth between 2.7 and 4.0 m using a tracked John Deer 230LC Hydraulic Excavator fitted with a toothed bucket. The test pits were terminated at practical bucket refusal or the maximum reach of the excavator.

The test pits were located within existing trails or within previously disturbed ground associated with trial and drill pad construction. The test pit ID numbers, dates completed and surveyed locations are summarized in Table 5-2.

Table 5-2: Test Pit Program Summary

Test Pit ID	Planned ID	Final Depth (m)	Easting[1] (m)	Northing[1] (m)	Elevation[1] (masl)	Date Completed
T18-01TP	NA	3.2	618635	6051793	848	1/31/2018
T18-02TP	NA	4.0	618354	6053134	818	2/5/2018
T18-03TP	NA	3.1	617316[2]	6053388[2]	808[2]	2/6/2018
T18-04TP	Geo04	3.6	617939	6053557	811	2/6/2018
T18-05TP	NA	3.0	618222	6053485	813	2/6/2018
T18-06TP	NA	3.3	618188	6054074	788	2/6/2018
T18-07TP	NA	2.7	618019	6054291	785	2/6/2018
T18-08TP	NA	3.2	618226	6053894	797	2/6/2018
T18-09TP	NA	3.2	619008[2]	6052695[2]	821[2]	2/7/2018
T18-10TP	NA	3.6	616234[2]	6051965[2]	897[2]	2/12/2018
T18-11TP	NA	3.0	616607	6051628	923	2/13/2018
T18-12TP	NA	2.9	616277	6051458	930	2/13/2018

[1]: Datum: UTM NAD83, Zone 9 North. Coordinates and elevation surveyed after completion of program and provided by Telkwa. Values rounded to nearest metre
[2]: Test pit not surveyed. Coordinates estimated using topographic map provided by Telkwa.

Geotechnical logs based on these test pits are presented in Appendix A. The logs include the following:

- Soil layer description, including Unified Soil Classification System (USCS) classification/soil type, particle size and shape, plasticity, color and odor, fabric and structure, moisture, consistency or relative density, and inferred soil unit;
- Samples and pocket penetrometer testing; and
- Photos of the excavation.

Additional relevant information noted during the excavation, including water inflow, sloughing and excavator resistance, have also been added to the geotechnical logs.

5.3 Geotechnical Diamond Drilling

SRK proposed a geotechnical drilling program comprising two dedicated drillholes (T18-02D and T18-05D) that were to be located along the proposed east wall of the pit. The drillholes were drilled using a Boart Longyear 38 Diamond Drill by Driftwood Drilling Ltd. The purpose of the two proposed drillholes was to investigate the rock mass and structural geology conditions behind the proposed east wall. These drillholes were to be geotechnical logged, sampled, point load strength tested and televiewer surveyed to collect discontinuity orientation data. However, the televiewer surveying of these drillholes was unsuccessful due to poor image quality (T18-02D) and drillhole instability issues (T18-05D).

Additional geotechnical data collected in three other diamond drillholes located central to the proposed pit that were primarily purposed for geochemical and coal quality sampling (T18-01D, T18-03D and T18-07D). This additional data included:

- T18-01D was logged geotechnically during standby time by the SRK geotechnical supervisor; and
- Televiewer surveys in T18-01D, T18-03D and T18-07D that were completed as part of the downhole geophysical suite of tools.

As part of the overall study, three hydrogeology diamond drillholes were advanced for the installation of piezometers. SRK did not geotechnical log, sample or test soil and rock core from these drillholes. Table 5-3 provides a summary of the overall diamond drilling program.

Table 5-3: Diamond Drilling Program Summary

Drillhole ID	Primary Purpose	Length[1] (mah)	Dip (°)	Azimuth (°)	Easting[2] (m)	Northing[2] (m)	Elevation[2] (masl)	Geotech Logging	Televiewer Survey (m)
T18-01D	Geochemical/Coal Quality	78.7	-90	0	617841	6050689	958	Yes	16.5 – 78.7
T18-02D	Geotechnical	124.9	-60	42	618412	6050732	928	Yes	12.0 – 124.9[3]
T18-03D	Geochemical/Coal Quality	102.6	-90	0	617080	6051772	904	No	10.5 – 102.6
T18-04D	Hydrogeology	70.0	-90	0	615955	6051115	939	No	Not attempted
T18-05D	Geotechnical	180.4	-70	64	617988	6051733	893	Yes	No[4]
T18-06D	Hydrogeology	131.3	-90	0	616245	6052647	853	No	Not attempted
T18-07D	Geochemical/Coal Quality	213.7	-90	0	617318	6052051	864	No	7.5 – 213.7
T18-08D	Hydrogeology	53.2	-90	0	618515	6053379	805	No	Not attempted

[1]: mah = metres along hole, relative to ground surface.

[2]: Datum: UTM NAD83, Zone 9 North. Coordinates and elevation surveyed after completion of program and provided by Telkwa. Values rounded to nearest metre.

[3]: Survey has poor image quality.

[4]: Survey not attempted because of drillhole instability.

5.3.1 Geotechnical Logging

The recovered rock core from the geotechnical drillholes was logged, sampled, tested, boxed and photographed on-site. Geotechnical data was collected in accordance with SRK standard logging procedures. The descriptive terms and standards used by SRK to describe the geotechnical characteristics of the rock core are consistent with terminology recommended by the International Society for Rock Mechanics (ISRM).

Downhole plots of the following geological and geotechnical parameters that were logged are presented in Appendix B.

- Rock type and major structural features;
- Total Core Recovery;
- Rock Quality Designation (RQD);
- Fracture Spacing;
- ISRM Field Rock Strength Estimates;
- Point Load Test results ($Is_{(50)}$);
- Interval Joint Condition Rating (JCR); and
- Rock Mass Rating System (RMR_{89}) (Bieniawski, 1989).

5.3.2 Point Load Testing

Point Load Strength Index testing was carried out following logging and photographs. The testing was carried out on representative rock types, generally at 3 to 4 m depth intervals. The point load testing data and results are presented in Appendix C.

5.4 Downhole Geophysics

Downhole geophysical surveys were conducted by Century Wireline Services (Century). Century carried out the following downhole geophysical logging surveys:

- Borehole deviation (azimuth and tilt);
- Caliper;
- Gamma;
- Neutron density; and
- Acoustic televiewer (ATV) surveys in selected drillholes.

The televiewer surveys provide images of the borehole wall and can be used to determine the orientations and depth of structural geological features observed in the borehole images. The raw televiewer images were processed by Century and reoriented to true north. Century reportedly used a rotation of +18.2° to correct the data for local magnetic declination. The processed logs were provided to SRK along with orientation data from Century's structural picks and are presented in Appendix D.

5.5 Laboratory Testing

Representative soil and rock samples were collected after the core was logged and photographed. Samples were sent to the Golder Associates (Golder) laboratory in Burnaby, British Columbia for testing. The laboratory tests included:

- Soil Testing:
  - 19 Particle Size Distribution Tests with Hydrometer (ASTM D422);
  - 18 Atterberg Limits (Plasticity) (ASTM D4318-10);
  - 4 Proctor Soil Compaction Tests (ASTM D698);
  - 4 Hydraulic Conductivity Tests (ASTM D5084-10 Method C)
  - 3 Direct Sear Tests of Soil (Consolidated/Drained) (ASTM D3080);
  - 10 Soil Resistivity Tests (ASTM G187);
  - 10 Soil pH Tests (ASTM D4972); and
  - 35 Water Content Tests (ASTM D2216)
- Rock Testing:
  - 6 Uniaxial Compressive Strength of Intact Rock (ASTM D7012 Method C);
  - 3 Uniaxial Compressive Strength of Intact Rock with Elastic Moduli (ASTM D7012 Method D); and,
  - 3 Direct Shear Tests on Rock (ASTM D5607).

Laboratory test results are presented in Appendix E.

6 Results of the Soil Geotechnical Investigations

6.1 Material Observations

The surficial geology summary for the Tenas project area is based on the results of SRK's 2018 geotechnical investigation detailed in this report.

The overburden of the Tenas project area ranges from a thickness of approximately 4 m to over 100 m, as indicated by the most recent 3D Geology Model developed by Telkwa.

Most of the overburden materials above bedrock that were intercepted during the 2018 investigations were comprised of till. In general, the till was a sandy lean clay (CL). The clay typically contains silt and fine sand with some gravel, is commonly stiff to hard in consistency with low to medium plasticity, and well graded. Cobbles and boulders were encountered, and these generally comprised less than 5% of the materials recovered in the sonic drillholes. The colour ranges from medium-brown to very-dark-brown or dark-grey. Sand, silt and gravel lenses were commonly encountered within the till at depth. These materials are generally comparable to the massive diamicton till unit described by Levson et al.

Intervals of clayey sand (SC) or silty sand (SM) greater than 1 m were observed during the sonic drilling at various depths. The SC and SM materials typically contain some fines (either clay or silt), some gravel and are dense, well graded. The fines component can be low to medium plasticity. Full descriptions of the materials logged are presented in the soil logs in Appendix A.

The till materials are generally consistent with the results of the Piteau and Klohn Leonoff investigations carried our previously. The most apparent difference between the 2018 and the previous investigations, is the described composition of sand and gravel materials in the northwest of the project site, and the depth to bedrock. The previous Piteau investigations (Piteau, 1997) noted a very thick soil profile in historical drillhole TOB96-04. This thick unit was described as sand and gravel sized outwash deposits (Piteau, 1997). These outwash materials were not encountered in the 2018 drillholes.

6.2 Standard Penetration Testing Results

Standard Penetration Tests (SPT's) were conducted at 1.5 m intervals during the initial drilling depths, and then increased to 3 m if the material consistency materials were consistent at greater depths. The uncorrected SPT 'N' blows versus depth is plotted in Figure 6-1. There is reasonable correlation between the blows and depth, however, a large spread in the data exists. The data indicates that the uncorrected N blows were generally above 20 (i.e. very stiff soil) at 1.5 m below ground surface level and increased with depth.

SPT N blows for the sandy lean clay till (CL) varied between 15 to >50 correlating to a very-stiff to hard fine-grained material. SPT N values for intervals of clayey sand (SC) or silty sand (SM) varied from 30 to 50 correlating to a dense coarse-grained material. SPT N blows correlated with full material descriptions are presented in the soil logs in Appendix A.

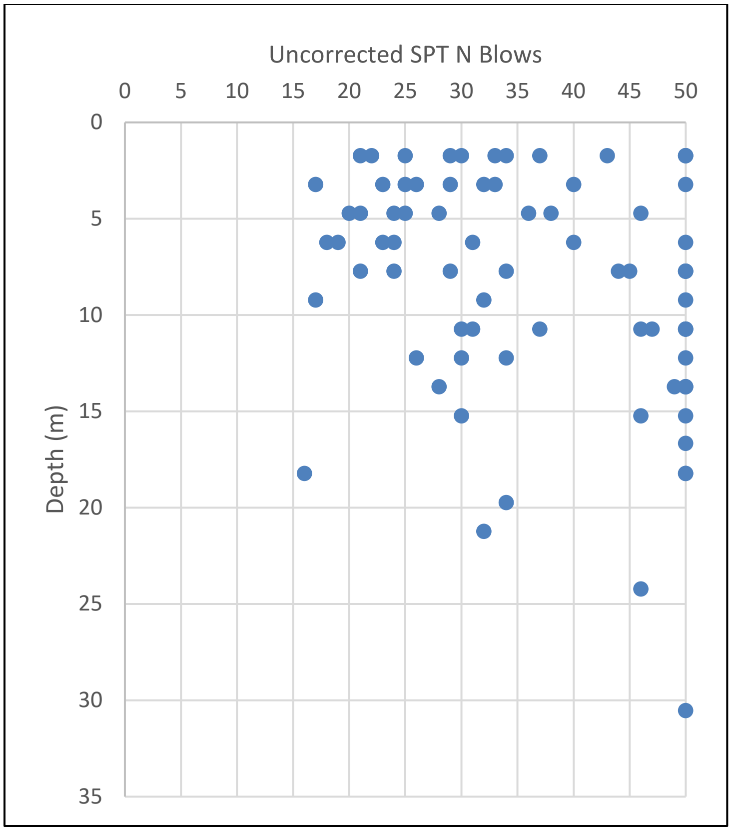


Figure 6-1: SPT N Blows vs. Depth

The historical SPT data from the Piteau investigations is presented in Figure 6-2. The data indicates a similar increasing SPT 'N' blow trend with depth.

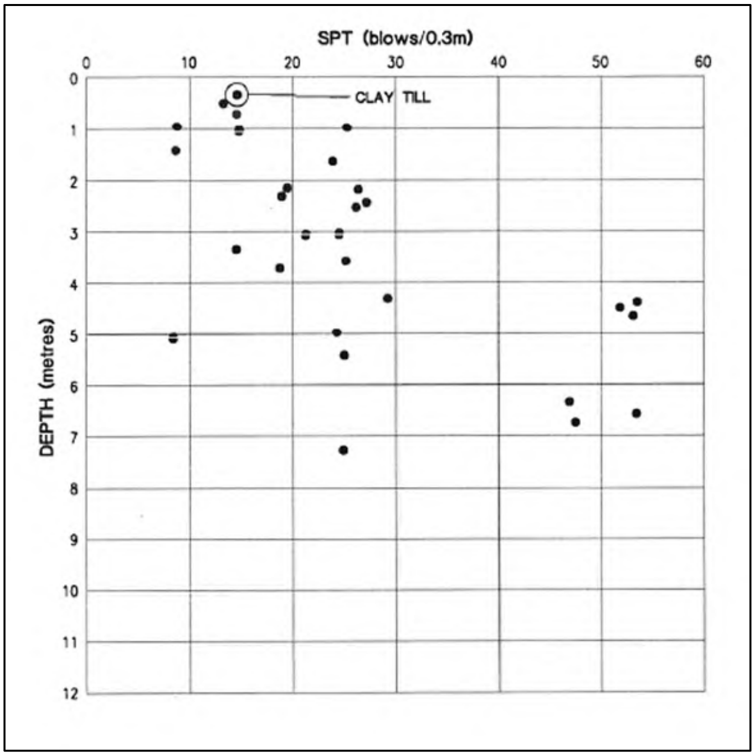


Figure 6-2: Historical SPT N Blows vs. Depth (Piteau, 1997)

6.3 Groundwater

Groundwater inflow was observed in four test pits during excavation. The groundwater inflow occurred in the first 1 m of the test pit within the looser gravelly till directly beneath the top soil and above the stiffer underling till materials. Higher water inflow was recorded at test pit T18-08TP at a depth of 0.2 m which corresponded to the base of gravelly fill from a historic access trail. No groundwater inflows were recorded during the sonic drilling work.

Four wells were installed during the sonic drilling. The wells were installed to aid the concurrent hydrogeology investigation. The full results from the hydrogeology investigation are presented in a separate report. Water level readings taken after installation are presented in Table 6-1.

Table 6-1: Water Level Readings of Wells Installed During Sonic Drilling

Location	Top of Casing Elevation (m)[1]	Depth to Water from Top of Casing (m)	Groundwater Elevation (m)	Date of Reading
T18-02S	835.72	14.46	821.26	3/26/2018
T18-09S	939.65	0.20	939.45	4/28/2018
T18-11S	790.21	Dry	<779.71	4/3/2018
T18-13S	815.22	Dry	<797.32	4/2/2018

[1]: Datum: UTM NAD83, Zone 9 North. Elevation surveyed after completion of program and provided by Telkwa.

6.4 Soil Lab Testing Results

The following sections provide a summary of the results of the soil samples that were sent to Golder. The full laboratory test reports are presented in Appendix E.

6.4.1 Particle Size Distribution Tests

Nineteen Particle Size Distribution (PSD) tests with hydrometer (ASTM D422) were completed. The percentages of gravel, sand and fines for each sample are presented in Table 6-2 and combined PSD curves of all the samples presented in Figure 6-3. The results show that the samples generally have a fines content greater than 50% with a typical sand content of 20% - 40% and a gravel content of 0 % - 20%. The shape of the PSD curves indicates that most samples are well graded.

It should be noted that some samples may underestimate the percentage of gravel or boulders that were observed in the in-situ soil. This is because large cobbles and boulders that were too large to sample in the field and cannot be practically included in the tests.

Table 6-2: Summary of PSD Test Results, 2018

Location	Sample ID	Sample Mid-Point Depth (m)	% Gravel	% Sand	% Fines
T18-01S	SPT-04	6.2	19.7	27.2	53.1
T18-02S	BLK-05	11.9	0.0	38.9	61.1
T18-02S	BLK-02	12.8	0.2	30.8	69.0
T18-02TP	BLK-01	1.0	17.7	30.9	51.4
T18-03S	BLK-02	9.2	17.9	67.5	14.6
T18-03TP	BLK-02	2.8	25.4	21.3	53.3
T18-04S	BLK-02	8.7	0.6	7.5	91.9
T18-05S	BLK-02	10.3	9.8	17.9	72.3
T18-07TP	BLK-02	2.0	28.3	29.5	42.2
T18-08S	SPT-05	9.2	8.8	33.3	57.9
T18-08TP	BLK-01	2.0	19.1	27.3	53.6
T18-09TP	BLK-02	3.0	10.0	20.7	69.3
T18-10S	BLK-01	3.9	10.0	27.9	62.1
T18-11S	BLK-01	0.3	26.9	35.5	37.6
T18-12S	BLK-04	24.3	28.7	37.7	33.6
T18-13S	SPT-01	1.7	6.4	30.9	62.7
T18-13S	BLK-01	12.7	0.6	4.3	95.1
T18-08D	W3-13	12.8	1.0	62.2	36.8
T18-07S	BLK-02 & BLK-03	14.7 & 21.7	26.6	27.7	45.7

Historical PSD tests results are presented in Table 6-3. The 2018 results are generally similar to the historical results in terms of gravel, sand and fines content. Full PSD curves for the historical data were not available.

Table 6-3: Historical PSD Tests (Piteau, 1997)

Location	Sample Mid-Point Depth (m)	% Gravel	% Sand	% Fines
TOB96-11	3.1	20	37	43
TOB96-11	5.5	12	28	60
TOB96-11	10.3	13	24	63
TOB96-13	3.2	13	31	56
TOB96-17	3.2	15	31	54
TOB96-18	3.2	17	29	54

6.4.2 Atterberg Limits (Plasticity)

Eighteen Atterberg Limit tests (ASTM D4318-10) were completed for soil classification. A summary of the test results is presented in Table 6-4 and plotted on a plasticity chart in Figure 6-4. In summary, the results indicate that the majority of the samples are a lean-clay (CL) with low to medium plasticity. Two samples were in the high plasticity range.

Historical Atterberg Limit tests are presented in Table 6-5 and in Figure 6-4. The 2018 results are generally similar to the historical results as most of the tested samples are within the lean-clay (CL) category as shown in Figure 6-4. Although the historical testing is limited, the results do indicate a slightly lower plasticity index.

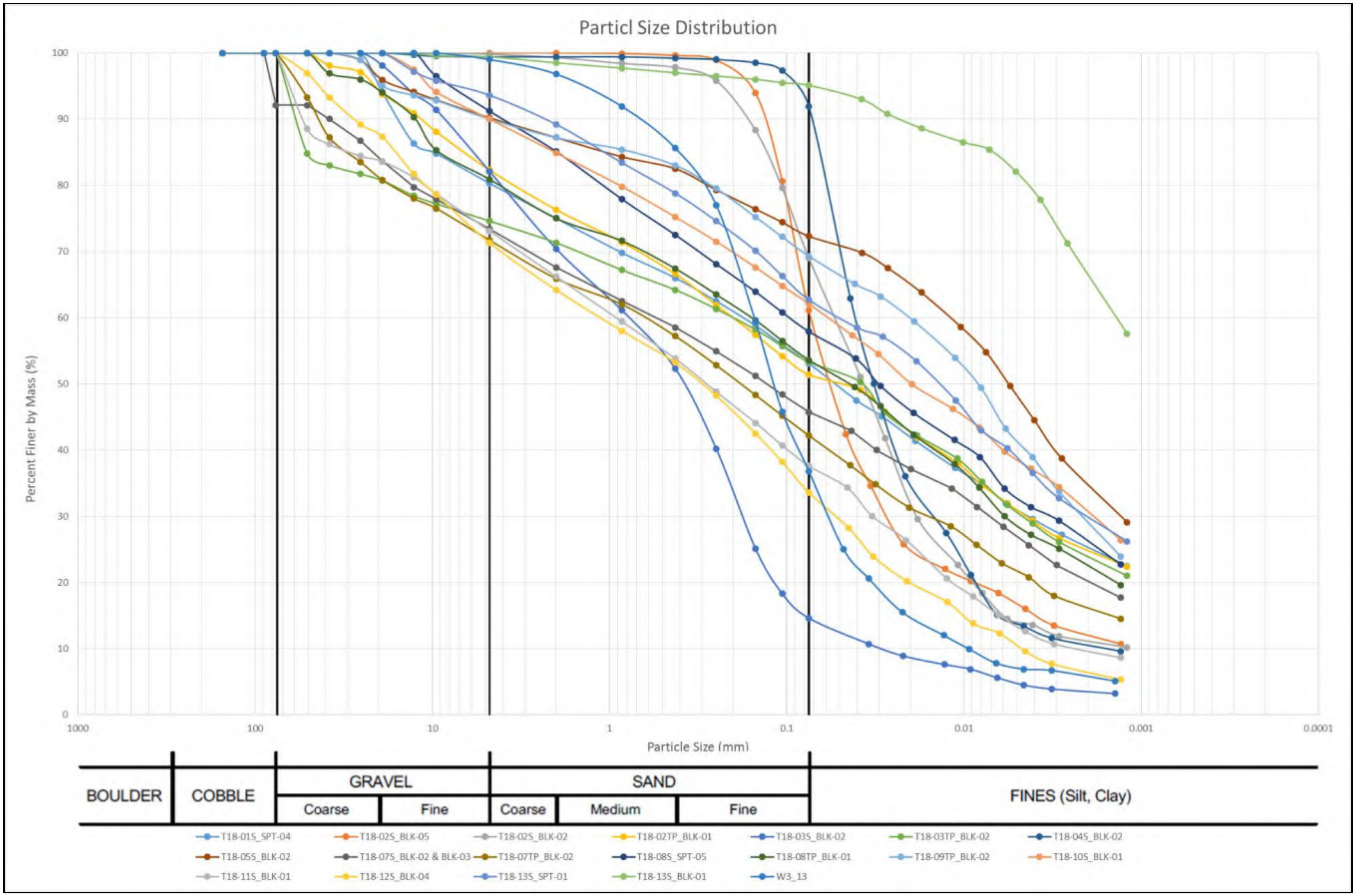


Figure 6-3: PSD Curves for All Tested Samples

Table 6-4: Summary of Atterberg Limit Test Results

Location	Sample ID	Sample Mid-Point Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Water Content (%)	Liquidity Index	USCS Soil Type
T18-01S	SPT-02	3.2	34	12	22	13.7	0.1	CL
T18-01S	BLK-02	7.2	29	11	18	12.0	0.1	CL
T18-02S	SPT-06	9.2	33	16	17	16.6	0.0	CL
T18-02S	BLK-05	11.9	23	16	7	25.3	1.3	CL
T18-02S	BLK-02	12.8	NP	NP	NP	12.6	NP	ML
T18-04S	BLK-02	8.7	NP	NP	NP	22.7	NP	ML
T18-04S	SPT-05	10.7	32	16	16	20.8	0.3	CL
T18-05S	SPT-01	1.7	19	13	6	12.6	-0.1	CL-ML
T18-05S	BLK-02	10.3	33	14	19	16.4	0.1	CL
T18-07S	BLK-02 & BLK-03	14.7 & 21.7	28	14	14	10.6	-0.2	CL
T18-07TP	BLK-02	2.0	29	15	14	10.3	-0.3	CL
T18-08S	SPT-07	15.2	29	16	13	13.4	-0.2	CL
T18-08TP	BLK-01	2.0	29	13	16	13.9	0.1	CL
T18-09S	BLK-01	7.3	24	12	12	9.3	-0.2	CL
T18-11S	BLK-02	6.7	32	16	16	19.4	0.2	CL
T18-12S	BLK-03	17.8	61	21	40	25.2	0.1	CH
T18-13S	SHL-01	6.3	28	12	16	13.9	0.1	CL
T18-13S	BLK-01	12.7	67	26	41	29.2	0.1	CH

NP: Non-Plastic

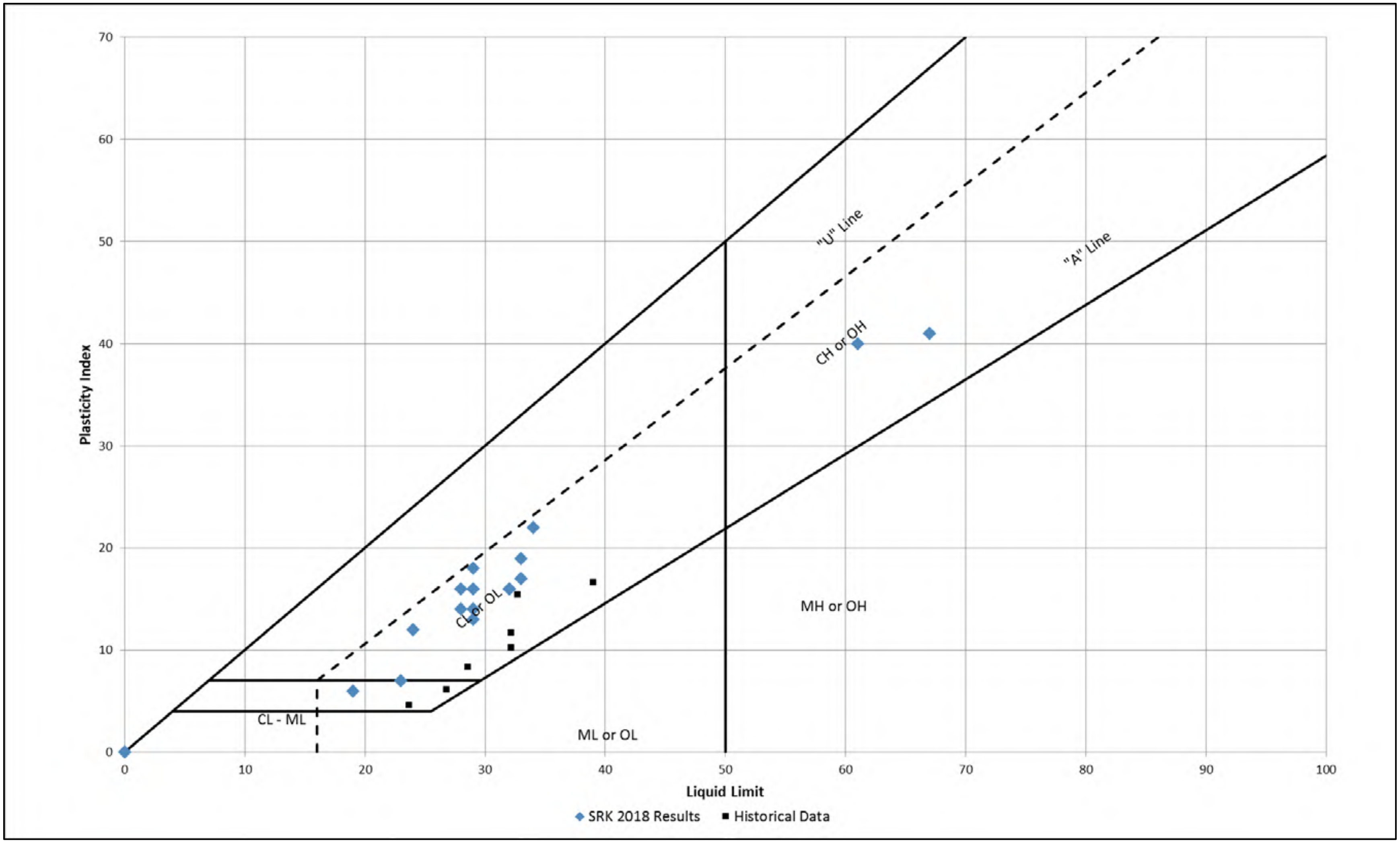


Figure 6-4: Atterberg Limits for 2018 Test Results and Historical Data

Table 6-5: Historical Atterberg Limit Tests (Piteau, 1997)

Drillhole	Sample Mid-Point Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Water Content (%)	USCS Soil Type
TOB96-11	3.1	29	20	8	11.3	CL
TOB96-11	5.5	32	22	10	11.0	CL
TOB96-11	10.3	24	19	5	15.7	CL-ML
TOB96-13	3.2	39	22	17	12.5	CL
TOB96-13	7.2	27	21	6	10.0	CL-ML
TOB96-17	3.2	33	17	15	14.1	CL
TOB96-18	3.2	32	21	12	13.0	CL

6.4.3 Compaction Testing

Four soil compaction tests (ASTM D698) were completed. It should be noted that bulk soil samples were combined for the compaction and permeability testing due to sample volume requirements. The samples were generally similar in composition, and therefore, considered reasonable to combine for testing. The exception was T18-13S BLK-01 and BLK-02 which was selected from an interval of interlayered clays and clayey sands. A summary of the test results is presented in Table 6-6.

Table 6-6: Compaction Test Results

Location	Sample ID	Sample Description	Sample Mid-Point Depth (m)	As-Received Water Content (%)	Corrected[1] Optimum Water Content (%)	Corrected[1] Max Dry Density (kg/m^3)
T18-05S	BLK-01 & BLK-02	Lean Clay with Sand (CL)	5.7 & 10.5	16.4	10.5	2108
T18-07S	BLK-02 & BLK-03	Sandy Lean Clay with Gravel (CL)	14.7 & 21.7	10.6	9.9	2128
T18-07TP	BLK-01 & BLK-02	Sandy Lean Clay with Gravel (CL)	1.0 & 2.0	11.9	9.7	2054
T18-13S	BLK-01 & BLK-02	Fat Clay (CH) and Clayey Sand (SC)	12.4 & 14.6	24.7	21.5[2]	1723[2]

[1]: Corrected for oversized fraction (ex. Gravel)

[2]: Correction not required

6.4.4 Permeability Testing

Four soil permeability tests (ASTM D3080) were completed on soil samples following the completion of the compaction tests. As detailed, the testing was conducted on combined samples. The samples were removed from the compaction molds, and then placed into the permeability mold for falling head tests. All samples were compacted to 95% of Standard Proctor density for permeability testing. A summary of the test results is presented in Table 6-7.

Table 6-7: Permeability Testing Results

Location	Sample ID	Sample Description	Sample Mid-Point Depth (m)	Average k_{20} (cm/s)	Average k_{20} (m/s)
T18-05S	BLK-01 & BLK-02	Lean Clay with Sand (CL)	5.7 & 10.5	2.15E-07	2.15E-09
T18-07S	BLK-02 & BLK-03	Sandy Lean Clay with Gravel (CL)	14.7 & 21.7	8.06E-07	8.06E-09
T18-07TP	BLK-01 & BLK-02	Sandy Lean Clay with Gravel (CL)	1.0 & 2.0	1.04E-05	1.04E-07
T18-13S	BLK-01 & BLK-02	Fat Clay (CH) and Clayey Sand (SC)	12.4 & 14.6	1.18E-08	1.18E-10

6.4.5 Remolded Soil Direct Shear Tests

Three soil direct shear tests (ASTM D3080) were performed on remolded and disturbed soil samples. A summary of the test results is presented in Table 6-8.

Table 6-8: Summary of Remolded Soil Direct Shear Results

Location	Sample ID	Sample Mid-Point Depth (m)	Peak Friction Angle (°)	Apparent Peak Cohesion (kPa)	Residual Friction Angle (°)	Apparent Residual Cohesion (kPa)
T18-02S	SPT-05	7.7	23	55	19	66
T18-12S	SPT-07	18.2	17	73	12	0
T18-10S	BLK-01	3.8	26	40	26	40

6.4.6 Resistivity and pH

Ten soil resistivity (ASTM G187) and pH (ASTM D4972) tests were completed. A summary of the test results is presented in Table 6-9. This testing was carried out as part of concurrent environmental studies and is included for completeness as this independent of the geotechnical program.

Table 6-9: Soil Resistivity and pH Results

Drillhole	Sample ID	Sample Mid-Point Depth	pH	Measured Resistance (Ω)	Calculated Resistivity (Ω.cm)
T18-02TP	BLK-01	1.0	6.4	7290	4884
T18-03S	BLK-02	9.2	8.4	13600	9112
T18-03TP	BLK-02	2.8	8	5620	3765
T18-04S	BLK-02	8.7	8.3	8050	5394
T18-05S	BLK-02	10.3	8.3	4420	2961
T18-07S	BLK-02 & BLK-03	14.7 & 21.7	8.5	4160	2787
T18-11S	BLK-01	0.3	6	25500	17085
T18-12S	BLK-04	24.3	8.3	5290	3544
T18-13S	SPT-01	1.7	8.1	6440	4315
T18-08D	W3-26	26.3	8.1	4590	3075

7 Results of Rock Geotechnical Investigations

7.1 Rock Types

Rock types encountered in the geotechnical drilling program generally comprised Skeena Group mudstone, siltstone, sandstone and coal. The typical appearance of representative rock types are presented in Figure 7-1, through Figure 7-4.

Engineering geological descriptions for each rock type are detailed below.

Coal (C):

Fine grained, bedded and cleated texture, dark grey and black, assessed fresh to extremely weathered, generally estimated extremely weak to very weak intact rock strength (R0 to R1).

Figure 7-1: Example Core of Coal Rock Type

Mudstone (MDST):

Fine grained, bedded, grey and dark grey, assessed fresh to highly weathered, generally estimated very weak to medium strong intact rock strength (R1 to R3). The mudstone is often interbedded with small coal seams and breaks on graphitic coated joints near major coal seams.

Figure 7-2: Example Core of Mudstone Rock Type

Siltstone (SLST):

Fine grained, bedded and laminated texture, dark grey, assessed fresh to moderately weathered, generally estimated very weak to medium strong intact rock strength (R2 to R3). The siltstone can be interbedded with small coal seams and breaks on graphitic coated joints near major coal seams.

Figure 7-3: Example Core of Siltstone Rock Type

Sandstone (SST):

Fine to medium grained, bedded and massive texture, light to dark grey, assessed fresh to moderately weathered, generally estimated moderate to strong intact rock strength (R3 to R4). Sandstone represents 5% of what was logged.

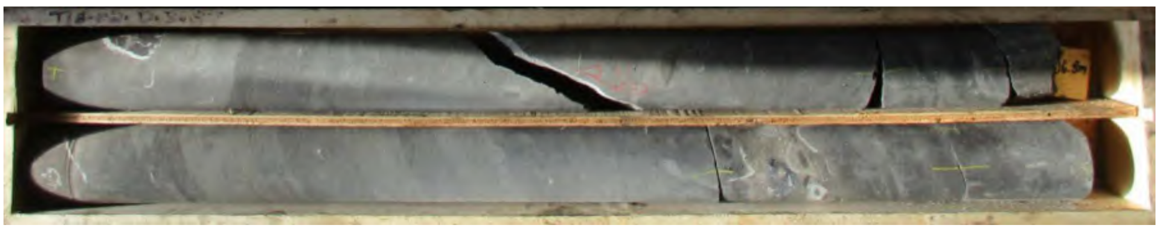


Figure 7-4: Example Core of Sandstone Rock Type

The logged lithology is plotted on the geotechnical logs in Appendix B and the general stratigraphy is shown on the geological sections in Appendix F.

7.2 Rock Strength

7.2.1 Estimated Strengths

Field estimates of intact rock strength were carried out during core logging. The field estimates of intact rock strength are based on the ISRM suggested methods summarized in Table 7-1.

Table 7-1: Summary of ISRM Intact Rock Strength Estimates (Brown, 1982).

Grade	Description	Field Identification	Approx. Range of Unconfined Compressive Strength (MPa)
R0	Extremely Weak Rock	Indented by thumbnail.	0.25 - 1.0
R1	Very Weak Rock	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0 - 5.0
R2	Weak Rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5.0 – 25
R3	Medium Strong Rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer.	25 – 50
R4	Strong Rock	Specimen requires more than one blow of geological hammer to fracture it.	50 – 100
R5	Very Strong Rock	Specimen requires many blows of geological hammer to fracture it.	100 - 250
R6	Extremely Strong Rock	Specimen can only be chipped with geological hammer.	>250

Logged field estimates of intact rock strength for MDST, SLST and SST are presented in Figure 7-5. For the MDST, SLST and SST rock types, the strength of the rock was noted to be weaker parallell to bedding. The field estimates of intact rock strength for each geotechnical interval are shown in the downhole plots for each drillhole in Appendix B.

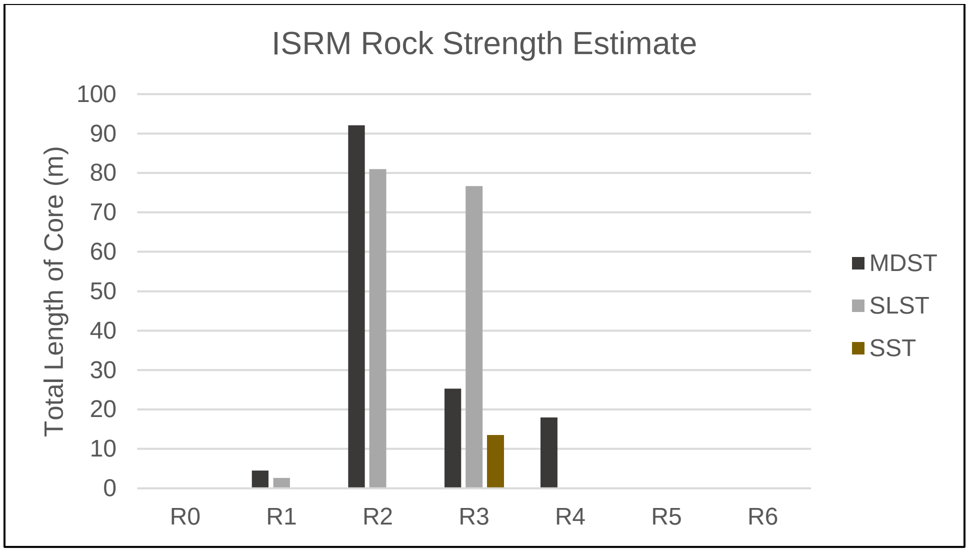


Figure 7-5: Field Estimates of Intact Rock Strength by Rock Type

7.2.2 Point Load Strength Index Testing

Point load strength index test results are summarised in Table 7-2. The complete results of the point load strength index testing are presented in Appendix C. All diametral tests were conducted parallel to bedding and all axial tests were conducted perpendicular to bedding.

Table 7-2: Summary of Point Load Strength Testing Results.

Lithology	Test Type	No. of Valid Tests	Range ($Is_{(50)}$ MPa)		Mean ($Is_{(50)}$ MPa)	Median ($Is_{(50)}$ MPa)	Standard Deviation ($Is_{(50)}$ MPa)
			Min	Max			
MDST	Diametral	30	0.11	1.56	0.55	0.51	0.34
	Axial	19	0.05	2.16	1.17	1.08	0.53
SLST	Diametral	47	0.07	3.74	0.67	0.51	0.60
	Axial	41	0.13	3.51	1.15	1.13	0.72
SST	Diametral	6	0.11	4.29	1.39	0.67	1.52
	Axial	0[1]	-	-	-	-	-

[1]: No appropriate axial samples were available for testing

For the MDST, SLST and SST rock types, the stregnth of the rock was noted to be weaker parallell to bedding (diametral tests).

7.2.3 UCS Testing

A total of nine Unconfined Compression Strength (UCS) tests were performed on rock core samples collected during the field program. Three samples were selected for additional measurement of Young's Modulus and Poison's Ratio. All samples were tested perpendicular to bedding. All rock types were observed to be weaker parallel to bedding. Laboratory tests results are provided in Appendix E and summarised in Table 7-3.

Table 7-3: Summary of 2018 UCS Test Results.

Drillhole	Sample #	Depth From (mah)[1]	Depth To (mah)[1]	Rock Type[2]	Dry Density (kg/m^3)	UCS (MPa)	Young's Modulus (GPa)	Poisson's Ratio	Valid Test
T18-02D	UCS-122	122.06	122.42	SLST	2486	25.2	-	-	Yes
T18-05D	UCS-128	127.5	127.86	MDST	2541	25.8	-	-	Yes
T18-05D	UCS-154	153.89	154.29	MDST	2614	42.3	-	-	Yes
T18-05D	UCS-173	172.5	172.95	SLST	2365	~~6.8~~	-	-	No[3]
T18-02D	UCS-060	59.97	60.63	MDST	2471	31.1	3.2	0.06	Yes
T18-05D	UCS-055	54.4	54.81	MDST	2549	52.5	4.9	0.08	Yes
T18-05D	UCS-113	112.5	112.8	SST	2253	23.5	2.3	0.21	Yes
T18-02D	UCS-066	66	66.36	MDST	2503	43.9	-	-	Yes
T18-02D	UCS-117	116.71	117.04	SST	2711	68.3	-	-	Yes

[1]: mah = metres along hole, relative to ground surface.

[2]: Rock type logged by Telkwa during sample collection.

[3]: Lab comments and photos indicate sample had a desiccation crack prior to testing, likely compromising integrity of the sample.

7.2.4 PLT Conversion Factor

The point load data was compared with the UCS testing by means of a conversion factor (CF). The CF was generated by plotting Is(50) values against the tested UCS sample (located within +/- 5 m). The average of the valid axial Is(50) values within 5 m of the UCS test was used to estimate a CF. A linear regression line was fitted for the data, as shown in Figure 7-6. Typically, CF ranges between 20 and 30 and is a site-specific relationship.

As Figure 7-6 shows, the UCS and Is(50) correlation for MDST is variable but indicate an overall CF of 27 as an appropriate value. There is not enough UCS tests to make a valid correlation between the PLT and UCS data for the SLSLT and SST rock types. However, the data that was collected indicates the CF is similar to that of the MDST.

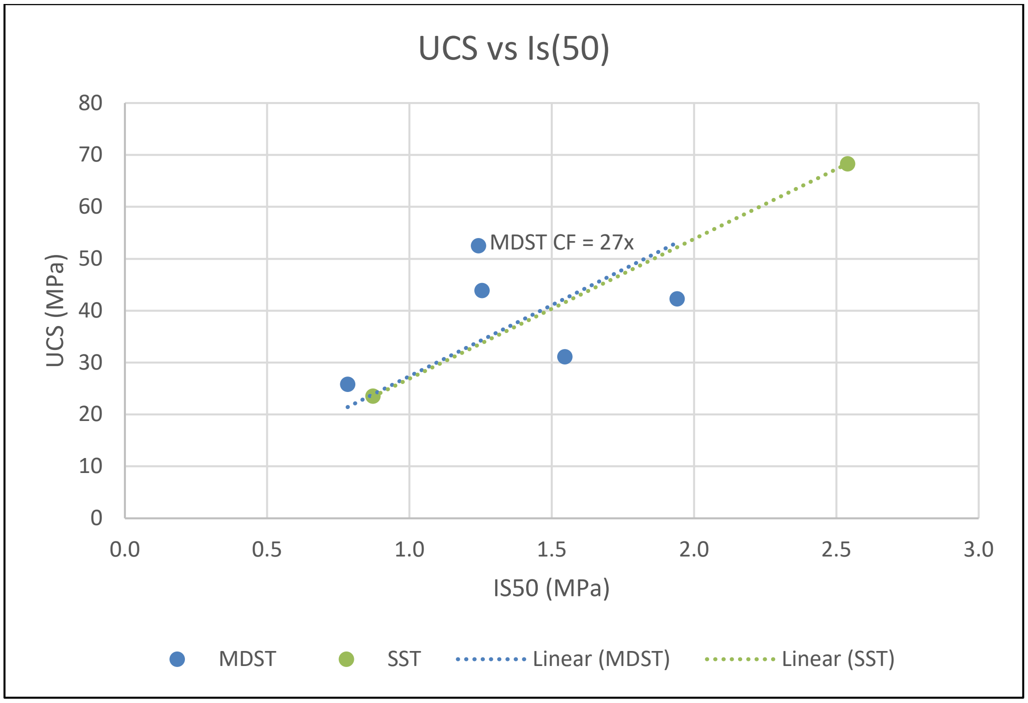


Figure 7-6: Is($_{50}$) vs UCS

7.3 Discontinuity Strength

7.3.1 Joint Condition Rating

The JCR is used in the RMR_{89} rock mass classification system (Bieniawski, 1989) to describe the small-scale surface characteristics of open discontinuities. A rating is assigned based on the observed discontinuity surface roughness and wall rock alteration, as presented in Table 7-4.

Table 7-4: Rating Guide for Joint Condition Rating (Bieniawski, 1989).

Condition of Joints	Rating
Soft gouge >5 mm thick, or joints open >5 mm; continuous joints	0
Slickensided surfaces, or gouge <5 mm thick, or joints open 1–5 mm; continuous joints	10
Slightly rough surfaces, separation <1 mm, soft joint wall rock	20
Rough surfaces, separation <1 mm, hard joint wall rock	25
Very rough surfaces, not continuous, no separation, hard joint wall rock	30

Logged JCR values for MDST, SLST< and SST are presented in Figure 7-7.

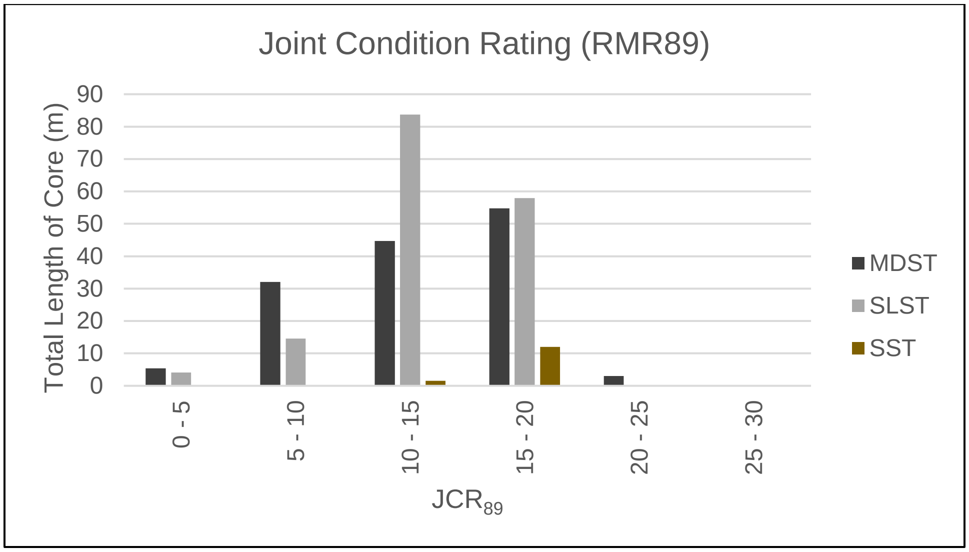


Figure 7-7: Logged JCR by Rock Type

The JCR for each geotechnical interval are shown in the downhole plots for each drillhole in Appendix B.

7.3.2 Direct Shear Testing Results

A total of three Direct Shear tests were performed on rock core samples collected during the field program. Laboratory tests results are provided in Appendix E and summarised in Table 7-5. Based upon the logged JCR values, the Direct Shear test results appear to be on the upper bound side of the roughness range.

Table 7-5: Direct Shear Test Results – Rock

Drillhole	Sample #	Depth From (mah)[1]	Depth To (mah)[1]	Rock Type[2]	Feature type	Cohesion-less Peak Friction Angle (°)	Peak Cohesion (kPa)	Residual Friction Angle (°)	Residual Apparent Cohesion (kPa)	Valid Test
T18-05D	DSS-129	128.55	128.95	MDST	Joint	31	0	28	31	Yes
T18-05D	DSS-153	153.35	153.65	MDST	Joint	31	0	29	0	Yes
T18-05D	DSS-156	155.45	155.65	SLST	Bedding	34	0	33	17	Yes

[1]: mah = metres along hole, relative to ground surface.

[2]: Rock type logged by Telkwa during sample collection.

7.4 Rock Mass Classification

A rock mass quality assessment using RMR_{89} rock mass classification system (Bieniawski, 1989) has been prepared for the rocks logged in each drillhole. RMR_{89} values were calculated on a geotechnical interval basis, with each interval assessed based on the actual conditions encountered during the geotechnical logging. Geotechnical logging intervals were selected on the basis of variations in strength, fracture frequency and/or lithology.

The RMR_{89} classification system ranks rock mass quality on the basis of the following five geotechnical parameters:

- *R1* = rating for the strength of intact rock material (rating = 0 to 15);
- *R2* = rating for drill core quality, RQD (rating = 3 to 20);
- *R3* = rating for spacing of joints (rating = 5 to 20);
- *R4* = rating for JCR (rating = 0 to 30); and
- *R5* = rating for groundwater (Jw) (rating = 0 to 15).

The overall rock mass quality is determined by summing the individual rankings as follows.

$$\boldsymbol{RMR_{89}} = R1 + R2 + R3 + R4 + R5$$

The rock mass class as a function of rock mass rating as summarized in Table 7-6.

Table 7-6: Summary of Rock Mass Rating System (Bieniawski, 1989).

Parameter	Range of Values						
UCS (MPa) Rating	>250 (15)	100-250 (12)	50-100 (7)	25-50 (4)	5-25 (2)	1-5 (1)	<1 (0)
RQD Rating	90-100% (20)	75-90% (17)	50-75% (13)	25-50% (8)	<25% (3)		
Joint Spacing Rating	>2 m (20)	0.6-2 m (15)	200-600 mm (10)	60-200 mm (8)	<60 mm (5)		
Joint Condition Rating, (JCR)	Very rough No separation Hard wall rock (30)	Slightly rough Separation <1 mm Hard wall rock (25)	Slightly rough Separation<1 mm Soft wall rock (20)	Slickensides, Separation or gouge <5 mm (10)	Soft gouge or Separation >5 mm (0)		
Groundwater (Jw) Rating	Completely Dry (15)	Damp (10)	Moist (7)	Mod. Pressure (4)	Severe (0)		
Total RMR_{89} Value (Sum of Ratings for 5 Items) =							
Rating	100 – 81	80 – 61	60 – 41	40 - 21	20 – 0		
Category	5 – Very Good	4 – Good	3 – Fair	2 - Poor	1 - Very Poor		

Notes: MPa = megapascal; Rating values are shown in parentheses.

The five geotechnical parameters logged and the resulting RMR_{89} for each geotechnical interval are shown in the downhole plots for each drillhole in Appendix B. A histogram of the geotechnical interval RMR_{89} distribution for the 2018 drilling program is shown in Figure 7-8.

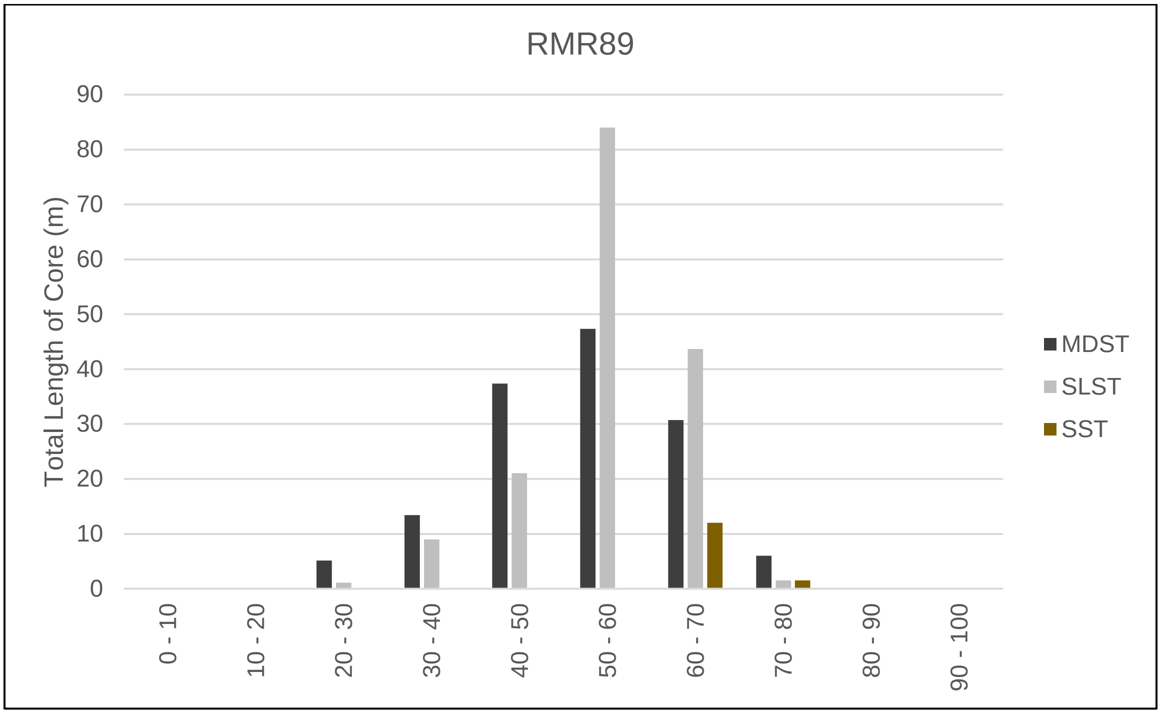


Figure 7-8: Logged RMR_{89} Values by Rock Type

7.5 Structural Orientation

7.5.1 Televiewer Stereographic Data

Stereographic projections of the orientated core data for T18-01D, T18-02D, T18-03D, and T18-05D were plotted using the Rocscience software DIPS™ (Version 6.0). The lower hemisphere, equal area projection is referenced to true north. The stereographic projections T18-01D, T18-02D, T18-03D, and T18-05D are presented in Figure 7-9, Figure 7-10, Figure 7-11, and Figure 7-12. Downhole geophysical logs prepared by Century are provided in Appendix D.

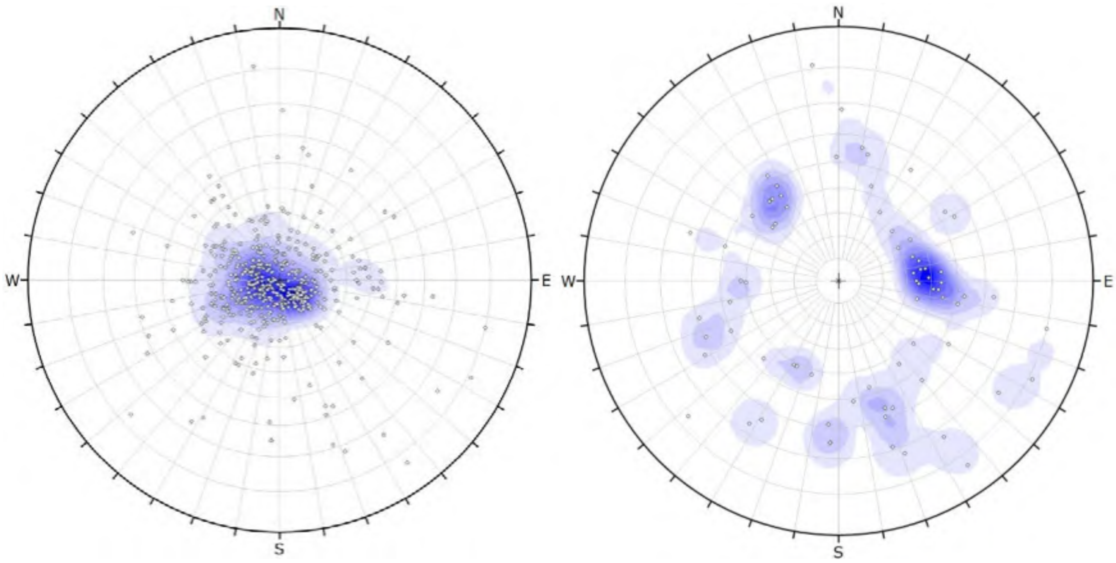


Figure 7-9: Stereographic Projection of ATV data of T18-01D. (Left: All Data; Right: bedding Poles removed to show any other joint concentrations)

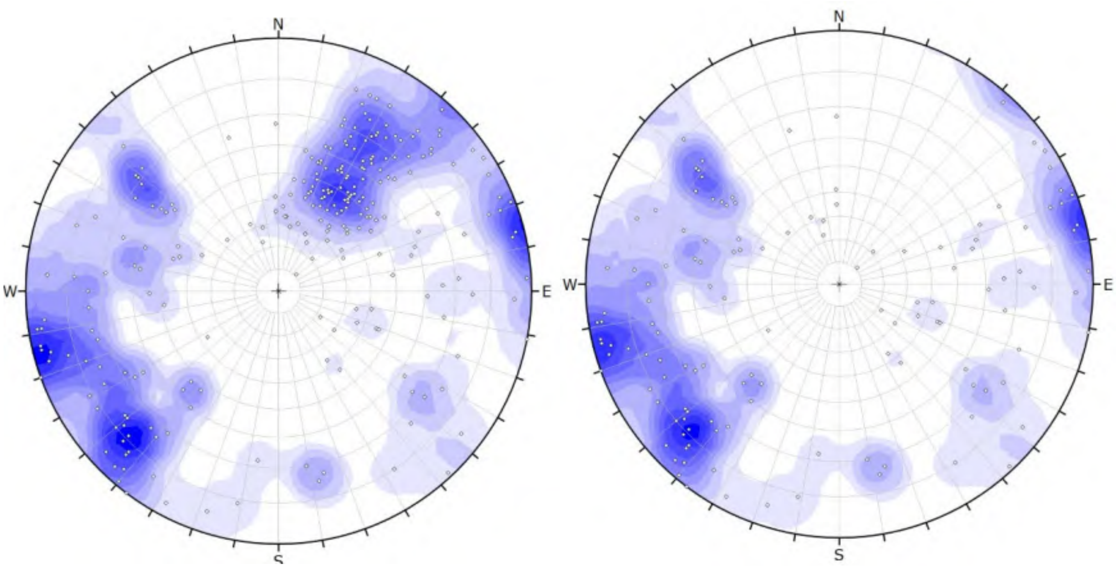


Figure 7-10: Stereographic Projection of ATV data of T18-02D. (Left: All Data; Right: Bedding Poles Removed to show any other joint concentrations)

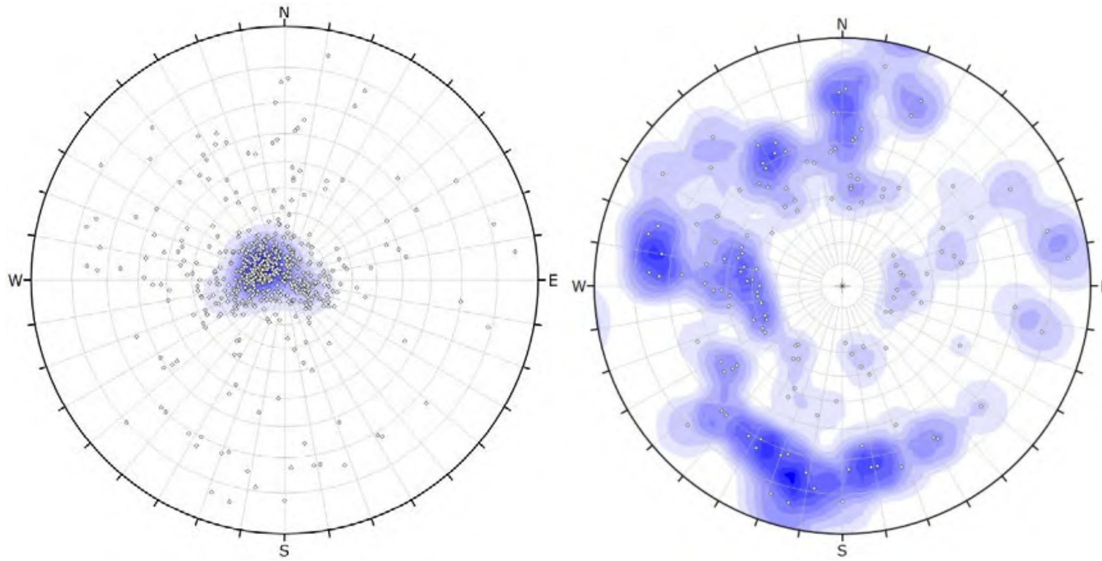


Figure 7-11: Stereographic Projection of ATV data of T18-03D. (Left: All Data; Right: Bedding Poles Removed to show any other joint concentrations)

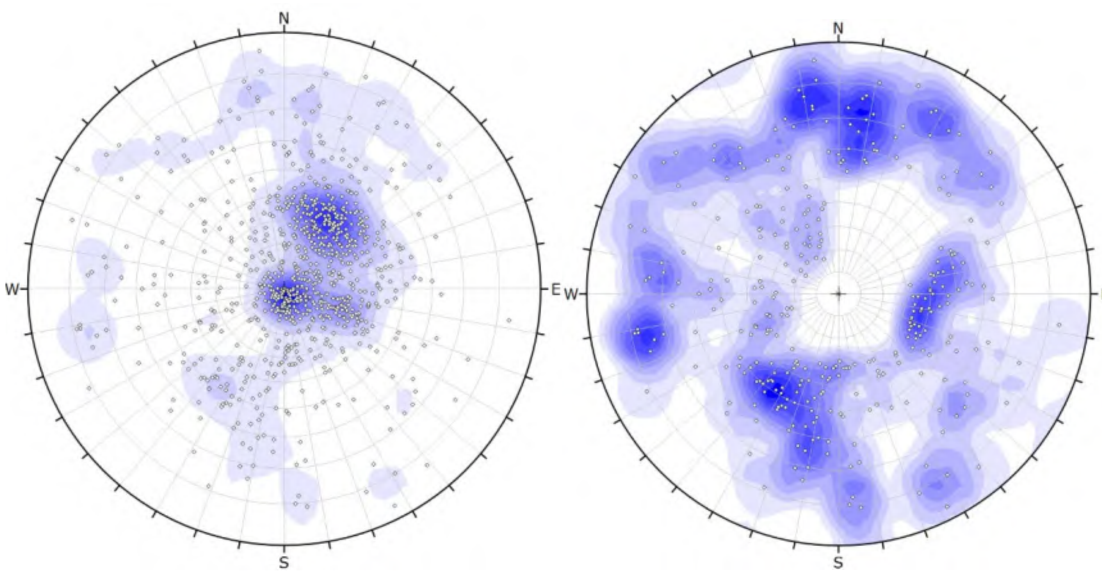


Figure 7-12: Stereographic Projection of ATV data of T18-07D. (Left: All Data; Right: Bedding Poles Removed to show any other joint concentrations)

The following observations can be made from the ATV results:

- Drillholes T18-01D, T18-03D, T18-07D
  - Bedding is typically shallow dipping and corresponds with the west-limb of the deposit.
  - Joint orientations are highly scattered; however, two main orthogonal joint sets can be observed. This includes a steeply, dipping joint striking NNE-SSW and a steeply dipping joint set striking E-W. No obvious joint set concertation’s are observed in T18-01D. The vertically of these three drillholes results in under sampling of the steep joint sets.
- Drillhole T18-02D
  - Bedding is moderately dipping at angles between 40 and 60 degrees to the southwest.
  - Two joint sets can be observed, including includes a steeply, dipping joint striking NNW-SSE and a steeply dipping joint set striking E-W. This indicates some rotation of the joint orientations along the east-limb of the deposit, however, the data capture in T18-02D was poor.

7.5.2 Major Structures

Major structures that were logged, such as faults or crushed coal/rock, are presented in the downhole plots in Appendix B. The fracture frequency and RMR of logged intervals with major structures reflect their impact on the quality of the rock mass, and the presence of potential major structures. The major structure data from this program should be considered in the development of the 3D structural geology models for the deposit.

8 Conclusions

Based on the results of the 2018 geotechnical soil and rock investigations, the following conclusions can be made:

<u>Soil Investigation:</u>

- The surficial soil materials intercepted in the sonic drillholes and test pit excavations are consistent with the regional interpretation that includes the presence of a wide-spread diamicton till material (Levson et al, 1997).
- The majority of the surficial soils intercepted were described as a sandy lean clay till (CL). The clay till typically contains silt and fine sand with some gravel. Intervals of clayey sand (SC) or silty sand (SM) greater than 1 m were observed during the sonic drilling at various depths. The sandy lean clay till was intercepted in all 2018 investigation locations.
- The soil laboratory test results provide a reasonable characterization of the till materials and are generally consistent with the historical test results.
- The strength testing indicates that the fine grain materials are generally very stiff to hard, and the coarse material intercepted was dense.

<u>Rock Investigation:</u>

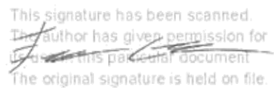
- The lithology intercepted in the drilling program correlates with the Skeena group and consisted of mudstones, siltstones, and sandstones with inter-bedded, bituminous coal seams. The Hazelton volcanic group was not intercepted in the diamond drillholes.
- The assessed strengths were generally R3 to R4 for the sandstones, R2 to R3 for the siltstones, and R2 to R3 for the mudstones. All rock types were observed to be weaker parallel to bedding. Laboratory intact rock testing work supported the field strength estimates from geotechnical logging.
- RMR_{89} typically ranges from 46 to 60 for the mudstones, 52 to 61 for the siltstones, 64 to 69 for the sandstones and 20 for the coal.
- Discontinuities captured from the acoustic televiewer surveys indicate that bedding orientations are similar to the 3D Tenas geological model (Telkwa, 2018). Shallow east-dipping bedding exists on the west side of the deposit, and moderately to steeply west dipping on the east side. Two major steeply dipping joints sets have also been identified.
- Major structures, such as faults or crushed coal/rock were encountered during the drilling program. The major structure data from this program should be incorporated into the Tenas deposit 3D structural geology model.

The collection of televiewer survey orientation data from geotechnical drillholes T18-02D and T18-05D was unsuccessful. Orientation data from these two drillholes was intended to support the stability assessment and design of the East Wall. Any new diamond drillholes should be televiewer surveyed to confirm the relationship of the two-steeply dipping joints with bedding, and the presence of any other minor joint sets. This work would support the feasibility pit slope stability and design work.

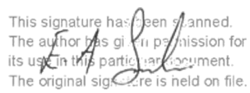
The results of the soil geotechnical investigations should be reviewed on an ongoing basis as new feasibility designs are produced to evaluate the expected foundation conditions and requirement for any additional data to be collected to reduce uncertainty in design and/or geotechnical risks. Should the excavation be significantly deep in the southwest portion of the proposed sediment ponds, additional soil investigations would be needed to be evaluate the expected foundation conditions.

9 Closure

This report, Tenas Project – Factual Data Report for 2018 Geotechnical Investigation, was prepared by

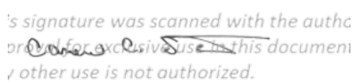


Erik Cernik, EIT
Staff Consultant - Mining Rock Mechanics



Ed Saunders, PEng
Senior Consultant – Mining Rock Mechanics

and reviewed by



Cam Scott, PEng
Principal Consultant - Geotechnical

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for Telkwa Coal Ltd. . Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

10 References

Bieniawski, Z.T, 1989. Engineering Rock Mass Classifications. New York: Wiley.

Brown, E.T, 1982. Rock Characterisation, Testing and Monitoring. International Society for Rock Mechanics Suggested Methods. Oxford: Pergamon Press. 211 p.

Klohn Leonoff, 1985. Stage II Geotechnical, Hydrological, and Hydrogeological Design report: Klohn Lenoff Consulting Engineers.

Levson et al, 1997. Quaternary Geology and Ice-Flow Studies in the Smithers and Hazelton Map Areas (93L and M): Implications for Exploration: British Columbia Geological Survey Branch. Geological Fieldwork 1997. Paper 1998-1.

NRC, 2015. 2015 National Building Code Seismic Hazard Calculation for site: 54.6163 N, 127.152 W: National Resources Canada. Accessed May 15, 2018.

Palsgrove, R. 1991. Stratigraphy, Sedimentology and Coal Quality of the Lower Skeena Group, Telkwa Coalfield, Central British Columbia

Piteau, 1994. Engineering Geology and Geotechnical Assessment for the Pit 7 and Pit 8 Areas: Piteau Associates Engineering Ltd.

Piteau, 1994.Water Management of Tailings Pond and Pits 7 and 8: Piteau Associates Engineering Ltd.

Piteau, 1997. Engineering Geology and Geotechnical Assessment for the Tenas Pit and Waste Dumps: Piteau Associates Engineering Ltd.

Piteau, 1998. Geotechnical Assessment for the Coal Haul Roads, Tailings Pond and Plant Site: Piteau Associates Engineering Ltd.

SRK, 2017. Staged Production Pre-feasibility Study for the Telkwa Project: SRK Consulting (Canada) Inc.

Telkwa, 2018. Project Geological Map: Telkwa Coal Ltd.