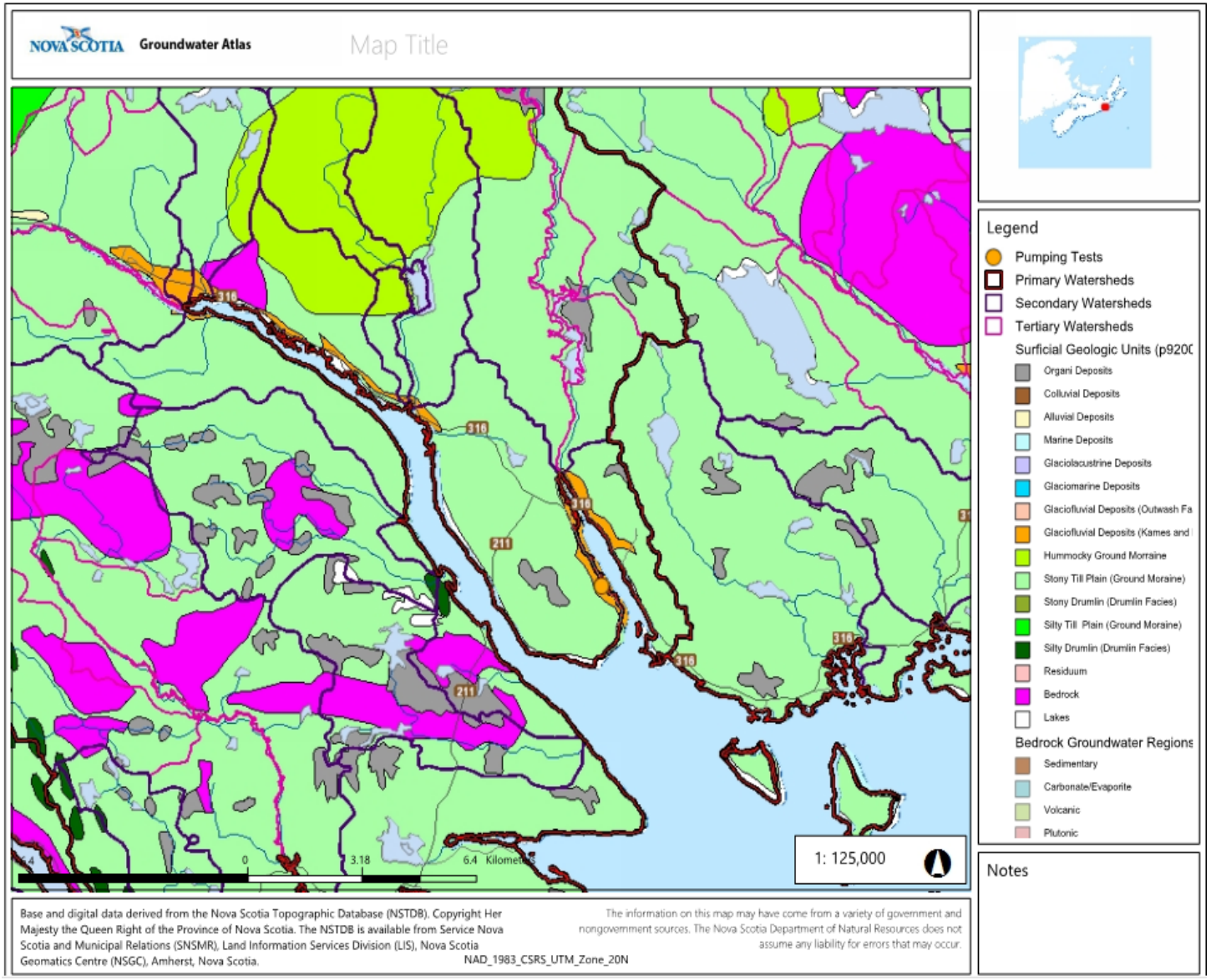


Figure 2 Surficial Geology from Nova Scotia Groundwater Atlas accessed March 5, 2018

LOCAL SURFICIAL GEOLOGY

The surficial geology of the site study area is composed of stony till material originating from the erosion of the underlying area bedrock as mentioned in the previous section. This material is described as a cobbly, silty sand till with frequent cobbles and boulders and generally little variation in composition. The till is typically very sandy and can contain pebble to cobble sized clasts. Up to 95% of these clasts are the product of local erosion events. With increasing proximity to the coastline the sand component of the till decreases and the silt content increases. Silt and clay content of the till typically increases with depth. (Orex, 1990).

Depth to bedrock from the surface has been reported between 1 and 7 metres while bedrock outcrops are rarely observed (Orex, 1990).

The Property has been the subject of previous historical mining activity starting 1893. Intermittent activity on the property between 1910 and 1984 included metallurgical test work, reprocessing of tailings, shaft sinking, and cross-cutting (MineTec PEA 2014). Mill tailing were dumped into the Goldbrook lake and subsequently they have been trasnsported down stream and deposited onto the Goldbrook Lake flood plain. Secondary growth in the form of tag alders, maples, birch, spruce, balsam and tamarack currently cover this area (Orex, 1990).

3.3.2 REGIONAL BEDROCK GEOLOGY

Most of the southern mainland of Nova Scotia occurs within the Meguma zone (hereafter referred to as the Meguma Supergroup). The Meguma Supergroup corresponds to a Cambro-Ordivician sedimentary rock succession and includes a basal sandy flysch sequence known as the Goldenville Group. This sequence is estimated to be approximately 6.7 km thick, but with an unknown base. The Goldenville Group sequence is overlain by a shaley flysch sequence known as the Halifax Group (Figure 3). The Halifax Group measures approximately 11.8 km in thickness (*Sangster and Smith, 2007*). (WSP, 2018). The distribution of the geological units is presented on figure below.

The massive, thick-bedded metagreywacke sequence of the Goldenville Group is dark grey (carbonaceous) to light grey in colour and contains thin slate horizons that commonly separate the thick, coarser beds. The Goldenville Group grades upwards through manganese-rich strata into a basal Halifax Group unit that consists of sulphidic black slate. The manganese-rich section, along with Tremadocian fossils, marks the transition between the two groups. Black carbonaceous sulphidic slate and thinly bedded to cross-laminated metasiltstone comprise much of the Halifax Group, but lithologies in the uppermost stratigraphy consist mostly of grey-green slate and siltstone (Sangster and Smith, 2007).

The Meguma Supergroup is pervasively folded and characterized by kilometre-scale wavelengths and east - west to northeast - southwest axial trace directions. Folds are upright to slightly inclined, with plunges to both east and west. Doubly-plunging fold trends produce domal structural culminations that in many instances correspond with historic gold producing districts. Cleavages are also a predominant structural feature and include regional slaty cleavage and pressure-solution cleavage.

The Meguma Supergroup in the eastern part of Nova Scotia was metamorphosed to greenschist-amphibolite facies grade during the mid-Devonian Acadian Orogeny ca. 400 Ma) and was subsequently intruded by peraluminous granite, granodiorite, and minor mafic intrusions of mid Devonian to Carboniferous age (375 Ma) (Sangster and Smith, 2007) (WSP, 2018)

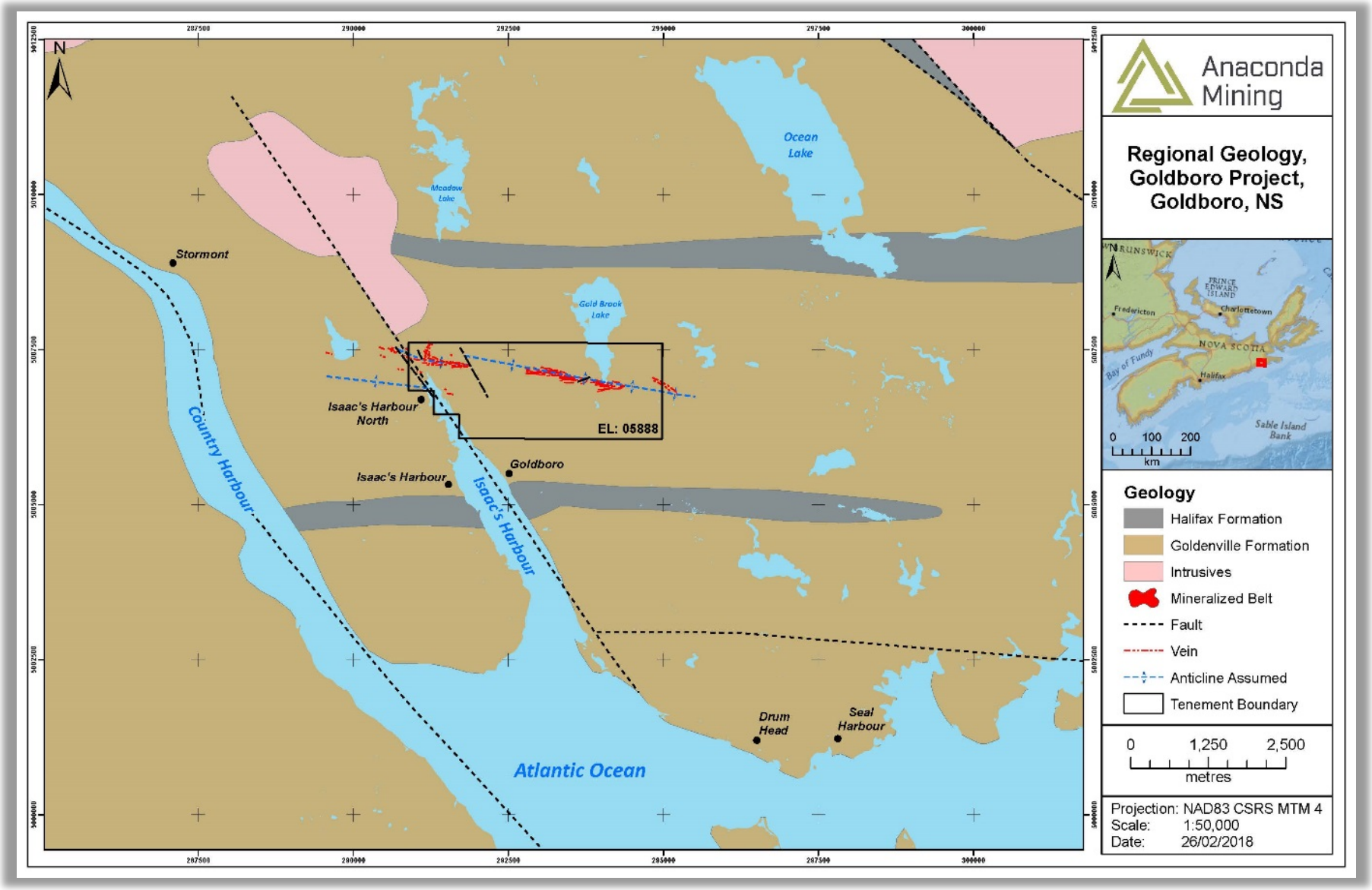


Figure 3 Regional Geology Map from Minetech International Ltd., Preliminary Economic Assessment Report, 2014

3.3.3 LOCAL GEOLOGY

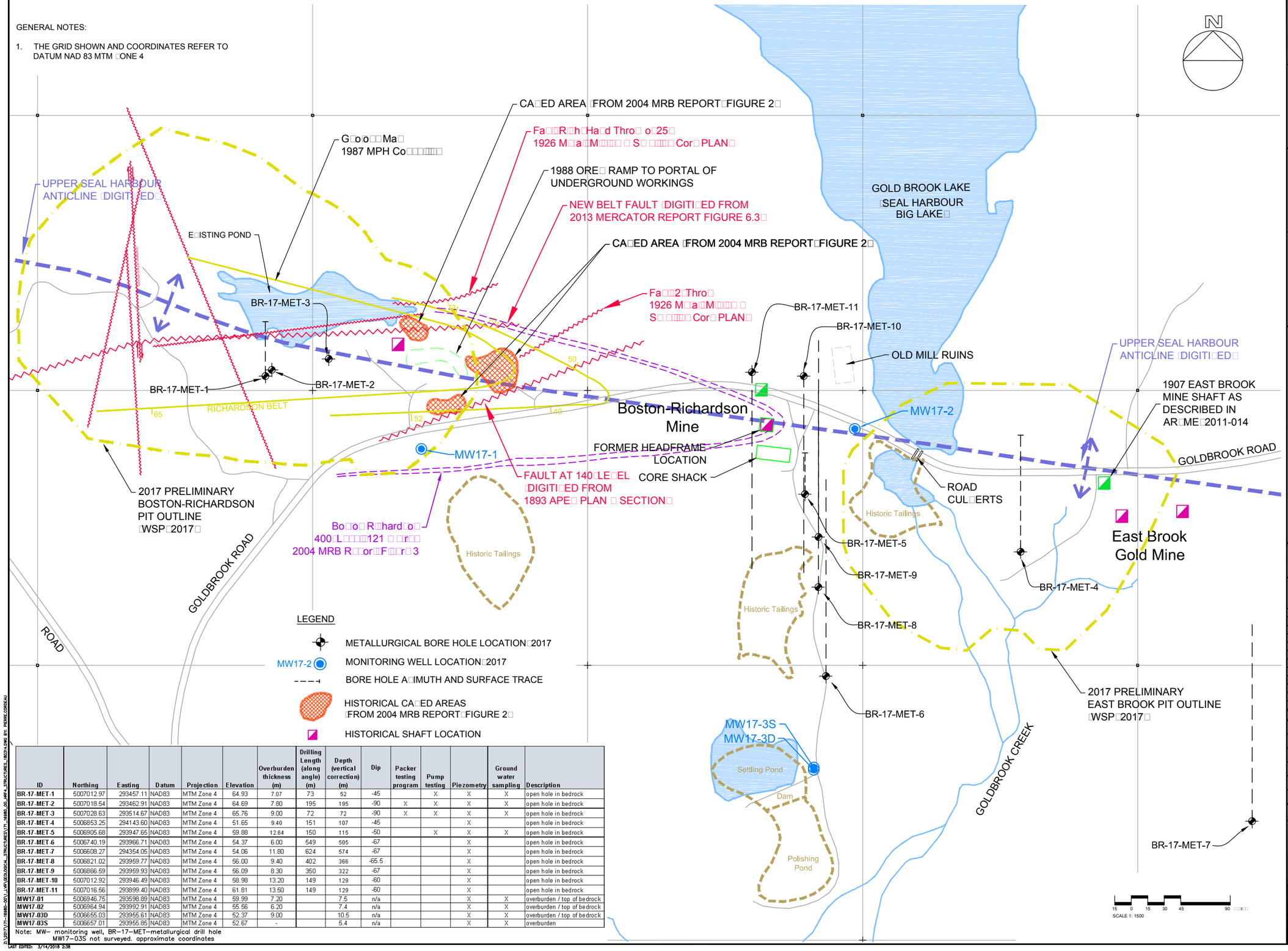
The proposed work area is entirely underlain by sedimentary rocks of the Goldenville Group. The Goldenville Group has been characterized through, outcrop settings, diamond core drilling and underground exploration. This group is composed of greywacke, arenite, and slate. The greywacke is described as varying betweem as massive with good sorting to moderately bedded and moderately sorted, to thinly bedded with argilaceous material (Orex, 1990).

The stratigraphic succession of the study area is repeated across the axial zone of the Upper Seal Harbour anticline (WSP, 2018). The anticline is an upright, east-west trending fold that plunges to the east and can be traced for more than 13 km (see Figure 4 below). Within the property area this inclination has been observed between 10° to 30°. The structure of the local bedrock varies between highly and intensely fractured. Several joint sets were observed in bedrock outcrops. Two dominant sets are oriented at about 200 and 340 degrees and dip approximately 60 to 70 degrees. The bedrock is also highly faulted with quartz vein intrusion along fault shear zone which cross cut the strata. Some faults are highly brecciated (Orex, 1990).

The axial trace and apex of the Upper Seal Harbour anticline is cut by several steeply dipping, northwest and east trending brittle faults that have the effect of disrupting continuity of local, individual mineralized quartz-slate belts (See Figure 5). The east trending New Belt Fault (Figure 4) is an example of a structure that produces such dislocation and passes from the south limb of the anticline to the north limb as shown on the cross section below (Figure 5). Gold-bearing belts intersected by the faults commonly show brecciation and brittle shearing of both quartz and slate lithologies, with distribution of eroded material along the fault plane. Sedimentary sequences differ across this fault and have been referred to separately as the South and North limbs in previous property reporting (WSP, 2018).

GENERAL NOTES:

1. THE GRID SHOWN AND COORDINATES REFER TO DATUM NAD 83 MTM □ONE 4



LEGEND

- METALLURGICAL BORE HOLE LOCATION□2017
- MW17-2 MONITORING WELL LOCATION□2017
- BORE HOLE A□IMUTH AND SURFACE TRACE
- HISTORICAL CA□ED AREAS □FROM 2004 MRB REPORT□FIGURE 2□
- HISTORICAL SHAFT LOCATION

ID	Northing	Easting	Datum	Projection	Elevation	Overburden thickness (m)	Drilling Length (along angle) (m)	Depth (vertical correction) (m)	Dip	Packer testing program	Pump testing	Piezometry	Ground water sampling	Description
BR-17-MET-1	5007012.97	293457.11	NAD83	MTM Zone 4	64.93	7.07	73	52	-45		X	X	X	open hole in bedrock
BR-17-MET-2	5007018.54	293462.91	NAD83	MTM Zone 4	64.69	7.80	195	195	-90	X	X	X	X	open hole in bedrock
BR-17-MET-3	5007028.63	293514.67	NAD83	MTM Zone 4	65.76	9.00	72	72	-90	X	X	X	X	open hole in bedrock
BR-17-MET-4	5006853.25	294143.60	NAD83	MTM Zone 4	51.65	9.40	151	107	-45			X		open hole in bedrock
BR-17-MET-5	5006905.68	293947.65	NAD83	MTM Zone 4	59.88	12.64	150	115	-50		X	X	X	open hole in bedrock
BR-17-MET-6	5006740.19	293966.71	NAD83	MTM Zone 4	54.37	6.00	549	505	-67			X		open hole in bedrock
BR-17-MET-7	5006608.27	294354.05	NAD83	MTM Zone 4	54.06	11.80	624	574	-67			X		open hole in bedrock
BR-17-MET-8	5006821.02	293959.77	NAD83	MTM Zone 4	56.00	9.40	402	366	-65.5			X		open hole in bedrock
BR-17-MET-9	5006866.59	293959.93	NAD83	MTM Zone 4	56.09	8.30	350	322	-67			X		open hole in bedrock
BR-17-MET-10	5007012.92	293946.49	NAD83	MTM Zone 4	58.98	13.20	149	129	-60			X		open hole in bedrock
BR-17-MET-11	5007016.56	293899.40	NAD83	MTM Zone 4	61.81	13.50	149	129	-60			X		open hole in bedrock
MW17-01	5006946.75	293598.89	NAD83	MTM Zone 4	59.99	7.20		7.5	n/a			X	X	overburden / top of bedrock
MW17-02	5006964.94	293992.91	NAD83	MTM Zone 4	55.56	6.20		7.4	n/a			X	X	overburden / top of bedrock
MW17-03D	5006655.03	293955.61	NAD83	MTM Zone 4	52.37	9.00		10.5	n/a			X	X	overburden / top of bedrock
MW17-03S	5006657.01	293955.85	NAD83	MTM Zone 4	52.67	-		5.4	n/a			X	X	overburden

Note: MW- monitoring well, BR-17-MET-metallurgical drill hole
MW17-03S not surveyed. approximate coordinates

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CLIENT:

Anaconda Mining GOLDBORO PROJECT

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CLIENT REF. #:

PROJECT:

CONSULTANT:

wsp

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IS	RE	DATE (M/D/Y)	DESCRIPTION

PROJECT NO: 171-16980-00
DATE: MARCH, 2018
ORIGINAL SCALE: 1:500 (Arch D Sheet)
DESIGNED BY: A. DENES
DRAWN BY: P. CORDEAU
CHECKED BY:
APPROVED BY:
IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm
DISCIPLINE:

TITLE:

FIGURE 4 –

MINING ANG GEOLOGICAL STRUCTURE LOCATIONS

DOCUMENT NUMBER: 171-16980-00
SHEET #: 1 OF 1
ISSUE: HYDROGEOLOGICAL REPORT
DATE OF: MARCH 14, 2018
REV #: 0

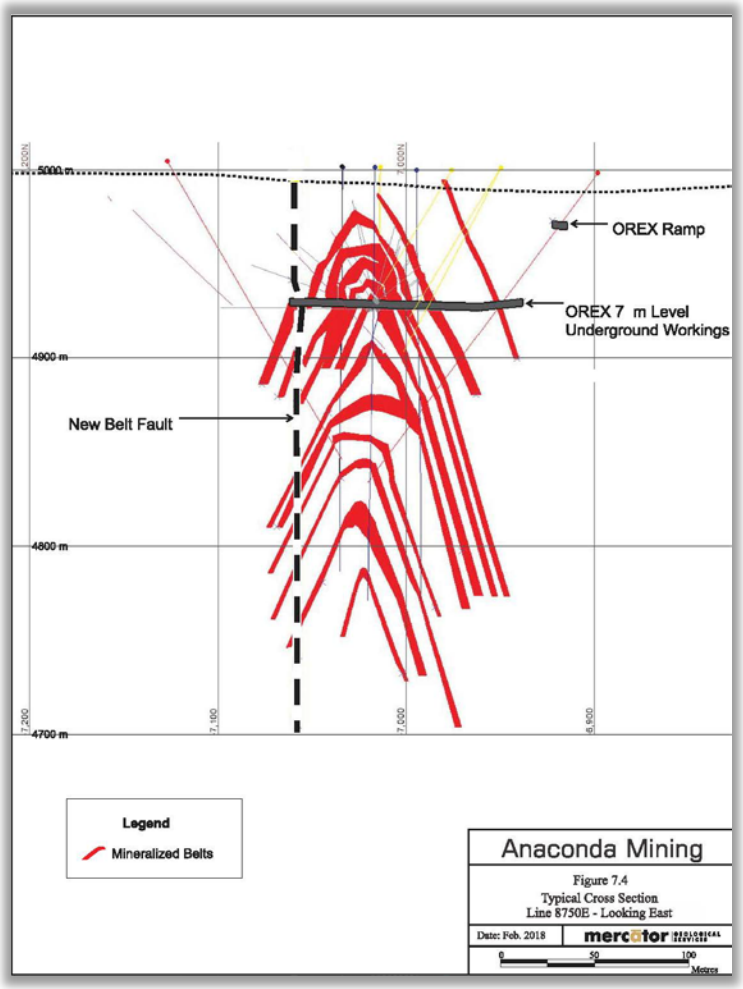

Figure 5 Typical Cross Section as described in the WSP Preliminary Economic Assessment, 2018

3.4 HYDROGEOLOGY

Nova Scotia's aquifers have been broadly divided into two bedrock and five surficial groundwater regions based on existing mapping of the dominant bedrock types and sediment deposits (see Figure 6 below). Hydrogeologic characterization of the groundwater regions was carried out by classifying over 70,000 water well records, over 900 pumping test records and over 1000 inorganic groundwater chemistry records into the major groundwater regions, and conducting statistical analyses for various hydrogeologic properties. The statistical summaries provide a general guide to expected hydrogeological properties, and the mapping and associated databases developed during this study provide a useful framework for more detailed assessment activities (Gavin W. Kennedy and John Drage, 2009).

The median well yield of 20 lpm was calculated for the Metamorphic Meguma Supergroup groundwater region from pumping test data and 13.6 m^2/d from well log data (driller's yield estimate upon completion of drilling). The median transmissivity for this groundwater region is 1.3 m^2/d (Gavin W. Kennedy and John Drage, 2009).

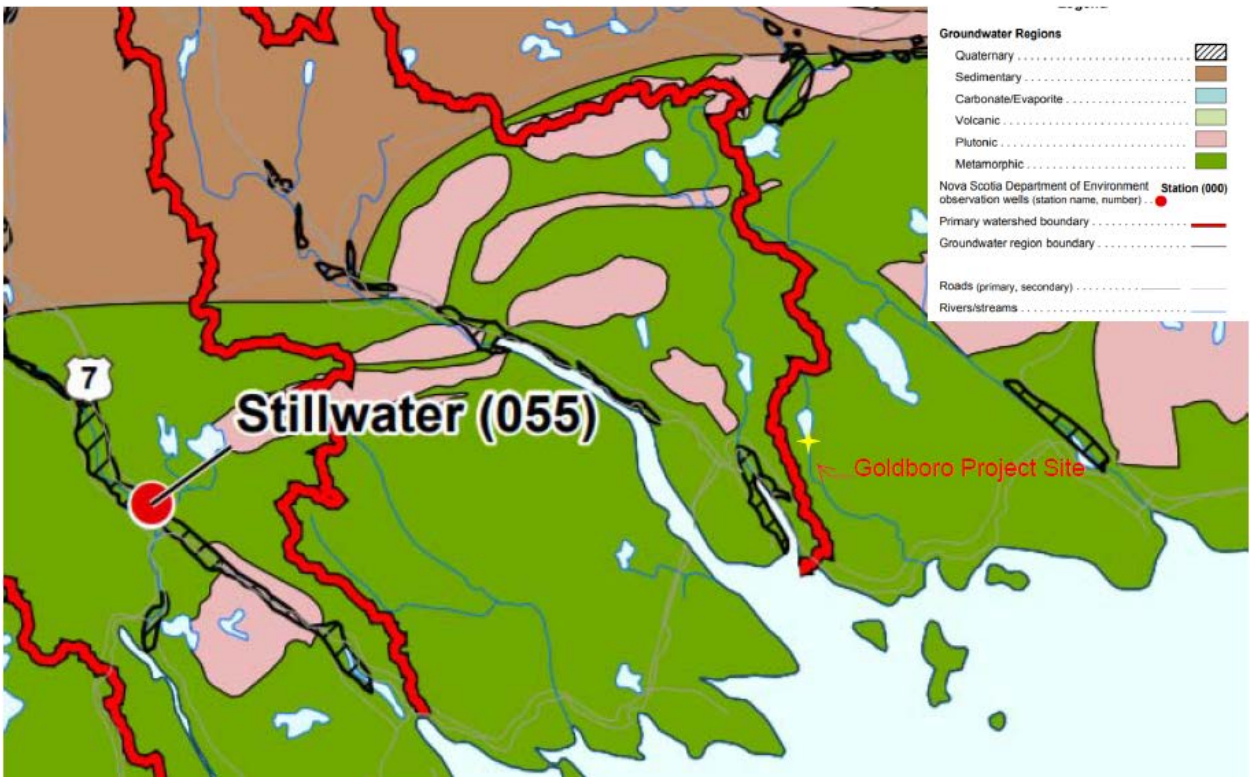

Figure 6 Local Groundwater Regions

3.4.1 LOCAL HYDROSTRATIGRAPHIC UNITS

The hydrostratigraphic units have been defined by earth materials with similar hydraulic properties, notably water storage and transmission capacity. Within the study area four hydrostratigraphic units have been identified. These units are: glacial till, peat deposits, bedrock and mine workings (Orex, 1990). The units are described in the following paragraphs.

- Glacial Till: The till unit is estimated to be between 1 m to 7 m thick. It has been described in the preceding geology section of this report. A primary source of recharge for this unit is precipitation dependent (Orex 1990).
- Peat Deposits: Significant peat deposits have developed on the northwest shore of Gold Brook Lake as well as near Beaver Pond where topographic depressions with poor drainage characteristics are present as well as within the flood plain zone of Gold Brook (Orex, 1990).
- Bedrock: The bedrock unit composed of the Goldenville and Halifax formations were observed at or near the surface as well as below the till unit. The geology of these units was discussed in a previous section. Permeability in the bedrock unit is considered predominantly secondary being influenced by fractures, faults, joints and cleavage planes. Observations made in mine working in 1989 indicated that some large faults have been made impervious by breccia fines (Orex 1990- EIA).
- Mine Workings: The flooded old mine workings are considered a distinct hydrostratigraphic unit due to the large storage and transmissivity capacity. Apparently typical inflow rates into these mine workings during dewatering activities ranged from 18.5 to 21.1 l/s, however no other details figures in the Orex 1990 report about the area pumped, the extent of the workings dewatered or the water level measurements in shafts or other observations points, showing that this flowrate was generated by groundwater penetrating into the mine works. A cross section of the Boston-Richardson mine shaft is presented in the following Figure 7.

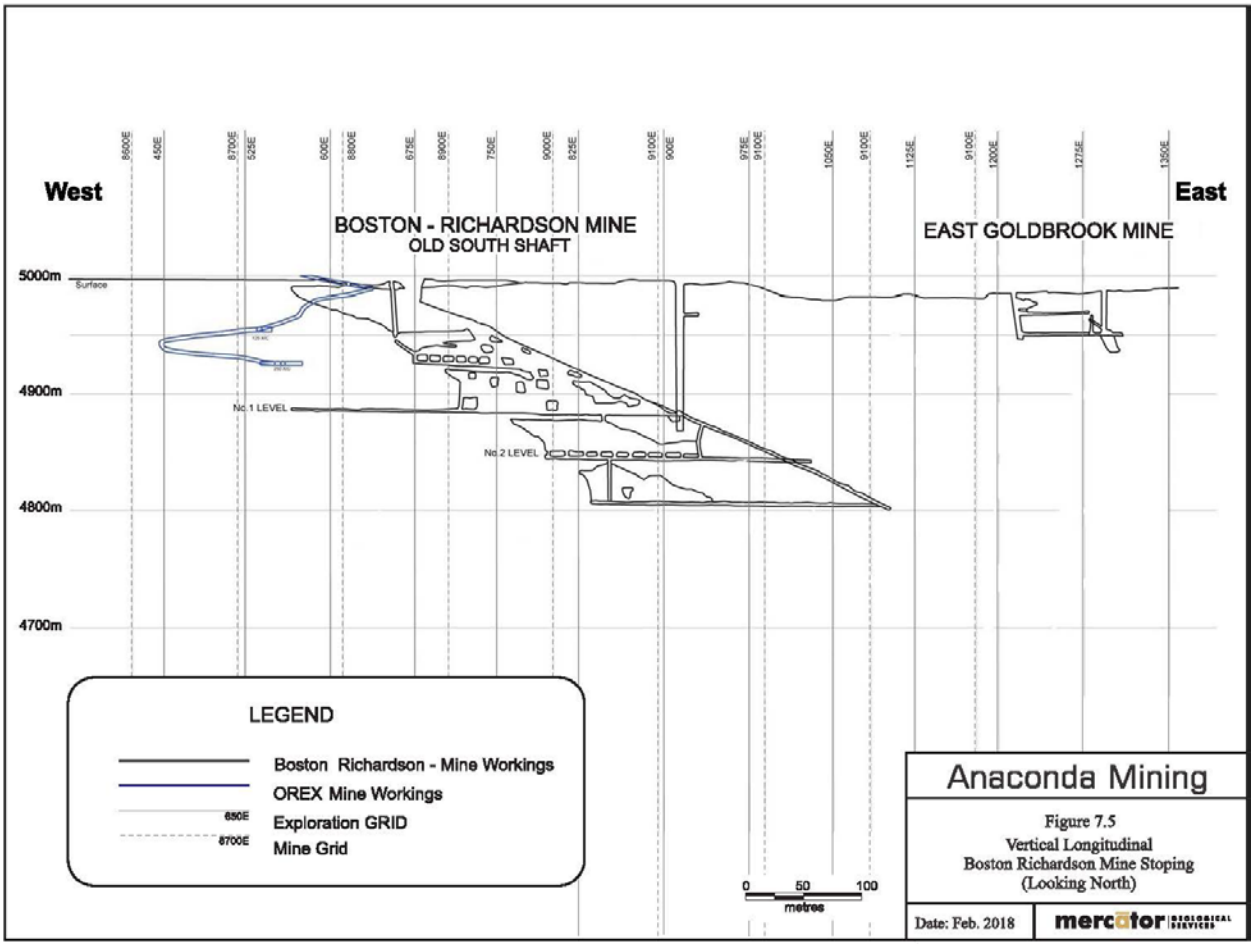

Figure 7 Vertical Longitudinal Section showing the Boston-Richardson mine shaft looking north (WSP 2018)

3.4.2 CURRENT GROUNDWATER USE

A search was completed for water wells within a 4 km radius of the Site on March 1st, 2018. The search was completed using the Nova Scotia Groundwater Atlas online resource. A screen shot of the results collected from the online atlas is provided below in Figure 8.

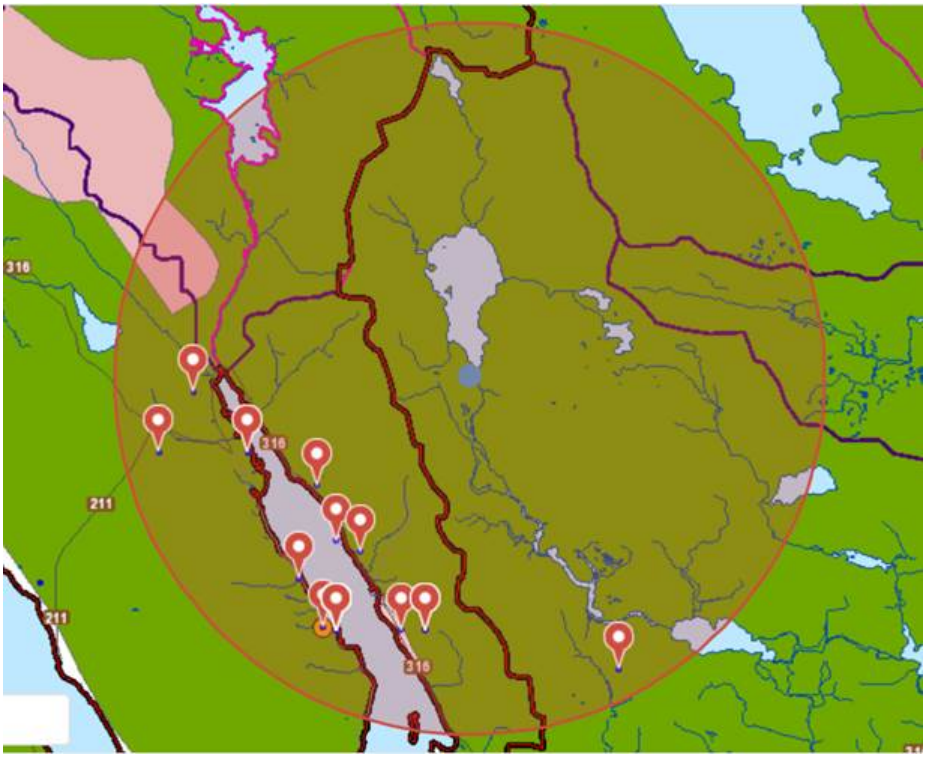

Figure 8 Screen shot from Nova Scotia Groundwater Atlas taken March 1st, 2018

The figure above shows the proposed mine site as a blue dot and the radius of query as the transparent orange circle. Water wells are identified by red pins. Due to a limitation with the site's data resolution not all wells could be presented in the same image.

The search provided 24 wells and boreholes of which six are located east of the harbour. The screen shot above identifies the six (6) wells east of the harbour along with six others located to the west of the harbour. Due to the natural barrier the harbour presents, those wells to the east of the harbour are of greater interest to this report. A summary of the findings from the search follows:

- Of these six wells to the east of the harbour, one was dug and the others drilled.
- Of the five drilled wells one is listed to be for commercial use and the others for domestic use.
- Two of the drilled wells were advanced to between 35 m and 45 m, the other three were advanced to between 85 m and 95 m. The commercial use well was advanced to 91.35 m.
- Well yields reported for those wells completed in the bedrock closer to the surface (35 m to 45 m) vary between 18 Lpm and 68 Lpm. Well yields for those wells completed between 85 m and 95 m were reported between 2 Lpm and 14 Lpm.

There are two primary watersheds and six secondary watersheds observed within a 4 km radius of the site. The secondary watersheds are delineated by thick red lines in Figure 8. The proposed mine work area is located within the Clam Harbour/St. Francis primary watershed and an unnamed secondary watershed. Of those wells identified within 4 km of the site, only the commercial well is located within the same primary and secondary watershed. This well is located approximately 3.5 km to the south of the site.

A review of the Guysborough county data for domestic water supply from Hydrogeologic characterization of Nova Scotia's groundwater regions , 2009 (Kennedy and Drage, 2009) indicates approximately 85 % of the population is supplied by private wells, of which 75% is from bedrock aquifer wells.

4 FIELD WORK RESULTS

4.1 STRATIGRAPHY

Typical boreholes at this site encountered the following stratigraphic sequence: a layer of minor topsoil/root mat with organics overlying; a brown to grey silty sand with gravel and trace clay fill; follow by cobbles and boulders in a silty sand with gravel and trace clay matrix; followed by bedrock. Cobles and boulders were frequent to very frequent at all the borehole locations below the fill deposits. Individual strata are described below. Detailed stratigraphy is shown on borehole logs in Appendix B as well as sieve analysis results.

4.1.1 TOPSOIL/ROOTMAT

A thin layer of topsoil material was encountered at the surface of the boreholes at all monitoring well locations except MW-03S. The brown to grey to black, saturated material was comprised of silt, sand, gravels and organics derived from the forest vegetation.

4.1.2 FILL

4.1.2.1 FILL (CRUSHED ROCK)

An approximately 300mm thick layer of crushed rock was encountered at the surface in boreholes MW17-03D and MW17-03S. The material can be described as moist to dry, light grey to grey sand and gravel with some silt. The fill material was used as roadway gravel structure for the adjacent Goldbrook Road.

Laboratory testing of the fill samples indicated the following particle size distribution (gradation):

- 29.3 % silt and clay,
- 44.3 % sand,
- 26.4 % gravel,

Results from the laboratory indicate a classification of the soil matrix as a silty sand with gravel (SM) with trace clay.

4.1.2.2 FILL (WASTE ROCK)

An estimated 700mm to 1000mm thick layer of waste rock fill or re-worked overburden material was encountered in all the boreholes. The material can be described as moist to saturated, brown to grey silty sand and gravel with trace clay. The fill material is likely from previous road building operation and/or cut/fill operation during historical site developments.

Laboratory testing of the fill samples indicated the following particle size distribution (gradation):

- 15.8 – 32.5 % silt and clay,
- 29.3 - 30.1 % sand,
- 37.5 – 54.9 % gravel,

Results from the laboratory indicate a classification of the soil matrix as a silty gravel with sand (GM) with trace clay.

4.1.3 SILTY GRAVEL WITH SAND (GM)

A silty sandy gravel and trace clay with frequent to very frequent cobbles and boulders was encountered below the fill (waste rock) layer in borehole MW17-01 and MW17-02. The moist to saturated, grey material returned Standard Penetration Testing N-Values that indicate a compact to very dense compactness (relative density). Observed refusal to penetration of the spilt spoon interfered with sampling throughout this layer, due to frequent contact with cobbles and/or boulders. This means that difficulties were encountered to recover the necessary samples to carry out all the desired laboratory tests to reach a detailed overburden description.

Laboratory testing of obtained samples of the silty sandy gravel indicated the following particle size distribution (gradation):

- 12.6 – 21.6 % silt and clay, of which less than 1% is clay. Sample quantities didn't allow the hydrometer testing in all samples, but field observation indicate a non-significant clay content.
- 29 – 32 % sand,
- 55 – 56 % gravel,

Results from the laboratory indicate a classification of the soil matrix as a silty gravel with sand (GM) with trace clay to a sandy gravel, a little silt, with trace clay (GM). Due to sample recovery issues during drilling, we recommend carrying out test pits with an excavator in the overburden to complete the preliminary material descriptions.

4.1.4 SILTY SAND WITH GRAVEL (SM)

A silty sand with gravel and trace clay with frequent to very frequent cobbles and boulders was encountered below the silty sandy gravel (GM) layer in boreholes MW17-01 and MW17-02. This material was also present as bedrock overburden material within the borehole at MW17-03D and MW17-03S, below the sand and gravel fill. The moist to saturated, grey material returned Standard Penetration Testing N-Values that indicated a compact to very dense compactness (relative density). Observed refusal to penetration of the spilt spoon interfered with sampling throughout this layer, due to frequent contact with cobbles and/or boulders. This means that difficulties were encountered to recover the necessary samples to carry out all the desired laboratory tests to reach a detailed overburden description.

Laboratory testing of samples of the silty sand with gravel and trace clay indicated the following particle size distribution (gradation):

- 29-35 % silt and clay, of which 2% was clay,
- 23 - 37 % sand,
- 28 -48 % gravel,

Results from the laboratory indicate a classification of the soil matrix as a silty sand and gravel with trace clay (SM) to a silty gravelly sand with trace clay (SM). Due to sample recovery issues during drilling, we recommend carrying out test pits with an excavator in the overburden to complete the preliminary material descriptions.

4.2 BEDROCK OPEN FRACTURE AND JOINT OBSERVATIONS

The DGI interpretation of the acoustic and optical televiewer survey completed by DGI in October 2017 indicate the location of open fractures and joints. WSP used the DGI draft final analysis plots to identify possible water transmitting zones based on the following criteria:

- The structural feature identified by DGI was an open fracture or joint.

- The acoustic log shows an enlargement of the borehole.
- Caliper log indicates a breakout in the borehole log, meaning an enlargement of the borehole diameter as well.

These potential higher permeability zones were compiled in the table located in Appendix C to determine the frequency of the water bearing zones along the depth. Open joints or fractures than 0.04 cm aperture were not considered in the analysis.

This analysis of the potential open joints/fracture length and frequency in the 195 m deep BR-17-MET-2 borehole indicates the followings:

- The first 20 m of bedrock (from depths of 9 m to 32.50 m) has the most potential water circulation zones, representing 20% of the total length;
- The following 42 m of bedrock (from depths of 32.5 m to 74.50 m) show the total potential water circulation zones decreases to 10% of the total length;
- The remaining of 104 m (from depths of 74.5 m to 195 m) indicate an average of 1.4% potential water circulation zones of the total length.

This analysis of the potential open joints/fracture length and frequency in the 72 m deep BR-17-MET-3 borehole indicates the followings:

- The first 20 m of bedrock (from depths of 9 m to 29 m) has the most potential water circulation zones, representing 21% of the total length;
- The following 26 m of bedrock (from depths of 29 m to 55 m) show the total potential water circulation zones decreases to 5% of the total length;
- The remaining of the investigated zone of 17 m (down to 72 m) has no significant structures that can permit water circulation.

Globally the potential water bearing zones are in the first 45 m of bedrock, which are calculated as 17% of the length in BR-17-MET-2 and 9% in the BR-17-MET-3. The remaining water circulation zone lengths represent approximately 3% of the investigated depth of approximately 140 m in the BR-17-MET-2. These estimations do not represent the secondary porosity of the bedrock.

4.3 HYDRAULIC TESTING RESULTS

Each of the tested intervals, selected with acoustic and optic televiewer survey results, showing open joints or fractures, to be the most subject to water transmission. Other structure types less favorable to water circulation as minor joint or fractures, bedding, foliations, veins, filled joint or fracture were not tested.

The detailed packer testing results interpreted with the software AquiferTest by Waterloo Hydrogeologic (WHI) are presented in the Appendix D and in the summary table, here after.

4.3.1 PACKER TESTING BR-MET-17-2

A total of thirteen (13) tests were initiated in BR-MET-17-2 which has a total depth of 195 m. Only ten (10) of thirteen (13) were completed in down to a depth of 109 m, due to leakage through the bedrock along the packer when water pressure was applied, due to a probable uneven borehole walls at the contact with the packer . The testing results in the BR-MET-17-2 indicate the followings:

- Nine out of the total of ten (10) tests results show a Lugeon value less than 1, which indicates a very tight rock.
- The hydraulic conductivity ranges for these nine tested zones, between 6 $x10^{-8}$ to 1 $x10^{-7}$ m/s, are very low.

- One tested zone located near the bedrock surface at depths between 10.22 m to 13.62 m, just below the steel casing showed a Lugeon value of 8 and a hydraulic conductivity of $9x10^{-7}$ m/s, which is considered moderate with few partly open fractures.
- The bedrock hydraulic conductivity of tested intervals decreased with depth, from $9x10^{-7}$ m/s near the top, to $8x10^{-8}$ m/s in the area around 32.66 m and then $6x10^{-8}$ m/s from 46 m to 109 m (the last two permeability values are a geometric average of test results from those zones).
- The values obtained characterizes the most conductive zones.
- Since fracture frequency, fractured zone length and bedrock hydraulic conductivity of fractured intervals decrease with depth, it can be assumed that the formation hydraulic conductivity decreases as well;
- The intervals without open joints or fractures can be considered to have negligible contribution into the future mine pit due to the very low hydraulic conductivity.

It has to be mentioned that the tested zones length was 3.40 m for all intervals in BR-MET-17-2.

These tests cannot evaluate the top of the bedrock if it were very fractured, since the casing usually has to be anchored in more competent bedrock below. The more permeable and fractured zones near the top of the bedrock are covered by the casing and don't permit water circulation around the borehole. These zones were tested by permeability testing in some monitoring wells (see Slug Testing section following).

Even if zones starting 110 m depth couldn't be tested, the low fracture frequency as well as the trend for lower permeability of the bedrock at deeper zones the assumption can be made that deeper bedrock has lower water circulation.

4.3.2 PACKER TESTING BR-MET-17-3

A total of five (5) tests were completed in BR-MET-17-3 to a depth of 72 m. based on the open fracture zones identified on the acoustic and optic televiewer survey plot.

The testing results in BR-MET-17-3 indicate the following:

- Two (2) out of the five (5) tests results show a Lugeon value of zero (0), due to dilatation behaviour of the rock under pressure, which indicates an impervious rock under natural flow conditions.
- One zone located between 27 m to 30 m below surface showed a moderate hydraulic conductivity of $1x10^{-6}$ m/s.
- The hydraulic conductivity for the other two tested zones was considered very low, 2 $x10^{-7}$ m/s and 3 $x10^{-7}$ m/s between the depths of 46 m to 58 m below surface. No other major open fracture or joint was identified by the DGI logging tool below a depth of 58 m.
- A fault/shear zone identified between 12.80 m and 13.60 m on the acoustic log and at 14.45 m on the structural identification (RQD 0%) was also tested and indicated a zero (0) Lugeon value, or zero absorption, which indicates that the fault has negligible permeability.
- These results characterize the most conductive zones in the borehole, since all the probable major open fractures and joints were targeted and tested.
- Since fracture frequency, fractured zone length and bedrock hydraulic conductivity of fractured intervals decrease with depth, it can be assumed that the formation hydraulic conductivity decreases as well.
- The intervals without open joints or fractures can be considered to have negligible contribution into the future mine pit due to the very low hydraulic conductivity.

The tested zones length was 2.30 m for the first packer test and 3.40 m for the following tested zones in BR-MET-17-3, as more perforated rods were brought to the site by the drilling contractor after the first test.

It has to be mentioned that the packer testing objective was to determine hydraulic conductivity of the bedrock under a lower pressure range to simulate natural flow conditions. The behaviour of the rock under the higher water pressures applied were frequently dilatation or void filling, which indicates that the hydraulic fracturing could occur if the injected water pressures were further increased.

Table 2 Packer test summary table

Borehole ID	Test ID	Test Date	Test Interval as Vertical Depth			Flow Rate Interval (m^3/min)	Bulk K (m/s)	Lugeon	Diagnostic Lugeon Behaviour
			Top (m)	Bottom (m)	Interval Length (m)				
BR-17-MET-2	1	2017-12-12	10.2	13.6	3.4	0.0016 - 0.0046	9E-07	8.2	laminar
BR-17-MET-2	2	2017-12-12	13.3	16.7	3.4	0.0002 - 0.0004	7E-08	0.6	turbulent
BR-17-MET-2	3	2017-12-12	18.6	22.0	3.4	0.0004 - 0.0010	1E-07	0.9	void filling
BR-17-MET-2	4	2017-12-12	21.4	24.8	3.4	0.0005 - 0.0015	9E-08	0.8	laminar
BR-17-MET-2	5	2017-12-12	29.3	32.7	3.4	0.0004 - 0.0010	8E-08	0.7	void filling
BR-17-MET-2	6	2017-12-13	46.3	49.7	3.4	0.0003 - 0.0010	6E-08	0.6	void filling
BR-17-MET-2	7	2017-12-13	50.3	53.7	3.4	0.0001 - 0.0008	2E-08	0.2	void filling
BR-17-MET-2	8	2017-12-14	69.6	73.0	3.4	0.0007 - 0.0021	1E-07	1.1	void filling
BR-17-MET-2	9	2017-12-14	93.6	97.0	3.4	0.0005 - 0.0011	9E-08	0.8	void filling
BR-17-MET-2	10	2017-12-14	105.7	109.1	3.4	0.0004 - 0.0011	7E-08	0.6	void filling
BR-17-MET-2	11	2017-12-15	111.7	115.1	leakage in the bedrock surrounding the packers				
BR-17-MET-2	12	2017-12-17	110.1	113.5	leakage in the bedrock surrounding the packers				
BR-17-MET-2	13	2017-12-17	135.6	138.5	leakage in the bedrock surrounding the packers				
BR-17-MET-3	1	2017-12-09	12.0	14.2	2.2	0.0000 - 0.0005	0E+00	0.0	dilation
BR-17-MET-3	2	2017-12-10	16.0	19.4	3.4	0.0000 - 0.0009	0E+00	0.0	dilation
BR-17-MET-3	3	2017-12-10	27.0	30.4	3.4	0.0032 - 0.0110	1E-06	9.9	laminar
BR-17-MET-3	4	2017-12-11	46.7	50.1	3.4	0.0009 - 0.0024	2E-07	1.5	laminar
BR-17-MET-3	5	2017-12-11	54.8	58.2	3.4	0.0014 - 0.0060	3E-07	3.0	laminar

4.3.3 SLUG TESTING

Slug testing results interpreted using the software AquiferTest by Waterloo Hydrogeologic are presented in the Appendix D and in the summary table 3, here after. The results can be summarised as follows:

- The upper till layer seems to be more permeable than the lower till with a hydraulic conductivity of 3 $x10^{-6}$ m/s (MW17-03S), which can be explained by the more gravelly matrix;
- The lower till layer is less permeable than the upper till, with a hydraulic conductivity of 6 $x10^{-7}$ m/s (average of two tests in MW17-1), which can be explained by a higher silt content in the till matrix;
- The top of the fractured bedrock and the bottom of the till (if permeable) shows a hydraulic conductivity within the range of 5 $x10^{-6}$ m/s to 8 $x10^{-6}$ m/s, based on the result of five (5) slug test completed in two (2) monitoring wells. This range is higher than the maximum permeability determined by packer testing.

Table 3 Slug test summary results

MW ID	Hydraulic conductivity (m/s)	Analysis Method	Slug Test Type	Stratigraphic Unit
MW 17-01	9E-07	Hvorslev	Falling head	Till (SM) (80%) and Bedrock (fractured greywacke) (20%)
MW 17-01	5E-07	Hvorslev	Rising head	Till (SM) (80%) and Bedrock (fractured greywacke) (20%)
MW 17-02	5E-06	Hvorslev	Falling head	Bedrock (fractured greywacke)(80%) and Till (SM) (20%)
MW 17-02	6E-06	Hvorslev	Rising head	Bedrock (fractured greywacke)(80%) and Till (SM) (20%)
MW 17-02	6E-06	Hvorslev	Rising head	Bedrock (fractured greywacke)(80%) and Till (SM) (20%)
MW 17-03D	8E-06	Hvorslev	Falling head	Bedrock (fractured greywacke)
MW 17-03D	8E-06	Hvorslev	Rising head	Bedrock (fractured greywacke)
MW 17-03S	3E-06	Hvorslev	Falling head	Till (SM)

4.3.4 BEDROCK PERMEABILITY V.S. DEPTH

An analysis was completed to compare the bedrock packer tests and slug tests permeability estimates with their associated depths. The results were summarized in the following table plotted on the graph below (Figure 9). A review of the distribution of points on the graph supposes a direct negative relationship between permeability and depth such that an increase in depth below surface can be associated with a decrease in permeability.

- The largest hydraulic conductivity measured in packer tests in both boreholes was is 1 $x10^{-6}$ m/s, which is considered a moderate permeability. This conductivity was found in one zone in each borehole, at depths above 20 m below surface.
- The hydraulic conductivity determined in the monitoring MW17-02 and MW17-03 by slug testing indicated that the first meter of the bedrock (which forms an aquifer with the bottom of the till) is more permeable, ranging from 4 $x10^{-6}$ m/s to 8 $x10^{-6}$ m/s.

Only permeability estimates made from bedrock well tests are included in this analysis therefore those results collected from within the overburden predominantly in the overburden are not presented. The results from the packer test at BR-17-MET-3 near 4 m and near 9 m below bedrock surface are not included on the graphic due to their null value estimate. Identical permeability estimates from MW17-02 and MW17-03D are presented only once.

Table 4 Summary of hydraulic conductivity of the bedrock from packer and permeability testing

Test ID	Hydraulic conductivity (m/s)	Testing depth in the bedrock (m)	Overburden thickness (m)	Testing depth (m)
BR-17-MET-2-T01	9E-07	4	7.8	12
BR-17-MET-2-T02	7E-08	7	7.8	15
BR-17-MET-2-T03	1E-07	13	7.8	20
BR-17-MET-2-T04	9E-08	15	7.8	23
BR-17-MET-2-T05	8E-08	23	7.8	31
BR-17-MET-2-T06	6E-08	40	7.8	48
BR-17-MET-2-T07	2E-08	44	7.8	52
BR-17-MET-2-T08	1E-07	64	7.8	71
BR-17-MET-2-T09	9E-08	88	7.8	95
BR-17-MET-2-T10	7E-08	100	7.8	107
BR-17-MET-3-T01	0E+00	4	9	13
BR-17-MET-3-T02	0E+00	9	9	18
BR-17-MET-3-T03	1E-06	20	9	29
BR-17-MET-3-T04	2E-07	39	9	48
BR-17-MET-3-T05	3E-07	48	9	57
MW17-02	6E-06	1	6	7
MW17-03D	8E-06	1	9	10

Note: *Testing depth is assessed as the middle of the well screen or the middle of the packer test set-up, measured from the ground surface. Only those slug tests completed in the bedrock were selected for analysis.

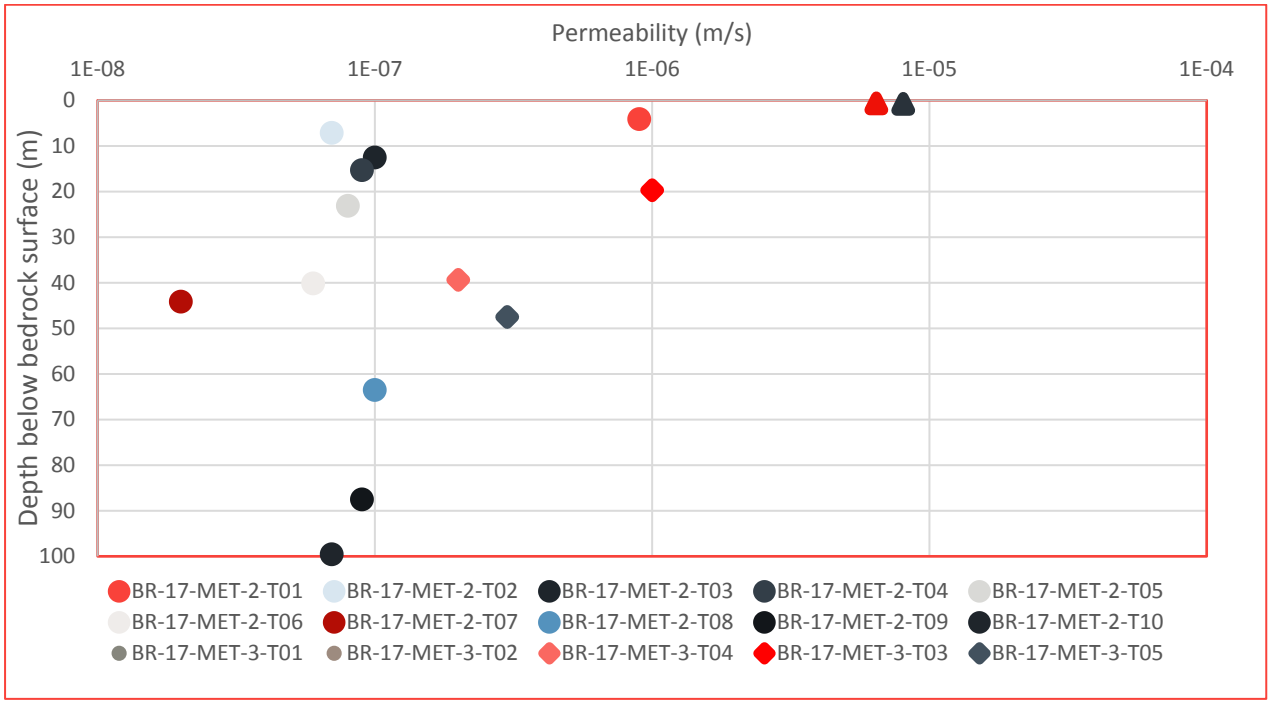

Figure 9 Permeability vs Bedrock Depth

4.3.5 PUMP TESTING INTERPRETATION

The four pumping tests were interpreted using AquiferTest WHI software for pumping and recovery testing stages. The pumping tests results and interpretation methods are presented in the following table and in Appendix D. The recovery stage was selected for single well tests.

In case of BR-MET-17-1 and BR-MET-17-2 the tests had to be considered as single well tests, since no drawdown was observed in the in these wells during their respective testing, despite the relatively short distance apart (approximately 5 meters).

The pumping and recovery stage was interpreted for BR-MET-17-3, where drawdown was observed in a nearby observation well.

The fractured rock analysis methods used consider the following assumptions for the dual porosity and Moench methods:

- The aquifer is confined and of infinite areal extent.
- The thickness of the aquifer is uniform over the area that will be influenced by the test.
- The well fully penetrates a fracture.
- The well is pumped at a constant rate.
- Prior to pumping, the piezometric surface is horizontal over the area that will be influenced by the test.
- The flow towards the well is in an unsteady state.

The estimated transmissivity in three (3) of the four wells tested was less than 1 m^2/d, which is considered very low. A higher transmissivity of 2 to 3 m^2/d was estimated in the BR-17-MET-3.

Results compared to the statistical values of hydrogeological properties of the Metamorphic groundwater region of the Meguma Supergroup (Gavin W. Kennedy, John Drage, GeoHalifax2009), indicate a lower range for the three boreholes tested and the same order of magnitude for one borehole (BR-MET-17-3). The median transmissivity for the Metamorphic groundwater region of the Meguma Supergroup is 1.3 m^2/d (from pumping tests) and a median yield of 13.6 l/min from driller's yield estimate data.

It has to be mentioned that the short duration of pumping due to the very low yield produced by theses boreholes can overestimate the transmissivity calculations. Feasibility of these test was even more difficult in angled boreholes (open hole boreholes) where the depth of the pump of approximately 20 m could be reached.

For three of four boreholes, permeability was calculated using an estimated aquifer thickness of approximately 50 m This thickness was based on a review of acoustic and televiewer results combined with packer testing results (when available), considering the most probable fractured zone thickness that can supply the water during the tests. For the BR-MET-17-3, the aquifer thickness intercepted by the monitoring well of 28 meters depth was considered.

The hydraulic conductivity ranges from $3x10^{-8}$ to $3x10^{-7}$ m/s in three locations and 10^{-6} m/s at BR-MET-17-3.

These values considered as order of magnitudes, were estimated in short pumping tests in existing small diameter angle and vertical boreholes. A more accurate evaluation can be done with lounger pumping tests in pumping wells designed and drilled specifically for these purpose.

Table 5 Short Pumping Test Results

Pumping Well or Borehole ID	Observed Well ID	Observed Well Length (along angle)	Observed Well Dip	Observed Well Depth (m)	Overburden thickness (m)	Aquifer thickness (m)	Average discharge rate (gpm)	Transmissivity (m^2/s)	T (m^2/d)	Hydraulic conductivity (m/s)	Analysis Method	Comments
BR-17-MET-01	BR-17-MET-01	73	-45	51,62	7,07	44,55	1,72	2,4E-06	0,20	5E-08	Recovery Theis & Jacob	Aquifer thickness from pumping well depth
BR-17-MET-02	BR-17-MET-02	189	-90	189,00	7,8	53,00	16,9	1,7E-06	0,15	3E-08	Recovery Theis & Jacob	Packer test and DGI survey showed fractured zones on the first 53 m zone of bedrock. No effect observed on water level in BR-17-MET-01 during pumping test at BR-17-MET-02.
BR-17-MET-03	PO-MET3-4,95m	37	-90	37,00	9,00	28,00	3,38	2,5E-05	2,15	9E-07	Double porosity	Observation well PO-4.95 is a 37 m deep borehole 5 m distance from pumping well BR-17-MET-03.
BR-17-MET-03	PO-MET3-4,95m	37	-90	37,00	9,00	28,00	3,38	4,0E-05	3,41	1E-06	Recovery Theis & Jacob	
BR-17-MET-05	BR-17-MET-05	150	-50	114,91	12,64	53,00	8,28	1,5E-05	1,29	3E-07	Moench Fracture Flow	No packer test or acoustic survey avilable in this borehole, the same fractured zone lenght considered as in BR-17-MET-2
BR-17-MET-05	BR-17-MET-05	150	-50	114,91	12,64	53,00	8,28	3,1E-06	0,26	6E-08	Recovery Theis & Jacob	

Angled and vertical wells
k - calculated with fractured aquifer thickness

4.3.6 DIRECTION OF GROUNDWATER FLOW

No existing data on regional piezometry of the bedrock or the regional bedrock aquifer extent is available. Regional groundwater divides or recharge zones are not documented either.

The groundwater located in the till follows usually the topography and is delimited by the extent of the catchment area. Limited groundwater monitoring wells in the till doesn't allow for an assessment of groundwater flow direction in the overburden, of which the topography is variable.

The direction of the hydraulic gradient in the bedrock aquifer is oriented to the south-east, which indicates an approximate direction of the groundwater flow direction (See piezometric map presented on Figure 10). This indicates a general tendency of the groundwater flow, however the fracture orientations, bedding planes dip and hydraulic conductivity have a major influence on the groundwater flow direction (for which detailed information is not available) and divert the flow in depth and space. In addition, a large number of fault zones known to be present at the site, which can have an influence on the groundwater flow network as well, where permeable. For example the apparent regional fault identified by the west-east lineation in which the Gold Brook mine is located, may provide a preferential pathway for groundwater flow in the permeable zones (more details in the Conceptual site model section).

Due to the general low permeability of the bedrock, it is expected that the extensive abandoned underground workings can have a significant influence on groundwater flow pathways and on overall groundwater flow velocity within the site.

NOT FOR CONSTRUCTION

PROPOSED LOCATION FOR WASTE ROCK STOCKPILE

PROPOSED LOCATION FOR SEDIMENT POND

E□ISTING STREAM

E□ISTING STREAM

GOLD BROOK LAKE
□SEAL HARBOUR BIG LAKE□
□Ma□□□ D□□h 3.0□ □M□a□ D□□h 1.7□□
Volume 1,211,894 cu.m. ±
No□a S□o□a La□□□□□□or□ Pro□ra□□

E□TENT OF SURFACE DRAINAGE AREA FOR GOLDBORO CREEK

SITE

ATLANTIC OCEAN

E□ISTING POND

PROPOSED B-R OPEN PIT

OPERATIONS AREA

E□ISTING 1988 BULK SAMPLE PORTAL

HISTORIC UNDERGROUND WORKINGS

CORE SHACK

FORMER HEADFRAME LOCATION

HISTORIC MILL LOCATION

Boston-Richardson Mine

BR-17-MET-3 (59.21 m)

BR-17-MET-1 (64.63 m)

BR-17-MET-2 (64.24 m)

BR-17-MET-11 (59.17 m)

BR-17-MET-10 (58.18 m)

E□ISTING UNDERGROUND 1988 BULK SAMPLE DRIFTS

MW17-2

MW17-1

ROAD CUL□ERTS

GOLDBROOK ROAD

HISTORIC UNDERGROUND WORKINGS

Ea□□
Go□d□roo□
M□□□

E□ISTING O□ERHEAD POWER LINE TO BE RELOCATED

BR-17-MET-5

HISTORIC TAILINGS

HISTORIC TAILINGS

BR-17-MET-9 (54.79 m)

BR-17-MET-4

HISTORIC TAILINGS

E□ISTING STREAM

BR-17-MET-8 (54.33 m)

TRAIL

i = 0.011 m/m

HISTORIC TAILINGS

E□TENT OF TAILINGS STORAGE FACILITY

BR-17-MET-6 (54.54 m)

MW17-3S
MW17-3D

E□ISTING SETTLING POND

PROPOSED STAGE 1 TAILINGS STORAGE FACILITY

DAM

E□ISTING POLISHING POND

GOLDBROOK CREEK

BR-17-MET-7 (52.91 m)

N.5007000
N.5006750
E.293250

59 58.5 58 57.5 57 56.5 56 55.5 55 54.5 54 53.5 53

LEGEND

- AD□ACENT PROPERTY LINES
- CA□ED AREA □FROM 2004 MRB REPORT□FIGURE 2□
- UNMARKED MINE ENTRANCE
- KNOWN MINE ENTRANCE □LOCATION APPRO□IMATE□
- METALLURGICAL BORE HOLE LOCATION□2017
- MONITORING WELLS□2017 IN O□ERBURDEN
- HISTORIC UNDERGROUND MINE WORKINGS
- 56 E□UIPOTENTIAL LINES □METER□
- HORI□ONTAL HYDRAULIC GRADIENT
- 54.33 □□ WATER ELE□ATION IN THE BEDROCK

Z:\2017\171-16980-00_MR\PIEZOMETRIC_MAP\171-16980_00_MRFIG_PIEZOMETRY_BD015.DWG BY: PIERRE.CORDEAU

LAST EDITED: 3/15/2018 10:23

CLIENT:

Anaconda Mining GOLDBORO PROJECT

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150 Yor□□S□r□□□S□□□410□
Toro□□o O□ar□o Ca□ada
M5H 3S5
T□□□□ho□□□ 416□304-6622
Fa□□ 416□363-4567
a□a□o□da□□□□□□□o□

CLIENT REF. #:

PROJECT:

CONSULTANT:

wsp
1300 YONGE STREET,
8th FLOOR,
TORONTO (ONTARIO)
CANADA M4T 1X3
TEL.: 416 484-4200 | FAX: 416 484-8260
wsp.com

SEAL:

DIMENSIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.

ELEVATION VALUES ARE IN METERS.

GENERAL NOTES:

1. INFORMATION PRESENTED IS PRELIMINARY ONLY AND NOT INTENDED FOR CONSTRUCTION.
2. THE GRID SHOWN AND COORDINATES REFER TO DATUM NAD 83 MTM □ONE 4.
3. THE PLOT SI□E THAT WILL PRO□IDE TRUE SCALE AND OPTIMUM READABILITY FOR THIS PLAN IS AN ARCH D □24□36□SHEET.
4. A PDF DOCUMENT OF THIS PLAN WILL BE AN APPRO□IMATE SCALE.

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ISSUED FOR – REVISION:

IS	RE	DATE (M/D/Y)	DESCRIPTION

PROJECT NO:	171-16980-00
DATE:	MARCH, 2018
ORIGINAL SCALE:	1:1500 (Arch D Sheet)
DESIGNED BY:	A.DENES
DRAWN BY:	P. CORDEAU
CHECKED BY:	
APPROVED BY:	

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm

DISCIPLINE:

TITLE:

FIGURE 10 –

PIEZOMETRIC MAP OF THE BEDROCK

DOCUMENT NUMBER: 171-16980-00

SHEET #: 1 OF 1

ISSUE: HYDROGEOLOGICAL REPORT

DATE OF: MARCH 15, 2018

REV #: 0

5 SURFACE AND GROUND WATER QUALITY

5.1 ASSESSMENT GUIDELINES

The following is a summary of water analytical results, which are presented in Tables within the text and in Appendix E. The results have been compared with Nova Scotia Environment Tier 1 Environmental Quality Standards (NSE Tier 1 EQS) for Groundwater and Surface water at potable, industrial sites with coarse grained soils. The groundwater samples were also compared against the Guidelines for Canadian Drinking Water Quality for reference, however these guidelines are equal to or less restrictive than the Nova Scotia provincial standards. Analytical certificates are presented in Appendix E, for reference.

5.2 SURFACE WATER QUALITY

Two surface water samples (WS4 and WS9) had been previously collected by Gemtec on June 11th, 2017 and submitted to AGAT for analysis of total metals. WSP resampled these locations on December 16th, 2017 (Goldbrook Lake, and Clarifying Pond) and submitted the samples for analysis of dissolved metals, including cyanide and mercury. In addition, major anions and cations were analysed as well, in order to compare surface and groundwater geochemical characteristics.

Metal concentrations were compared with those reported by Gemtec (following table). All surface water samples report metals exceedances of aluminum, arsenic and iron. Total and dissolved metal concentrations were in the same range at the same locations. One surface water sample (Goldbrook Lake) reported a dissolved cadmium concentration of 0.018 µg/L (WSP) which exceeds the NSE Tier 1 EQS for Surface Water, but was slightly higher than the detection limit of 0.017 µg/l. All other parameters were found to be below applicable guidelines.

In general, analytical results of the two samples collected by WSP are comparable to those collected by Gemtec, however some differences are noted. Mercury was not detected in the Gemtec samples, however dissolved mercury concentrations were reported as 0.013 µg/L and 0.017 µg/L in the samples collected by WSP (Goldbrook Lake and Clarifying Pond respectively). Additionally, cyanide was detected in one sample collected by WSP from the clarifying pond (0.0021 mg/L). A zinc concentration of 7.5 µg/L was reported in the WSP Goldbrook Lake sample. Zinc was not detected in the corresponding Gemtec sample collected from this location (WS9).

Table 6 Metals in Surface Water (WSP and Gemtec Samples)

Parameter	Units	RDL	Guideline[1]	WSP Surface Water Samples (dissolved metals)		GEMTEC Surface Water Samples (total metals)	
			Tier 1 EQS for Surface Water	Goldbrook Lake	Clarifying Pond	WS9 - Goldbrook lake	WS4 - Clarifying Pond
				FUW530	FUW532		
				16-Dec-17	16-Dec-17	11-Jun-17	11-Jun-17
Aluminum	ug/L	5	5	**360**	**120**	**245**	**120**
Antimony	ug/L	2	20	ND	ND	<2	<2
Arsenic	ug/L	2	5	**22**	**93**	**7**	**128**
Barium	ug/L	5	1000	3,1	5	<5	<5
Beryllium	ug/L	2	5,3	ND	ND	<2	<2
Bismuth	ug/L	2	-	ND	ND	<2	<2
Boron	ug/L	5	1200	ND	ND	<5	7
Cadmium	ug/L	0,017	0,01	**0,018**	ND	<0.017	<0.017
Chromium	ug/L	1	-	ND	ND	<1	<1
Cobalt	ug/L	1	10	ND	ND	<1	<1
Copper	ug/L	1	2	ND	ND	<1	<1
Cyanide	mg/L	0,002	5	-	-	<0.002	<0.002
Cyanides (Strong Acid Dissoc.)	mg/L	0,001	-	ND	0,0021	-	-
Iron	ug/L	50	300	**480**	**370**	**410**	**916**
Lead	ug/L	0,5	1	0,54	ND	<0.5	<0.5
Manganese	ug/L	2	820	25	2,4	18	73
Mercury (Total)	ug/L	0,026	0,026	-	-	<0.026	<0.026
Mercury (Dissolved)	ug/L	0,013	-	0,013	0,017	-	-
Molybdenum	ug/L	2	73	ND	ND	<2	<2
Nickel	ug/L	2	25	ND	ND	<2	<2
Selenium	ug/L	1	1	ND	ND	<1	<1
Silver	ug/L	0,1	0,1	ND	ND	<0.1	<0.1
Strontium	ug/L	5	21000	8,5	25	5	19
Thallium	ug/L	0,1	0,8	ND	ND	<0.1	<0.1
Tin	ug/L	2	-	ND	ND	<2	<2
Titanium	ug/L	2	-	3,8	ND	3	<2
Uranium	ug/L	0,1	300	ND	ND	<0.1	<0.1
Vanadium	ug/L	2	6	ND	ND	<2	<2
Zinc	ug/L	5	30	7,5	5,3	<5	5

Notes:

[1] Nova Scotia Environment Tier 1 Environmental Quality Standards for Surface Water, 2013

shading denotes a guideline exceedance

RDL denotes laboratory reported detection limit

\- denotes no value/not analysed

* 5 µg/L if pH < 6.5 or 100 µg/L if pH ≥ 6.5

Guideline Details

Tier 1 EQS for Surface Water
Land Use = All
Receptor of Concern = Ecological
Sampled Media = surface water
Pathway of Concern = surface water
Water Usage = freshwater (aquatic life)
Soil Type = n/a
istance to SW Receptor = 0 m

Sample Details

Goldbrook Lake	WSP Sample ID
FUW530	Laboratory Sample ID
16-Dec-17	Sampling date

5.3 GROUNDWATER QUALITY

A total of eight (8) groundwater samples were collected by WSP personnel on December 7th and 8th, 2017. Four (4) of these samples were collected from existing metallurgical boreholes drilled into bedrock (BR-17-MET-1, BR-17-MET-2, BR-17-MET-3, and BR-17-MET-5) after short pumping tests had been performed. The other four (4) samples (MW-1, MW-2, MW-3S and MW-3D) were collected from wells which had been drilled and installed in glacial till (MW17-03S) and bottom of the glacial till and top of the bedrock by WSP in December 2017 (MW17-01, MW17-02, MW17-03D). All groundwater samples were submitted to Maxxam for analysis of dissolved metals and general chemistry, including cyanide, mercury, major anions and cations. Analytical results of the bedrock and till wells were compared to NSE Tier 1 EQS and CDWQ standards to determine groundwater potability. Groundwater analytical results tables are in Appendix E.

It has to be mentioned that water taken from the Goldbrook Lake had to be used to drill through the cobbles and boulders and the wells. This can influence the water quality of the first sampling event which occurred shortly after drilling and development. Groundwater quality is subject to seasonal variation. Due to these factors re-sampling is recommended in order to more accurately complete the water quality data evaluation.

5.3.1 DISSOLVED METALS

One groundwater sample (MW17-03D) collected from a glacial till monitoring well (MW17-03D) contained dissolved arsenic at a concentration of 11 µg/L. This exceeds the NSE Tier 1 EQS and CDWS standards (10 µg/L). No other dissolved metals exceedances were noted in groundwater samples collected from wells installed in the glacial till. The table in Appendix E summarizes analytical results for glacial till wells.

Groundwater from the four (4) bedrock wells contained dissolved arsenic concentrations ranging from 39 µg/L to 170 µg/L. These concentrations exceed the NSE Tier 1 EQS and CDWQ regulated limit of 10 µg/L.

No other dissolved metal exceedances were noted in groundwater collected from the bedrock wells. Table 6 summarizes analytical results for total and dissolved metals in the bedrock well groundwater samples.

Mercury or cyanide was not detected in any of the eight samples analysed.

Elevated arsenic concentrations at the project site can be attributed to both natural occurring and anthropogenic source related to the past mining activities. Arsenic is a recurring problem across the province of Nova Scotia and a brief description of this situation is presented at the end of this section.

Due to the exceedances noted above, groundwater at the site is currently considered unsuitable for human consumption.

5.3.2 TOTAL METALS AND SUSPENDED SOLIDS

The four (4) bedrock well samples were also submitted for analysis of total metals and suspended solids. The total metals and suspended solids data can be used as input parameters for the feasibility study, for the treatment technology selection for an industrial water source, the discharge of the open pit or underground dewatering or the design of a water treatment system. The total metals analytical results are presented in the table located in Appendix E and as well as the suspended solids data.

Total metals concentrations were compared to Nova Scotia Environment Tier 1 Environmental Quality Standards for Surface Water (2013) to verify the regulatory compliance of the groundwater from the dewatering of the open pit (bedrock) discharging to surface water course (see following Table). The results show exceedance for the surface water quality standards for 10 metals (Al, As, Cd, Cu, Fe, Pb, Mn, Ag, Ti, V, Zn) and indicate a need for treatment

before discharge. Suspended solid concentrations varied from 93 to 270 mg/l in three samples and were very high (22 000 mg/l) in one sample (MET-1). This sample showed very high turbidity as well (>1000 NTU).

Groundwater from the four (4) bedrock wells contained total arsenic concentrations ranging from 140 µg/L to 970 µg/L. These concentrations exceed the NSE Tier 1 EQS and CDWQ regulated limit of 10 µg/L.

A total lead concentration of 17 µg/L was reported in one sample (MET-1), exceeding the NSE Tier 1 EQS and CDWQ regulated limit of 10 µg/L. Additionally, the total vanadium concentration of this sample was reported as 15 µg/L which exceeds the NSE Tier 1 EQS standard of 6.2 µg/L.

No other total metal exceedances were noted in groundwater collected from the bedrock wells. The following table summarizes analytical results for total metals in the bedrock well groundwater samples.

Total metal range was generally higher than the dissolved metals range for all parameters.

The metallurgical boreholes used for this study were not submitted to well development, since they were not built as pumping wells. Well development followed by longer duration pumping can significantly decrease the sediment content of the pumped water.

It can be observed that dissolved metal concentrations in filtered water samples were significantly lower than total metals (Table 6), but dissolved Al, As, Cu, Fe and Zn still exceed the surface water quality standard. Dissolved Cd slightly exceeded the standard in one sample, concentration close to the detection limit.

Table 7 Total and Dissolved Metals and Cyanide in Groundwater - Bedrock Wells

Parameter	Units	RDL	Guideline1	Guideline2	Groundwater Samples (Till Wells)			
			Tier 1 EQS for Groundwater	CDWQ	MW-1	MW-2	MW-3S	MW-3D
					FUW533	FUW534	FUW535	FUW536
					16-Dec-17	19-Dec-17	19-Dec-17	19-Dec-17
Dissolved Aluminum (Al)	ug/L	5	-	-	7,2	36	470	47
Dissolved Antimony (Sb)	ug/L	1	6	6	ND	ND	ND	ND
Dissolved Arsenic (As)	ug/L	10	10	10	1,8	2,6	1,4	**11**
Dissolved Barium (Ba)	ug/L	1	1000	1000	5,6	13	9,3	3,3
Dissolved Beryllium (Be)	ug/L	1	4	-	ND	ND	ND	ND
Dissolved Bismuth (Bi)	ug/L	2	-	-	ND	ND	ND	ND
Dissolved Boron (B)	ug/L	50	5000	5000	ND	ND	ND	ND
Dissolved Cadmium (Cd)	ug/L	0,01	5	5	0,021	0,14	0,031	ND
Dissolved Calcium (Ca)	ug/L	100	-	-	11000	9800	2000	7000
Dissolved Chromium (Cr)	ug/L	1	50	50	ND	ND	ND	ND
Dissolved Cobalt (Co)	ug/L	0,4	10	-	1	3,6	2,1	ND
Dissolved Copper (Cu)	mg/L	2	-	-	ND	3	17	2,8
Cyanide (Strong Acid Dissoc.)	mg/L	0,001	0,2	0,2	0,0011	ND	ND	ND
Dissolved Iron (Fe)	ug/L	50	-	-	ND	620	410	ND
Dissolved Lead (Pb)	ug/L	0,5	10	10	ND	ND	0,56	ND
Dissolved Magnesium (Mg)	ug/L	100	-	-	1300	1300	680	2400
Dissolved Manganese (Mn)	ug/L	2	-	-	73	850	180	31
Dissolved Mercury	ug/L	0,013	-	-	ND	0,032	ND	ND
Dissolved Molybdenum (Mo)	ug/L	2	70	-	ND	ND	ND	ND
Dissolved Nickel (Ni)	ug/L	2	100	-	2,7	5	7,6	2,6
Dissolved Phosphorus (P)	ug/L	100	-	-	ND	ND	ND	ND
Dissolved Potassium (K)	ug/L	100	-	-	1700	1700	1800	2300
Dissolved Selenium (Se)	ug/L	1	10	50	ND	ND	ND	ND
Dissolved Silver (Ag)	ug/L	0,1	100	-	ND	ND	0,18	ND
Dissolved Sodium (Na)	ug/L	100	-	-	16000	9400	4600	6100
Dissolved Strontium (Sr)	ug/L	2	4400	-	35	24	12	46
Dissolved Thallium (Tl)	ug/L	0,1	2	-	ND	ND	ND	ND
Dissolved Tin (Sn)	ug/L	2	4400	-	ND	ND	ND	ND
Dissolved Titanium (Ti)	ug/L	2	-	-	ND	ND	17	2,2
Dissolved Uranium (U)	ug/L	0,1	20	20	ND	ND	ND	ND
Dissolved Vanadium (V)	ug/L	2	6,2	-	ND	ND	ND	ND
Dissolved Zinc (Zn)	ug/L	5	5000	-	ND	15	14	7,9

Notes:

[1] Nova Scotia Environment Tier 1 Environmental Quality Standards for Groundwater, 2013

[2] Guidelines for Canadian Drinking Water Quality Summary Table, 2017

shading denotes a guideline exceedance

RDL denotes laboratory reported detection limit

\- denotes no value/not analysed

* 5 µg/L if pH < 6.5 or 100 µg/L if pH ≥ 6.5

Tier 1 EQS for Groundwater	
Land Use =	commercial/industrial
Receptor of Concern =	human
Sampled Media =	groundwater
Pathway of Concern =	n/a
Water Usage =	potable
Soil Type =	coarse-grained
Distance to SW Receptor =	n/a

Sample Details	
MW-1	WSP Sample ID
FUW533	Laboratory Sample ID
16-Dec-17	Sampling date

ARSENIC IN NOVA SCOTIA

Arsenic is considered the most prevalent naturally occurring groundwater contaminant in the province, and research over the past four decades has indicated that bedrock geology is the most important control on arsenic concentrations in well water in Nova Scotia. The province has conducted extensive surveys of arsenic in various media (till, sediment, bedrock, groundwater), primarily in areas underlain by bedrock related to the Goldenville and Halifax groups (the formation underlying the project site) or South Mountain Batholith, and has compiled arsenic concentration data from water wells across Nova Scotia (NSNR, Kennedy and Drage. 2016, NSNR Arsenic Map 2017).

These regions are associated with greater concentrations of the naturally occurring arsenic. Drilled wells are associated with a significantly higher probability of elevated levels of arsenic compared to dug wells. In these groundwater regions, the calculated geomean of arsenic concentrations, as determined from 188 samples across the province, is reported as 1.0 µg/L (ref 3). However, approximately 13% of samples included in this analysis were found to contain concentrations of naturally occurring arsenic at concentrations which exceed the regulated limit of 10 µg/L.

The main anthropogenic source of arsenic in Nova Scotia has been identified as tailings and waste rock in past-producing gold districts in the Goldenville and Halifax groups of the Meguma terrane. Geogenic sources of arsenic are widespread, consisting primarily of arsenopyrite and arsenian pyrite. Dug wells in past-producing gold districts, however, are associated with higher exceedance rates of the Health Canada MAC for arsenic in drinking water compared to dug wells in areas outside of gold districts (ref 3). The 99% of wells sampled for arsenic survey in the county of Guysborough were dug wells and it can be assumed that those wells intercept mostly the overburden (maybe the top of the bedrock). Some of these wells showed exceedances for arsenic concentration.

5.3.3 GENERAL CHEMISTRY

Four glacial till wells and four bedrock wells as well as two surface water locations were sampled for the analysis of general chemistry parameters. These parameters were used for the purpose of defining separate geochemical groups within the study area and to support future evaluations for extraction water management scenarios. Data from these general chemical analyses are presented in the table located in Appendix E.

General chemistry results were compared with the NSE Tier 1 EQS and CDWQ. Of the parameters analysed none exceeded the NSE Tier 1 EQS criteria. Exceedances in comparison to the CDWQ guidelines were noted in some samples for colour and pH. It should be noted that the CDWQ guideline for colour is an aesthetic objective and not related to a health risk.

The pH results from both surface water samples as well as from the shallow till monitoring well and BR-17-MET-1 and BR-17-MET-2 were beyond the CDWQ guideline acceptable interval of 7.0 – 10.5. Reported pH values beyond the guideline intervals were between 5.8 and 6.8 pH. It should be noted that pH is a highly variable parameter that should be analysed within 15 minutes from sample collection as recommended by Maxxam and the APHA standard reference method they follow. The distance of the field work from the laboratory made this constraint impossible to meet and therefore these results should be taken as a general reference and not an accurate representation of the actual pH condition at these locations. pH readings from the field were collected using a calibrated instrument. The results of the field readings are included in the table located in Appendix E. These results are within 1 pH unit of the analytical results.

General chemistry data have no applicable criteria in Table 3 of the NSE Tier 1 EQS when considering the case of borehole discharge to surface water bodies.

An assessment of the distinct geochemical groups are discussed in the section that follows.

5.3.4 GEOCHEMISTRY

Groundwater and surface water sample results were used for a comparison of the geochemical characteristics. The following piper plot diagram shows four distinct groups:

- The Goldbrook Lake
- The groundwater from the deepest borehole MET-2 (197m),
- The groundwater from the second deepest borehole MET-5 (150 m at 50^0 angle) and
- The group of shallower boreholes in the bedrock including the monitoring wells intercepting the till and the surface rock.

These results will be used to compare deeper and shallower bedrock formations along with fracture frequency and hydraulic conductivity.

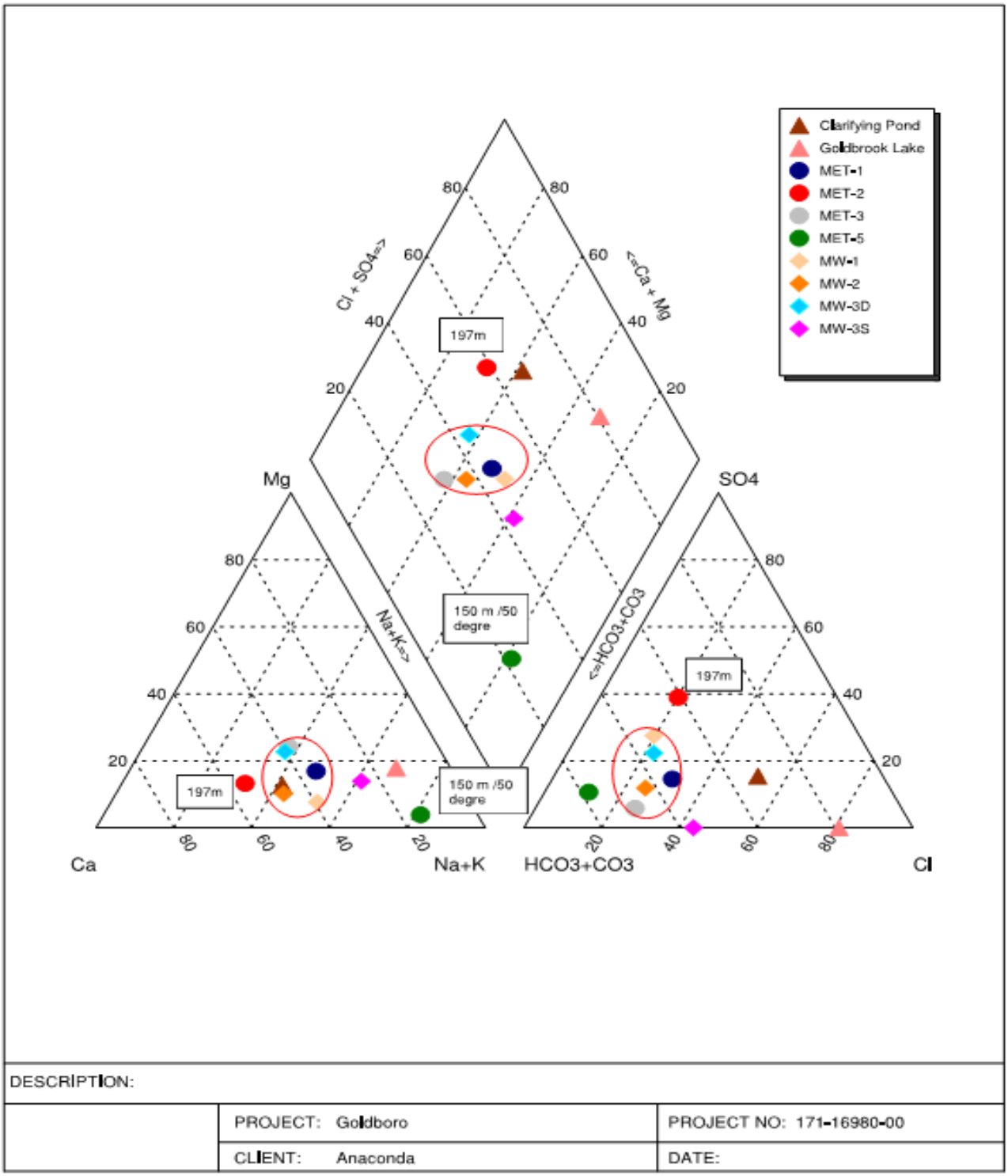


Figure 11 Geochemical Interpretation- Piper Plots

6 HYDROGEOLOGICAL CONCEPTUAL SITE MODEL

The hydrogeological conceptual model primary objective is assessing the mine site by considering the most data and observations to conceptualise the groundwater regime under current, pre-mine development conditions. Moreover, the model is used to evaluate the potential impacts on groundwater as mining progresses, as well as the impacts on mining as a result of the groundwater behaviour. These data are often qualitative in early stages of the project from looking at previous work or a desk study, but as the project advances and more test work and monitoring data is collected, the database becomes more quantitative.

The preliminary conceptual site model was developed including the following features:

- Ground and top of bedrock elevations,
- Proximity of water bodies and its depths (lakes, ponds, brooks, etc.), including possible hydraulic connections with the overburden and the bedrock,
- Hydraulic properties of overburden and bedrock, including the fault zones
- Existing underground mine workings and hydraulic properties;
- Possible hydraulic connections of the future pit with water bodies based on geochemistry, hydraulic properties of the overburden and the bedrock and piezometry.

The hydrogeological conceptual model of the Goldboro site is presented in the following cross-section, and summarised below.

Recharge to the hydrogeological system is likely to occur through the overburden, since no glaciolacustrine clays, nor preferential recharge zones as permeable overburden (sitting directly onto bedrock) or fractured rock outcrops, are not seem to be present in the area surrounding the project site. However the regional topography shows a slight slope towards the south, which indicate a possible regional flow in the bedrock from north to south.

The groundwater located in the till follows generally the topography and is delimited by the extent of the catchment area. The upper till seems to be more permeable (hydraulic conductivity of 3 x10-6 m/s), than the lower till (with a hydraulic conductivity of 6 x10-7 m/s). The bedrock aquifer seems to be semi-confined by the silty gravelly dense lower till layer, which explains the artesian water levels measured in two boreholes.

Groundwater flow within the bedrock is expected to be controlled by secondary porosity/ permeability (fractures) since the bedrock matrix is considered negligible. The frequency and aperture width of water-conducting fractures decrease with depth.

Testing in monitoring wells at the whole mine site, including the future pit as well, indicated that a thin layer of a higher hydraulic conductivity (6 x10^{-6} m/s) hydrostratigraphic unit exists at the interface of the top of bedrock and bottom of the till.

Testing in the future pit area shows that the principal groundwater flows in the bedrock are limited to the first 60 m of bedrock, where most of the fracture zones are present. As mentioned in the previous sections, the packer testing results in the upper 20 m of the more fractured bedrock varies from zero (minimum range) to moderate hydraulic conductivity (10^{-6} m/s maximum range), with an average of 10^{-7} m/s, considered low permeability. The next 40 m bedrock interval is less fractured, 5 to 10% compared to 20% of the top 20 m of bedrock, and the tested fractured zones show the same average hydraulic conductivity of 10^{-7} m/s. The next 100 meters of bedrock shows less than 1% fractured zones (based on the acoustic and optical televiewer survey in one borehole), of which hydraulic conductivity is within the same low range of 10-7 m/s. The packer testing results, combined to short pumping and permeability testing show an overall low transmissivity below the first 1 to 2 m of higher permeability bedrock.

The apparent regional New-Belt Fault identified by the west-east lineation in which the Gold Brook mine is located and other faults with potential for higher permeability may provide a preferential pathway for groundwater flow in the bedrock. The locations of groundwater infiltration zones in existing mine working are not available, however observations made in mine working in 1989 indicated that some large faults have been made impervious by breccia fines (Orex 1990- EIA). Packer testing and pump testing in borehole BR-17-MET-1, which seems to intercept the New Belt Fault, show low permeability of the fault at the location crossed by the borehole.

The flooded old mine workings are considered a distinct hydrostratigraphic unit due to the large storage and transmissivity capacity. Apparently typical inflow rates into these mine workings during dewatering activities ranged from 18.5 to 21.1 l/s (Orex 1990). Based on the testing completed within the framework of this study it can be assumed that the upper 60 m of bedrock had a more significant water inflow contribution to the mine workings, without excluding the possible contribution of some permeable fault, since the extent of the workings dewatered, the water level measurements or water entry zones are not documented. This hydraulic behaviour is suggested regionally by analysing the yield of water wells which indicate higher flowrates for wells taping the first 40 m of bedrock aquifer (from 18 to 68 Lpm), compared to those obtained in 90 m deep wells (2 to 13 Lpm), as mentioned previously in section 3.4.2.

More testing is required to better understand the hydraulic connections between the mine workings, the surrounding aquifer and the fault zones.

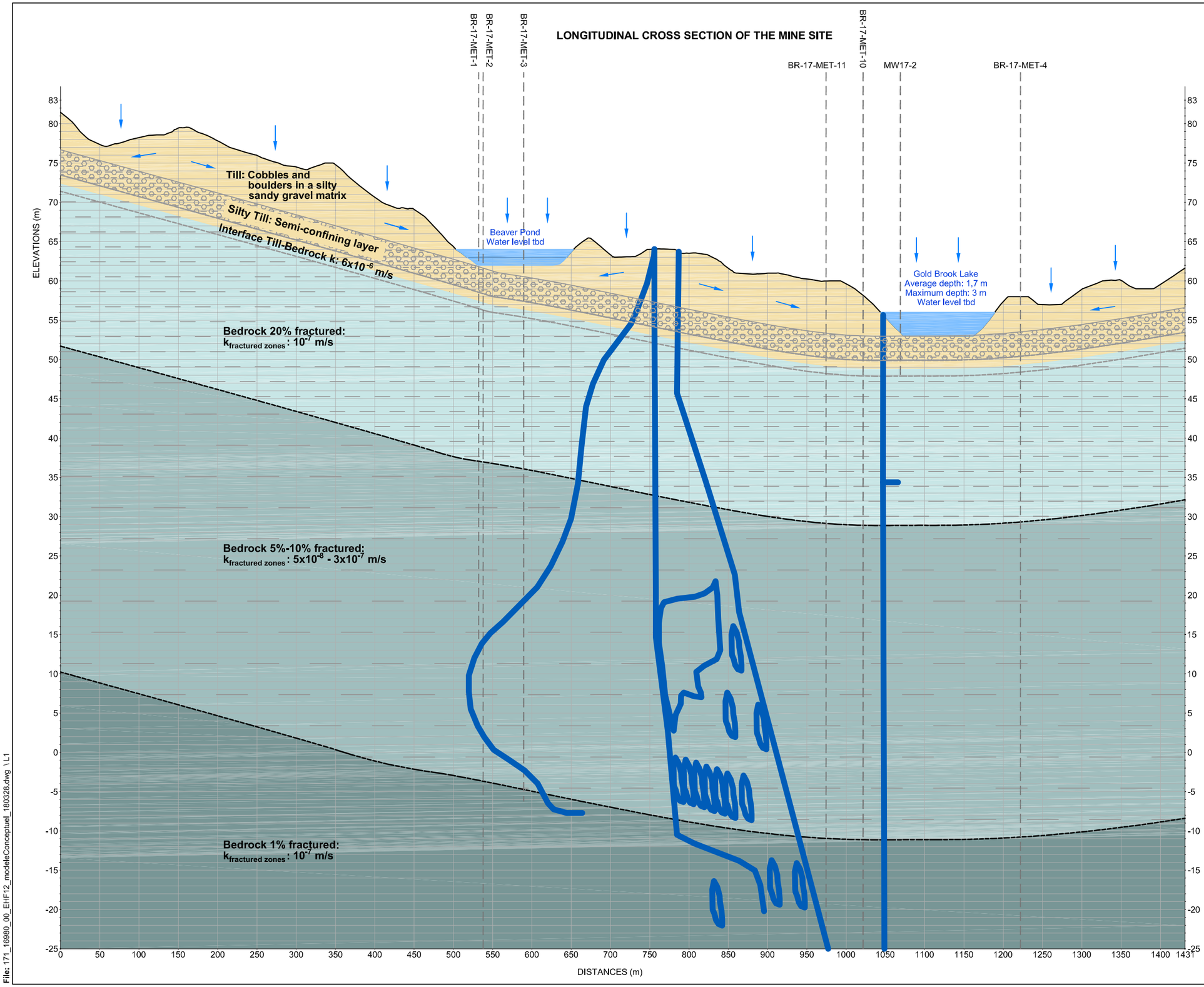
The direction of the hydraulic gradient in the bedrock aquifer is oriented to the south-east, which indicates a general tendency of the groundwater flow, however the fracture orientations, bedding planes dip and hydraulic conductivity have a major influence on the groundwater flow direction (for which detailed information is not available) and divert the flow in depth and space.

The surface water and groundwater interactions can be summarised as follows:

- The groundwater flow in the upper till seems to discharge into the Gold Brook Lake, to Gold Brook stream and other smaller water courses,
- The Gold Brook Lake which has a maximum depth of 3 m and an average depth of 1.7 m seems to be underlined by the lower and less permeable till layer,
- The Beaver Pond, probably less deep than the Gold Brook Lake, appears to be underlined by the upper and lower till as well,
- The low permeability of the lower till layer underlying the Gold Brook Lake seems to create a hydraulic barrier between the bedrock and the lake.

These assumptions need to be verified by water level monitoring of the lake, pond and groundwater along with additional soil characterization.

The preliminary conceptual site model is based on limited hydraulic data and can be completed with pumping tests of the existing mine workings.



Vertical Exaggeration: 1:10

Anaconda Mining GOLDBORO PROJECT

HYDROGEOLOGICAL REPORT

Goldboro Project,
Nova Scotia, Canada

Figure 12

Hydrogeological Conceptual Site Model

wsp

Preparation: *A. Dénes*
Drawing: *P. Cordeau*
Verification: *A. Dénes*

171-16980-00

2018-03-28

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7 IMPACT ASSESSMENT CONSIDERATIONS

Dewatering of the open pit mine and the Boston-Richardson Mine existing workings, would likely have an influence on local groundwater regime. The influence of dewatering on the area of study would be represented by a depressed water table and pressure head and redirected groundwater flow towards the mine.

According to MineTec PEA report (2014), previous mining and dewatering had no impact on the nearest residential wells. Water wells are located in a distance range of 3 to 4 km.

Pit dewatering would create a larger capture zone than the past existing mine working dewatering. During the planned dewatering and rehabilitation of old mine workings, the water entry zones impermeabilization should reduce water seepage into the workings and reduce the radius of influence of the dewatering.

The influence of the pit dewatering should be limited to :

- The bedrock surface, where a thin permeable fractured and weathered zone is present, and
- The first 60 m of bedrock aquifer, which would supply the major part of the water into the pit.

The rest of the 125 meters of bedrock should not have a significant contribution to water inflow into a 200 m deep pit.

The pit and mine dewatering should not have a significant influence on the Gold Brook Lake or the Gold Brook, due to the presence of the silty dense till layer that seems to maintain the wetland in the Gold Brook valley and the aquifer semi-confined and locally artesian (in lower topography areas).

The extent of the capture zone of the dewatering of the future Boston Richardson pit and mine workings could be estimated by hydrogeologic numerical modeling which would require more detail on stratigraphy (test pits) and surface and groundwater elevations (monitoring by data loggers).

Hydrogeological risks and uncertainties related to the project site hydrogeology include:

- Potential for highly transmissive structures in pit vicinity that may cause increased inflow rates to pit. The 2018 testing program intersected one fault zone in a limited area. The existence of transmissive structures can be determined by a high capacity pumping test of the mine workings and monitoring of existing boreholes and water bodies with pressure transducers. Future pumping test program would require planning using the layout and construction details of the mine workings, location of water entry zones (historical data) and selection of representative boreholes and shafts for monitoring.
- The character of the resulting cone of groundwater depression, or drawdown from pit development, and its extent and magnitude with distance from the pit.
- The quality of groundwater flowing into the pit (from shallow and deep horizons) requires more sampling events and analysis to validate whether specific management or treatment is required before it is either used in the plant, or discharged to the environment.

8 CONCLUSIONS AND RECOMMENDATIONS

The following can be concluded from the pre-feasibility hydrogeological study investigation:

- The Goldboro Property has been the subject of previous historical mining activity starting 1893. Intermittent mining activity occurred on the property between 1910 and 1984;
- Under a waste rock fill, the surficial geology is composed of stony till material described as a silty, gravelly sand till with frequent cobbles and boulders. The upper till is more gravely compared to the lower till which is sitlier.
- The Property is underlain by folded sedimentary rocks of the Cambro-Ordovician Goldenville Group of the Meguma Supergroup. This group consists of interbedded meta-greywacke, meta-arenite, and meta-siltstone (slate or argillite) that are affected by the east-west trending, upright, Upper Seal Harbour anticline.
- The bedrock is highly faulted (east trending New Belt Fault is an example) with quartz vein intrusion along fault shear zone which cross cut the strata. Some faults are highly brecciated;
- The main hydrostratigraphic units are the glacial till, the peat deposit, the bedrock and the underground mine workings;
- Six (6) water wells are located within a radius of 3 to 4 km from the site, of which one is a dug well in the overburden and five (5) are drilled wells in the bedrock. The wells completed at a depth of 45 m indicated a higher yield between 18 Lpm and 68 Lpm, compared to the deeper wells (95 m) for which the reported flowrate was between 2 Lpm and 14 Lpm.
- Packer testing in two boreholes targeted fractured intervals. Nine out of the total of ten (10) tests results, completed down to a depth of 110 m in the first borehole, show a Lugeon value less than 1, which indicates a very tight rock and hydraulic conductivity of $1x10^{-7}$ m/s. One tested zone located near the bedrock surface at depths between 10.22 m to 13.62 m, just below the steel casing showed a Lugeon value of 8 and a hydraulic conductivity of $9x10^{-7}$ m/s, which is considered moderate with few partly open fractures. In the second borehole tested down to 58 m, four (4) out of the five (5) tests results show a Lugeon value of 0 to 3, meaning a maximum hydraulic conductivity of 3 $x10^{-7}$ m/s, and one zone showed a Lugeon of 10 and a moderate hydraulic conductivity of $1x10^{-6}$ m/s.
- Hydraulic conductivity determined by permeability testing in monitoring wells indicates a more permeable gravelly matrix of the till near the surface (k: 3 $x10^{-6}$ m/s) than in the depth, where the till is siltier (k: 6 $x10^{-7}$ m/s). The top of the fractured bedrock and the bottom of the till (when permeable) shows an average hydraulic conductivity 6 $x10^{-6}$ m/s, higher than the maximum permeability determined by packer testing.
- The estimated transmissivity in three (3) of the four wells submitted to short pumping tests was less than 1 m^2/d, which is considered very low and lower than the median trassmissivity of the Metamorphic groundwater region of the Meguma Supergroup. A higher transmissivity of 2 to 3 m^2/d was estimated in the BR-17-MET-3, which is the same order of magnitude for the Meguma groundwater region. The hydraulic conductivity ranges from $3x10^{-8}$ to $3x10^{-7}$ m/s in three locations and 10^{-6} m/s at BR-MET-17-3.
- Regional piezometry of the bedrock aquifer or extent are unknown. The groundwater located in the till generally follows usually the topography and is delimited by the extent of the catchment area. The direction of the hydraulic gradient in the bedrock aquifer at the site is oriented to the south-east, which indicates a general tendency of the groundwater flow, however the fracture or fault orientations, bedding planes dip and hydraulic conductivity divert the flow. In addition, a large number of fault zones known to be present at the site, which can have an influence on the groundwater flow network as well.
- Surface water quality was compared to NSE Tier 1 EQS in samples previously collected by Gemtec and by WSP in this mandate. All surface water samples report metals exceedances of aluminum, arsenic and iron. Total metal (Gemtec) and dissolved metal (WSP) concentrations were in the same range at the same locations. One surface water sample (Goldbrook Lake) reported a cadmium concentration of 0.018 µg/L (WSP) which exceeds the

NSE Tier 1 EQS for Surface Water, but was slightly higher than the detection limit of 0.017 µg/l. In general, analytical results of samples collected by WSP (analysed at Maxxam laboratory) are comparable to those collected by Gemtec (analysed at AGAT laboratory), with differences in mercury (not detected in the Gemtec samples, 0.013 µg/L and 0.017 µg/L in WSP samples), cyanide (detected only by WSP at the clarifying pond, 0.0021 mg/L) and zinc reported in the WSP sample only (7.5 µg/L).

- Groundwater quality, determined in filtered samples collected from existing metallurgical boreholes after short pumping tests and monitoring wells, exceeds the NSE Tier 1 EQS and CDWS standards for arsenic only. Dissolved mercury or cyanide was not detected in any of the eight samples analysed. Elevated arsenic concentrations at the project site can be attributed to both natural occurring and anthropogenic source related to the past mining activities. None of the samples analysed for general chemistry parameters exceeded the NSE Tier 1 EQS standards for potable water except pH and colour.
- Total metals concentrations in groundwater exceed the NSE Tier 1 EQS standards for surface water for 10 metals (Al, As, Cd, Cu, Fe, Pb, Mn, Ag, Ti, V, Zn) and indicate a need for treatment of the pumped groundwater from the dewatering of the open pit before discharge. The results show Suspended solid concentrations were very high (22 000 mg/l) in one sample (MET-1). The metallurgical boreholes used for this study were not submitted to well development, since they were not built as pumping wells. Well development followed by longer duration pumping can significantly decrease the sediment content of the pumped water, therefore decreasing the total metal content as well. However, dissolved metal concentrations in filtered water samples but Al, As, Cu, Fe and Zn still exceed the surface water quality standard. Dissolved Cd slightly exceeded the standard in one sample as well, concentration close to the detection limit.

The preliminary hydrogeological conceptual site model is described below:

- Recharge in the project area to the hydrogeological system is likely to occur through the overburden, since no preferential recharge zones seem to be present. However the regional topography shows a slight slope towards the south, which indicate a possible regional flow in the bedrock from north to south.
- The groundwater located in the till follows usually the topography and is delimited by the extent of the catchment area. The lower till appears to be less permeable than the upper till and seems to act as a semi-confining layer for the bedrock aquifer, which can be artesian locally.
- Groundwater flow within the bedrock is expected to be controlled by secondary porosity (fractures) since the bedrock matrix is considered negligible.
- Acoustic and optical televiewer survey in existing boreholes along with packer testing indicated that the frequency and aperture width of fractures decrease with depth, ranging from 20% of total fractured zone length in the first 20 m of bedrock, to less than 1% for the following 100 meters bedrock interval starting below 60 m. Since fracture frequency and fractured zone length decrease with depth, with the same average hydraulic conductivity of fractured zones of 10^{-7} m/s, the bulk hydraulic conductivity of the formation decreases with depth as well. The packer testing results, combined with short pumping and permeability testing show an overall low transmissivity below the first 1 to 2 m of higher permeability bedrock.
- The apparent regional New-Belt Fault identified by the west-east lineation in which the Gold Brook mine is located and other faults with potential for higher permeability may provide a preferential pathway for groundwater flow in the bedrock. The locations of groundwater infiltration zones in existing mine working are not available, however historical observations made in mine working indicated that some large faults have been made impervious by breccia fines. Packer testing and pump testing in one borehole, which seems to intercept the New Belt Fault, show low permeability of the fault at the location crossed by the borehole.
- Based on the testing completed within the framework of this study it can be assumed that the upper 60 m of bedrock had a more significant water inflow contribution to the mine workings, without excluding the possible contribution of some permeable fault, since the extent of the workings dewatered, the water level measurements or water entry zones are not documented. More testing is required to better understand the hydraulic connections between the mine workings, the surrounding aquifer and the fault zones.

The surface water and groundwater interaction can be summarized as follows:

- The groundwater flow in the upper till seems to discharge into the Gold Brook Lake, to Gold Brook stream and other smaller water courses,
- The Gold Brook Lake which has a maximum depth of 3 m and an average depth of 1.7 m seems to be underlined by the lower and less permeable till layer;
- The Beaver Pond, probably less deep than the Gold Brook Lake, appears to be underlined by the upper and lower till as well;
- The low permeability of the lower till layer underlying the Gold Brook Lake seems to create a hydraulic barrier between the bedrock and the lake.

These assumptions need to be verified by water level monitoring of the lake, pond and groundwater along with additional soil characterization. The preliminary conceptual site model is based on limited hydraulic data and can be completed with pumping tests of the existing mine workings.

The impact assessment considerations are the followings:

- Dewatering of the mine pit and the Boston-Richardson Mine workings, would likely have an influence on local groundwater regime. The influence of dewatering on the area of study would be represented by a depressed water table and pressure head and redirected groundwater flow towards the mine.
- Pit dewatering would create a larger capture zone than the past existing mine workings dewatering, extent of which can be limited by the impermeabilization of water entry zones in the existing mine workings.
- The influence of the pit dewatering should be limited to the bedrock surface, where a thin permeable fractured and weathered zone is present, followed by the first 60 m of bedrock aquifer, which would supply the major part of the water into the pit. The rest of the 125 m of bedrock should not have a significant contribution to water inflow into a 200 m deep pit.
- The pit and mine dewatering should not have a significant influence on the Gold Brook Lake or the Gold Brook, due to the presence of the silty dense till layer that seems to maintain the wetland in the Gold Brook valley, the aquifer semi-confined and locally artesian (in lower topography areas).
- The extent of the capture zone of the dewatering of the future Boston Richardson pit and mine workings could be estimated by hydrogeologic numerical modeling which would require more detail on stratigraphy (test pits) and surface and groundwater elevations (monitoring by data loggers).

Hydrogeological risks and uncertainties related to the project site hydrogeology:

- Potential for highly transmissive structures in pit vicinity that may cause increased inflow rates to pit. The existence of transmissive structures can be determined by a high capacity pumping test of the mine workings.
- The character of the resulting cone of groundwater depression from pit development, and its extent and magnitude with distance from the pit.
- The quality of groundwater flowing into the pit (from shallow and deep horizons) requires more sampling events and analysis to validate whether specific management or treatment is required before it is either used in the plant, or discharged to the environment.

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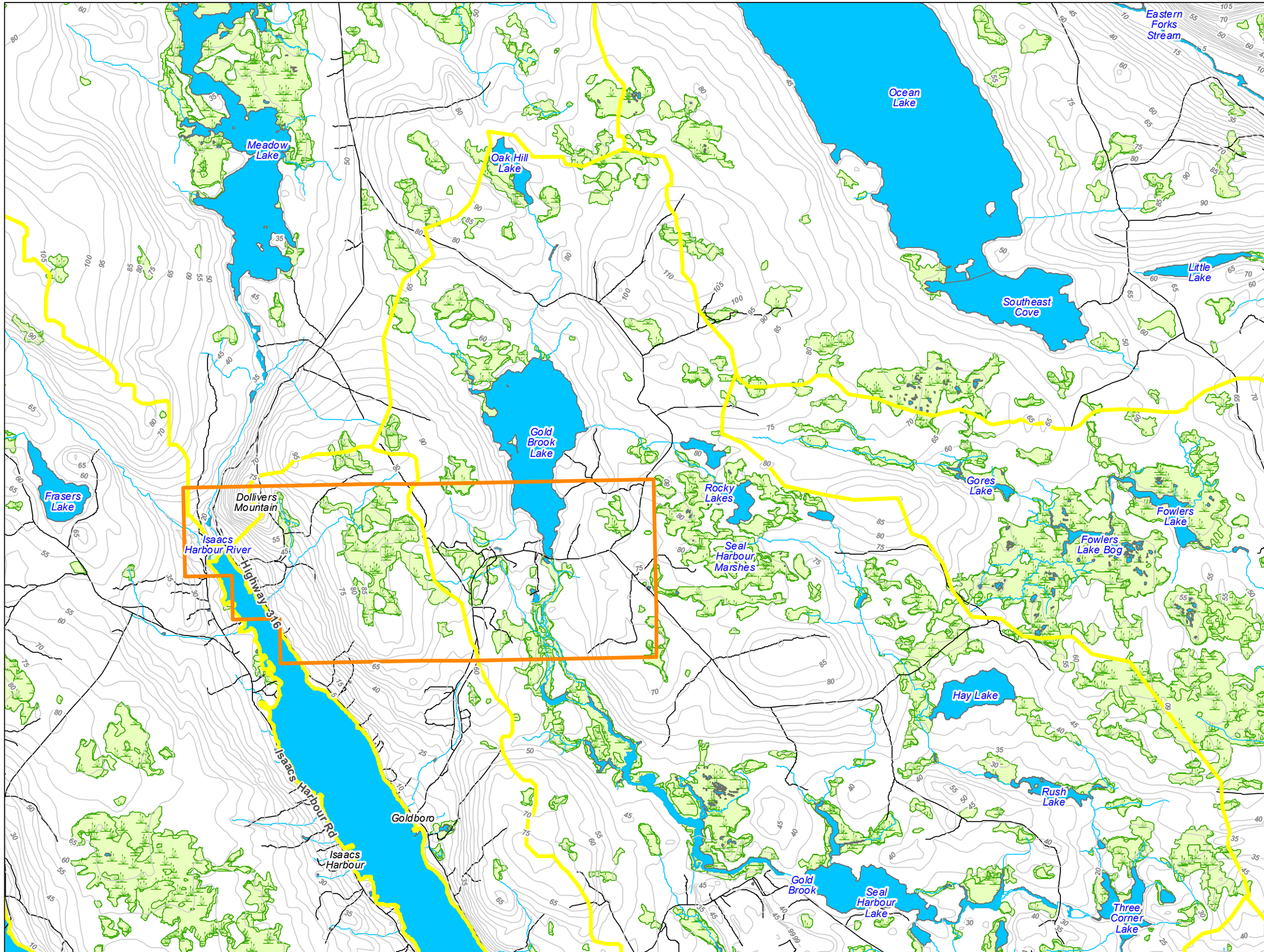
APPENDIX

A TOPOGRAPHIC MAP



CLIENT:

[redacted]

Anaconda Mining Inc.
150 York Street, Suite 410
Toronto, Ontario
Canada
M5H 3S5

anacondamining.com

PROJECT:

GOLDBORO PROJECT

CONSULTANT:

1300 YONGE STREET
8th FLOOR
TORONTO, ONTARIO
CANADA
M4T 1X3

wsp.com

SEAL:

LEGEND:

- ANACONDA MINING INC. EX. LIC.# 05888
- SECONDARY WATERSHED AREA
- ELEVATION CONTOURS (GeoNova 5m Intervals)
- ROAD NETWORK
- WATERCOURSE
- WATERBODY
- WETLAND

N

NOTES:

1. DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
2. ELEVATIONS ARE IN METRES
3. INFORMATION PRESENTED IS PRELIMINARY ONLY AND NOT INTENDED FOR CONSTRUCTION
4. DATUM - NAD 1983 CSRS
5. PROJECTION - UTM ZONE 20 NORTH

DISCLAIMER: COPYRIGHT:
THIS DRAWING AND DESIGN IS COPYRIGHT PROTECTED WHICH SHALL NOT BE USED, REPRODUCED OR REVISED WITHOUT WRITTEN PERMISSION BY WSP GROUP. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DEIMENSIONS AND UTILITY LOCATIONS AND REPORT ALL ERRORS AND OMISSIONS PRIOR TO COMMENCING WORK. THIS DRAWING IS NOT TO BE SCALED.

ISSUED FOR - REVISION:

IS	RE	DATE(M/D/Y)	DESCRIPTION

PROJECT NO:	171-16980-00
DATE:	MARCH, 2018
ORIGINAL SCALE:	1:32,000
DESIGNED BY:	A. DÉNES
DRAWN BY:	T.MOREHOUSE
CHECKED BY:	
APPROVED BY:	

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE

25mm

TITLE:

REGIONAL TOPOGRAPHY

DOCUMENT NUMBER:

171-16980-00

SHEET #:

ISSUE:

HYDROGEOLOGICAL REPORT

REV#

0

DATE OF: MARCH 21, 2018

Path: S:\GIS\2_PROJECTS\2017\171_16980_AnacondaMining_Goldboro_NS\8_MXD\20180321_171_16980_OverviewSiteLocation.mxd

APPENDIX

B

BOREHOLE LOGS, GRAIN SIZE ANALYSIS AND PIEZOMETRY TABLE

APPENDIX

B-1 *BOREHOLE LOGS*

MONITORING WELL : **MW17-01** record

Prepared by: **M. Mazerolle** Date (start): **07/12/2017**
Reviewed by: **A.Denes** Date (end): **08/12/2017**

Project name:	**Goldboro Mine - Hydrology and Hydrogeology Invest.**	Project number:	**171-16980**
Site:	**Goldboro, NS**	Geographic Coordinates:	X = 606608.1778 mE Y = 5006330.83 mN
Sector:	**Guysborough**	Surface Elevation:	60.623 m
Client:	**Anaconda Mining Inc.**	Top of PVC Elevation:	61.57 m

Drilling Company:	Logan Drilling
Drilling Equipment:	CME 75
Drilling Method:	/ HQ Casing
Borehole Diameter:	96mm
Drilling Fluid:	Water

ODOUR
S - Slight
M - Moderate
P - Persistent

VISUAL
D - Disseminated Prod.
S - Saturated with Prod.

SAMPLE TYPE
DC = Diamond Corer
SS = Split Spoon

CHEMICAL ANALYSIS
GSA = Grain Size Analysis

Water Level · Free Phase

SAMPLE STATE: Intact · Reworked · Lost · Coring

GEOLOGY / LITHOLOGY

DEPTH ELEVATION (m)	LITHOLOGY	DESCRIPTION
		Ground surface.
60.62		FILL (Waste rock) : Silty sand and gravel, reddish brown to brown, moist to wet, loose. Minor topsoil at surface.
1.00 / 59.62		TILL (GM) : Cobbles and boulders in a silty gravel with sand and trace clay matrix, brown to light grey and grey, compact to very dense, moist to saturated. Occasionnal to frequent cobbles and boulders.
3.00 / 57.62		TILL (GM) : Cobbles and Boulders in a sandy gravel matrix, some silt and trace clay,
3.60 / 57.02		TILL (SM) : Cobbles and Boulders in a silty sand with gravel and trace clay matrix, grey, wet to saturated, compact to very dense. Frequent cobbles and boulder. Sand portion of the matrix is fine to medium.
7.20		
7.50 / 53.12	Roc atteint	BEDROCK (Greywacke) : Light grey to grey Greywacke, fractured, iron staining at seams, some weathering.

MONITORING WELL

DIAG.	DESCRIPTION
0.00	Above Ground Protector (0.95m)/PVC Riser
0.00	Bentonite
0.25	
	WATER (17/12/2017) Depth: 1.15 m Elev.: 59.47 m
	Silica Sand No. 2
3.00	50mm PVC Riser
	Bentonite
5.70	
6.00	
	Silica Sand No.2
	50mm PVC Slot 20
7.20	
7.50	Cave-in PVC push-in type Well point

SAMPLES

SAMPLE STATE	% RECOVERY (%RQD)	Blows/6" (N-Value)	NUMBER	ANALYSIS	DUPLICATE	DEPTH (M)
	54	2-5-8-47 (13)	SS 1 (0.00-0.60)	GSA		0.60
	100	28-R	SS 2 (0.60-0.78)	GSA		0.78
			DC 1 (0.78-1.50)			1.50
	44	23-R	SS 3 (1.50-1.73)	GSA		1.73
			DC 2 (1.73-3.00)			3.00
	55	15-15-28-R (43)	SS 4 (3.00-3.60)	GSA		3.60
			DC 3 (3.60-4.50)			4.50
	100	R	SS 5 (4.50-4.53)			4.53
			DC 4 (4.53-6.00)			6.00
	100	42-R	SS 6 (6.00-6.23)	GSA		6.23
	100	R	DC 5 (6.23-6.75)			6.75
			SS 7 (6.75-6.80)			6.80
			DC 6 (6.80-7.50)			7.50

Notes: End of borehole in greywacke bedrock at 7.5 meter below ground surface (mbgs).

Groundwater was measured post-drilling at 1.15 mbgs on December 17, 2017.

Approximate elevation based on survey data provided by Anaconda Mining Inc.

Projet : MW_LOGS - MTL2.GPJ Type rapport : WSP_EN_PUITS-ENVIRONNEMENTAL_STM Data Template : WSP_TEMPLATE_GEOTECH.GDT 21/2/2018

MONITORING WELL : **MW17-02** record

Prepared by: **M. Mazerolle** Date (start): **18/12/2017**
Reviewed by: **A.Denes** Date (end): **18/12/2017**

Project name:	**Goldboro Mine - Hydrology and Hydrogeology Invest.**	Project number:	**171-16980**
Site:	**Goldboro, NS**	Geographic Coordinates:	X = 607001.7264 mE Y = 5006356.334 mN
Sector:	**Guysborough**	Surface Elevation:	55.65 m
Client:	**Anaconda Mining Inc.**	Top of PVC Elevation:	56.85 m

Drilling Company:	Logan Drilling
Drilling Equipment:	CME 75
Drilling Method:	/ HQ Casing
Borehole Diameter:	96mm
Drilling Fluid:	Water

ODOUR
S - Slight
M - Moderate
P - Persistent

VISUAL
D - Disseminated Prod.
S - Saturated with Prod.

SAMPLE TYPE
DC = Diamond Corer
SS = Split Spoon

CHEMICAL ANALYSIS
GSA = Grain Size Analysis

Water Level — Free Phase

SAMPLE STATE: Intact — Reworked — Lost — Coring

GEOLOGY / LITHOLOGY

DEPTH ELEVATION (m)	LITHOLOGY	DESCRIPTION
		Ground surface.
55.65		FILL (Waste Rock) : Silty sand and gravel, brown to grey, moist to wet, loose. Minor topsoil at surface.
1.00 / 54.65		TILL (GM) : Cobbles and boulders in a sandy gravel with variable silt content and trace clay matrix, light grey to grey, compact to very dense, moist to saturated. Frequent to very frequent cobbles and boulders. Sand portion of the matrix is fine to medium.
4.00 / 51.65		TILL (SM) : Cobbles and boulders in a silty sand with gravel and trace clay matrix, light grey to grey, compact to very dense, moist to saturated. Frequent to very frequent cobbles and boulders. Sand portion of the matrix is fine to medium.
6.20 / 49.45		BEDROCK (Greywacke) : Light grey to grey Greywacke, severaly fractured at 50-70 deg to horizontal, iron staining at seams, some weathering.
7.40 / 48.25	Roc atteint	

MONITORING WELL

DIAG.	DESCRIPTION
0.00	Above Ground Protector (1.20m)/PVC Riser
0.00	Bentonite
0.00	
0.25	
	WATER (18/12/2017) Depth: 1.10 m Elev.: 54.55 m
	Silica Sand No. 2
	50mm PVC Riser
3.95	
	Bentonite
5.45	
5.90	
	Silica Sand No.2
	50mm PVC Slot 20
7.40	PVC Push-in type well point

SAMPLES

SAMPLE STATE	% RECOVERY (%RQD)	Blows/6" (N-Value)	NUMBER	ANALYSIS	DUPLICATE	DEPTH (M)
	71	3-8-R/0.13	SS 1 (0.00-0.43)	GSA		0.43
	41		DC 1 (0.43-1.40)			1.40
	0	R	SS 2 (1.40-1.40)			1.65
	50	R				
	0		SS 3 (1.65-1.65)			
	50		DC 2 (1.40-2.90)			2.90
	25					3.20
	0	R	SS 4 (3.20-3.20)			
	25		DC 3 (2.90-4.40)			4.40
	0	R	SS 5 (4.40-4.40)			
	23		DC 4 (4.40-5.90)	GSA		5.45
			Cutt. (5.40-5.45)			5.90
	80 (0)		DC 5 (5.90-7.40)			7.40

Notes: End of borehole in greywacke bedrock at 7.4 meter below ground surface (mbgs).

Groundwater was measured post-drilling at 1.1 mbgs on December 18, 2017.

Approximate elevation based on survey data provided by Anaconda Mining Inc.

Projet : MW_LOGS - MTL2.GPJ Type rapport : WSP_EN_PUITS-ENVIRONNEMENTAL_STM Data Template : WSP_TEMPLATE_GEOTECH.GDT 21/2/2018

MONITORING WELL : **MW17-03D** record

Prepared by: **M. Mazerolle** Date (start): **18/12/2017**
Reviewed by: **A.Denes** Date (end): **19/12/2017**

Project name:	**Goldboro Mine - Hydrology and Hydrogeology Invest.**	Project number:	**171-16980**
Site:	**Goldboro, NS**	Geographic Coordinates:	X = 606970.1963 mE Y = 5006045.832 mN
Sector:	**Guysborough**	Surface Elevation:	51.19 m
Client:	**Anaconda Mining Inc.**	Top of PVC Elevation:	52.24 m

Drilling Company:	Logan Drilling
Drilling Equipment:	CME 75
Drilling Method:	/ HQ Casing
Borehole Diameter:	96mm
Drilling Fluid:	Water

ODOUR
S - Slight
M - Moderate
P - Persistent

VISUAL
D - Disseminated Prod.
S - Saturated with Prod.

SAMPLE TYPE
DC = Diamond Corer
SS = Split Spoon

CHEMICAL ANALYSIS
GSA = Grain Size Analysis

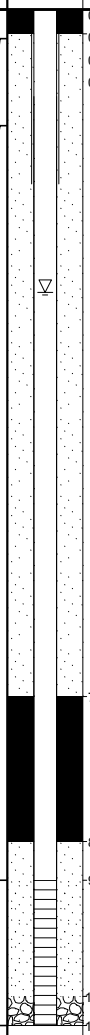
Water Level Free Phase

SAMPLE STATE: Intact, Reworked, Lost, Coring

GEOLOGY / LITHOLOGY

DEPTH ELEVATION (m)	LITHOLOGY	DESCRIPTION
		Ground surface.
0.30 / 50.89		FILL (Crushed Rock) : Sand and Gravel with some silt, light grey to grey, dry to moist, compact.
1.20 / 49.99		FILL (Waste rock) : gravelly sand and silt, grey and brown, moist to wet, compact to dense.
		TILL (SM) : Cobbles and boulders in a silty gravelly sand with trace clay to gravelly sand with variable silt content and trace clay matrix, light grey to grey, compact to very dense, moist to saturated. Frequent to very frequent cobbles and boulders.Sand portion of the matrix is fine to medium.
9.00 / 42.19		BEDROCK (Greywacke) : Light grey to grey Greywacke, fractured at 60-75 deg to horizontal, iron staining at seams, some weathering.
10.50 / 40.69	Roc atteint	

MONITORING WELL



DIAG.	DESCRIPTION
0.00	Above Ground Protector (1.05m)/PVC Riser
0.00	Bentonite
0.00	
0.25	
	WATER (19/12/2017) Depth: 2.95 m Elev.: 48.24 m
	Silica Sand No. 2
	50mm PVC Riser
7.10	
	Bentonite
8.60	
9.00	
	Silica Sand No.2
	50mm PVC Slot 20
10.20	
10.50	Cave-in PVC push-in type well point

SAMPLES

SAMPLE STATE	% RECOVERY (%RQD)	Blows/6" (N-Value)	NUMBER	ANALYSIS	DUPLICATE	DEPTH (M)
	54	8-8-9-16 (17)	SS 1 (0.00-0.60)	GSA		0.60
	71	18-24-24-32 (48)	SS 2 (0.60-1.20)	GSA		1.20
	0	R	SS 3 (1.20-1.20)			
	33		DC 1 (1.20-2.10)			2.10
	39		DC 3 (2.10-3.00)			2.70
	0	R	SS 4 (2.70-2.70)			3.00
	39		DC 5 (3.00-4.50)			4.05
	30		DC 5 (3.00-4.50)			
	0	R	SS 4 (4.05-4.05)			4.50
	30					
	25		DC 6 (4.50-6.00)			6.00
	30		DC 7 (6.00-7.50)			7.50
	32		DC 8 (7.50-9.00)			9.00
	80 (50)		DC 9 (9.00-10.50)			10.50

Notes: End of borehole in greywacke bedrock at 10.5 meter below ground surface (mbgs).

Groundwater was measured post-drilling at 2.95 mbgs on December 19, 2017.

Approximate elevation based on survey data provided by Anaconda Mining Inc.

Projet : MW_LOGS - MTL2.GPJ Type rapport : WSP_EN_PUITS-ENVIRONNEMENTAL_STM Data Template : WSP_TEMPLATE_GEOTECH.GDT 21/2/2018

MONITORING WELL : **MW17-03S** record

Prepared by: **M. Mazerolle** Date (start): **19/12/2017**
Reviewed by: **A.Denes** Date (end): **19/12/2017**

Project name:	**Goldboro Mine - Hydrology and Hydrogeology Invest.**	Project number:	**171-16980**
Site:	**Goldboro, NS**	Geographic Coordinates:	X = O
Sector:	**Guysborough**		Y = N
Client:	**Anaconda Mining Inc.**	Surface Elevation:	51.35 m
		Top of PVC Elevation:	52.39 m

Drilling Company:	Logan Drilling
Drilling Equipment:	CME 75
Drilling Method:	/ HQ Casing
Borehole Diameter:	96mm
Drilling Fluid:	Water

ODOUR
S - Slight
M - Moderate
P - Persistent

VISUAL
D - Disseminated Prod.
S - Saturated with Prod.

SAMPLE TYPE
AS = Auger Sample
DC = Diamond Corer

CHEMICAL ANALYSIS

Water Level Free Phase

SAMPLE STATE: Intact, Reworked, Lost, Coring

DEPTH ELEVATION (m)	GEOLOGY / LITHOLOGY: LITHOLOGY	GEOLOGY / LITHOLOGY: DESCRIPTION	MONITORING WELL: DIAG.	MONITORING WELL: DESCRIPTION	SAMPLES: SAMPLE STATE	% RECOVERY (%RQD)	Blows/6" (N-Value)	NUMBER	ANALYSIS	DUPLICATE	DEPTH (M)
		Ground surface.									
0.30 / 51.05		FILL (Crushed Rock) : Sand and gravel with some silt, light grey to grey, dry to moist,		0.00 Above Ground Protector (1.04m)/PVC Riser; 0.00 Bentonite				AG 1 (0.00-1.20)			
1.20 / 50.15		FILL (Waste rock): gravelly sand and silt, grey and brown , moist to wet, compact to dense.		1.20							1.20
		TILL (SM) : Cobbles and boulders in a silty gravelly sand with trace clay to gravelly sand with variable silt content and trace clay matrix, light grey to grey, compact to very dense, moist to saturated. Frequent to very frequent cobbles and boulders.Sand portion of the matrix is fine to medium.		50mm PVC Riser; Cave-in; WATER (19/12/2017) Depth: 3.03 m Elev.: 48.32 m; 3.60; 3.90		33		DC 1 (1.20-2.70)			2.70
						53		DC 2 (2.70-4.20)			4.20
				Silica Sand No.2; 50mm PVC Slot 20		40		DC 3 (4.20-5.40)			
5.40 / 45.95		End of borehole in Till at 5.4 meter below ground surface (mbgs).		5.30 Cave-in; 5.40 PVC push-in type well point							5.40

Borehole drilled without soil sampling. Stratigraphy from MW-03D.

Groundwater was measured post-drilling at 3.03 mbgs on December 19, 2017.

Approximate elevation and coordinates based on survey data for MW3D provided by Anaconda Mining Inc. and a distance between the two wells of 2 m west of MW3D (toward core shack).

Projet : MW_LOGS - MTL2.GPJ Type rapport : WSP_EN_PUITS-ENVIRONNEMENTAL_STM Data Template : WSP_TEMPLATE_GEOTECH.GDT 21/2/2018

APPENDIX

B-2 *GRAIN SIZE ANALYSIS REPORT*

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-173
		EMISSION DATE :	01-24-2018

MATERIAL :

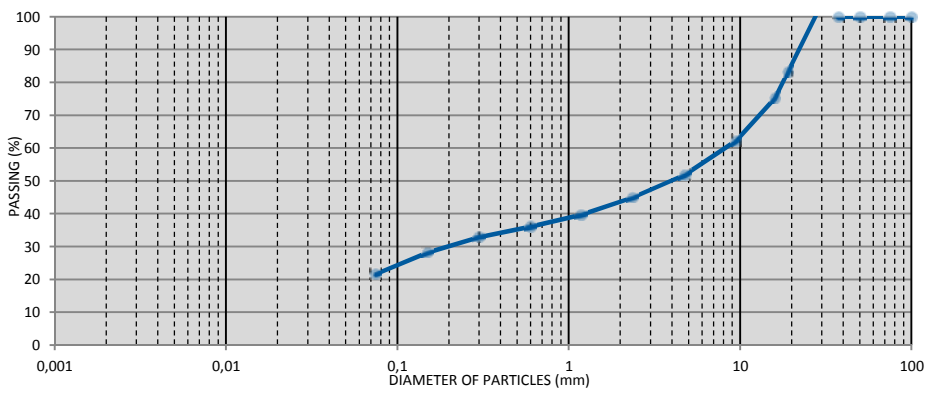
Material :	Natural Soil	Origin :	Monitoring Well
Type :		Location :	MW1- 0'-2'
Use :	Geotechnical Study		
Sampled by : Marc Mazerole	Date : 12-07-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**100**			
31,5	**106**			
19	**83**			
16	**75**			
9,5	**62**			
4,75	**52**			
2,36	**45**			
1,18	**40**			
0,600	**36**			
0,300	**33**			
0,150	**28**			
0,075	**22**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :		Unified classification :
Gravel:	48,2 %	D_{30} :	0,209	Description :
Sand:	30,1 %	D_{60} :	8,482	Sandy , silty & clayey gravel
Silt & Clay:	21,6 %	C_c :		
	%	C_u :		

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-174
		EMISSION DATE :	01-24-2018

MATERIAL :

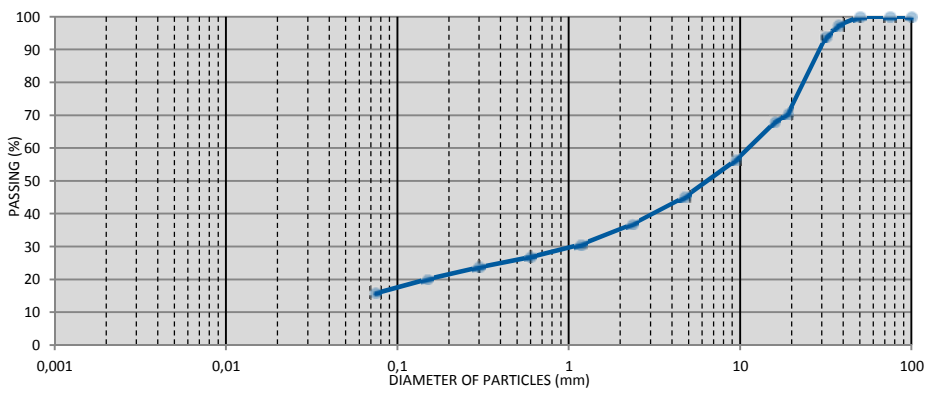
Material :	Natural Soil	Origin :	Monitoring Well
Type :		Location :	MW1- 2'-2'7"
Use :	Geotechnical Study		
Sampled by :	Marc Mazerole	Date : 12-07-2018	Received on : 01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**97**			
31,5	**94**			
19	**70**			
16	**68**			
9,5	**56**			
4,75	**45**			
2,36	**37**			
1,18	**31**			
0,600	**27**			
0,300	**24**			
0,150	**20**			
0,075	**16**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :		Unified classification :	
Gravel:	54,9 %	D_{30} :	1,096	Description :	
Sand:	29,3 %	D_{60} :	11,553	Sandy gravel, a little silt and clay	
Silt & Clay:	15,8 %	C_c :			
	%	C_u :			

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-175
		EMISSION DATE :	01-24-2018

MATERIAL :

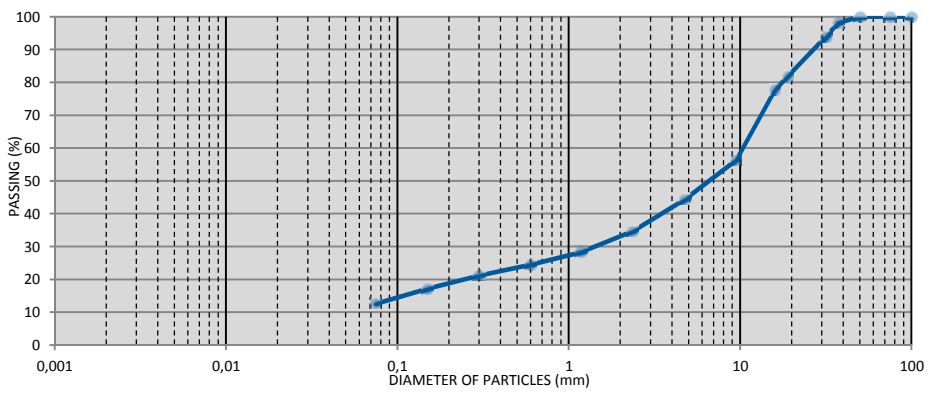
Material :	Natural Soil			Origin :	Monitoring Well
Type :				Location :	MW1- 5'-5'9"
Use :	Geotechnical Study				
Sampled by :	Marc Mazerole	Date :	12-07-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**98**			
31,5	**94**			
19	**82**			
16	**78**			
9,5	**56**			
4,75	**44**			
2,36	**35**			
1,18	**28**			
0,600	**24**			
0,300	**21**			
0,150	**17**			
0,075	**13**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0	%	D_{10} :		Unified classification :
Gravel:	55,6	%	D_{30} :	1,502	Description :
Sand:	31,8	%	D_{60} :	10,630	Sandy gravel, a little silt and clay
Silt & Clay:	12,6	%	C_c :		
		%	C_u :		

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-176
		EMISSION DATE :	01-24-2018

MATERIAL :

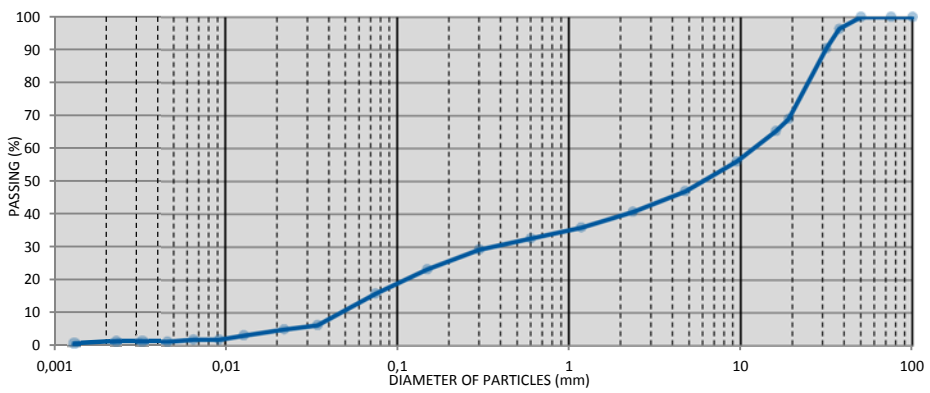
Material :	Natural Soil			Origin :	Monitoring Well
Type :				Location :	MW1- 10'-12'
Use :	Geotechnical Study				
Sampled by :	Marc Mazerole	Date :	12-08-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**96**			
31,5	**90**			
19	**69**			
16	**65**			
9,5	**56**			
4,75	**47**			
2,36	**41**			
1,18	**36**			
0,600	**33**			
0,300	**29**			
0,150	**23**			
0,075	**16**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :	0,050	Unified classification :	
Gravel:	53,0 %	D_{30} :	0,365	Description :	
Sand:	31,1 %	D_{60} :	12,260	Sandy gravel, a little silt, traces of clay	
Silt:	15,1 %	C_c :	0,2		
Clay:	0,8 %	C_u :	244,6		

BY SEDIMENTOMETRY (BNQ 2501-025)

Diameter (mm)	Passing (%)
0,0343	**6,3**
0,0220	**5,0**
0,0128	**3,1**
0,0092	**1,9**
0,0065	**1,9**
0,0046	**1,3**
0,0032	**1,3**
0,0023	**1,3**
0,0013	**0,6**

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-177
		EMISSION DATE :	01-24-2018

MATERIAL :

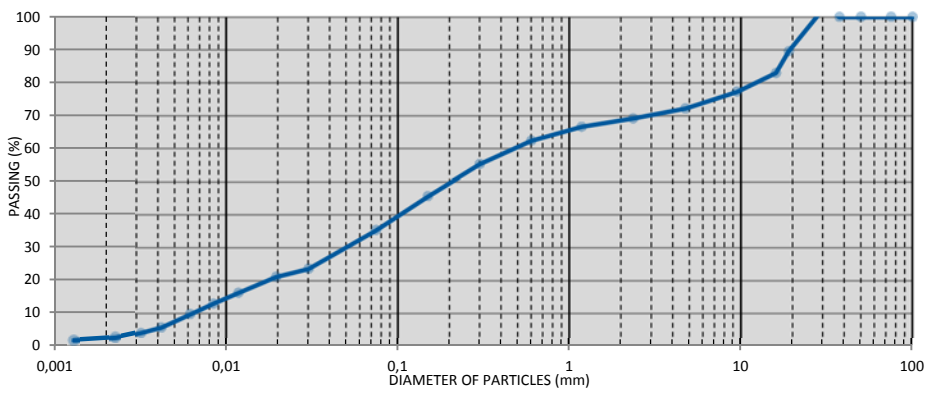
Material :	Natural Soil			Origin :	Monitoring Well
Type :				Location :	MW1- 20'-20'9"
Use :	Geotechnical Study				
Sampled by :	Marc Mazerole	Date :	12-08-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**100**			
31,5	**104**			
19	**90**			
16	**83**			
9,5	**77**			
4,75	**72**			
2,36	**69**			
1,18	**67**			
0,600	**62**			
0,300	**55**			
0,150	**46**			
0,075	**35**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :	0,006	Unified classification :	
Gravel:	27,8 %	D_{30} :	0,055	Description :	
Sand:	36,8 %	D_{60} :	0,500	Silty , gravelly sand, traces of clay	
Silt:	33,2 %	C_c :	0,9		
Clay:	2,2 %	C_u :	79,0		

BY SEDIMENTOMETRY (BNQ 2501-025)

Diameter (mm)	Passing (%)
0,0302	**23,6**
0,0196	**21,2**
0,0118	**16,3**
0,0084	**13,0**
0,0062	**9,8**
0,0042	**5,7**
0,0032	**4,1**
0,0023	**2,4**
0,0013	**1,6**

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-178
		EMISSION DATE :	01-24-2018

MATERIAL :

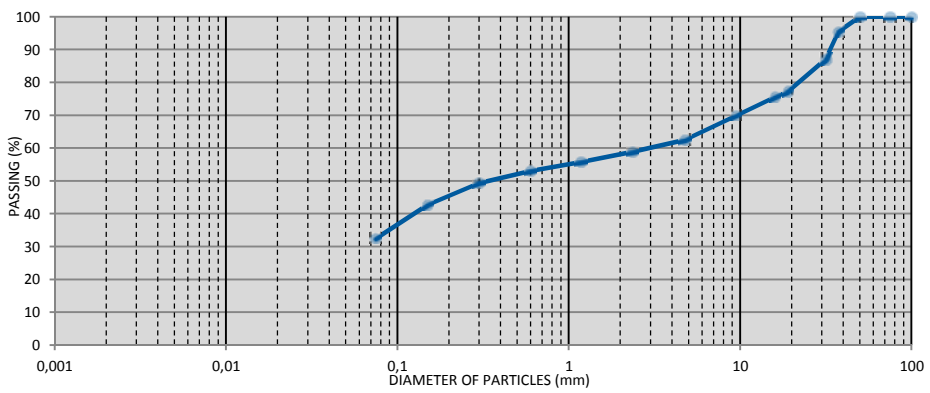
Material :	Natural Soil	Origin :	Monitoring Well
Type :		Location :	MW2- 0'-2'
Use :	Geotechnical Study		
Sampled by : Marc Mazerole	Date : 12-18-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**95**			
31,5	**87**			
19	**77**			
16	**76**			
9,5	**70**			
4,75	**62**			
2,36	**59**			
1,18	**56**			
0,600	**53**			
0,300	**49**			
0,150	**43**			
0,075	**32**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :		Unified classification :
Gravel:	37,5 %	D_{30} :		Description :
Sand:	30,0 %	D_{60} :	3,116	Silty & clayey , sandy gravel
Silt & Clay:	32,5 %	C_c :		
	%	C_u :		

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-179
		EMISSION DATE :	01-24-2018

MATERIAL :

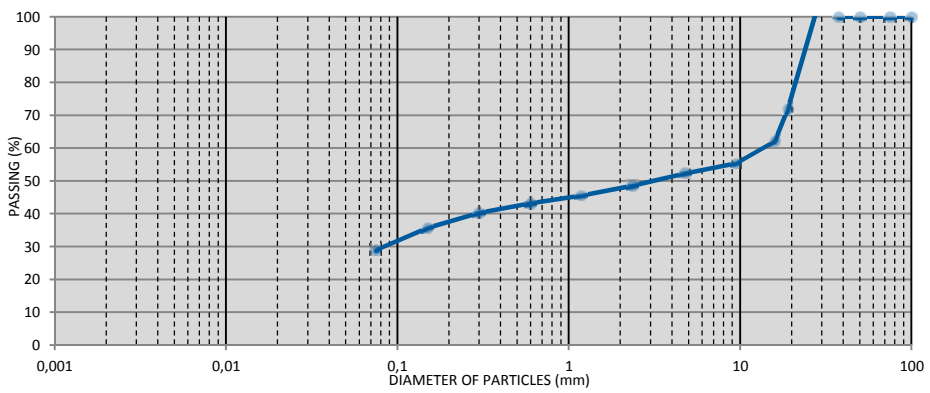
Material :	Natural Soil			Origin :	Monitoring Well
Type :				Location :	MW2-cuttings 18'
Use :	Geotechnical Study				
Sampled by :	Marc Mazerole	Date :	12-18-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**100**			
31,5	**111**			
19	**72**			
16	**62**			
9,5	**55**			
4,75	**52**			
2,36	**49**			
1,18	**46**			
0,600	**43**			
0,300	**40**			
0,150	**36**			
0,075	**29**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0	%	D_{10} :		Unified classification :
Gravel:	47,8	%	D_{30} :	0,087	Description :
Sand:	23,3	%	D_{60} :	14,029	Silty & clayey , sandy gravel
Silt & Clay:	29,0	%	C_c :		
		%	C_u :		

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-182
		EMISSION DATE :	01-24-2018

MATERIAL :

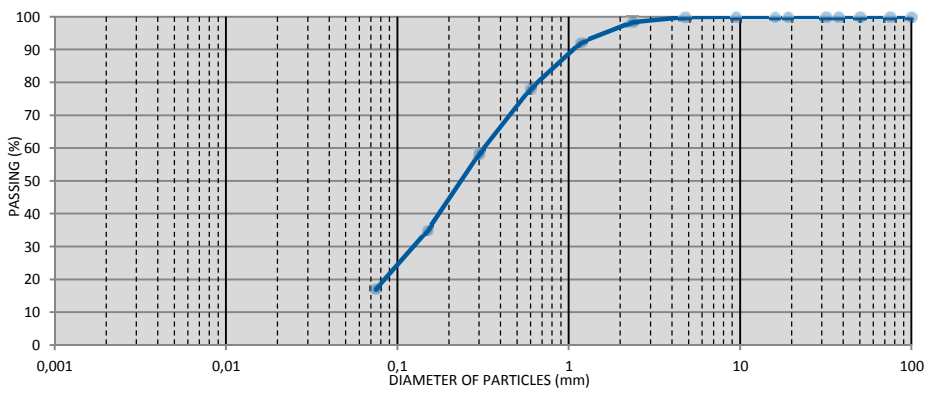
Material :	Natural Soil	Origin :	Monitoring Well
Type :		Location :	MW3S-cuttings 18'
Use :	Geotechnical Study		
Sampled by : Marc Mazerole	Date : 12-19-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**100**			
31,5	**100**			
19	**100**			
16	**100**			
9,5	**100**			
4,75	**100**			
2,36	**98**			
1,18	**92**			
0,600	**78**			
0,300	**58**			
0,150	**35**			
0,075	**17**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :		Unified classification :
Gravel:	0,1 %	D_{30} :	0,130	Description :
Sand:	82,8 %	D_{60} :	0,329	Sand, a little silt and clay, traces of gravel
Silt & Clay:	17,0 %	C_c :		
	%	C_u :		

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-180
		EMISSION DATE :	01-24-2018

MATERIAL :

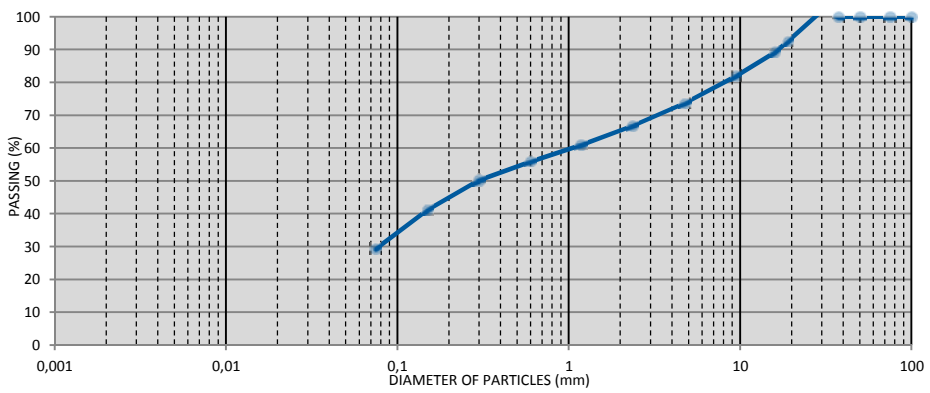
Material :	Natural Soil			Origin :	Monitoring Well
Type :				Location :	MW3D-0'-2'
Use :	Geotechnical Study				
Sampled by :	Marc Mazerole	Date :	12-19-2018	Received on :	01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
100	**100**			
75	**100**			
50	**100**			
37,5	**100**			
31,5	**103**			
19	**93**			
16	**89**			
9,5	**82**			
4,75	**74**			
2,36	**67**			
1,18	**61**			
0,600	**56**			
0,300	**50**			
0,150	**41**			
0,075	**29**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0	%	D_{10} :		Unified classification :
Gravel:	26,4	%	D_{30} :	0,079	Description :
Sand:	44,3	%	D_{60} :	1,079	Silty & clayey , gravelly sand
Silt & Clay:	29,3	%	C_c :		
		%	C_u :		

BY SEDIMENTOMETRY

Diameter (mm)	Passing (%)

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Nicolas Ouellet

SOILS AND GRANULAR MATERIALS
LABORATORY TESTING

CLIENT :	Anaconda	PROJECT No. :	171-16980-00
SITE :	Goldboro	LABORATORY SAMPLE No.:	G18-181
		EMISSION DATE :	31-01-2018

MATERIAL :

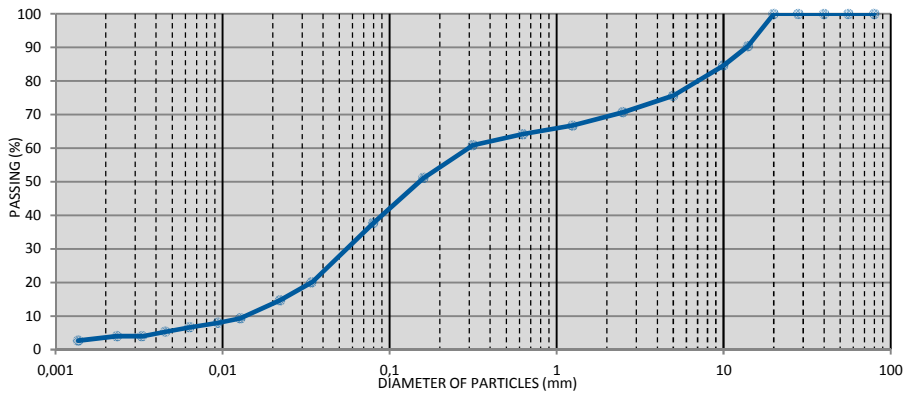
Material :	Natural Soil	Origin :	Monitoring Well
Type :		Location :	MW3D-2'-4'
Use :	Geotechnical Study		
Sampled by :	Marc Mazerole	Date : 12-19-2018	Received on : 01-06-2018

GRANULOMETRIC ANALYSIS

BY SIEVING (BNQ 2501-025)

Diameter (mm)	Passing (%)	Requirements Min	Requirements Max	N.Conf.
112				
80	**100**			
56	**100**			
40	**100**			
28	**100**			
20	**100**			
14	**90**			
10	**85**			
5	**76**			
2,5	**71**			
1,25	**67**			
0,630	**64**			
0,315	**61**			
0,160	**51**			
0,080	**38**			

GRANULOMETRIC CURVE



DESCRIPTION

Cobble:	0,0 %	D_{10} :	0,014	Unified classification :
Gravel:	24,4 %	D_{30} :	0,060	Description :
Sand:	37,9 %	D_{60} :	0,301	Silty , gravelly sand, traces of clay
Silt:	34,6 %	C_c :	0,9	
Clay:	3,1 %	C_u :	21,6	

BY SEDIMENTOMETRY (BNQ 2501-025)

Diameter (mm)	Passing (%)
0,0341	**20,0**
0,0221	**14,7**
0,0128	**9,3**
0,0094	**8,0**
0,0064	**6,7**
0,0045	**5,3**
0,0033	**4,0**
0,0023	**4,0**
0,0014	**2,7**

VARIOUS TESTS

TESTS	RESULTS	REQUIREMENTS

PROCTOR TEST

Method :	
Maximum dry density :	
Optimum water content :	

REMARKS :

Prepared by : Sonia Bagué

Verified by : Abdelwahab Kamel Ing.

APPENDIX

B-3 *PIEZOMETRY TABLE*

TABLE

Piezometry
Goldboro Mines - Hydrogeological Investigation
Project No.: 171-16980

Borehole / Monitoring Well ID	MTM Zone 4		Soil Elevation (m)	GW elevation 16.12.2018	Casing Dip (°)	Well Elevations			December 7-8, 2017		December 15, 2017		December 16,2017		December 17-19, 2017	
	Easting (x)	Northing (y)				Exposed Well Length (m) @ angle	Ground Elevation-MTM (m)*	Top of Steel/PVC Casing Elevation (m) *Adjusted for inclination*	Depth to Water Table from top of casing (m) @ angle	Water Table Elevation (m) *Adjusted for Inclination*	Depth to Water Table from top of casing (m) @ angle	Water Table Elevation (m) *Adjusted for Inclination*	Depth to Water Table from top of casing (m) @ angle	Water Table Elevation (m) *Adjusted for Inclination*	Depth to Water Table from top of casing (m) @ angle	Water Table Elevation (m) *Adjusted for Inclination*
BR-17-MET-1	293457,11	5007012,97	64,93	64,02	45	0,390	64,93	65,21	1,53	64,13		-	1,68	64,02		-
BR-17-MET-2	293462,91	5007018,54	64,69	64,69	90	0,150	64,69	64,84	0,10	64,74		-	0,15	64,69		-
BR-17-MET-3	293514,67	5007028,63	65,76	61,47	90	0,330	65,76	66,09	3,09	63,00		-	4,62	61,47		-
BR-17-MET-4	294143,60	5006853,25	51,65	51,47	45	0,670	51,65	52,12		-		-	0,92	51,47		-
BR-17-MET-5	293947,65	5006905,68	59,88	55,06	50	0,400	59,88	60,19	6,69	55,06		-		-		-
BR-17-MET-6	293966,71	5006740,19	54,37	54,54	67	0,520	54,37	54,85		-		-	0,33	54,54		-
BR-17-MET-7**	294354,05	5006608,27	54,06	54,24	67	0,100	54,06	54,15		-		-	-0,10	54,24		-
BR-17-MET-8	293959,77	5006821,02	56,00	54,85	65,5	0,00	56,00	56,00		-		-	1,26	54,85		-
BR-17-MET-9	293959,93	5006866,59	56,09	54,82	67	0,60	56,09	56,64		-		-	1,99	54,82		-
BR-17-MET-10	293946,49	5007012,92	58,98	58,60	60	0,18	58,98	59,14		-		-	0,62	58,60		-
BR-17-MET-11	293899,40	5007016,56	61,81	60,10	60	0,19	61,81	61,97		-		-	2,16	60,10		-
MW-1	5006946,75	293598,89	59,99		90	0,95	60,62	61,57		-	1,92	59,65	1,90	59,67	2,1	59,47
MW-2	5006964,94	293992,91	55,56	54,55	90	1,20	55,65	56,85		-	N/A	N/A	N/A	N/A	2,3	54,55
MW-3D	5006655,03	293955,61	52,37	48,24	90	1,05	51,19	52,24		-	N/A	N/A	N/A	N/A	4	48,24
MW-3S*	5006657,01	293955,85	52,67		90	1,04	***51,35***	52,39		-	N/A	N/A	N/A	N/A	4,07	48,32

Survey data provided by Anaconda Mining Inc.
***MW-3S ground elevation data estimated from field observations/measurements**

APPENDIX

C

FRACTURE ZONE EVALUATION REPORTS

APPENDIX

C-1 *FRACTURE ZONE ANALYSIS TABLE*

Appendix C - Table: Analysis of Fracture Lengh and Frequency - BR-17-MET-2

Logging Depth Interval (mbgs)	Lenght of Evaluated Zone (m)	Percentage fractured within length analyzed (%)	Fractured Interval Top (mbgs)	Fractured Interval Bottom (mbgs)	Fractured Interval Thickness (m)	Packer Test Interval (mbgs)	Permeability (m/s)	Stratigraphy
9.00 - 32.52	23.52	20%	10.10	11.70	1.60	10.22 - 13.62	9E-07	7.8 m - 18.5 m: GREYWACKE, light to dark grey in colour, very fractured and iron weathering on all surfaces. Sizes rang from 1 cm to 15 cm in lengths. Some sections pitted and weathered.
			13.20	15.40	2.20	13.25 - 16.65	7E-08	
					-	18.64 - 22.04	1E-07	18.5 m - 23.4 m: GREYWACKE, medium grey, fractured, fresh without weathering sizes range from 1 cm to 6 cm in size Thinly bedded, fine grained. R5/W1
			21.80	22.00	0.20	21.440 - 24.84	9E-08	
			29.50	30.20	0.70	29.26 - 32.66	8E-08	29.3 m - 35.15 m: ARGILLITE, fresh, more natural fracturing, some chlorite present on some bedding planes. Cleavage subparallel to core axis noted. Chlorite infill can be scratched with a knife. R4/W1
			31.00	31.10	0.10	29.26 - 32.66	8E-08	
32.52 - 74.52	42.00	10%			-	-	-	35.15 m - 45.8 m: Succession of mostly competent layers of alternating greywacke and argillite. No fractures or shear zones of note observed.
			46.20	46.70	0.50	46.28 - 49.66	6E-08	45.8 m - 46.64 m: ARGILLITE, medium grey, fine grained, minor chlorite alteration Contact with greywacke following is abrupt, yet well healed. Some sericitic alteration of micaceous minerals.
			48.10	48.40	0.30	46.28 - 49.66	6E-08	46.64 m - 48.70 m: GREYWACKE, medium grey, fine grained and thinly laminated Bedding at 10 degrees from core axis with some talc infill. R5/W1. Bedding cleavage as close as 2 cm apart.
			48.70	49.00	0.30	46.28 - 49.66	6E-08	48.7 m - 49.1 m: GREYWACKE fractured zone, unweathered/fresh rock. Very broken up and angular pieces. Possible shear zone.
			50.10	50.90	0.80	50.26 - 53.66	2E-08	50.2 m - 53.1 m: ARGILLITE, fault or shear zone. Locally altered to chlorite/graphite at 50.30, 50.45, 50.50, 50.80, 51.9 52.66 and 52.90. Shear zones are very black and can be scraped with fingernail. 5 cm thick. Shear zones appear to be subhorizontal (15 degrees off horizontal)
			52.20	52.80	0.60	50.26 - 53.66	2E-08	
					0.00	-	-	53.1 m - 62.5 m : QUARTZ VEIN, massive with chloritic and massive intrusions as well as sulphides (arseno and pyrite). Massive texture. Broken up but may be due to britle nature of quartz. Some country rock (argillite) within quartz veins.
			62.60	62.80	0.20	-	-	62.55 - 65.00: ARGILLITE, medium grey, very fine grained with finely laminated bedding. Bedding is healed Chloritic alteration on some bedding surfaces.
			67.10	67.40	0.30	-	-	65.00 m - 67.60 m: GREYWACKE with some solution cleavage fractures and calcite infilling on fractures at 70 degrees to core axis. Some sulphide mineralization approaching quartz vein. R5/W1
			70.80	72.20	1.40	69.64 - 73.04	1E-07	71.0 m - 71.6 m: ARGILLITE, contact at 15 degrees off core axis. Medium grained with some calcite infilling on bedding planes. Solution fractures. R4/W1 71.6 m - 74.10 m: GREYWACKE, medium grey with some quartz veining parallel to bedding. Some solution fractures
74.52 - 196.5	121.04	1.4%			-	-	-	71.6 m - 94.7 m: Succession of mostly competent layers of alternating greywacke and argillite. Quartz veins were observ at between 74.1 m - 74.6 m, 93.8 m - 94.2 m and 94.4 m - 94.7 m.
			95.00	95.60	0.60	93.64 - 97.04	9E-08	94.7 m - 95.9 m: ARGILLITE, some alteration and shear zone at 95 to 95.4 with chloritic alteration and presence of clay mineralization. Very weak and can be scraped with fingernail. R3/W2
			106.80	107.20	0.40	105.66 - 109.06	7E-08	97.4 m - 116.6 m: ARGILLITE, bedding planes are poorly developed and concordant joint set is not visible. Fractures at 107, 109 and 113 m for 10 cm, R4/W1. Bedding varies from 10 to 30 degrees core axis. SAMPLE BR-17-MET-2 #5 at 114.62 m, 93 Mpa
			113.70	113.80	0.10	-	-	
					0.00	-	-	116.60 m - 183.50 m: Succession of mostly competent layers of alternating greywacke and argillite.
			184.90	185.00	0.10	-	-	183.50 m - 185.20 m: QUARTZ VEIN, milky white and massive.
			187.45	187.55	0.10	-	-	187.50 m -188.00 m: ARGILLITE dark grey, fine grained. Gouge at upper contact with quartz vein for 10 cm. Bedding plane is near vertical. R4/W1
					-	-	-	188.00 m - 194.20 m: Succession of mostly competent layers of alternating greywacke and argillite. Some massive quartz veins observed.
			194.10	194.50	0.40	-	-	194.20 m - 197.00 m: GREYWACKE medium grey with well developed solution bedding planes with spacing of approximately 1-2 cm at 30 degrees to core axis.

Appendix C - Table: Analysis of Fracture Lengh and Frequency - BR-17-MET-3

Logging Depth Interval (mbgs)	Lenght of Evaluated Zone (m)	Percentage fractured within length analyzed (%)	Fractured Interval Top (mbgs)	Fractured Interval Bottom (mbgs)	Fractured Interval Thickness (m)	Packer Test Interval (mbgs)	Permeability (m/s)	Stratigraphy
9.00 - 29.20	20.20	21%	-	-	-	-	-	9.00 m - 12.00 m: ARGILLITE, light grey with iron alteration on surfaces. Bedding is near vertical. Quartz vein at 9.8, brittle shear zone at 10 m for 20 cm. No open joints/fractures identified.
			12.7	13.6	0.9	12.00 - 14.22	0	12.00 m - 14.45 m: GREYWACKE, medium grey with fine grains and thinly laminated bedding. R5. Surfaces are fresh/unweathered with arsenopyrite mineralization
			17.6	19.2	1.6	16.00 - 19.40	0	16.6 m - 20.3 m: ARGILLITE, medium grey. Small shear zones with chloritic/graphitic alteration at 19.7, 19.2, 19.50 m for 10 cm. R4/W1. Sericitic alteration locally
			27.7	28.4	0.7	27.00 - 30.40	1E-06	20.3 m -29.05 m: ARGILLITE, medium grey. Bedding at 30 degrees to core axis. Elongated sulphide mineralization throughout, parallel to bedding.
			28.6	29.2	0.6	27.00 - 30.40	1E-06	29.05 m - 30.05 m: ARGILLITE, Fractured zone/shear zone with pieces up to 10 cm, but typically a few cm in size. Chloritic alteration and possible clay infillings (,1mm) R4, W2
29.20 - 55.40	26.20	5%	35	35.1	0.1	-	-	33.00 m - 35.10 m: GREYWACKE, light grey with fine grains and laminated bedding Bedding is not well developed. Flat lying sub parallel fracture present. 35.10 m - 35.40 m: QUARTZ VEIN, light grey in colour. Massive without any features or fractures.
			40	40.2	0.2	-	-	37.00 m - 45.40 m: ARGILLITE R4/W1 without any alteration or weathering poorly developed bedding planes that are well healed SAMPLE BR-17-MET-4 #3 @44.24 m
			47.4	48.1	0.7	46.65 - 50.05	2E-07	46.0 m - 48.75 m: ARGILLITE, R4/W1, medium grey and fine grained with developed bedding planes, well healed at 30 degrees to core axis 48.75 m - 49.35 m: QUARTZ VEIN with shear/gouge zone in middle with altered chlorite than can be scraped with knife. Milky white and without texture.
			-	-	-	-	-	48.75 m - 55.13 m: Succession of mostly competent layers of alternating argillite and quartz. Shear zone observed in quartz layer between 48.75 m and 49.35 m.
			55.2	55.4	0.2	54.80 - 58.20	3E-07	55.13 m - 56.8 m: QUARTZ VEIN milky white quartz massive without structure Light grey to black inclusions. Without apparent structure
55.4 - 72.00	16.60	0%	-	-	-	-	-	56.80 m - 72 m: Succession of mostly competent layers of alternating argillite and greywacke. A quartz vein observed between 58.52 m and 59.00 m. Chloritic alteration in proximity to the quartz vein. Surface can be scraped with knife. Brittle angular rock alteration with exception of minor chloritic infill on some joints between 66.00 m - 70.50 m. End of borehole 72 m.

APPENDIX

C-2 *DGI ACOUSTICS AND OPTICAL TELEVIEWER PLOTS*

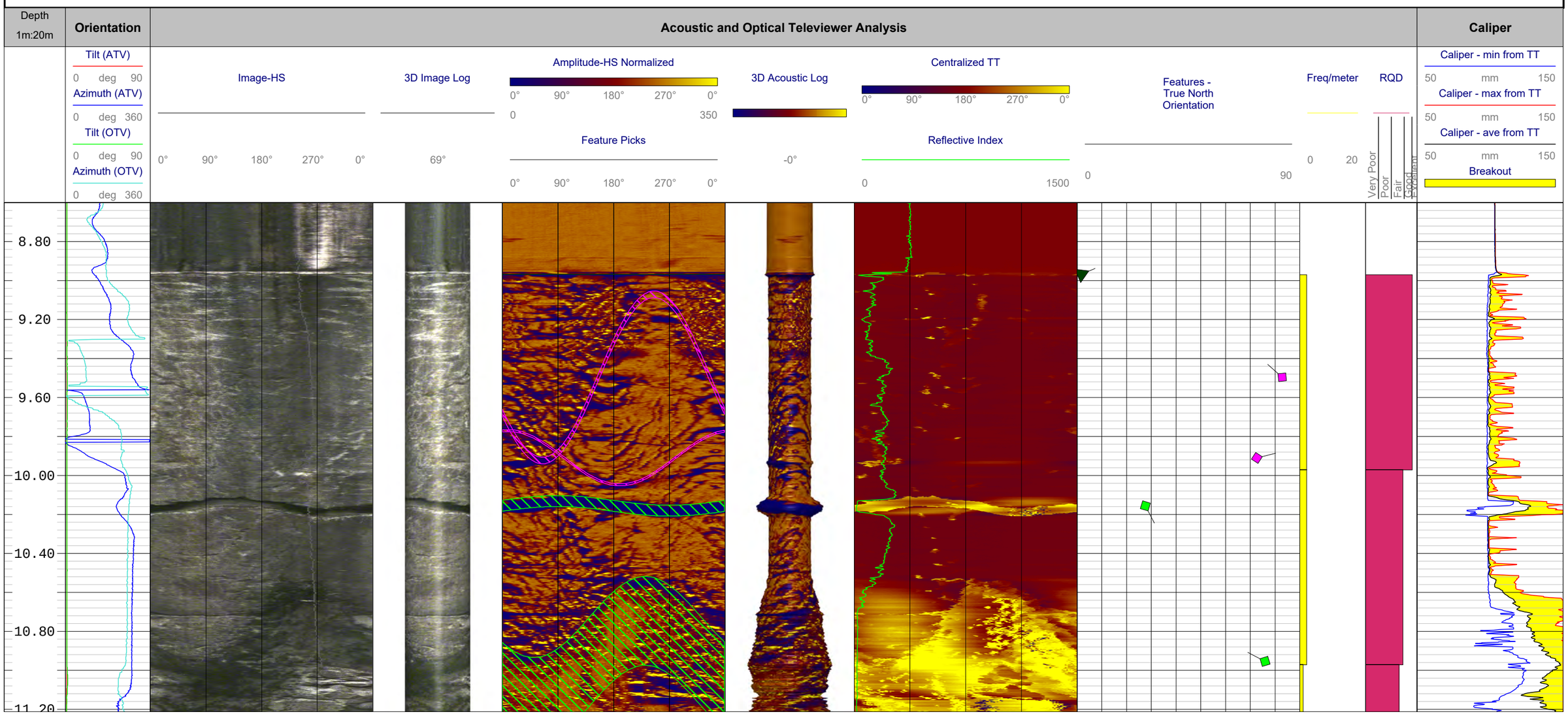
ACOUSTIC and OPTICAL TELEVIEWER PLOT

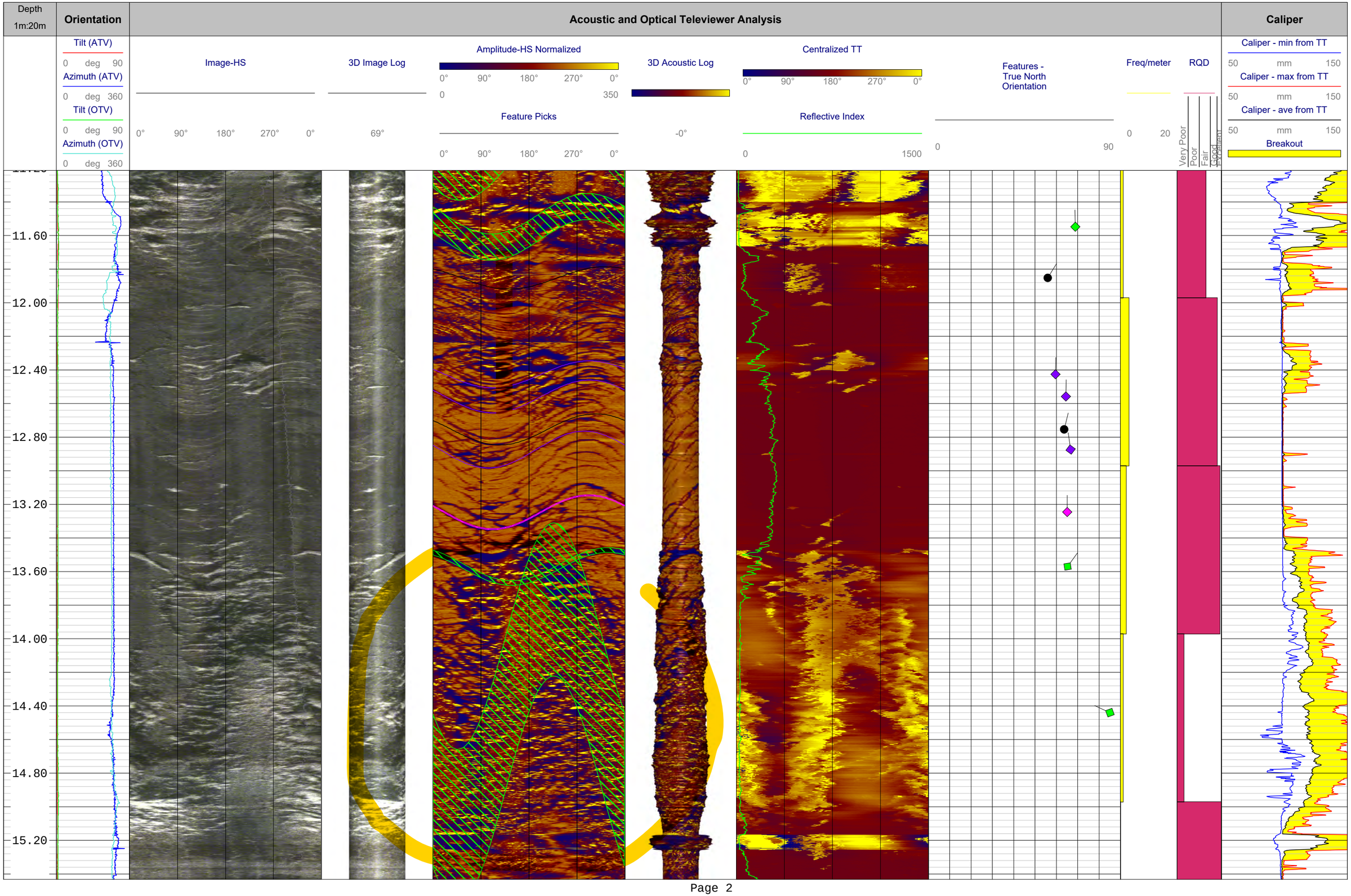
DGI GEOSCIENCE INC.

Company:	Anaconda	**Total Depth:**	197 m	**UTM X (Easting):**	293461	**Notes:**
Hole ID:	BR-17-02	**Surveyed Depth:**	195 m	**UTM Y (Northing):**	5007020	
Acquisition date(s):	Oct. 14, 2017	**Hole Diameter:**	HQ	**UTM Z (Elevation):**	5000	
Field Personnel:	R. Morrison, C. Loft	**Hole Type:**	Core			
Legal Location:	Nova Scotia	**Casing Depth:**	8.97 m			
Survey Day(s):	1	**Fluid Type:**	Water			

LEGEND - STRUCTURE TYPE

Btm of Casing | Major Open Joint/Fracture | Partially Open Joint/Fracture | Minor Joint/Fracture | Bedding/ Banding/ Foliation | Vein - Group 1 | Lithology Contact | Filled Joint/Fracture

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Azimuth (OTV)
0 deg 360
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3D Image Log
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Amplitude-HS Normalized
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Feature Picks
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Centralized TT
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Reflective Index
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Features - True North Orientation
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Freq/meter
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RQD
Very Poor
Poor
Fair
Good
Excellent
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Caliper - max from TT
50 mm 150
Caliper - ave from TT
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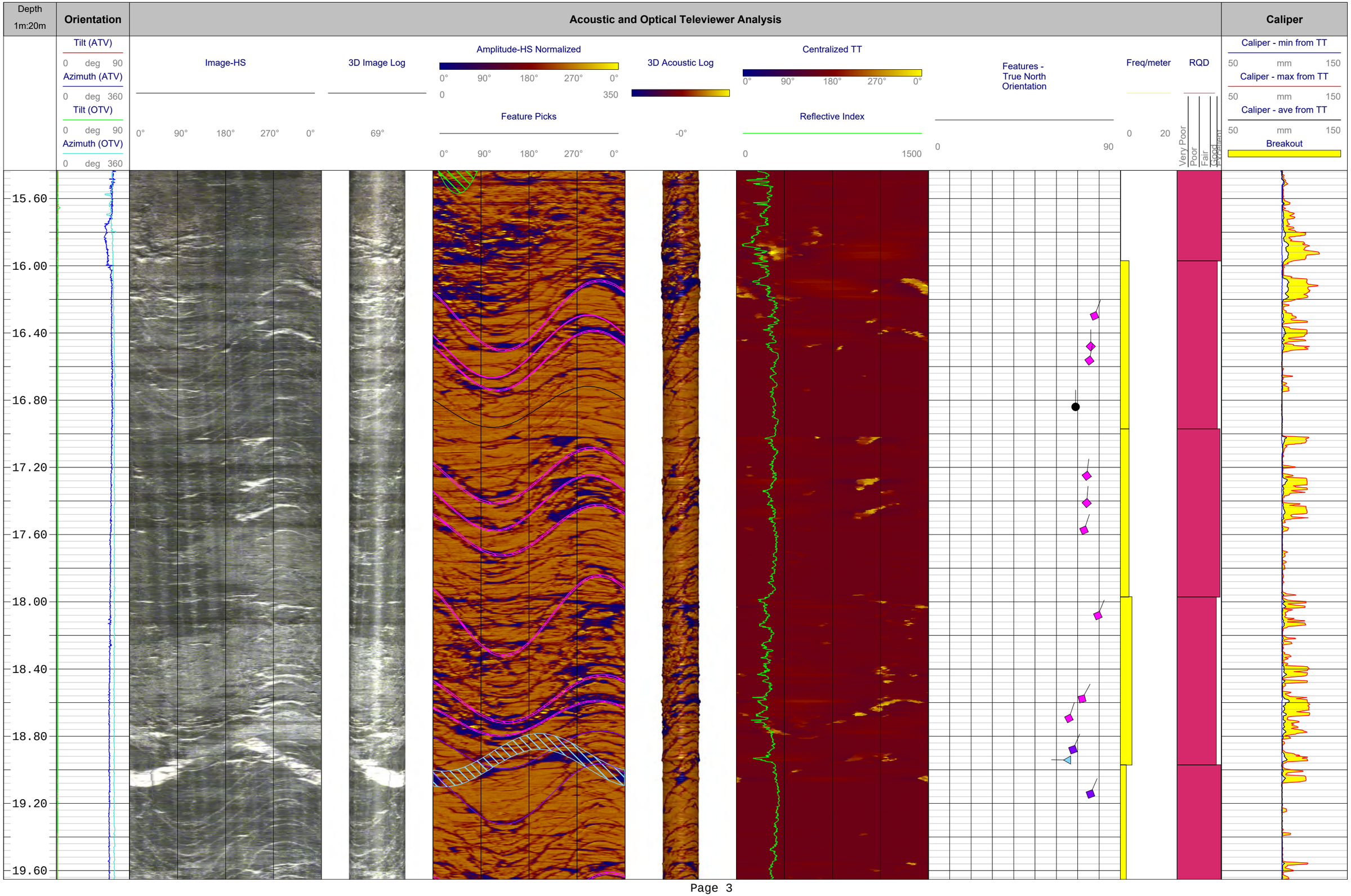
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Reflective Index
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Features - True North Orientation
0 90
Freq/meter
0 20
RQD
Very Poor
Poor
Fair
Good
Excellent
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Caliper - max from TT
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Caliper - ave from TT
50 mm 150
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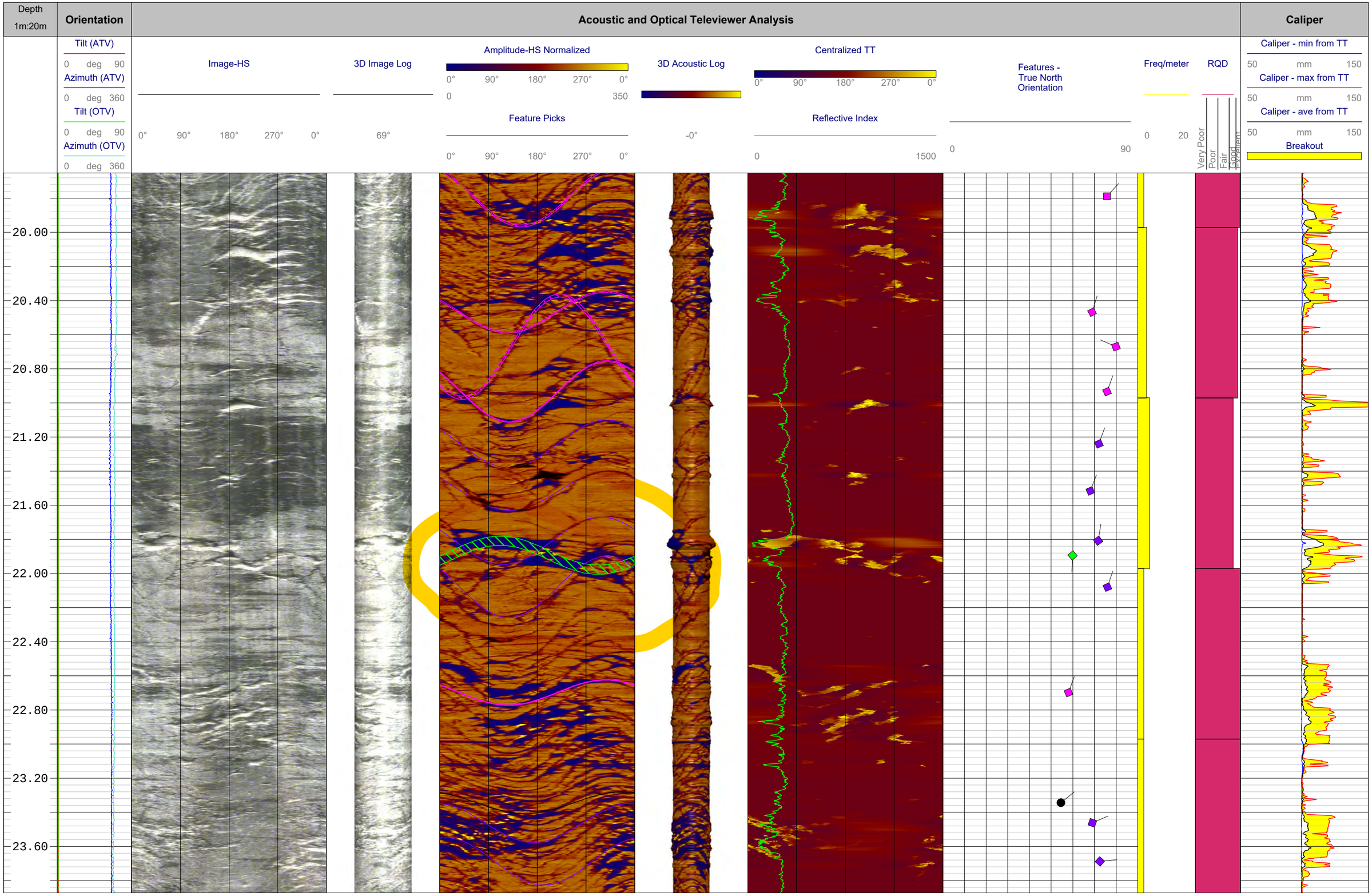
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Freq/meter
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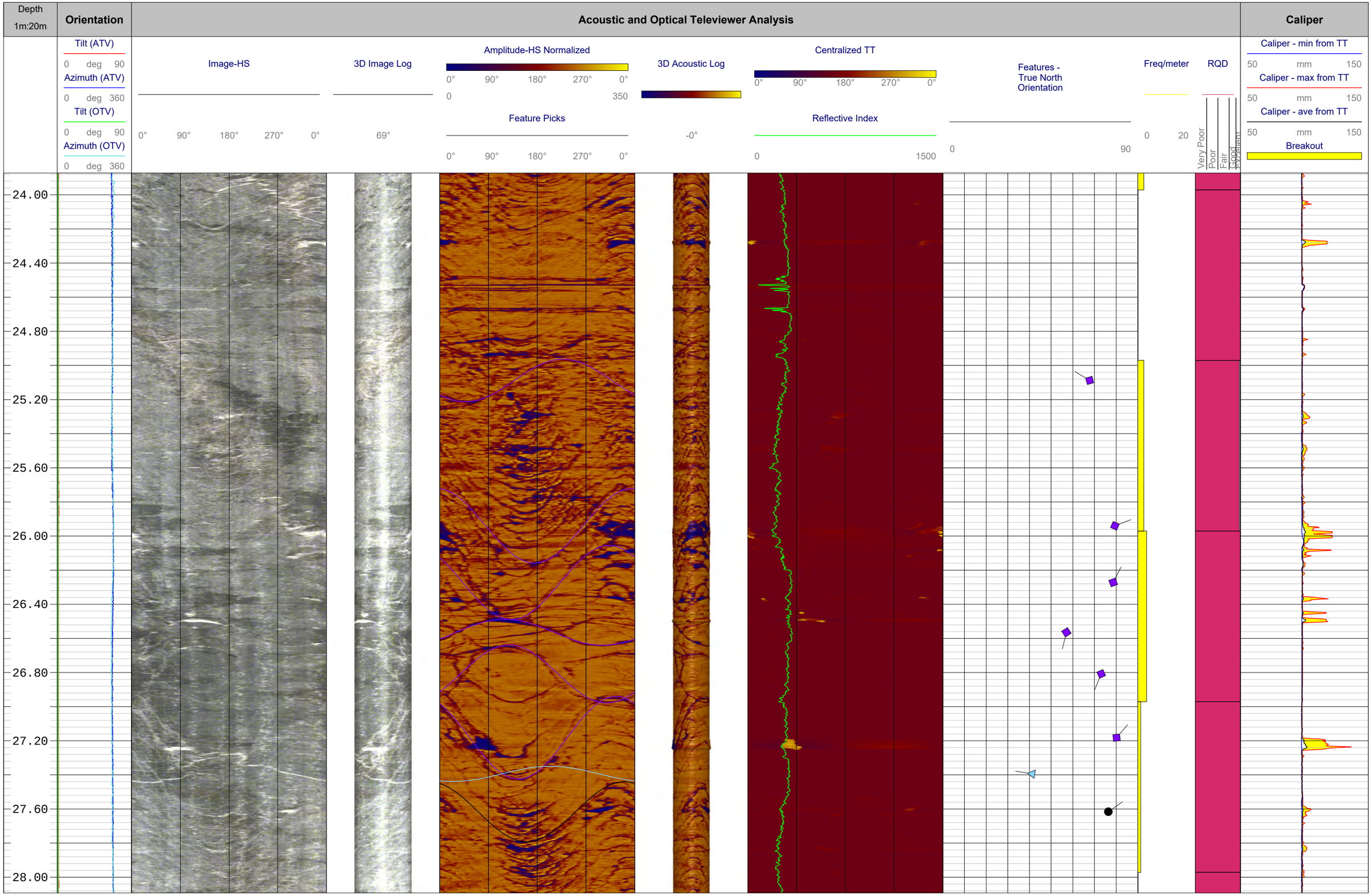
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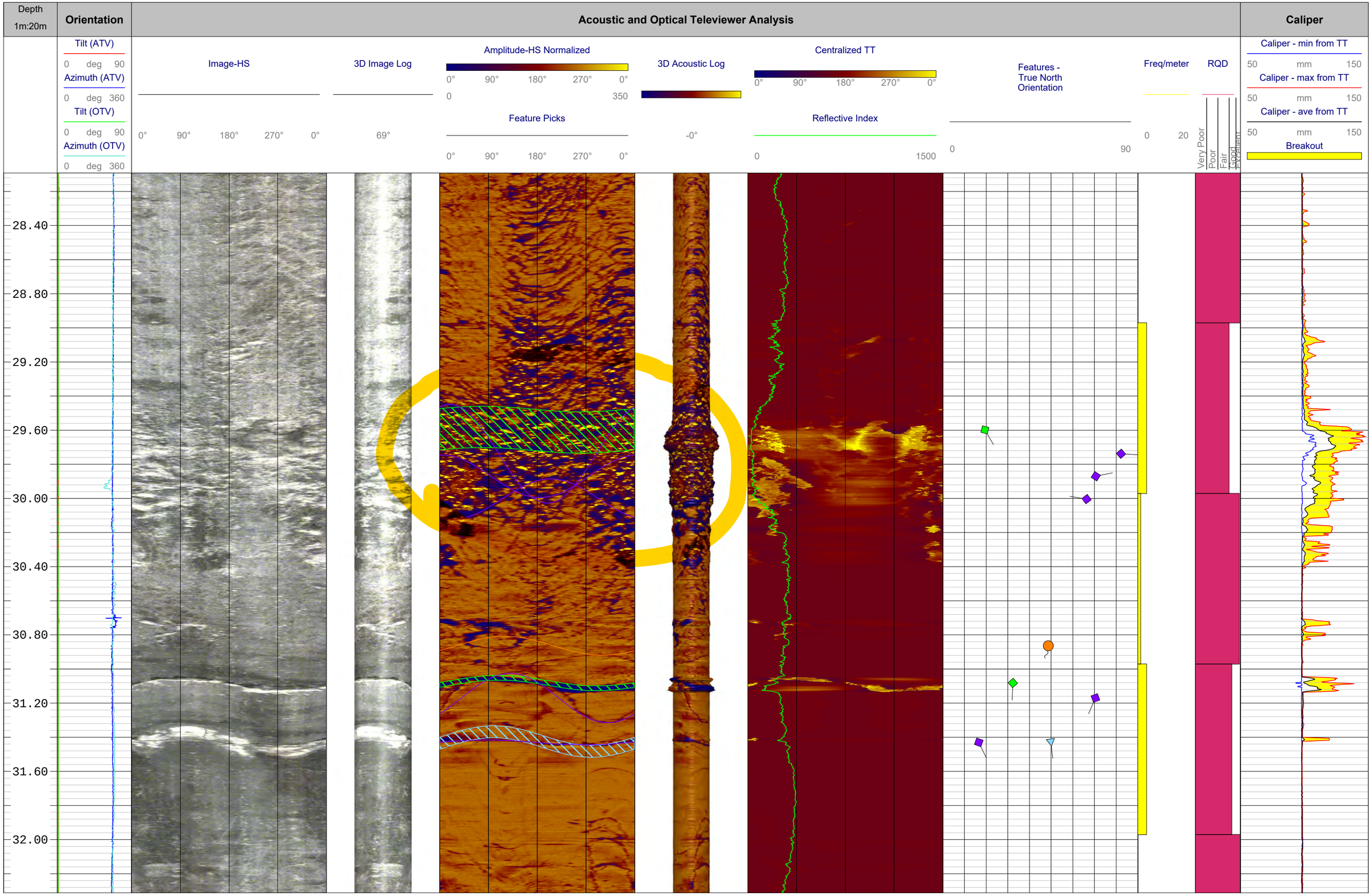
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Freq/meter
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Caliper - max from TT
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Caliper - ave from TT
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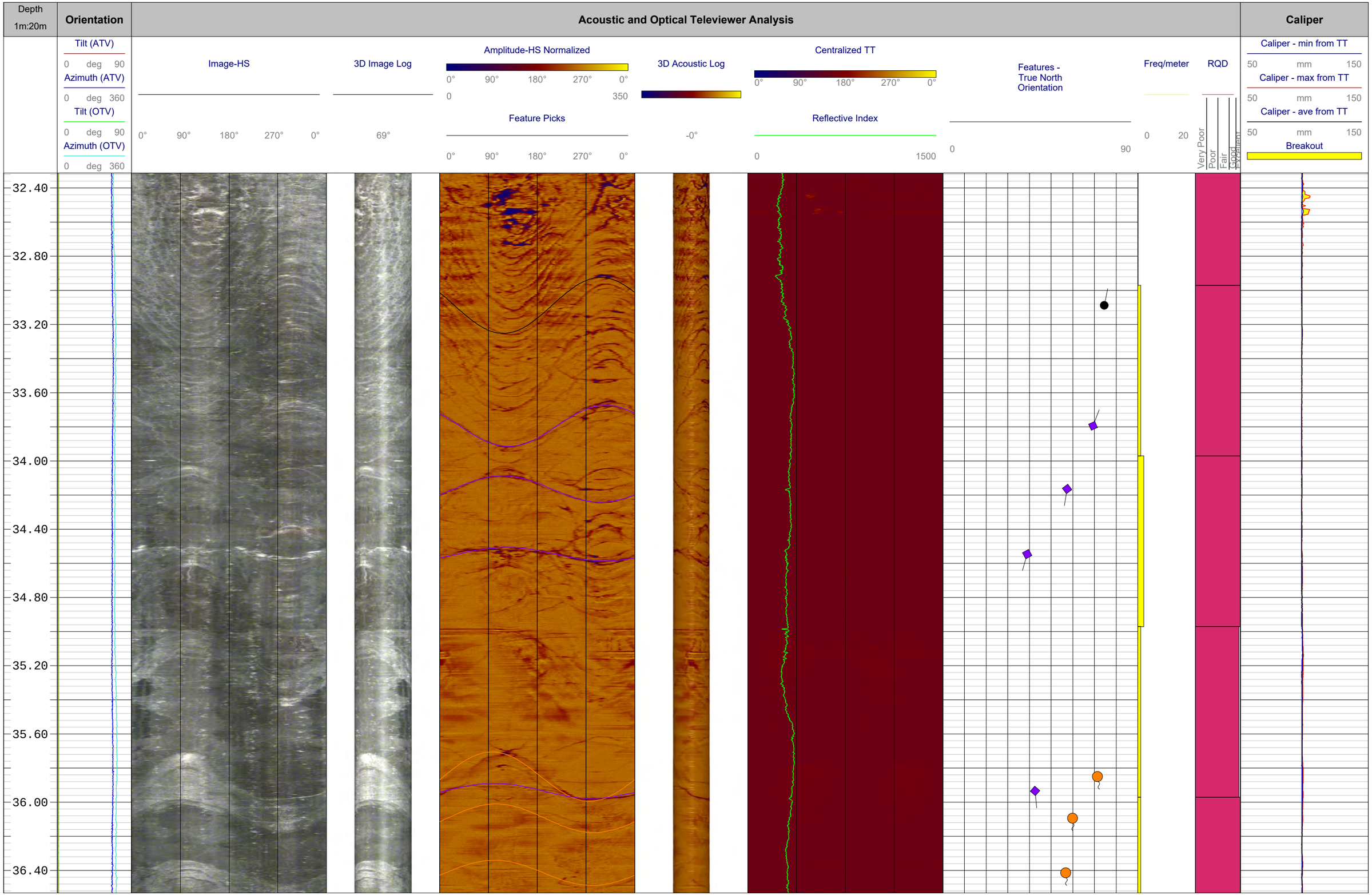
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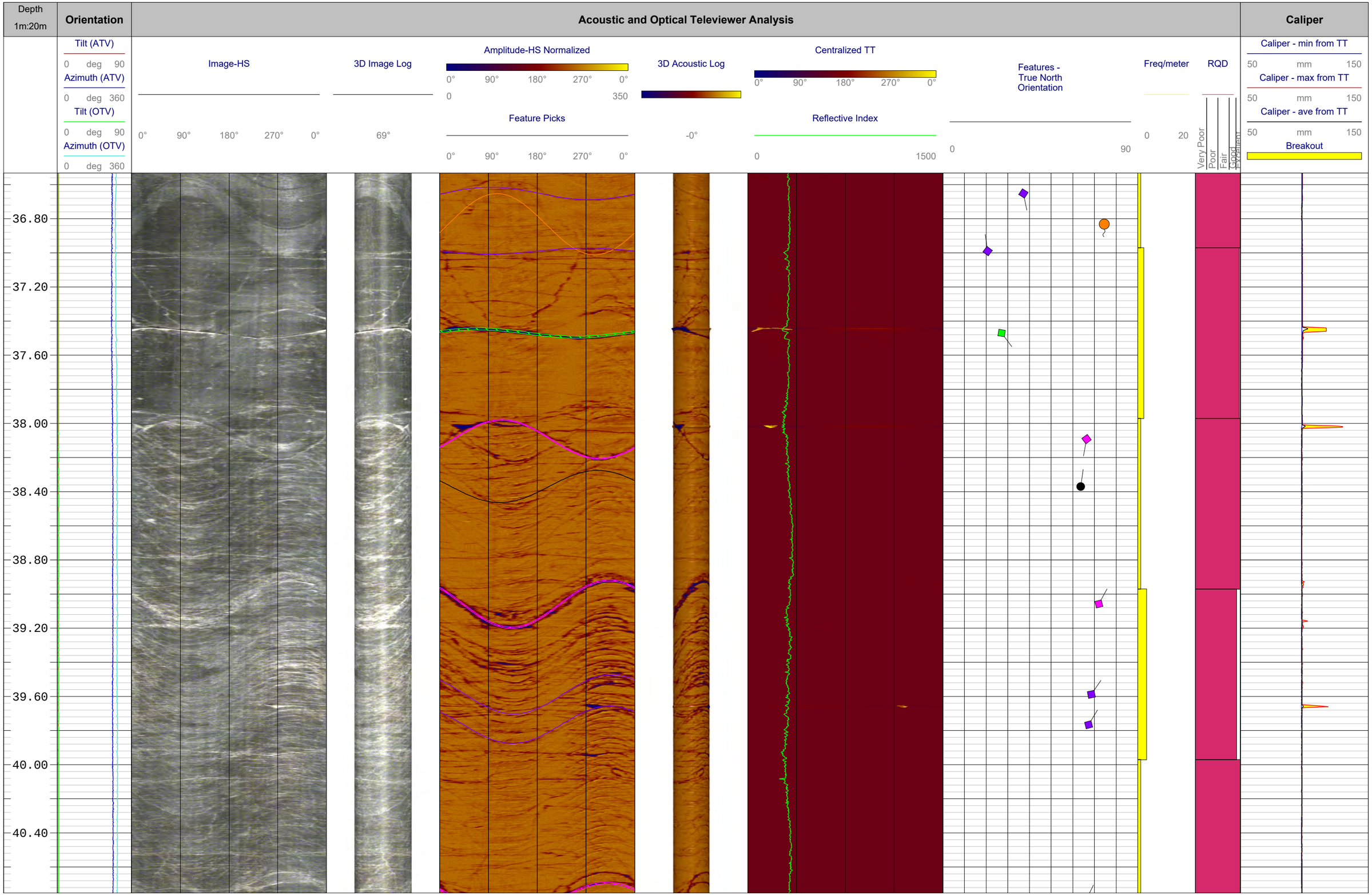
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Freq/meter
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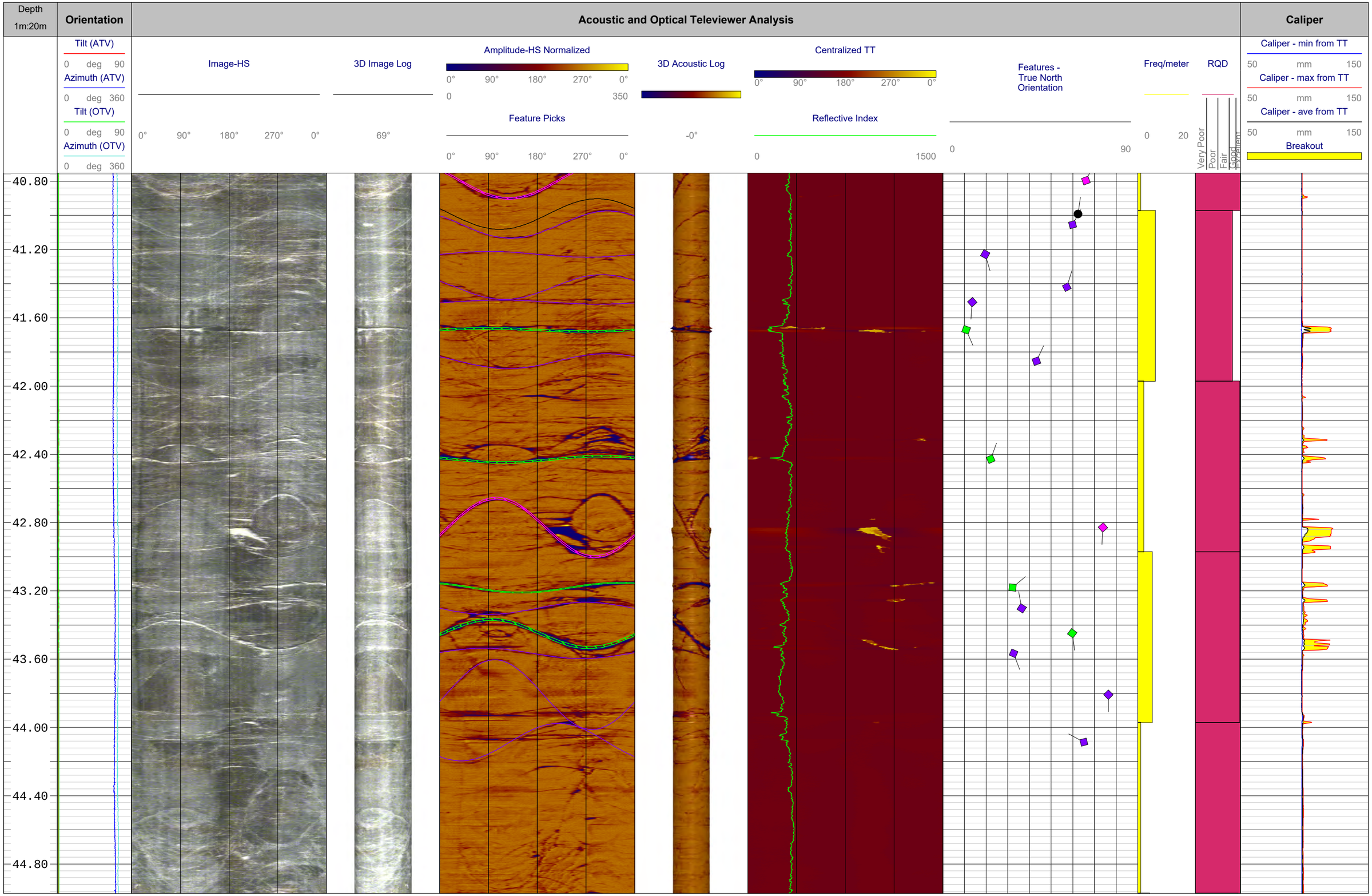
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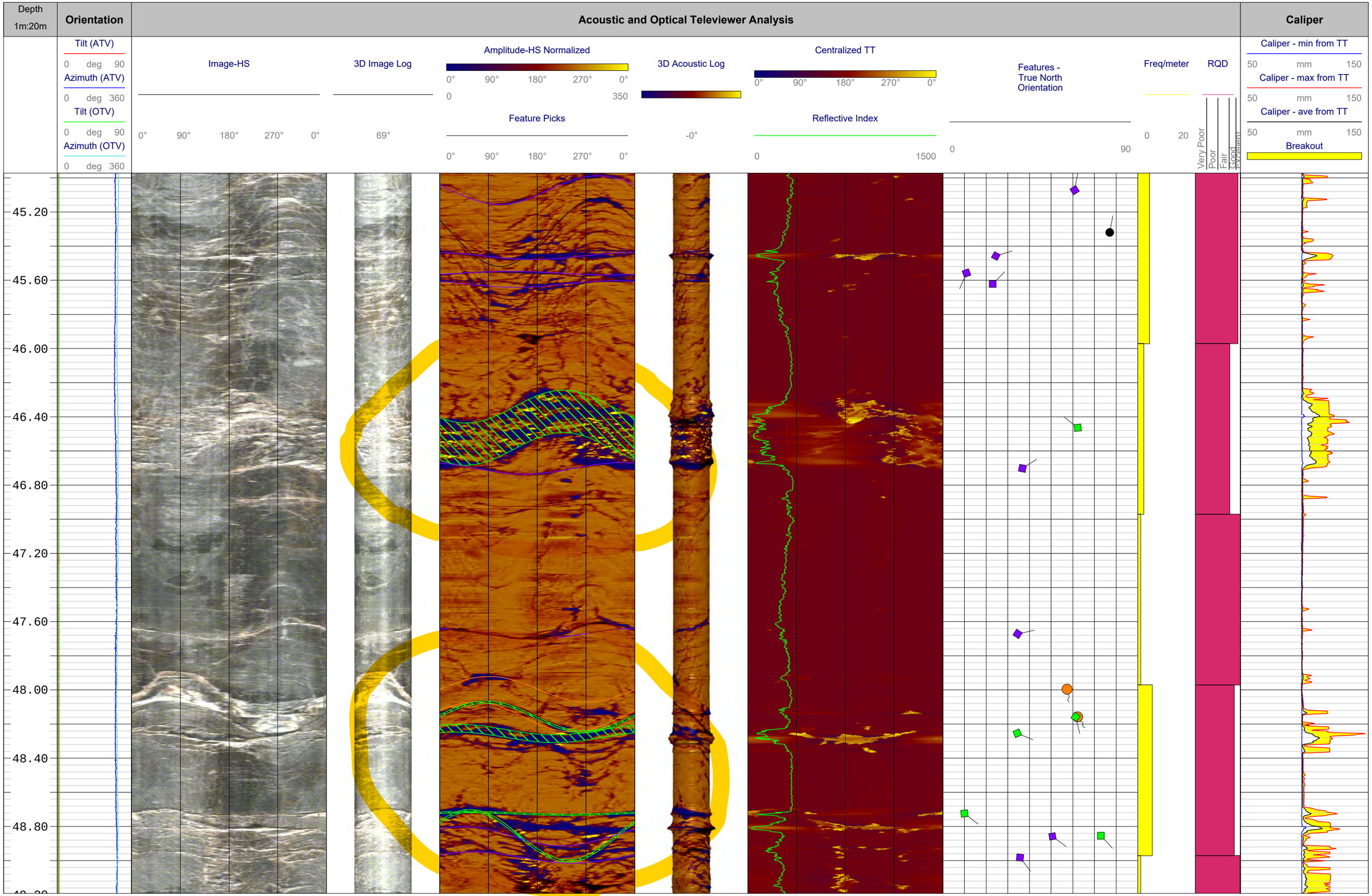
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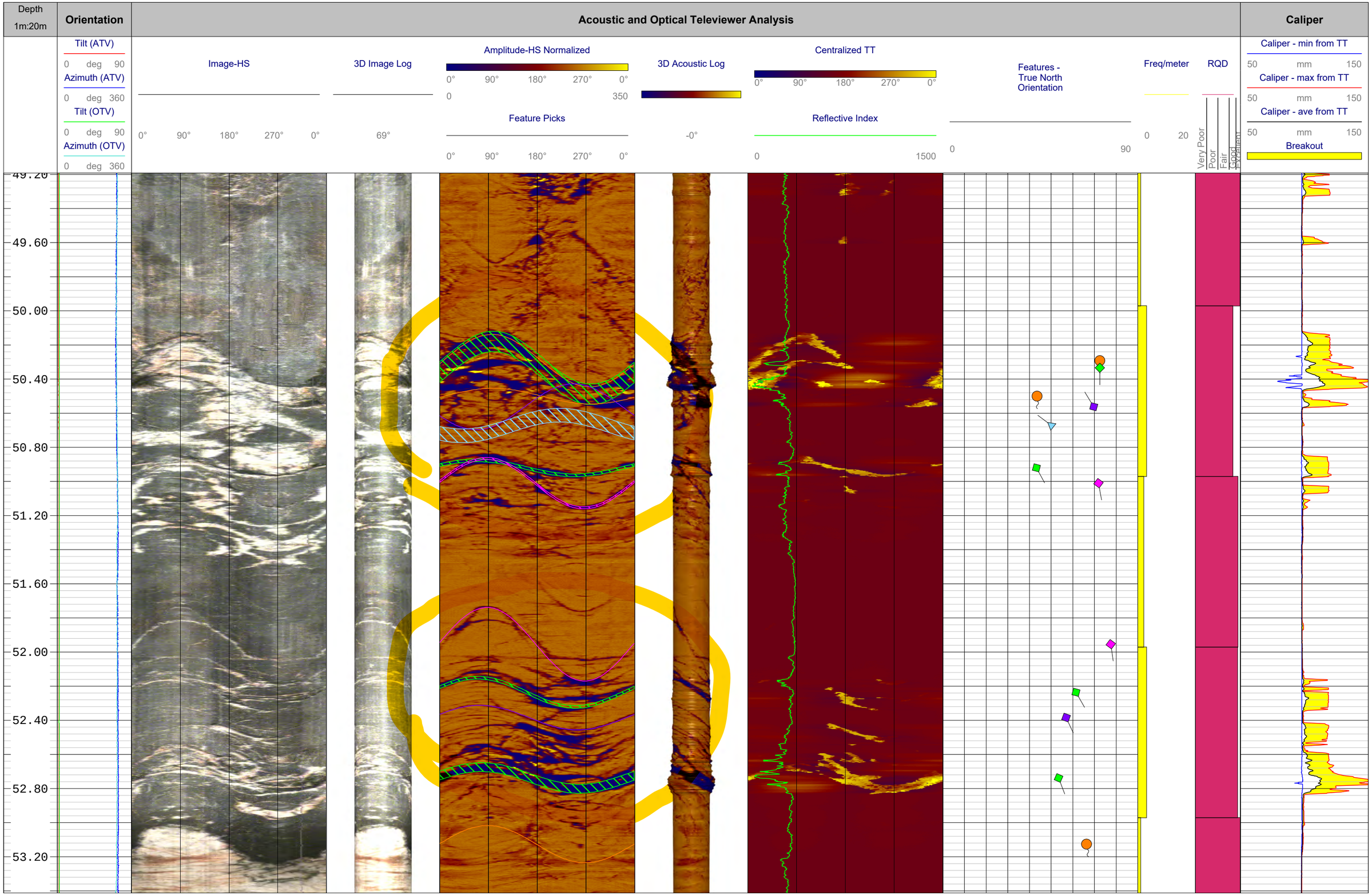
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Reflective Index
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Features - True North Orientation
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Freq/meter
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Poor
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Good
Excellent
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Caliper - ave from TT
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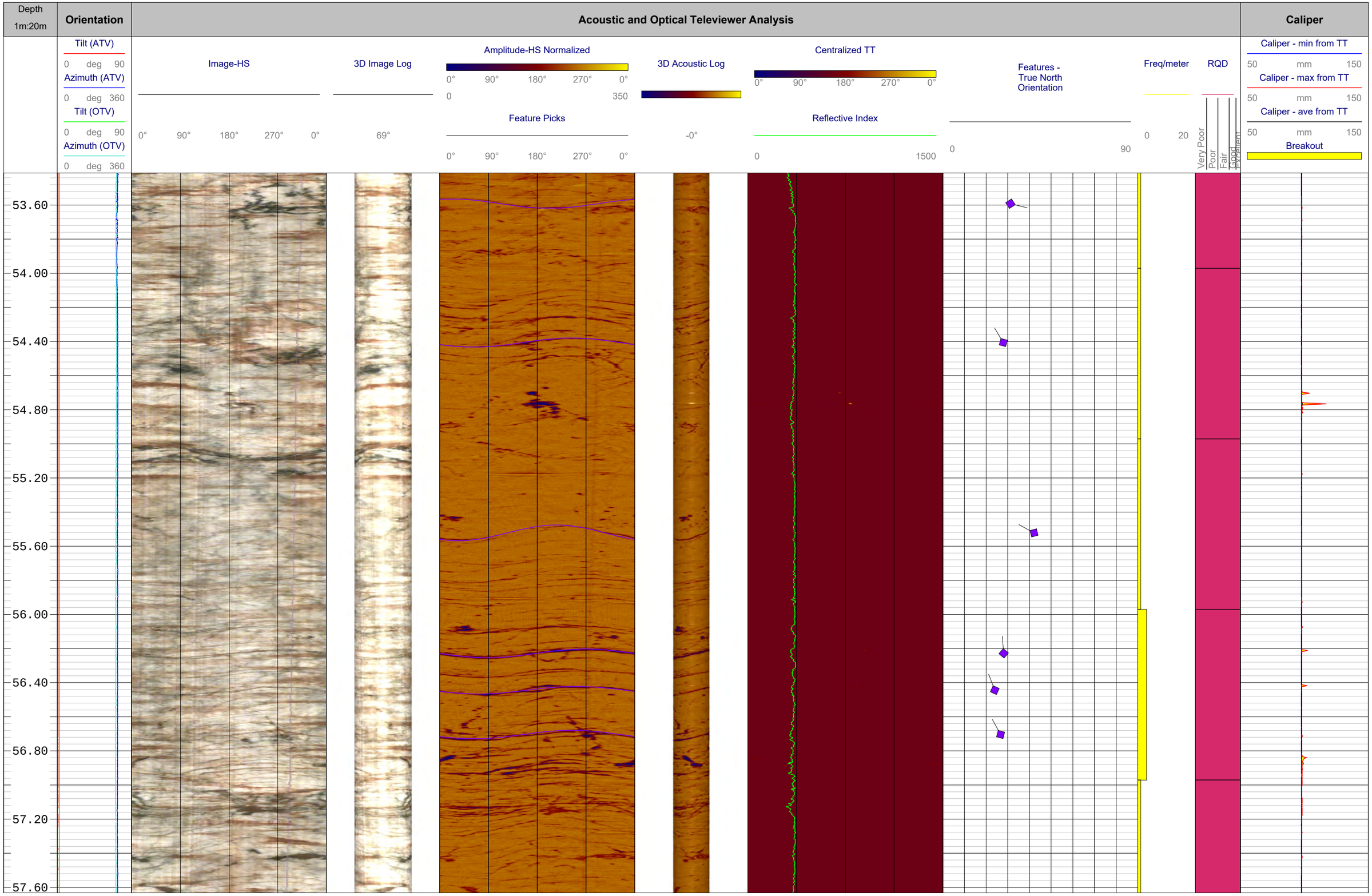
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Poor
Fair
Good
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