

Appendix F

Geotechnical Investigations Report



Waitakere Coastal Communities Landslide Risk Assessment




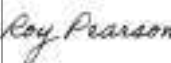

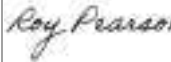
Appendix F – Geotechnical Investigations Report - Muriwai

Auckland Council

15 May 2024

→ **The Power of Commitment**



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F1. Introduction

F1.1 Purpose of this report

GHD has been engaged by Auckland Council (AC)¹ to carry out landslide risk assessments and to provide associated landslide risk management advice and geotechnical investigations in the Waitakere area, specifically for the residential areas of Muriwai, Piha and Karekare.

One of the project work items is to conduct a geotechnical borehole investigation to understand the subsurface conditions in the vicinity of the 80 m-high escarpment to the east of Muriwai township that experienced damaging landslides in February 2023. This report is a factual account of the work undertaken, the materials that were encountered and their geotechnical characterisation from laboratory testing. These results are used to inform the engineering geological characterisation in Overall Report Appendix B.

Groundwater monitoring was installed in some boreholes for future groundwater monitoring by AC and some of this data is presented.

This report is an appendix to the overall GHD landslide risk report and should be read in conjunction with it, as well as associated appendices. The overall report contains additional information and synthesises the results of other appended assessments carried out by GHD.

F1.2 Background

Two significant rainfall events affected the Waitakere area in late January and early February 2023, resulting from the impacts of ex-tropical cyclones Hale and Gabrielle, respectively.

The Cyclone Gabrielle weather event of 14 February 2023 resulted in widespread catastrophic flooding and slope instability in the settlement of Muriwai where several debris avalanches (which included rocks and trees) occurred, some of which developed into saturated debris flows that resulted in damage to buildings and infrastructure. Two fatalities occurred due to impact of landslides on private dwellings. This tragic event was similar to a 1965 storm event that also claimed two lives.

Following the event, rapid building assessment of residential properties was undertaken in Muriwai, with some houses having access by owners restricted (a yellow placard – e.g. access in daylight hours only) and some for which no access was permitted (a red placard). Dwellings that retained unrestricted access were white placarded.

F1.3 Scope

The intention of the geotechnical investigation and groundwater monitoring installation was to:

- Support the development of the ground model of the site
- Provide an of understanding of geotechnical properties of previously failed landslide material
- Understand the presence of significant geological boundaries that may be influencing slope failure
- Identify groundwater profiles within the slope and their response to rain events, and to provide ongoing, telemetered data for use by AC.

¹ As part of contract CW198379, Master Services Agreement CCCS: CW74240 dated 7/09/2019, subsequent work item 'Waitakere Coastal Communities Landslide Risk Assessment', dated 26/04/2023

The scope for this investigation is as follows:

Boreholes

- Drill nine boreholes advanced to a depth of between 11 m and 80 m below ground level (bgl) at Muriwai in locations at the top and below the escarpment where landslides occurred in February 2023, with the following distribution:
 - Three approximately 80 m deep boreholes at Oaia Road, east of (above) the Muriwai escarpment
 - Three boreholes below the Muriwai escarpment on Domain Crescent (two to approximately 11 m bgl and one to approximately 41 m bgl)
 - Three boreholes below the Muriwai escarpment on Motutara Road (two to approximately 11 m bgl and one to approximately 41 m bgl)
- Log the recovered material using NZGS (2005) guidelines
- Conduct Standard Penetration Tests (SPTs) at 1.5 m intervals
- Record data in AGS4 format and upload borehole logs to the New Zealand Geotechnical Database

Groundwater monitoring

- Install standpipe piezometer screens in some of the boreholes
- Measure initial water levels during drilling and following screen installation
- Supervise installation of water level data recorders and AC monitoring-compatible telemetry hardware to allow ongoing data collection (by AC)

Laboratory testing

- Testing of recovered soils and rocks including:
 - Atterberg Limit testing
 - Particle size distribution (wet sieve) tests
 - Unconfined Compressive Strength tests
 - Pinhole and Crumb dispersibility

This report may be updated in the future to include ongoing data.

F1.4 Report structure

This report is a factual account of the Muriwai geotechnical investigation and is one of six appendices that are part of assessing the risk-to-life from landslides at Muriwai. A list of report appendices is presented in Table F1.

Table F1 Summary of accompanying Muriwai landslide risk assessment reports

Report Section	Description
Overall Report	Waitakere Coastal Communities Landslide Risk Assessment (Muriwai) Overall Report
Appendix A	Figures
Appendix B	Engineering Geological Report
Appendix C	Slope Stability Assessment
Appendix D	RAMMS debris flow analysis
Appendix E	Landslide Risk Assessment
Appendix F	<i>Geotechnical Investigations Report (this report)</i>

F2. Site investigation overview

F2.1 General

Intrusive site investigations commenced on the 29th of June 2023 and were completed on the 18th of August 2023. The location of Muriwai is shown in Figure F1 below and a plan showing the borehole locations is presented in Figure F1-1 in Appendix F1.

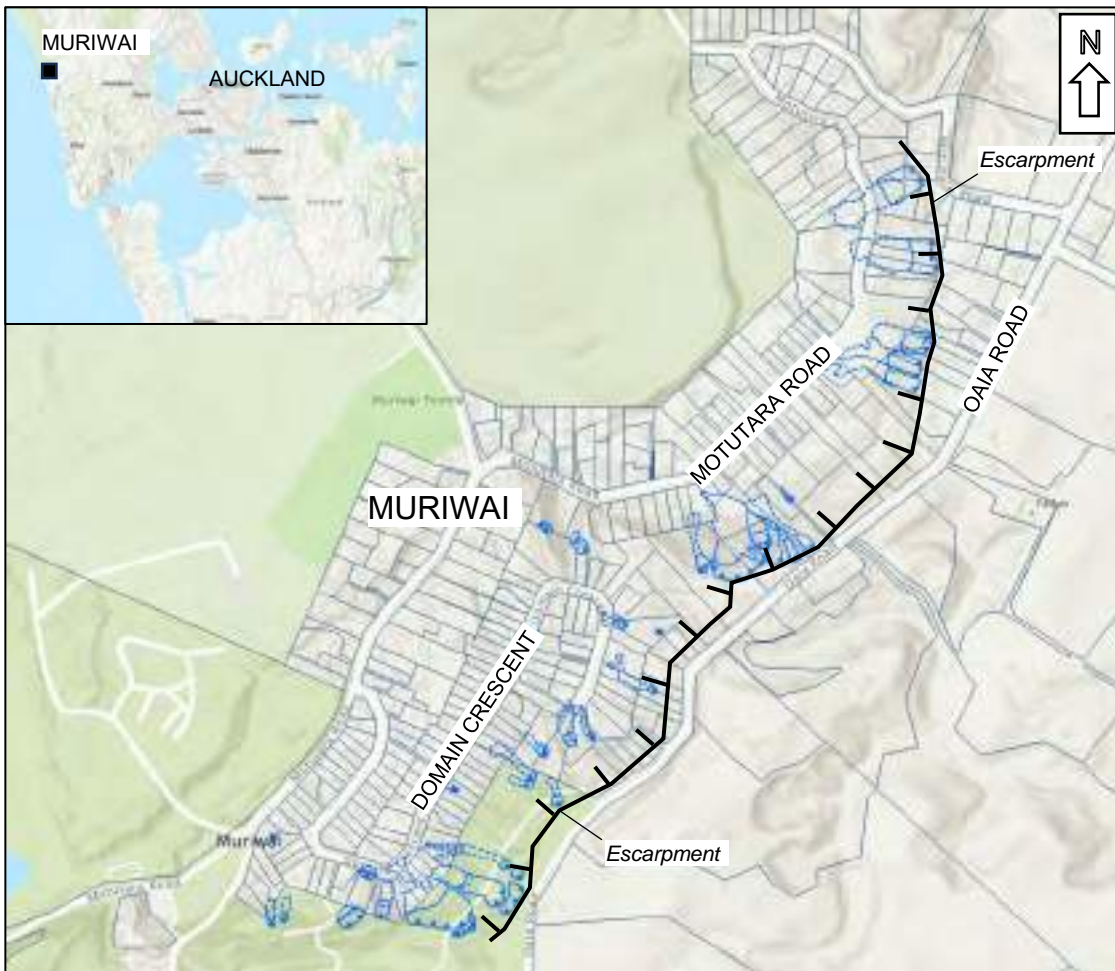


Figure F1 Muriwai location showing the February 2023 landslides mapped by GHD (blued lines)

All nine boreholes were drilled within the road reserve, with three holes along each of Oaia Road, Domain Crescent and Motutara Road. Six groundwater dataloggers with telemetry hardware were installed in the boreholes with piezometer screens. The location, depth and installation summary of these holes are presented in Table F2 below.

F2.2 Subcontractor management

GHD engaged DCN Drilling Limited (DCN) to undertake the site investigation physical works. DCN directly engaged and managed additional subcontractors required to complete the physical works on site, including traffic management and buried services clearance.

Babbage Geotechnical Laboratory (BGL) and Geotechnics Ltd were engaged to carry out geotechnical laboratory testing. ConnectM2M Limited installed piezometer dataloggers and telemetry.

Table F2 Borehole investigations summary (all holes to target depth)

Location ID	Street location	Easting	Northing	Reduced level (m)	Termination depth (m bgl)	Screen interval (m bgl)
BH-M01	Oaia Road	1728691	5923873	138.0	79.60	73 – 79
BH-M02		1728387	5923493	144.5	79.57	60 – 66
BH-M03		1728010	5923112	150.0	79.64	73 – 79
BH-M04	Domain Crescent	1727699	5923031	53.0	10.95	No installation
BH-M05		1727856	5923234	63.5	10.95	No installation
BH-M06		1728033	5923293	90.0	40.95	21 – 27
BH-M07	Motutara Road	1728235	5923652	52.0	40.64	33 – 39
BH-M08		1728392	5923798	63.0	10.95	No installation
BH-M09		1728448	5923911	72.5	10.95	7.2 – 10.2

F3. Site investigation methodology

F3.1 Boreholes

Boreholes were completed as follows:

- Hand auger or hydro-excavation to 1.5 m bgl to avoid striking buried services.
- Conventional ('Open Barrel') coring to recover nominal 83 mm diameter core in low strength near surface material.
- Wireline triple tube (HQT) coring to recover nominal 61mm diameter core at greater depths.

Boreholes without piezometers installed were backfilled with bentonite and the surface reinstated. All well covers were capped with plastic lockable lids and rubber gaskets ('toby box'), flush to ground level. All receiver/transmitter units that house the telemetry equipment were installed in an adjacent service box, which itself is covered with a lockable plastic lid flush to ground level.

For BH-M06 & 07 wells are within the road, with the service boxes being offset less than 1 m away (outside of carriageway).

A short length of connecting wire is buried at shallow depth (less than 1 m bgl) between the well head and the service box. For BH-M06 and BH-M07, this is encased in a PVC plastic sleeve. Wire connections are not marked at ground level.

Borehole logs, core photographs and piezometer installation details are presented in Appendix F2.

F3.2 In-situ strength testing

The following in-situ strength testing was performed during the drilling of boreholes.

F3.2.1 Standard penetration testing (SPT)

Standard Penetration Testing (SPTs) were performed at 1.5 m intervals in accordance with NZS 4402: 1988 Test 6.5.1 "Determination of the penetration resistance of a soil". SPT results are recorded on the borehole logs in Appendix F2 with the associated hammer calibration sheets. SPT results plotted against reduced level are presented in Figure F2.

Values given on the attached borehole logs are uncorrected N values. Table F3 gives the hammer efficiency value for each SPT hammer used during the site investigations. The associated drilling rig is reported on the corresponding borehole log. SPT calibration documentation is presented in Appendix F4.

Table F3 *Overview of the SPT hammer efficiency of the drilling rig*

Drilling Rig	SPT Trip Hammer Reference	SPT Hammer Efficiency	Boreholes Drilled
TR 200	3	68.5 %	All boreholes except BH-M04
MOR 700	1	68.1 %	BH-M04

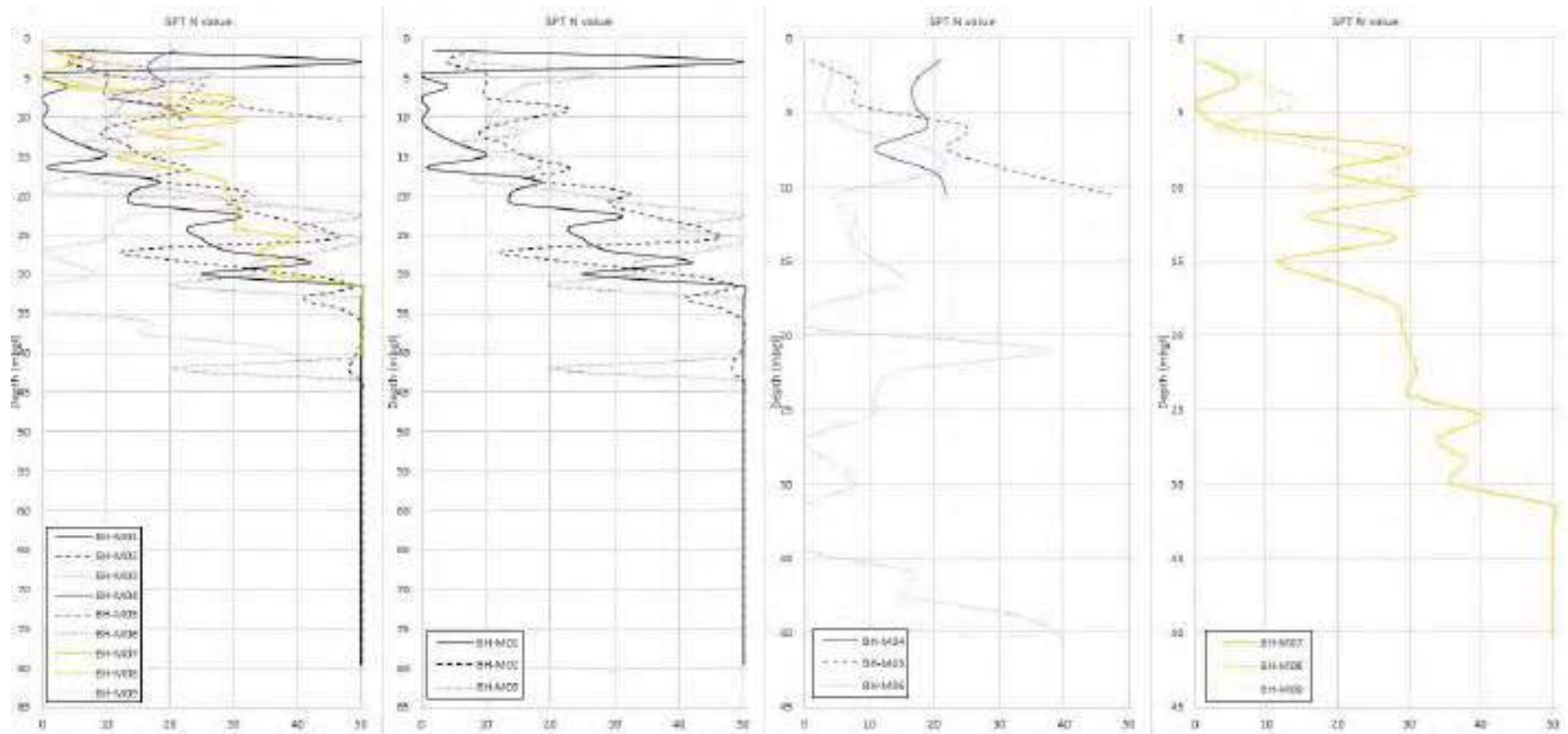


Figure F2 Uncorrected SPT 'N' value graphs against depth (m bgl) for all boreholes (left graph), with the same information separated into borehole groupings for clarity

F3.2.2 Handheld shear vane

Shear vane testing was performed during drilling of machine boreholes where cohesive soils were encountered. Measurements were typically taken every 1.5 m depth from core prior to extrusion from the core barrel.

All shear strengths shown on the appended logs are corrected vane shear strengths derived in accordance with the NZGS “*Guideline for Hand Held Shear Vanes Test*” (2001). The peak and remoulded vane readings represent hand-held dial readings from a 19 mm vane, adjusted using the calibration sheets attached in Appendix F4. These are reported on the logs as undrained shear strength and are summarised in Table F4.

Table F4 Shear vane testing summary

Borehole	Test Depth (m bgl)	Vane Serial Number	Corrected Peak Undrained Shear Strength (kPa)	Corrected Residual Undrained Shear Strength (kPa)	Note
BH-M01	3.0	GEO902	>211	n/a	Vane unable to penetrate
BH-M02	0.5	GEO1060	155	87	
BH-M02	1.0	GEO1060	142	74	
BH-M02	1.5	GEO1060	111	59	
BH-M02	3.0	GEO1060	>211	n/a	Vane unable to penetrate
BH-M06	3.0	GEO902	>211	n/a	Vane unable to penetrate
BH-M06	4.5	GEO902	>211	n/a	Vane unable to penetrate
BH-M08	3.0	GEO902	>211	n/a	Vane unable to penetrate

F3.3 Groundwater level monitoring

F3.3.1 Piezometer construction and static readings

Groundwater readings were periodically taken during the drilling programme (see Table F5). Groundwater levels measured in piezometers following bore development are summarised in Table F5.

F3.3.2 Variable head permeability (slug) testing

Slug testing was carried out between the 28th and 30th of August 2023 to estimate the permeability of the materials in the screened range of the piezometers. Rising and falling head tests were carried out in all six piezometers installed.

The data obtained from the rising and falling head tests were analysed using Aqtesolv Software (v 4.51), and the hydraulic conductivity values were obtained using the Bower and Rice (1976) and Hvorslev (1951) solutions. The results are provided in Table F6.

Table F5 Groundwater levels following piezometer installation and bore development.

Bore ID	Ground Elevation (m RL)	Screen Interval (m bgl)	Groundwater level											
			28 Aug 2023		29 Aug 2023		30 Aug 2023		9 th Apr 2024		17 th Apr 2024		19 th Apr 2024	
			(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)	(m bgl)	(m RL)
BH-M01	138.0	73 – 79	59.38	78.62	Not read				51.51	86.49	Not read		Not read	
BH-M02	144.5	60 – 66	84.79	59.73	84.76	59.74	Not read		Not read		59.75	84.75	59.74	84.76
BH-M03	150.0	73 – 79	<i>Dry</i>	-	<i>Dry</i>	-	<i>Dry</i>	-	Not read		<i>Dry</i>	-	<i>Dry</i>	-
BH-M06	90.0	21 – 27	19.97	70.02	19.82	70.17	19.86	70.14	Not read		19.65	70.35	18.51	71.49
BH-M07	52.0	33 – 39	Not read	-	7.32	44.68	Not read		Not read		7.36	44.64	7.52	44.48
BH-M09	72.5	7.2 – 10.2	6.83	65.67	6.83	65.67	Not read		Not read		7.22	65.28	7.23	65.27

Table F6 Results from the hydraulic conductivity tests (data from BH-M09 was not credible and is not presented)

Bore ID	Hydraulic conductivity (m/s)		
	Bouwer-Rice	Hvorslev	Mean
BH-M01	8.8E-08	1.0E-07	9.5E-08
BH-M02	5.5E-09	6.5E-09	5.9E-09
BH-M06	1.7E-08	2.3E-08	2.0E-08
BH-M07	3.4E-08	4.1E-08	7.1E-08
	1.4E-07	1.3E-07	

F3.3.3 Telemetry

To allow long-term remote monitoring of water levels in piezometers by AC each piezometer was fitted with a pressure transducer data logger and cellular telemetry unit. Data loggers and telemetry are self-contained, vented and battery powered.

The telemetered groundwater monitoring equipment includes:

- Hydrostatic Level Sensor (PTX-002) and associated cable,
- Site Sentinel (X1-001 4G),
- Road Marker Antenna (XANT-007),
- Analogue Junction Box - 1 input with vent (XIO-004)
- Marley 250 mm x 250 mm sealed cable management pit.

Each hydrostatic level sensor records and reports the level of water above the sensor. Each telemetered unit is configured to record this water level at 15-minute intervals. The data is transmitted daily at 2 pm. Once transmitted, the data is pushed directly to Auckland Councils Hydrotel system. A summary of the installation depths of the hydrostatic level sensors in meters below ground level (m bgl), and an approximated² value in m RL, is provided in Table F7.

Groundwater plots from the telemetered data, between the period of 19th October 2023 and 22nd March 2024 are presented in Appendix F5. Rainfall data taken from the Muriwai Golf Course (available on Auckland Council's Environmental Data Portal) for the same date range has been plotted on the graphs also. The groundwater data trace presented in Appendix F5 for BH-M01 represents a signal that is unverifiable and as such has been assumed to be erroneous.

Table F7 Hydrostatic Level Sensor install depth summary.

Bore ID	Hydrostatic Level Sensor Installation Depth	
	Measured value in m bgl	Approximate value in m RL ²
BH-M01	66.2	71.8
BH-M02	65.85	78.7
BH-M03	79.0	71.0
BH-M06	27.0	63.0
BH-M07	39.0	13.0
BH-M09	10.3	62.2

² Hydrostatic Level Sensor installation depth presented in m RL is calculated using the estimated collar height of the bore. This collar height has been estimated from a local GIS viewer and has not been measured using GNSS techniques.

F3.4 Investigation locations

The location of each borehole was recorded using handheld GPS, which has a metre-scale accuracy. This was compared with Auckland Council's online GIS viewer using measurements of investigation locations relative to known features.

Latitude and longitude are presented in terms of the New Zealand Transverse Mercator (NZTM 2000), the internationally recognised type of projection formally defined as the LINZS25002 standard (standard for New Zealand Geodetic Datum 2000 Projections), with elevation shown in the Auckland 1946 local mean sea level (MSL), one of thirteen local MSL circuits used in New Zealand.

F4. Geotechnical laboratory testing

F4.1 General

The following tests were scheduled for selected samples by BGL:

- Atterberg Limit, (NZS 4402:1986, Test 2.2, 2.3 & 2.4)
- Particle Size Distribution (Wet Sieve), (NZS 4402:1986, Test 2.8.1)
- Particle Size Distribution (Hydrometer), (NZS 4402:1986, Test 2.8.4)
- Detection of Presence of Allophane in Soils: (NZS4402:1986, Test 3.4)
- Unconfined Compressive Strength (UCS). (NZS4402:1986,Test 6.3.1)

The following tests were scheduled for selected samples by Geotechnics Ltd:

- Pinhole, (ASTM D4647-13 2020)
- Dispersibility by the Crumb Method (BS 1377: Part 5: 1990 Clause 6.3, not IANZ accredited)
- Water Content, (NZS 4402: 1986, Test 2.1)

The number and type of tests are presented in Table F8. Testing results are presented in Appendix F3.

Table F8 General summary of geotechnical laboratory testing scheduled.

Investigation ID	Water content	Atterberg limits (PL, LL, PI)	Particle size distribution (wet sieve)	Particle size distribution (hydrometer)	Crumb test	Uniaxial compressive strength (UCS)	Pinhole	Allophane Presence
BH-M01	1	1	2	1	1		1	
BH-M02	1		1			13	1	
BH-M03			1			9		
BH-M05			1					
Bh-M06			1					
BH-M07			3					
BH-M08			2					1
BH-M09			2					

F4.2 Atterberg Limit

One sample was tested for Atterberg Limits, (NZS 4402:1986, Test 2.2, 2.3 & 2.4); the result is plotted on the plasticity index chart in Figure F3.

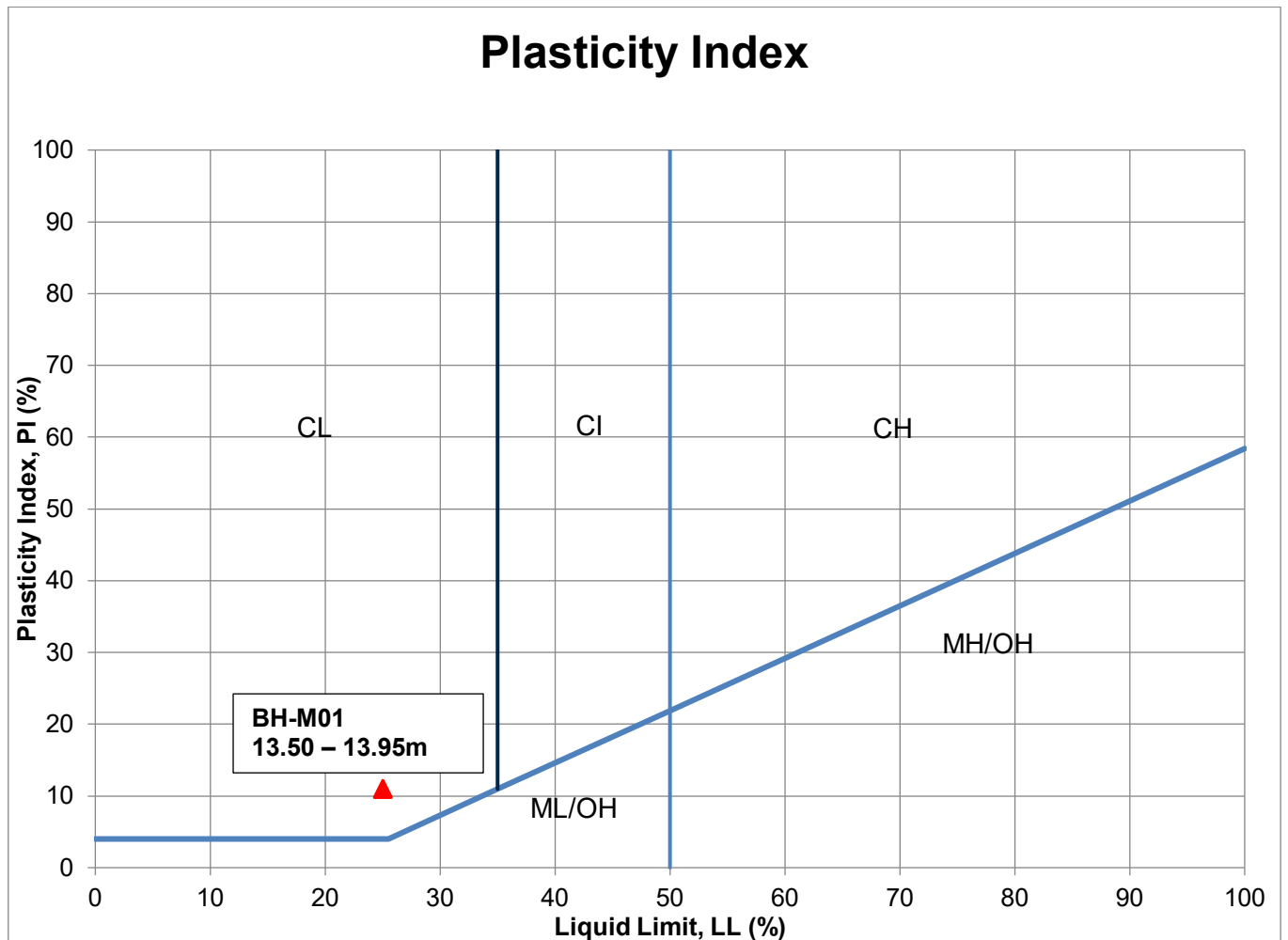


Figure F3 Plasticity Index chart

F4.3 Particle Size Distribution

Thirteen samples were taken from BH-M01 to BH-M09 and tested for Particle Size Distribution (PSD - wet sieve). One PSD sample from BH-M01 was tested for PSD - hydrometer (NZS 4402:1986 Test 2.8.4). The results are presented in Figure F4.

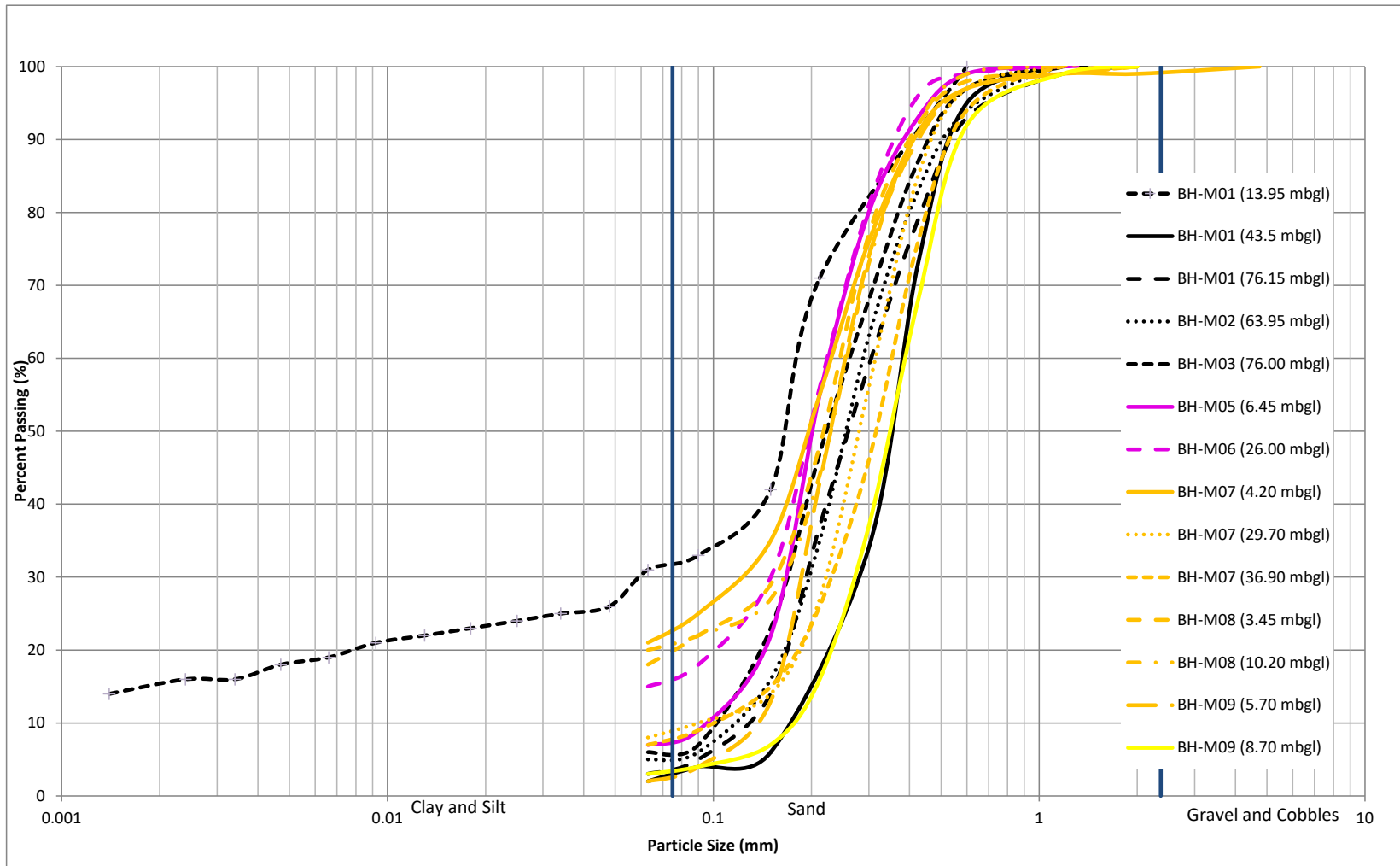


Figure F4 Particle Size Distribution chart

F4.4 Detection of Presence of Allophane in Soils:

One sample (BH-M08, 10.00-10.10m) was tested for presence of allophane (NZS4402:1986, Test 3.4). The result indicates an allophane content of less than 5%.

F4.5 Pinhole and Crumb Testing

Two samples were tested for dispersibility using Pinhole (ASTM D4647-13) and Crumb (BS 1377: Part 5: 1990 Clause 6.3) methods. The results are outlined in Table F9.

Table F9 Summary of Pinhole and Crumb Testing

Sample (BH & Depth)	Lab Description	Pinhole Method Classification	Crumb Method Classification
BH-M01 - 2.02 -2.06 m	Clayey SILT, dark brown; very soft, wet, high plasticity.	D1 (dispersive)	Grade 4 - Strong reaction (dispersive)
BH-M02 – 1.96 – 2.00 m	Silty CLAY, orange brown; very soft, wet, high plasticity	ND1 (non-dispersive)	Grade 4 - Strong reaction (dispersive)

F4.6 Uniaxial Compressive Strength (UCS)

UCS testing was undertaken by BGL on Awhiti Group core samples from BH-M02 and BH-M03 (NZS4402:1986, Test 6.3.1). The results are presented against depth in Figure F5 .

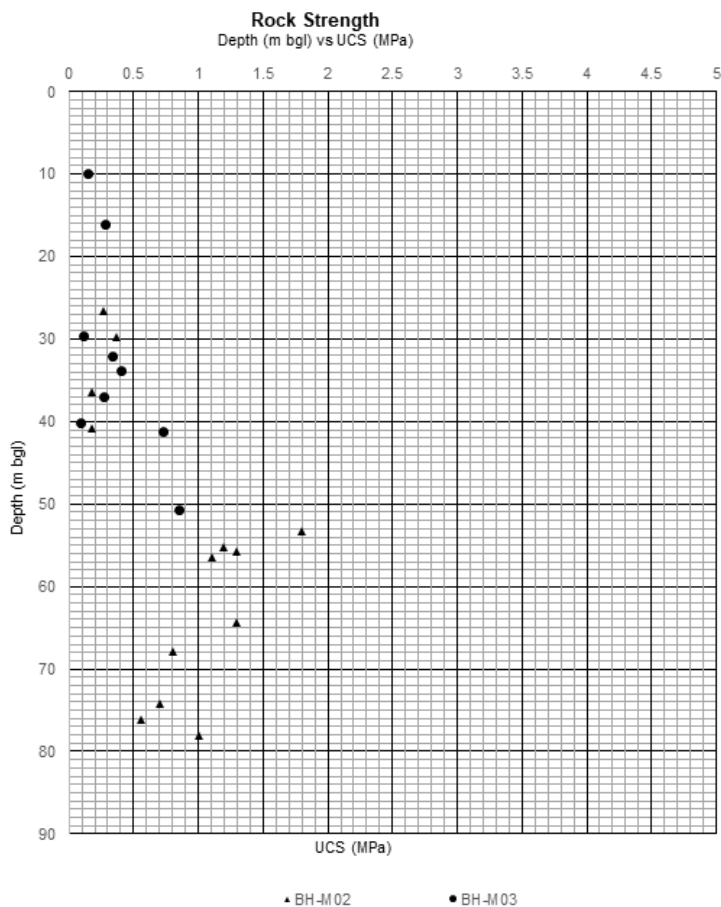


Figure F5 Uniaxial Compressive Strength (UCS) versus depth

F5. References

Auckland Council GIS Viewer, Retrieved March 2020,
<https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>

Auckland Council (2019), *“Professional Services Term Contract – Geotechnical Works Professional Services Scope”*

Bouwer & Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, *Water Resources Research*, vol. 12, no. 3, pp. 423-428.

Hvorslev, 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bul. no. 26, Waterways Experiment Station, Corps of Engineers, U.S. Army, Vicksburg, Mississippi

New Zealand Geotechnical Society (2005) *“Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes”*

New Zealand Geotechnical Society (2001) *“Guideline for Hand Held Shear Vane Test”*

New Zealand Standard 4402 (1986) *“Methods of testing soils for civil engineering purposes”*

F6. Limitations

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This report presents information obtained from, and testing undertaken at or in connection with, specific sample points, investigation locations and test points. Conditions at other parts of the site may be different from conditions found at the specific sample points. The actual characteristics of materials may vary significantly.

Sampling, investigations and testing were undertaken at a specific point in time. Ground conditions, including groundwater levels and contaminant concentrations can change over time. Therefore, the information from the sampling, investigations and testing may not represent the conditions that may be encountered across the site at any future point in time.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as physical access and the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended, abbreviated, or issued in part in any way without prior written approval by GHD. GHD does not accept liability in connection with the issuing of an unapproved or modified version of this report.






Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. If the revealed ground or groundwater conditions vary from those assumed or described in this report the matter should be referred back to GHD.

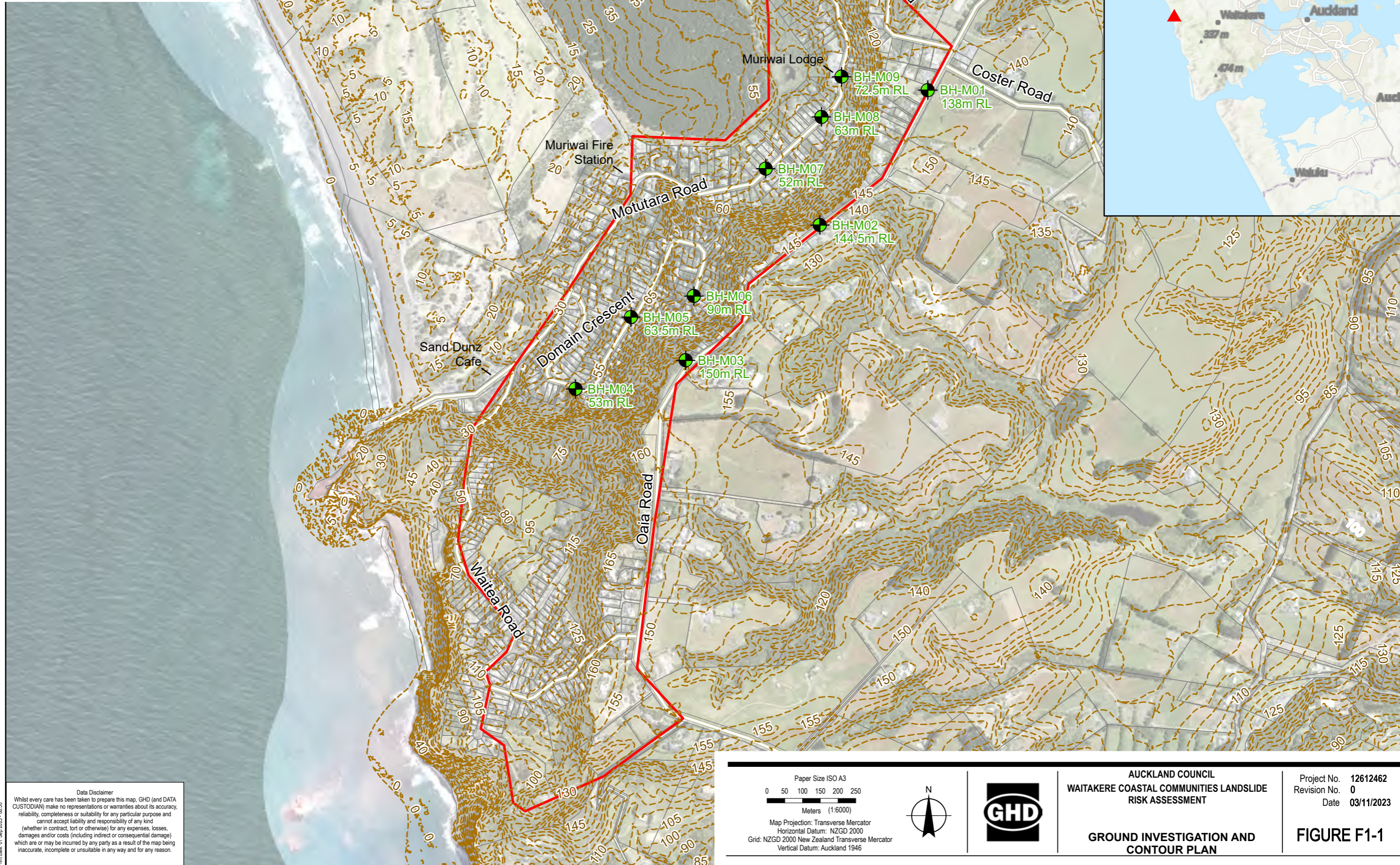
Appendices

Appendix F1

Site Plan

LEGEND

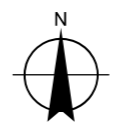
-  Investigation Points (GHD, 2023)
-  Contour (5m)
-  Approximate Site Boundary Extent
-  Property Boundary
-  Road



Data Disclaimer
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Paper Size ISO A3
 0 50 100 150 200 250
 Meters (1:6000)

Map Projection: Transverse Mercator
 Horizontal Datum: NZGD 2000
 Grid: NZGD 2000 New Zealand Transverse Mercator
 Vertical Datum: Auckland 1946




AUCKLAND COUNCIL
WAITAKERE COASTAL COMMUNITIES LANDSLIDE RISK ASSESSMENT

GROUND INVESTIGATION AND CONTOUR PLAN

Project No. 12612462
 Revision No. 0
 Date 03/11/2023

FIGURE F1-1

N:\NZ\Auckland\Projects\12612462\GIS\Map\Working\12612462_Figures_A210_A219.aprx
 Print Date: 01 Sep 2023 - 08:50

Data source: World Hillshade: Esri, CGIAR
 World Imagery: Auckland Council, Maxar
 World Topographic Map: Swis NZ, Esri, HERE, Garmin, Foursquare, FAO, METINASA, USGS, LINZ-Parcel, Road, GHD- Borehole Locations, Site extend - 20230811. Created by: gpollan

Appendix F2

Borehole Logs and Photographs

- Glossary of symbols
- Borehole logs and photoboards

GLOSSARY OF SYMBOLS



This standard sheet should be read in conjunction with all test hole log sheets and any idealised geological sections prepared for the investigation report.

GENERAL ABBREVIATIONS

Activity type / drilling method

DT	Dual tube	OP	Observation pit/trench
CA	Casing advancement	PM	Pressuremeter test hole
EXP	Logged exposure	PQTT	PQ triple tube coring
GCOP	GCO probe	RC	Rotary cored
HA	Hand Auger	RCG	Rotary drilling in common ground
HV	Hydro Vacuum excavation	RO	Rotary open hole
HQTT	HQ triple tube coring	SCP	Static cone penetrometer
ICBR	In situ CBR test	SH	Shaft
IDEN	In situ density test	SNC	Sonic core drilling
INST	Instrument	SPT	Standard penetration test
IVAN	In situ vane test	TP	Trial pit/trench
MHA	Machine Hollow auger	TT	Triple tube coring
MSA	Machine Solid auger	VC	Vibrocore
NQTT	NQ triple tube coring	W	Wash boring
OB	Open barrel		

Sampling type

AMAL	Amalgamated sample	LB	Large bulk disturbed sample (for earthworks testing)
B	Bulk disturbed sample	LDS	Large Disturbed Sample
BLK	Block sample	M	Mazier type sample
C	Core sample	P	Piston sample
CBR	CBR mould sample	TW	Thin walled push in sample
D	Small disturbed sample	U	Undisturbed sample - open drive
ES	Soil sample for environmental testing	U100	U110 Undisturbed Sample
EW	Water sample for environmental testing	U76	U76 Undisturbed Sample
G	Gas sample	UT	Thin wall open drive tube sampler
J	Jar	W	Water sample

Other testing

F	Falling Head Permeability Test
N	Total blows - SPT Value
PK	Packer Test
PP	Pocket Penetrometer (suffixed by value in kPa)
PT	Pressuremeter Test
R	Rising Head Permeability Test
SV	Shear Vane Test (suffixed by value in kPa, peak/residual values)
UTP	Unable to penetrate (shear vane testing)
TD	Target depth
HCL	Hydrochloric acid

WELL SYMBOLS



Sand



Grout



Solid Pipe



Gravel



Concrete



Slotted Pipe



Bentonite

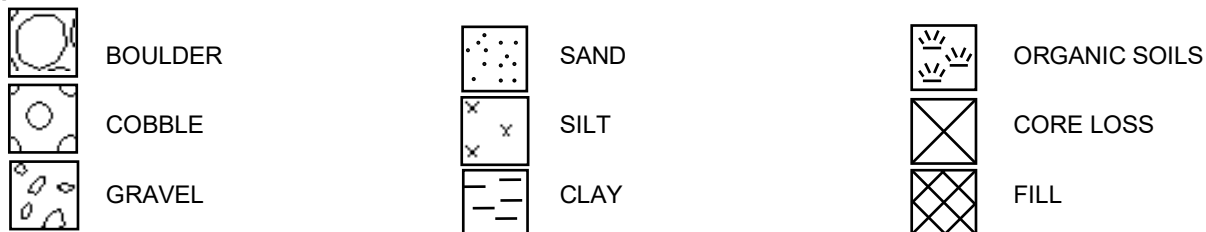
GROUNDWATER SYMBOLS




Groundwater level

SOIL SYMBOLS

Main Components



Note: Composite soil types will be signified by combined symbols, e.g.  Sandy CLAY

SOIL DESCRIPTION ABBREVIATIONS

Consistency

D	Dense
D-VD	Dense to very dense
F	Firm
F-St	Firm to stiff
H	Hard
L	Loose
L-MD	Loose to medium dense
MD	Medium dense
MD-D	Medium dense to dense
S	Soft

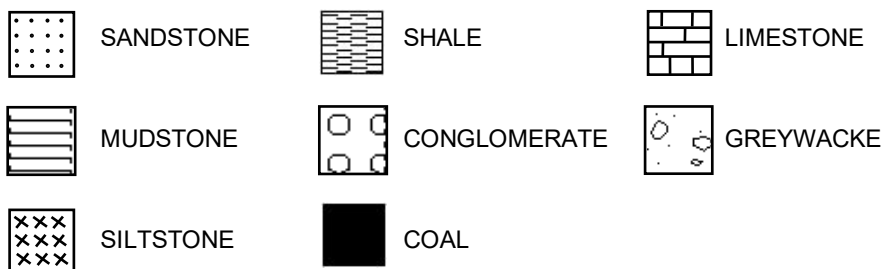
S-F	Soft to firm
St	Stiff
St-VSt	Stiff to very stiff
VD	Very dense
VL	Very loose
VL-L	Very loose to loose
VS	Very soft
VS-S	Very soft to soft
VSt	Very stiff
VSt-H	Very Stiff to hard

Moisture Condition

D	Dry
D-M	Dry to moist
M	Moist
M-W	Moist to wet
S	Saturated
W	Wet

ROCK SYMBOLS

Sedimentary



Metamorphic



Igneous



Note: Additional rock symbols may be allocated for a particular project. Interbedded rock will be represented using alternatively the above symbols

ROCK DESCRIPTION ABBREVIATIONS

Rock Strength

EW	Extremely weak
EW - VW	Extremely to very weak
VW	Very weak
VW - W	Very weak to weak
W	Weak
W - MS	Weak to moderately strong
MS	Moderately strong
MS - S	Moderately strong to strong
S	Strong
S - VS	Strong to very strong
VS	Very strong
VS - ES	Very strong to extremely strong
ES	Extremely strong

Weathering

RS	Residual soil
CW-RS	Completely weathered to residual soil
CW	Completely weathered
HW-CW	Highly weathered to completely weathered
HW	Highly weathered
MW-HW	Moderately weathered to highly weathered
MW	Moderated weathering
SW-MW	Slightly weathered to moderately weathered
SW	Slightly Weathered
UW-SW	Unweathered to slightly weathered
UW	Unweathered (fresh)

DEFECT DESCRIPTION ABBREVIATIONS

Fracture Type

BP	Bedding Plane
CB	Cross Bed
Cl	Cleavage
CS	Crushed Seam
CZ	Crush zone
Fl	Foliation
FZ	Fractured Zone (>250 mm)
JS	Joint set

JT	Joint
SF	Sheared Surface
SM	Seam
SS	Sheared Seam
SZ	Sheared Zone (>250 mm)
VN	Vein

Inclination

SB	Sub-horizontal
G	Gently inclined
M	Moderately inclined
S	Steeply inclined
VS	Very steeply inclined
SV	Sub-vertical

Aperture

T	Tight
VN	Very Narrow
N	Narrow
MN	Moderately Narrow
MW	Moderately Wide
W	Wide
VW	Very Wide

Roughness

sl	Slickensided
r	Rough
sm	Smooth

Infilling or Coating

CN	Clean
X	Carbonaceous
CLAY	Clay
KT	Chlorite
CA	Calcite
Fe	Iron Oxide
MI	Micaceous
QZ	Quartz
VE	Veneer

Texture

Pl	Planar
St	Stepped
U	Undulating

Spacing

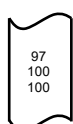
EC	Extremely closely spaced
VC	Very closely spaced
C	Closely spaced
MW	Moderately widely spaced
W	Widely spaced
VW	Very widely spaced

Joint Set Counts

X 2	2 joints
X 3	3 joints
X 4	4 joints
X 5	5 joints
X 6	6 joints
X 7	7 joints
X 8	8 joints
X 9	9 joints
> 10	> 10 joints

Visual Defects

Core Recovery Parameters



TCR – Total Core Recovery %
 SCR – Solid Core Recovery %
 RQD – Rock Quality Designation %



Visual representation of defect angle from horizontal (example shown is 45°)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01

Sheet : 1 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023

Completed: 5/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728691.45

Northing: 5923873.69

System: NZTM2000

RL: 138

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
	0		Clayey SILT with some organics; brown, mottled orange and grey. 'Soft to firm', moist, low plasticity. Organics, rootlets and roots. [TOPSOIL].	TOPSOIL	M	CS FI											
	0.5		Clayey SILT with minor organics; brown, mottled orange and grey. 'Soft to firm', moist, low plasticity. Organics, rootlets. [FILL].	FILL					HA				100				
	1.2		Clayey SILT with some roots; brown, speckled grey. 'Soft', moist, low plasticity. Roots, 3 to 25 mm in diameter. [AWHITU SAND FORMATION]. 1.35 - 1.50 Wet.		W	'S'				SPT			100				
	1.9		Silty CLAY; brown, speckled grey. 'Soft', moist, high plasticity.		M												
	2.7		Silty fine SAND; dark brown, speckled black-grey. Very dense, moist.			VD				OB			100				
	3.3		CORE LOSS							SPT			100				
	3.65		Silty fine SAND; dark brown, speckled black and grey. Very dense, moist.		M	VD				HQTT			71				
	4.64		CORE LOSS							SPT			0				
	6		Silty fine SAND; grey, speckled black. Loose, moist.		M	L				HQTT			0				
	6.64		CORE LOSS							SPT			38				
	6.64		Silty fine SAND; grey, speckled black. Loose, moist.		M	VL				HQTT			82				
	7.95									SPT			0				

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

Report ID: GENERAL_LOG || Project: BH-M01_REV3.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 2 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect (mm)	Instrumentation	Water level
							Number / Type	Result									
129	9.1		Clayey silty fine SAND; grey, speckled black. Very loose, moist. (continued from layer starting at 8.0m)	AWHITU SAND FORMATION					HQTT				78				
9.7			Sandy SILT with some clay; grey with minor brown streaks. 'Very soft', saturated, non-plastic. Sand, fine.		S	'VS'	SPT 0/0 0/1 N = 1		SPT					78			
10	9.7		Silty fine SAND; grey with minor light brown streaks. Wet.		W	-			HQTT					100			
10.35			Clayey silty fine SAND; grey with some light brown streaks. Very loose, moist.		M	VL	SPT 0/0 0/0 0/0 N = 0		SPT					0			
10.95			Sandy SILT with minor clay; grey, streaked light brown. 'Very soft', wet, non-plastic. Sand, fine to medium.		W	'VS'			HQTT					100			
11.7			Silty fine SAND; light grey, streaked brown, speckled black. Very loose, wet.			VL	SPT 0/0 0/0 1/1 N = 2		SPT					0			
12			12.45 - 18.00 Very loose to loose.		VL-L			HQTT					100				
13								SPT					100				
14								HQTT					100				
15								SPT					0				
16								HQTT					100				

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01

Sheet : 3 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023

Completed: 5/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728691.45

Northing: 5923873.69

System: NZTM2000

RL: 138

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated w Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation	Water level	
							Number / Type	Result										
121	16.40 - 16.50		Silty fine SAND; light grey, streaked brown, speckled black. Very loose, wet. (continued from layer starting at 11.7m)	AWHITU SAND FORMATION			SPT 0/0 0/1 0/0 N = 1	HQTT					100					
17	18.00 - 18.50		16.40 - 16.50 Brown streaks. 18.00 - 18.50 Medium dense.		MD		SPT 2/2 3/3 4/8 N = 18	SPT						0				
18	18.50 - 19.00		Fine SAND, trace silt; grey. Medium dense, moist.		M				HQTT					100				
19	20.00 - 20.40		Silty fine to medium SAND with trace clay; light brown, streaked light orange. Medium dense, moist.					SPT 1/1 2/3 4/5 N = 14	SPT						0			
20	20.40 - 21.45		Fine SAND, trace silt; grey. Medium dense, moist.						HQTT						100			
21	21.45 - 22.00		Silty fine to medium SAND with trace clay; light brown, streaked light orange. Medium dense, moist.				SPT 2/2 2/3 4/5 N = 14	SPT						0				
22	22.00 - 23.00		Fine to medium SAND, trace silt; grey, mottled orange; indistinctly, very thinly bedded at 5-10°. Medium dense to dense, moist.					HQTT						100				
23	23.00 - 24.00						SPT 3/5 8/8 7/8 N = 31	SPT						0				
24	24.00 - 24.00							HQTT						100				

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

Report ID: GENERAL_LOG || Project: BH-M01_REV3.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

4-07-2023



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 4 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
113	25		Fine to medium SAND, trace silt; grey, mottled orange; indistinctly, very thinly bedded at 5-10°. Medium dense to dense, moist. (continued from layer starting at 21.5m)	AWHITU SAND FORMATION			SPT 2/4 5/5 5/8 N = 23		SPT				100				
112	26		Highly weathered, dark grey-green, speckled light grey and black, fine to medium grained SANDSTONE; extremely weak				SPT 2/4 5/5 6/9 N = 25		SPT					100			
111	27		27.65 Grey-green.				SPT 4/4 4/6 8/11 N = 29		SPT					100			
110	28		Highly weathered, orange brown, speckled grey and dark brown, fine to medium grained SANDSTONE; extremely weak.				SPT 8/8 9/10 11/12 N = 42		SPT					0			
109	29		Highly weathered, orange brown, streaked black, dark grey and dark red, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-20°.				SPT 5/6 5/5 7/8 N = 25		SPT					0			
108	30		Moderately weathered, dark grey, fine to medium grained SANDSTONE; extremely weak.				SPT 8/13 15/17 18 for 65mm N > 50		SPT					82			
107	31								HQTT				100				
106	32								SPT				100				

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 5 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
32.2			Highly weathered, brown, streaked orange and black, fine to medium grained SANDSTONE; extremely weak.	AWHITU SAND FORMATION					HQTT		MW		100				
33.28			CORE LOSS				SPT 14/20 24/26 for 55mm N > 50			SPT		HW		100			
34.4			Highly weathered, orange brown, speckled grey and dark brown, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-25°.				SPT 19/21 25/25 for 65mm N > 50 (solid cone)			SPT				8			
37.2			Highly weathered, orange brown, speckled grey and dark brown, fine to medium grained SANDSTONE; extremely weak.				SPT 27/23 for 50mm N > 50 (solid cone)			HQTT				100			
38.8							SPT 26/24 for 55mm N > 50 (solid cone)			SPT				0			
39.8						SPT 27/23 for 55mm N > 50 (solid cone)			HQTT				100				
39.8									SPT				0				
39.8									HQTT				100				

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

Report ID: GENERAL_LOG || Project: BH-M01_REV3.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 6 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated UCS Strength (MPa)	TCR	SCR	RQD (%)	Defect	Spacing (mm)	Instrumentation	Installation	Water level	
							Number / Type	Result														
197	41		Highly weathered, brown, speckled grey and dark brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-20°. (continued from layer starting at 39.8m)	AWHITU SAND FORMATION			SPT 28/22 for 50mm N > 50 (solid cone)		HQTT				100									
196	42		Highly weathered, brown, speckled dark orange brown, fine to medium grained SANDSTONE; extremely weak.				SPT 25/25 for 60mm N > 50 (solid cone)		HQTT					0								
195	43							SPT 29/21 for 45mm N > 50 (solid cone)		HQTT					100							
194	44							SPT 28/22 for 50mm N > 50 (solid cone)		HQTT					0							
193	45		45.00 - 45.03 Extremely weak, dark brown LIGNITE.				SPT 28/22 for 50mm N > 50 (solid cone)		HQTT					100								
192	46						SPT 35/15 for 20mm N > 50 (solid cone)		HQTT					0								
191	47		Highly weathered, brown, speckled grey and dark orange brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-30°.						HQTT					100								

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 7 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
189	49		Highly weathered, brown, speckled grey and dark orange brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-30°. (continued from layer starting at 46.8m) 48.00 - 48.65 Trace organic fragments to 5 mm.	AWHITU SAND FORMATION			SPT 32/18 for 25mm N > 50 (solid cone)		HQTT		HW		0				
188	50		Highly weathered, orange brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak.				SPT 20/30 for 45mm N > 50 (solid cone)		HQTT				0				
187	51		Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.														
186	52		Completely weathered, brown, mottled light yellowish brown, SILTSTONE; extremely weak.									CW		0			
185	53		Moderately weathered, grey, speckled light brown, fine to medium grained SANDSTONE; extremely weak. 51.20 - 51.35 20-40 mm shell fragments.					SPT 39/11 for 15mm N > 50 (solid cone)		HQTT				0			
184	54		Moderately weathered, dark grey-green, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-30° with very closely spaced irregular laminations of silty sandstone.					SPT 42/18 for 5mm N > 50 (solid cone)		HQTT				0			
183	55		Moderately weathered, brown, mixed grey and light yellow, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly laminated at 15-25°.					SPT 38/12 for 35mm N > 50 (solid cone)		HQTT				0			
182	55		Moderately weathered, dark grey-brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-35°.				SPT 33/17 for 35mm N > 50 (solid cone)		HQTT				0				

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
04/07/23	08:00	22.25	55.63

Report ID: GENERAL_LOG || Project: BH-M01_REV3.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 8 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated W _u Strength (MPa)	TCR SCR RQD (%)	Defect (mm) Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
57			Moderately weathered, dark grey-brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-35°. (continued from layer starting at 54.8m)	AWHITU SAND FORMATION			SPT 24/26 for 55mm N > 50 (solid cone)		HQTT				100					
58							SPT 20/30 for 55mm N > 50 (solid cone)		HQTT					0				
59							SPT 29/21 for 50mm N > 50 (solid cone)		HQTT					100				
60			Moderately weathered, dark grey, mixed brown and orange, fine to medium grained SANDSTONE; extremely weak.				SPT 29/21 for 50mm N > 50 (solid cone)		HQTT					0				
61			CORE LOSS															
62			Highly to moderately weathered, dark grey, mottled brown-orange, fine to medium grained SANDSTONE; extremely weak.				SPT 25/25 for 55mm N > 50 (solid cone)		HQTT					88				
63			CORE LOSS															
64			Moderately weathered, grey, mottled orange, fine to medium grained SANDSTONE; extremely weak.				SPT 31/19 for 55mm N > 50 (solid cone)		HQTT					0				
65			Moderately weathered, dark grey, fine to medium grained SANDSTONE; extremely weak.										84					
66			CORE LOSS															
67													22					

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01

Sheet : 9 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023

Completed: 5/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728691.45

Northing: 5923873.69

System: NZTM2000

RL: 138

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated UCS Strength (MPa)	TCR	SCR	RQD (%)	Defect (mm)	Spacing (mm)	Instrumentation	Water level
							Number / Type	Result												
			CORE LOSS (continued from layer starting at 63.1m)																	
			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 5-15°.				SPT 26/24 for 60mm N > 50 (solid cone)							22						
			CORE LOSS											0						
			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 30-45°.											82						
			CORE LOSS											0						
			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 30-45°.											83						
			CORE LOSS											0						
			Moderately weathered, dark grey-green, mottled brown and grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 10-20°.											100						
			LIGNITE; black. 'Hard', moist.		M	'H'														
			Moderately weathered, dark grey-green, mottled brown and grey, fine to medium grained SANDSTONE; extremely weak.											0						
			CORE LOSS																	
			Moderately weathered, dark grey-green, mottled brown and grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-20°.											88						
			CORE LOSS											0						
			Moderately weathered, grey, fine to medium grained SANDSTONE; extremely weak.											33						

Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 17 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M01
 Sheet : 10 of 10
 Hole Length : 79.60m
 Scale @ A4 : 1:40

Commenced: 29/06/2023 Completed: 5/07/2023

Logged : JM
 Processed : JM
 Checked : JHS

Easting: 1728691.45 Northing: 5923873.69 System: NZTM2000
 RL: 138 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
73	73		Moderately weathered, grey, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 71.6m)	AWHITU SAND FORMATION			SPT 34/16 for 20mm N > 50 (solid cone)		HQTT				0				
74	74		Moderately weathered, dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; thinly bedded at 25-35°.				SPT 40/10 for 10mm N > 50 (solid cone)		HQTT					0			
75	75						SPT 33/17 for 30mm N > 50 (solid cone)		HQTT					0			
76	76						SPT 26/24 for 55mm N > 50 (solid cone)		HQTT					0			
77	77						SPT 29/21 for 50mm N > 50 (solid cone)		HQTT					0			
79	79					SPT 35/15 for 20mm N > 50 (solid cone)		HQTT					0				
79.6	79.6		End of Hole @ 79.60m, Target Depth.										0				

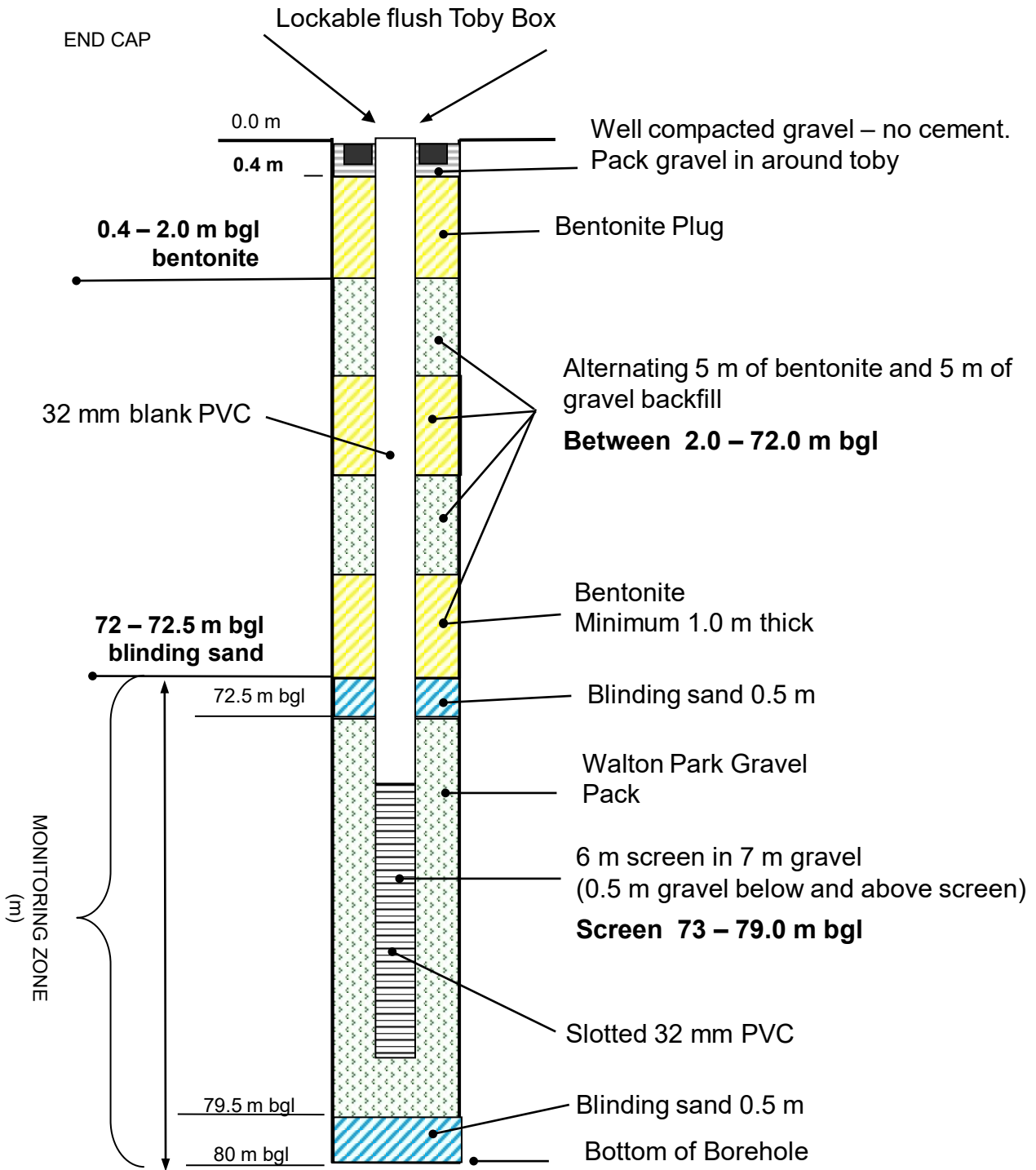
Notes and Comments:
 End of Hole @ 79.60m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
05/07/23	08:05	26.9	72.095
18/07/23	16:15	35.5	79.59

BH-M01 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728691.45 E
Job Number	12612462		5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728691.45 E 5923873.69 N
Job Number	12612462	Location	17 Oaia Rd, Muriwai
Client	Auckland Council		
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728691.45 E 5923873.69 N
Job Number	12612462	Location	17 Oaia Rd, Muriwai
Client	Auckland Council		
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728691.45 E 5923873.69 N
Job Number	12612462	Location	17 Oaia Rd, Muriwai
Client	Auckland Council		
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Photograph @ 6.0 m not recovered.

Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728691.45 E
Job Number	12612462		5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		



Report of photographs



Site identification – BH-M01

Project	AC Geo Panel – Waitākere	Coordinates	1728691.45 E
Job Number	12612462	(NZTM 2000)	5923873.69 N
Client	Auckland Council	Location	17 Oaia Rd, Muriwai
Date	29 June to 5 July 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 1 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation	Water level
							Number / Type	Result									
144.5	0.0		Clayey SILT; dark brown, mottled orange-brown. 'Very stiff', moist, low plasticity. [TOPSOIL].	TOPSOIL	M	'VSt'											
144.5	0.4		Clayey SILT; brown, speckled orange-dark brown. Very stiff, moist, low plasticity. [FILL].	FILL		VSt	SV@0.5m 155/87 kPa		HA								
143.5	1.0		Clayey SILT with trace sand; brown, mottled and streaked orange. Very stiff, moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION].				SV@1m 142/74 kPa										
143.5	1.7		Clayey SILT; brown, mottled and streaked orange. 'Very stiff', moist, low plasticity.			'VSt'	SV@1.5m 111/59 kPa SPT 1/1 2/2 2/2 N = 8			SPT			100				
142.5	3.0		3.00 - 3.20 Hard.			H	SV@3m UTP SPT 1/0 1/1 1/1 N = 4				OB		100				
141.5	3.2		Clayey SILT with minor sand; brown streaked yellow-orange. 'Stiff', moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION]			'St'				SPT			100				
140.5	3.8		3.80 - 3.95 Speckled black.								OB		100				
140.5	3.95		Clayey fine SAND; grey speckled black. Moist.										100				
140.0	4.3		Silty fine SAND; light grey speckled black, streaked orange. Loose, moist.			L	SPT 1/1 1/2 3/4 N = 10						100				
139.0	6.0												100				
138.0	6.8		6.80 With trace clay.				SPT 1/1 1/3 3/3 N = 10						0				
137.0	7.0												100				
137.0	7.8		Amorphous PEAT; brown-black, streaked red-orange. 'Very			'VSt'	SPT 1/0 1/3 3/3 N = 10						100				

DRAFT

Report ID: GENERAL_LOG || Project: BH-M02_MK.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

8-08-2023



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Commenced: 4/08/2023

Completed: 17/08/2023

Hole No. : BH-M02

Sheet : 2 of 10

Hole Length : 79.57m

Scale @ A4 : 1:40

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
136	8.15		stiff, moist. CORE LOSS (continued from layer starting at 8.0m)	AWHITU SAND FORMATION	-	-												
			Amorphous PEAT; brown-black, streaked red-orange. 'Very stiff', moist.		M	'Vst'				OB				81				
	8.7		Silty fine to medium SAND; grey-brown, streaked orange-yellow. Medium dense, moist.				MD							81				
9			CORE LOSS					SPT 1/2 4/6 6/7 N = 23			SPT			100				
135	9.45		CORE LOSS															
10	10		Silty fine to medium SAND; light grey, streaked dark grey. Medium dense, moist; indistinctly, closely bedded at 0-5°.		M	MD		SPT 1/1 2/3 4/5 N = 14			HQTT			52				
134			CORE LOSS															
11	11		Silty fine to medium SAND; light grey, streaked dark grey. Loose, moist.		M	L		SPT 3/0 1/1 3/4 N = 9			SPT			0				
133	11.74		Clayey SILT; grey. 'Stiff', moist.				'St'											
132	12		Silty fine to medium SAND; light grey, speckled black; indistinctly very thinly bedded at 0-5°. Medium dense, moist.				MD				HQTT			100				
131	12.66		CORE LOSS															
130	13		CORE LOSS				SPT 2/2 4/5 N = 13			SPT			0					
129	13.95		CORE LOSS															
	14.3		Silty fine to medium SAND; grey-orange, speckled light grey-black. Medium dense, moist.	M	MD					HQTT			67					
15	15		CORE LOSS				SPT 2/1 2/3 5/6 N = 16			SPT			0					
16	15.45		CORE LOSS										0					

Report ID: GENERAL_LOG || Project: BH-M02_MK.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 3 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation	Water level
							Number / Type	Result									
			CORE LOSS (continued from layer starting at 15.5m)														
128	16.5		Silty fine to medium SAND; light brownish grey. Medium dense, moist.		M	MD	SPT 2/1 2/4 7/10 N = 23			HQTT				0			
	16.95		CORE LOSS							SPT				100			
17	17.6		Silty fine to medium SAND; light brownish grey. Medium dense, moist.		M	MD				HQTT				38			
	18.2		Clayey SILT with minor sand; grey, speckled black. 'Firm to stiff, moist, low plasticity. Sand, fine to coarse. 18.20 - 18.35 Grey, speckled black.			'F-St'	SPT 4/4 4/4 4/5 N = 17			SPT				100			
18	18.7		Silty fine to medium SAND; light grey-light brown, streaked and mottled orange; indistinctly bedded very thinly bedded at 40°. Medium dense, moist.			MD				HQTT				100			
	19.95		CORE LOSS							SPT				0			
19	20.6		Silty fine to medium SAND; light grey-light brown, streaked light orange, mottled orange. Medium dense, moist.		M	MD				HQTT				38			
	21.45		Silty fine to medium SAND; orange brown, speckled black, streaked yellow-orange. Medium dense, moist. 21.85 - 21.90 Dark orange-red.							SPT				0			
20	22.50		22.50 - 23.60 Dense.							HQTT				100			
	23.6		22.60 - 23.60 Orange-brown, streaked orange.			D	SPT 4/6 6/7 8/8 N = 29			SPT				0			
21	23.6		Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. 23.60 Carbonaceous fragments up to 10mm.				SPT 4/6 7/8 9/11 N = 35			HQTT				100			
22																	
23																	
24																	

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
08/08/23	08:10	7.7	19.95



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02
 Sheet : 4 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023 Completed: 17/08/2023

Logged : JM
 Processed : JM
 Checked : JHS 23/08/2023

Easting: 1728387.63 Northing: 5923493.52 System: NZTM2000
 RL: 144.5 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level		
							Number / Type	Result											
120			Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. <i>(continued from layer starting at 23.6m)</i>	AWHITU SAND FORMATION			SPT 3/3 7/11 12/13 N = 43		SPT				44						
25											HQTT				100				
119										SPT 4/8 10/12 12/12 N = 46		SPT				44			
26												HQTT				100			
118																			
27			27.00 - 29.40 Medium dense.			MD	SPT 2/2 2/3 3/5 N = 13		SPT				0						
117																			
28			28.00 - 28.25 With patches of carbonaceous material.						HQTT				100						
116																			
29						D	SPT 3/2 4/5 6/9 N = 24		SPT				100						
115									HQTT				100						
30							SPT 6/7 8/9 10/13 N = 40		SPT				100						
114									HQTT				100						
31																			
113							SPT 9/10 12/14 14/9 N = 49 (solid cone)		SPT				0						
									HQTT				100						

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLS are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02
 Sheet : 5 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023 Completed: 17/08/2023

Logged : JM
 Processed : JM
 Checked : JHS 23/08/2023

Easting: 1728387.63 Northing: 5923493.52 System: NZTM2000
 RL: 144.5 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQR (%)	Defect	Spacing (mm)	Instrumentation	Water level
							Number / Type	Result												
1112			Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. <i>(continued from layer starting at 23.6m)</i>							HQTT				100						
33							SPT 12/12 8/9 12/12 N=41 (solid cone)			SPT				0						
34										HQTT				100						
35							SPT 9/11 10/12 12/13 N=47 (solid cone)			SPT				0						
36			36.00 - 40.50 Very dense.			VD	SPT 14/16 18/18 14 for 55mm N > 50 (solid cone)			SPT				0						
37										HQTT				100						
38			37.90 - 38.00 Very thinly bedded at 20-30°.				SPT 15/16 19 for 75mm N > 50 (solid cone)			SPT				0						
39										HQTT				100						
40							SPT 11/11 12/16 for 75mm N > 50 (solid cone)			SPT				0						
										HQTT				100						

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 6 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQR (%)	Defect	Spacing (mm)	Instrumentation	Water level
							Number / Type	Result												
104	40.5		Fine to medium SAND; orange brown, speckled black; distinctly very thinly bedded at 5-15°. Dense, moist. <i>(continued from layer starting at 23.6m)</i>						HQTT											
41			Highly weathered, orange brown, streaked orange, speckled black, fine to medium grained, indistinctly bedded SANDSTONE; extremely weak; very thinly bedded at 20-30°.				41.00 C 40.80		HQTT											
42	41.8		Highly weathered, greenish grey, streaked brown-orange, speckled black, fine to medium grained SANDSTONE; extremely weak.					SPT 9/10 12/12 12/12 N = 48 (solid cone)	SPT											
43	42.8 42.642.45		Silty CLAY; ligh grey, streaked dark grey-orange. 'Stiff', moist, low plasticity.	M	'St'				HQTT											
43			Highly weathered, light grey, speckled dark grey-black, SILTSTONE; extremely weak.						HQTT											
43			Highly weathered, brown, streaked and speckled orange-black, fine to medium grained SANDSTONE; extremely weak.						HQTT											
44			Highly weathered, light orange brown, streaked orange, speckled black, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-25°.					SPT 8/11 14/15 15/6 for 25mm N > 50 (solid cone)	SPT											
45				AWHITU SAND FORMATION					HQTT											
45								SPT 11/14 28/24 for 55mm N > 50 (solid cone)	SPT											
46									HQTT											
47								SPT 12/15 25/25 for 65mm N > 50 (solid cone)	SPT											
47									HQTT											

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
09/08/23	08:30	13.6	40.95



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 7 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
196			Highly weathered, light orange brown, streaked orange, speckled black, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 15-25°. (continued from layer starting at 43.0m)	AWHITU SAND FORMATION			SPT 14/14 18/19 14 for 50mm N > 50 (solid cone)		SPT					0				
49								SPT 13/16 22/28 for 75mm N > 50 (solid cone)		HQTT					100			
195								SPT 16/18 24/26 for 50mm N > 50 (solid cone)		SPT					0			
50										HQTT					100			
194			52.00 - 52.63 Light orange brown, streaked orange.					SPT 21/29 for 60mm N > 50 (solid cone)		SPT					0			
51										HQTT					100			
193			Highly weathered, brown, speckled black, fine to medium grained SANDSTONE; extremely weak.				SPT 23/27 for 60mm N > 50 (solid cone)		SPT					0				
52			53.50 - 54.00 100% flush loss.						HQTT					100				
192			53.90 - 54.13 Dark greyish brown.						SPT					0				
53			CORE LOSS						HQTT					73				
191			Highly weathered, dark brown-grey, speckled black, fine to medium grained SANDSTONE; extremely weak.				SPT 25/25 for 50mm N > 50 (solid cone)		SPT					0				
54			Highly weathered, brown, speckled black, fine to medium grained SANDSTONE; extremely weak.						HQTT					100				
190																		
55																		
189																		

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
14/08/23	08:30	36.63	54



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 8 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
188			Highly weathered, brown, speckled black, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 55.6m)	AWHITU SAND FORMATION			C	56.50 56.11		HQTT				100			
57							SPT 24/26 for 55mm N > 50 (solid cone)		SPT								0
187							C	56.90		HQTT		HW		100			
58							SPT 23/27 for 65mm N > 50 (solid cone)		SPT								0
186			CORE LOSS				C	60.13		HQTT				100			
59							SPT 24/26 for 55mm N > 50 (solid cone)		SPT								0
185			Highly weathered, brown, speckled black, fine to medium grained SANDSTONE; extremely weak.				C	61.45		HQTT				4			
60							SPT 21/29 for 70mm N > 50 (solid cone)		SPT								0
184			Highly weathered, dark brown, speckled black, medium to coarse grained SANDSTONE; weak.				C	61.8		HQTT		HW		100			
61							SPT 21/29 for 65mm N > 50 (solid cone)		SPT								0
183			Moderately weathered, greyish green, speckled black-grey, fine to medium grained SANDSTONE; extremely weak.				C	62.9		HQTT				0			
62							SPT 21/29 for 65mm N > 50 (solid cone)		SPT								0
182			Highly weathered, orange brown, speckled black-grey, fine to medium grained SANDSTONE; extremely weak.				C	63.5		HQTT		HW		100			
63							SPT 21/29 for 65mm N > 50 (solid cone)		SPT								0
181							C	63.5		HQTT		HW		100			

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 9 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
180			Highly weathered, orange brown, speckled black-grey, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 63.5m)	AWHITU SAND FORMATION			64.44 C	SPT 26/24 for 55mm N > 50 (solid cone)	HQTT				100				
65									SPT					0			
79			Moderately weathered, greyish green, speckled black-grey, fine to medium grained SANDSTONE; extremely weak.					64.72 C		HQTT				100			
66										SPT				0			
78										HQTT				100			
67										SPT				0			
77										HQTT				100			
68										SPT				0			
76			Silty fine to medium SAND; greyish green, speckled black-grey. Very dense, moist.				67.93 C	SPT 50 for 65mm bouncing @ 65 mm	HQTT				100				
69			CORE LOSS						SPT				0				
75			Moderately weathered, greenish grey, speckled black-grey, fine to medium grained SANDSTONE; extremely weak.						HQTT				69				
70			CORE LOSS						SPT				0				
74									HQTT				86				
71			Moderately weathered, grey, speckled black-dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-15°.						SPT				0				
73									HQTT								

DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 500
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
16/08/23	08:05	18.3	70.5



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 150 Oaia Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M02

Sheet : 10 of 10
 Hole Length : 79.57m
 Scale @ A4 : 1:40

Commenced: 4/08/2023

Completed: 17/08/2023

Logged : JM

Processed : JM

Checked : JHS 23/08/2023

Easting: 1728387.63

Northing: 5923493.52

System: NZTM2000

RL: 144.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated UCS Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
72			Moderately weathered, grey, speckled black-dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-15°. (continued from layer starting at 70.8m)	AWHITU SAND FORMATION			SPT 35/15 for 15mm N > 50 (solid cone)		HQTT		MW		0					
73														100				
74			CORE LOSS					SPT 31/19 for 20mm N > 50 (solid cone)						0				
75			Moderately weathered, grey, speckled black-dark grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very thinly bedded at 0-15°. 74.50 - 75.12 Distinctly bedded, very closely spaced, very thinly bedded, dark grey, sandstone beds at sub-horizontal angles.					SPT 30/20 for 45mm N > 50 (solid cone)		HQTT		MW		59				
76			CORE LOSS					SPT 31/19 for 25mm N > 50 (solid cone)						0				
77			Moderately weathered, grey, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely bedded at 0-10°.				SPT 31/19 for 25mm N > 50 (solid cone)		HQTT		MW		87					
78							SPT 50 for 75mm bouncing @ 75 mm						0					
79			Highly weathered, dark grey, fine to medium grained SANDSTONE, trace carbonaceous material; extremely weak.						HQTT		HW		100					
80			End of Hole @ 79.57m, Target Depth.				SPT 50 for 70mm bouncing @ 70 mm						0					

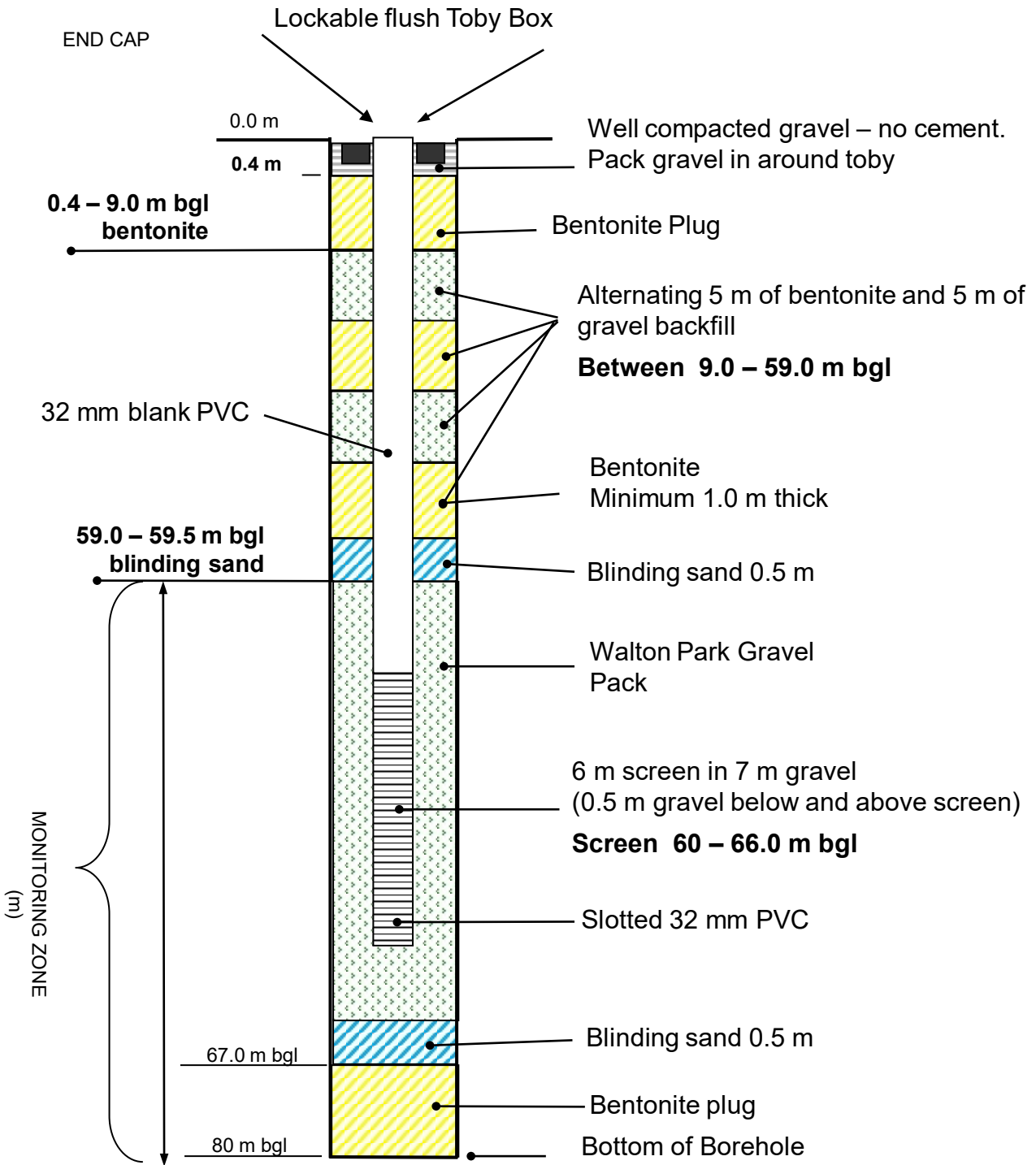
DRAFT

Notes and Comments:
 End of Hole @ 79.57m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO1060

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

BH-M02 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728387.63 E
Job Number	12612462		5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728387.63 E
Job Number	12612462		5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728387.63 E
Job Number	12612462		5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		



Report of photographs



Site identification – BH-M02

Project	AC Geo Panel – Waitākere	Coordinates	1728387.63 E
Job Number	12612462	(NZTM 2000)	5923493.52 N
Client	Auckland Council	Location	150 Oaia Rd, Muriwai
Date	7 August to 17 July 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Commenced: 25/07/2023

Completed: 3/08/2023

Hole No. : BH-M03

Sheet : 1 of 10

Hole Length : 79.64m

Scale @ A4 : 1:40

Logged : JM, MK

Processed : MK

Checked : JHS 23/08/2023

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

RL: 150

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect (mm Spacing)	Instrumentation Installation	Water level
							Number / Type	Result									
149	0		HAND AUGERED. NOT LOGGED		-	-				HA							
148	1.5		Silty fine to medium SAND; orange-brown, speckled black. Loose, moist. [AWHITU SAND FORMATION]		M	L	SPT 2/2 2/3 2/3 N=9			SPT				100			
147	2.55 - 2.73		Light brown.							OB				100			
147	2.73 - 4.30		Orange brown.							OB				100			
146	4.3		Silty fine to medium SAND; light grey streaked orange. Medium dense, moist.	AWHITU SAND FORMATION		MD	SPT 5/5 5/6 7/8 N=27			SPT				100			
145	4.65 - 4.70		Orange brown.							SPT				100			
144	5.30		Grey.							HQTT				100			
144	5.55 - 4.3		Silty CLAY, some sand; grey. 'Hard', moist, high plasticity. Sand: fine, orange.			'H'				HQTT				100			
144	5.60 - 6.00		Silty fine to medium SAND; light grey. Medium dense, moist. Grey-orange brown.			MD				SPT				100			
143	6.45		CORE LOSS		-	-				SPT				100			
143	6.8		Silty fine to medium SAND; light grey mottled orange brown. Medium dense, moist.		M	MD	SPT 3/3 4/4 4/4 N=16			SPT				100			
142	7.95						SPT 1/2 2/3 3/5 N=13			SPT				100			

DRAFT

Notes and Comments:

End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

Ground Water Level

Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Date Time Reading (mbgl) Hole depth (mbgl)

Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 2 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

Processed : MK

RL: 150

Datum: AUCKHT1946

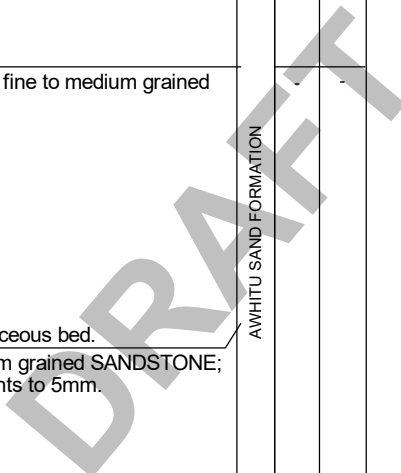
Checked : JHS 23/08/2023

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SQR (%)	Defect Spacing (mm)	Instrumentation	Water level
							Number / Type	Result									
141	9		CORE LOSS (continued from layer starting at 8.0m)						HQTT				0				
140	9.00 - 9.05		Silty fine to medium SAND; light grey. Medium dense, moist. Orange.	M	MD	SPT 2/2, 2/3, 3/4, N = 12	10.13	C		SPT			100				
140	9.70 - 10.50		Grey locally mottle orange brown.						HQTT				100				
140	9.95		Gently inclined, orange brown, 15 mm bed.						HQTT				100				
139	10.5		Silty fine to medium SAND, some carbonaceous inclusions; grey. Medium dense, moist.			SPT 1/1, 1/2, 2/5, N = 10				SPT			0				
138	11.15		Completely to highly weathered, grey, fine to medium grained SANDSTONE; extremely weak.						HQTT				100				
137	12.52		12.50 - 12.52 Sub-horizontal carbonaceous bed. Highly weathered, grey, fine to medium grained SANDSTONE; very weak with carbonaceous fragments to 5mm.								CW						
137	13.20 - 13.33		Orange-grey.						HQTT				100				
136	13.33		Silty CLAY, minor sand; grey. 'Very stiff', moist, high plasticity. Sand: fine.	M	'VST'	SPT 0/1, 0/1, 1/3, N = 5				SPT			0				
135	14.13		14.03 - 14.13 Mottled orange. Silty fine to medium SAND; light grey, mottled orange. Medium dense, moist.		MD				HQTT				100				
134	15.55		Highly weathered, light grey, fine to medium grained SANDSTONE; extremely weak.			SPT 3/3, 4/4, 4/6, N = 18				SPT			0				
134	16.00								HQTT				100				

Notes and Comments:
 End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



28-07-2023

31-07-2023



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 3 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Processed : MK

Checked : JHS 23/08/2023

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

RL: 150

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQR	Defect	Spacing (mm)	Instrumentation	Water level
							Number / Type	Result												
16.27	16.27		Highly weathered, light grey, fine to medium grained SANDSTONE; very weak. 16.21 - 16.27 Stained orange.	AWHITU SAND FORMATION	M	MD	16.27	C		HQTT		HW		100						
17.15	17.15		Silty fine to medium SAND; light grey, mottled orange. Medium dense, moist.							SPT				100						
17.15	17.15		Silty fine to medium SAND; light grey, mottled orange. Medium dense, moist.								HQTT			100						
18.55	18.55		Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak.										HW		100					
18.55	18.55		Silty fine to medium SAND; orange brown. Loose to medium dense, moist.		M	L-MD				SPT					100					
19.00	19.00		Highly weathered, brown, fine to medium grained SANDSTONE; extremely weak.								HQTT				100					
19.00	19.00		19.00 - 19.15 Orange.										HW		100					
19.35	19.35		Completely weathered, orange, fine to medium grained SANDSTONE; extremely weak										CW							
19.35	19.35		Silty fine to medium SAND; orange. Medium dense, moist.		M	MD				SPT					0					
19.95	19.95		CORE LOSS																	
20.4	20.4		Silty fine to medium SAND; orange. Dense, moist.	M	D					HQTT				57						
21.45	21.45		CORE LOSS																	
22.45	22.45		Sandy SILT; brownish grey. 'Stiff', moist, low plasticity. Sand: fine.	M	'St'					HQTT				48						
22.45	22.45		Silty fine to medium SAND; orange. Moist.																	
22.45	22.45		Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak.						SPT					100						
23.7	23.7		Silty fine to medium SAND; orange. Dense, moist.	M	D					HQTT				100						

Notes and Comments:
 End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 4 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

Processed : MK

RL: 150

Datum: AUCKHT1946

Checked : JHS 23/08/2023

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation	Water level
							Number / Type	Result									
24.45	24.45	X	Silty fine to medium SAND; orange. Dense, moist. (continued from layer starting at 23.7m)	AWHITU SAND FORMATION			SPT 6/6 8/8 11/12 N = 40		SPT				0				
24.9	24.9	X	CORE LOSS							HQTT				57			
25.23	25.23	X	Silty fine to medium SAND; orange. Moist.		M					HQTT							
25.91	25.91	X	Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak.					SPT 7/11 16/18 16 for 35mm N > 50		SPT		HW		100			
26.08	26.08	X	CORE LOSS							HQTT				82			
26.92	26.92	X	Highly weathered, light brown, fine to medium grained SANDSTONE; extremely weak. 26.35 - 26.92 Grades to dark orange.							HQTT							
27.45	27.45	X	Completely weathered, orange, fine to medium grained SANDSTONE; extremely weak.				SPT 6/7 10/11 11/12 N = 44		SPT		HW		0				
28.45	28.45	X	Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.				SPT 6/7 8/8 8/9 N = 33		SPT		CW		100				
29.55	29.55	X	31.45 - 31.55 Completely weathered. Clayey SILT, some sand; grey. 'Hard', moist, low plasticity. Sand: fine.	M		'H'	SPT 4/4 6/8 9/10 N = 33		SPT		HW		100				
31.55	31.55	X	31.55 - 32.50 Grades to underlying geology with depth.				SPT 3/4 5/5 5/5 N = 20		SPT		HW		100				

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Report ID: GENERAL_LOG || Project: BH-M03_MK_REV4.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

Notes and Comments:
 End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical		Orientation:		Ground Water Level			
Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
Shear Vane Id:							



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 6 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

Processed : MK

RL: 150

Datum: AUCKHT1946

Checked : JHS 23/08/2023

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SQR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
109	41		Highly weathered, dark brown-orange, fine to medium grained SANDSTONE; very weak. (continued from layer starting at 39.5m)	AWHITU SAND FORMATION			40.14	SPT 8/10 12/12 13/13 N > 50	HQTT				100				
	41.1		Highly weathered, grey SILTSTONE; very weak.				40.43		SPT					0			
	41.55		Highly weathered, grey-brown, indistinctly bedded SILTSTONE; very weak; very thinly bedded at 0-5°.				41.15		HQTT					100			
108	42		Completely weathered, greyish brown MUDSTONE; extremely weak.				41.43	SPT 3/3 5/5 5/5 for 75mm N > 50 (solid cone)	SPT					100			
	42.6		Highly weathered, grey-orange, indistinctly bedded, fine to medium grained SANDSTONE; very weak.						HQTT					100			
107	43		Highly weathered, orange, fine to medium grained SANDSTONE; extremely weak. 43.00 - 43.03 Dark brown layer. 43.02 - 43.03 Moderately strongly cemented layer.					SPT 12/16 18/20 12 for 35mm N > 50 (solid cone)	SPT					0			
106	44		43.84 Dark orange brown.				SPT 23/27 for 65mm N > 50 (solid cone)	HQTT					100				
105	45						SPT 21/29 for 70mm N > 50 (solid cone)	HQTT					0				
104	46		Highly weathered, red streaked brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin iron oxide laminations, inclined 10-30°.					HQTT					100				
103	47							SPT					0				
102	48							HQTT					100				

DRAFT

Notes and Comments:

End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

Ground Water Level

Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Date	Time	Reading (mbgl)	Hole depth (mbgl)
28/07/23	08:00	8.4	40.95



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 7 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

Processed : MK

RL: 150

Datum: AUCKHT1946

Checked : JHS 23/08/2023

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated UCS Strength (MPa)	TCR SQR (%)	Defect Spacing (mm)	Instrumentation	Water level	
							Number / Type	Result										
101	49.1		Highly weathered, red streaked brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin iron oxide laminations, inclined 10-30°. (continued from layer starting at 45.4m)	AWHITU SAND FORMATION			SPT 21/29 for 60mm N > 50 (solid cone)		HQTT				0					
100	50		Highly weathered, orange, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin, black and red, iron oxide beds inclined 5-10°. 49.74 Reddish brown. 50.00 - 50.03 Black, moderately strongly cemented. 50.00 - 50.73 Orange brown.				SPT 20/30 for 65mm N > 50 (solid cone)		HQTT					0				
99	51		50.73 - 51.00 Reddish brown.															
98	52		51.12 Dark orange brown. 51.42 Brown.															
97	53		52.50 - 55.63 Brown-orange. CORE LOSS					SPT 28/22 for 45mm N > 50 (solid cone)		HQTT					0			
96	54		Highly weathered, orange, distinctly thin to very thin bedded brown, fine to medium grained SANDSTONE; extremely weak; very closely spaced, very thin, black-red, iron oxide stained beds inclined 5-10°.					SPT 26/24 for 50mm N > 50 (solid cone)		HQTT					89			
95	55							SPT 21/29 for 55mm N > 50 (solid cone)		HQTT					0			
94	56		55.63 - 56.60 Dark brown, speckled black.					SPT 22/28 for 55mm N > 50 (solid cone)		HQTT					100			

Notes and Comments:
 End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
31/07/23	08:15	13.6	54.13



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 8 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Processed : MK

Checked : JHS 23/08/2023

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

RL: 150

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQD (%)	Defect	Spacing (mm)	Instrumentation	Water level	
							Number / Type	Result													
193	56.6	X	Highly weathered, orange, distinctly thinly to very thinly bedded brown, fine to medium grained SANDSTONE; extremely weak; very closely spaced, very thin, black-red, iron oxide stained beds inclined 5-10°. (continued from layer starting at 52.8m)	AWHITU SAND FORMATION			SPT 25/25 for 55mm N > 50 (solid cone)		HQTT					100							
191	57	X	Highly weathered, brown, fine to medium grained SANDSTONE; extremely weak.					SPT 26/24 for 60mm N > 50 (solid cone)		HQTT					0						
191	58	X	Highly weathered, light brown SILTSTONE; extremely weak.							HQTT					100						
191	59	X	58.90 - 59.05 Brown, streaked orange and dark brown.							HQTT					0						
190	59	X	Highly weathered, brown, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin silty sand beds at 5-15°.					SPT 25/25 for 60mm N > 50 (solid cone)		HQTT						100					
189	60	X					SPT 26/24 for 50mm N > 50 (solid cone)		HQTT						0						
188	61	X							HQTT						100						
188	62	X							HQTT						0						
187	62.25	X	CORE LOSS						HQTT						56						
187	63	X					SPT 27/23 for 65mm N > 50 (solid cone)		HQTT						0						
186	63	X	Highly weathered, brown, indistinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, thin silty sand beds at 10-20°.						HQTT						60						

DRAFT

Notes and Comments:

End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical		Orientation:		Ground Water Level			
Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
Shear Vane Id:							



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 9 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

Processed : MK

RL: 150

Datum: AUCKHT1946

Checked : JHS 23/08/2023

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQD (%)	Defect	Spacing (mm)	Instrumentation	Water level
							Number / Type	Result												
65.15			CORE LOSS (continued from layer starting at 64.0m)						HQTT											
65.15			Silty fine to medium SAND; brown, streaked and speckled orange; indistinctly very thinly bedded at 10-25°. Very dense, moist.		M	VD	SPT 22/28 for 55mm N > 50 (solid cone)		HQTT											
66.54			CORE LOSS				SPT 21/29 for 70mm N > 50 (solid cone)		HQTT											
67.5			Silty fine to medium SAND; brown, streaked orange, speckled black. Very dense, moist.	AWHITU SAND FORMATION	M	VD	SPT 14/16 24/26 for 70mm N > 50 (solid cone)		HQTT											
67.5			CORE LOSS				SPT 11/12 14/17 19 for 75mm N > 50 (solid cone)		HQTT											
67.5							SPT 8/11 13/16 18/3 for 10mm N > 50 (solid cone)		HQTT											

DRAFT

Notes and Comments:

End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical		Orientation:		Ground Water Level			
Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
Shear Vane Id:							



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 250 Oaia Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M03

Sheet : 10 of 10
 Hole Length : 79.64m
 Scale @ A4 : 1:40

Commenced: 25/07/2023

Completed: 3/08/2023

Logged : JM, MK

Easting: 1728010.05

Northing: 5923112.26

System: NZTM2000

Processed : MK

RL: 150

Datum: AUCKHT1946

Checked : JHS 23/08/2023

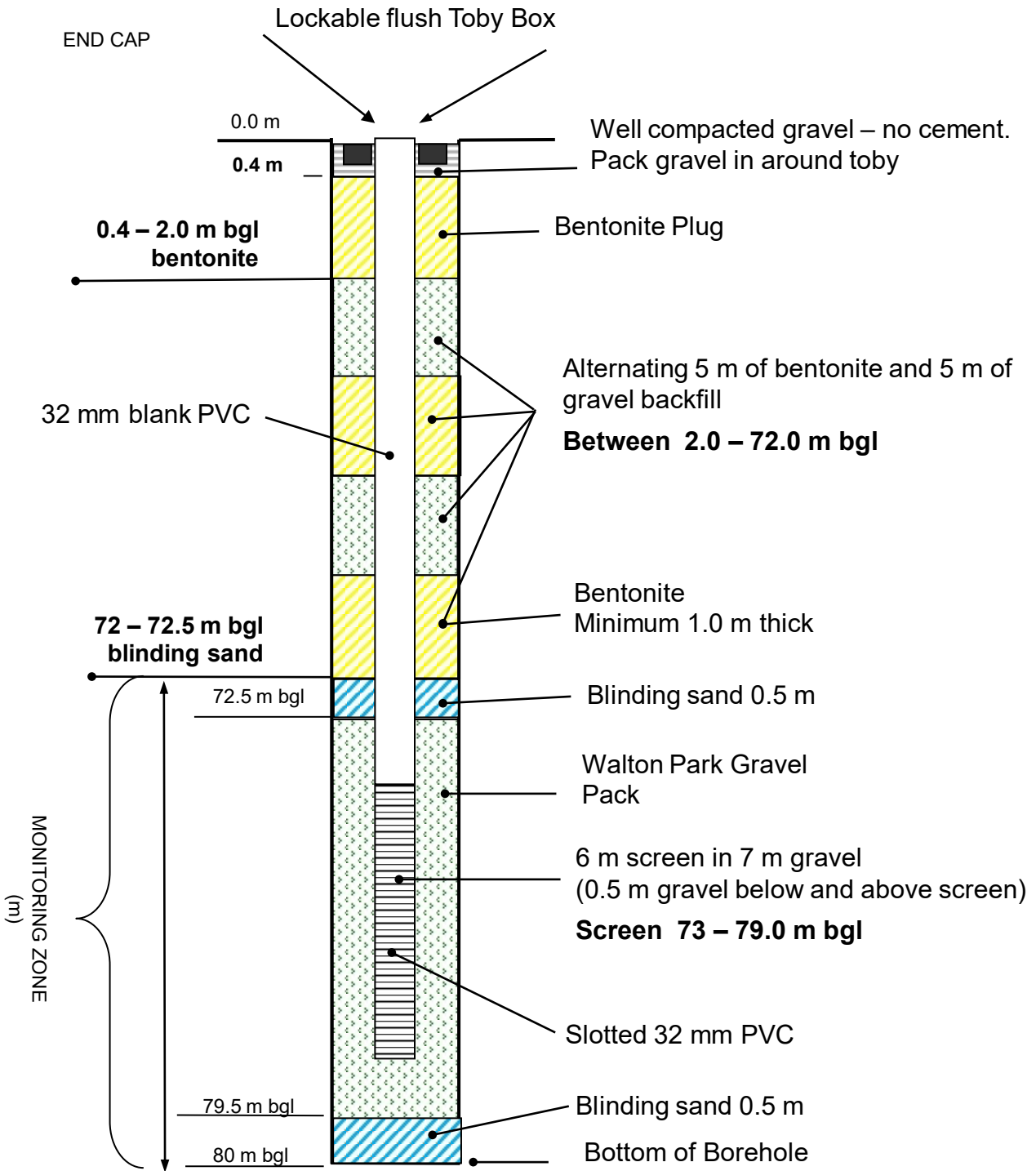
RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
72.29			Silty fine to medium SAND; brown, streaked orange, speckled black. Very dense, moist. (continued from layer starting at 67.5m) CORE LOSS		-	-	SPT 14/17 22/28 for 65mm N > 50 (solid cone)		SPT					0			
72.97			Silty fine to medium SAND; brown, streaked orange, speckled black. Very dense, moist.		M	VD			HQTT					43			
74.08			CORE LOSS		-	-	SPT 12/14 16/16 18 for 65mm N > 50 (solid cone)		SPT					0			
74.08			CORE LOSS		-	-			HQTT					18			
75.985			Silty fine to medium SAND; greyish brown, streaked reddish brown. Very dense, moist.		M	VD	SPT 10/12 15/16 7 for 65mm N > 50 (solid cone)		SPT					0			
75.985			75.90 - 76.00 Very weakly cemented iron oxide bed.						HQTT					100			
75.985			76.30 - 76.40 Very weakly cemented iron oxide bed.						HQTT								
76.98			CORE LOSS		-	-	SPT 14/23 26/24 for 55mm N > 50 (solid cone)		SPT					0			
76.98			Highly weathered, greyish brown, distinctly bedded, fine to medium grained SANDSTONE; extremely weak; very closely spaced, very thinly bedded, brown sandstone beds at 5-15°. 76.98 - 77.08 Completely weathered, recovered as sand. 77.50 - 77.60 Completely weathered, recovered as sand.						HQTT					81			
78.43			CORE LOSS		-	-	SPT 27/23 for 50mm N > 50 (solid cone)		SPT					0			
78.43			CORE LOSS		-	-			HQTT					21			
79.64			End of Hole @ 79.64m, Target Depth.				SPT 25/25 for 60mm N > 50 (solid cone)		SPT					0			

Notes and Comments:
 End of Hole @ 79.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
02/08/23	08:00	16.3	72.29

BH-M03 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728010.05 E
Job Number	12612462		5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
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Report of photographs



Site identification – BH-M03

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Job Number	12612462	(NZTM 2000)	5923112.26 N
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728010.05 E
Job Number	12612462		5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
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Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		

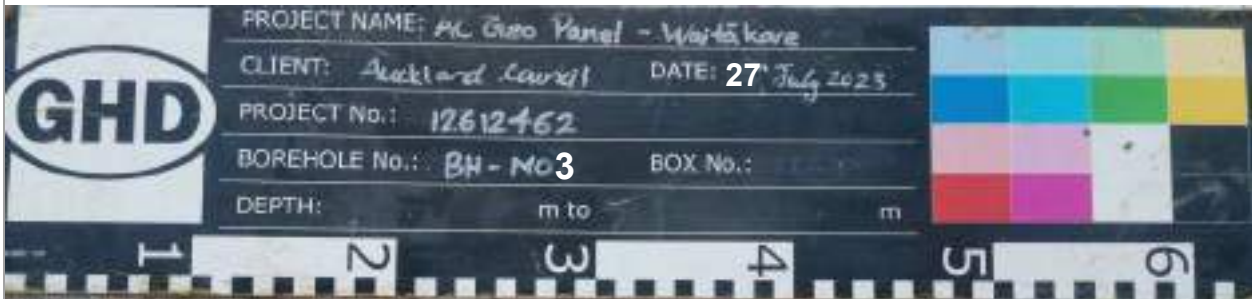


Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		



Report of photographs



Site identification – BH-M03

Project	AC Geo Panel – Waitākere	Coordinates	1728010.05 E
Job Number	12612462	(NZTM 2000)	5923112.26 N
Client	Auckland Council	Location	250 Oaia Rd, Muriwai
Date	25 July to 3 August 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 45 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M04
 Sheet : 1 of 3
 Hole Length : 10.95m
 Scale @ A4 : 1:25

Commenced: 10/08/2023 Completed: 10/08/2023

Logged : JM
 Processed : JM
 Checked : JHS 24/08/23

Easting: 1727699.87 Northing: 5923031.54 System: NZTM2000
 RL: 53 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
	0		HYDROVAC. NO RECOVERY.														
	0.7		Completely weathered, brown, streaked orange-black, fine grained SANDSTONE; extremely weak. [AWHITU SAND FORMATION].														
	0.85		Silty CLAY; brown with orange, grey and orange-red streaks. 'Very stiff', moist, high plasticity.	AWHITU SAND	M	'VSt'				OB				100			
	1.25		Clayey SILT; grey with light grey streaks. 'Very stiff', moist, low plasticity.														
	1.35		Clayey SILT; red. 'Very stiff', moist, low plasticity. [NIHOTUPU FORMATION]							SPT				100			
	1.95		Clayey SILT, some gravel; dark brown, mottled orange-grey. 'Very stiff to hard', moist, low plasticity. Gravel, fine to medium, subangular, siltstone.	NIHOTUPU FORMATION		'VSt-H'				OB				100			
	3.3		Clayey SILT, trace gravel; reddish brown, mottled and streaked grey and brown. 'Very stiff'; moist, low plasticity. Gravel, fine to medium, subangular, siltstone.			'VSt'				SPT				100			
	4.8									SPT				100			

DRAFT

Notes and Comments:
 End of Hole @ 10.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Groundwater not measured.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: MAR 700
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 45 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M04
 Sheet : 2 of 3
 Hole Length : 10.95m
 Scale @ A4 : 1:25

Commenced: 10/08/2023 Completed: 10/08/2023

Logged : JM
 Processed : JM
 Checked : JHS 24/08/23

Easting: 1727699.87 Northing: 5923031.54 System: NZTM2000
 RL: 53 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level												
							Number / Type	Result																							
147	6		Clayey SILT, trace gravel; reddish brown, mottled and streaked grey and brown. 'Very stiff'; moist, low plasticity. Gravel, fine to medium, subangular, siltstone. (continued from layer starting at 3.3m)	NIHOTUPU FORMATION	M	'VSt'	SPT	3/3	OB	SPT	100			100																	
			6.65 - 7.20 Contains minor subangular siltstone gravel.																												
			6.80 - 8.95 Trace fine sand.																												
146	7						SPT	2/2	OB	SPT	100			51																	
			8.10 30mm interbed of very stiff red clay.																												
145	8						SPT	2/3	OB	SPT	62			62																	
144	9		CORE LOSS						OB	SPT	100			100																	
143	9		Clayey SILT with trace gravel; reddish brown, mottled and streaked orange-brown-black. 'Very stiff', moist, low plasticity. Sand, fine. Gravel, fine, subangular, siltstone.	M	'VSt'		SPT	2/3	OB	SPT	100			100																	

DRAFT

Notes and Comments:
 End of Hole @ 10.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Groundwater not measured.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: MAR 700
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 45 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M04
 Sheet : 3 of 3
 Hole Length : 10.95m
 Scale @ A4 : 1:25

Commenced: 10/08/2023 Completed: 10/08/2023

Logged : JM
 Processed : JM
 Checked : JHS 24/08/23

Easting: 1727699.87 Northing: 5923031.54 System: NZTM2000
 RL: 53 Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
11.42	11		Clayey SILT with trace gravel; reddish brown, mottled and streaked orange-brown-black. "Very stiff", moist, low plasticity. Sand, fine. Gravel, fine, subangular, siltstone. (continued from layer starting at 9.0m)	NIHOTUPU FORMATION			SPT 3/4 5/5 6/6 N = 22		OB				100				
11.00	11		End of Hole @ 10.95m, Target Depth.														
12.41	12																
13.40	13																
14.39	14																

DRAFT

Notes and Comments:
 End of Hole @ 10.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Groundwater not measured.

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: MAR 700
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

Refer to explanation sheets for abbreviation and symbols

Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1727699.87 E
Job Number	12612462		5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1727699.87 E
Job Number	12612462		5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		



Report of photographs



Site identification – BH-M04

Project	AC Geo Panel – Waitākere	Coordinates	1727699.87 E
Job Number	12612462	(NZTM 2000)	5923031.54 N
Client	Auckland Council	Location	45 Domain Crescent, Muriwai
Date	10 August 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 58 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M05

Sheet : 2 of 2
 Hole Length : 10.95m
 Scale @ A4 : 1:40

Commenced: 18/07/2023

Completed: 18/07/2023

Logged : MK

Processed : MK

Checked : JHS 22/08/2023

Easting: 1727856.03

Northing: 5923234.43

System: NZTM2000

RL: 63.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SQR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level												
							Number / Type	Result																					
155	8.40		Fine to medium SAND with some silt; grey. Medium dense, moist. (continued from layer starting at 5.6m)	AWHITU SAND FORMATION	-	-	SPT 3/4 6/7 9/11 N = 33		HOTT				100																
154	8.40 - 9.25	Greenish grey.																											
154	9.25		Silty fine SAND; grey. Medium dense, moist.																		SPT					100			
154	9.45		CORE LOSS																										
154	9.45		Fine to medium SAND with some silt; grey. Moist.																										
153	9.8		Moderately weathered, grey SILTSTONE; very weak.				SPT 6/8 9/11 12/15 N = 47		HOTT				86																
153	10.3		Moderately weathered, greenish grey, fine to medium grained SANDSTONE; extremely weak.						SPT					100															
151	11.0		End of Hole @ 10.95m, Target Depth.																										

Notes and Comments:
 End of Hole @ 10.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Groundwater not measured.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:

Contractor: DCN

Equipment: TR 200

Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		



Report of photographs



Site identification – BH-M05

Project	AC Geo Panel – Waitākere	Coordinates	1727856.03 E
Job Number	12612462	(NZTM 2000)	5923234.43 N
Client	Auckland Council	Location	58 Domain Crescent, Muriwai
Date	18 July 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 128 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M06

Sheet : 1 of 6
 Hole Length : 40.95m
 Scale @ A4 : 1:40

Commenced: 20/07/2023

Completed: 21/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728033.15

Northing: 5923293.53

System: NZTM2000

RL: 89.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect (mm)	Instrumentation	Water level
							Number / Type	Result									
89.5	0		HYDROVAC. NO RECOVERY.		-	-											
88.5	1.5		Sandy SILT with trace clay; light brown, streaked orange-grey. 'Stiff to very stiff', moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION].	AWHITU SAND FORMATION	M	F	SPT 1/1 1/1 1/1 N = 4		HV				0				
87.5	3.0		CORE LOSS				SV@3m UTP SPT 1/1 1/1 1/1 N = 4		OB				100				
86.5	3.45		Sandy SILT with trace clay; grey, speckled black. Very stiff to hard, moist. Sand, fine to medium.	AWHITU SAND FORMATION	M	VS-H			OB				100				
85.5	5.4		Silty fine to medium SAND; grey, streaked orange-red, speckled black. Loose, moist. [PALAEO-COLLUVIUM] 5.40 - 5.85 Orange brown-grey. 5.45 5-10mm very weakly iron oxide cemented lamination. 5.80 5-10mm very weakly iron oxide cemented lamination.	PALAEO-COLLUVIUM		L	SV@4.5m UTP SPT 0/0 0/1 1/1 N = 3		OB				100				
83.5	7.1		Fine SAND with trace silt and fine gravel sized organic fragments; light brown. Medium dense, moist. [AWHITU SAND FORMATION]			MD	SPT 1/1 1/1 2/3 N = 7		OB				100				
82.5							SPT 2/3 3/4 5/7 N = 19		SPT				89				

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Report ID: GENERAL_LOG || Project: BH-M06_REV02_MK.GPJ || Library: GHD - NZ.GD.GLB || Date: 25 August 2023

Notes and Comments: End of Hole @ 40.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Shear Vane Id: GEO902							



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 128 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M06

Sheet : 2 of 6
 Hole Length : 40.95m
 Scale @ A4 : 1:40

Commenced: 20/07/2023

Completed: 21/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728033.15

Northing: 5923293.53

System: NZTM2000

RL: 89.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect (mm)	Instrumentation	Water level
							Number / Type	Result									
181	9		Fine SAND with trace silt and fine gravel sized organic fragments; light brown. Medium dense, moist. [AWHITU SAND FORMATION] (continued from layer starting at 7.1m)	AWHITU SAND FORMATION			SPT 3/4 6/5 5/5 N = 21		HQTT				100				
180	10		CORE LOSS				SPT 1/1 1/1 1/2 N = 5		SPT				0				
179	11		Silty fine SAND; orange-brown, streaked grey. Loose, moist. [PALAEO-COLLUVIUM] 11.05 - 11.10 Organic fragments 10-20mm in diameter.	PALAEO-COLLUVIUM	M	L			HQTT				100				
178	12		11.70 - 11.80 Light grey. 11.90 - 12.00 Organic fragments to 5mm.				SPT 2/2 2/2 2/2 N = 8		SPT				100				
177	13		CORE LOSS				SPT 1/1 1/2 2/2 N = 7		SPT				0				
176	14		Silty fine to medium SAND with 10-30 mm inclusions of silty clay; light brown, streaked orange, speckled black. Moist. Clay, grey. 'Firm to stiff', moist, high plasticity.		M				HQTT				100				
175	15		CORE LOSS				SPT 1/1 3/2 3/3 N = 11		SPT				0				
174	16		Silty fine SAND; light brown, streaked orange, speckled black. Medium dense, moist. 15.65 Orange brown. 15.70 10-20mm very weakly iron oxide cemented lamination.		M	MD			HQTT				100				

DRAFT

Report ID: GENERAL_LOG || Project: BH-M06_REV02_MK.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

Notes and Comments:
 End of Hole @ 40.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 128 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M06

Sheet : 3 of 6
 Hole Length : 40.95m
 Scale @ A4 : 1:40

Commenced: 20/07/2023

Completed: 21/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728033.15

Northing: 5923293.53

System: NZTM2000

RL: 89.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation	Water level
							Number / Type	Result									
173	16.66.5		Silty fine SAND; light brown, streaked orange, speckled black. Medium dense, moist. (continued from layer starting at 15.5m)	PALAEO-COLLUVIUM				SPT 1/1, 2/4, 6/3, N = 15	HQTT				100				
17			Silty CLAY; grey, speckled and streaked orange-red speckles. 'Firm', moist, high plasticity.			'F'			SPT					93			
172			Silty fine SAND with closely spaced thin interbeds of silty clay; light grey mottled orange. Medium dense, moist. Clay, firm, moist, high plasticity.				MD			HQTT				100			
18	18		CORE LOSS					SPT 1/1, 0/0, 1/1, N = 2	SPT				0				
18	18.45		Clayey SILT with minor sand with very closely spaced very thin interbeds of sandy silt and trace fine gravel sized organic fragments; light grey, mottled orange. Firm, moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION]	AWHITU SAND FORMATION	M	'F'			HQTT				100				
19	19.5		CORE LOSS						SPT 0/0, 0/0, 0/0, N = 0	SPT				0			
19	20.20.6		Silty CLAY; grey-brown. 'Firm', moist, high plasticity. Silty fine SAND; light grey, streaked orange. Dense, moist.		M	'F'	D		SPT 4/6, 9/9, 9/10, N = 37	SPT				100			
20	21.45		CORE LOSS						HQTT				29				
20	22		Silty fine SAND; light grey. Medium dense, moist.	M		MD			HQTT				48				
21	22.5		CORE LOSS					SPT 2/3, 4/4, 3/3, N = 14	SPT				0				
21	22.95		Silty fine SAND; light grey. Loose to medium dense, wet.	W		L-MD			HQTT				100				

DRAFT

Report ID: GENERAL_LOG || Project: BH-M06_REV02_MK.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

Notes and Comments:
 End of Hole @ 40.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical	Orientation:
Contractor: DCN	
Equipment: TR 200	
Shear Vane Id: GEO902	

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
20/07/23	15:45	19.6	21.95
21/07/23	08:30	3.8	21.95



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 128 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M06

Sheet : 4 of 6
 Hole Length : 40.95m
 Scale @ A4 : 1:40

Commenced: 20/07/2023

Completed: 21/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728033.15

Northing: 5923293.53

System: NZTM2000

RL: 89.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
65	24.45	X	Silty fine SAND; light grey. Loose to medium dense, wet. (continued from layer starting at 23.0m)	AWHITU SAND FORMATION	-	-	SPT 1/2 2/3 3/3 N = 11	SPT	-	-	-	-	96	-	-	-	
			CORE LOSS														
25	25.95	X	Silty fine SAND, light brown, locally orange brown. Moist.	AWHITU SAND FORMATION	M	-	SPT 2/1 1/2 3/4 N = 10	SPT	-	-	-	-	0	-	-	-	
			CORE LOSS														
63	27	X	Silty fine SAND, light brown, locally orange brown. Moist.	AWHITU SAND FORMATION	M	-	SPT 4/2 0/0 0/0 N = 0	SPT	-	-	-	-	100	-	-	-	
			CORE LOSS														
27	28.3	X	Silty CLAY with trace organics; dark grey, streaked brown-orange. 'Firm', moist, high plasticity. [PALAEO-COLLUVIUM]	PALAEO-COLLUVIUM	M	'F'	SPT 1/1 0/0 1/3 N = 4	SPT	-	-	-	-	0	-	-	-	
			CORE LOSS														
28	29.8	X	Clayey SILT with trace sand; grey, streaked orange, speckled black. 'Firm', moist, low plasticity. Sand, fine. [AWHITU SAND FORMATION]	AWHITU SAND FORMATION	-	-	SPT 1/1 1/2 2/3 N = 8	SPT	-	-	-	-	65	-	-	-	
			CORE LOSS														
29	30.45	X	Clayey SILT with trace sand; grey, streaked orange, speckled black. 'Firm', moist, low plasticity. Sand, fine.	AWHITU SAND FORMATION	M	'F'	SPT 0/0 0/0 N = 0	SPT	-	-	-	-	0	-	-	-	
			CORE LOSS														
30	30.80	X	Dark grey organic streaks.	AWHITU SAND FORMATION	-	-	SPT 0/0 0/0 N = 0	SPT	-	-	-	-	100	-	-	-	
			CORE LOSS														
31	31.5	X	CORE LOSS														

DRAFT

Notes and Comments:
 End of Hole @ 40.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 128 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M06

Sheet : 5 of 6
 Hole Length : 40.95m
 Scale @ A4 : 1:40

Commenced: 20/07/2023

Completed: 21/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728033.15

Northing: 5923293.53

System: NZTM2000

RL: 89.5

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
157	33.0	X	Sandy SILT; light grey, streaked light grey-brown. 'Firm', moist, low plasticity. Sand, fine. (continued from layer starting at 32.0m)	AWHITU SAND FORMATION	M	'F'	SPT 0/0 0/0 0/0 N = 0		HQTT				100				32
156	33.8	X	Silty CLAY with trace organics; dark grey-brown. 'Firm to stiff', moist, high plasticity. [PALAEO-COLLUVIUM]	PALAEO-COLLUVIUM		'F-S'	SPT 0/0 0/0 0/0 N = 0		HQTT				100				33
155	34.8	X	Clayey SILT with minor organics; grey, mottled brown. 'Soft', wet, low plasticity.	PALAEO-COLLUVIUM	W	'S'	SPT 0/0 0/0 0/0 N = 0		HQTT				100				34
154	35.5	X	Silty CLAY; dark grey-brown. 'Firm', moist, high plasticity. [AWHITU SAND FORMATION]		M	'F'			HQTT				100				35
153	36.0	X	Clayey SILT with trace sand; light grey, streaked dark grey-brown. 'Firm', moist, low plasticity. Sand, fine. CORE LOSS				SPT 2/3 3/4 4/6 N = 17		SPT				0				36
152	36.8	X	Silty fine SAND; light grey, streaked orange brown. Medium dense, moist. 36.80 - 38.20 Orange streaks inclined 50-60°.	AWHITU SAND FORMATION	M	MD	SPT 1/1 3/4 4/4 N = 15		HQTT				100				37
151	38.0	X	38.80 Orange brown and grey.						SPT				0				38
150	39.1	X	Silty fine to medium SAND; brown, speckled black. Dense, moist.			D	SPT 2/3 5/7 11/11 N = 34		HQTT				100				39
									SPT				96				40
									HQTT				100				

Notes and Comments:
 End of Hole @ 40.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 128 Domain Crescent, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M06

Sheet : 6 of 6
 Hole Length : 40.95m
 Scale @ A4 : 1:40

Commenced: 20/07/2023

Completed: 21/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728033.15

Northing: 5923293.53

System: NZTM2000

RL: 89.5

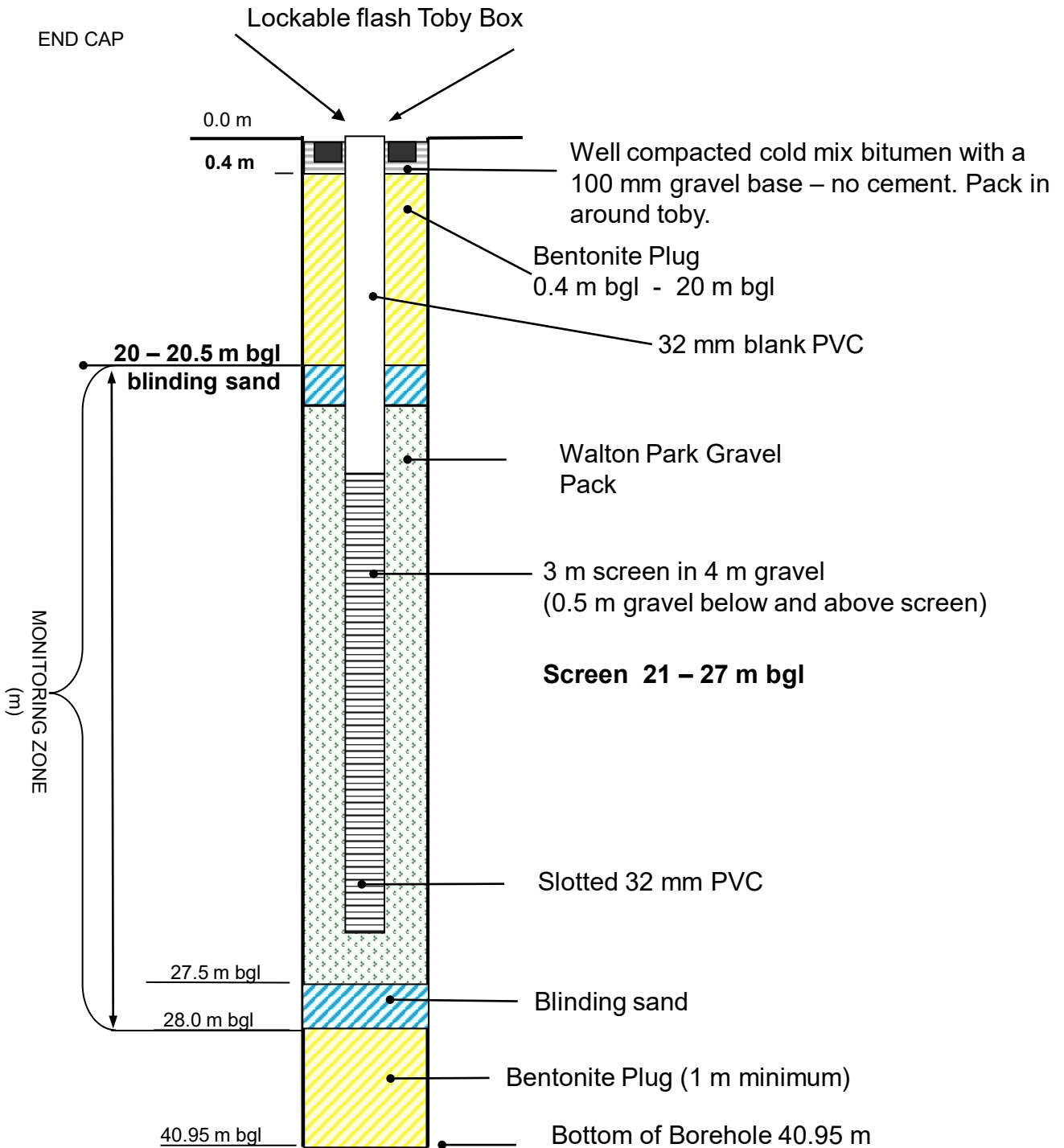
Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect (mm Spacing)	Instrumentation Installation	Water level
							Number / Type	Result									
40.95	40.95	[Symbol]	Silty fine to medium SAND; brown, speckled black. Dense, moist. (continued from layer starting at 39.1m)						HQTT				100				
40.95	40.95	[Symbol]	CORE LOSS				SPT 6/7 8/9 11/12 N = 40		SPT					0			
41	41		End of Hole @ 40.95m, Target Depth.														

DRAFT

Notes and Comments: End of Hole @ 40.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject for future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Shear Vane Id: GEO902		24/07/23	08:45	21.26	40.95		

BH-M06 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728033.15 E
Job Number	12612462		5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs

Site identification – BH-M06



Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728033.15 E
Job Number	12612462		5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates	1728033.15 E
Job Number	12612462	(NZTM 2000)	5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		



Report of photographs



Site identification – BH-M06

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728033.15 E
Job Number	12612462		5923293.53 N
Client	Auckland Council	Location	128 Domain Crescent, Muriwai
Date	20 to 21 July 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 265 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M07

Sheet : 1 of 6
 Hole Length : 40.64m
 Scale @ A4 : 1:40

Commenced: 10/07/2023

Completed: 12/07/2023

Logged : LA, MK

Easting: 1728235.26

Northing: 5923652.39

System: NZTM2000

Processed : MK

RL: 52

Datum: AUCKHT1946

Checked : JHS

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
	0.2		ASPHALT HYDROVAC. NO RECOVERY	FILL													
51	1		Organic SILT with some sand and minor roots; dark brown. 'Stiff', moist, low plasticity. Sand, fine to medium. [PALAEO-COLLUVIUM]		M	'St'		SPT 0/0 0/0 0/1 N = 1		HV				0			
49	2		Clayey SILT with some sand; grey. 'Soft', wet, low plasticity. Sand, fine.		W	'S'				OB				100			
	2.9		Silty fine to medium SAND; grey. Wet.			'VS'				SPT				67			
	3.53		Highly weathered, orange brown, fine to medium grained SANDSTONE; very weak.		W					OB				100			
48	4		Silty fine to medium SAND; orange brown. Loose to medium dense, wet.	PALEO-COLLUVIUM						SPT				0			
	4		Silty fine to coarse SAND with trace gravel; light to dark grey, streaked brown-orange, mottled brown-grey. Very loose, moist. Gravel, fine to coarse, sub-angular to sub-rounded.		M	VL		SPT 0/0 0/0 0/0 N = 0		OB				100			
47	5		Silty fine to medium SAND; orange. Loose, moist. [AWHITU SAND FORMATION]							SPT				100			
46	6		CORE LOSS							OB				100			
	7.5		Highly weathered, light grey-brown SILTSTONE; extremely weak.	AWHITU SAND FORMATION						SPT				100			
44	7.5		Highly weathered, light grey-brown SILTSTONE; extremely weak.					SPT 4/4 4/5 10/11 N = 30		SPT				100			

Notes and Comments:
 End of Hole @ 40.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: Tr-200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 265 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M07

Sheet : 2 of 6
 Hole Length : 40.64m
 Scale @ A4 : 1:40

Commenced: 10/07/2023

Completed: 12/07/2023

Logged : LA, MK

Easting: 1728235.26

Northing: 5923652.39

System: NZTM2000

Processed : MK

RL: 52

Datum: AUCKHT1946

Checked : JHS

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SQR RQD (%)	Defect (mm Spacing)	Instrumentation	Water level
							Number / Type	Result									
8.1		X	Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak.	AWHITU SAND FORMATION			SPT 2/2 3/4 5/7 N = 19	120mm	HQTT		HW		100				
9.45			CORE LOSS							SPT				100			
10.5		X	Silty fine SAND; dark greenish grey. Medium dense to dense, moist.		M	MD-D	SPT 3/4 6/7 9/9 N = 31			SPT				100			
11.25		X	Silty fine to medium SAND; dark orange brown. Moist.							HQTT				33			
12		X	Silty fine to medium SAND; dark orange brown. Medium dense, moist.		M	MD	SPT 2/2 3/3 5/5 N = 16			SPT				67			
13.95		X	CORE LOSS							HQTT				100			
14.53		X	Highly weathered, dark orange brown, fine to medium grained SANDSTONE; extremely weak.							HQTT		HW		62			
14.53		X	Fine to medium SAND with some silt; orange brown. Moist.		M												
15		X	CORE LOSS							SPT				0			
15.35		X	Silty fine to medium SAND; light grey. Medium dense, moist.		M	MD	SPT 1/0 2/3 3/4 N = 12			SPT				100			
15.85		X								HQTT							

Notes and Comments:

End of Hole @ 40.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

Ground Water Level

Contractor: DCN
 Equipment: Tr-200
 Shear Vane Id:

Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 265 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M07

Sheet : 3 of 6
 Hole Length : 40.64m
 Scale @ A4 : 1:40

Commenced: 10/07/2023

Completed: 12/07/2023

Logged : LA, MK

Easting: 1728235.26

Northing: 5923652.39

System: NZTM2000

Processed : MK

RL: 52

Datum: AUCKHT1946

Checked : JHS

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RCD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
16.95		X	Silty fine to medium SAND; orange brown. Medium dense, moist. (continued from layer starting at 15.9m)	AWHITU SAND FORMATION			SPT 1/2 3/4 6/7 N = 20	HQTT					100				
17.6		X	CORE LOSS											100			
18.45		X	Silty fine to medium SAND; orange brown. Medium dense, moist.		M	MD	SPT 3/3 5/6 8/9 N = 28	HQTT						38			
18.75		X	CORE LOSS											0			
19.4		X	Silty fine to medium SAND; orange brown. Medium dense, moist. 18.90 - 19.40 Brownish grey.		M	MD	SPT 4/4 6/6 7/10 N = 29	HQTT						76			
20.4		X	CORE LOSS											100			
20.9		X	Silty fine to medium SAND; orange brown. Medium dense, moist.		M	MD	SPT 4/4 5/6 8/9 N = 30	HQTT						48			
21.621		X	CORE LOSS											100			
22.1		X	Silty fine to medium SAND; orange brown. Medium dense to dense, moist.		M	MD-D	SPT 3/5 6/7 9/9 N = 31	HQTT						76			
23.2		X	23.20 - 24.50 Dark reddish brown.											100			

Notes and Comments:

End of Hole @ 40.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical

Orientation:

Ground Water Level

Contractor: DCN

Equipment: Tr-200

Shear Vane Id:

Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 265 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M07

Sheet : 4 of 6
 Hole Length : 40.64m
 Scale @ A4 : 1:40

Commenced: 10/07/2023

Completed: 12/07/2023

Logged : LA, MK

Easting: 1728235.26

Northing: 5923652.39

System: NZTM2000

Processed : MK

RL: 52

Datum: AUCKHT1946

Checked : JHS

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level		
							Number / Type	Result											
24.7	24.50 - 24.70		Silty fine to medium SAND; orange brown. Medium dense to dense, moist. (continued from layer starting at 21.6m)	AWHITU SAND FORMATION	-	-	SPT 6/7 6/7 8/9 N = 30	SPT	SPT	100			100						
25.15	24.50 - 24.70		24.50 - 24.70 Fine sand.								HQTT		57						
25.5	25.20 - 25.30		Silty fine to medium SAND; orange brown. Moist. 25.20 - 25.30 Carbonaceous inclusions.				M					SPT				100			
25.5	25.50 - 25.67		Silty fine to medium SAND; reddish orange brown. Dense, moist. 25.50 - 25.67 Carbonaceous fragments to 10 mm.				D			SPT 6/7 9/10 10/11 N = 40	SPT					100			
26.33	26.33 - 26.47		26.33 - 26.47 Very closely spaced iron oxide stained laminations at 20-30°.									HQTT				100			
27.4	27.4									SPT 4/6 7/8 9/10 N = 34	SPT					100			
28.4	28.4											HQTT				100			
29.4	29.4									SPT 5/6 7/8 11/12 N = 38	SPT					100			
30.4	30.4											HQTT				100			
31.3	29.00 - 30.00		29.00 - 30.00 Very closely spaced, orange brown laminations at 15-30°.									SPT				100			
31.3	31.3		Highly weathered, orange brown, fine to medium grained SANDSTONE; extremely weak. Recovered as; Silty SAND. Very dense, moist.				SPT 13/14 15/20 15 for 50mm N > 50	SPT					100						
32.0	32.0								SPT				100						

Notes and Comments:
 End of Hole @ 40.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: Tr-200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 265 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M07
 Sheet : 5 of 6
 Hole Length : 40.64m
 Scale @ A4 : 1:40

Commenced: 10/07/2023 Completed: 12/07/2023

Logged : LA, MK

Easting: 1728235.26 Northing: 5923652.39 System: NZTM2000
 RL: 52 Datum: AUCKHT1946

Processed : MK
 Checked : JHS

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR	SCR	RQD (%)	Defect	Spacing (mm)	Instrumentation	Installation	Water level
							Number / Type	Result													
32.25	32.25		Silty fine to medium SAND; dark reddish orange brown. Very dense, moist.	AWHITU SAND FORMATION	M	VD			HQTT		HW										
32.69	32.82		Carbonaceous fragments to 10 mm.																		
33.35	33.40		Completely weathered, dark orange brown, distinctly bedded, fine to coarse SANDSTONE; extremely weak; very thinly bedded at 40-45°. Iron staining.					SPT 10/12, 13/14, 12/12, N > 50 (solid cone)		SPT		CW									
33.35	33.40		CORE LOSS							HQTT											
34.15	34.15		Completely weathered, brown, streaked red-orange, fine to medium grained SANDSTONE; extremely weak.					SPT 7/12, 14/15, 15/6 for 25mm, N > 50 (solid cone)		SPT		CW									
36.3	36.3		Fine to medium SAND with some silt; dark orange brown. Very dense, moist.		M	VD			HQTT												
37.50	37.50		37.50 ~20 mm layer of fine to medium, sub-angular, dark red iron stained, sandstone gravel.				SPT 23/27 for 70mm, N > 50 (solid cone)		SPT												
38.8	38.8		Highly weathered, dark reddish brown, mottled dark grey-orange brown, fine to medium grained SANDSTONE; extremely weak.						HQTT												
39.8	39.8						SPT 9/14, 24/26 for 65mm, N > 50 (solid cone)		SPT		HW										

Notes and Comments:
 End of Hole @ 40.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: Tr-200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
12/07/23	08:30	0.2	33.45



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 265 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M07
 Sheet : 6 of 6
 Hole Length : 40.64m
 Scale @ A4 : 1:40

Commenced: 10/07/2023 Completed: 12/07/2023

Logged : LA, MK

Easting: 1728235.26 Northing: 5923652.39 System: NZTM2000
 RL: 52 Datum: AUCKHT1946

Processed : MK
 Checked : JHS

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated UCS Strength (MPa)	TCR SCR RQD (%)	Defect (mm) Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
			Highly weathered, dark grey, fine to medium grained SANDSTONE; extremely weak. (continued from layer starting at 39.8m)						HOT				100				
							SPT 25/25 for 60mm N > 50 (solid cone)		SPT					0			
41			End of Hole @ 40.64m, Target Depth.														
42																	
43																	
44																	
45																	
46																	
47																	

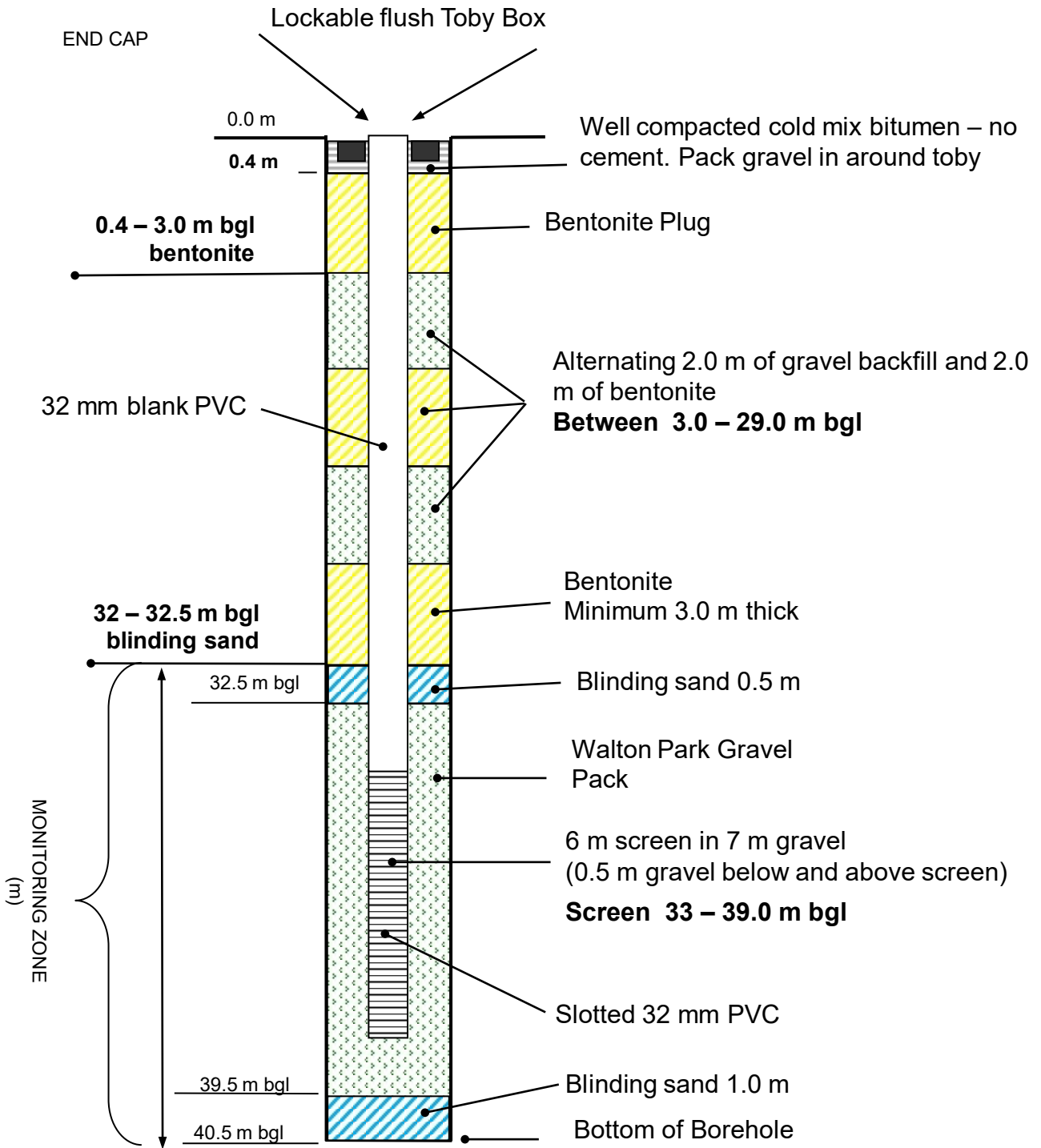
Notes and Comments:
 End of Hole @ 40.64m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.

Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: Tr-200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)
12/07/23	14:00	1.02	40.635

BH-M07 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728235.26 E
Job Number	12612462		5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates (NZTM 2000)	1728235.26 E
Job Number	12612462		5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		



Report of photographs



Site identification – BH-M07

Project	AC Geo Panel – Waitākere	Coordinates	1728235.26 E
Job Number	12612462	(NZTM 2000)	5923652.39 N
Client	Auckland Council	Location	265 Motutara Road, Muriwai
Date	10 to 12 July 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 217 Motutara Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M08

Sheet : 1 of 2
 Hole Length : 10.95m
 Scale @ A4 : 1:40

Commenced: 7/07/2023

Completed: 7/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728392.17

Northing: 5923798.19

System: NZTM2000

RL: 63

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR RQD (%)	Defect (mm Spacing)	Instrumentation Installation	Water level
							Number / Type	Result									
62	0		HYDROVAC - NO RECOVERY		-	-											
61	1.5		Silty fine to medium SAND with pockets of organics to 25 mm; grey, mottled light grey. Very loose, moist. [PALAEO-COLLUVIUM]		M	VS	SPT 0/0 0/0 N=0			HV				0			
60	2.85 - 3.15		2.85 - 3.15 Grey-green.							OB				100			
59	3.15		Silty fine to medium SAND; light grey, mottled orange. Loose, moist.			L	SV@3m UTP SPT 1/1 1/1 3/4 N=9			SPT				100			
58	4.55 - 4.65		4.55 - 4.65 Medium dense.			MD	SPT 1/1 2/3 4/5 N=14			OB				100			
57	6.10 - 7.20		6.10 - 7.20 Dark brown, speckled black.				SPT 1/0 1/0 1/1 N=3			SPT				0			
56	6.45		Silty fine to medium SAND; dark grey-green, speckled black. Medium dense, moist.			MD				OB				100			
	7.20 - 7.30		7.20 - 7.30 Light grey, speckled black.							SPT				100			
	7.30 - 8.05		7.30 - 8.05 Brown, speckled black-light grey, streaked green-orange.														
	7.55 - 7.65		7.55 - 7.65 Reddish orange, speckled black.				SPT 1/1 3/3 5/7 N=18							100			

DRAFT

Notes and Comments:
 End of Hole @ 10.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Groundwater not measured.

Inclination: Vertical Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id: GEO902

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)

Refer to explanation sheets for abbreviation and symbols



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 217 Motutara Rd, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M08

Sheet : 2 of 2
 Hole Length : 10.95m
 Scale @ A4 : 1:40

Commenced: 7/07/2023

Completed: 7/07/2023

Logged : JM

Processed : JM

Checked : JHS

Easting: 1728392.17

Northing: 5923798.19

System: NZTM2000

RL: 63

Datum: AUCKHT1946

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQR (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
54	8.76	X	Silty fine to medium SAND; dark grey-green, speckled black. Medium dense, moist. <i>(continued from layer starting at 6.5m)</i> 8.05 - 8.70 Orange brown, speckled black-light grey. 8.25 - 8.35 Indistinctly, very thinly bedded at 5-15°	PALAEO-COLLUVIUM	-	'St'	SPT 2/2 5/7 8/9 N = 29	10.50 B-10 12/22	OB	SPT	HOTT	SPT	76	76	100	83	0
9	9.2	X	Silty CLAY; light grey, streaked orange-brown. 'Stiff', moist, high plasticity.		M	MD											
9	9.45	X	CORE LOSS		M	MD											
9	9.63	X	Silty fine to medium SAND; orange-brown, speckled black-light grey. Medium dense, moist.		M	MD											
10	9.83	X	Silty fine to medium SAND; light grey; distinctly, very thinly bedded at 20-30° Medium dense, moist.	M	MD	SPT 1/1 1/2 5/7 N = 15	10.00	SPT	HOTT	SPT	76	76	100	83	0		
10	9.83	X	CORE LOSS	M	MD												
11	10.95	X	End of Hole @ 10.95m, Target Depth.														

DRAFT

Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Groundwater not measured. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level			
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)
	Shear Vane Id: GEO902							

Report of photographs



Site identification – BH-M08

Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		



Report of photographs



Site identification – BH-M08

Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		



Report of photographs



Site identification – BH-M08

Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		



Report of photographs



Site identification – BH-M08

Project	AC Geo Panel – Waitākere	Coordinates	1728367.96 E
Job Number	12612462	(NZTM 2000)	5923777.42 N
Client	Auckland Council	Location	217 Motutara Road, Muriwai
Date	7 July 2023		





Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 140 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M09

Sheet : 1 of 2
 Hole Length : 10.95m
 Scale @ A4 : 1:40

Commenced: 13/07/2023

Completed: 13/07/2023

Logged : MK

Processed : MK

Checked : JHS 23/08/2023

Easting: 1728448.77

Northing: 5923911.2

System: NZTM2000

RL: 72.5

Datum:

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated Unconfined Strength (MPa)	TCR SCR ROD (%)	Defect (mm)	Instrumentation Installation	Water level
							Number / Type	Result									
72.5	0.40-3	[Hatched pattern]	Silty fine SAND; orange brown. Moist. [FILL]	FILL	M	-											
72.5	0.40-3	[Dotted pattern]	Sandy fine to medium GRAVEL; grey. Moist. Gravel, sub-rounded to sub-angular. Sand, fine. HYDROVAC. NO RECOVERY.							HV							
71.5	1.5	[Dotted pattern]	Silty fine to medium SAND, minor clay; dark orange brown, mottled black-grey. Very loose, moist. [AWHITU SAND FORMATION]		M	VL	SPT 1/0 1/1 N = 3			SPT				100			
71.5	1.95	[Dotted pattern]	CORE LOSS														
70.5	2.45	[Dotted pattern]	Silty fine to medium SAND, minor clay; dark orange brown, mottled black-grey. Loose, moist.		M	L				OB				52			
70.5	3.2	[Dotted pattern]	Silty fine to medium SAND; dark orange brown. Loose, moist.				SPT 2/2 2/3 3/3 N = 10			SPT				100			
70.5	4	[Dotted pattern]	CORE LOSS							OB				100			
70.5	4	[Dotted pattern]	CORE LOSS							HQTT				0			
70.5	4.5	[Dotted pattern]	Silty fine to medium SAND; dark orange brown. Loose, moist.	AWHITU SAND FORMATION	M	L	SPT 1/2 2/2 3/3 N = 10			SPT				100			
70.5	6.00	[Dotted pattern]					SPT 2/2 2/2 3/3 N = 10			HQTT				100			
70.5	6.00	[Dotted pattern]								SPT				100			
70.5	6.00	[Dotted pattern]								HQTT				100			
70.5	7	[Dotted pattern]					SPT 1/2 2/2 3/3 N = 10			SPT				100			
70.5	7	[Dotted pattern]								HQTT				100			
70.5	7.20 - 9.63	[Dotted pattern]	7.20 - 9.63 With moderately widely spaced 100-200 mm extremely weakly cemented beds.							SPT				100			

DRAFT

Report ID: GENERAL_LOG || Project: BH-M09.GPJ || Library: GHD - NZGD.GLB || Date: 25 August 2023

Notes and Comments:
 End of Hole @ 10.95m, Target Depth.
 Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey.
 Refer to explanation sheets for abbreviation and symbols

Inclination: Vertical
 Orientation:
 Contractor: DCN
 Equipment: TR 200
 Shear Vane Id:

Ground Water Level			
Date	Time	Reading (mbgl)	Hole depth (mbgl)



Project : AC Geo Panel - Waitakere
 Client : Auckland Council
 Site : 140 Motutara Road, Muriwai 0881
 Job Number: 12612462

Hole No. : BH-M09
 Sheet : 2 of 2
 Hole Length : 10.95m
 Scale @ A4 : 1:40

Commenced: 13/07/2023 Completed: 13/07/2023

Logged : MK
 Processed : MK
 Checked : JHS 23/08/2023

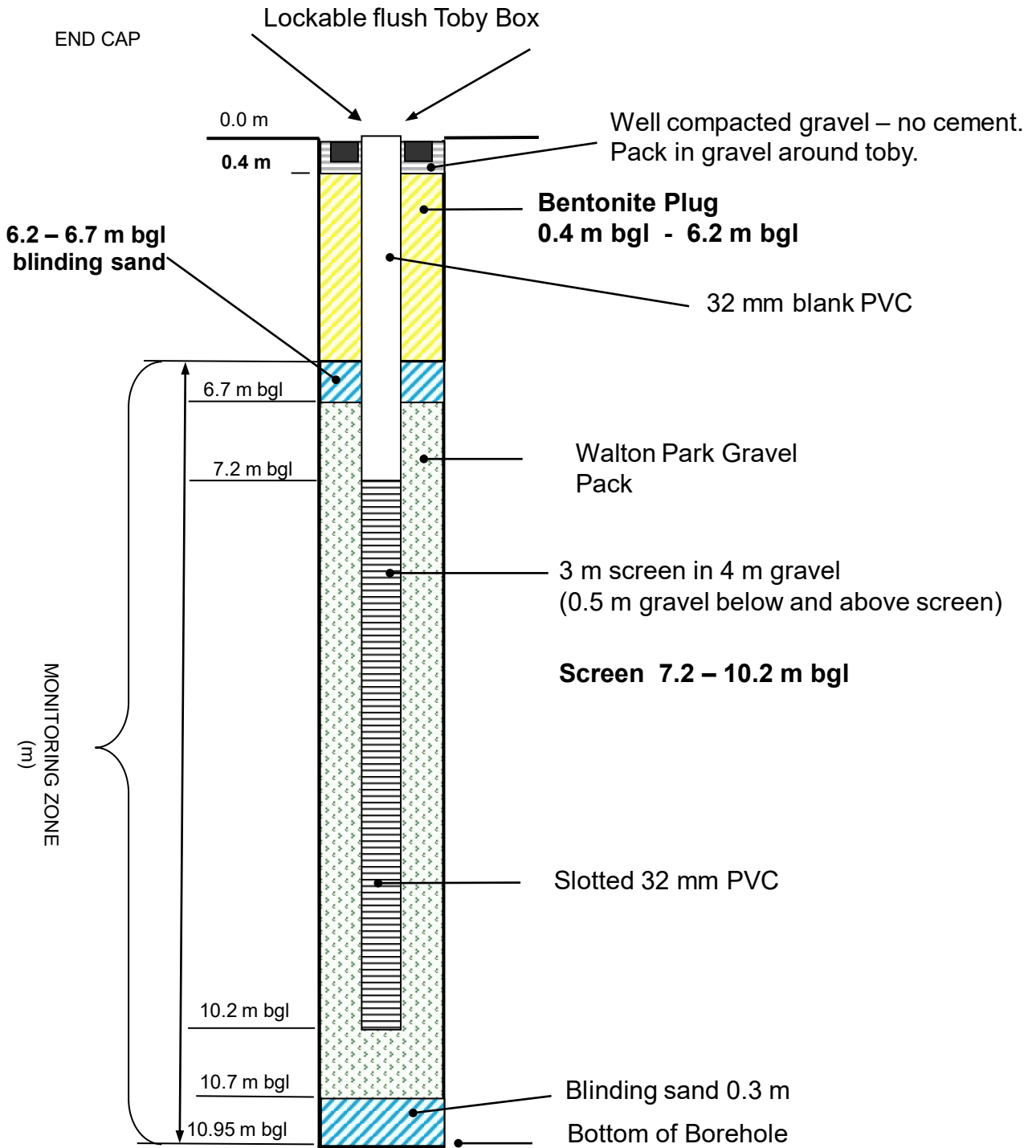
Easting: 1728448.77 Northing: 5923911.2 System: NZTM2000
 RL: 72.5 Datum:

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistency / Relative density	Sample		Casing	Method	Flush Return (%)	Weathering	Estimated W Strength (MPa)	TCR SCR RCD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level	
							Number / Type	Result										
164	9		Silty fine to medium SAND; dark orange brown. Loose, moist. <i>(continued from layer starting at 4.5m)</i>	AWHITU SAND FORMATION			SPT 1/2 2/2 3/3 N = 10		HQTT				100				9	
163	9.63		Highly weathered, dark orange brown, fine to medium grained SANDSTONE; extremely weak.							HQTT				78				9.63
162	10.35		Silty fine to coarse SAND; dark orange brown. Medium dense, moist.		M	MD	SPT 2/2 3/5 6/9 N = 23			HQTT				100				10.35
161	11		End of Hole @ 10.95m, Target Depth.						SPT					100				11

DRAFT

Notes and Comments: End of Hole @ 10.95m, Target Depth. Coordinates and RLs are approximated from the local GIS viewer. Locations are subject to future survey. Refer to explanation sheets for abbreviation and symbols	Inclination: Vertical		Orientation:		Ground Water Level				
	Contractor: DCN		Equipment: TR 200		Date	Time	Reading (mbgl)	Hole depth (mbgl)	
	Shear Vane Id:		17/07/23	12:15	1.5	10.95	17/07/23	14:15	3.27

BH-M09 - Muriwai



NOT TO SCALE

Report of photographs



Site identification – BH-M09

Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs



Site identification – BH-M09

Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs



Site identification – BH-M09

Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs



Site identification – BH-M09

Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs



Site identification – BH-M09

Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Report of photographs



Site identification – BH-M09

Project	AC Geo Panel – Waitākere	Coordinates	1728448.77 E
Job Number	12612462	(NZTM 2000)	5923911.20 N
Client	Auckland Council	Location	140 Motutara Road, Muriwai
Date	17 July 2023		



Appendix F3

Laboratory Test Results

Please reply to: W.E. Campton

Page 1 of 3

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

22nd September 2023

ATTERBERG LIMITS TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of Atterberg Limits testing at BGL of a soil sample delivered to this laboratory during August 2023. Test results are summarised below, with page 3 showing where the sample plots on the Unified Soil Classification System (Casagrande) Chart. Test standards used were:

Water Content:	NZS4402:1986:Test 2.1
Liquid Limit:	NZS4402:1986:Test 2.2
Plastic Limit:	NZS4402:1986:Test 2.3
Plasticity Index:	NZS4402:1986:Test 2.4

Borehole Number	Sample Number	Depth (m)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
BH-M01	S1	13.50 – 13.95	29.0	25 ◆	14 ◆	11 ◆

◆ = The soil fraction passing a 425µm sieve was used for the liquid limit and plastic limit tests.

The whole soil was used for the water content test (the soil was in a natural state), and the soil fraction passing a 0.425mm sieve was used for the liquid limit and plastic limit tests. The soil was wet up and dried where required for the liquid limit and plastic limit tests.

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. Test 2.2: liquid limit and test 2.3: plastic limit are reported to the nearest whole number.

Please note that the test results relate only to the sample as-received, and relate only to the sample under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Please reply to: W.E. Campton

Page 1 of 16

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

25th September 2023

WET SIEVE PARTICLE-SIZE DISTRIBUTION TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of wet sieve particle-size distribution testing at BGL of soil samples delivered to this laboratory during August & September 2023. Test results are summarised below, with the following pages showing graphs and detailed results.

Test standards used were:

Water Content: NZS4402:1986:Test 2.1

Wet Sieve Test: NZS4402:1986:Test 2.8.1

Borehole Number	Sample Number	Depth (m)	Fraction of Sample (% of Dry Mass)		
			GRAVEL (2 – 60mm)	SAND (0.06 – 2mm)	SILT & CLAY FRACTIONS (< 0.06mm)
BH-M01	S3	43.50 – 43.80	0	98	2
BH-M05	S1	6.45 – 6.65	0	93	7
BH-M07	S1	4.20 – 4.50	1	78	21
BH-M07	S2	29.70 – 30.00	0	92	8
BH-M08	S1	3.45 – 3.70	0	82	18
BH-M08	S3	10.20 – 10.50	0	80	20
BH-M09	S1	5.70 – 6.00	0	98	2

Please note that the results table immediately above with the various particle-size fractions is included for your information only, and is not included in the IANZ endorsement for this report.

Borehole Number	Sample Number	Depth (m)	Fraction of Sample (% of Dry Mass)		
			GRAVEL (2 – 60mm)	SAND (0.06 – 2mm)	SILT & CLAY FRACTIONS (< 0.06mm)
BH-M01	D4	76.15 – 76.50	0	97	3
BH-M02	D14	63.95 – 64.25	0	95	5
BH-M03	D10	76.00 – 76.30	0	94	6
BH-M06	D1	26.00 – 26.30	0	85	15
BH-M07	D3	36.90 – 37.20	0	93	7
BH-M09	D2	8.70 – 9.00	0	97	3

Please note that the results table immediately above with the various particle-size fractions is included for your information only, and is not included in the IANZ endorsement for this report.

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. Test 2.8.1: wet sieve, the percentages passing the sieves are reported to nearest 1%.

The wet sieve method used by BGL is a slight variation of the 2.8.1 test standard. It is, in our opinion, a more accurate method as it does not rely on an assumed total dry mass determined from water content testing of sub-samples, but actually determines & uses the exact total dry mass (*opinion not IANZ endorsed*).

The following departures from the test standard occurred ;

- The total dry mass of the entire sieved sample was determined, and was not calculated by using two water content sub-samples as in the standard.
- A detergent was used to deflocculate the sample rather than a sodium hexametaphosphate/sodium carbonate dispersing agent solution.
- The recovery of the wet fines (i.e. the silt & clay passing the 63µm wash sieve) for determining the percentage of silt & clay was omitted (as per 2.8.1 Note 7), therefore the percentage passing the 63µm was obtained by difference. A 10% hydrochloric acid flocculating agent was therefore not used.

Please note that the test results relate only to the samples as-received, and relate only to the samples under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	11-Aug-23
Compiled By:	JL	11-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M01** **Sample No:** **S3**

Depth: **43.50 - 43.80m** **Water Content:** **22.1 % (material < 37.5mm)**

TEST METHOD:

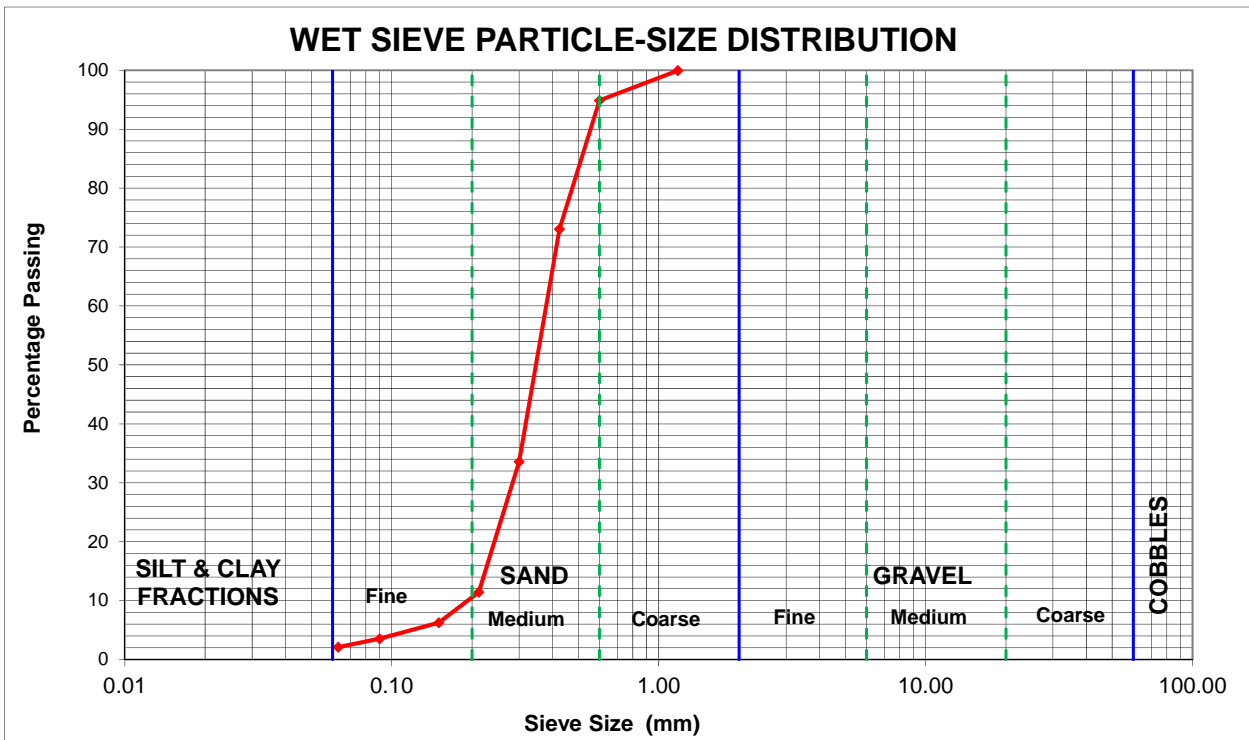
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	95
0.425	73
0.300	34
0.212	11
0.150	6
0.090	4
0.063	2

			TOTAL	
				%
COBBLES:	200 - 60mm		0	
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	5	98	%
	(Medium) 0.6 - 0.2mm	84		
	(Fine) 0.2 - 0.06mm	9		
SILT & CLAY FRACTIONS:	< 0.06mm		2	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	11-Aug-23
Compiled By:	JL	11-Aug-23
Checked By:	JF	14-Aug-23

BH: BH-M05 **Sample No:** S1

Depth: 6.45 - 6.65m **Water Content:** 27.7 % (material < 37.5mm)

TEST METHOD:

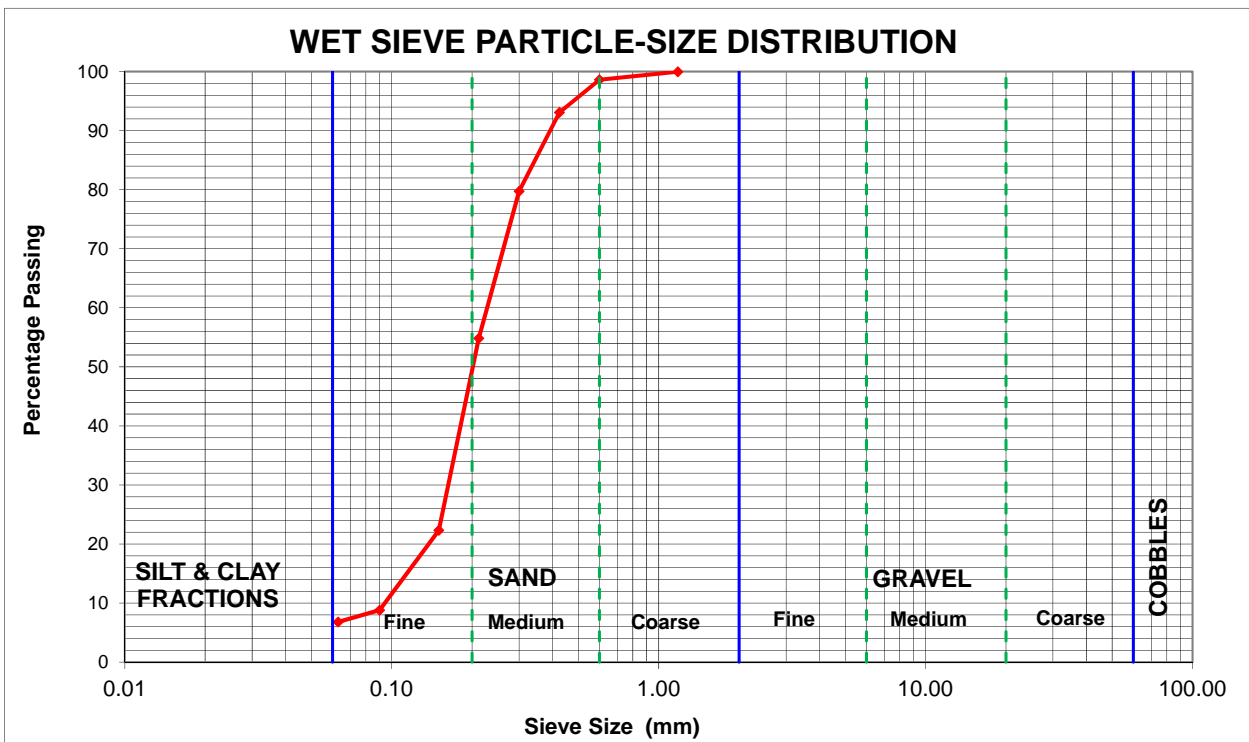
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	99
0.425	93
0.300	80
0.212	55
0.150	22
0.090	9
0.063	7

COBBLES:		200 - 60mm		TOTAL	
				0	%
GRAVEL:	(Coarse)	60 - 20mm	0	0	%
	(Medium)	20 - 6mm	0		
	(Fine)	6 - 2mm	0		
SAND:	(Coarse)	2.0 - 0.6mm	1	93	%
	(Medium)	0.6 - 0.2mm	50		
	(Fine)	0.2 - 0.06mm	42		
SILT & CLAY FRACTIONS:		< 0.06mm		7	%
				100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	14-Aug-23
Compiled By:	JL	14-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M07** **Sample No:** **S1**

Depth: **4.20 - 4.50m** **Water Content:** **31.0 %** (material < 37.5mm)

TEST METHOD:

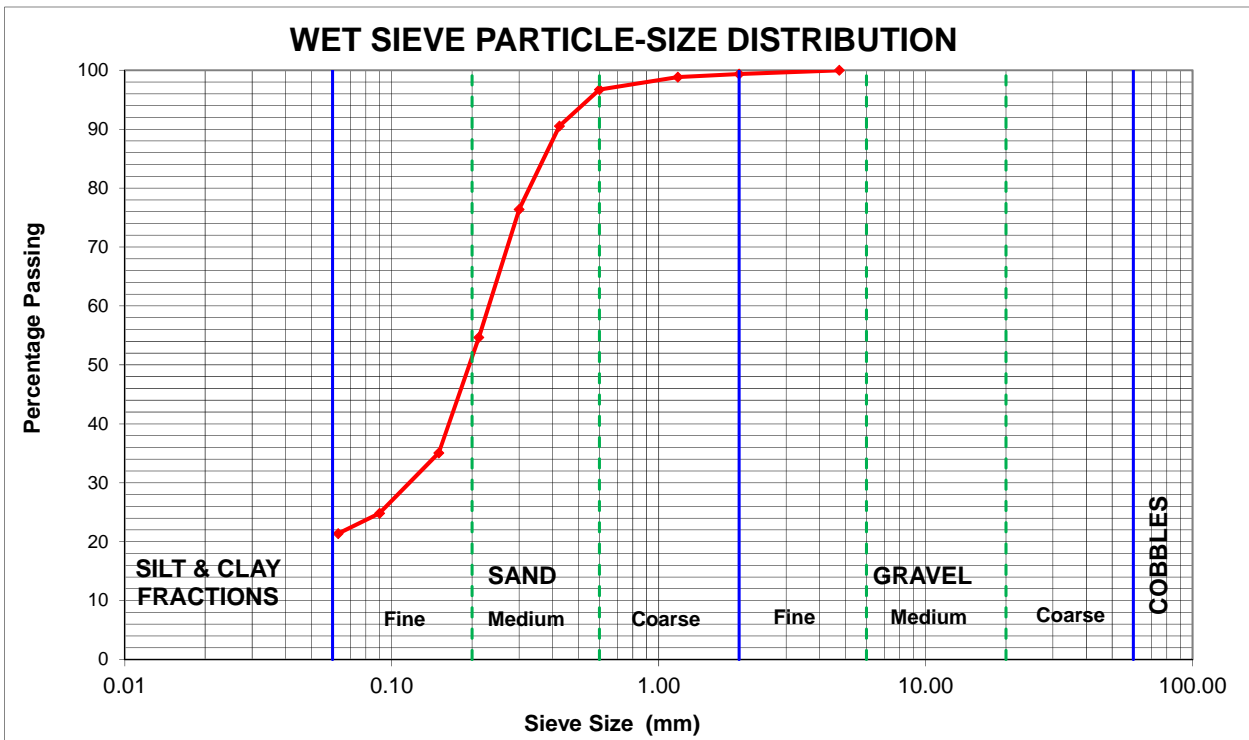
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
4.75	100
2.00	99
1.18	99
0.600	97
0.425	91
0.300	76
0.212	55
0.150	35
0.090	25
0.063	21

		TOTAL	
			%
COBBLES:	200 - 60mm	0	0 %
GRAVEL:	(Coarse) 60 - 20mm	0	1 %
	(Medium) 20 - 6mm	0	
	(Fine) 6 - 2mm	1	
SAND:	(Coarse) 2.0 - 0.6mm	2	78 %
	(Medium) 0.6 - 0.2mm	46	
	(Fine) 0.2 - 0.06mm	30	
SILT & CLAY FRACTIONS:	< 0.06mm	21	21 %
		100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	14-Aug-23
Compiled By:	JL	14-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M07** **Sample No:** **S2**

Depth: **29.70 - 30.00m** **Water Content:** **25.4 % (material < 37.5mm)**

TEST METHOD:

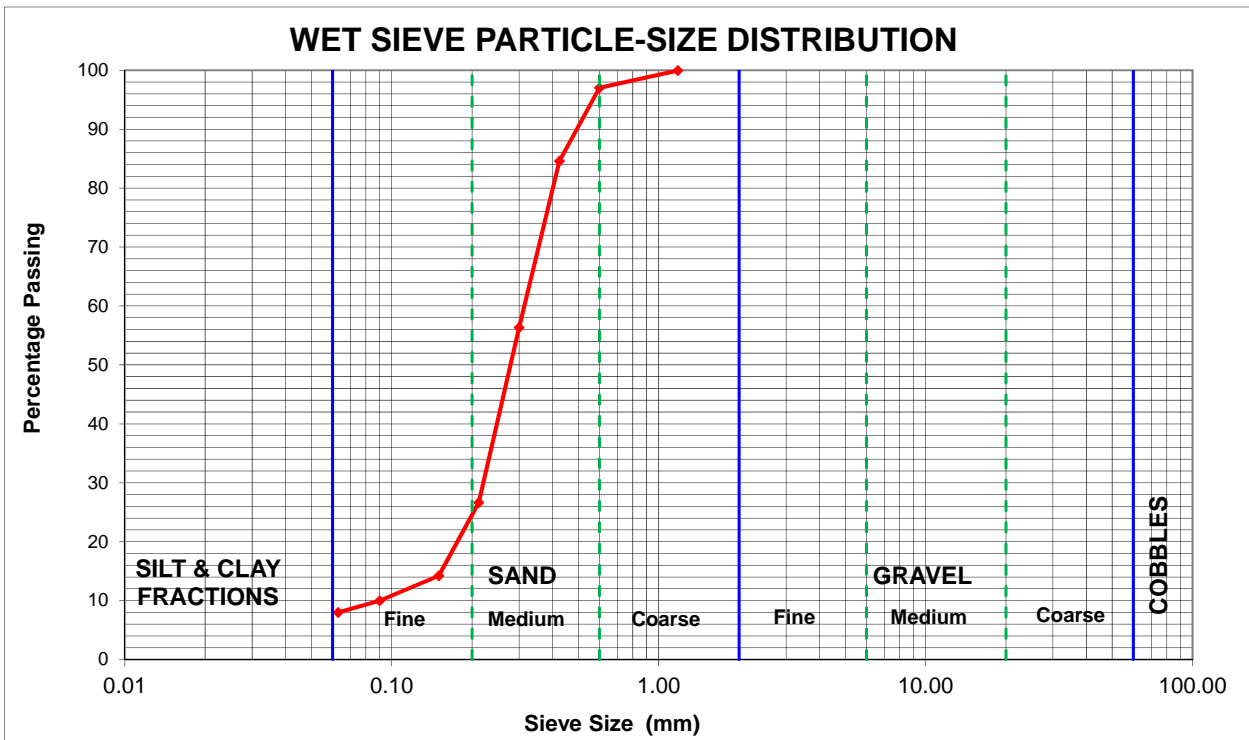
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	97
0.425	85
0.300	56
0.212	27
0.150	14
0.090	10
0.063	8

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	3	92	%
	(Medium) 0.6 - 0.2mm	72		
	(Fine) 0.2 - 0.06mm	17		
SILT & CLAY FRACTIONS:	< 0.06mm		8	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	11-Aug-23
Compiled By:	JL	11-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M08** **Sample No:** **S1**

Depth: **3.45 - 3.70m** **Water Content:** **42.5 % (material < 37.5mm)**

TEST METHOD:

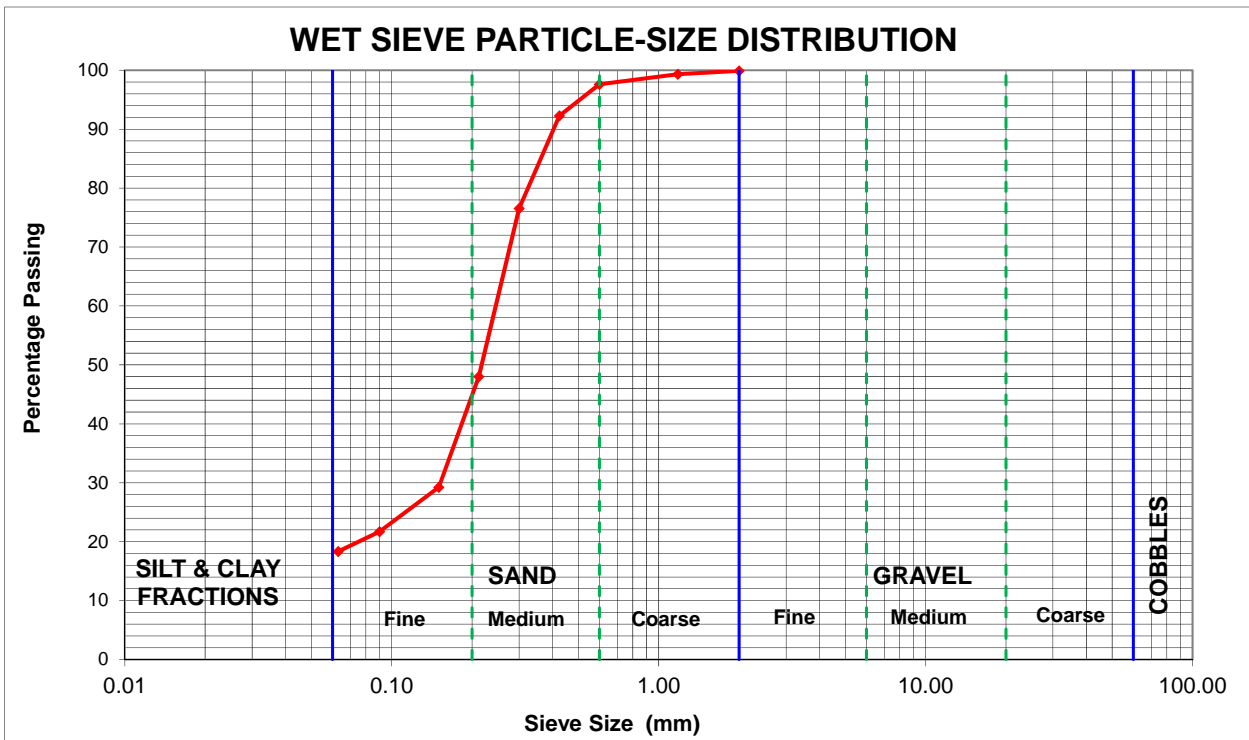
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	98
0.425	92
0.300	77
0.212	48
0.150	29
0.090	22
0.063	18

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	2	82	%
	(Medium) 0.6 - 0.2mm	53		
	(Fine) 0.2 - 0.06mm	27		
SILT & CLAY FRACTIONS:	< 0.06mm		18	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	14-Aug-23
Compiled By:	JL	14-Aug-23
Checked By:	JF	14-Aug-23

BH: BH-M08 **Sample No:** S3

Depth: 10.20 - 10.50m **Water Content:** 26.2 % (material < 37.5mm)

TEST METHOD:

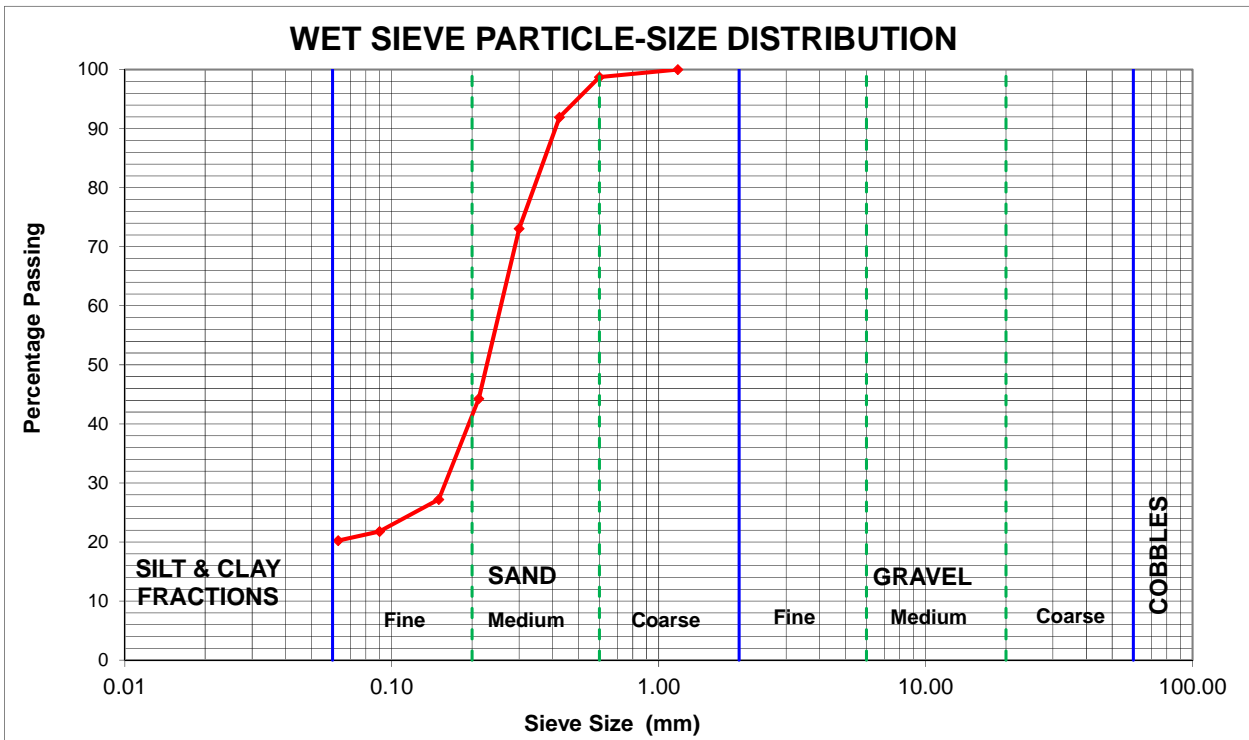
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
1.18	100
0.600	99
0.425	92
0.300	73
0.212	44
0.150	27
0.090	22
0.063	20

		TOTAL	
			%
COBBLES:	200 - 60mm	0	0
GRAVEL:	(Coarse) 60 - 20mm	0	0
	(Medium) 20 - 6mm	0	
	(Fine) 6 - 2mm	0	
SAND:	(Coarse) 2.0 - 0.6mm	1	80
	(Medium) 0.6 - 0.2mm	58	
	(Fine) 0.2 - 0.06mm	21	
SILT & CLAY FRACTIONS:	< 0.06mm	20	100%

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	WEC / JL	14-Aug-23
Compiled By:	JL	14-Aug-23
Checked By:	JF	14-Aug-23

BH: **BH-M09** **Sample No:** **S1**

Depth: **5.70 - 6.00m** **Water Content:** **26.2 % (material < 37.5mm)**

TEST METHOD:

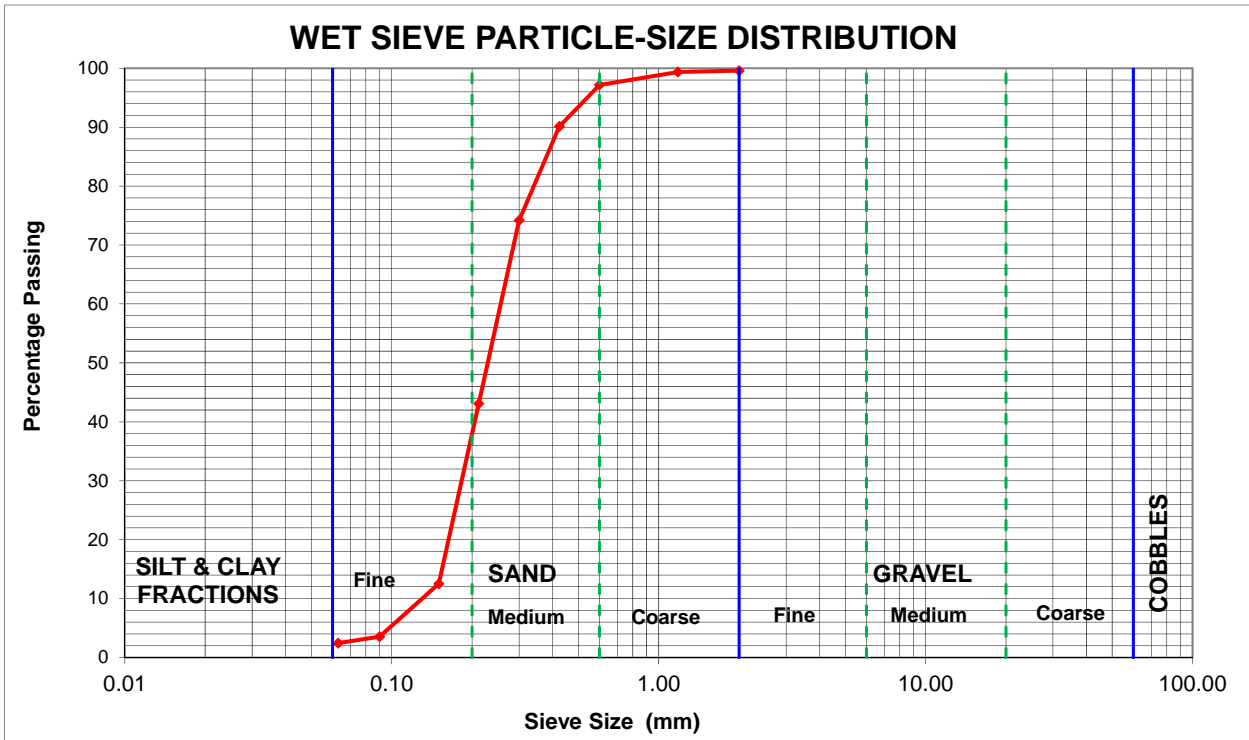
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	97
0.425	90
0.300	74
0.212	43
0.150	13
0.090	4
0.063	2

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	3	98	%
	(Medium) 0.6 - 0.2mm	59		
	(Fine) 0.2 - 0.06mm	36		
SILT & CLAY FRACTIONS:	< 0.06mm		2	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW / JL	21 & 25/09/23
Compiled By:	JL	25-Sep-23
Checked By:	JF	25-Sep-23

BH: **BH-M01** **Sample No:** **D4**

Depth: **76.15 - 76.50m** **Water Content:** **26.2 % (material < 37.5mm)**

TEST METHOD:

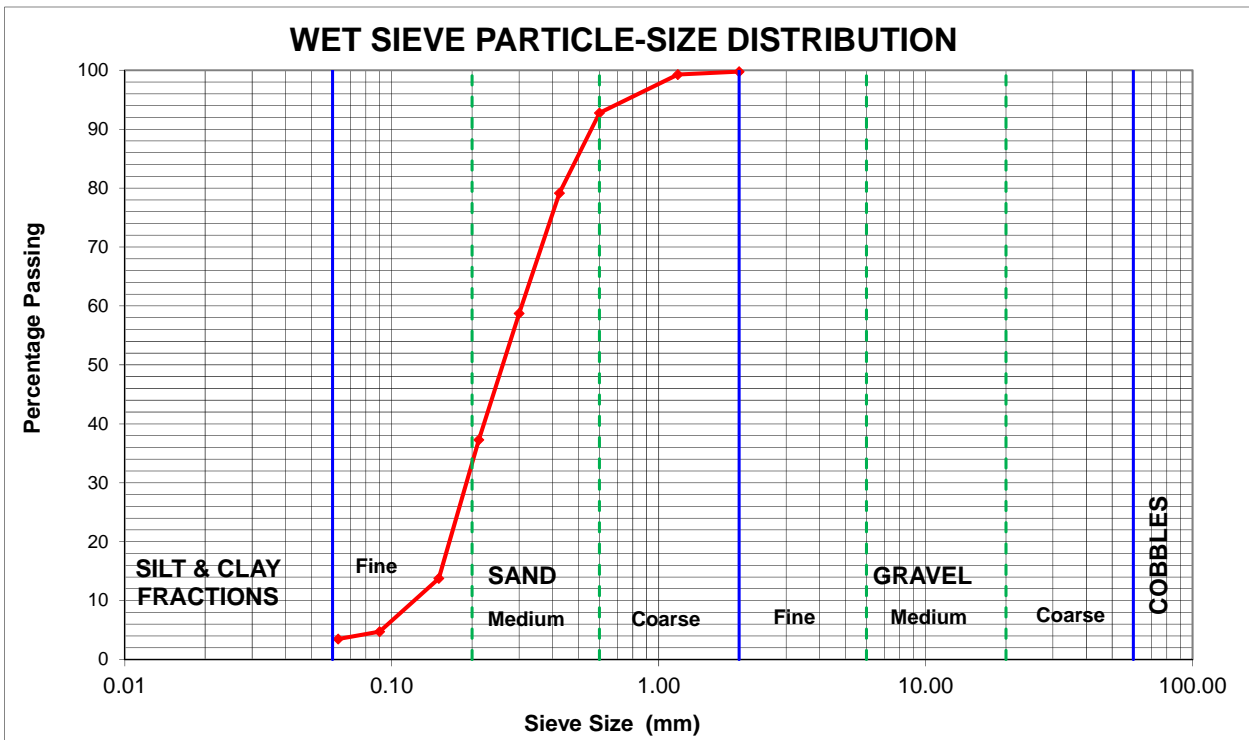
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	93
0.425	79
0.300	59
0.212	37
0.150	14
0.090	5
0.063	3

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	7	97	%
	(Medium) 0.6 - 0.2mm	60		
	(Fine) 0.2 - 0.06mm	30		
SILT & CLAY FRACTIONS:	< 0.06mm		3	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: BH-M02 **Sample No:** D14

Depth: 63.95 - 64.25m **Water Content:** 24.2 % (material < 37.5mm)

TEST METHOD:

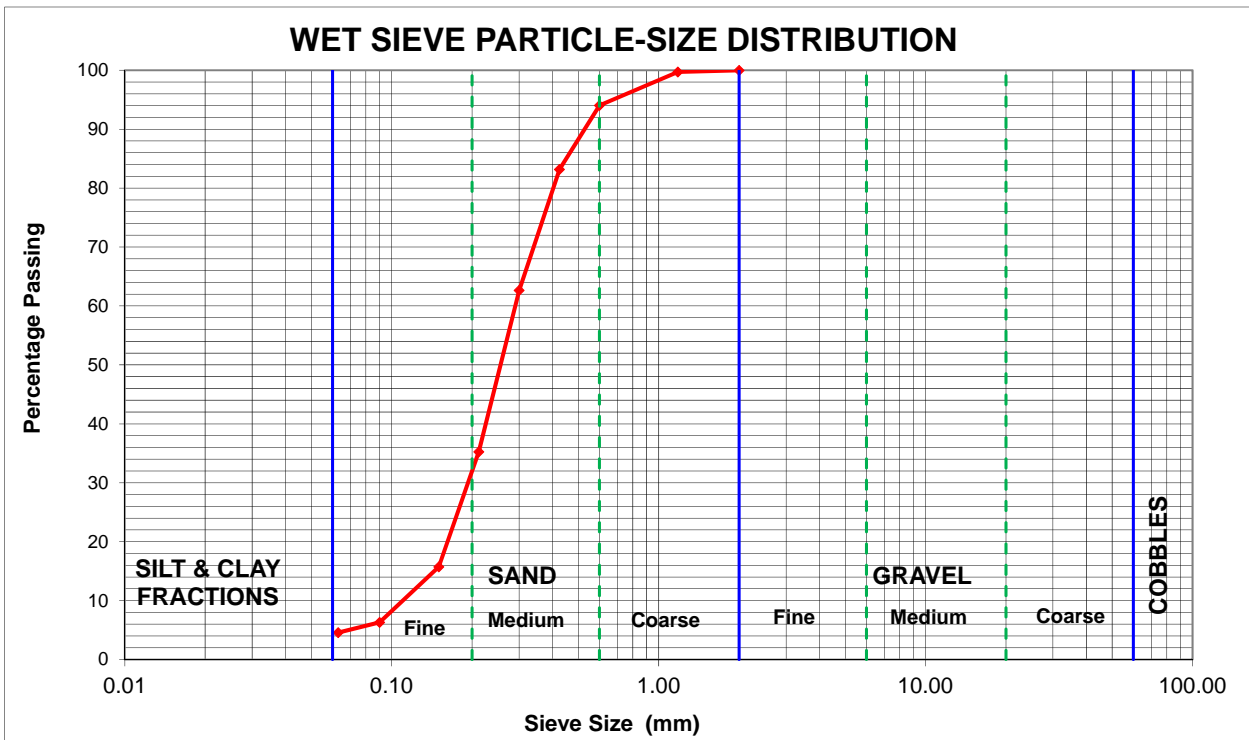
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	94
0.425	83
0.300	63
0.212	35
0.150	16
0.090	6
0.063	5

		TOTAL	
			%
COBBLES:	200 - 60mm	0	0
GRAVEL:	(Coarse) 60 - 20mm	0	0
	(Medium) 20 - 6mm	0	
	(Fine) 6 - 2mm	0	
SAND:	(Coarse) 2.0 - 0.6mm	6	95
	(Medium) 0.6 - 0.2mm	62	
	(Fine) 0.2 - 0.06mm	27	
SILT & CLAY FRACTIONS:	< 0.06mm	5	5
		100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: **BH-M03** **Sample No:** **D10**

Depth: **76.00 - 76.30m** **Water Content:** **25.2 %** (material < 37.5mm)

TEST METHOD:

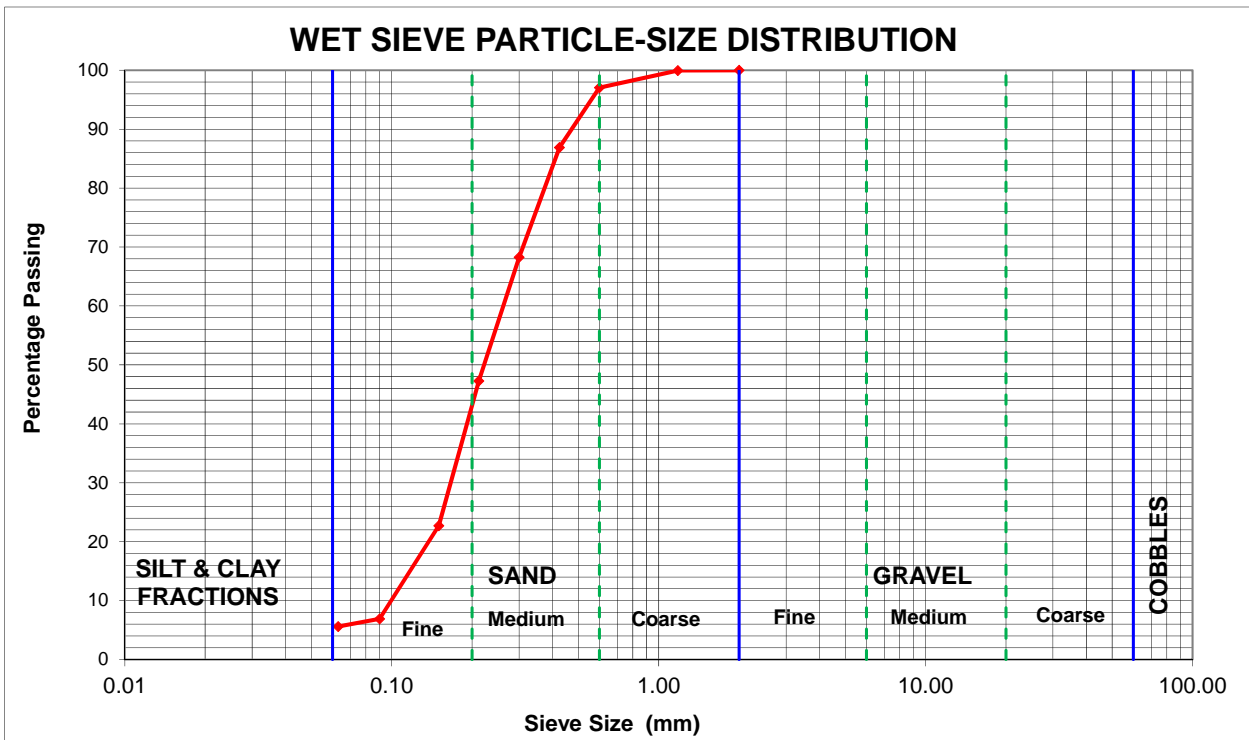
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	97
0.425	87
0.300	68
0.212	47
0.150	23
0.090	7
0.063	6

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	3	94	%
	(Medium) 0.6 - 0.2mm	54		
	(Fine) 0.2 - 0.06mm	37		
SILT & CLAY FRACTIONS:	< 0.06mm		6	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: **BH-M06** **Sample No:** **D1**

Depth: **26.00 - 26.30m** **Water Content:** **19.9 % (material < 37.5mm)**

TEST METHOD:

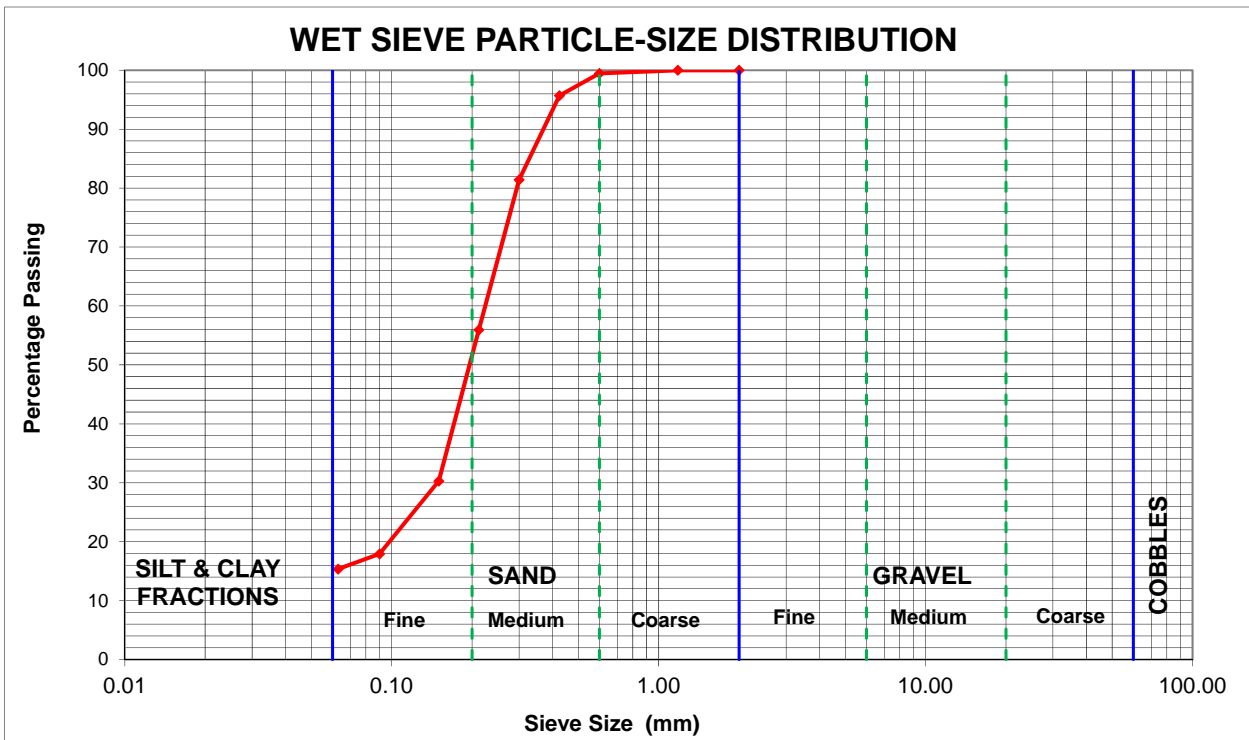
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	99
0.425	96
0.300	81
0.212	56
0.150	30
0.090	18
0.063	15

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	1	85	%
	(Medium) 0.6 - 0.2mm	47		
	(Fine) 0.2 - 0.06mm	37		
SILT & CLAY FRACTIONS:	< 0.06mm		15	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JW	21-Sep-23
Compiled By:	JW	21-Sep-23
Checked By:	WEC	21-Sep-23

BH: **BH-M07** **Sample No:** **D3**

Depth: **36.90 - 37.20m** **Water Content:** **25.8 %** (material < 37.5mm)

TEST METHOD:

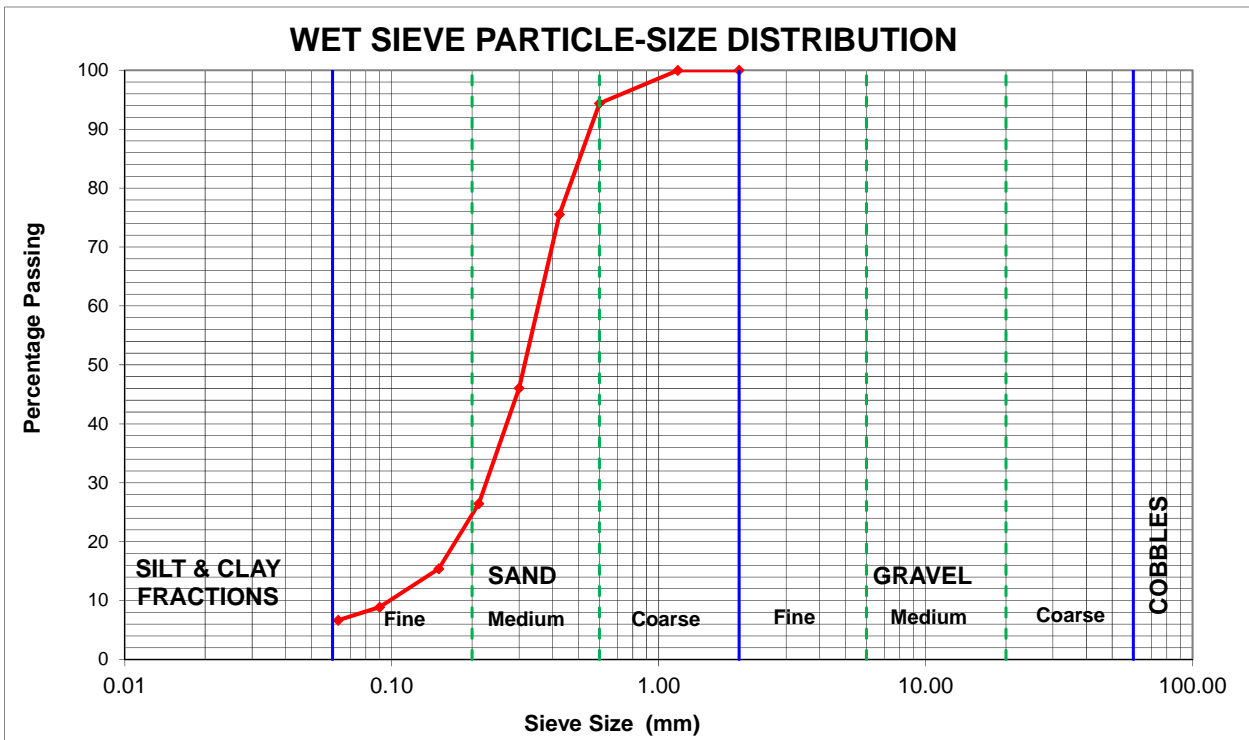
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	100
0.600	94
0.425	76
0.300	46
0.212	26
0.150	15
0.090	9
0.063	7

COBBLES:		200 - 60mm		TOTAL	
				0	%
GRAVEL:	(Coarse)	60 - 20mm	0	0	%
	(Medium)	20 - 6mm	0		
	(Fine)	6 - 2mm	0		
SAND:	(Coarse)	2.0 - 0.6mm	6	93	%
	(Medium)	0.6 - 0.2mm	70		
	(Fine)	0.2 - 0.06mm	17		
SILT & CLAY FRACTIONS:		< 0.06mm		7	%
				100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Project: **WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION**

PARTICLE-SIZE DISTRIBUTION BY WET SIEVE

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1

Tested By:	JL	25-Sep-23
Compiled By:	JL	25-Sep-23
Checked By:	JF	25-Sep-23

BH: **BH-M09** **Sample No:** **D2**

Depth: **8.70 - 9.00m** **Water Content:** **25.8 %** (material < 37.5mm)

TEST METHOD:

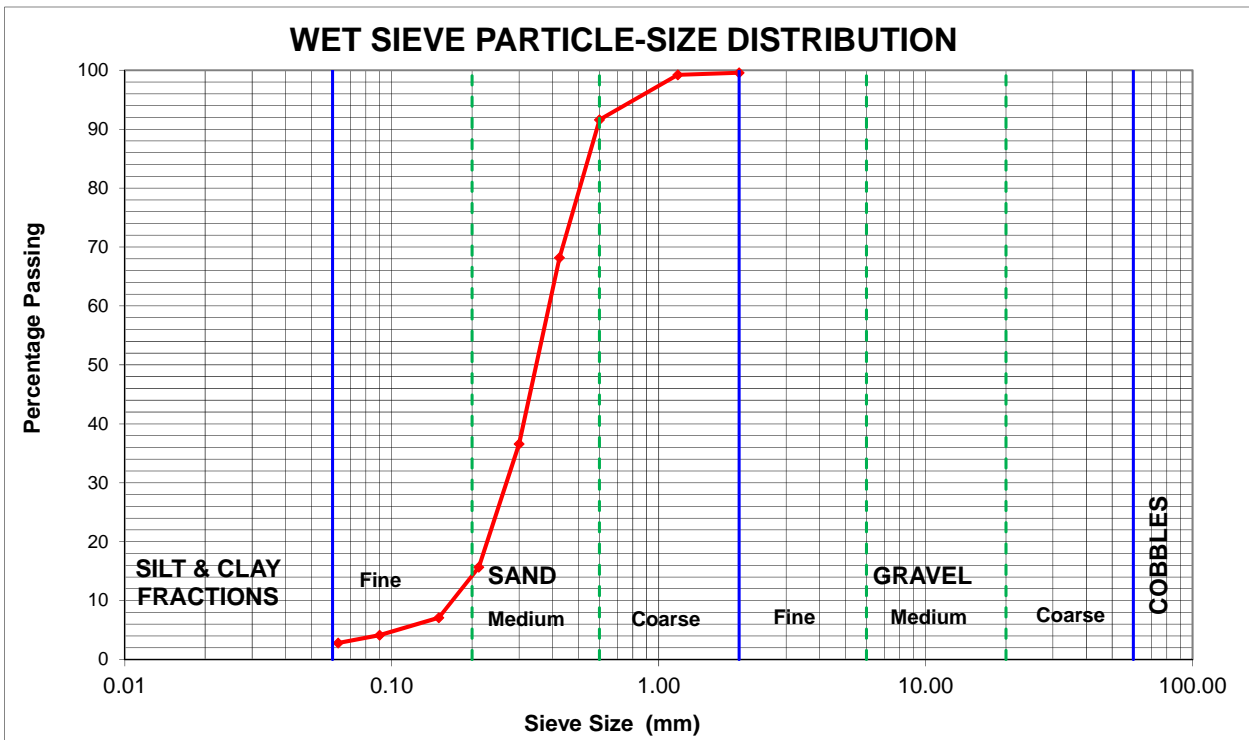
Sample weighed wet, then oven-dried and re-weighed. Sample then washed over a 63µm sieve. Sample then oven dried, weighed & sieved over a stack of test sieves. The percentage passing the 63µm was obtained by difference.

SIEVE ANALYSIS (% of dry mass)

Sieve Size (mm)	Percentage Passing
2.00	100
1.18	99
0.600	92
0.425	68
0.300	37
0.212	16
0.150	7
0.090	4
0.063	3

			TOTAL	
COBBLES:	200 - 60mm		0	%
GRAVEL:	(Coarse) 60 - 20mm	0	0	%
	(Medium) 20 - 6mm	0		
	(Fine) 6 - 2mm	0		
SAND:	(Coarse) 2.0 - 0.6mm	8	97	%
	(Medium) 0.6 - 0.2mm	78		
	(Fine) 0.2 - 0.06mm	11		
SILT & CLAY FRACTIONS:	< 0.06mm		3	%
			100%	

Please note that the various particle-size fractions shown above is included for your information only, and is not included in the IANZ endorsement for this report.



Please reply to: W.E. Campton

Page 1 of 3

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

22nd September 2023

HYDROMETER PARTICLE-SIZE DISTRIBUTION TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of hydrometer particle-size distribution testing at BGL of a soil sample delivered to this laboratory during August 2023. Test results are summarised below, with page 3 showing a graph and detailed results.

Test standards used were:

Water Content: NZS4402:1986:Test 2.1
Wet Sieve Test: NZS4402:1986:Test 2.8.1
Hydrometer Test: NZS4402:1986:Test 2.8.4

Borehole Number	Sample Number	Depth (m)	Hydrometer Grading (% of Dry Mass)			
			GRAVEL (2 – <9.50mm)	SAND (0.06 – 2mm)	SILT FRACTION (0.002 – 0.06mm)	CLAY FRACTION (< 0.002mm)
BH-M01	S2	13.95 – 14.30	0	70	15	15

The whole soil was used for this hydrometer test. As the organic content of the soil tested was very low, peroxide pretreatment was not carried out. A solid density of 2.65t/m³ was assumed for this hydrometer test, and is not part of the IANZ endorsement for this report.

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. Test 2.8.1: wet sieve & Test 2.8.4: hydrometer, the 'percentages passing' and 'percentages finer than' are reported to nearest 1%.

Please note that the test results relate only to the sample as-received, and relate only to the sample under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

PARTICLE-SIZE DISTRIBUTION BY HYDROMETER

Test Methods: NZS4402: 1986: Test 2.1, Test 2.8.1, Test 2.8.4

Tested By:	WEC	10-Aug-23
Compiled By:	WEC	11-Aug-23
Checked By:	JF	14-Aug-23

BH No: BH-M01 Sample No: S2 Depth: 13.95 - 14.30m

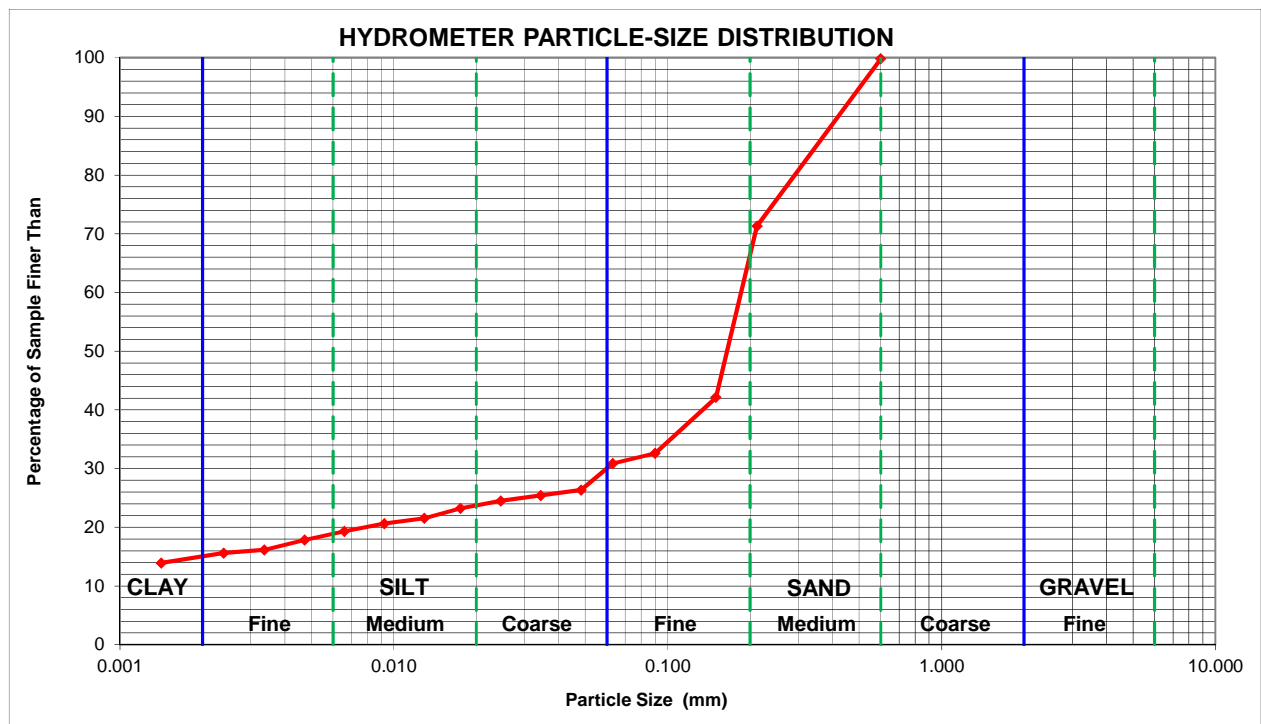
Water Content (%): 26.4
 Sample History: Natural / Air Dried / Oven Dried / Unknown
 pH of sedimentation suspension: 8.5

Particle Size (mm)	% Finer Than
0.600	100
0.212	71
0.150	42
0.090	33
0.063	31
0.048	26
0.034	25
0.025	24
0.018	23
0.013	22
0.0092	21
0.0066	19
0.0047	18
0.0034	16
0.0024	16
0.0014	14

HYDROMETER ANALYSIS (% of dry mass)

HYDROMETER ANALYSIS (% of dry mass)				TOTAL	
GRAVEL:	(Medium)	< 9.5 - 6mm	0	0	%
	(Fine)	6 - 2mm	0		
SAND:	(Coarse)	2.0 - 0.6mm	0	70	%
	(Medium)	0.6 - 0.2mm	33		
	(Fine)	0.2 - 0.06mm	37		
SILT FRACTION:	(Coarse)	0.06 - 0.02mm	6	15	%
	(Medium)	0.02 - 0.006mm	5		
	(Fine)	0.006 - 0.002mm	4		
CLAY FRACTION:			< 0.002mm	15	%
				100%	

HYDROMETER TEST WAS CARRIED OUT ON THE WHOLE SOIL / SOIL FRACTION PASSING A 9.50mm SIEVE



Please reply to: W.E. Campton

Page 1 of 1

GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

22nd September 2023

DETECTION OF THE PRESENCE OF ALLOPHANE

Dear Mette,

Re: **WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION**

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following table presents the results of 'Detection of the Presence of Allophane in Soils' testing at BGL of a soil sample delivered to this laboratory during August 2023. This sample was tested in accordance with the following standard:

Detection of Presence of Allophane in Soils: NZS4402:1986:Test 3.4

Borehole Number	Sample Number	Depth (m)	Allophane Content
BH-M08	S2	10.00 – 10.10	< 5%

Please note that the test results relate only to the sample as-received, and relate only to the sample under test. Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Please reply to: W.E. Campton

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GHD Limited
PO Box 6543
Wellesley Street
Auckland 1141

Job Number: 63532#L
BGL Registration Number: 2806
Checked by: WEC

Attention: **METTE van LITH**

2nd October 2023

UNCONFINED COMPRESSIVE STRENGTH (UCS) TESTING

Dear Mette,

Re: WAITAKERE LHRA – MURIWAI GROUND INVESTIGATION

Your Reference:

Report Number: 63532#L/AL Waitakere LHRA

The following report presents the results of Uniaxial Unconfined Compressive Strength Testing at BGL of rock core samples delivered to this laboratory on the 18th of September 2023. These samples were tested in accordance with the following standards:

Water Content:	NZS4402:1986:Test 2.1
Unconfined Compressive Strength Test:	NZS4402:1986:Test 6.3.1

The table below summarises the test results, with the following pages presenting sample measurements and test data.

Borehole Number	Sample Number	Depth (m)	FAILURE CONDITIONS			
			Unconfined Compressive Strength (kPa)	Strain at Failure		Failure Mode
				%	mm	
BH-M02	S1	26.50 – 26.75	270	0.74	0.89	planar
BH-M02	S2	29.69 – 29.92	370	0.75	0.86	planar
BH-M02	S3	36.35 – 36.65	180	0.50	0.61	planar
BH-M02	S4	40.80 – 41.00	180	0.46	0.55	planar

Borehole Number	Sample Number	Depth (m)	FAILURE CONDITIONS			
			Unconfined Compressive Strength (kPa)	Strain at Failure		Failure Mode
				%	mm	
BH-M02	S5	53.30 – 53.90	1,800	0.49	0.59	brittle
BH-M02	S6	55.20 – 55.50	1,200	0.52	0.63	planar
BH-M02	S7	55.80 – 56.11	1,300	0.42	0.51	brittle
BH-M02	S8	56.50 – 56.90	1,100	0.50	0.60	brittle
BH-M02	S9	64.44 – 64.72	1,300	0.45	0.55	brittle
BH-M02	S10	67.93 – 68.33	800	0.48	0.58	brittle
BH-M02	S11	74.20 – 74.50	700	0.59	0.71	brittle
BH-M02	S12	76.13 – 76.40	560	0.43	0.51	brittle
BH-M02	S13	78.14 – 78.47	1,000	0.45	0.54	brittle
BH-M03*	UCS01	9.93 – 10.13	140	1.0	0.81	plastic / brittle
BH-M03	UCS02	16.00 – 16.27	280	1.0	1.2	brittle
BH-M03	UCS03	29.55 – 29.75	110	0.75	0.81	planar
BH-M03	UCS04	31.95 – 32.23	330	1.7	2.0	planar
BH-M03	UCS05	33.76 – 34.06	400	0.55	0.67	planar / brittle
BH-M03	UCS06	37.00 – 37.25	270	0.60	0.72	planar / brittle
BH-M03	UCS07	40.14 – 40.43	92	0.74	0.85	plastic
BH-M03	UCS08	41.15 – 41.43	720	0.81	0.94	planar
BH-M03	UCS09	50.73 – 51.00	850	0.62	0.74	brittle

Please note that the sample indicated with an asterisk () was less than that required by the test standard i.e. "The test is limited to specimens in the form of right cylinders of height approximately equal to twice the diameter", therefore the results for this sample are not IANZ endorsed. In our experience the UCS value determined for this sample will be higher than if the sample had a length of twice the diameter (*opinion not IANZ endorsed*).

As per the reporting requirements of NZS4402: 1986: Test 2.1: water content is reported to two significant figures for values below 10%, and to three significant figures for values of 10% or greater. As per the reporting requirements of NZS4402: 1986: Test 6.3.1: UCS, dry density is reported to the nearest 0.05t/m³, the unconfined compressive strength is reported to two significant figures, and the strain & rate of axial compression at failure is reported to two significant figures.

Please note that the test results relate only to the samples as-received, and relate only to the samples under test.

Thank you for the opportunity to carry out this testing. If you have any queries regarding the content of this report please contact the person authorising this report below at your convenience.

Yours faithfully,

Justin Franklin
Key Technical Person
Assistant Laboratory Manager
Babbage Geotechnical Laboratory



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation. This report may not be reproduced except in full & with written approval from BGL.

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S1

Depth: 26.50 – 26.75m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.54** mm

Initial Length: **119.87** mm

Initial Mass: **663.65** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.50** t/m³

Water Content After Test: **29.0** %

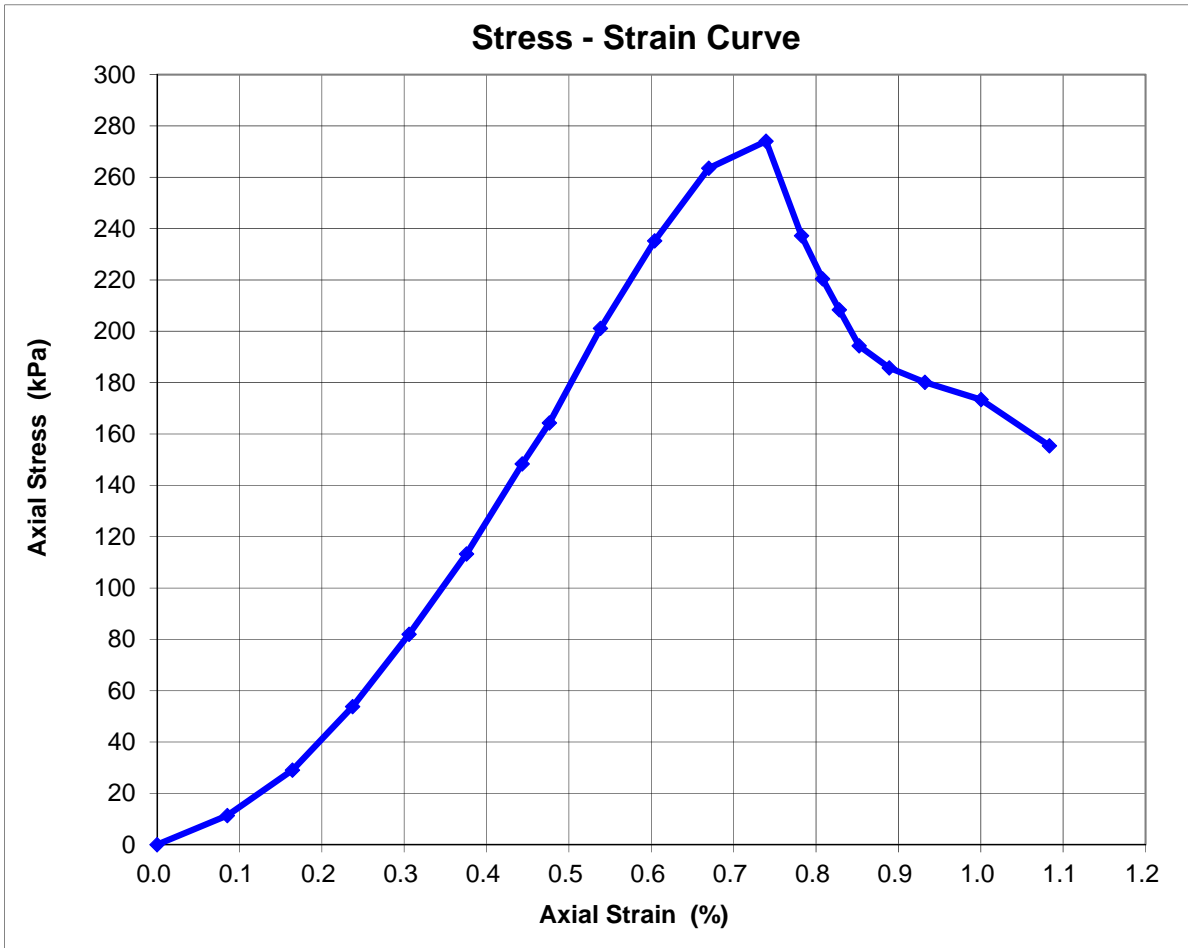
Failure Conditions:

Strain at failure: **0.74** %

Compression at failure: **0.89** mm

Rate of Compression: **0.22** mm / minute

Mode of Failure: **planar**



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 6 of 69 Version 3, July 2022
PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S1

Depth: 26.50 – 26.75m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S2

Depth: 29.69 – 29.92m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.86** mm

Initial Length: **115.09** mm

Initial Mass: **641.83** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.45** t/m³

Water Content After Test: **32.1** %

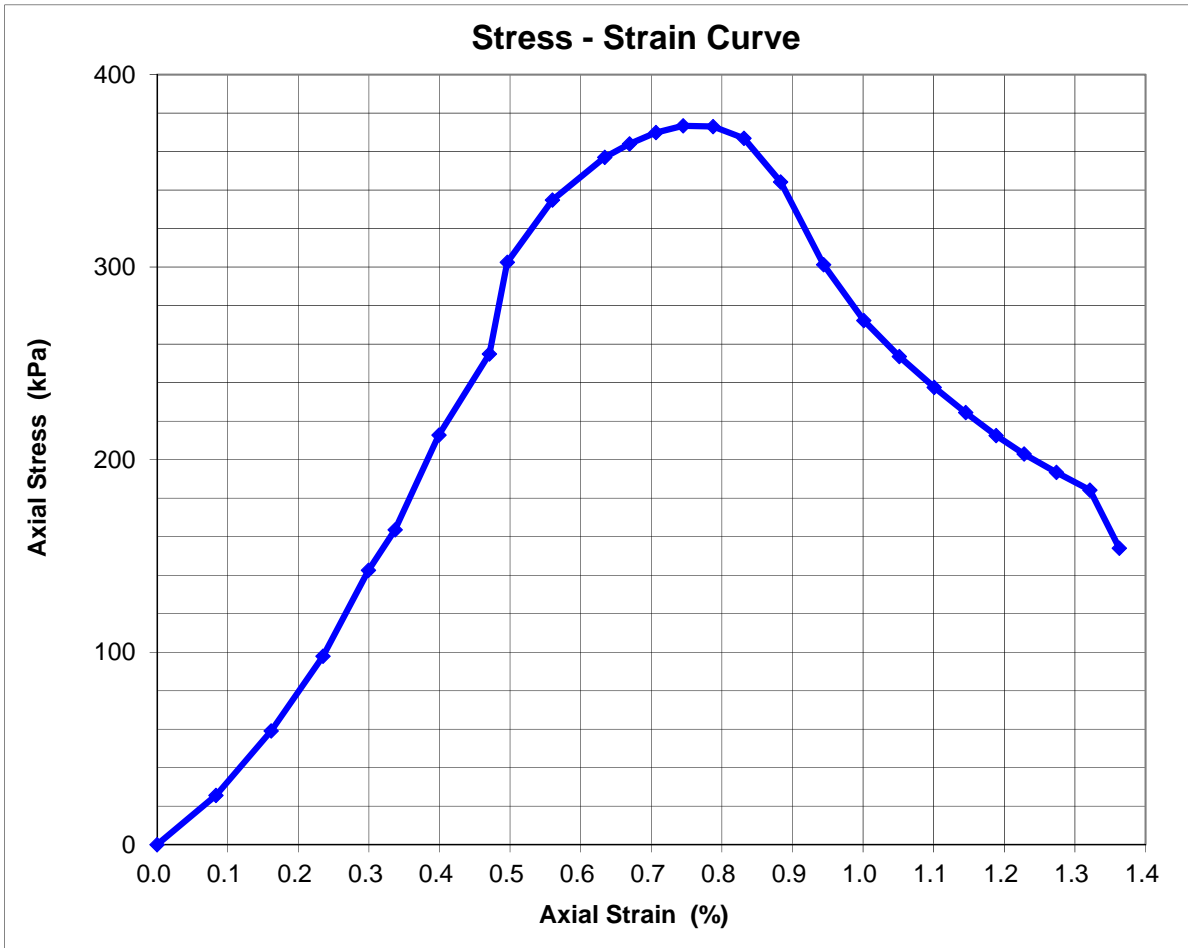
Failure Conditions:

Strain at failure: **0.75** %

Compression at failure: **0.86** mm

Rate of Compression: **0.21** mm / minute

Mode of Failure: **planar**



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PROJECT:	WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION		

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S2

Depth: 29.69 – 29.92m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S3

Depth: 36.35 – 36.65m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.05** mm

Initial Length: **120.04** mm

Initial Mass: **662.61** g

Initial Bulk Density: **2.02** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **23.8** %

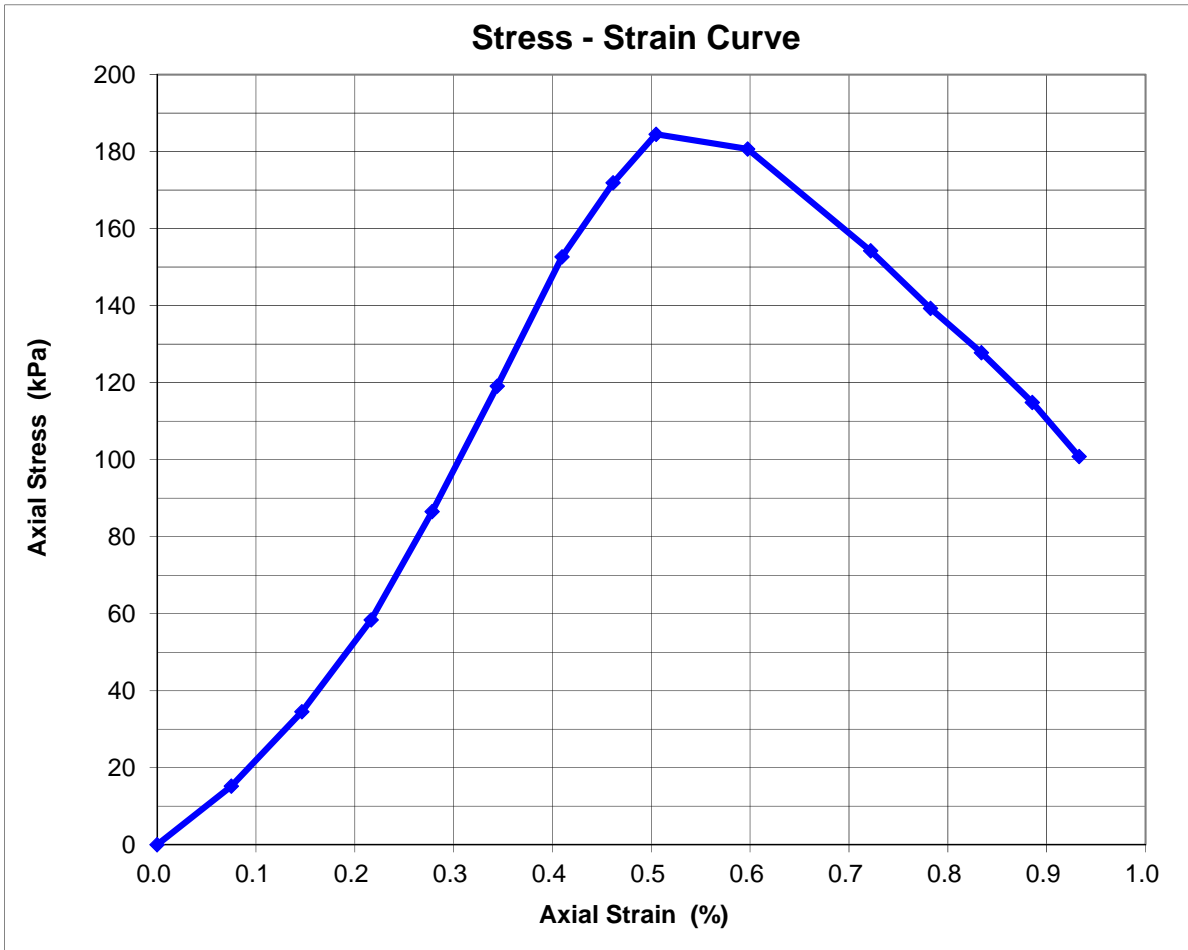
Failure Conditions:

Strain at failure: **0.50** %

Compression at failure: **0.61** mm

Rate of Compression: **0.20** mm / minute

Mode of Failure: **planar**



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PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S3

Depth: 36.35 – 36.65m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02 **Sample Number: S4** **Depth: 40.80 – 41.00m**

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.61** mm

Initial Length: **119.91** mm

Initial Mass: **690.28** g

Initial Bulk Density: **2.00** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **24.6** %

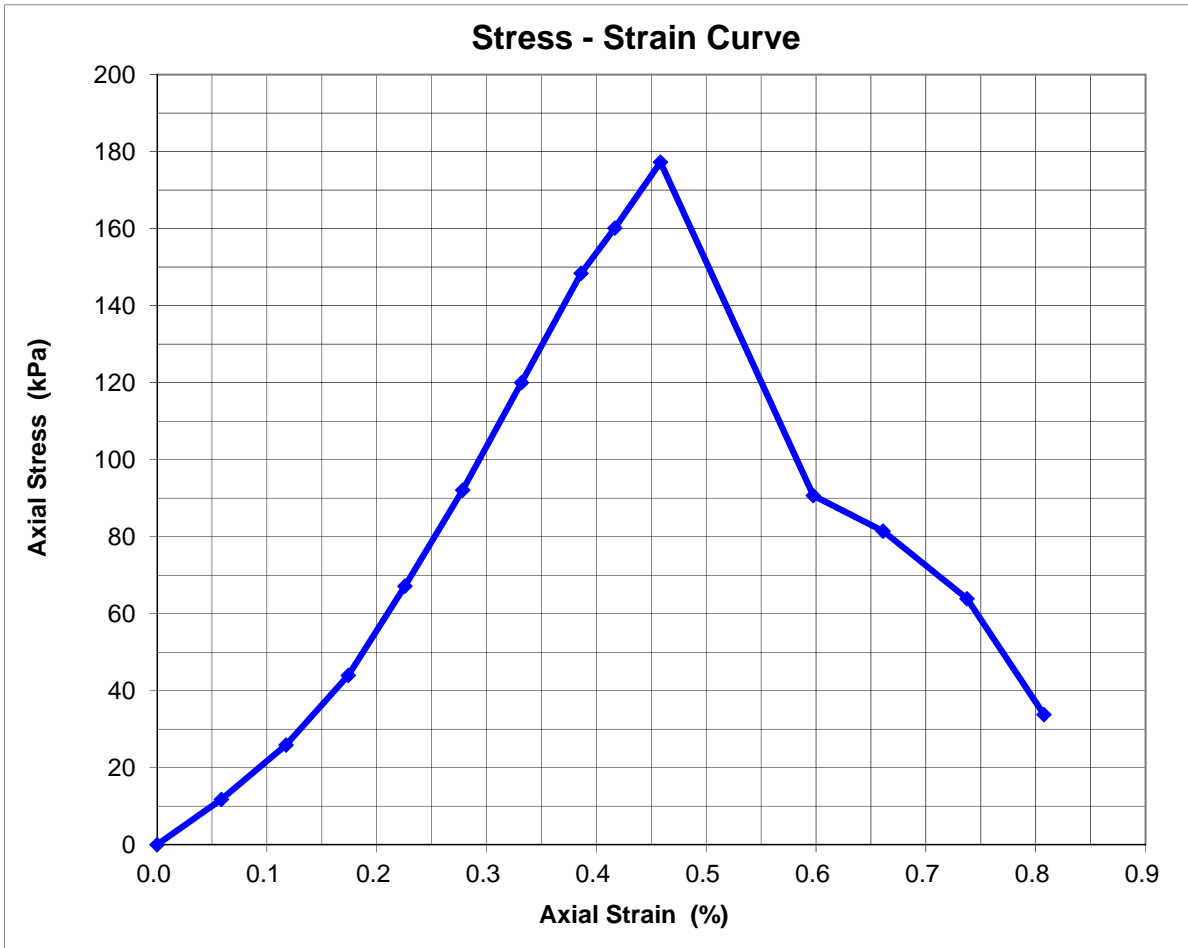
Failure Conditions:

Strain at failure: **0.46** %

Compression at failure: **0.55** mm

Rate of Compression: **0.16** mm / minute

Mode of Failure: **planar**



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 15 of 69 Version 3, July 2022
PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02 Sample Number: S4 Depth: 40.80 – 41.00m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S5

Depth: 53.30 – 53.90m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.39** mm

Initial Length: **120.43** mm

Initial Mass: **662.48** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.55** t/m³

Water Content After Test: **24.7** %

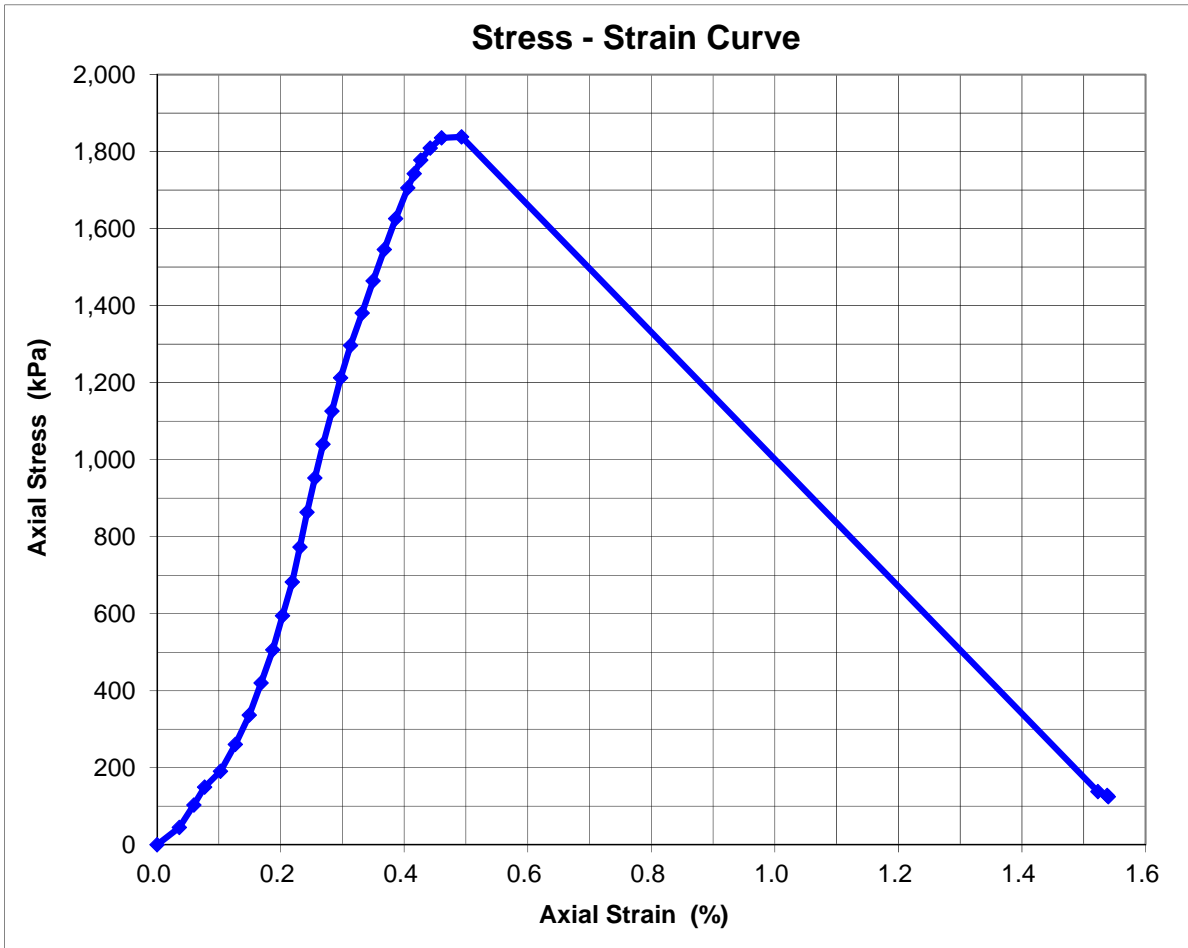
Failure Conditions:

Strain at failure: **0.49** %

Compression at failure: **0.59** mm

Rate of Compression: **0.084** mm / minute

Mode of Failure: brittle



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 18 of 69 Version 3, July 2022
PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M02**

Sample Number: **S5**

Depth: **53.30 – 53.90m**

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, very weak, orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02 Sample Number: S6 Depth: 55.20 – 55.50m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.39** mm

Initial Length: **119.93** mm

Initial Mass: **673.48** g

Initial Bulk Density: **1.96** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **19.5** %

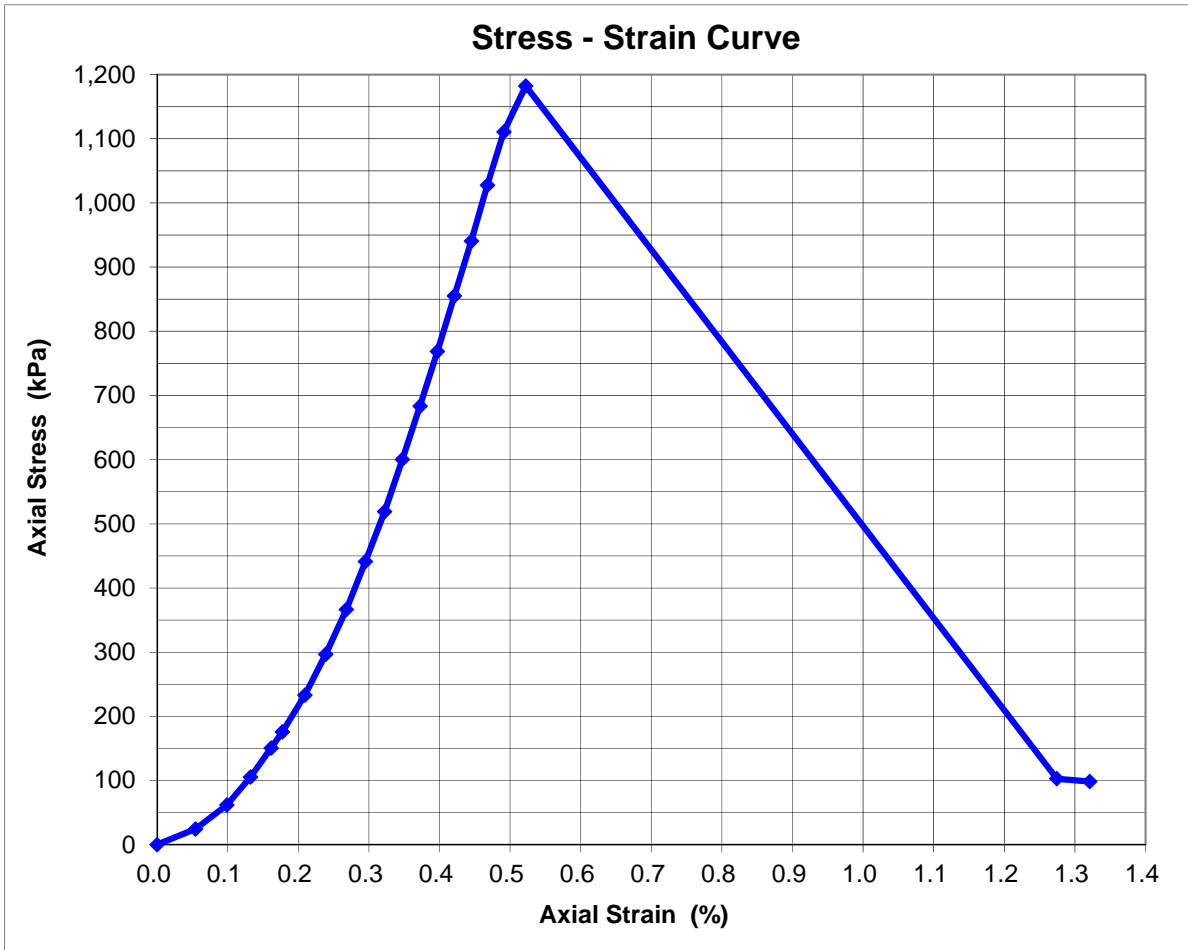
Failure Conditions:

Strain at failure: **0.52** %

Compression at failure: **0.63** mm

Rate of Compression: **0.093** mm / minute

Mode of Failure: **planar**



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 21 of 69 Version 3, July 2022
PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S6

Depth: 55.20 – 55.50m

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to medium, very weak, dark orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S7

Depth: 55.80 – 56.11m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **56.94** mm

Initial Length: **120.02** mm

Initial Mass: **586.43** g

Initial Bulk Density: **1.92** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **20.6** %

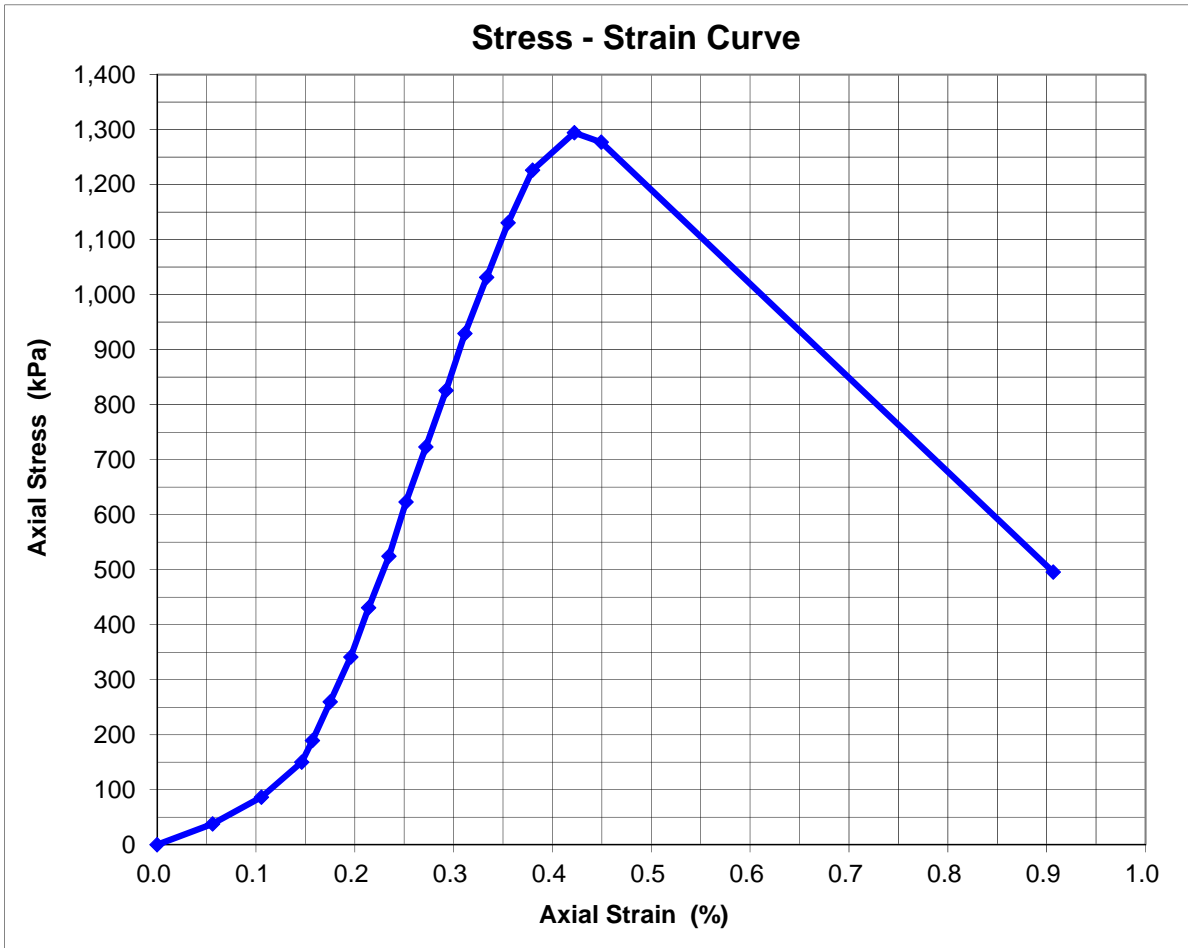
Failure Conditions:

Strain at failure: **0.42** %

Compression at failure: **0.51** mm

Rate of Compression: **0.085** mm / minute

Mode of Failure: brittle



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 24 of 69 Version 3, July 2022
PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02 Sample Number: S7 Depth: 55.80 – 56.11m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, very weak, dark orange, weakly to moderately cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S8

Depth: 56.50 – 56.90m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.05** mm

Initial Length: **120.11** mm

Initial Mass: **636.25** g

Initial Bulk Density: **1.93** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **20.8** %

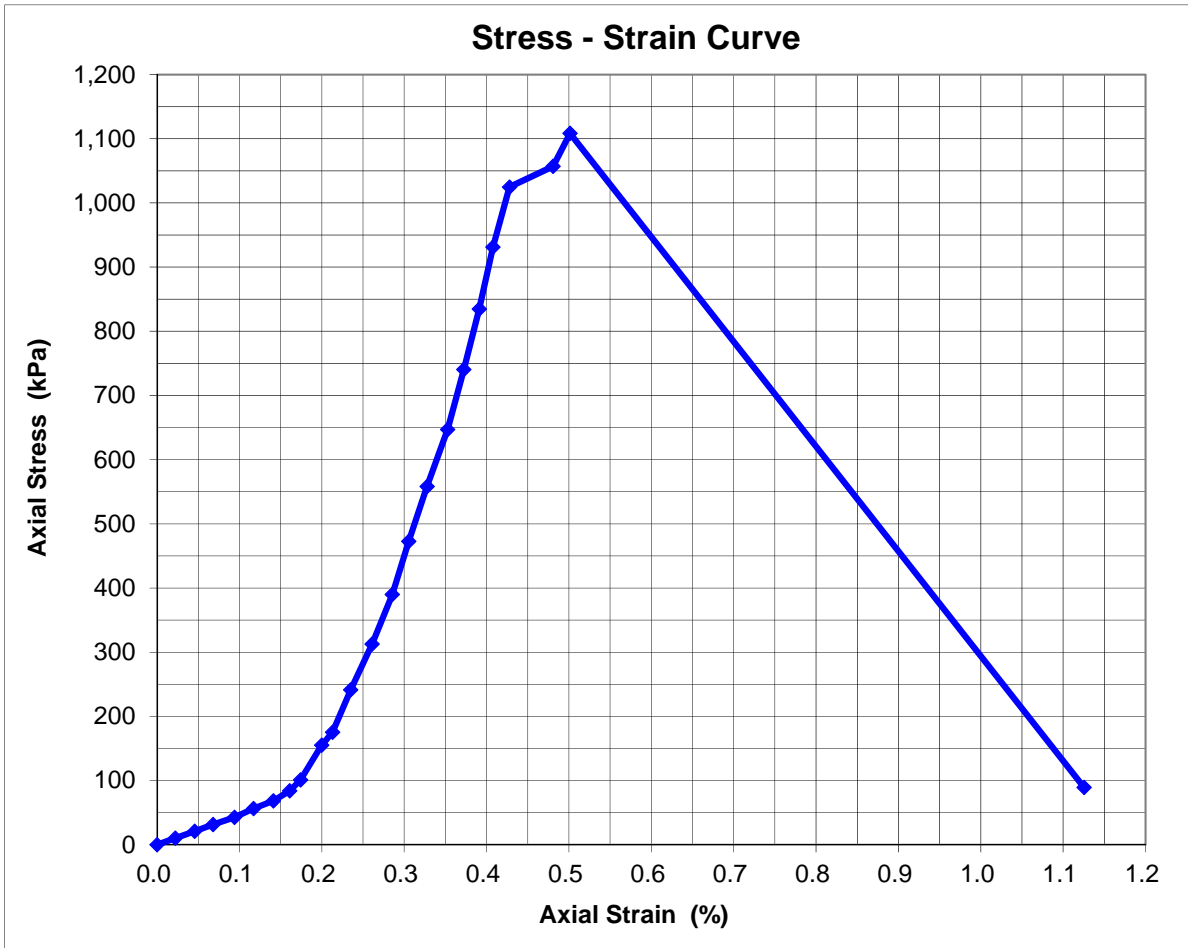
Failure Conditions:

Strain at failure: **0.50** %

Compression at failure: **0.60** mm

Rate of Compression: **0.098** mm / minute

Mode of Failure: brittle



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 27 of 69 Version 3, July 2022
PROJECT:		WAITAKERE LHRA - MURIWAI GROUND INVESTIGATION	

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S8

Depth: 56.50 – 56.90m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, very weak, dark orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S9

Depth: 64.44 – 64.72m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **58.56** mm

Initial Length: **121.19** mm

Initial Mass: **667.98** g

Initial Bulk Density: **2.05** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **22.9** %

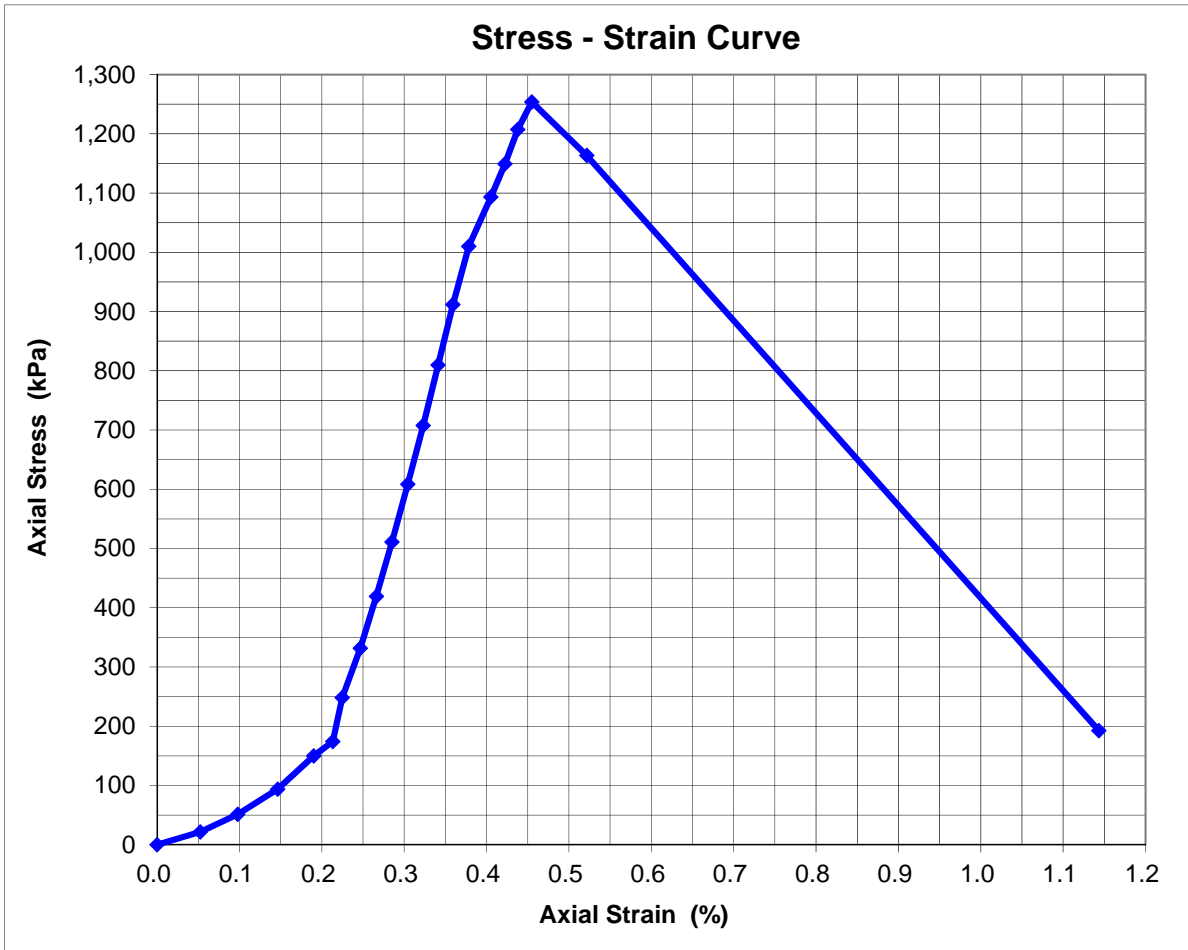
Failure Conditions:

Strain at failure: **0.45** %

Compression at failure: **0.55** mm

Rate of Compression: **0.088** mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S9

Depth: 64.44 – 64.72m

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, very weak, dark brownish orange, weakly to moderately cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S10

Depth: 67.93 – 68.33m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: mm

Initial Length: mm

Initial Mass: g

Initial Bulk Density: t/m³

Initial Dry Density: t/m³

Water Content After Test: %

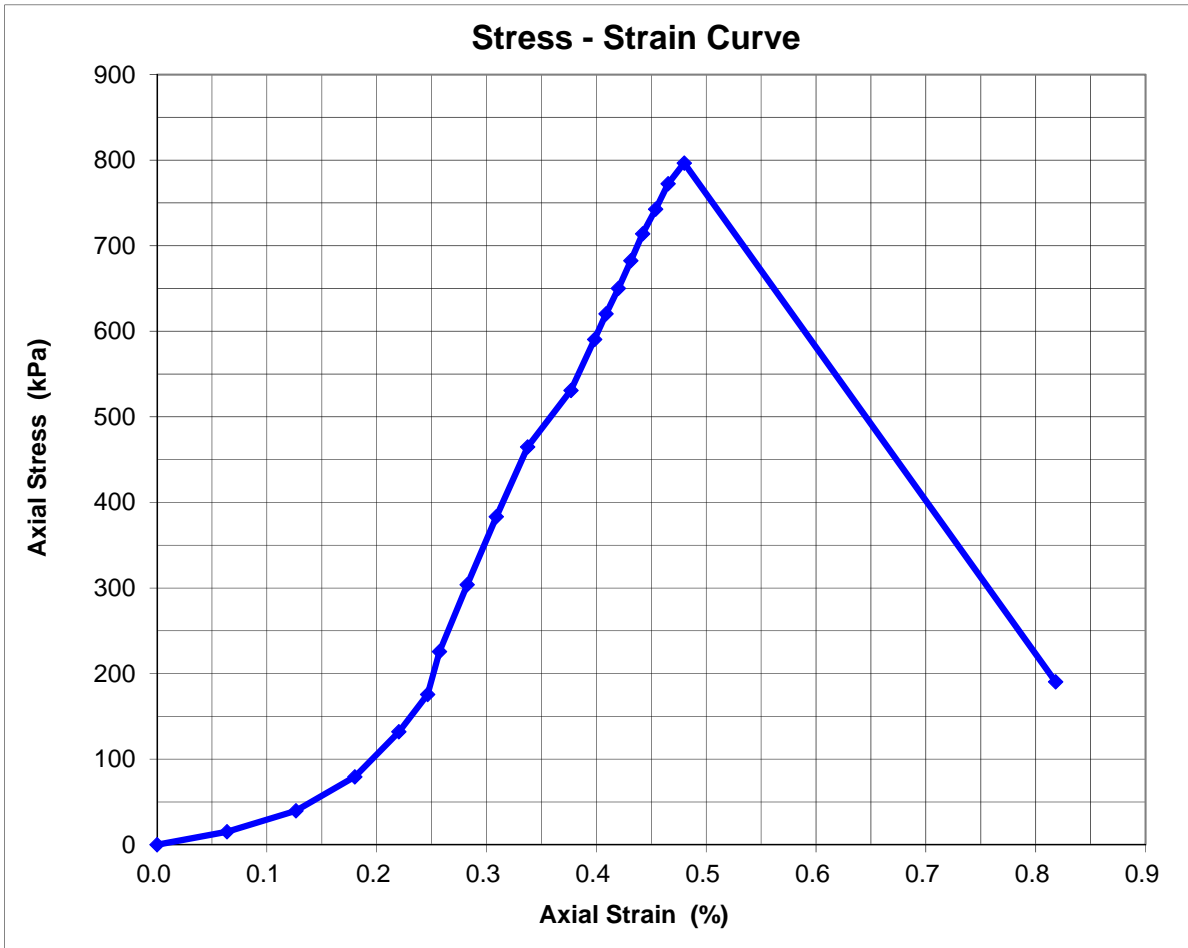
Failure Conditions:

Strain at failure: %

Compression at failure: mm

Rate of Compression: mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S10

Depth: 67.93 – 68.33m

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to coarse, extremely weak, dark orangish brown, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S11

Depth: 74.20 – 74.50m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.76** mm

Initial Length: **120.00** mm

Initial Mass: **655.99** g

Initial Bulk Density: **1.89** t/m³

Initial Dry Density: **1.45** t/m³

Water Content After Test: **31.8** %

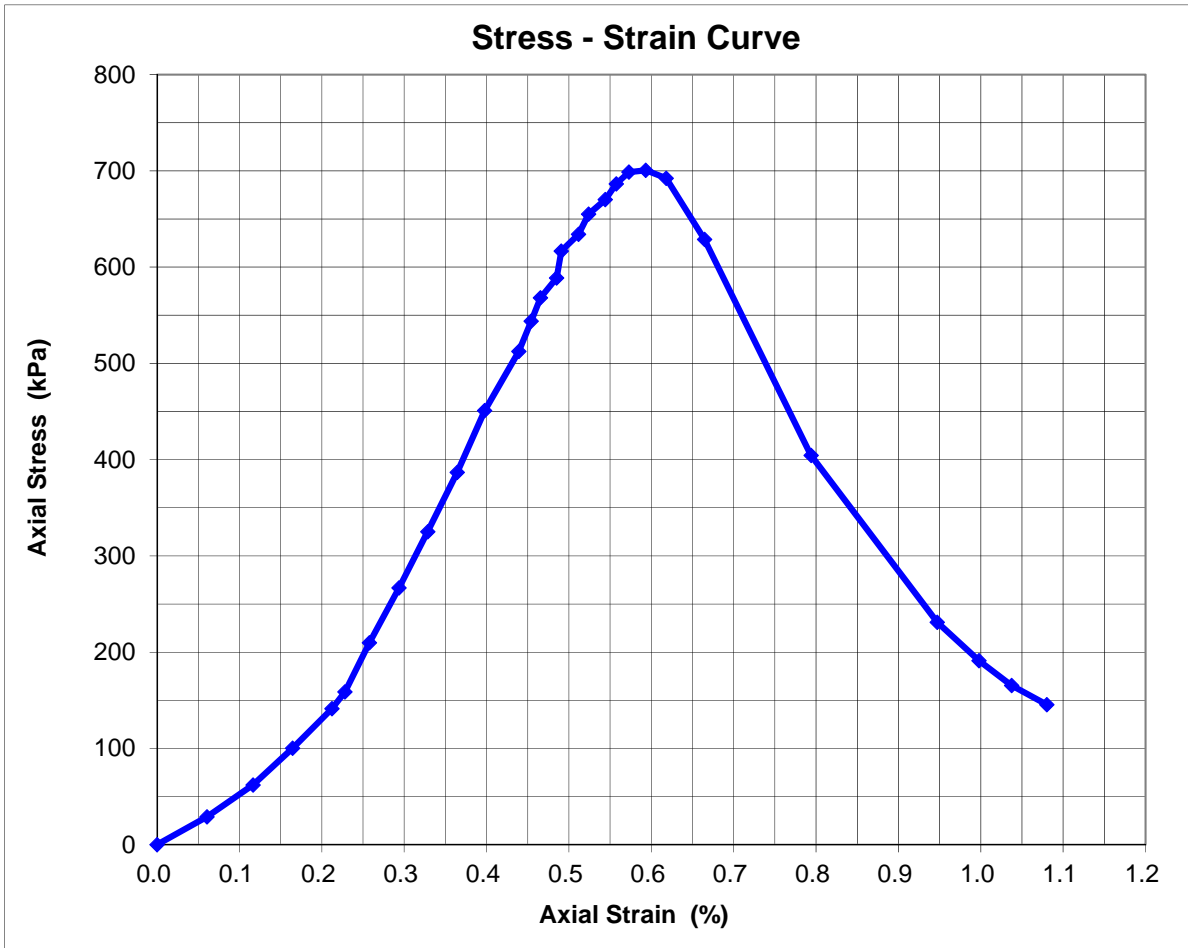
Failure Conditions:

Strain at failure: **0.59** %

Compression at failure: **0.71** mm

Rate of Compression: **0.13** mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S11

Depth: 74.20 – 74.50m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, brown, weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S12

Depth: 76.13 – 76.40m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.63** mm

Initial Length: **119.95** mm

Initial Mass: **647.59** g

Initial Bulk Density: **1.87** t/m³

Initial Dry Density: **1.40** t/m³

Water Content After Test: **31.8** %

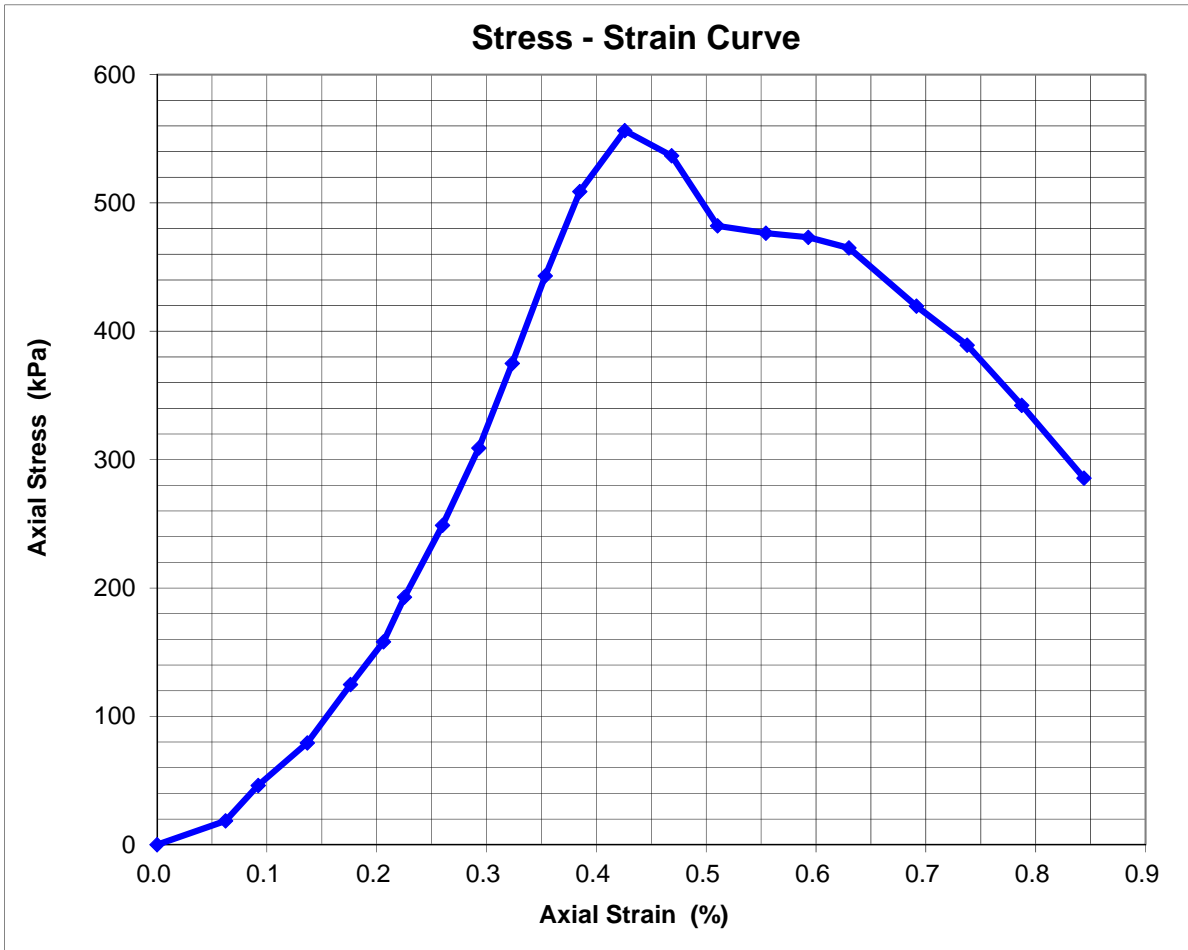
Failure Conditions:

Strain at failure: **0.43** %

Compression at failure: **0.51** mm

Rate of Compression: **0.11** mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02 Sample Number: S12 Depth: 76.13 – 76.40m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak, grey with light brown oxidation around circumference, weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S13

Depth: 78.14 – 78.47m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **58.59** mm

Initial Length: **120.07** mm

Initial Mass: **633.33** g

Initial Bulk Density: **1.96** t/m³

Initial Dry Density: **1.55** t/m³

Water Content After Test: **25.4** %

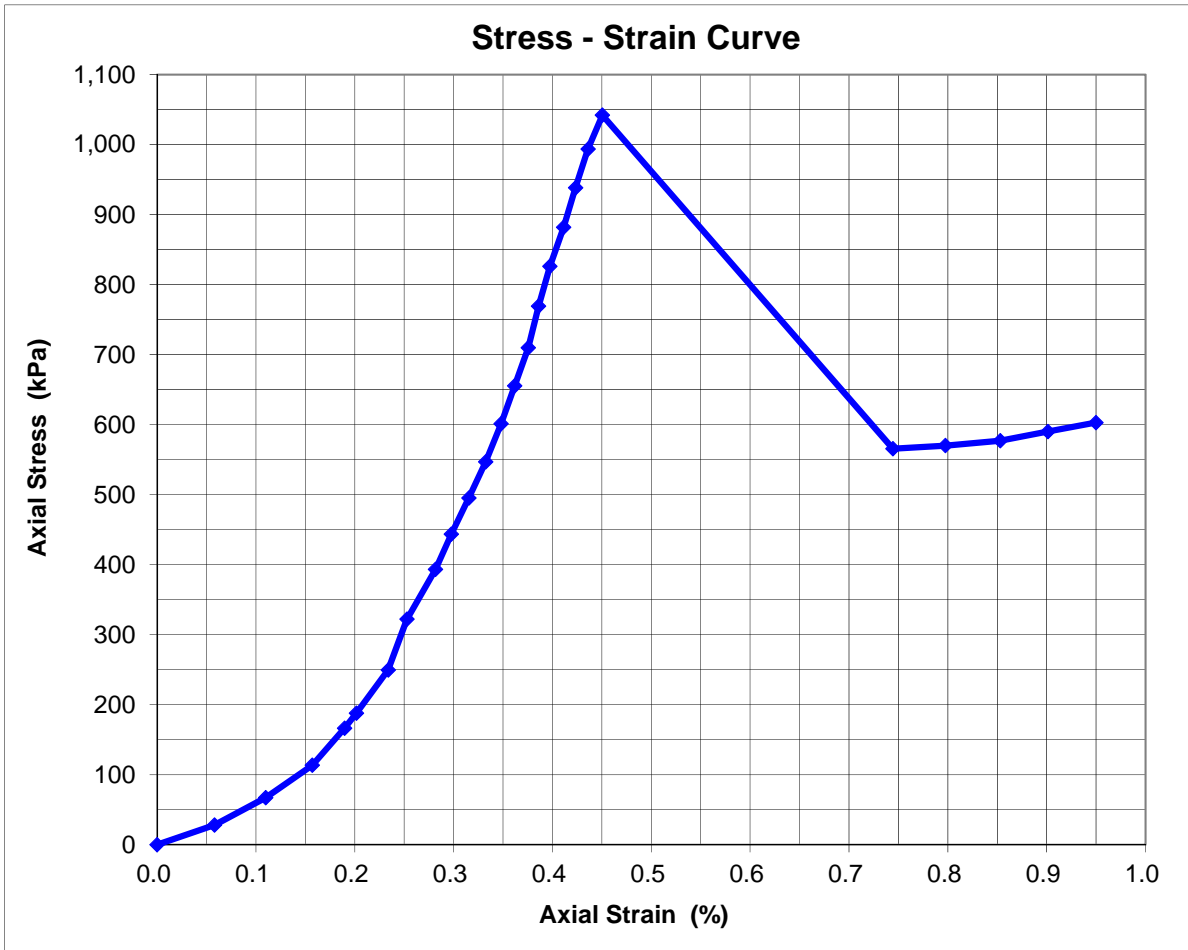
Failure Conditions:

Strain at failure: **0.45** %

Compression at failure: **0.54** mm

Rate of Compression: **0.092** mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M02

Sample Number: S13

Depth: 78.14 – 78.47m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to coarse, extremely weak to very weak, banded brown & dark brown, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS01

Depth: 9.93 – 10.13m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: mm

Initial Length: mm

Initial Mass: g

Initial Bulk Density: t/m³

Initial Dry Density: t/m³

Water Content After Test: %

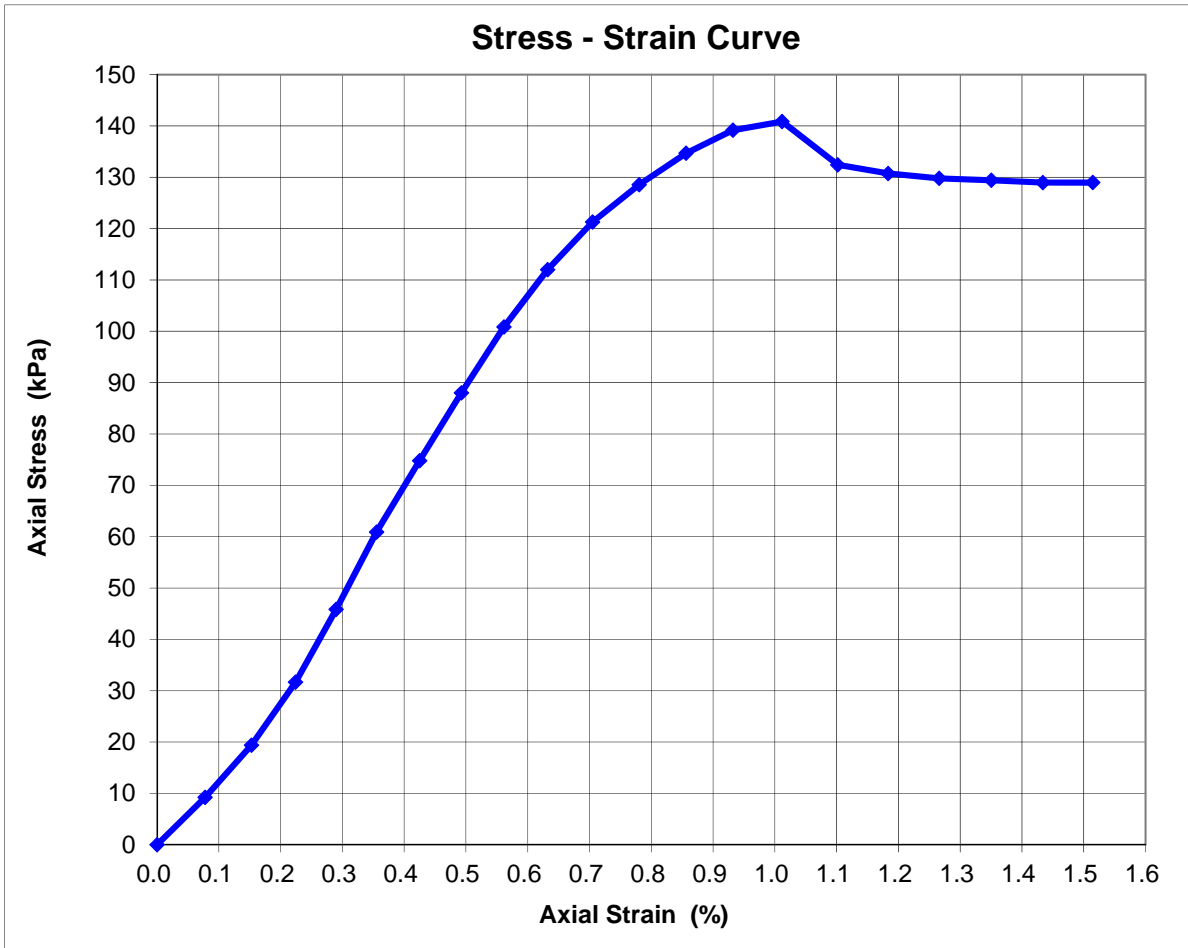
Failure Conditions:

Strain at failure: %

Compression at failure: mm

Rate of Compression: mm / minute

Mode of Failure: plastic / brittle



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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS01 Depth: 9.93 – 10.13m

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine, extremely weak, banded orange, dark orange & yellow, very weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS02 Depth: 16.00 – 16.27m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	3.064	0.000	0.000	5.256	0.0	2645.0	0
0.28	3.120	0.057	0.000	5.265	42.0	2646.3	16
0.58	3.183	0.120	0.001	5.270	70.8	2647.7	27
0.87	3.240	0.177	0.001	5.278	106.4	2648.9	40
1.15	3.297	0.234	0.002	5.286	149.7	2650.2	56
1.45	3.354	0.290	0.002	5.295	194.2	2651.5	73
1.73	3.406	0.343	0.003	5.305	245.3	2652.6	92
2.02	3.454	0.391	0.003	5.317	302.0	2653.7	114
2.32	3.507	0.443	0.004	5.327	353.9	2654.8	133
2.60	3.559	0.495	0.004	5.338	410.2	2656.0	154
2.88	3.612	0.548	0.005	5.349	464.8	2657.2	175
3.18	3.657	0.593	0.005	5.354	487.9	2658.2	184
3.47	3.697	0.633	0.005	5.358	508.1	2659.1	191
3.60	3.725	0.661	0.006	5.362	529.7	2659.7	199
3.75	3.754	0.690	0.006	5.366	550.0	2660.3	207
3.88	3.782	0.718	0.006	5.370	568.1	2661.0	213
4.02	3.811	0.747	0.006	5.373	584.8	2661.6	220
4.17	3.840	0.776	0.006	5.376	602.2	2662.3	226
4.30	3.867	0.804	0.007	5.380	619.5	2662.9	233
4.43	3.896	0.832	0.007	5.383	635.6	2663.5	239
4.58	3.923	0.860	0.007	5.386	651.6	2664.1	245
4.72	3.953	0.889	0.007	5.389	664.5	2664.8	249
4.85	3.982	0.918	0.008	5.392	678.4	2665.4	255
5.00	4.012	0.948	0.008	5.394	690.5	2666.1	259
5.13	4.042	0.978	0.008	5.396	701.4	2666.8	263
5.27	4.072	1.009	0.008	5.398	710.4	2667.5	266
5.42	4.103	1.040	0.009	5.400	720.3	2668.2	270
5.55	4.132	1.069	0.009	5.402	730.7	2668.8	274
5.68	4.162	1.098	0.009	5.404	740.2	2669.5	277
5.83	4.194	1.130	0.009	5.405	747.1	2670.2	280
5.97	4.226	1.162	0.010	5.406	751.9	2670.9	282
6.10	4.258	1.194	0.010	5.407	754.0	2671.6	282
6.25	4.291	1.227	0.010	5.407	754.5	2672.4	282
6.38	4.323	1.260	0.010	5.406	752.6	2673.1	282
6.52	4.359	1.295	0.011	5.405	747.2	2673.9	279
6.67	4.396	1.332	0.011	5.404	740.3	2674.7	277
6.80	4.431	1.367	0.011	5.402	729.7	2675.5	273
6.93	4.467	1.403	0.012	5.400	718.9	2676.3	269
7.08	4.502	1.439	0.012	5.397	707.6	2677.1	264
7.22	4.537	1.474	0.012	5.394	693.2	2677.9	259
7.35	4.573	1.509	0.013	5.391	674.0	2678.7	252

Unconfined Compressive Strength: 280 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 **Sample Number: UCS02** **Depth: 16.00 – 16.27m**

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: mm

Initial Length: mm

Initial Mass: g

Initial Bulk Density: t/m³

Initial Dry Density: t/m³

Water Content After Test: %

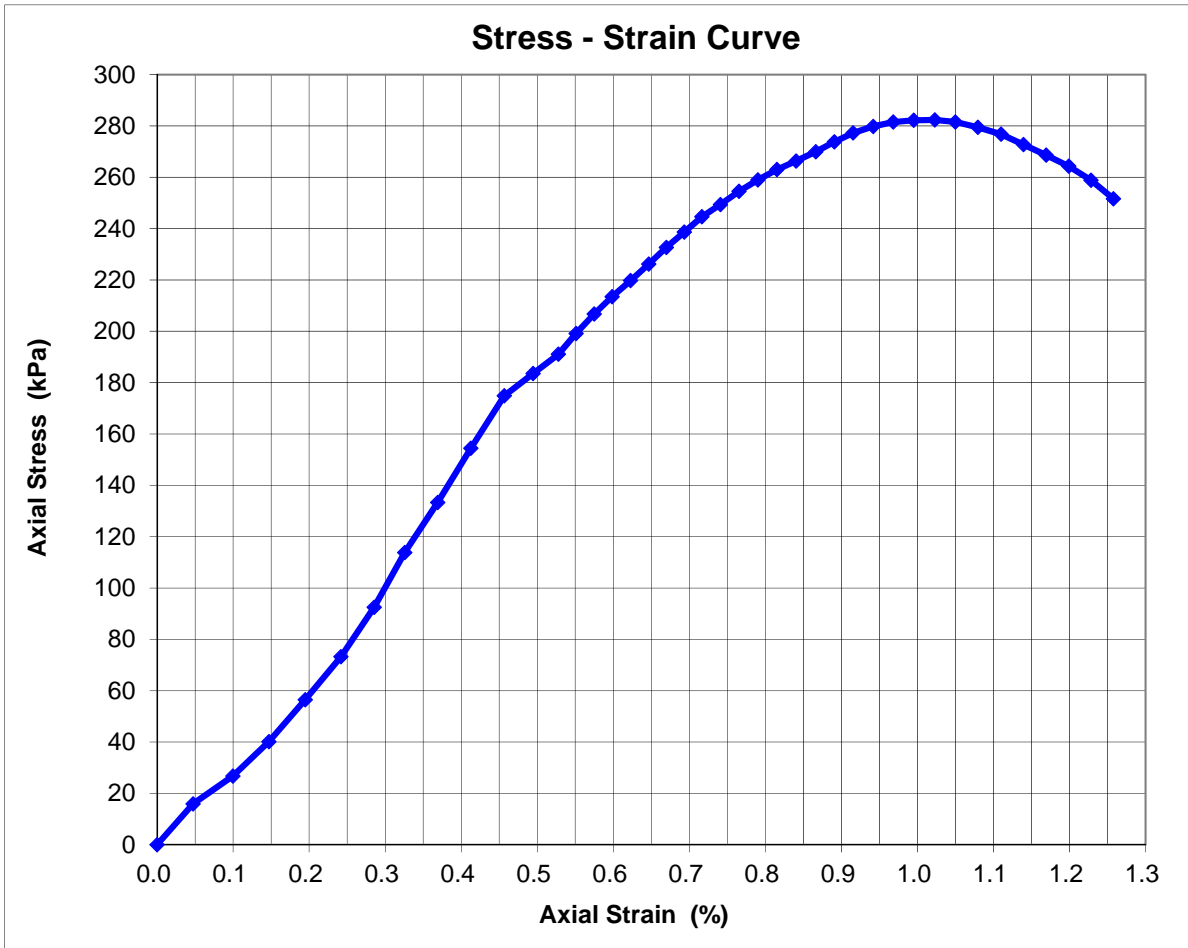
Failure Conditions:

Strain at failure: %

Compression at failure: mm

Rate of Compression: mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS02 Depth: 16.00 – 16.27m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine, extremely weak, light grey, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS03 Depth: 29.55 – 29.75m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.93** mm

Initial Length: **108.76** mm

Initial Mass: **614.84** g

Initial Bulk Density: **2.00** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **23.4** %

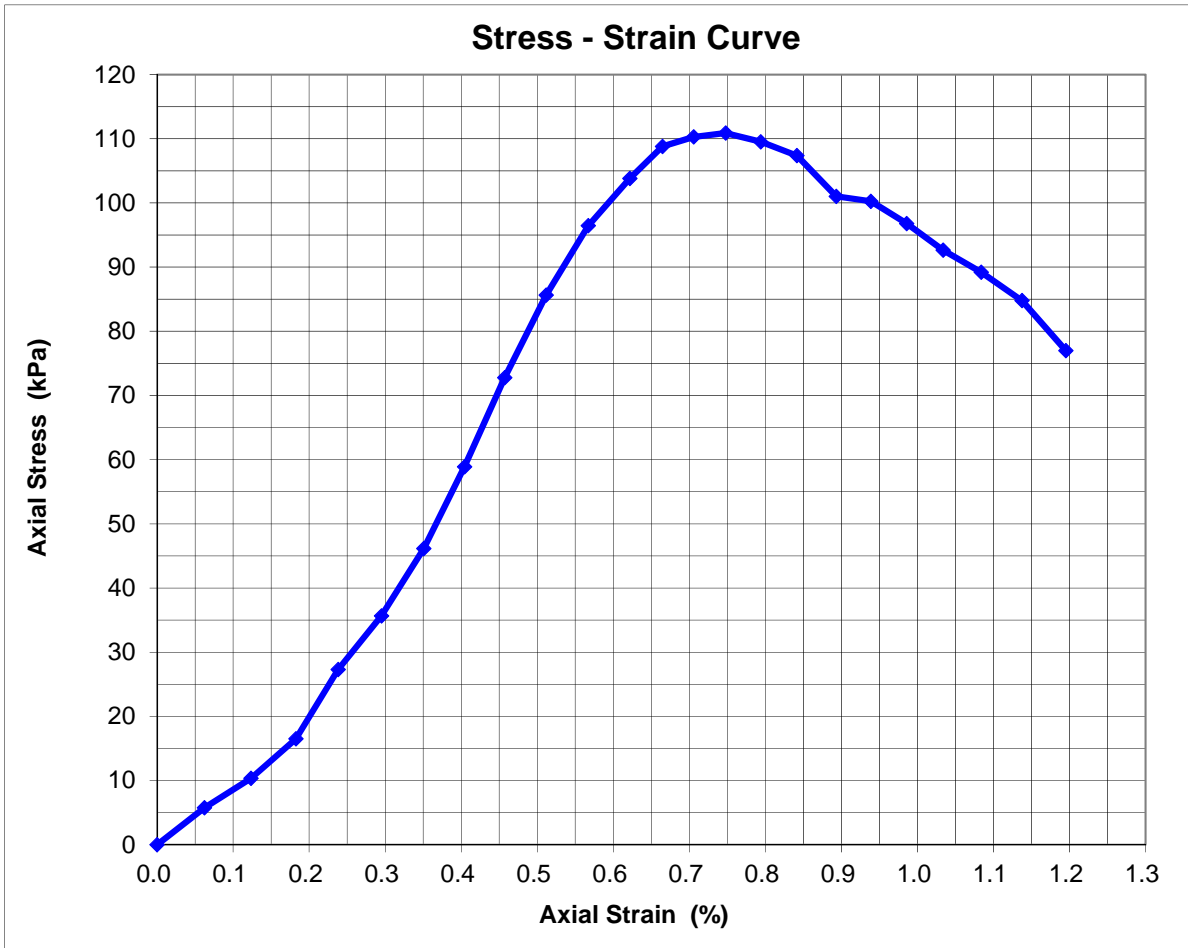
Failure Conditions:

Strain at failure: **0.75** %

Compression at failure: **0.81** mm

Rate of Compression: **0.21** mm / minute

Mode of Failure: **planar**



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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS03

Depth: 29.55 – 29.75m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to medium, extremely weak, orange, weakly cemented.

SAMPLE BEFORE TEST

SAMPLE AFTER TEST





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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	27-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS04 Depth: 31.95 – 32.23m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	2.463	0.000	0.000	5.251	0.0	2604.0	0
0.28	2.522	0.059	0.000	5.257	30.8	2605.2	12
0.58	2.580	0.117	0.001	5.262	54.0	2606.5	21
0.87	2.641	0.178	0.001	5.266	76.2	2607.8	29
1.15	2.702	0.239	0.002	5.271	99.0	2609.2	38
1.45	2.763	0.300	0.003	5.275	121.1	2610.5	46
1.73	2.825	0.362	0.003	5.280	144.3	2611.8	55
2.02	2.886	0.423	0.004	5.285	168.9	2613.2	65
2.32	2.947	0.484	0.004	5.290	193.3	2614.5	74
2.60	3.008	0.545	0.005	5.295	219.4	2615.9	84
2.88	3.069	0.606	0.005	5.300	244.7	2617.2	93
3.18	3.128	0.665	0.006	5.305	272.2	2618.5	104
3.47	3.188	0.725	0.006	5.311	300.2	2619.8	115
3.75	3.247	0.784	0.007	5.316	327.4	2621.1	125
3.97	3.289	0.826	0.007	5.321	349.2	2622.0	133
4.17	3.329	0.866	0.007	5.325	370.3	2622.9	141
4.37	3.370	0.907	0.008	5.329	391.0	2623.8	149
4.58	3.410	0.947	0.008	5.333	412.8	2624.7	157
4.78	3.451	0.988	0.008	5.338	436.1	2625.6	166
5.00	3.492	1.029	0.009	5.342	457.6	2626.5	174
5.40	3.550	1.087	0.009	5.347	480.5	2627.8	183
5.82	3.610	1.147	0.010	5.354	518.4	2629.1	197
6.23	3.692	1.229	0.010	5.364	565.2	2630.9	215
6.63	3.773	1.311	0.011	5.373	609.2	2632.7	231
7.05	3.857	1.394	0.012	5.381	653.1	2634.6	248
7.47	3.938	1.475	0.012	5.390	695.1	2636.4	264
7.87	4.020	1.557	0.013	5.398	735.0	2638.2	279
8.28	4.104	1.641	0.014	5.405	773.3	2640.1	293
8.48	4.146	1.683	0.014	5.409	790.8	2641.0	299
8.90	4.230	1.768	0.015	5.415	821.2	2642.9	311
9.12	4.273	1.810	0.015	5.417	834.9	2643.9	316
9.32	4.314	1.852	0.015	5.420	846.9	2644.8	320
9.52	4.358	1.895	0.016	5.422	856.1	2645.8	324
9.73	4.402	1.939	0.016	5.423	864.1	2646.8	326
9.93	4.447	1.984	0.017	5.424	866.5	2647.8	327
10.13	4.493	2.030	0.017	5.423	864.0	2648.8	326
10.35	4.541	2.078	0.017	5.420	849.7	2649.9	321
10.55	4.593	2.130	0.018	5.415	821.0	2651.1	310
10.75	4.649	2.186	0.018	5.407	782.4	2652.3	295
10.97	4.703	2.240	0.019	5.399	743.6	2653.5	280
11.17	4.761	2.298	0.019	5.388	685.5	2654.8	258

Unconfined Compressive Strength: 330 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS04

Depth: 31.95 – 32.23m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: mm

Initial Length: mm

Initial Mass: g

Initial Bulk Density: t/m³

Initial Dry Density: t/m³

Water Content After Test: %

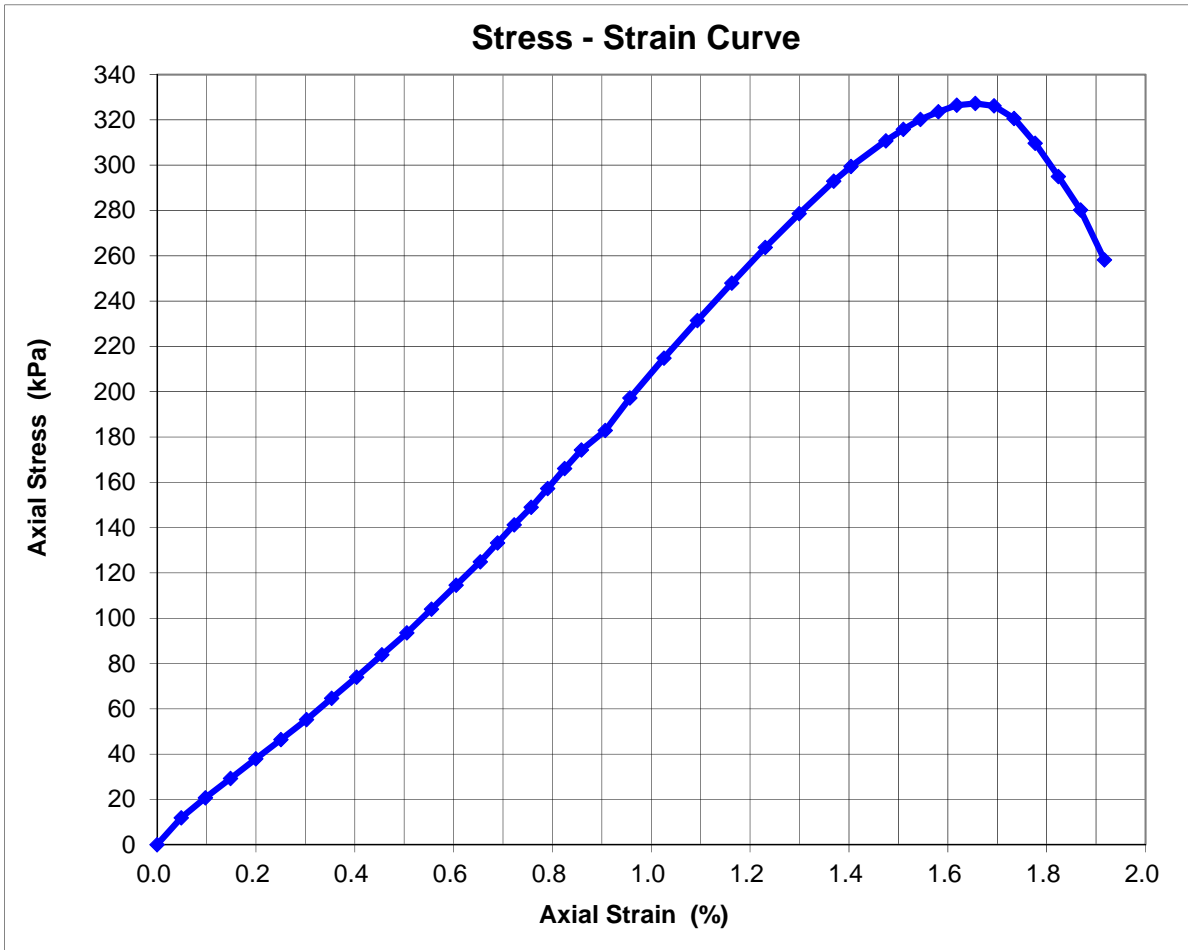
Failure Conditions:

Strain at failure: %

Compression at failure: mm

Rate of Compression: mm / minute

Mode of Failure: planar



Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 54 of 69 Version 3, July 2022
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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	27-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS04

Depth: 31.95 – 32.23m

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to medium, extremely weak, light grey, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS05

Depth: 33.76 – 34.06m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **57.58** mm

Initial Length: **120.16** mm

Initial Mass: **611.10** g

Initial Bulk Density: **1.95** t/m³

Initial Dry Density: **1.55** t/m³

Water Content After Test: **24.6** %

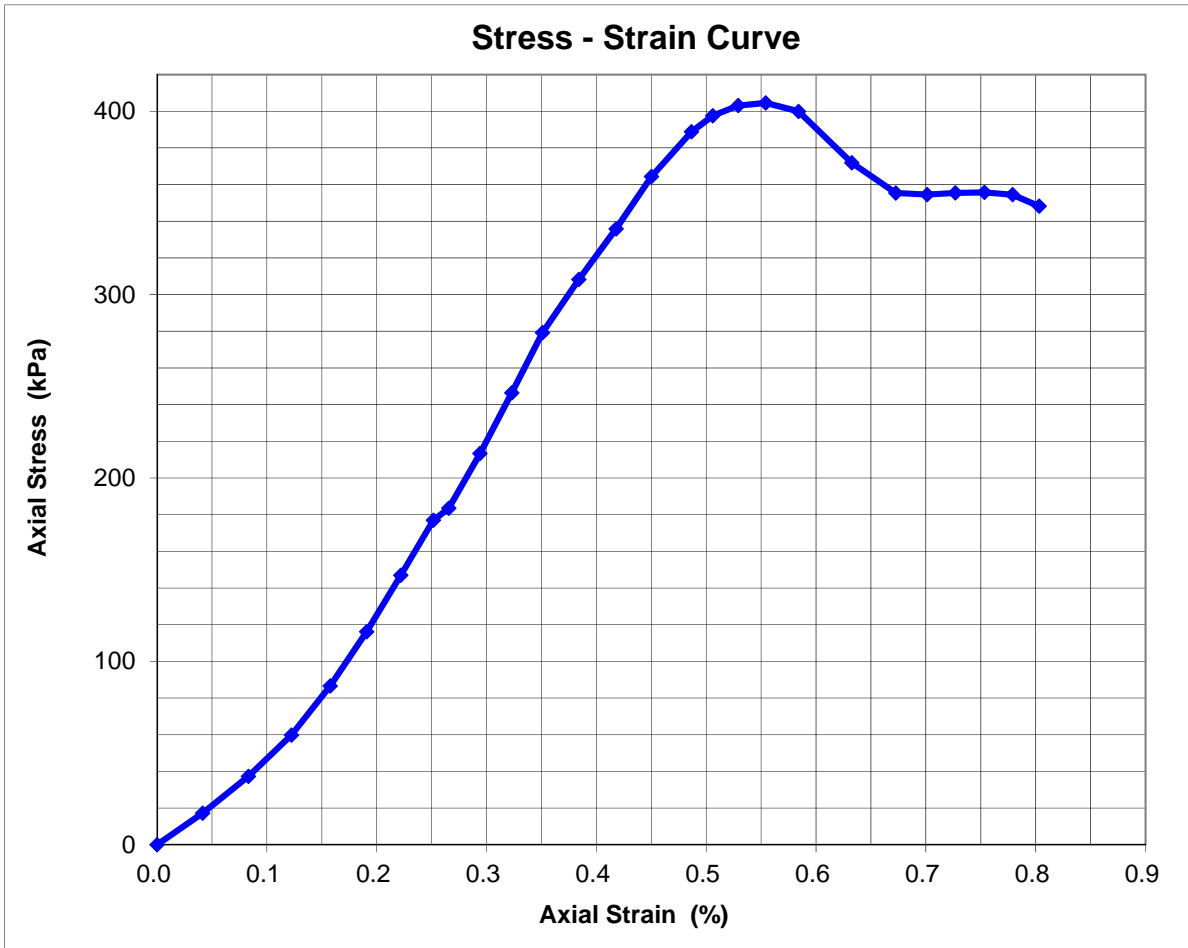
Failure Conditions:

Strain at failure: **0.55** %

Compression at failure: **0.67** mm

Rate of Compression: **0.14** mm / minute

Mode of Failure: **planar / brittle**



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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	28-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS05 Depth: 33.76 – 34.06m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to medium, extremely weak, dark orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST





Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 58 of 69 Version 3, July 2022
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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	28-Sep-23
	Compiled By:	WEC	28-Sep-23
	Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS06 Depth: 37.00 – 37.25m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	7.535	0.000	0.000	5.252	0.0	2836.6	0
0.13	7.564	0.028	0.000	5.254	14.0	2837.3	5
0.28	7.591	0.056	0.000	5.256	22.9	2838.0	8
0.42	7.614	0.079	0.001	5.259	35.4	2838.5	12
0.55	7.640	0.105	0.001	5.261	47.9	2839.1	17
0.70	7.667	0.132	0.001	5.263	59.7	2839.7	21
0.83	7.692	0.157	0.001	5.267	75.3	2840.3	27
0.98	7.720	0.184	0.002	5.270	90.2	2841.0	32
1.12	7.746	0.211	0.002	5.273	107.8	2841.6	38
1.27	7.772	0.237	0.002	5.276	124.0	2842.2	44
1.40	7.797	0.261	0.002	5.281	147.1	2842.8	52
1.53	7.821	0.286	0.002	5.286	170.8	2843.4	60
1.68	7.844	0.309	0.003	5.291	198.7	2844.0	70
1.82	7.867	0.332	0.003	5.297	226.6	2844.5	80
1.95	7.888	0.353	0.003	5.303	259.0	2845.0	91
2.10	7.910	0.374	0.003	5.310	291.7	2845.5	103
2.23	7.930	0.394	0.003	5.317	326.3	2846.0	115
2.37	7.949	0.414	0.003	5.324	363.7	2846.4	128
2.52	7.968	0.432	0.004	5.331	401.3	2846.9	141
2.65	7.986	0.451	0.004	5.340	443.2	2847.3	156
2.78	8.002	0.467	0.004	5.342	452.6	2847.7	159
2.93	8.015	0.480	0.004	5.343	458.5	2848.0	161
3.07	8.022	0.487	0.004	5.345	470.7	2848.2	165
3.20	8.040	0.505	0.004	5.354	513.3	2848.6	180
3.35	8.061	0.525	0.004	5.362	552.3	2849.1	194
3.48	8.082	0.546	0.005	5.369	590.8	2849.6	207
3.62	8.104	0.568	0.005	5.377	627.8	2850.1	220
3.77	8.127	0.591	0.005	5.384	662.6	2850.7	232
3.90	8.150	0.614	0.005	5.390	696.1	2851.2	244
4.03	8.176	0.640	0.005	5.396	724.0	2851.9	254
4.18	8.201	0.666	0.006	5.401	750.0	2852.5	263
4.32	8.226	0.691	0.006	5.406	773.8	2853.1	271
4.45	8.253	0.718	0.006	5.406	774.8	2853.7	271
4.60	8.344	0.809	0.007	5.363	558.7	2855.9	196
4.73	8.375	0.840	0.007	5.361	547.3	2856.6	192
4.87	8.401	0.866	0.007	5.361	551.3	2857.3	193
5.02	8.428	0.893	0.007	5.362	552.5	2857.9	193
5.15	8.470	0.934	0.008	5.358	533.5	2858.9	187

Unconfined Compressive Strength: 270 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS06

Depth: 37.00 – 37.25m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.10** mm

Initial Length: **119.92** mm

Initial Mass: **686.61** g

Initial Bulk Density: **2.02** t/m³

Initial Dry Density: **1.70** t/m³

Water Content After Test: **19.5** %

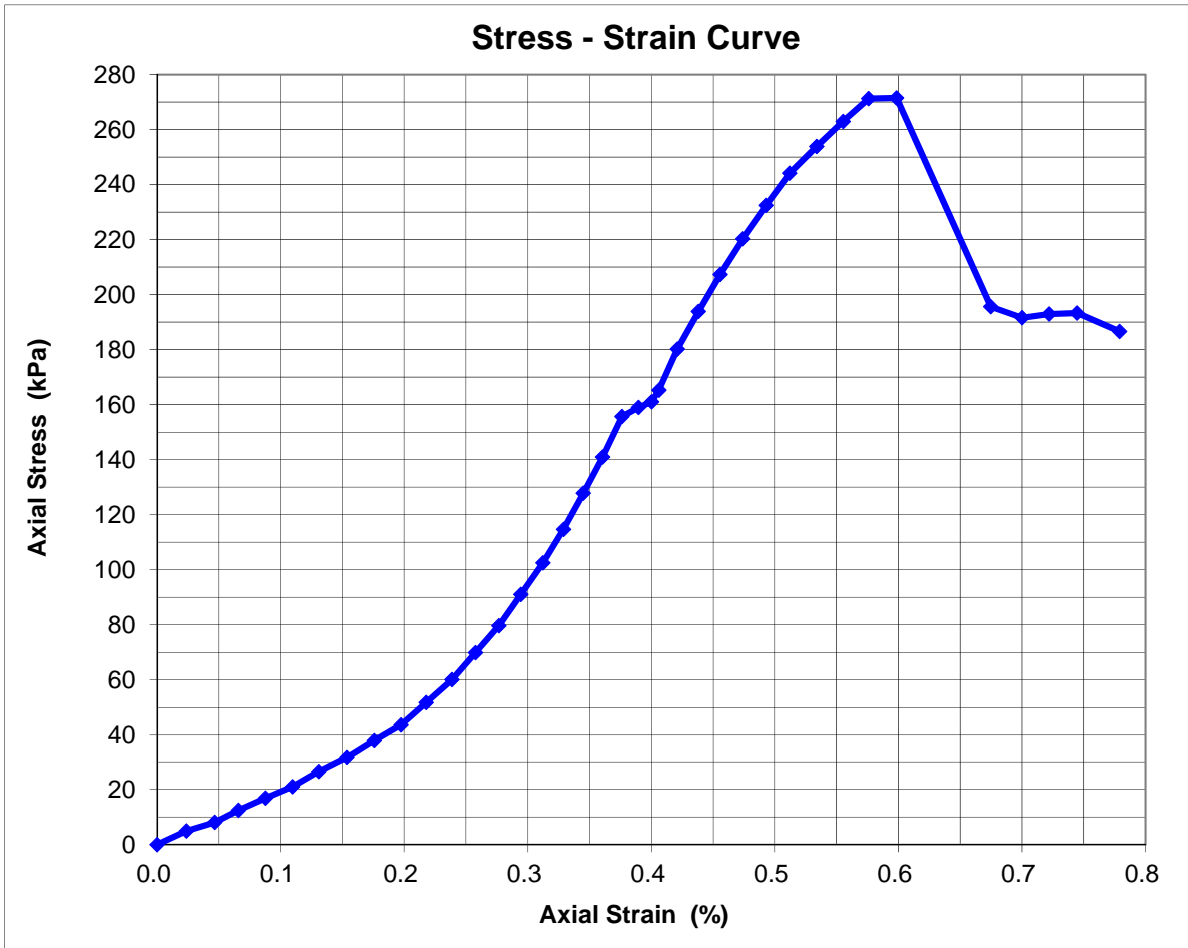
Failure Conditions:

Strain at failure: **0.60** %

Compression at failure: **0.72** mm

Rate of Compression: **0.16** mm / minute

Mode of Failure: **planar / brittle**



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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS06

Depth: 37.00 – 37.25m

Sample Description (*not part of BGL IANZ Accreditation*):

SANDSTONE, fine to medium, extremely weak, dark orange, uncemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS07

Depth: 40.14 – 40.43m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.04** mm

Initial Length: **114.86** mm

Initial Mass: **660.65** g

Initial Bulk Density: **2.03** t/m³

Initial Dry Density: **1.65** t/m³

Water Content After Test: **23.4** %

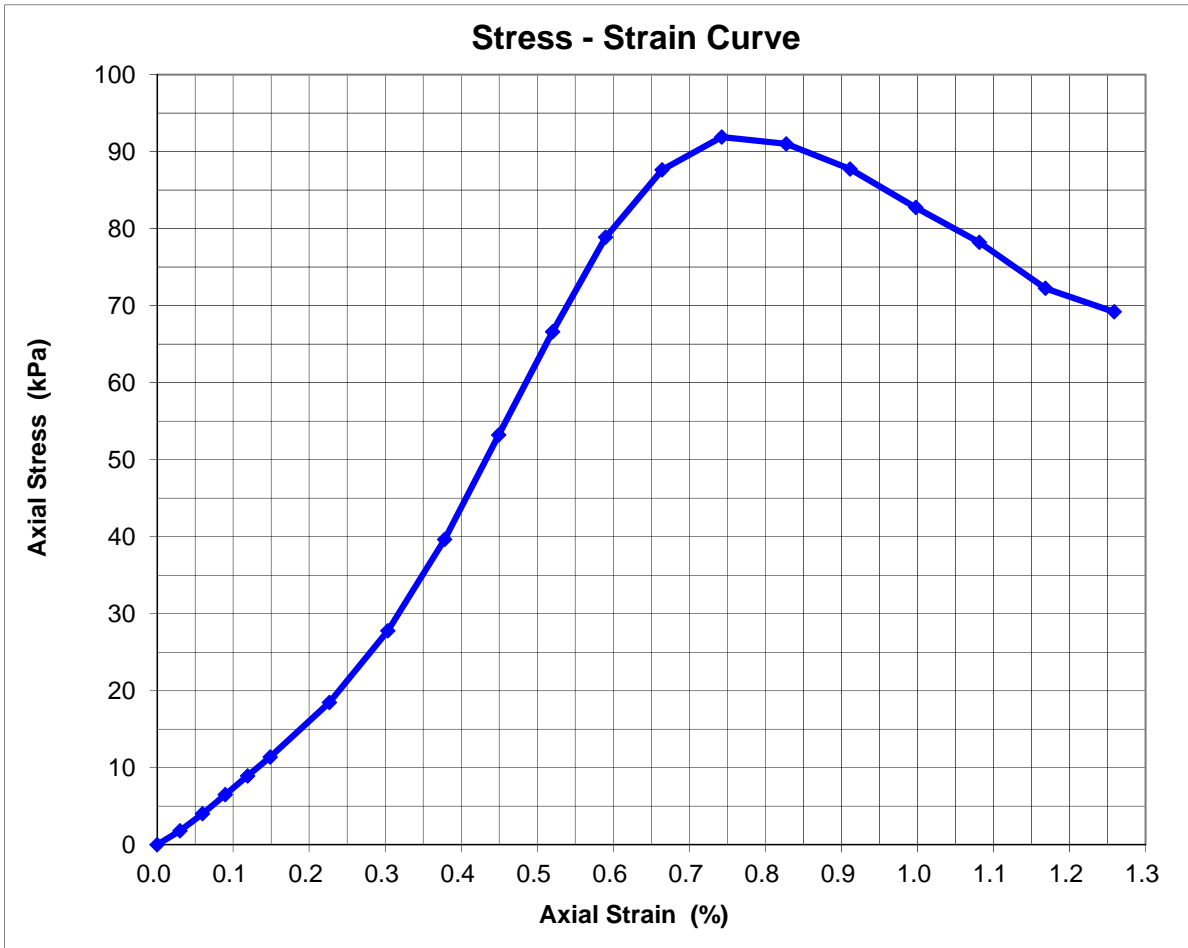
Failure Conditions:

Strain at failure: **0.74** %

Compression at failure: **0.85** mm

Rate of Compression: **0.23** mm / minute

Mode of Failure: plastic



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Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: **BH-M03**

Sample Number: **UCS07**

Depth: **40.14 – 40.43m**

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to medium, extremely weak, dark orange, uncemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST





Job No: 63532#L	Reg. No: 2806	Report No: 63532#L/UCS Waitakere LHRA	Page 64 of 69 Version 3, July 2022
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Unconfined Compressive Strength of Cohesive Soils Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1	Tested By:	WEC	28-Sep-23
	Compiled By:	WEC	2-Oct-23
	Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS08 Depth: 41.15 – 41.43m

Time (minutes)	Compression Gauge (mm)	Specimen Compression (mm)	Strain	Load Gauge (mm)	Axial Force (N)	Corrected Area (mm ²)	Axial Stress (kPa)
0.00	10.723	0.000	0.000	5.249	0.0	2914.3	0
0.37	10.791	0.068	0.001	5.257	43.0	2916.0	15
0.75	10.855	0.133	0.001	5.267	89.7	2917.6	31
1.12	10.907	0.185	0.002	5.285	181.8	2918.9	62
1.50	10.953	0.230	0.002	5.308	295.4	2920.1	101
1.87	10.994	0.271	0.002	5.332	419.8	2921.1	144
2.23	11.015	0.293	0.003	5.345	482.5	2921.6	165
2.62	11.053	0.330	0.003	5.364	577.7	2922.6	198
2.98	11.099	0.376	0.003	5.388	701.2	2923.7	240
3.27	11.134	0.411	0.004	5.408	796.8	2924.6	272
3.53	11.168	0.445	0.004	5.428	899.7	2925.5	308
3.82	11.201	0.478	0.004	5.449	1003.2	2926.3	343
3.95	11.219	0.496	0.004	5.459	1056.8	2926.7	361
4.23	11.254	0.531	0.005	5.480	1161.6	2927.6	397
4.52	11.289	0.567	0.005	5.500	1263.3	2928.5	431
4.65	11.307	0.584	0.005	5.511	1315.4	2929.0	449
4.78	11.325	0.602	0.005	5.521	1366.7	2929.4	467
4.93	11.343	0.620	0.005	5.531	1419.0	2929.9	484
5.07	11.361	0.638	0.005	5.542	1470.3	2930.3	502
5.20	11.378	0.655	0.006	5.552	1522.3	2930.7	519
5.35	11.396	0.673	0.006	5.562	1573.4	2931.2	537
5.48	11.414	0.691	0.006	5.572	1623.3	2931.7	554
5.63	11.432	0.709	0.006	5.582	1673.5	2932.1	571
5.77	11.452	0.729	0.006	5.592	1720.6	2932.6	587
5.90	11.471	0.748	0.006	5.601	1769.1	2933.1	603
6.05	11.491	0.768	0.007	5.610	1814.7	2933.6	619
6.18	11.510	0.787	0.007	5.619	1859.9	2934.1	634
6.32	11.530	0.807	0.007	5.629	1907.0	2934.6	650
6.47	11.551	0.828	0.007	5.637	1948.9	2935.1	664
6.60	11.571	0.848	0.007	5.645	1988.8	2935.6	677
6.75	11.593	0.870	0.007	5.651	2020.2	2936.2	688
6.88	11.616	0.893	0.008	5.659	2058.3	2936.8	701
7.02	11.641	0.918	0.008	5.663	2081.5	2937.4	709
7.17	11.666	0.943	0.008	5.667	2101.4	2938.0	715
7.30	11.693	0.970	0.008	5.666	2096.0	2938.7	713
7.43	11.726	1.003	0.009	5.656	2046.6	2939.5	696
7.58	11.893	1.170	0.010	5.490	1212.5	2943.8	412
7.72	11.970	1.247	0.011	5.433	923.8	2945.7	314
7.87	12.025	1.302	0.011	5.421	863.6	2947.1	293
8.00	12.069	1.347	0.012	5.413	825.6	2948.3	280
8.13	12.106	1.383	0.012	5.408	800.0	2949.2	271

Unconfined Compressive Strength: 720 kPa

Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	2-Oct-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 **Sample Number: UCS08** **Depth: 41.15 – 41.43m**

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **60.92** mm

Initial Length: **116.96** mm

Initial Mass: **585.46** g

Initial Bulk Density: **1.72** t/m³

Initial Dry Density: **1.15** t/m³

Water Content After Test: **49.9** %

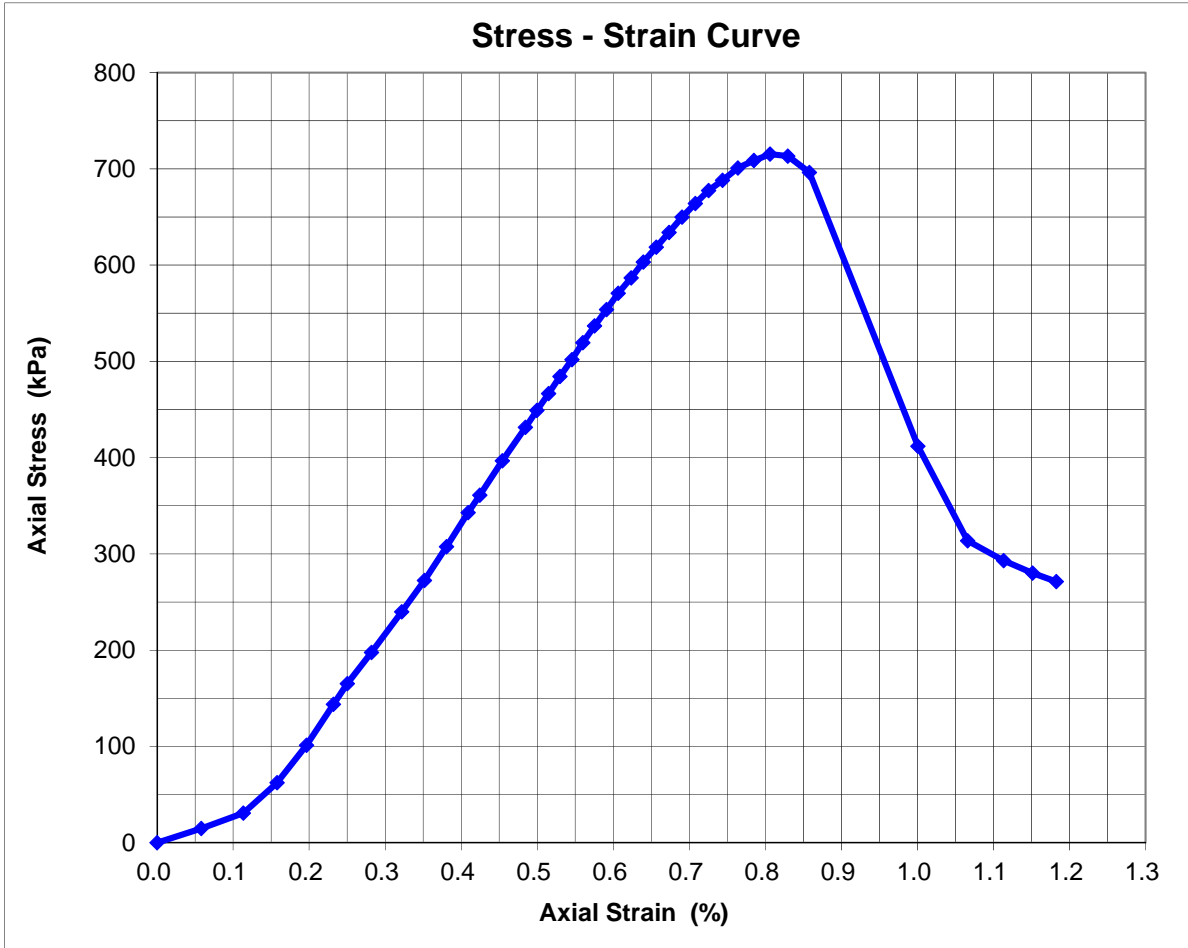
Failure Conditions:

Strain at failure: **0.81** %

Compression at failure: **0.94** mm

Rate of Compression: **0.13** mm / minute

Mode of Failure: **planar**



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Unconfined Compressive Strength of Cohesive Soils
 Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	2-Oct-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS08 Depth: 41.15 – 41.43m

Sample Description (*not part of BGL IANZ Accreditation*):

SILTSTONE, extremely weak, grey.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST



Unconfined Compressive Strength of Cohesive Soils

Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03

Sample Number: UCS09

Depth: 50.73 – 51.00m

Test Performed on: rock / whole soil
 Sample History: disturbed / undisturbed / remoulded / recompacted / unknown
 Sample Method & Type: from core sample / from tube sample

Initial Diameter: **59.73** mm

Initial Length: **119.88** mm

Initial Mass: **652.28** g

Initial Bulk Density: **1.94** t/m³

Initial Dry Density: **1.60** t/m³

Water Content After Test: **20.2** %

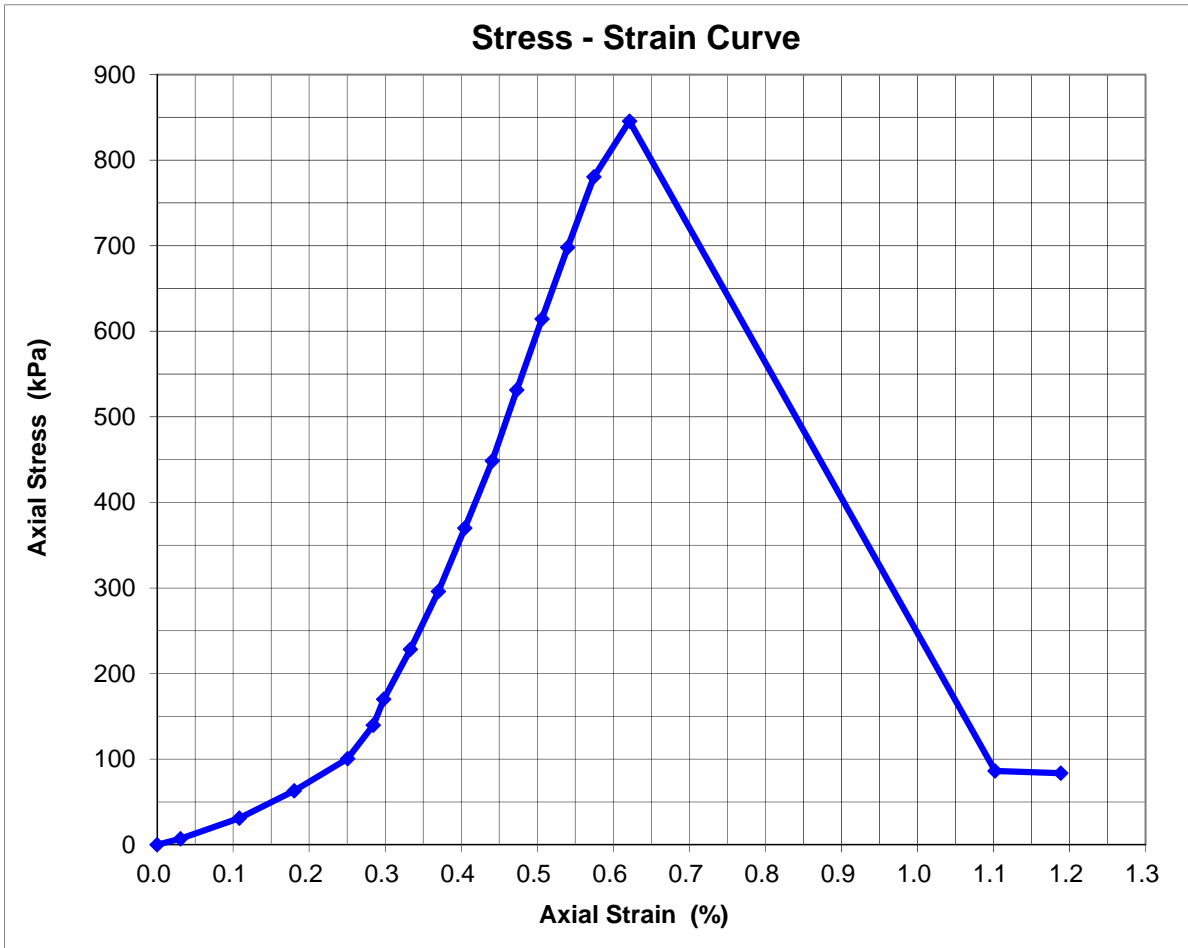
Failure Conditions:

Strain at failure: **0.62** %

Compression at failure: **0.74** mm

Rate of Compression: **0.14** mm / minute

Mode of Failure: brittle



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Unconfined Compressive Strength of Cohesive Soils
Test Methods: NZS4402: 1986: Test 2.1 / Test 6.3.1

Tested By:	WEC	28-Sep-23
Compiled By:	WEC	28-Sep-23
Checked By:	JF	2-Oct-23

Borehole: BH-M03 Sample Number: UCS09 Depth: 50.73 – 51.00m

Sample Description (not part of BGL IANZ Accreditation):

SANDSTONE, fine to medium, extremely weak, dark orange, weakly cemented.

SAMPLE BEFORE TEST



SAMPLE AFTER TEST





18 October 2023

Our Ref: 1092481.0.1.0 & 1092481.0.2.0/Rep1

Customer Ref: 12612462

GHD Limited
Level 2, GHD Centre
27 Napier Street
Freemans Bay
Auckland 1011

Attention: John Southworth

Dear John

Muriwai Laboratory Test Report

Customer's Instructions

The detailed testing instructions were provided with a schedule from Mr. John Southworth.

Sampling Procedure

Samples have been tested as received from the customer.

Sample Location Plan

Not applicable.

Samples

Three core samples were received. All samples were labelled with Borehole number, sample reference, and depth.

Date of Sample Receipt

27 September 2023

Test Method(s)

ASTM D4647-13 (2020) - Pinhole

BS 1377: Part 5: 1990 Clause 6.3 - Dispersibility by the Crumb Method (not IANZ accredited)

NZS 4402: 1986 Test 2.1 - Water Content

Material Description

Descriptions are provided in the attached presentation pages.

Test Results

Test results are attached.

Test Remarks

Test remarks are detailed on the presentation pages.

General Remarks

Samples not destroyed during testing, will be retained for one month from the date of this report before being discarded.

Descriptions are enclosed for your information but are not covered under the IANZ endorsement of this report.

This report has been prepared for the benefit of GHD Limited, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

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If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of the letterhead page.

GEOTECHNICS LTD

Report approved by:

Authorised for Geotechnics by:



.....
Helen Wang
Triaxial Laboratory Manager
Key Technical Person

.....
Corey Papu-Gread
Project Director



18-Oct-23

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1 Hill Street
 Onehunga
 Auckland
 New Zealand
 p. +64 9 356 3510

Geotechnics Project ID: 1092481.0.1.0
 QESTLab Work Order ID:
 Customer Project ID: 12612462

Site/Location: Muriwai Location ID: BH-M01
 Sample Ref.: C5 Depth: 2.02 - 2.06 (m)
 Test Method Used: ASTM D4647-13 (2020) Pinhole Test (Method A)
 NZS 4402:1986 Test 2.1 Determination of Water Content

Initial Water Content 48.7 (%) Initial Bulk Density 1.65 (t/m³)
 Final Water Content 61.5 (%) Initial Dry Density 1.11 (t/m³)

Hydraulic head H (mm)	Duration of flow (min)	Rate of flow q (mL/sec)	Cloudiness of flow	
			From side	From top
50	5	1.14	Dark	Very dark
		1.25	Dark	Very dark
		1.28	Dark	Very dark
50	--			
180	--			
380	--			
1020	--			
Hole diameter after test:		2.2	(mm)	Dispersion Category: D1

Sample Description: Clayey SILT, dark brown; very soft, wet, high plasticity.

Sample History: Undisturbed core trimmed at natural water content.

Test Remarks:

- The pinhole was formed with 1.1 mm diameter pin.
- Distilled water was used in test.
- Classification:
 D1, D2 -- Dispersive;
 ND4, ND3 -- Moderately to slightly dispersive;
 ND2, ND1 -- Non-dispersive.
- The soil classified as non-dispersive still can erode in some circumstances.

Tested by: PIHE Date: 12/10/2023 Approved by KTP: Date: 18/10/2023



1 Hill Street
 Onehunga
 Auckland
 New Zealand
 p. +64 9 356 3510

Geotechnics Project ID: 1092481.0.1.0
 QESTLab Work Order ID:
 Customer Project ID: 12612462

Site/Location: Muriwai Location ID: BH-M02
 Sample Ref.: C15 Depth: 1.96 - 2.00 (m)
 Test Method Used: ASTM D4647-13 (2020) Pinhole Test (Method A)
 NZS 4402:1986 Test 2.1 Determination of Water Content

Initial Water Content 52.3 (%) Initial Bulk Density 1.69 (t/m³)
 Final Water Content 47.9 (%) Initial Dry Density 1.11 (t/m³)

Hydraulic head H (mm)	Duration of flow (min)	Rate of flow q (mL/sec)	Cloudiness of flow	
			From side	From top
50	5	0.36	Perfectly clear	Perfectly clear
		0.36	Perfectly clear	Perfectly clear
		0.35	Perfectly clear	Perfectly clear
50	5	0.33	Perfectly clear	Perfectly clear
		0.34	Perfectly clear	Perfectly clear
		0.34	Perfectly clear	Perfectly clear
180	5	0.75	Perfectly clear	Perfectly clear
		0.76	Perfectly clear	Perfectly clear
		0.74	Perfectly clear	Perfectly clear
380	5	1.20	Perfectly clear	Perfectly clear
		1.16	Perfectly clear	Perfectly clear
		1.15	Perfectly clear	Perfectly clear
1020	5	2.39	Perfectly clear	Perfectly clear
		2.43	Perfectly clear	Perfectly clear
		2.38	Perfectly clear	Perfectly clear
Hole diameter after test:		1.0	(mm)	Dispersion Category: ND1


Sample Description: Silty CLAY, orange brown; very soft, wet, high plasticity.

Sample History: Undisturbed core trimmed at natural water content.

Test Remarks:

- The pinhole was formed with 1.1 mm diameter pin.
- Distilled water was used in test.
- Classification:
 D1, D2 -- Dispersive;
 ND4, ND3 -- Moderately to slightly dispersive;
 ND2, ND1 -- Non-dispersive.
- The soil classified as non-dispersive still can erode in some circumstances.

Tested by: PIHE Date: 10/10/2023 Approved by KTP: *[Signature]* Date: 18/10/2023

 GEOTECHNICS	1 Hill Street, Onehunga, Auckland 1061 P 64 09 356 3510 www.geotechnics.co.nz		
Determination of Dispersibility - Crumb Method - BS 1377: Part 5: 1990 Clause 6.3			
Site:	Muriwai	Job No:	1092481.0000.2.0
Test Pit/BH No:	BH-M01 / C5	Sample No:	AKL657.1
Stopwatch ID:	S0596		
Sample Description:	clayey SILT, dark brown; very soft, wet, high plasticity		
Descriptive behaviour of the crumbs observed after allowing to stand for 5 to 10 min			
Observations:	Grade 4 - Strong reaction		
The soil classified asdispersive..... according to this test method.			
Remarks:			
Test Pit/BH No:	BH-M02 / C15	Sample No:	AKL657.2
Stopwatch ID:	S0596		
Sample Description:	silty CLAY, orange brown; very soft, wet, high plasticity		
Descriptive behaviour of the crumbs observed after allowing to stand for 5 to 10 min			
Observations:	Grade 4 - Strong reaction		
The soil classified asdispersive..... according to this test method.			
Remarks:			
Balance ID:	B0012		
Reagent Used: 0.001M solution of Sodium Hydroxide: Dissolve 0.04g of anhydrous sodium hydroxide in distilled water to make 1L of solution.			
Procedure: Prepare a few crumbs, each about 6mm to 10mm diameter, from a representative portions of the soil at the natural moisture content. Drop the crumbs into a beaker about one-third full of the sodium hydroxide solution. Observe the reaction after allowing to stand for 5 min to 10 min.			
OBSERVATIONS: Observe the behaviour of the crumbs in accordance with the following guidelines. Grade 1: No reaction: Crumbs may slake or run out to form a shallow heap on the bottom of the beaker, but there is no sign of cloudiness caused by colloids in suspension. Grade 2: Slight reaction: A very slight cloudiness can be seen in the water at the surface of a crumb. Grade 3: Moderate reaction: There is an easily recognizable cloud of colloids in suspension, usually spreading out in thin streaks at the bottom of the beaker Grade 4: Strong reaction: A colloidal cloud covers most of the bottom beaker, usually as a thin skin. In extreme cases all the water becomes cloudy.			
Grades 1 and 2 represent a non- dispersive reaction.			
Grades 3 and 4 represent a dispersive reaction.			
Remarks:			
Tested by:	KESA	Date:	10/10/2023
Checked by:	GEGO	Date:	10/10/2023

Appendix F4

Calibration Certificates for Shear Vane and SPT Hammer



Calibration Certificate

Certificate No: M720664.01

Certificate Issued To	GHD Limited		Address	3/27 Napier Street Freemans Bay Auckland	
Purchase Order No					
Manufacturer	Geotechnics	Model	Geovane	S/No	902
				Unique ID	
Description	Handheld shear vane with matching blade(s)				
Calibration Date	3/04/2023	Temp During Test	19.7 to 20.1 °C		
Method	MCC 5.51c.01 – Handheld Soil Shear Vane Testers (2021), Guideline for Hand Held Shear Vane Test (NZGS, 2001) was used as a guide.				

Results

19 mm Ø Vane Blade

Shear Strength = A × Reading	A (kPa/div)	1.446	Area Ratio	23.3%
------------------------------	-------------	-------	------------	-------

Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)
0	0	30	43	60	87	90	130	120	174
2	3	32	46	62	90	92	133	122	176
4	6	34	49	64	93	94	136	124	179
6	9	36	52	66	95	96	139	126	182
8	12	38	55	68	98	98	142	128	185
10	14	40	58	70	101	100	145	130	188
12	17	42	61	72	104	102	148	132	191
14	20	44	64	74	107	104	150	134	194
16	23	46	67	76	110	106	153	136	197
18	26	48	69	78	113	108	156	138	200
20	29	50	72	80	116	110	159	140	202
22	32	52	75	82	119	112	162		
24	35	54	78	84	121	114	165		
26	38	56	81	86	124	116	168		
28	40	58	84	88	127	118	171		

The expanded uncertainty of measurement, expressed at the 95% confidence level, is ±4.1 kPa. The coverage factor (k) is 2.

Remarks

When received, this equipment was in good condition.

Measurement results are traceable to the International System of Units (SI), or other recognised references via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

This certificate has been prepared for the benefit of GHD Limited, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This calibration was performed at 1 Hill Street, Onehunga, Auckland, NZ.

Prepared by

 Ivan Caresosa
Calibration Technician

Checked by

 Agnelo Vaz
Senior Metrologist

Key Technical Person

 Agnelo Vaz
Senior Metrologist





Calibration Certificate

Certificate No: M720829.03

Certificate Issued To	GHD Limited - Auckland		Address	3, GHD Centre 27 Napier Street Freemans Bay Auckland 1011	
Purchase Order No	11910201_BG-01.BG-01-04				
Manufacturer	Geotechnics	Model	Geovane	S/No	1060
Description	Handheld shear vane with matching blade(s)				
Calibration Date	15/05/2023	Temp During Test	19.1 to 19.5 °C		
Method	MCC 5.51c.01 – Handheld Soil Shear Vane Testers (2021), Guideline for Hand Held Shear Vane Test (NZGS, 2001) was used as a guide.				

Results

19 mm Ø Vane Blade

Shear Strength = A × Reading	A (kPa/div)	1.547	Area Ratio	23.5%
-------------------------------------	--------------------	--------------	-------------------	-------

Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)	Reading (div)	Shear Strength (kPa)
0	0	30	46	60	93	90	139	120	186
2	3	32	49	62	96	92	142	122	189
4	6	34	53	64	99	94	145	124	192
6	9	36	56	66	102	96	148	126	195
8	12	38	59	68	105	98	152	128	198
10	15	40	62	70	108	100	155	130	201
12	19	42	65	72	111	102	158	132	204
14	22	44	68	74	114	104	161	134	207
16	25	46	71	76	118	106	164	136	210
18	28	48	74	78	121	108	167	138	213
20	31	50	77	80	124	110	170	140	217
22	34	52	80	82	127	112	173		
24	37	54	84	84	130	114	176		
26	40	56	87	86	133	116	179		
28	43	58	90	88	136	118	183		

The expanded uncertainty of measurement, expressed at the 95% confidence level, is ± 7.6 kPa. The coverage factor (k) is 2.

Remarks

When received, this equipment was in good condition.

Measurement results are traceable to the International System of Units (SI), or other recognised references via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

This certificate has been prepared for the benefit of GHD Limited - Auckland, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This calibration was performed at 1 Hill Street, Onehunga, Auckland, NZ.

Prepared by


Ivan Caresosa
Calibration Technician

Checked by


Annalyse Ryan
Metrologist | Team Leader

Key Technical Person


Annalyse Ryan
Metrologist | Team Leader





Attention: Dave Penney
Organisation: DCN Drilling Limited
Email: dave@dcndrilling.co.nz

Letter Report:

SPT Energy Measurements on 5No. SPT Trip Hammers

1. Introduction

This letter report summarises the results of the Standard Penetration Test (SPT) energy measurements on 5No. SPT trip hammers for DCN Drilling Limited on 9 February 2023, at the site of 70A Maxwell Road, Maramarua, Waikato.

The SPT energy measurements were carried out to determine the average energy transfer ratio from the SPT hammer to the SPT rods during the Standard Penetration Tests. The SPT energy measurements were undertaken in accordance with ASTM D4633-16: *Standard Test Method for Energy Measurement for Dynamic Penetrometers*.

A Pile Driving Analyzer (PDA) Model 8G with add on SPT Analyzer software and a NW size instrumented SPT rod (manufactured by Pile Dynamics, Inc.) were used to acquire the test data. Adaptors from NW thread to tapered API thread were used on both ends of the instrumented rod to connect to the SPT rods.

The PDA system uses the Case Method equations to evaluate the test data. The maximum energy transfer (EMX) at the gauge location was obtained as the maximum value from integrating the product of force (F) and velocity (v) over time: $EMX = \max \int F(t)v(t)dt$.

In summary, the measured energy transfer ratios (ETR) for the 5No. SPT trip hammers are:

- Trip Hammer #1, average ETR of 68.1%.
- Trip Hammer #2, average ETR of 69.0%.
- Trip Hammer #3, average ETR of 68.5%.
- Trip Hammer #4, average ETR of 73.5%.
- Trip Hammer #5, average ETR of 63.9%.

The calibration certificates of the instruments used for SPT energy measurements are attached in Appendix A. The results of energy measurements are attached in Appendix B. The representative force and velocity plots are attached in Appendix C.



2. Drill Rigs

The Morooka drill rig and approximate 61 mm outer diameter SPT rods were used for energy measurements on the trip hammers #1 and #2. The trailer mounted drill rig and approximate 60 mm outer diameter SPT rods were used for energy measurements on the trip hammers #3, #4 and #5. Photos of the two rigs are presented in Figures 2-1 and 2-2 below.



Figure 2-1: Photos of the Morooka drill rig and the instrumented SPT rod assembly.



Figure 2-2: Photos of the trailer mounted drill rig and the instrumented SPT rod assembly.



3. Energy Measurements of SPT Trip Hammer #1

Photos of the SPT trip hammer #1 are presented in Figure 3-1 below.



Figure 3-1: Photos of SPT trip hammer #1

A summary of energy measurements on the trip hammer #1 is presented in Table 3-1 below.

Table 3-1: Summary of energy measurements on SPT trip hammer #1

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #1	1	13.5	35	0.281 – 0.351	0.303	59.2% - 73.9%	63.9%
	2	15	35	0.306 – 0.380	0.339	64.4% - 80.1%	71.3%
	3	16.5	44	0.311 – 0.352	0.327	65.5% - 74.1%	69.0%
	Overall			-	0.323	-	68.1%



4. Energy Measurements of SPT Trip Hammer #2

Photos of the SPT trip hammer #2 are presented in Figure 4-1 below.



Figure 4-1: Photos of SPT trip hammer #2

A summary of energy measurements on the trip hammer #2 is presented in Table 4-1 below.

Table 4-1: Summary of energy measurements on SPT trip hammer #2

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #2	1	9	31	0.265 – 0.330	0.299	55.8% - 69.6%	63.0%
	2	10.5	37	0.329 – 0.364	0.347	69.2% - 76.7%	73.1%
	3	12	29	0.319 – 0.363	0.336	67.2% - 76.5%	70.8%
	Overall			-	0.327	-	69.0%



5. Energy Measurements of SPT Trip Hammer #3

Photos of the SPT trip hammer #3 are presented in Figure 5-1 below.



Figure 5-1: Photos of SPT trip hammer #3

A summary of energy measurements on the trip hammer #3 is presented in Table 5-1 below.

Table 5-1: Summary of energy measurements on SPT trip hammer #3

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #3	1	9	19	0.336 – 0.401	0.360	70.7% - 84.4%	75.9%
	2	10.5	34	0.292 – 0.336	0.312	61.5% - 70.9%	65.7%
	3	12	50	0.277 – 0.323	0.304	58.5% - 68.1%	64.0%
	Overall			-	0.325	-	68.5%



6. Energy Measurements of SPT Trip Hammer #4

Photos of the SPT trip hammer #4 are presented in Figure 6-1 below.



Figure 6-1: Photos of SPT trip hammer #4

A summary of energy measurements on the trip hammer #4 is presented in Table 6-1 below.

Table 6-1: Summary of energy measurements on SPT trip hammer #4

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #4	1	9	32	0.321 – 0.376	0.354	67.7% - 79.2%	74.7%
	2	10.5	35	0.335 – 0.377	0.359	70.6% - 79.4%	75.6%
	3	12	50	0.288 – 0.372	0.334	60.6% - 78.4%	70.3%
	Overall			-	0.349	-	73.5%



7. Energy Measurements of SPT Trip Hammer #5

Photos of the SPT trip hammer #5 are presented in Figure 7-1 below.



Figure 7-1: Photos of SPT trip hammer #5

A summary of energy measurements on the trip hammer #5 is presented in Table 7-1 below.

Table 7-1: Summary of energy measurements on SPT trip hammer #5

SPT Hammer No.	Test No.	Depth below ground level (m)	SPT 'N'	Range of Transferred Energy (kN-m)	Average Transferred Energy (kN-m)	Range of Energy Transfer Ratio	Average Energy Transfer Ratio
Trip Hammer #5	1	9	49	0.274 – 0.340	0.301	57.6% - 71.7%	63.5%
	2	10.5	29	0.270 – 0.339	0.300	56.9% - 71.4%	63.3%
	3	12	48	0.278 – 0.330	0.309	58.5% - 69.6%	65.0%
	Overall			-	0.303	-	63.9%



8. Limitations

This letter report has been prepared solely for the benefit of our client DCN Drilling Limited with respect to the particular instructions and relevant information provided to us. This letter report shall not be relied upon by any third parties or for any other purposes without our prior review and written agreement.

Authorised for Roc Consulting Limited by:

Richard (Liqiang) Zhang

Director | Principal Geotechnical Engineer

Email: Richard@roconsulting.co.nz

Phone: +64 27 506 5893

Appendix:

- A. Instrument Calibration Certificates
- B. SPT Energy Measurements Results
- C. Representative Force and Velocity Plots



Appendix A

Instrument Calibration Certificates

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model 8G

Serial Number: 5402 LE

was calibrated on 14 JAN 2023

using a PDA Calibration Box whose output was calibrated with test equipment traceable to NIST.

This certificate is valid for 2 years from above date.



Tested by:

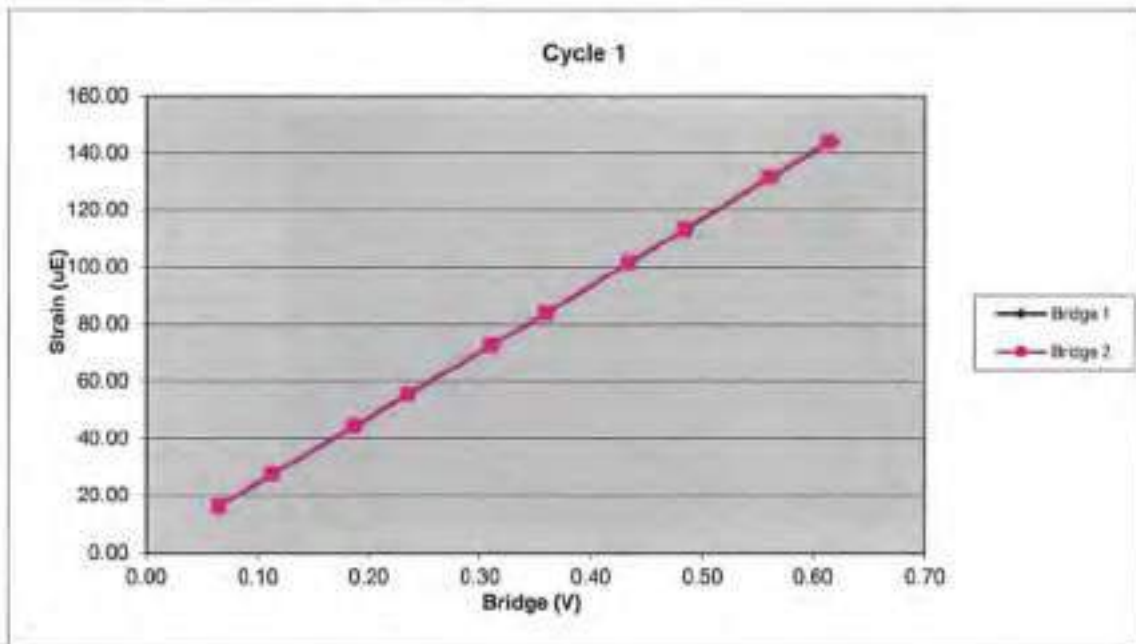


Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA

680NW		Cycle 1		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1047.49	16.11	0.07	0.06
3	1838.02	27.52	0.11	0.11
4	3029.38	44.17	0.19	0.19
5	3792.43	55.49	0.24	0.23
6	4997.05	72.74	0.31	0.31
7	5790.22	84.07	0.36	0.36
8	6984.70	101.62	0.44	0.43
9	7812.18	113.27	0.49	0.48
10	9035.41	131.64	0.56	0.56
11	9892.03	143.89	0.62	0.61

Bridge 1		Bridge 2	
Force Calibration (lb/V)	16069.95	Force Calibration (lb/V)	16102.53
Offset	-7.33	Offset	12.05
Correlation	0.999998	Correlation	0.999997
Strain Calibration ($\mu\text{E/V}$)	232.27	Strain Calibration ($\mu\text{E/V}$)	232.74
Offset	0.58	Offset	0.86
Correlation	0.999985	Correlation	0.999981

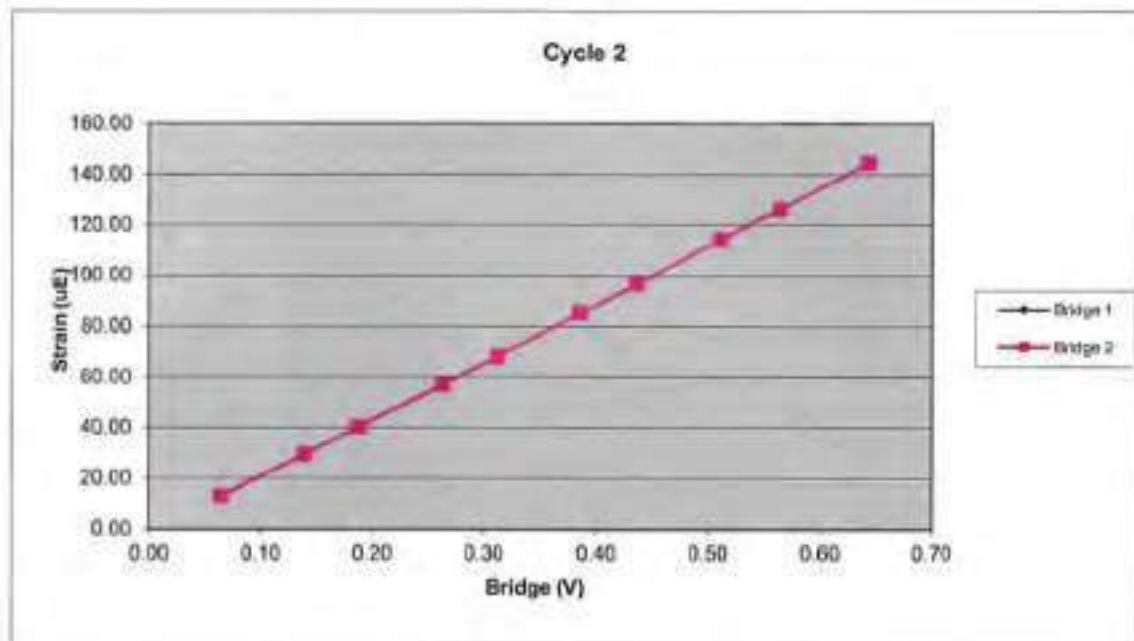
Force Strain Calibration	
EA (Kips)	69183.82
Offset	-47.26
Correlation	0.999980



680NW		Cycle 2		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1021.07	12.60	0.06	0.06
3	2216.04	29.05	0.14	0.14
4	2992.44	40.06	0.19	0.19
5	4197.45	56.78	0.26	0.26
6	4972.97	67.81	0.31	0.31
7	6170.08	84.96	0.39	0.39
8	6996.98	96.33	0.44	0.44
9	8196.33	113.89	0.51	0.51
10	9059.10	125.94	0.57	0.56
11	10316.06	143.97	0.64	0.64

Bridge 1		Bridge 2	
Force Calibration (lb/V)	16051.95	Force Calibration (lb/V)	16067.32
Offset	-10.90	Offset	-22.23
Correlation	0.999998	Correlation	0.999998
Strain Calibration ($\mu\text{E/V}$)	227.16	Strain Calibration ($\mu\text{E/V}$)	227.38
Offset	-2.46	Offset	-2.62
Correlation	0.999971	Correlation	0.999975

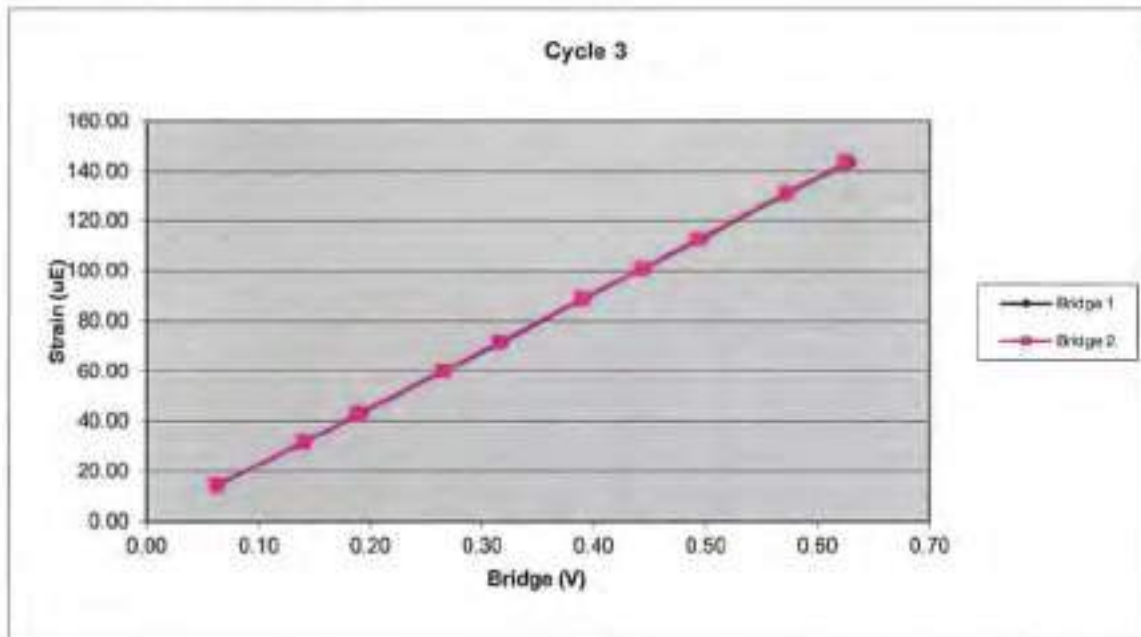
Force Strain Calibration	
EA (Kips)	70660.67
Offset	163.19
Correlation	0.999981



680NW		Cycle 3		
Sample	Force (lb)	Strain (μ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1020.49	14.40	0.06	0.06
3	2263.02	31.58	0.14	0.14
4	3049.95	43.03	0.19	0.19
5	4268.70	60.16	0.27	0.27
6	5085.36	71.61	0.32	0.32
7	6271.27	88.94	0.39	0.39
8	7122.33	100.84	0.44	0.44
9	7937.92	112.58	0.50	0.49
10	9201.80	131.04	0.57	0.57
11	10082.99	143.34	0.63	0.62


Bridge 1		Bridge 2	
Force Calibration (lb/V)	16048.19	Force Calibration (lb/V)	16118.06
Offset	-13.64	Offset	2.18
Correlation	0.999997	Correlation	0.999996
Strain Calibration (μ E/V)	228.89	Strain Calibration (μ E/V)	229.89
Offset	-0.75	Offset	-0.52
Correlation	0.999975	Correlation	0.999975

Force Strain Calibration	
EA (Kips)	70109.18
Offset	39.07
Correlation	0.999984



Bridge Excitation (V) 5
Shunt Resistor (ohm) 60.4k

Calibration Factors	680NW		
Bridge 1 ($\mu\text{E}/\text{V}$)	229.44	Bridge 2 ($\mu\text{E}/\text{V}$)	230.00
EA Factor (Kips)	69984.56	Area (in^2)	2.33

Calibrated by: 
Calibrated Date: 1/12/2023

Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.

Calibration performed on **14 JAN 2023**

Serial No: K12864 Temperature: 73.0 °F

Model: PR Humidity: 49%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

416.1 mv/5000g

(83.2 μ v/g)

R²: 0.999916 [Chip programmed]

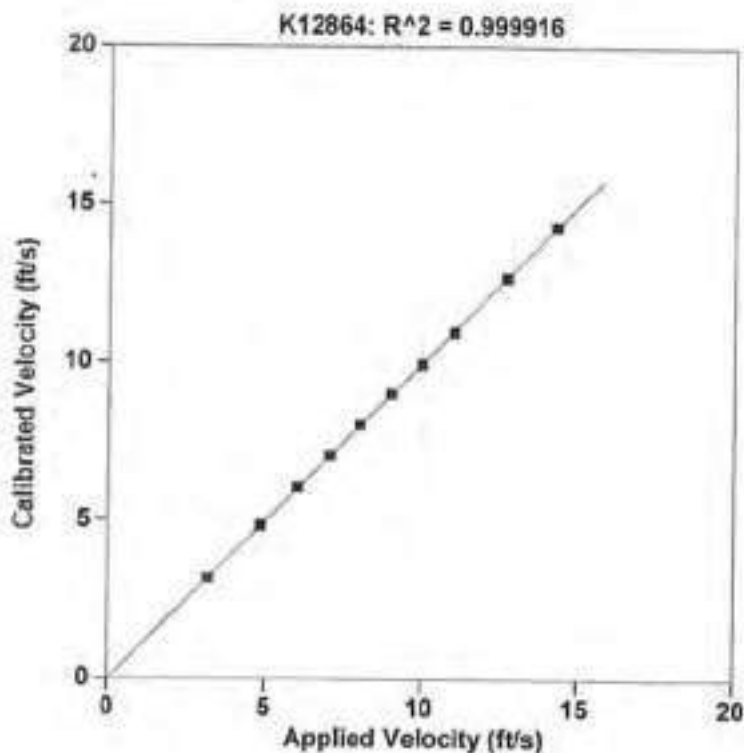
Operator: William Johnson

William Johnson
Signed

Ref Acc 1: 725051 Cal on: 24Mar2022
1035 g's/volt

Ref Acc 2: 725171 Cal on: 24Mar2022
1049 g's/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



Reference Velocity	S/N K12864 Velocity
ft/s	ft/s
3.178	3.180
4.832	4.851
6.009	6.063
7.063	7.059
8.019	8.055
9.010	9.034
9.990	9.952
11.010	10.962
12.703	12.691
14.307	14.318

Maximum Acceleration: 959 g's

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.

Calibration performed on **14 JAN 2023**

Serial No: K12865 Temperature: 73.0 °F

Model: PR Humidity: 50%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

430.9 mv/5000g

(86.2 $\mu\text{v/g}$)

R²: 0.999905 [Chip programmed]

Operator: William Johnson

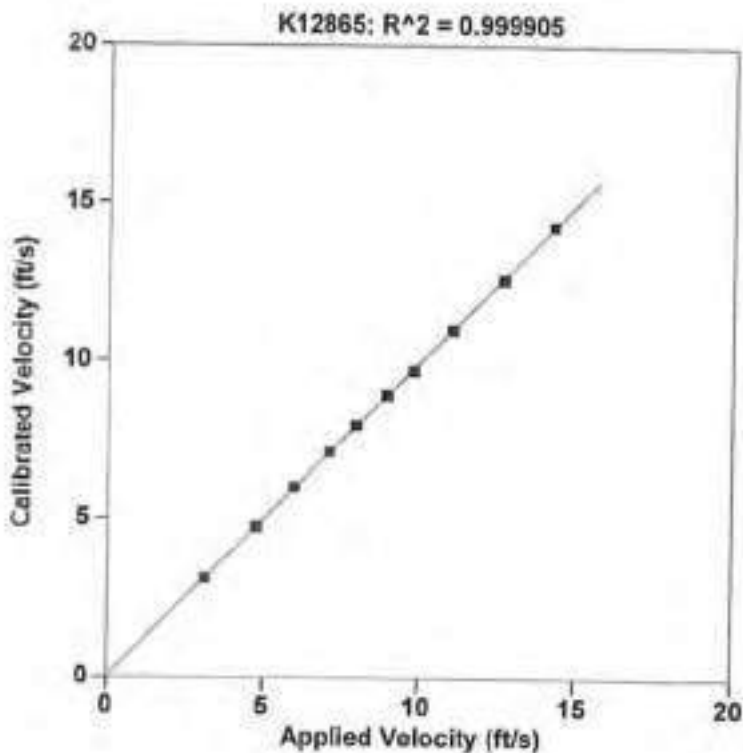


Signed

Ref Acc 1: 72505! Cal on: 24Mar2022
1035 g's/volt

Ref Acc 2: 72517! Cal on: 24Mar2022
1049 g's/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



Reference Velocity	S/N K12865 Velocity
ft/s	ft/s
3.173	3.138
4.769	4.760
5.982	6.019
7.127	7.146
7.959	7.988
8.938	8.943
9.775	9.724
11.013	11.001
12.641	12.601
14.249	14.294

Maximum Acceleration: 963 g's



Appendix B

SPT Energy Measurements Results

Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.1
 OP: RZ

BH02 Test 1 at 13.5m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 15.2 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
14	13.5	0	284.7	60.0	140	2.24	21.0	2,170	15	92.8	0.5
15	13.5	0	293.1	61.8	161	2.42	23.0	2,208	10	107.0	1.1
16	13.5	0	289.2	60.9	140	2.21	22.8	2,040	18	93.3	0.5
17	13.5	0	310.3	65.4	152	2.31	21.7	2,223	24	101.0	0.4
18	13.5	0	309.9	65.3	155	2.43	21.2	2,237	25	103.0	0.9
19	13.5	0	305.3	64.3	159	2.44	21.0	2,295	20	105.5	1.0
20	13.5	0	317.4	66.9	156	2.70	21.6	2,377	25	103.7	0.9
21	13.5	0	332.1	70.0	153	2.31	20.9	2,298	42	101.7	0.6
22	13.5	0	280.8	59.2	145	2.24	21.0	2,152	21	96.4	0.4
23	13.5	0	350.6	73.9	152	2.37	20.5	2,358	71	101.1	0.4
24	13.5	0	301.4	63.5	144	2.30	12.2	2,283	31	95.5	0.5
25	13.5	0	334.0	70.4	161	2.51	18.2	2,405	41	107.4	0.3
26	13.5	0	280.8	59.2	149	2.29	21.3	2,250	12	99.3	0.3
27	13.5	0	288.6	60.8	150	2.31	21.8	2,294	13	99.9	0.5
28	13.5	0	300.1	63.2	151	2.29	21.8	2,220	28	100.4	0.2
29	13.5	0	304.3	64.1	162	2.49	22.1	2,254	16	107.7	0.9
30	13.5	0	317.5	66.9	175	2.80	21.7	2,344	29	116.6	0.7
31	13.5	0	308.1	64.9	157	2.49	12.7	2,112	18	104.3	1.0
32	13.5	0	322.6	68.0	159	2.41	21.6	2,190	33	106.0	0.5
33	13.5	0	299.1	63.0	156	2.72	21.5	2,228	8	104.0	0.8
34	13.5	0	292.0	61.5	157	2.28	21.1	2,092	10	104.4	0.8
35	13.5	0	300.1	63.2	161	2.69	21.4	2,145	12	107.2	0.7
36	13.5	0	299.7	63.2	170	2.77	20.7	2,045	8	113.2	0.8
37	13.5	0	311.7	65.7	162	2.51	21.4	2,095	36	107.8	0.8
38	13.5	0	300.9	63.4	165	2.39	20.8	2,033	25	109.8	0.9
39	13.5	0	302.9	63.8	160	2.45	21.9	2,017	16	106.3	1.0
40	13.5	0	301.4	63.5	165	2.62	22.3	1,846	8	109.9	0.8
41	13.5	0	304.4	64.2	149	2.32	21.1	1,818	19	99.4	0.8
42	13.5	0	290.0	61.1	151	2.32	21.3	1,861	18	100.7	1.1
43	13.5	0	287.3	60.5	145	2.29	21.5	1,860	14	96.8	0.7
44	13.5	0	306.6	64.6	161	2.65	22.4	1,851	25	106.9	0.9
45	13.5	0	283.6	59.8	163	2.19	22.5	1,836	22	108.3	0.5
46	13.5	0	301.2	63.5	165	2.52	22.5	1,875	10	109.7	1.0
47	13.5	0	294.6	62.1	146	2.31	21.4	1,750	10	97.4	0.7
48	13.5	0	312.1	65.8	160	2.80	20.9	1,898	15	106.5	0.7
Average			303.4	63.9	156	2.44	20.9	2,113	21	103.7	0.7

Total number of blows analyzed: 35

BL# Sensors

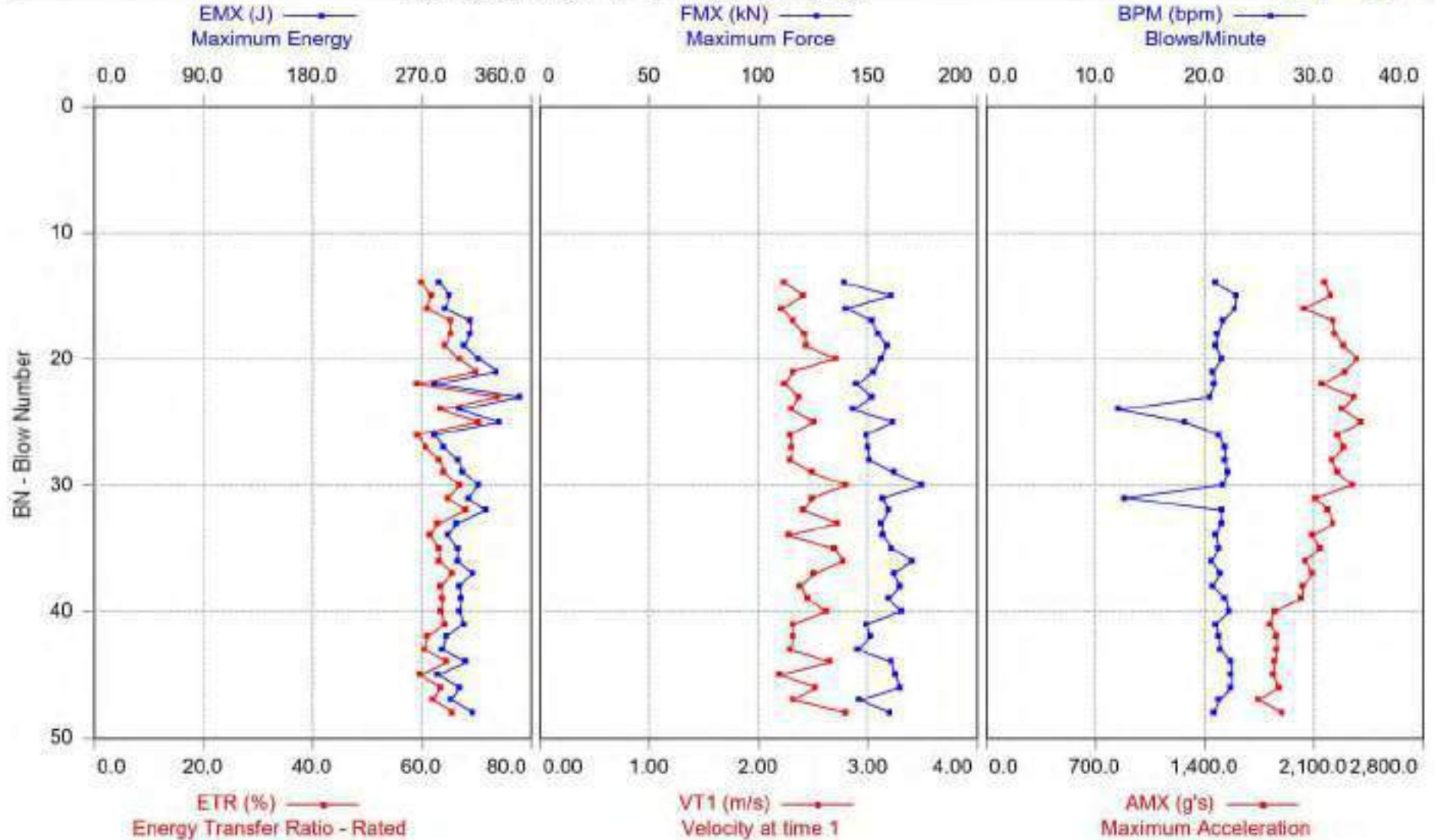
14-48 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 19 seconds 12:16 pm - 12:18 pm BN 1 - 48



2023-02-09 DCN Drilling - SPT Drop Hammer No.1



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.1_1
 OP: RZ

BH02 Test 2 at 15m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 16.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
16	15.0	0	349.9	73.7	151	2.75	21.3	2,928	36	100.3	0.5
17	15.0	0	351.4	74.1	156	2.79	21.8	3,026	30	103.5	0.7
18	15.0	0	379.9	80.1	157	2.76	23.0	2,919	50	104.3	0.6
19	15.0	0	362.2	76.3	147	2.71	22.8	2,782	47	97.5	0.6
20	15.0	0	336.4	70.9	150	2.74	21.3	2,909	34	99.8	0.5
21	15.0	0	335.8	70.8	145	2.68	21.2	2,754	34	96.8	0.6
22	15.0	0	360.9	76.1	152	2.71	21.1	2,915	39	101.2	0.6
23	15.0	0	366.7	77.3	152	2.70	20.9	2,829	38	101.2	0.6
24	15.0	0	344.4	72.6	161	2.70	22.0	2,940	27	107.3	0.6
25	15.0	0	340.2	71.7	150	2.71	20.4	2,861	34	100.1	0.6
26	15.0	0	349.4	73.6	153	2.73	9.2	2,982	33	102.0	0.7
27	15.0	0	342.0	72.1	150	2.63	21.8	2,826	32	99.5	0.7
28	15.0	0	313.5	66.1	143	2.59	22.9	2,668	31	95.0	0.6
29	15.0	0	343.0	72.3	145	2.62	21.5	2,763	39	96.5	0.6
30	15.0	0	338.3	71.3	147	2.63	21.3	2,721	41	98.0	0.6
31	15.0	0	334.4	70.5	158	2.74	22.0	2,952	31	105.2	0.6
32	15.0	0	374.1	78.8	149	2.68	22.0	2,892	38	99.5	0.5
33	15.0	0	343.9	72.5	152	2.67	22.2	2,891	32	101.2	0.6
34	15.0	0	342.9	72.3	141	2.63	22.3	2,633	40	94.1	0.6
35	15.0	0	311.1	65.6	149	2.62	22.4	2,762	31	98.8	0.6
36	15.0	0	338.7	71.4	147	2.64	22.3	2,690	43	97.8	0.6
37	15.0	0	348.5	73.4	145	2.60	22.1	2,629	38	96.4	0.6
38	15.0	0	315.0	66.4	147	2.62	21.6	2,704	32	98.1	0.6
39	15.0	0	334.4	70.5	147	2.59	21.5	2,760	28	97.9	0.7
40	15.0	0	318.1	67.0	148	2.64	22.9	2,756	26	98.5	0.6
41	15.0	0	324.2	68.3	145	2.53	22.1	2,659	23	96.6	0.6
42	15.0	0	331.0	69.7	144	2.63	21.5	2,782	29	96.0	0.7
43	15.0	0	334.2	70.4	151	2.58	21.6	2,779	29	100.6	0.5
44	15.0	0	324.7	68.4	146	2.54	22.6	2,548	30	96.8	0.5
45	15.0	0	305.6	64.4	149	2.54	21.5	2,586	23	99.2	0.5
46	15.0	0	329.9	69.5	148	2.58	22.3	2,653	30	98.4	0.5
47	15.0	0	309.1	65.1	146	2.58	21.9	2,614	17	96.9	0.6
48	15.0	0	323.0	68.1	145	2.59	16.4	2,660	19	96.2	0.7
49	15.0	0	349.4	73.6	145	2.64	21.4	2,699	37	96.8	0.6
50	15.0	0	341.2	71.9	165	2.93	21.3	3,043	29	109.9	0.8
Average			338.5	71.3	149	2.66	21.3	2,786	33	99.4	0.6

Total number of blows analyzed: 35

BL# Sensors

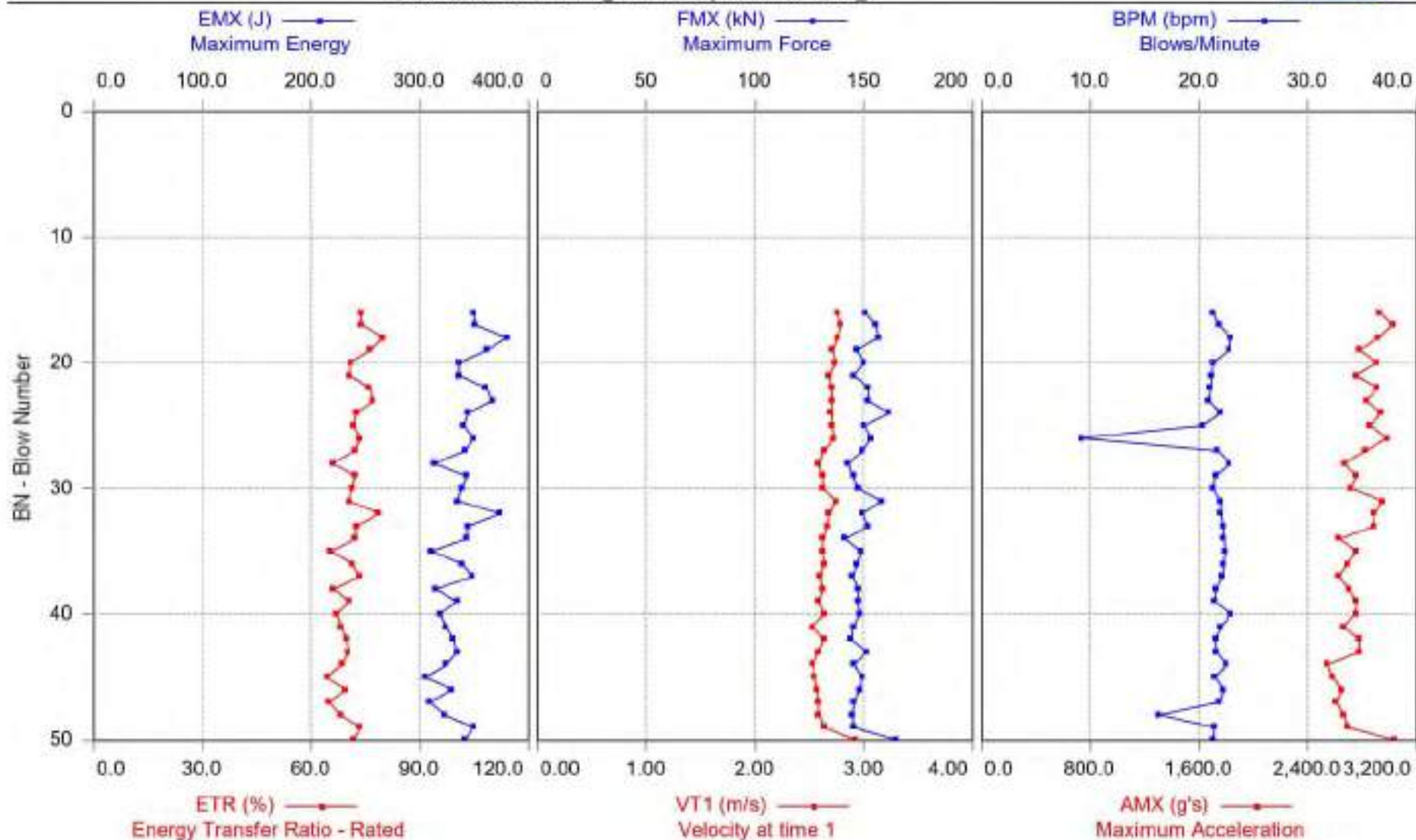
16-50 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 18 seconds 12:54 pm - 12:57 pm BN 1 - 50



2023-02-09 DCN Drilling - SPT Drop Hammer No.1_1



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.1_2
 OP: RZ

BH02 Test 3 at 16.5m
 Date: 09-February-2023

AR: 15.03 cm² SP: 77.3 kN/m²
 LE: 18.2 m EM: 206,843 MPa
 WS: 5,123.0 m/s JC: 0.90

EMX: Maximum Energy AMX: Maximum Acceleration
 ETR: Energy Transfer Ratio - Rated DMX: Maximum Displacement
 FMX: Maximum Force CSX: Compression Stress Maximum
 VT1: Velocity at time 1 FVP: Force/Velocity Proportionality
 BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
19	16.5	0	311.8	65.7	156	2.89	20.7	2,551	13	104.0	0.7
20	16.5	0	314.7	66.3	162	2.94	21.8	2,543	19	107.8	0.7
21	16.5	0	329.9	69.5	209	3.18	20.8	2,737	10	139.4	0.4
22	16.5	0	331.7	69.9	193	3.43	20.2	2,758	12	128.5	0.4
23	16.5	0	311.9	65.7	173	2.86	20.6	2,647	14	115.3	0.7
24	16.5	0	331.9	69.9	182	3.26	19.9	2,765	12	121.1	0.5
25	16.5	0	351.7	74.1	217	3.51	19.8	2,703	18	144.4	0.3
26	16.5	0	323.2	68.1	179	3.06	21.3	2,644	9	118.9	0.6
27	16.5	0	318.4	67.1	179	2.82	21.2	2,635	14	119.3	0.7
28	16.5	0	341.3	71.9	238	3.67	21.1	2,927	9	158.1	0.2
29	16.5	0	324.5	68.4	237	3.18	21.6	3,022	10	157.7	0.2
30	16.5	0	324.3	68.3	183	3.14	21.1	2,749	11	121.6	0.5
31	16.5	0	321.3	67.7	218	3.40	21.9	2,838	10	144.7	0.3
32	16.5	0	319.7	67.4	178	3.10	22.3	2,664	13	118.3	0.5
33	16.5	0	319.6	67.4	179	2.97	20.7	2,590	8	119.3	0.6
34	16.5	0	330.5	69.6	174	3.25	21.6	2,582	8	115.7	0.5
35	16.5	0	321.9	67.8	182	3.19	21.7	2,682	12	121.4	0.5
36	16.5	0	322.6	68.0	176	3.28	21.6	2,616	9	117.0	0.4
37	16.5	0	314.6	66.3	185	3.35	15.4	2,407	8	123.3	0.6
38	16.5	0	326.2	68.7	253	3.13	21.1	2,811	8	168.4	0.7
39	16.5	0	326.8	68.9	169	3.00	21.2	2,466	17	112.4	0.7
40	16.5	0	325.5	68.6	255	3.10	22.0	2,826	8	169.9	0.7
41	16.5	0	347.9	73.3	236	3.85	21.9	2,771	15	156.8	0.3
42	16.5	0	344.1	72.5	200	3.35	20.6	2,427	14	132.9	0.6
43	16.5	0	335.8	70.8	210	3.64	21.3	2,687	8	139.4	0.4
44	16.5	0	322.4	67.9	196	3.47	21.3	2,545	8	130.7	0.5
45	16.5	0	343.5	72.4	209	3.55	21.7	2,452	17	139.2	0.4
46	16.5	0	325.9	68.7	244	3.69	12.3	2,704	8	162.2	0.2
47	16.5	0	349.0	73.5	186	3.28	20.3	2,490	19	123.6	0.6
48	16.5	0	320.3	67.5	185	3.17	21.7	2,482	8	123.2	0.7
49	16.5	0	345.7	72.8	210	3.64	21.0	2,486	18	140.0	0.4
50	16.5	0	321.9	67.8	204	3.59	21.6	2,550	8	135.6	0.5
51	16.5	0	310.7	65.5	247	3.60	22.1	2,705	11	164.4	0.2
52	16.5	0	331.4	69.8	218	3.75	21.8	2,560	19	144.7	0.4
53	16.5	0	323.4	68.2	247	3.60	22.0	2,690	8	164.6	0.3
54	16.5	0	319.6	67.3	260	3.28	17.7	2,712	12	172.9	0.5
55	16.5	0	316.4	66.7	189	3.33	21.7	2,525	31	125.5	0.5
56	16.5	0	332.6	70.1	251	3.73	20.8	2,627	18	167.3	0.2
57	16.5	0	335.2	70.6	242	3.54	20.3	2,508	31	161.3	0.2
58	16.5	0	334.2	70.4	210	3.50	21.1	2,429	29	139.5	0.4
59	16.5	0	327.9	69.1	243	3.71	21.5	2,540	22	161.9	0.2
60	16.5	0	321.9	67.8	204	3.62	21.0	2,408	23	135.5	0.4
61	16.5	0	321.5	67.7	262	3.32	20.5	2,760	17	174.1	0.5
62	16.5	0	329.8	69.5	237	3.71	11.4	2,475	27	158.0	0.3
Average			327.4	69.0	208	3.36	20.6	2,629	14	138.6	0.5

Total number of blows analyzed: 44

BL# Sensors

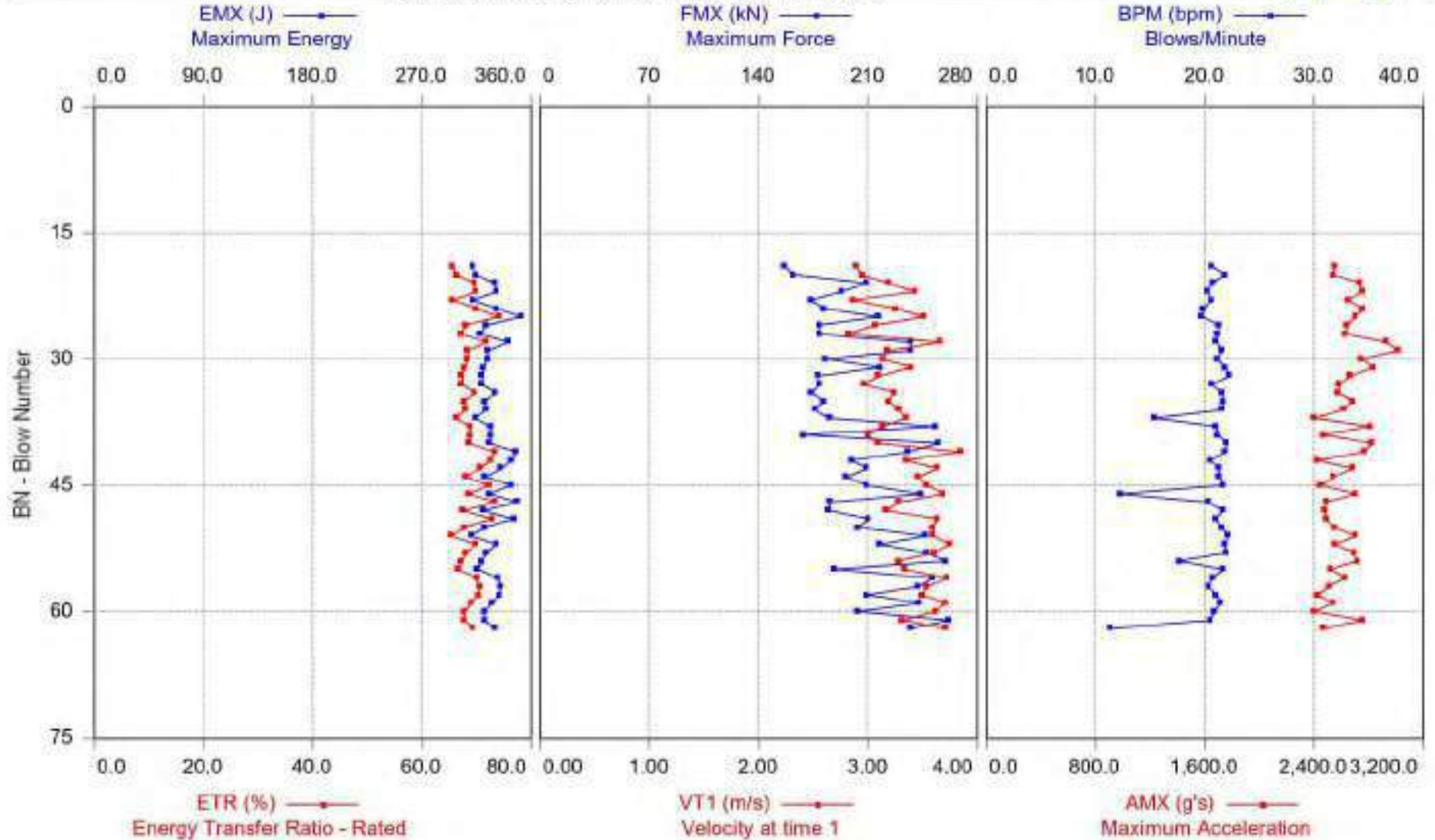
19-62 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 59 seconds 1:30 pm - 1:33 pm BN 1 - 62



2023-02-09 DCN Drilling - SPT Drop Hammer No.1_2



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.2
 OP: RZ

BH02 Test 1 at 9m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 10.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
12	9.0	0	281.0	59.2	184	2.24	13.0	1,329	18	122.7	0.6
13	9.0	0	317.7	66.9	210	3.02	10.4	1,457	21	139.9	0.6
14	9.0	0	317.3	66.9	249	3.16	12.3	1,640	19	165.7	0.5
15	9.0	0	288.4	60.8	192	2.60	19.6	1,240	21	127.9	0.7
16	9.0	0	294.9	62.2	202	2.63	14.7	1,359	16	134.3	0.6
17	9.0	0	317.1	66.8	254	3.03	18.8	1,652	21	169.3	0.6
18	9.0	0	290.8	61.3	215	2.91	18.8	1,248	19	143.1	0.6
19	9.0	0	292.1	61.5	191	2.50	19.8	1,112	19	126.9	0.5
20	9.0	0	276.7	58.3	184	2.15	17.7	1,048	18	122.6	0.4
21	9.0	0	279.3	58.9	197	2.17	19.8	1,083	16	130.9	0.8
22	9.0	0	315.5	66.5	252	3.12	21.0	1,712	18	167.7	0.6
23	9.0	0	264.6	55.8	185	2.40	18.9	1,126	16	123.1	0.7
24	9.0	0	294.5	62.1	231	2.92	11.2	1,548	16	153.5	0.6
25	9.0	0	297.0	62.6	205	2.80	19.9	1,137	14	136.5	0.6
26	9.0	0	287.0	60.5	225	2.78	18.7	1,217	17	149.5	0.6
27	9.0	0	295.2	62.2	246	2.97	19.9	1,450	15	163.9	0.7
28	9.0	0	316.8	66.8	226	2.83	11.2	1,736	20	150.2	0.6
29	9.0	0	330.4	69.6	222	3.09	11.7	1,485	17	147.9	0.5
30	9.0	0	315.6	66.5	194	3.12	15.2	1,185	11	129.2	0.5
31	9.0	0	285.0	60.1	219	2.38	16.1	1,277	15	145.4	0.8
32	9.0	0	279.7	58.9	251	2.90	10.3	1,463	16	166.9	0.6
33	9.0	0	302.1	63.7	197	2.40	18.4	1,070	19	131.2	0.6
34	9.0	0	311.2	65.6	243	3.00	19.1	1,481	12	161.6	0.7
35	9.0	0	308.3	65.0	245	3.15	16.6	1,528	15	162.8	0.6
36	9.0	0	324.3	68.3	254	3.17	17.5	1,718	19	169.1	0.6
37	9.0	0	303.9	64.0	183	2.96	16.2	1,716	19	121.8	0.5
38	9.0	0	274.9	57.9	196	2.64	15.5	1,152	15	130.3	0.6
39	9.0	0	291.6	61.4	190	2.60	19.5	1,315	13	126.1	0.6
40	9.0	0	290.8	61.3	193	2.76	14.2	1,127	15	128.5	0.6
41	9.0	0	308.1	64.9	224	3.19	20.7	1,342	16	149.2	0.6
42	9.0	0	311.9	65.7	244	3.09	14.7	1,599	15	162.1	0.6
Average			298.8	63.0	216	2.79	16.5	1,373	17	143.9	0.6

Total number of blows analyzed: 31

BL# Sensors

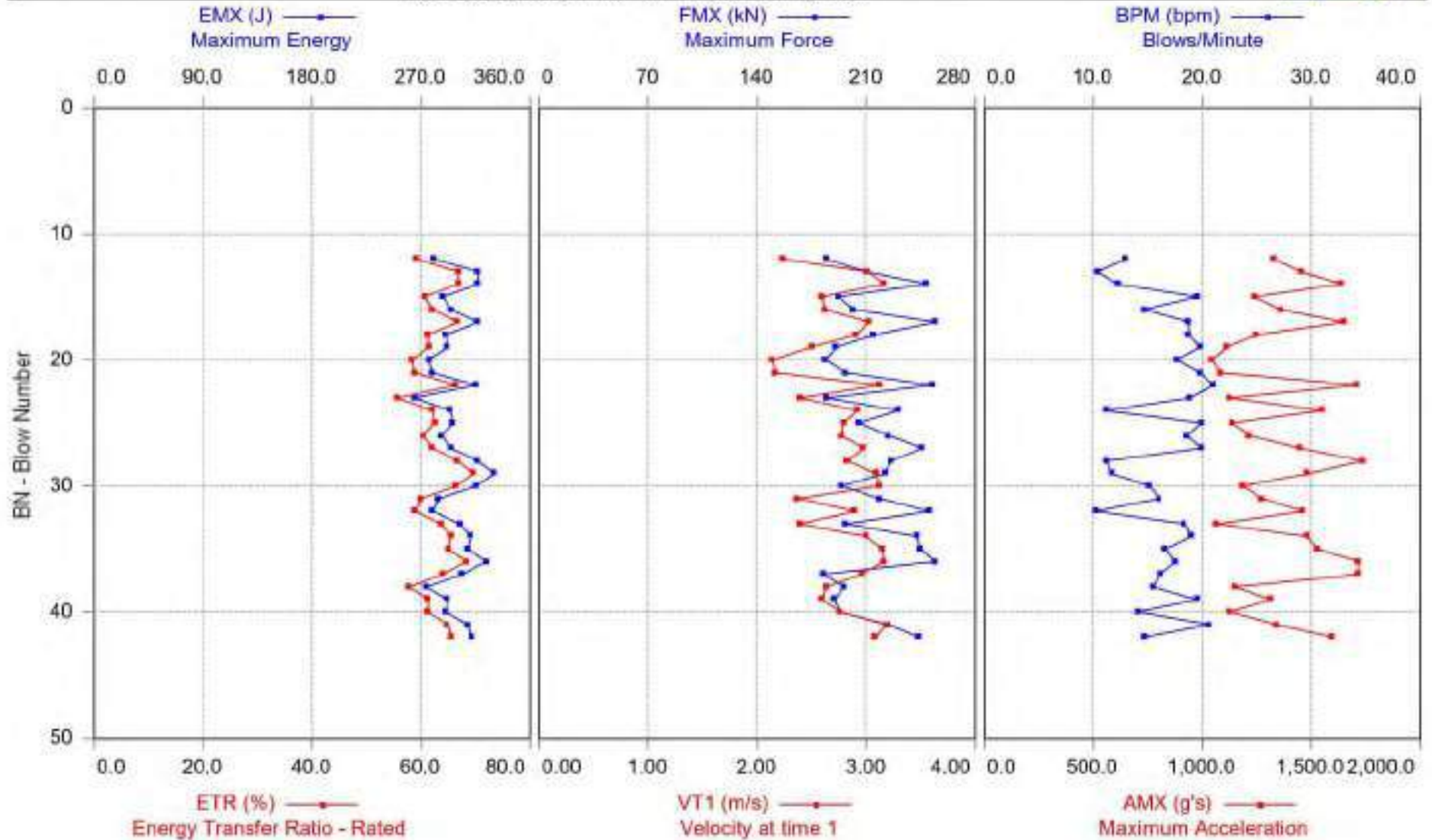
12-42 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 26 seconds 10:16 am - 10:18 am BN 3 - 42



2023-02-09 DCN Drilling - SPT Drop Hammer No.2



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.2_1
 OP: RZ

BH02 Test 2 at 10.5m
 Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m²

LE: 12.2 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy

AMX: Maximum Acceleration

ETR: Energy Transfer Ratio - Rated

DMX: Maximum Displacement

FMX: Maximum Force

CSX: Compression Stress Maximum

VT1: Velocity at time 1

FVP: Force/Velocity Proportionality

BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
13	10.5	0	350.1	73.8	219	3.26	20.7	2,702	34	145.8	0.2
14	10.5	0	352.0	74.2	238	3.40	22.4	2,814	25	158.3	0.2
15	10.5	0	359.0	75.7	211	3.43	21.7	2,752	29	140.1	0.3
16	10.5	0	343.3	72.4	200	3.32	22.2	2,692	24	133.1	0.3
17	10.5	0	359.2	75.7	216	3.39	22.4	2,579	28	143.7	0.3
18	10.5	0	348.5	73.4	233	3.13	22.8	2,699	27	155.3	0.1
19	10.5	0	339.5	71.5	205	3.42	23.1	2,606	29	136.5	0.5
20	10.5	0	348.7	73.5	210	3.28	22.9	2,723	29	139.7	0.5
21	10.5	0	341.4	71.9	188	3.28	22.4	2,506	19	125.3	0.6
22	10.5	0	340.6	71.8	232	3.51	22.3	2,547	21	154.1	0.2
23	10.5	0	336.8	71.0	244	3.30	21.4	2,813	24	162.4	0.1
24	10.5	0	352.2	74.2	219	3.54	22.0	2,694	24	145.5	0.3
25	10.5	0	351.3	74.0	228	3.45	21.7	2,871	25	151.9	0.2
26	10.5	0	338.8	71.4	212	3.43	23.1	2,623	24	141.1	0.3
27	10.5	0	352.3	74.2	211	3.35	22.4	2,690	27	140.6	0.4
28	10.5	0	358.3	75.5	267	3.43	21.4	3,219	22	177.6	0.2
29	10.5	0	340.4	71.7	213	3.50	22.0	2,673	25	141.9	0.3
30	10.5	0	328.6	69.2	192	2.95	22.1	2,652	28	127.5	0.7
31	10.5	0	348.9	73.5	197	3.25	22.8	2,770	24	130.8	0.5
32	10.5	0	349.8	73.7	202	3.08	22.2	2,757	27	134.4	0.5
33	10.5	0	348.8	73.5	196	3.42	22.3	2,811	25	130.3	0.4
34	10.5	0	338.0	71.2	192	3.31	22.7	2,795	27	128.0	0.4
35	10.5	0	340.4	71.7	200	3.09	23.6	2,721	25	132.8	0.5
36	10.5	0	340.3	71.7	224	3.57	22.6	2,812	18	149.3	0.3
37	10.5	0	344.9	72.7	205	3.15	22.2	2,587	33	136.6	0.5
38	10.5	0	352.7	74.3	255	3.49	21.6	3,164	19	169.7	0.2
39	10.5	0	339.4	71.5	197	3.20	22.0	2,741	24	130.8	0.5
40	10.5	0	364.0	76.7	196	3.20	22.1	2,719	29	130.5	0.5
41	10.5	0	355.2	74.8	196	3.02	23.1	2,565	29	130.2	0.6
42	10.5	0	357.7	75.4	202	3.20	22.2	2,688	24	134.5	0.4
43	10.5	0	349.9	73.7	212	3.31	22.4	2,783	26	141.2	0.3
44	10.5	0	354.8	74.8	227	3.59	22.0	2,839	20	150.8	0.2
45	10.5	0	333.5	70.3	197	3.33	22.3	2,651	13	130.8	0.4
46	10.5	0	360.5	76.0	206	3.12	22.6	2,523	31	136.9	0.6
47	10.5	0	341.5	72.0	196	2.98	22.0	2,643	27	130.6	0.6
48	10.5	0	337.0	71.0	189	3.24	21.2	2,530	23	125.6	0.6
49	10.5	0	339.5	71.5	211	3.43	21.9	2,745	21	140.4	0.4
Average			347.0	73.1	212	3.31	22.2	2,722	25	140.9	0.4

Total number of blows analyzed: 37

BL# Sensors

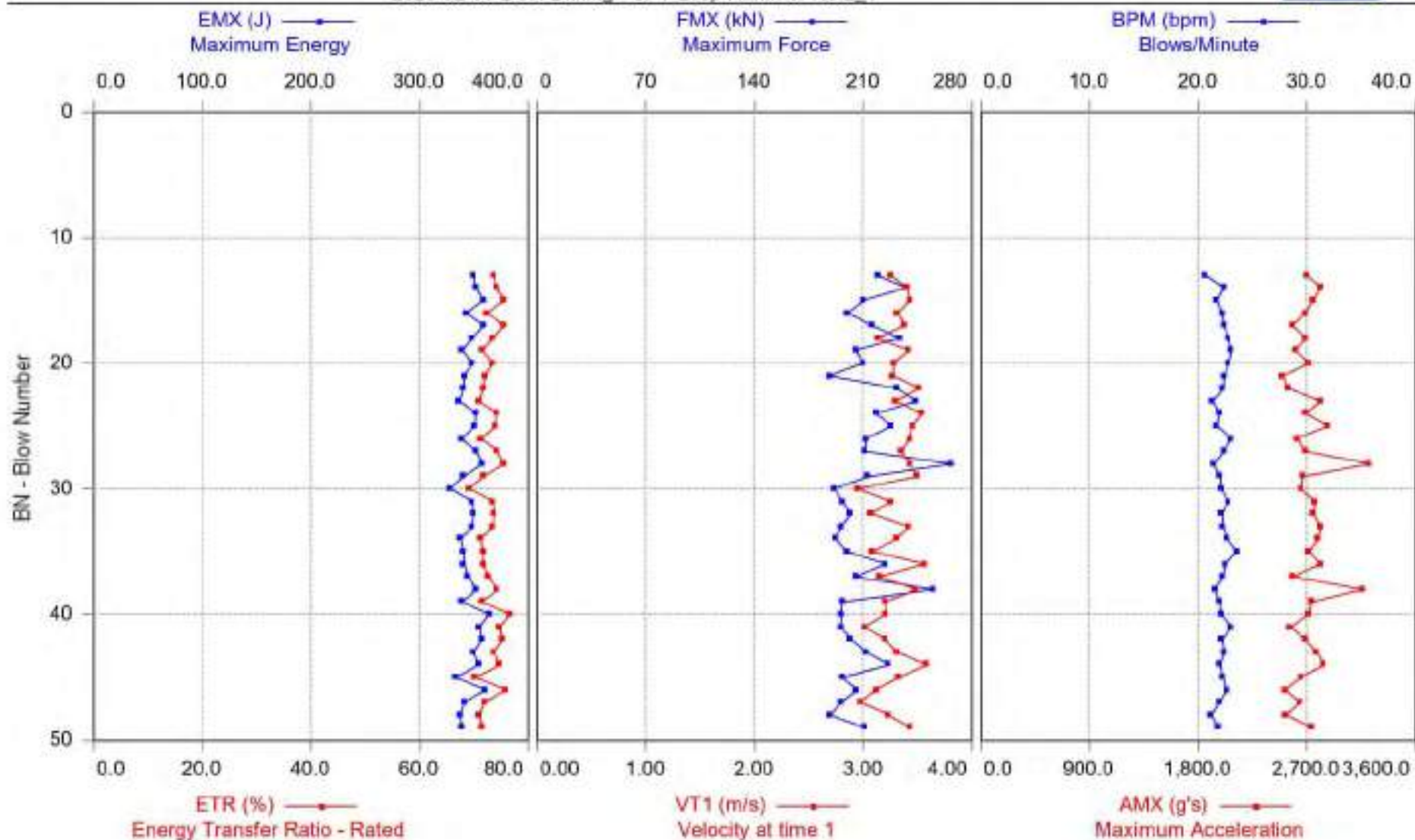
13-49 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 9 seconds 10:45 am - 10:47 am BN 1 - 49



2023-02-09 DCN Drilling - SPT Drop Hammer No.2_1



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.2_2
 OP: RZ

BH02 Test 3 at 12m
 Date: 09-February-2023

AR: 15.03 cm²

SP: 77.3 kN/m²

LE: 13.7 m

EM: 206,843 MPa

WS: 5,123.0 m/s

JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
10	12.0	0	336.6	70.9	252	3.39	20.8	2,896	24	167.7	0.6
11	12.0	0	336.2	70.8	255	3.18	21.3	3,276	30	169.9	0.7
12	12.0	0	325.6	68.6	198	3.27	20.6	2,627	24	131.8	0.6
13	12.0	0	335.9	70.8	251	3.73	20.6	2,792	25	167.1	0.3
14	12.0	0	352.5	74.3	213	3.48	21.9	2,577	30	141.9	0.4
15	12.0	0	339.4	71.5	258	3.63	21.3	2,951	29	171.4	0.3
16	12.0	0	356.7	75.2	216	3.45	21.4	2,658	29	144.0	0.3
17	12.0	0	336.5	70.9	260	3.26	15.3	3,163	23	172.7	0.7
18	12.0	0	344.9	72.7	229	3.51	21.8	2,761	23	152.3	0.3
19	12.0	0	318.7	67.2	192	2.82	21.6	2,536	25	127.9	0.8
20	12.0	0	338.4	71.3	260	3.29	21.6	3,115	25	173.3	0.6
21	12.0	0	335.9	70.8	208	3.40	21.8	2,556	21	138.2	0.6
22	12.0	0	346.6	73.0	248	3.69	21.3	2,699	33	165.0	0.3
23	12.0	0	328.9	69.3	210	3.39	20.5	2,548	22	140.0	0.4
24	12.0	0	329.0	69.3	266	3.23	21.9	2,843	22	177.1	0.6
25	12.0	0	352.7	74.3	230	3.34	21.6	2,707	36	152.7	0.4
26	12.0	0	340.6	71.8	258	3.23	22.3	2,937	22	171.3	0.7
27	12.0	0	344.2	72.5	266	3.64	21.4	3,132	22	177.1	0.2
28	12.0	0	322.5	68.0	229	3.74	21.7	2,627	20	152.2	0.3
29	12.0	0	325.9	68.7	259	3.60	21.1	2,771	17	172.4	0.3
30	12.0	0	328.3	69.2	259	3.43	22.1	2,742	19	172.0	0.5
31	12.0	0	330.6	69.7	213	3.53	21.7	2,657	21	141.5	0.4
32	12.0	0	321.8	67.8	230	3.58	21.6	2,615	19	152.8	0.3
33	12.0	0	326.1	68.7	256	3.39	22.6	2,535	14	170.1	0.5
34	12.0	0	362.9	76.5	259	3.70	21.7	2,792	39	172.0	0.3
35	12.0	0	335.3	70.7	253	3.79	22.2	2,753	23	168.0	0.2
36	12.0	0	342.1	72.1	262	3.41	21.7	2,777	23	174.2	0.3
37	12.0	0	325.4	68.6	198	3.09	21.2	2,370	23	131.8	0.7
38	12.0	0	328.0	69.1	248	3.66	21.8	2,617	21	165.3	0.2
Average			336.1	70.8	239	3.44	21.3	2,760	24	159.1	0.4

Total number of blows analyzed: 29

BL# Sensors

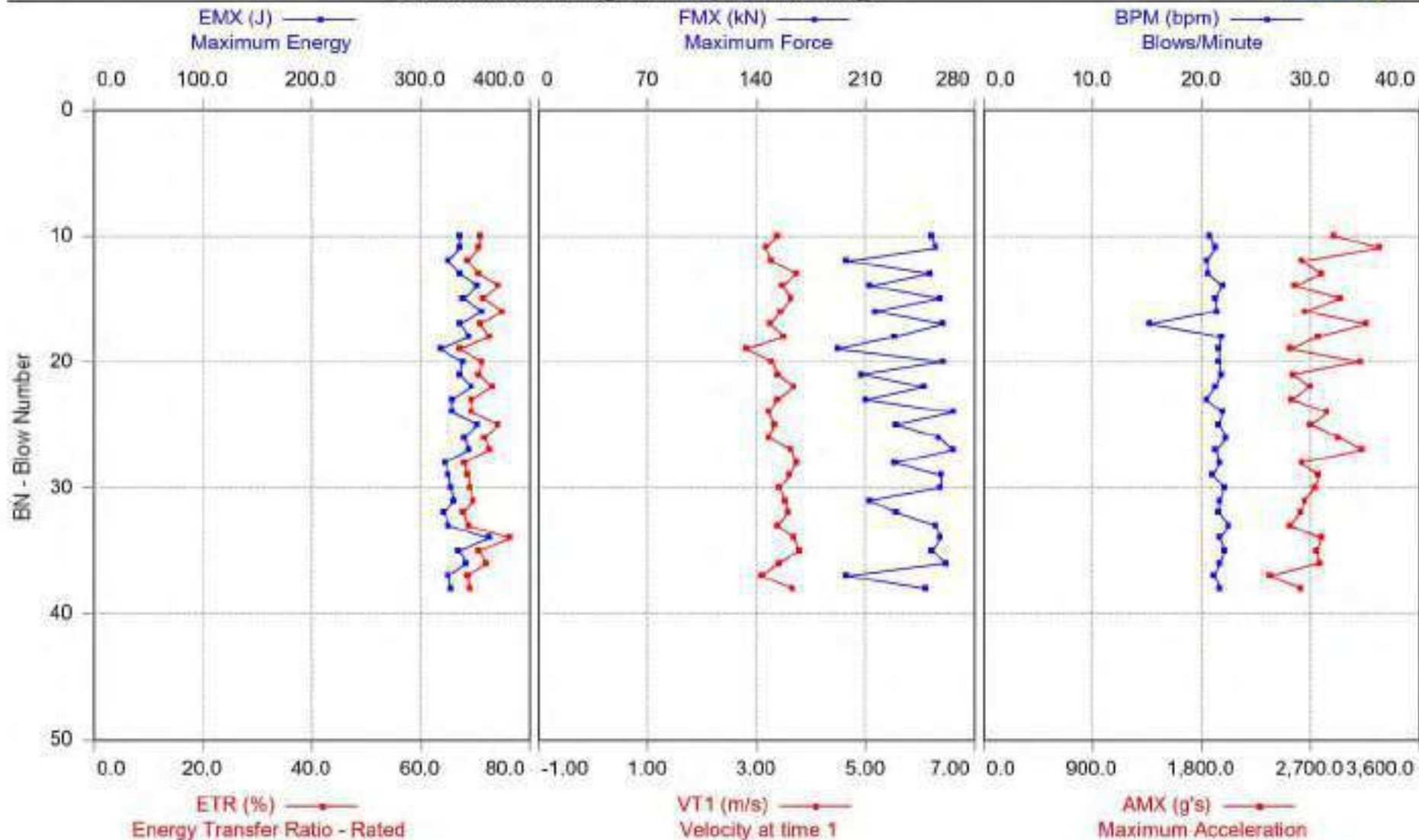
10-38 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12854] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 1 minute 45 seconds 11:18 am - 11:19 am BN 1 - 38



2023-02-09 DCN Drilling - SPT Drop Hammer No.2_2



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3
 OP: RZ

BH03 Test 1 at 9m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 10.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
8	9.0	0	361.7	76.2	226	3.75	19.0	2,910	32	150.5	0.5
9	9.0	0	366.2	77.2	219	3.94	20.6	2,749	24	145.8	0.5
10	9.0	0	348.7	73.5	276	3.53	20.6	3,211	24	183.5	0.3
11	9.0	0	349.1	73.6	197	3.33	21.1	2,718	24	131.2	0.8
12	9.0	0	400.6	84.4	206	3.77	20.0	2,654	44	136.9	0.6
13	9.0	0	359.3	75.7	223	3.99	18.3	2,859	29	148.2	0.5
14	9.0	0	353.2	74.4	243	3.85	21.0	3,051	22	161.4	0.5
15	9.0	0	354.6	74.7	188	3.58	21.2	2,601	25	124.9	0.7
16	9.0	0	343.7	72.4	192	3.43	20.2	2,668	25	127.9	0.8
17	9.0	0	360.1	75.9	236	3.97	14.0	2,844	23	156.7	0.6
18	9.0	0	367.2	77.4	199	3.93	20.8	3,131	21	132.1	0.6
19	9.0	0	363.3	76.6	209	3.92	20.0	2,563	20	138.8	0.7
20	9.0	0	370.6	78.1	210	4.07	21.4	2,653	22	139.7	0.6
21	9.0	0	357.6	75.4	263	3.91	20.2	2,882	24	175.2	0.6
22	9.0	0	368.3	77.6	233	4.22	21.3	2,711	21	155.1	0.5
23	9.0	0	347.6	73.3	201	3.69	21.0	2,595	17	133.8	0.7
24	9.0	0	358.8	75.6	248	4.33	20.7	2,636	17	164.8	0.5
25	9.0	0	335.5	70.7	244	3.58	21.1	2,770	25	162.1	0.5
26	9.0	0	373.5	78.7	243	4.59	19.8	2,912	17	161.9	0.5
Average			360.0	75.9	224	3.86	20.1	2,796	24	149.0	0.6

Total number of blows analyzed: 19

BL# Sensors

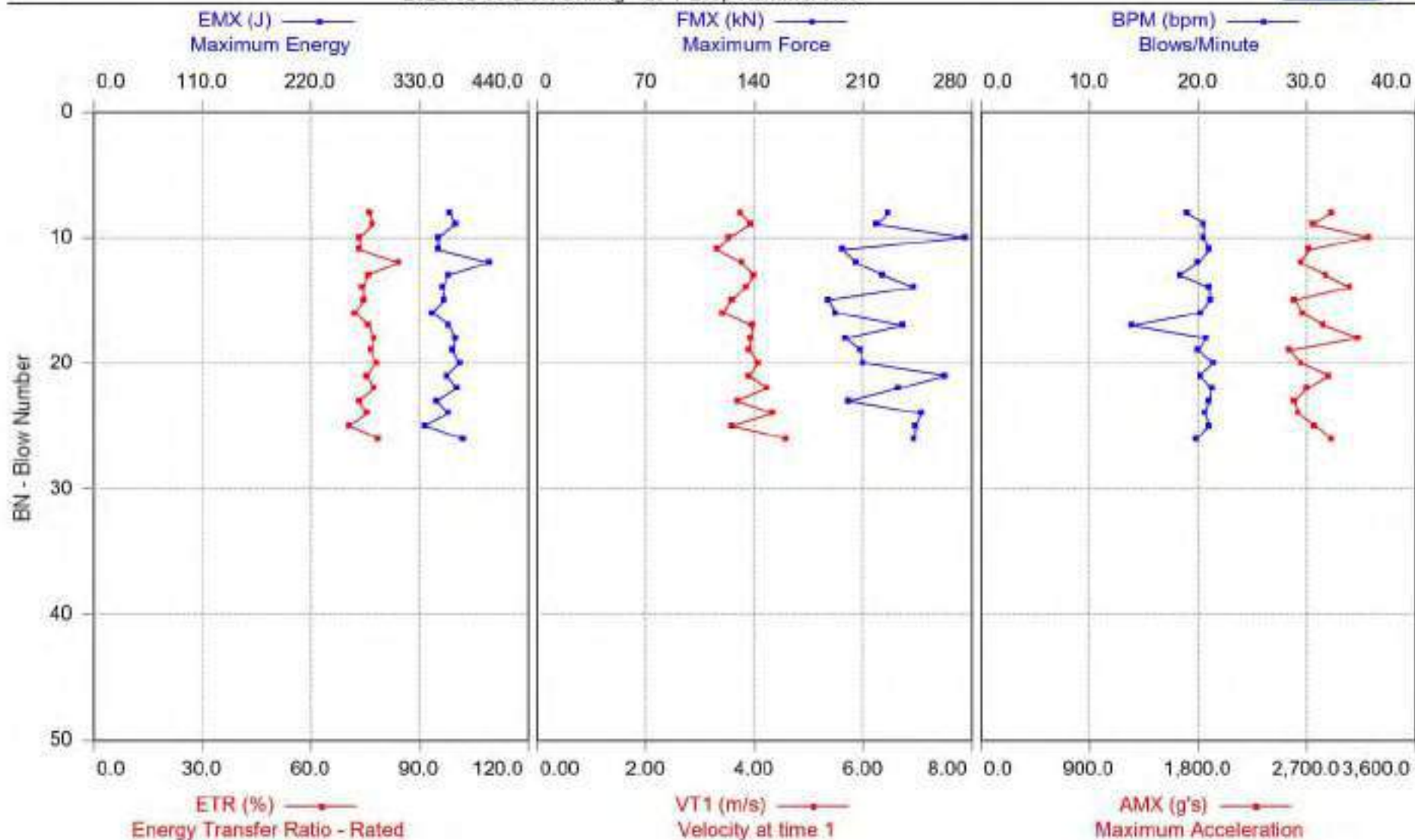
8-26 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 1 minute 16 seconds 11:35 am - 11:36 am BN 1 - 26



2023-02-09 DCN Drilling - SPT Drop Hammer No.3



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3_1
 OP: RZ

BH03 Test 2 at 10.5m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 12.2 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
11	10.5	0	336.4	70.9	219	3.51	16.9	3,086	30	145.6	0.3
12	10.5	0	301.1	63.4	191	3.06	22.9	2,665	27	126.7	0.6
13	10.5	0	296.2	62.4	181	2.72	23.0	2,513	20	120.4	0.4
14	10.5	0	318.4	67.1	215	3.25	22.3	3,115	23	143.1	0.5
15	10.5	0	304.8	64.2	233	3.15	21.4	3,315	21	155.2	0.2
16	10.5	0	299.0	63.0	184	3.44	14.7	2,607	17	122.5	0.4
17	10.5	0	308.2	64.9	203	3.56	21.3	2,676	17	134.8	0.4
18	10.5	0	310.0	65.3	222	3.30	20.9	2,853	16	147.5	0.2
19	10.5	0	313.6	66.1	192	3.32	21.0	2,604	17	128.0	0.4
20	10.5	0	304.9	64.3	242	3.10	21.2	3,208	16	160.8	0.6
21	10.5	0	315.6	66.5	236	3.28	21.4	3,203	20	157.3	0.6
22	10.5	0	312.5	65.9	210	3.69	21.3	2,855	15	139.6	0.4
23	10.5	0	320.3	67.5	192	3.54	21.4	2,741	24	127.4	0.5
24	10.5	0	318.7	67.2	246	3.33	21.7	3,153	21	163.6	0.2
25	10.5	0	291.7	61.5	185	3.04	21.6	2,518	14	123.4	0.6
26	10.5	0	298.1	62.8	191	2.76	22.8	2,470	18	126.8	0.4
27	10.5	0	319.1	67.2	232	3.56	22.3	2,990	24	154.6	0.2
28	10.5	0	325.6	68.6	226	3.50	22.9	3,013	21	150.3	0.3
29	10.5	0	319.0	67.2	254	3.55	21.0	3,225	20	168.9	0.2
30	10.5	0	308.7	65.1	166	3.16	20.3	2,466	26	110.4	0.8
31	10.5	0	321.2	67.7	174	3.40	22.0	2,368	35	115.6	0.6
32	10.5	0	315.2	66.4	183	3.42	21.3	2,562	25	121.5	0.4
33	10.5	0	303.4	63.9	238	3.12	21.3	3,327	19	158.5	0.3
34	10.5	0	313.3	66.0	173	3.12	22.5	2,428	22	115.3	0.5
35	10.5	0	318.3	67.1	186	3.65	20.9	2,520	16	123.6	0.4
36	10.5	0	307.0	64.7	184	3.56	21.2	2,451	14	122.2	0.5
37	10.5	0	317.8	67.0	192	3.66	20.9	2,438	17	127.9	0.5
38	10.5	0	315.5	66.5	194	3.66	21.5	2,462	16	129.2	0.5
39	10.5	0	309.8	65.3	241	3.38	20.8	3,034	18	160.5	0.4
40	10.5	0	316.7	66.7	233	3.41	20.5	3,042	19	155.2	0.3
41	10.5	0	295.5	62.3	172	2.95	20.6	2,384	18	114.6	0.6
42	10.5	0	318.7	67.2	208	3.78	20.7	2,418	17	138.3	0.3
43	10.5	0	296.9	62.6	177	2.91	15.7	2,272	16	117.9	0.7
44	10.5	0	327.8	69.1	196	3.30	20.2	2,518	32	130.4	0.5
Average			311.7	65.7	205	3.33	20.9	2,750	20	136.4	0.4

Total number of blows analyzed: 34

BL# Sensors

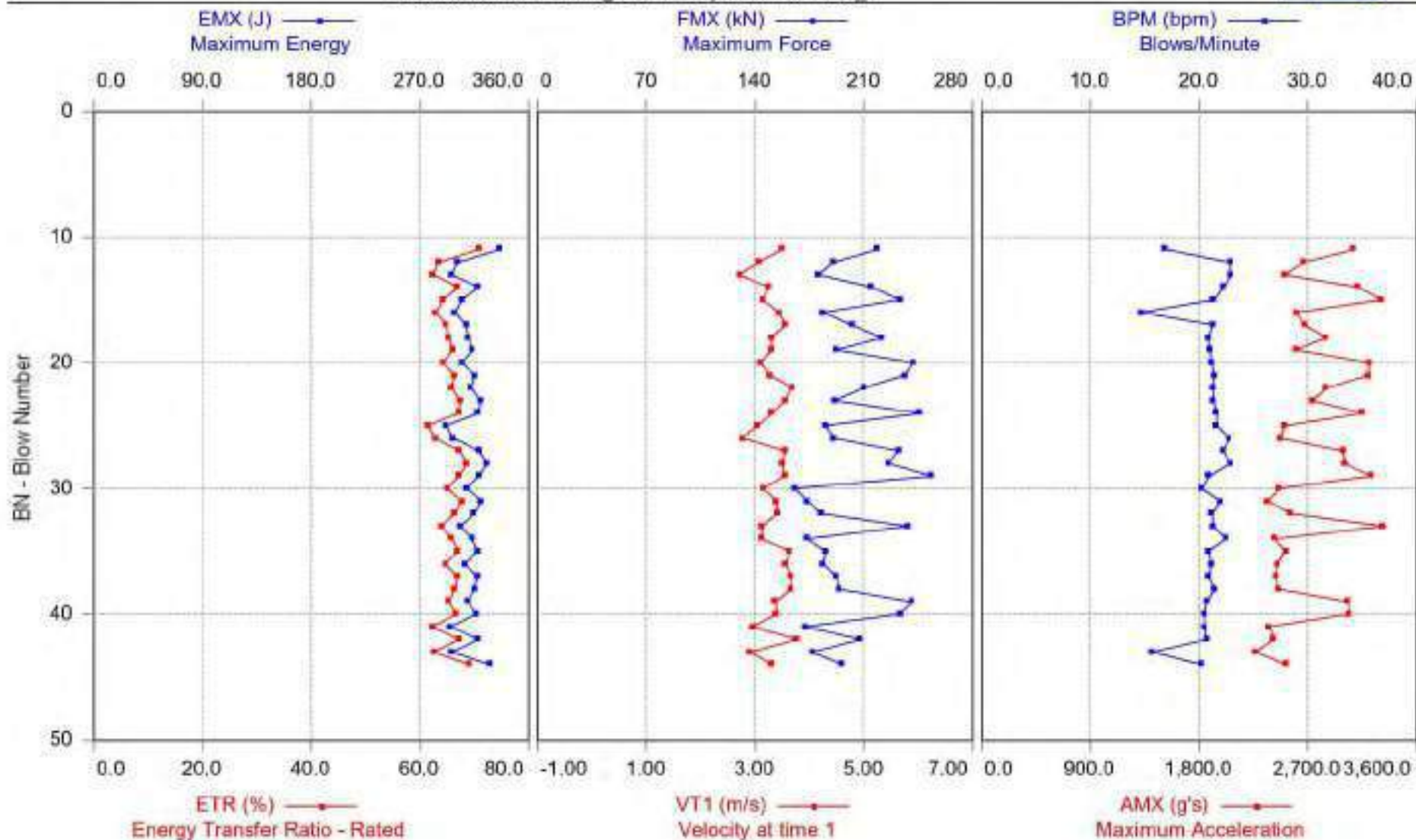
11-44 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 26 seconds 12:03 pm - 12:05 pm BN 1 - 44



2023-02-09 DCN Drilling - SPT Drop Hammer No.3_1



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3_2
 OP: RZ

BH03 Test 3 at 12m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 13.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
11	12.0	0	323.3	68.1	252	3.24	16.1	2,854	14	167.9	0.5
12	12.0	0	318.7	67.2	251	3.33	20.0	2,831	9	166.7	0.3
13	12.0	0	323.1	68.1	191	3.23	20.6	2,498	24	127.3	0.6
14	12.0	0	305.7	64.4	186	3.11	20.3	2,444	9	123.9	0.5
15	12.0	0	310.6	65.4	188	3.25	20.3	2,318	14	125.2	0.4
16	12.0	0	319.3	67.3	197	3.45	21.6	2,464	8	131.0	0.3
17	12.0	0	321.2	67.7	237	3.43	20.5	2,464	10	157.6	0.1
18	12.0	0	322.9	68.0	231	3.44	20.0	2,423	17	154.0	0.2
19	12.0	0	312.5	65.8	208	3.27	20.7	2,350	9	138.2	0.3
20	12.0	0	300.2	63.3	174	3.29	20.4	2,202	8	115.6	0.6
21	12.0	0	305.4	64.4	213	3.66	19.9	2,187	8	141.4	0.3
22	12.0	0	319.0	67.2	225	3.78	19.8	2,288	8	149.4	0.3
23	12.0	0	290.2	61.2	245	3.11	20.0	2,478	10	162.7	0.6
24	12.0	0	316.6	66.7	243	3.50	20.6	2,711	8	161.6	0.2
25	12.0	0	296.5	62.5	216	3.24	19.8	2,006	7	143.5	0.2
26	12.0	0	299.9	63.2	181	3.08	21.4	2,168	10	120.4	0.6
27	12.0	0	310.2	65.4	181	3.45	20.2	2,130	7	120.5	0.5
28	12.0	0	296.5	62.5	166	3.12	20.7	2,093	7	110.4	0.7
29	12.0	0	290.9	61.3	170	3.01	19.4	2,005	7	112.9	0.5
30	12.0	0	309.5	65.2	218	3.65	19.0	2,106	7	144.7	0.3
31	12.0	0	293.9	61.9	240	3.39	19.6	2,337	7	159.8	0.5
32	12.0	0	307.7	64.8	228	3.58	20.1	2,303	7	151.8	0.2
33	12.0	0	294.5	62.1	209	3.19	20.7	1,979	10	138.9	0.4
34	12.0	0	288.0	60.7	188	3.21	20.2	1,984	7	125.4	0.4
35	12.0	0	300.2	63.3	245	3.32	19.7	2,100	7	163.0	0.2
36	12.0	0	297.8	62.8	243	3.48	19.6	2,151	7	161.4	0.6
37	12.0	0	319.6	67.3	215	3.58	22.4	2,166	15	143.2	0.4
38	12.0	0	295.4	62.2	202	3.08	16.7	1,918	7	134.5	0.5
39	12.0	0	300.1	63.2	194	3.14	20.4	1,940	7	129.2	0.6
40	12.0	0	291.4	61.4	167	2.99	21.5	1,804	7	111.1	0.6
41	12.0	0	306.9	64.7	226	3.60	20.8	1,933	7	150.3	0.3
42	12.0	0	316.1	66.6	232	3.81	21.3	2,104	7	154.1	0.2
43	12.0	0	306.4	64.6	159	2.91	15.9	1,571	12	105.8	0.7
44	12.0	0	307.9	64.9	200	3.29	20.5	1,664	7	133.1	0.3
45	12.0	0	310.8	65.5	173	3.07	20.2	1,701	9	115.4	0.7
46	12.0	0	298.9	63.0	157	3.05	14.7	1,633	9	104.5	0.5
47	12.0	0	312.3	65.8	175	3.01	19.6	1,707	11	116.2	0.6
48	12.0	0	304.1	64.1	231	3.33	20.9	2,221	7	153.9	0.6
49	12.0	0	302.1	63.7	193	3.29	19.8	1,583	7	128.3	0.4
50	12.0	0	300.7	63.4	194	3.17	20.6	1,584	9	128.9	0.5
51	12.0	0	296.0	62.4	171	2.88	20.8	1,438	8	113.5	0.7
52	12.0	0	299.9	63.2	187	3.03	19.5	1,581	9	124.5	0.6
53	12.0	0	301.4	63.5	247	3.50	20.4	2,237	7	164.2	0.6
54	12.0	0	311.2	65.6	248	3.45	19.4	1,980	15	164.8	0.5
55	12.0	0	291.8	61.5	213	3.30	19.8	1,517	10	141.6	0.4
56	12.0	0	285.2	60.1	235	3.06	20.9	1,381	7	156.6	0.6
57	12.0	0	277.4	58.5	224	2.88	20.4	1,593	7	148.9	0.6
58	12.0	0	293.2	61.8	188	3.06	20.7	1,340	13	125.3	0.5
59	12.0	0	295.5	62.3	239	3.24	13.5	1,853	9	159.1	0.5
60	12.0	0	277.6	58.5	224	2.93	20.5	1,408	7	149.3	0.3

Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.3_2
OP: RZ

BH03 Test 3 at 12m
Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
	Average		303.5	64.0	208	3.27	19.8	2,035	9	138.6	0.5

Total number of blows analyzed: 50

BL# Sensors

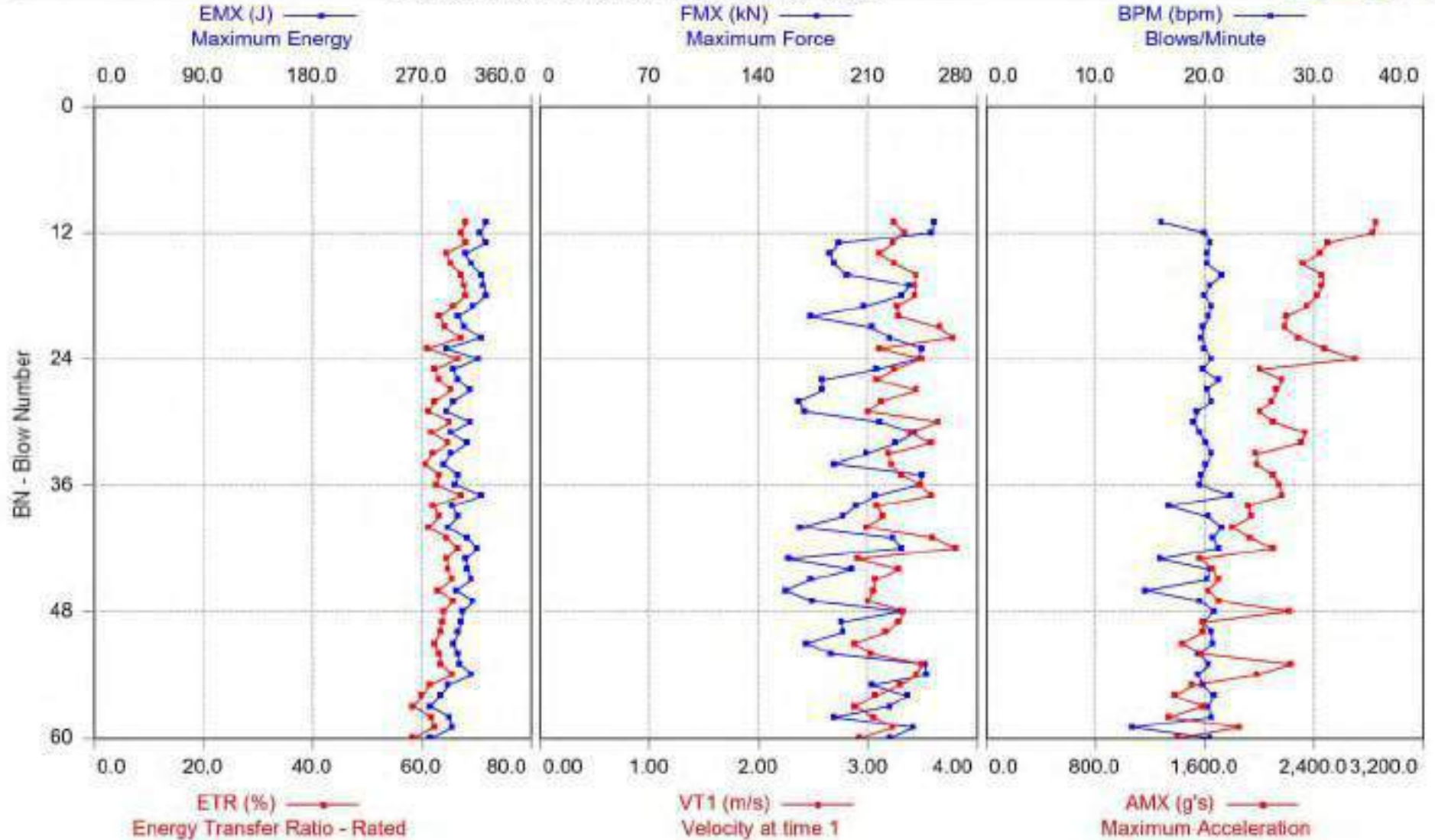
11-60 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 58 seconds 12:27 pm - 12:30 pm BN 1 - 60



2023-02-09 DCN Drilling - SPT Drop Hammer No.3_2



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4
 OP: RZ

BH01 Test 1 at 9m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 10.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
12	9.0	0	339.0	71.4	210	3.25	14.8	3,041	21	139.8	0.8
13	9.0	0	376.0	79.2	202	3.22	18.9	2,998	52	134.5	0.8
14	9.0	0	353.8	74.6	218	3.37	20.6	3,239	18	145.4	0.8
15	9.0	0	344.4	72.6	222	3.23	19.6	2,876	20	147.7	0.7
16	9.0	0	336.5	70.9	211	3.24	19.3	3,012	20	140.2	0.7
17	9.0	0	321.0	67.7	202	3.23	15.5	2,990	20	134.5	0.8
18	9.0	0	353.5	74.5	228	3.34	18.1	3,156	16	151.4	0.6
19	9.0	0	368.9	77.7	234	3.45	18.6	3,285	20	155.4	0.6
20	9.0	0	356.2	75.1	231	3.39	20.8	3,278	19	154.0	0.8
21	9.0	0	355.5	74.9	214	3.52	18.8	3,105	18	142.2	0.6
22	9.0	0	356.5	75.1	290	3.96	20.3	4,159	12	193.2	0.6
23	9.0	0	368.7	77.7	249	3.68	18.5	3,610	20	165.9	0.7
24	9.0	0	359.9	75.8	235	3.54	19.0	3,450	15	156.0	0.5
25	9.0	0	367.4	77.4	235	3.46	18.6	3,211	21	156.4	0.6
26	9.0	0	345.3	72.8	208	3.50	18.4	3,180	15	138.5	0.6
27	9.0	0	369.9	78.0	256	3.71	19.9	3,858	15	170.6	0.6
28	9.0	0	347.4	73.2	210	3.48	18.9	3,104	19	139.6	0.7
29	9.0	0	373.4	78.7	237	3.70	20.0	3,391	18	157.6	0.6
30	9.0	0	328.4	69.2	206	3.21	14.5	2,959	20	136.9	0.7
31	9.0	0	370.7	78.1	223	3.46	19.9	3,128	16	148.6	0.8
32	9.0	0	356.5	75.1	240	3.53	12.7	3,377	13	159.9	0.5
33	9.0	0	366.3	77.2	215	3.56	19.0	2,875	23	142.8	0.7
34	9.0	0	354.3	74.7	242	3.74	18.4	3,016	12	160.9	0.5
35	9.0	0	352.8	74.3	217	3.64	18.4	2,767	21	144.4	0.6
36	9.0	0	337.8	71.2	219	3.51	19.3	2,793	14	145.4	0.6
37	9.0	0	360.7	76.0	233	3.73	18.8	2,649	18	155.1	0.6
38	9.0	0	366.0	77.1	239	3.72	17.4	2,884	19	158.8	0.6
39	9.0	0	349.3	73.6	225	3.51	19.5	2,742	13	150.0	0.7
40	9.0	0	346.4	73.0	239	3.95	18.8	2,732	17	159.3	0.6
41	9.0	0	347.8	73.3	223	3.81	18.6	2,835	22	148.0	0.6
42	9.0	0	367.0	77.3	226	3.67	18.2	2,778	18	150.5	0.7
43	9.0	0	344.3	72.5	217	3.67	18.2	2,739	9	144.4	0.7
Average			354.4	74.7	227	3.53	18.4	3,101	19	150.9	0.7

Total number of blows analyzed: 32

BL# Sensors

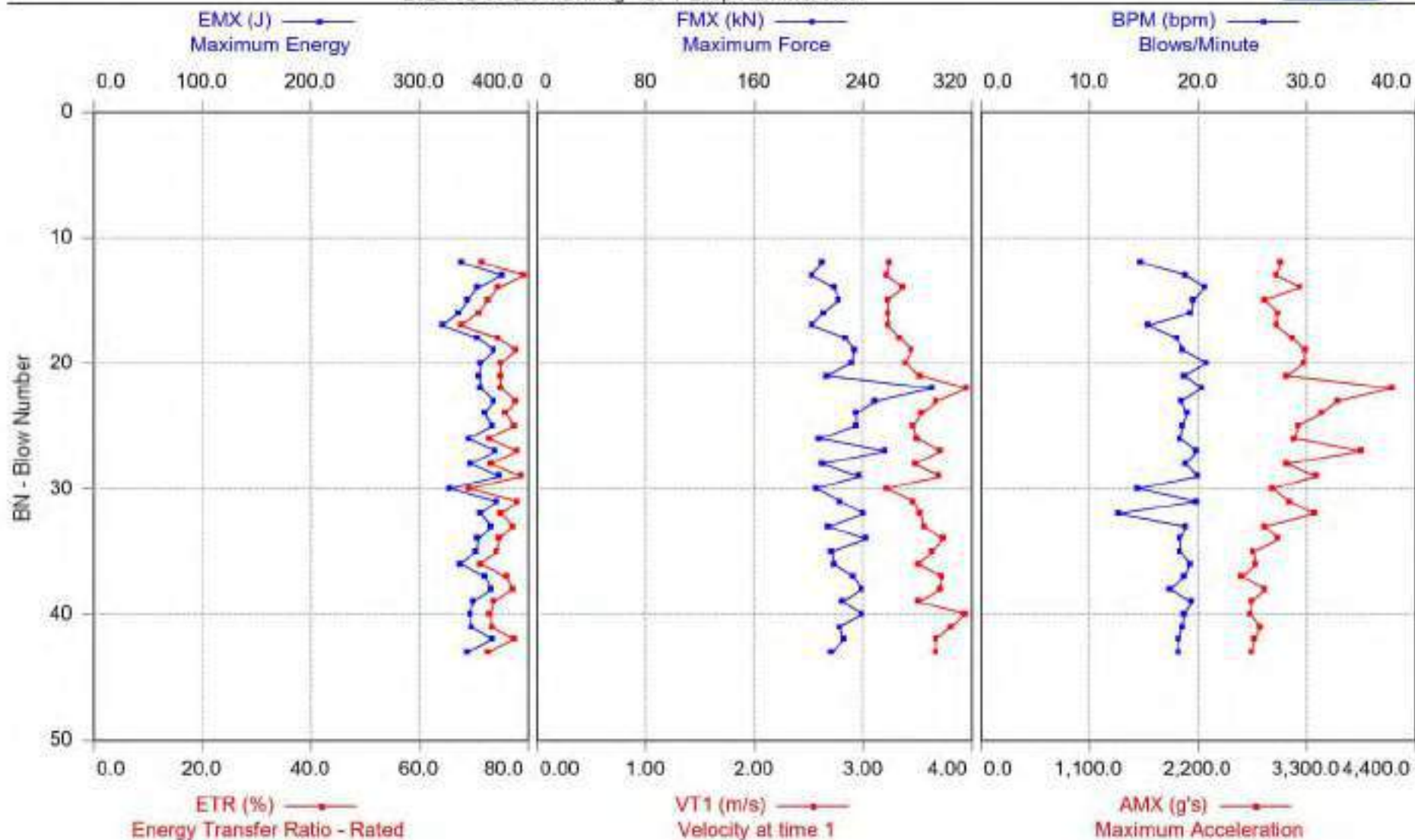
12-43 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 24 seconds 9:09 am - 9:11 am BN 1 - 43



2023-02-09 DCN Drilling - SPT Drop Hammer No.4



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4_1
 OP: RZ

BH01 Test 2 at 10.5m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 12.2 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
13	10.5	0	376.8	79.4	254	3.49	19.7	3,351	20	169.2	0.7
14	10.5	0	362.5	76.4	231	3.47	19.6	3,022	22	153.9	0.7
15	10.5	0	372.8	78.6	235	3.52	19.9	2,980	27	156.6	0.6
16	10.5	0	359.4	75.7	267	3.66	19.7	3,594	20	177.5	0.6
17	10.5	0	369.6	77.9	236	3.45	19.5	2,948	26	156.7	0.7
18	10.5	0	374.7	79.0	237	3.47	15.3	3,226	20	157.6	0.7
19	10.5	0	372.2	78.4	250	3.52	19.8	3,493	24	166.4	0.6
20	10.5	0	357.9	75.4	279	3.90	18.5	3,818	17	185.6	0.6
21	10.5	0	350.7	73.9	239	3.54	18.9	3,061	18	159.0	0.5
22	10.5	0	346.3	73.0	209	3.41	19.9	3,111	17	138.8	0.7
23	10.5	0	364.7	76.9	296	4.02	20.2	3,935	21	197.1	0.6
24	10.5	0	348.8	73.5	243	3.77	19.0	3,008	14	161.5	0.6
25	10.5	0	370.7	78.1	257	3.68	15.8	3,150	18	170.9	0.5
26	10.5	0	357.2	75.3	257	3.85	19.6	3,090	18	170.7	0.5
27	10.5	0	348.5	73.4	215	3.19	20.3	2,820	22	143.0	0.7
28	10.5	0	341.9	72.1	200	3.26	18.8	2,803	25	132.9	0.8
29	10.5	0	357.9	75.4	220	3.64	14.7	2,891	18	146.3	0.7
30	10.5	0	355.1	74.8	259	4.00	20.4	2,920	17	172.2	0.5
31	10.5	0	374.4	78.9	238	3.91	19.2	2,980	19	158.5	0.6
32	10.5	0	362.2	76.3	220	3.69	20.5	2,985	13	146.5	0.5
33	10.5	0	362.3	76.4	219	3.89	19.2	2,728	17	145.6	0.5
34	10.5	0	346.6	73.0	285	3.61	19.6	3,169	16	189.9	0.2
35	10.5	0	365.1	76.9	222	3.82	20.1	2,822	20	147.7	0.6
36	10.5	0	334.9	70.6	217	3.67	20.0	2,501	15	144.6	0.6
37	10.5	0	365.9	77.1	220	3.94	13.3	2,840	20	146.6	0.5
38	10.5	0	362.2	76.3	241	4.01	19.1	2,736	18	160.0	0.6
39	10.5	0	337.7	71.2	210	3.45	19.7	2,549	17	140.0	0.7
40	10.5	0	361.4	76.2	277	3.84	19.9	3,192	16	184.4	0.6
41	10.5	0	370.0	78.0	286	3.73	19.5	3,606	15	190.2	0.6
42	10.5	0	350.2	73.8	224	3.77	19.8	2,726	12	148.9	0.7
43	10.5	0	363.3	76.6	256	3.93	19.9	2,754	19	170.3	0.6
44	10.5	0	357.0	75.2	231	3.89	18.9	2,673	13	153.5	0.5
45	10.5	0	357.6	75.4	240	4.08	19.5	2,699	19	160.0	0.6
46	10.5	0	347.5	73.2	225	3.89	19.2	2,589	14	149.4	0.5
47	10.5	0	347.9	73.3	213	3.14	18.2	2,388	25	141.4	0.9
Average			358.7	75.6	240	3.69	19.0	3,005	19	159.8	0.6

Total number of blows analyzed: 35

BL# Sensors

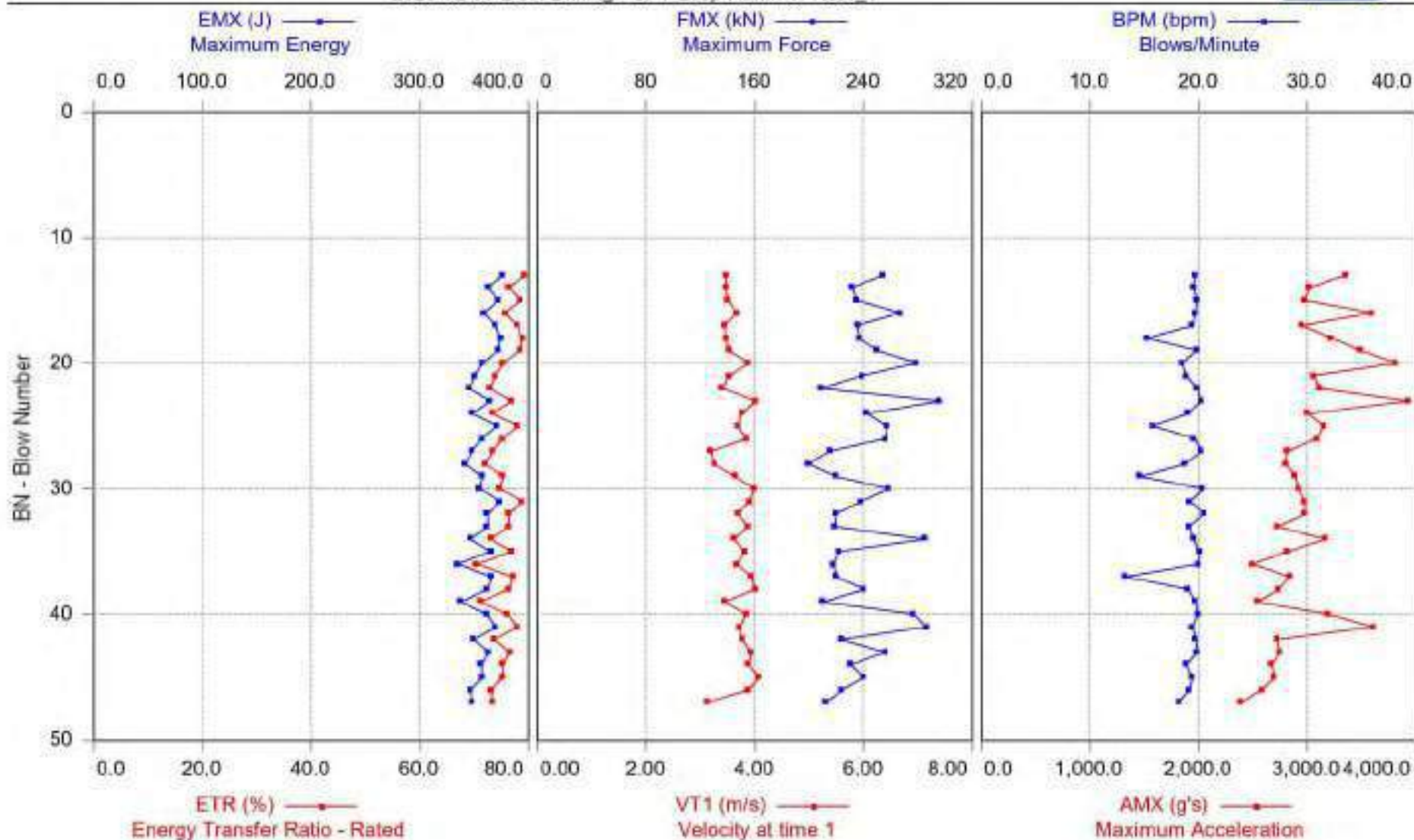
13-47 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 25 seconds 9:35 am - 9:38 am BN 1 - 47



2023-02-09 DCN Drilling - SPT Drop Hammer No.4_1



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4_2
 OP: RZ

BH01 Test 3 at 12m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 13.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
10	12.0	0	358.9	75.6	226	3.28	20.2	2,659	17	150.3	0.7
11	12.0	0	354.2	74.6	224	3.17	20.4	2,822	19	149.2	0.5
12	12.0	0	322.2	67.9	212	2.95	16.2	2,586	23	140.9	0.5
13	12.0	0	371.9	78.4	236	3.79	20.5	3,096	17	157.3	0.6
14	12.0	0	358.4	75.5	231	3.66	20.7	2,572	25	153.7	0.6
15	12.0	0	338.3	71.3	216	3.34	21.5	2,414	20	143.7	0.7
16	12.0	0	368.5	77.6	233	3.97	21.4	2,755	22	155.1	0.6
17	12.0	0	332.9	70.2	208	2.78	21.0	2,351	27	138.3	0.7
18	12.0	0	364.0	76.7	224	3.74	21.4	2,953	18	149.2	0.6
19	12.0	0	347.2	73.2	216	3.34	21.9	2,324	25	144.0	0.6
20	12.0	0	357.2	75.3	235	3.81	14.8	2,925	18	156.0	0.7
21	12.0	0	347.4	73.2	203	2.80	20.8	2,562	31	135.2	0.5
22	12.0	0	358.2	75.5	228	3.72	16.7	2,984	11	151.6	0.6
23	12.0	0	344.7	72.6	219	2.84	22.4	2,286	42	145.4	0.8
24	12.0	0	353.4	74.5	242	4.01	22.8	2,790	17	160.9	0.5
25	12.0	0	342.9	72.3	239	3.98	20.0	2,514	15	158.9	0.5
26	12.0	0	330.3	69.6	255	3.47	19.9	2,761	11	169.9	0.7
27	12.0	0	346.4	73.0	233	3.80	20.6	2,468	13	154.7	0.6
28	12.0	0	348.3	73.4	222	3.62	21.1	2,186	14	147.7	0.7
29	12.0	0	341.4	71.9	235	3.71	21.7	2,268	10	156.4	0.6
30	12.0	0	344.3	72.6	257	3.98	21.5	2,583	12	171.1	0.5
31	12.0	0	347.2	73.2	258	3.89	20.9	2,314	14	171.9	0.5
32	12.0	0	356.7	75.2	244	4.02	20.4	2,300	11	162.3	0.6
33	12.0	0	342.3	72.1	230	3.55	17.6	2,133	13	152.7	0.6
34	12.0	0	358.3	75.5	241	4.16	19.6	2,220	10	160.2	0.5
35	12.0	0	319.3	67.3	227	3.25	19.2	2,011	16	150.7	0.7
36	12.0	0	304.6	64.2	211	2.75	20.0	1,792	12	140.7	0.6
37	12.0	0	348.6	73.5	238	4.10	19.6	2,363	11	158.3	0.5
38	12.0	0	316.5	66.7	216	2.80	19.9	2,094	9	143.4	0.6
39	12.0	0	347.9	73.3	227	3.94	20.1	2,388	15	151.2	0.5
40	12.0	0	321.7	67.8	236	3.81	16.7	2,071	9	157.1	0.5
41	12.0	0	325.0	68.5	231	3.66	12.2	1,943	13	153.9	0.6
42	12.0	0	316.2	66.6	223	3.80	19.2	2,144	9	148.4	0.5
43	12.0	0	363.6	76.6	220	3.83	20.4	2,585	22	146.3	0.6
44	12.0	0	334.1	70.4	273	3.47	19.9	2,400	10	181.6	0.6
45	12.0	0	287.8	60.6	212	2.66	19.4	1,925	10	140.9	0.6
46	12.0	0	330.4	69.6	223	3.58	19.3	1,865	10	148.3	0.5
47	12.0	0	288.2	60.7	262	2.68	20.1	1,790	8	174.3	0.8
48	12.0	0	300.0	63.2	207	2.64	20.2	1,616	8	137.4	0.4
49	12.0	0	309.6	65.3	217	2.61	20.9	1,759	12	144.1	0.5
50	12.0	0	320.9	67.6	228	2.82	16.6	1,677	12	151.7	0.6
51	12.0	0	299.9	63.2	178	2.25	19.2	1,458	18	118.1	0.7
52	12.0	0	319.5	67.3	261	2.86	19.0	1,933	12	173.9	0.8
53	12.0	0	318.6	67.1	229	2.87	20.9	1,823	12	152.1	0.6
54	12.0	0	299.3	63.1	206	2.85	20.6	1,547	12	136.9	0.5
55	12.0	0	297.7	62.7	204	2.81	14.3	1,558	9	135.5	0.5
56	12.0	0	328.9	69.3	207	2.84	20.7	1,566	14	137.9	0.6
57	12.0	0	316.0	66.6	254	2.63	21.8	1,865	13	169.0	0.6
58	12.0	0	316.2	66.6	219	2.98	20.5	1,605	11	145.6	0.6
59	12.0	0	308.8	65.1	191	2.36	20.9	1,338	9	126.9	0.6

Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.4_2
OP: RZ

BH01 Test 3 at 12m
Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
	Average		333.5	70.3	227	3.32	19.8	2,219	15	151.2	0.6

Total number of blows analyzed: 50

BL# Sensors

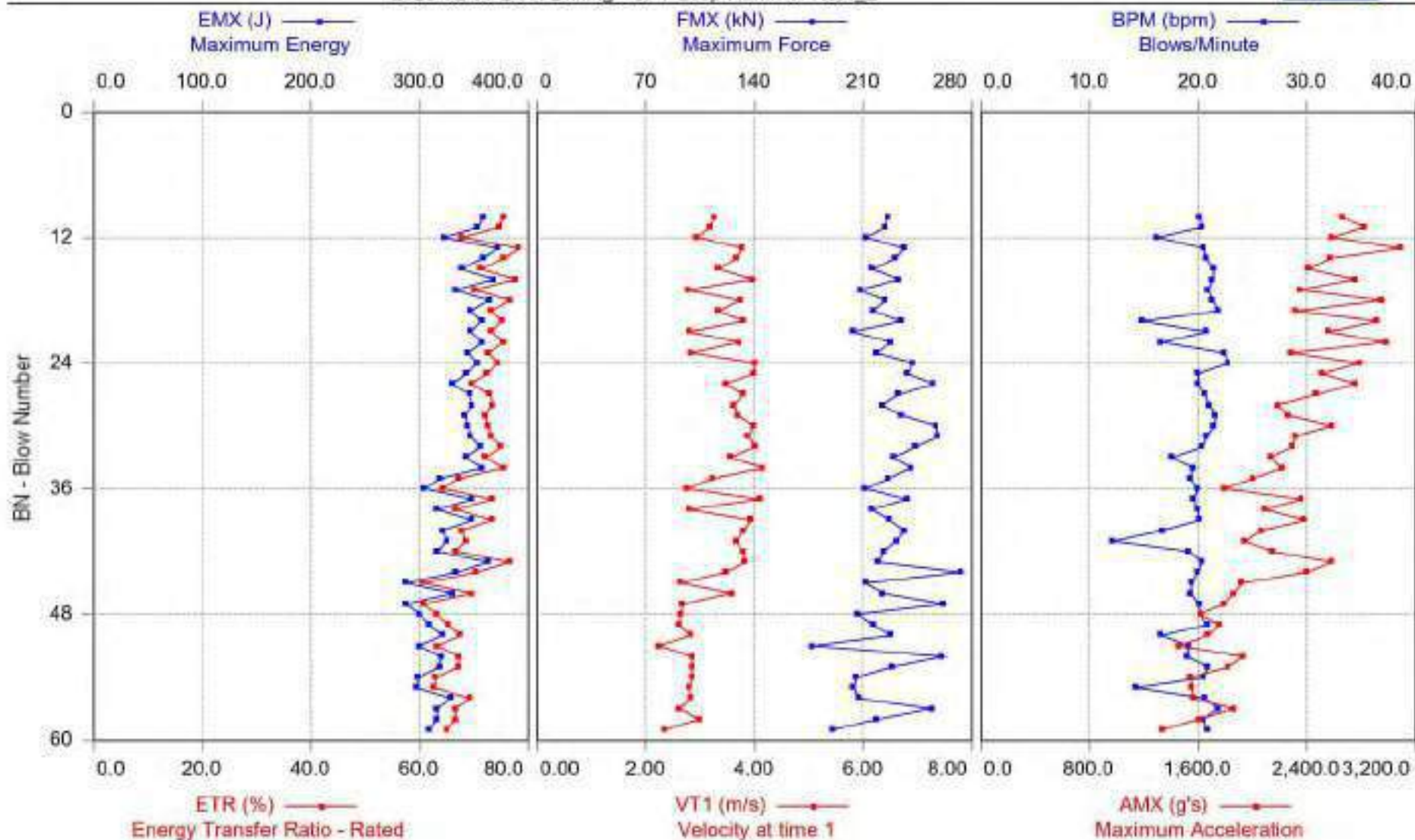
10-59 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 57 seconds 10:05 am - 10:08 am BN 1 - 59



2023-02-09 DCN Drilling - SPT Drop Hammer No.4_2



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5
 OP: RZ

BH04 Test 1 at 9m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 10.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
15	9.0	0	292.3	61.6	168	2.60	22.3	2,670	19	111.6	0.3
16	9.0	0	280.0	59.0	165	2.59	22.5	2,573	21	109.5	0.4
17	9.0	0	296.2	62.4	173	2.67	20.3	2,697	15	114.8	0.8
18	9.0	0	310.4	65.4	182	2.77	23.1	2,765	21	121.3	0.3
19	9.0	0	304.2	64.1	187	2.87	20.2	2,883	18	124.4	0.3
20	9.0	0	309.0	65.1	204	3.25	21.0	2,914	12	135.4	0.5
21	9.0	0	302.1	63.7	196	2.84	22.0	2,699	17	130.6	0.4
22	9.0	0	299.9	63.2	198	2.96	21.8	2,803	16	132.0	0.3
23	9.0	0	295.8	62.3	202	2.91	22.4	2,830	14	134.3	0.3
24	9.0	0	311.5	65.6	206	3.35	22.0	2,817	14	137.0	0.5
25	9.0	0	305.1	64.3	190	2.88	21.7	2,730	18	126.3	0.3
26	9.0	0	293.0	61.8	197	2.94	21.5	2,781	12	130.9	0.3
27	9.0	0	296.6	62.5	204	2.97	21.5	2,860	16	136.0	0.4
28	9.0	0	293.2	61.8	197	2.94	21.8	2,838	12	131.1	0.4
29	9.0	0	294.9	62.1	192	2.83	21.7	2,679	19	127.6	0.5
30	9.0	0	327.8	69.1	200	3.41	22.2	2,896	19	133.3	0.4
31	9.0	0	292.8	61.7	193	2.84	22.3	2,705	18	128.3	0.4
32	9.0	0	300.5	63.3	200	2.92	20.9	2,815	15	133.1	0.8
33	9.0	0	312.4	65.8	190	2.78	21.7	2,643	26	126.6	0.4
34	9.0	0	308.1	64.9	206	3.09	20.9	2,909	11	136.9	0.6
35	9.0	0	303.9	64.0	194	2.84	21.1	2,646	18	129.1	0.4
36	9.0	0	291.6	61.5	197	2.95	21.6	2,777	12	130.8	0.4
37	9.0	0	299.2	63.0	205	2.98	21.6	2,859	13	136.4	0.5
38	9.0	0	298.8	63.0	211	2.98	22.8	2,840	11	140.1	0.4
39	9.0	0	298.1	62.8	208	2.95	22.6	2,843	11	138.2	0.4
40	9.0	0	292.1	61.5	206	2.90	17.8	2,778	10	137.2	0.7
41	9.0	0	295.0	62.2	200	2.83	23.2	2,651	19	133.1	0.4
42	9.0	0	297.8	62.8	192	2.84	23.8	2,745	26	127.5	0.5
43	9.0	0	292.6	61.7	197	2.92	22.1	2,731	17	130.8	0.4
44	9.0	0	283.8	59.8	200	2.91	22.3	2,755	10	132.8	0.4
45	9.0	0	306.3	64.5	203	2.88	22.2	2,680	24	135.0	0.5
46	9.0	0	285.1	60.1	203	2.90	22.0	2,708	11	135.1	0.5
47	9.0	0	297.7	62.7	205	2.94	22.2	2,807	15	136.6	0.4
48	9.0	0	288.8	60.9	201	2.90	21.1	2,659	12	133.9	0.4
49	9.0	0	296.1	62.4	207	2.90	20.3	2,722	13	137.6	0.5
50	9.0	0	273.5	57.6	197	2.85	21.7	2,628	12	131.1	0.4
51	9.0	0	335.1	70.6	224	3.63	21.5	2,901	13	148.7	0.4
52	9.0	0	291.5	61.4	194	2.91	21.7	2,599	14	129.3	0.7
53	9.0	0	300.4	63.3	207	3.09	21.6	2,765	12	137.8	0.8
54	9.0	0	295.9	62.4	200	2.89	23.6	2,581	11	132.8	0.7
55	9.0	0	317.3	66.9	204	2.91	22.5	2,774	21	135.5	0.4
56	9.0	0	340.2	71.7	237	3.59	21.2	3,105	12	157.8	0.3
57	9.0	0	305.1	64.3	211	3.13	21.0	2,689	10	140.7	0.7
58	9.0	0	333.6	70.3	230	3.61	21.0	2,861	13	152.9	0.4
59	9.0	0	302.2	63.7	212	3.01	21.4	2,619	18	140.8	0.7
60	9.0	0	321.3	67.7	225	3.60	21.2	2,930	7	149.7	0.4
61	9.0	0	306.4	64.6	206	2.76	22.1	2,582	28	136.8	0.5
62	9.0	0	291.8	61.5	203	2.81	21.3	2,657	13	134.8	0.5
63	9.0	0	303.8	64.0	198	2.77	20.8	2,592	30	132.0	0.5
Average			301.4	63.5	200	2.97	21.7	2,755	16	133.4	0.5

Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5
OP: RZ

BH04 Test 1 at 9m
Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
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Total number of blows analyzed: 49

BL# Sensors

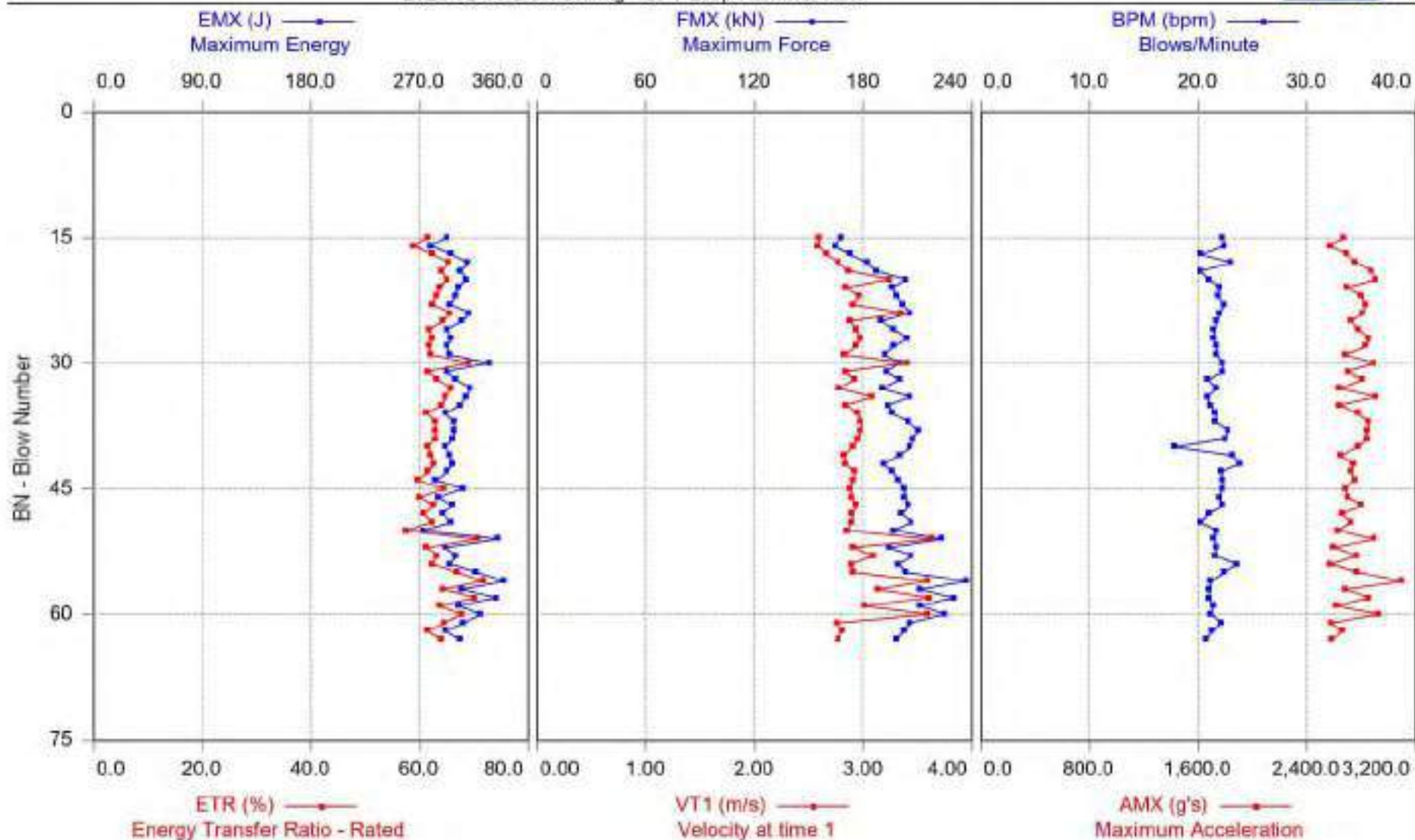
15-63 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 51 seconds 2:05 pm - 2:08 pm BN 1 - 63



2023-02-09 DCN Drilling - SPT Drop Hammer No.5



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5_1
 OP: RZ

BH04 Test 2 at 10.5m
 Date: 09-February-2023

AR: 15.03 cm² SP: 77.3 kN/m²
 LE: 12.2 m EM: 206,843 MPa
 WS: 5,123.0 m/s JC: 0.90

EMX: Maximum Energy AMX: Maximum Acceleration
 ETR: Energy Transfer Ratio - Rated DMX: Maximum Displacement
 FMX: Maximum Force CSX: Compression Stress Maximum
 VT1: Velocity at time 1 FVP: Force/Velocity Proportionality
 BPM: Blows/Minute

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
9	10.5	0	294.4	62.0	160	2.66	19.5	2,541	46	106.5	0.5
10	10.5	0	339.0	71.4	174	2.82	19.8	2,957	47	115.5	0.4
11	10.5	0	318.2	67.1	168	2.64	19.8	2,705	38	111.8	0.4
12	10.5	0	312.6	65.9	177	2.94	19.6	2,896	27	117.9	0.7
13	10.5	0	296.9	62.6	170	2.64	19.5	2,605	29	113.3	0.5
14	10.5	0	299.7	63.2	168	2.46	14.1	2,547	33	112.0	0.4
15	10.5	0	280.6	59.1	178	2.77	22.1	2,662	39	118.2	0.4
16	10.5	0	287.2	60.5	177	2.73	20.9	2,571	33	117.7	0.4
17	10.5	0	319.7	67.4	183	2.81	19.4	2,806	34	121.8	0.5
18	10.5	0	270.1	56.9	180	2.78	20.9	2,743	28	120.1	0.4
19	10.5	0	320.7	67.6	190	2.96	19.7	2,978	36	126.7	0.4
20	10.5	0	280.8	59.2	178	2.78	21.5	2,650	34	118.2	0.5
21	10.5	0	321.8	67.8	187	3.28	16.4	2,812	25	124.5	0.6
22	10.5	0	316.1	66.6	192	2.94	21.1	2,620	28	127.8	0.8
23	10.5	0	315.1	66.4	189	2.77	14.8	2,698	32	125.5	0.7
24	10.5	0	311.7	65.7	195	2.87	20.8	2,760	29	129.5	0.8
25	10.5	0	288.5	60.8	190	2.82	19.8	2,665	19	126.4	0.4
26	10.5	0	284.7	60.0	192	2.84	21.2	2,683	20	127.5	0.4
27	10.5	0	285.6	60.2	195	2.87	19.3	2,691	16	130.0	0.4
28	10.5	0	280.4	59.1	195	2.81	20.5	2,647	17	130.0	0.5
29	10.5	0	301.1	63.5	196	2.78	20.2	2,557	20	130.5	0.4
30	10.5	0	301.1	63.5	205	3.10	19.9	2,775	15	136.1	0.6
31	10.5	0	287.3	60.6	192	2.76	20.8	2,591	28	127.7	0.4
32	10.5	0	299.6	63.1	202	3.01	20.1	2,713	17	134.4	0.7
33	10.5	0	317.7	66.9	201	3.25	20.6	2,633	20	133.9	0.7
34	10.5	0	292.7	61.7	196	2.84	20.7	2,712	15	130.2	0.7
35	10.5	0	294.2	62.0	204	2.99	15.8	2,642	16	135.8	0.8
36	10.5	0	279.7	58.9	199	2.76	21.0	2,548	15	132.6	0.4
37	10.5	0	310.7	65.5	195	3.06	16.3	2,662	24	129.6	0.8
Average			300.3	63.3	187	2.85	19.5	2,692	27	124.5	0.5

Total number of blows analyzed: 29

BL# Sensors

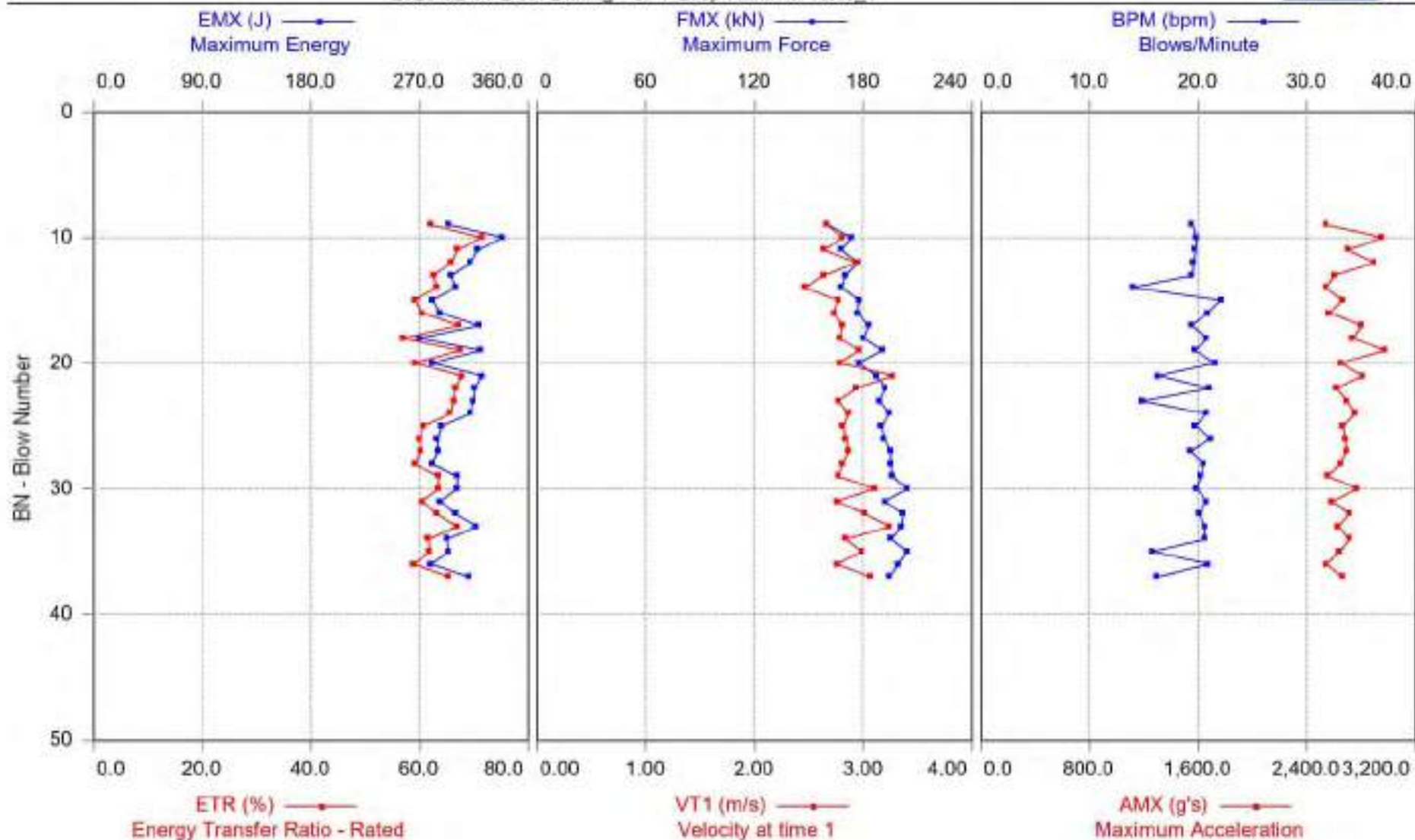
9-37 F1: [580NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
 A4: [K12865] 430.9 (1.00)

Time Summary

Drive 1 minute 51 seconds 2:38 pm - 2:40 pm BN 1 - 37



2023-02-09 DCN Drilling - SPT Drop Hammer No.5_1



Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5_2
 OP: RZ

BH04 Test 3 at 12m
 Date: 09-February-2023

AR: 15.03 cm²
 LE: 13.7 m
 WS: 5,123.0 m/s

SP: 77.3 kN/m²
 EM: 206,843 MPa
 JC: 0.90

EMX: Maximum Energy
 ETR: Energy Transfer Ratio - Rated
 FMX: Maximum Force
 VT1: Velocity at time 1
 BPM: Blows/Minute

AMX: Maximum Acceleration
 DMX: Maximum Displacement
 CSX: Compression Stress Maximum
 FVP: Force/Velocity Proportionality

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
10	12.0	0	313.0	66.0	199	2.99	20.2	2,997	33	132.7	0.4
11	12.0	0	312.5	65.9	191	2.93	21.9	2,933	26	126.9	0.4
12	12.0	0	308.5	65.0	193	2.96	19.5	2,999	26	128.2	0.4
13	12.0	0	289.0	60.9	186	2.88	20.1	2,838	25	123.6	0.4
14	12.0	0	283.8	59.8	194	2.86	18.9	2,765	25	128.8	0.5
15	12.0	0	291.0	61.3	195	2.83	19.6	2,774	27	129.4	0.5
16	12.0	0	308.0	64.9	200	2.89	19.4	2,881	35	133.1	0.5
17	12.0	0	307.3	64.8	200	2.98	19.5	2,968	35	132.9	0.5
18	12.0	0	295.6	62.3	203	2.91	19.8	2,825	36	135.1	0.5
19	12.0	0	325.8	68.7	199	3.00	20.9	2,939	35	132.5	0.4
20	12.0	0	295.5	62.3	187	2.88	16.5	2,837	18	124.7	0.4
21	12.0	0	299.2	63.1	181	2.84	19.2	2,758	20	120.7	0.8
22	12.0	0	303.3	63.9	198	2.88	20.0	2,793	31	131.7	0.6
23	12.0	0	307.7	64.8	203	2.95	19.5	2,874	25	135.3	0.7
24	12.0	0	296.5	62.5	203	2.95	21.0	2,833	30	135.3	0.4
25	12.0	0	314.8	66.3	206	2.97	12.6	2,890	23	137.2	0.5
26	12.0	0	304.0	64.1	189	3.26	19.1	2,823	13	125.7	0.6
27	12.0	0	321.8	67.8	193	3.27	19.9	2,897	13	128.4	0.7
28	12.0	0	329.4	69.4	192	3.29	19.8	2,972	16	127.5	0.8
29	12.0	0	314.0	66.2	208	3.40	19.2	3,069	14	138.2	0.5
30	12.0	0	303.7	64.0	197	3.12	19.3	2,789	13	130.8	0.6
31	12.0	0	309.1	65.1	210	3.18	19.7	2,987	13	139.5	0.6
32	12.0	0	290.4	61.2	200	2.82	19.7	2,733	20	133.0	0.5
33	12.0	0	291.3	61.4	185	2.52	18.2	2,603	29	122.8	0.4
34	12.0	0	292.4	61.6	191	2.98	20.5	2,743	15	126.9	0.8
35	12.0	0	308.4	65.0	197	2.85	21.0	2,837	25	131.0	0.5
36	12.0	0	318.7	67.2	202	2.89	17.3	2,829	38	134.7	0.4
37	12.0	0	310.5	65.4	206	2.96	21.5	2,838	20	137.1	0.5
38	12.0	0	315.8	66.5	202	2.91	19.7	2,889	23	134.7	0.5
39	12.0	0	309.3	65.2	204	2.98	21.0	3,013	15	135.7	0.5
40	12.0	0	308.9	65.1	208	2.96	20.4	2,918	24	138.2	0.5
41	12.0	0	310.3	65.4	201	2.94	19.8	2,800	28	133.5	0.5
42	12.0	0	277.8	58.5	192	2.88	19.5	2,650	24	127.6	0.5
43	12.0	0	308.1	64.9	201	2.93	19.6	2,879	26	133.6	0.5
44	12.0	0	309.5	65.2	194	3.10	20.1	3,028	15	129.0	0.7
45	12.0	0	315.8	66.5	188	3.13	17.1	2,750	18	125.0	0.8
46	12.0	0	324.1	68.3	208	3.35	20.7	3,011	23	138.6	0.6
47	12.0	0	296.9	62.6	195	2.87	19.1	2,895	16	129.6	0.5
48	12.0	0	316.8	66.8	199	3.07	20.0	2,935	18	132.2	0.8
49	12.0	0	323.5	68.2	210	3.30	19.4	3,144	23	139.7	0.6
50	12.0	0	330.3	69.6	224	3.67	19.5	3,098	17	149.0	0.4
51	12.0	0	307.0	64.7	214	3.29	20.1	2,844	17	142.1	0.6
52	12.0	0	310.2	65.4	196	2.80	20.8	2,724	21	130.5	0.5
53	12.0	0	328.2	69.2	203	3.27	19.2	2,830	24	134.9	0.7
54	12.0	0	328.1	69.1	219	3.53	19.8	3,162	14	146.0	0.5
55	12.0	0	312.5	65.9	203	2.99	19.5	2,808	21	134.8	0.8
56	12.0	0	306.5	64.6	203	3.00	19.0	2,954	17	134.8	0.6
57	12.0	0	327.3	69.0	200	2.85	20.1	2,754	30	132.7	0.4
Average			308.6	65.0	199	3.02	19.5	2,877	23	132.6	0.6

Total number of blows analyzed: 48

Case Method & ICAP® Results

2023-02-09 DCN Drilling - SPT Drop Hammer No.5_2
OP: RZ

BH04 Test 3 at 12m
Date: 09-February-2023

BL#	Depth m	BLC bl/m	EMX J	ETR (%)	FMX kN	VT1 m/s	BPM bpm	AMX g's	DMX mm	CSX MPa	FVP
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BL# Sensors

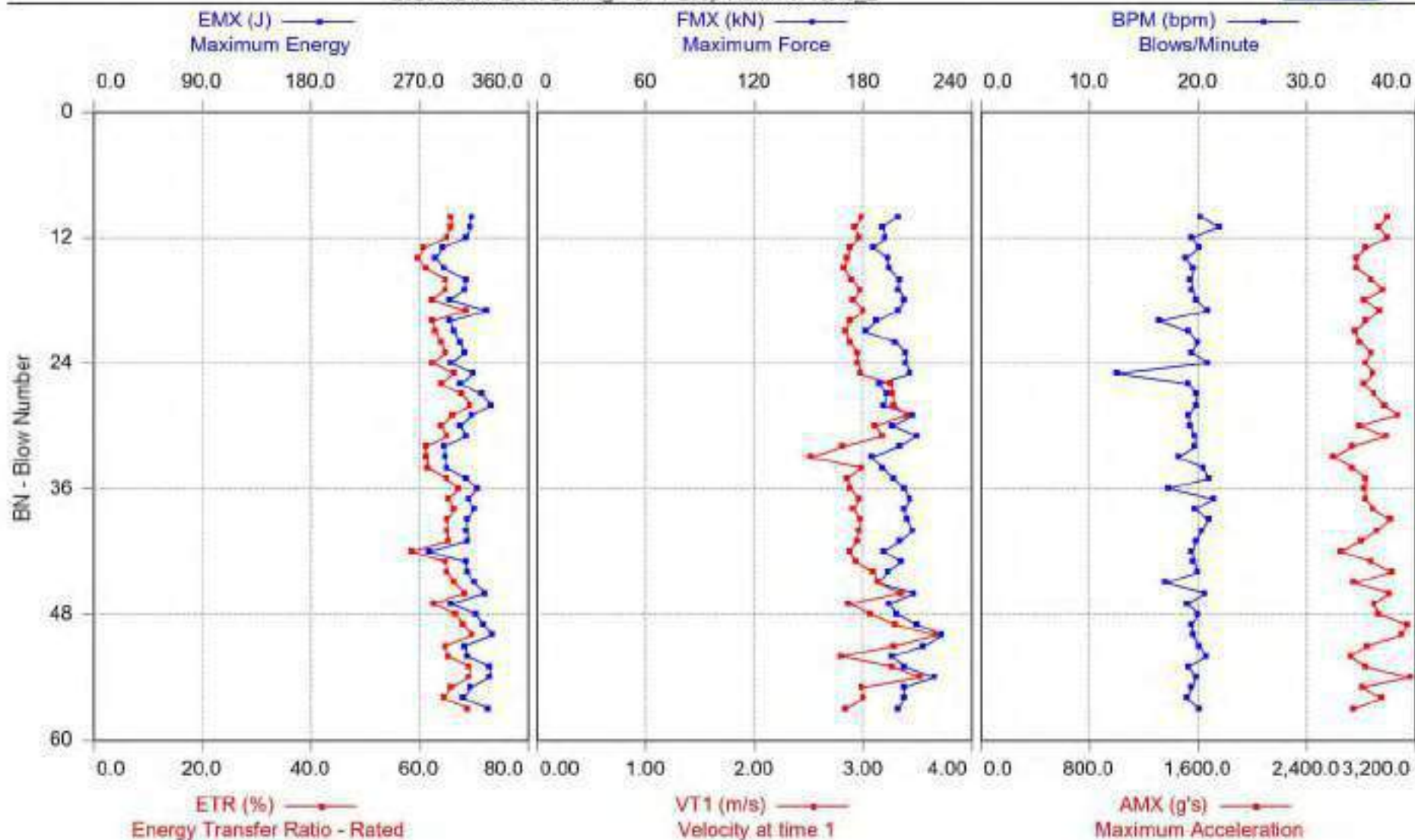
10-57 F1: [680NW1] 229.4 (1.00); F2: [680NW2] 230.0 (1.00); A3: [K12864] 416.1 (1.00);
A4: [K12865] 430.9 (1.00)

Time Summary

Drive 2 minutes 52 seconds 3:04 pm - 3:06 pm BN 1 - 57



2023-02-09 DCN Drilling - SPT Drop Hammer No.5_2





Appendix C

Representative Force and Velocity Plots

Roc Consulting Limited

2023-02-09 DCN Drilling

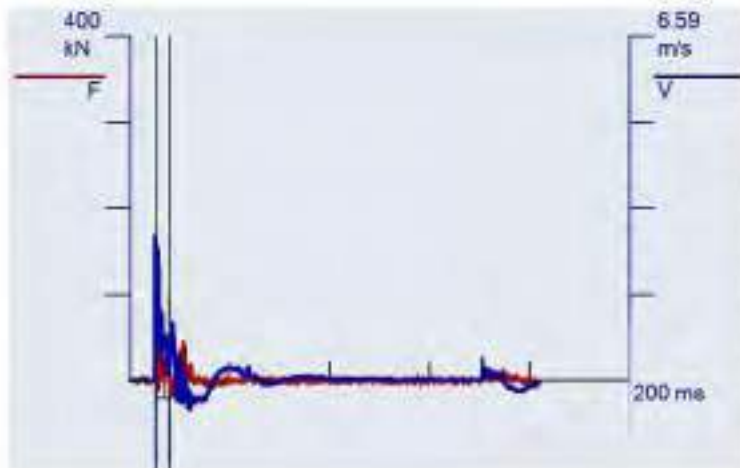
SPT Drop Hammer No.1

BH02 Test 1 at 13.5m

PDA Operator: RZ

Pile Driving Analyzer ® (PDA)

Version: 2022.35.2

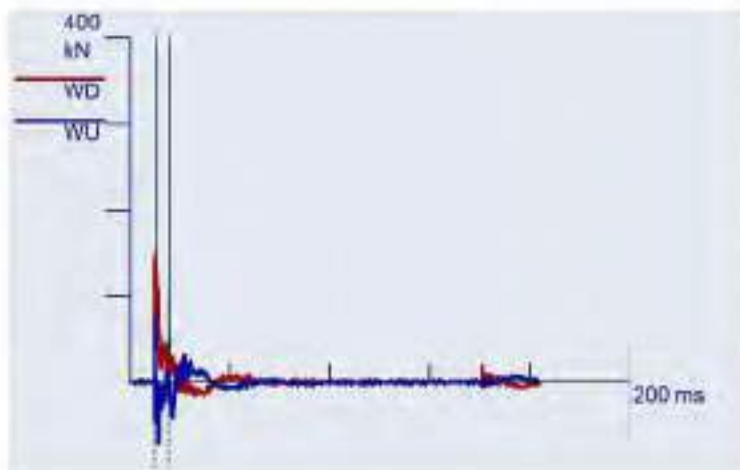


BN 36
09Feb2023 12:18:02 pm

CSX 113.2 MPa
DMX 8 mm
EFV 300 J
ETR 63.2 %
BPM 20.7 bpm
RAT 0.3
VMX 2.77 m/s
FMX 170 kN
DFN 7 mm
MEX 547 µE
EMX 300 J

LE 15.2 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kNm³
WS 5123.0 m/s
WC 5117.8 m/s
JC 0.90
JF 1.00

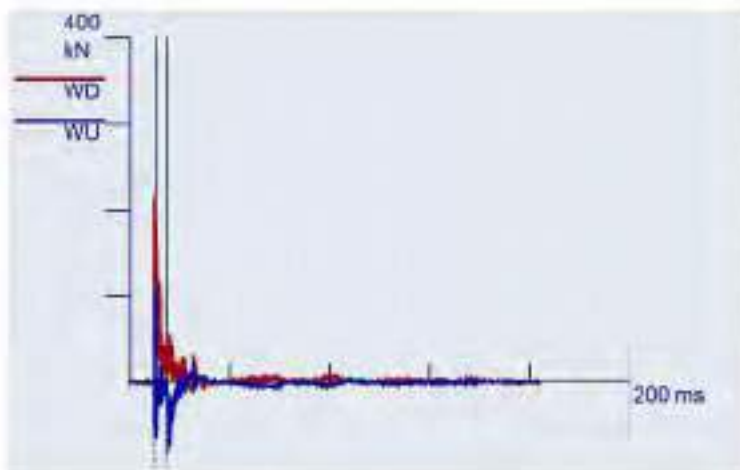
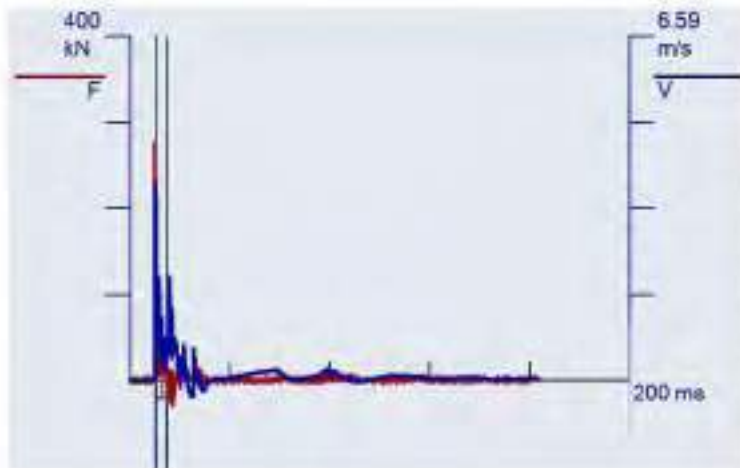
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



Roc Consulting Limited

2023-02-09 DCN Drilling
 SPT Drop Hammer No.4_1
 BH01 Test 2 at 10.5m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2



BN 40
 09Feb2023 09:37:48 am

CSX 184.4 MPa
 DMX 16 mm
 EFV 361 J
 ETR 76.2 %
 BPM 19.9 bpm
 RAT 1.1
 VMX 3.84 m/s
 FMX 277 kN
 DFN 16 mm
 MEX 891 µE
 EMX 361 J

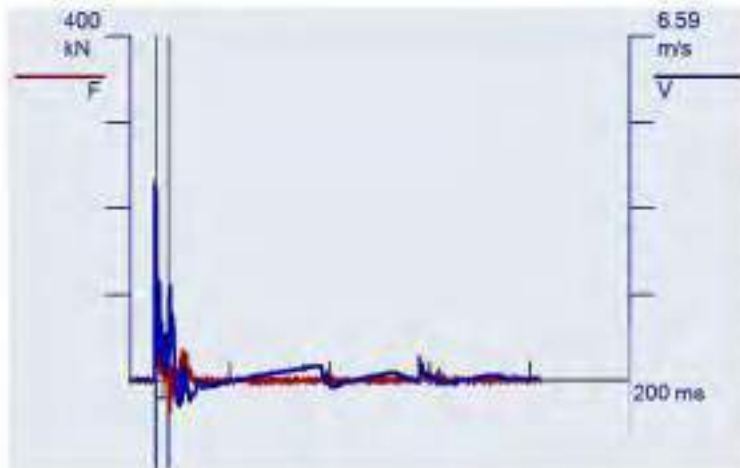
LE 12.2 m
 AR 15.03 cm²
 EM 206843 MPa
 SP 77.3 kN/m³
 WS 5123.0 m/s
 WC 5104.6 m/s
 JC 0.90
 JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

Roc Consulting Limited

2023-02-09 DCN Drilling
 SPT Drop Hammer No.4_2
 BH01 Test 3 at 12m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2

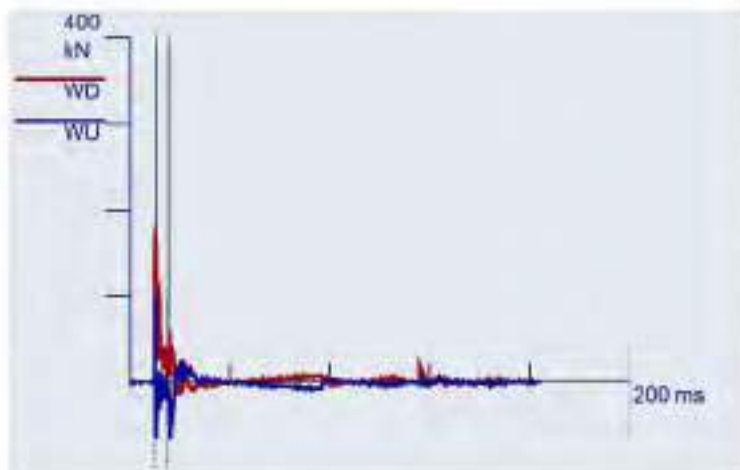


BN 41
 09Feb2023 10:07:22 am

CSX 153.9 MPa
 DMX 13 mm
 EFV 325 J
 ETR 68.5 %
 BPM 12.2 bpm
 RAT 1.1
 VMX 3.66 m/s
 FMX 231 kN
 DFN 13 mm
 MEX 744 µE
 EMX 325 J

LE 13.7 m
 AR 15.03 cm²
 EM 206843 MPa
 SP 77.3 kNm³
 WS 5123.0 m/s
 WC 5111.9 m/s
 JC 0.90
 JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



Roc Consulting Limited

2023-02-09 DCN Drilling

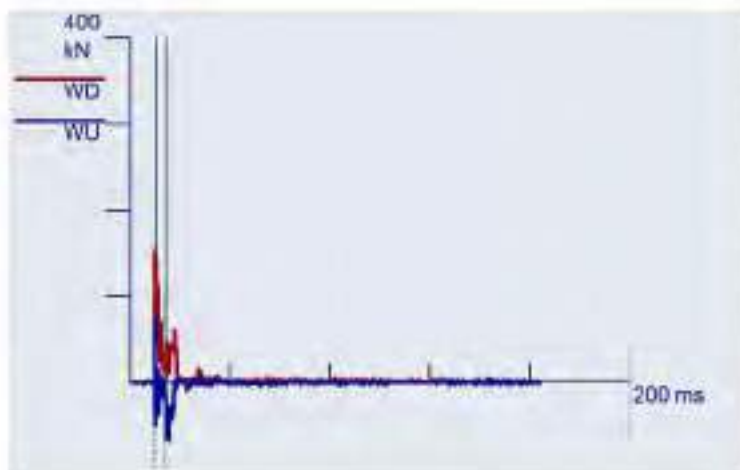
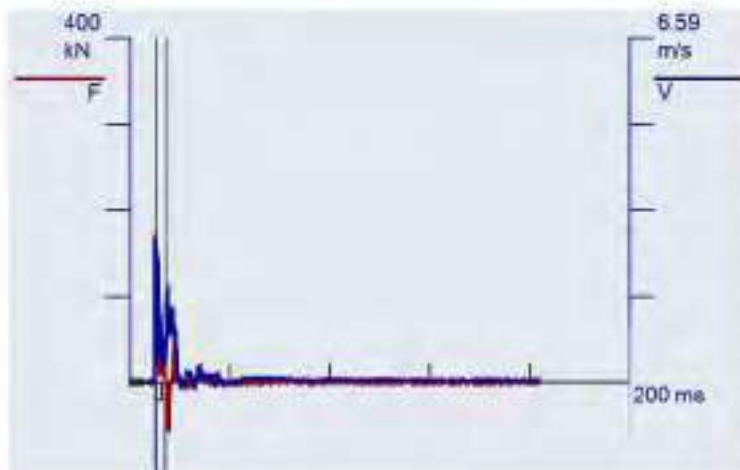
SPT Drop Hammer No.5

BH04 Test 1 at 9m

PDA Operator: RZ

File Driving Analyzer ® (PDA)

Version: 2022.35.2



BN 17
09Feb2023 02:05:43 pm

CSX 114.8 MPa
DMX 15 mm
EFV 296 J
ETR 62.4 %
BPM 20.3 bpm
RAT 1.1
VMX 2.67 m/s
FMX 173 kN
DFN 15 mm
MEX 555 µE
EMX 296 J

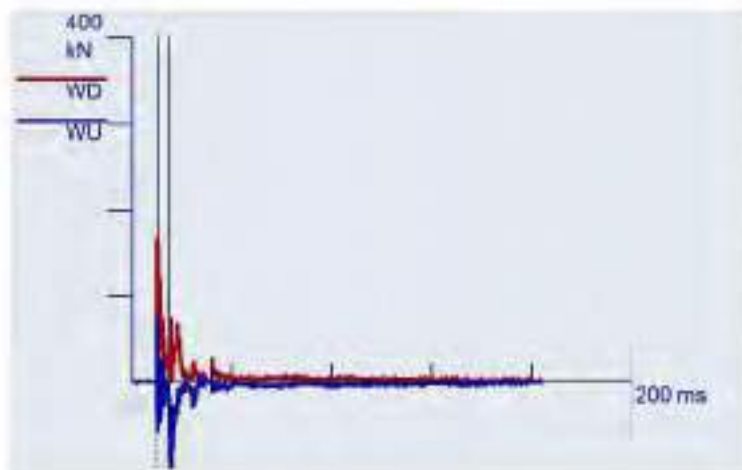
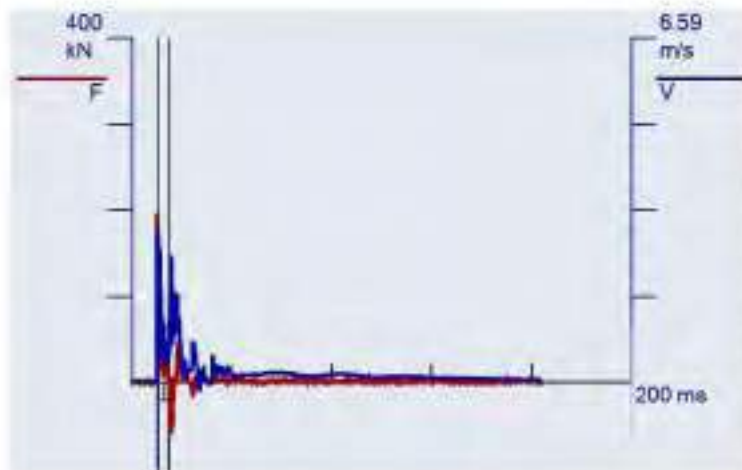
LE 10.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling
 SPT Drop Hammer No.5_1
 BH04 Test 2 at 10.5m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2



BN 24
 09Feb2023 02:40:02 pm

CSX 129.5 MPa
 DMX 29 mm
 EFV 312 J
 ETR 65.7 %
 BPM 20.8 bpm
 RAT 1.1
 VMX 2.87 m/s
 FMX 195 kN
 DFN 29 mm
 MEX 626 µE
 EMX 312 J

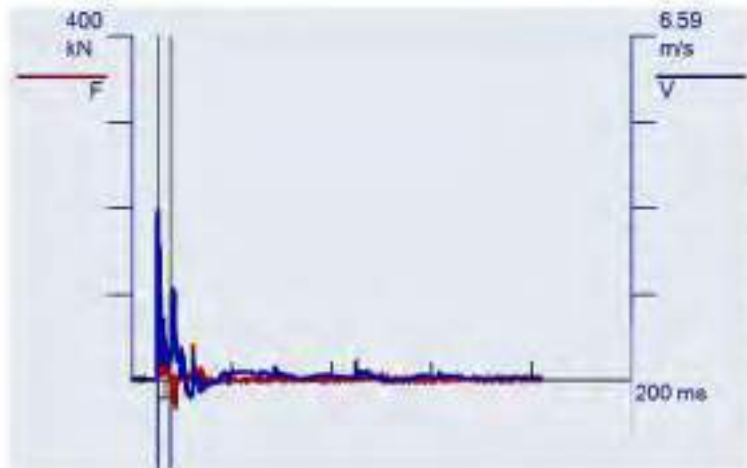
LE 12.2 m
 AR 15.03 cm²
 EM 206843 MPa
 SP 77.3 kNm³
 WS 5123.0 m/s
 WC 5104.6 m/s
 JC 0.90
 JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling
 SPT Drop Hammer No.5_2
 BH04 Test 3 at 12m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2

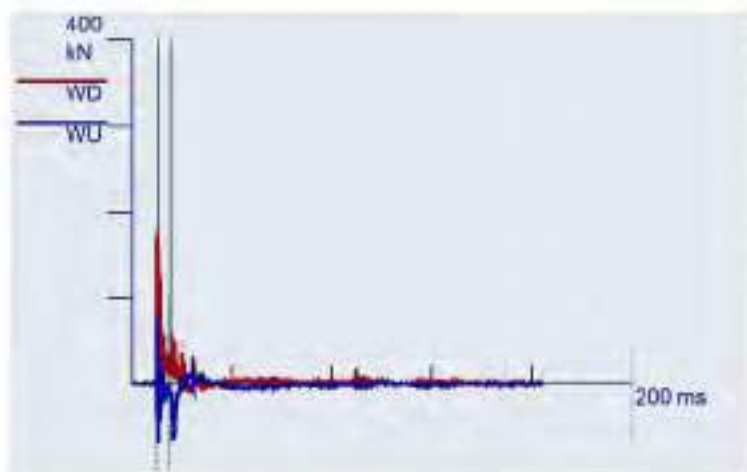


BN 28
 09Feb2023 03:05:25 pm

CSX 127.5 MPa
 DMX 16 mm
 EFV 329 J
 ETR 69.4 %
 BPM 19.8 bpm
 RAT 1.1
 VMX 3.29 m/s
 FMX 192 kN
 DFN 16 mm
 MEX 616 µE
 EMX 329 J

LE 13.7 m
 AR 15.03 cm²
 EM 206843 MPa
 SP 77.3 kNm³
 WS 5123.0 m/s
 WC 5111.9 m/s
 JC 0.90
 JF 1.00

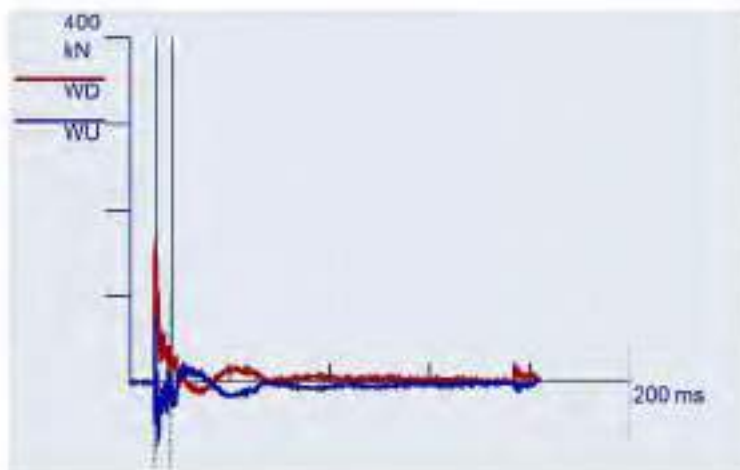
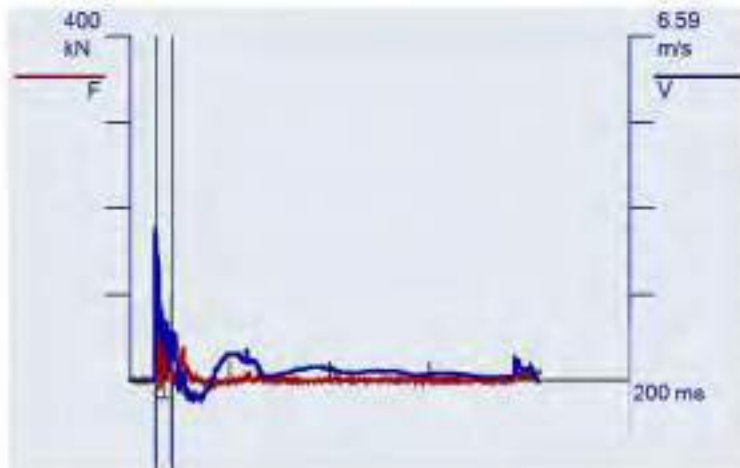
F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
 SPT Drop Hammer No.1_1
 BH02 Test 2 at 15m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2



BN 50
 09Feb2023 12:57:01 pm

CSX 109.9 MPa
 DMX 29 mm
 EFV 341 J
 ETR 71.9 %
 BPM 21.3 bpm
 RAT 0.3
 VMX 2.93 m/s
 FMX 165 kN
 DFN 27 mm
 MEX 531 μ E
 EMX 341 J

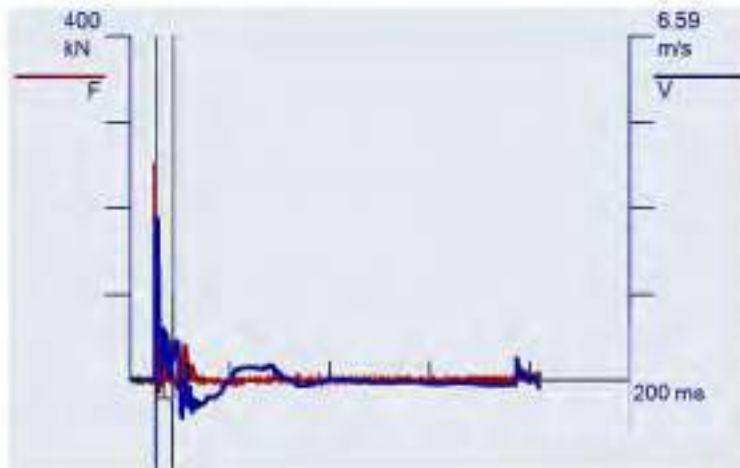
LE 16.7 m
 AR 15.03 cm^2
 EM 206843 MPa
 SP 77.3 kNm^3
 WS 5123.0 m/s
 WC 5122.7 m/s
 JC 0.90
 JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling
 SPT Drop Hammer No.1_2
 BH02 Test 3 at 16.5m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2

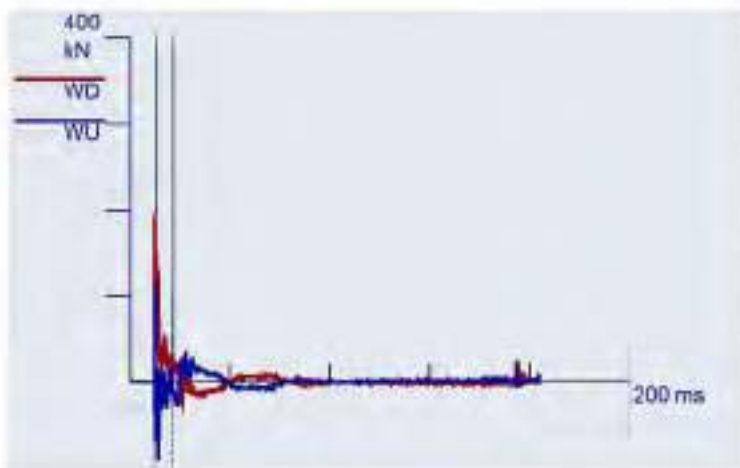


BN 38
 09Feb2023 01:32:11 pm

CSX 168.4 MPa
 DMX 8 mm
 EFV 326 J
 ETR 68.7 %
 BPM 21.1 bpm
 RAT 0.2
 VMX 3.13 m/s
 FMX 253 kN
 DFN -3 mm
 MEX 814 µE
 EMX 326 J

LE 18.2 m
 AR 15.03 cm²
 EM 206843 MPa
 SP 77.3 kNm³
 WS 5123.0 m/s
 WC 5112.4 m/s
 JC 0.90
 JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling

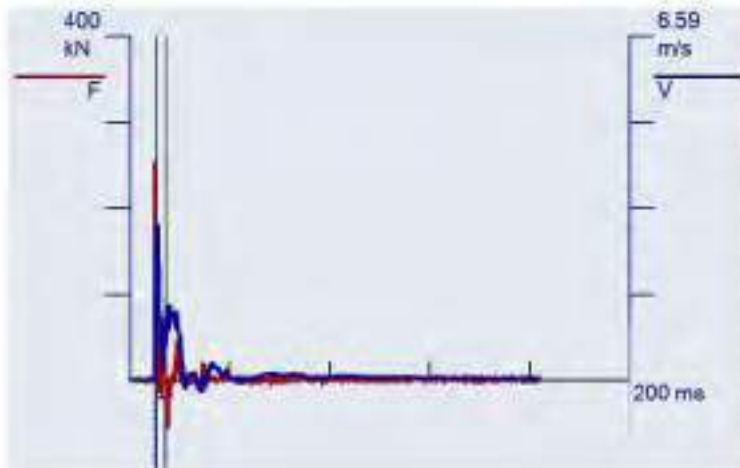
SPT Drop Hammer No.2

BH02 Test 1 at 9m

PDA Operator: RZ

File Driving Analyzer ® (PDA)

Version: 2022.35.2

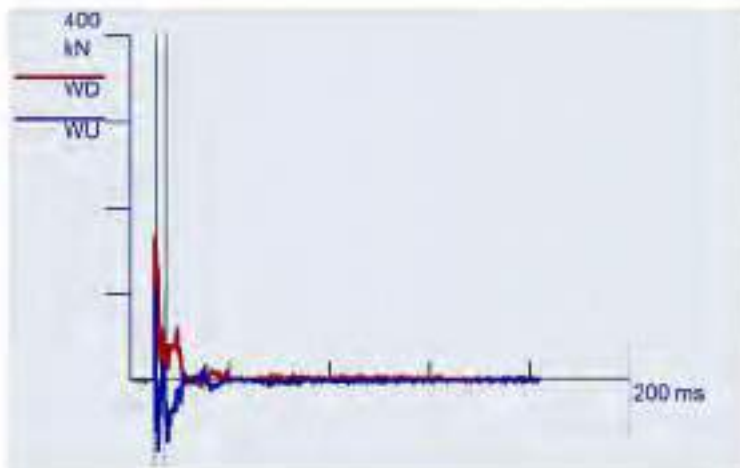


BN 17
09Feb2023 10:17:26 am

CSX 169.3 MPa
DMX 21 mm
EFV 317 J
ETR 66.8 %
BPM 18.8 bpm
RAT 0.3
VMX 3.03 m/s
FMX 254 kN
DFN 21 mm
MEX 818 μ E
EMX 317 J

LE 10.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

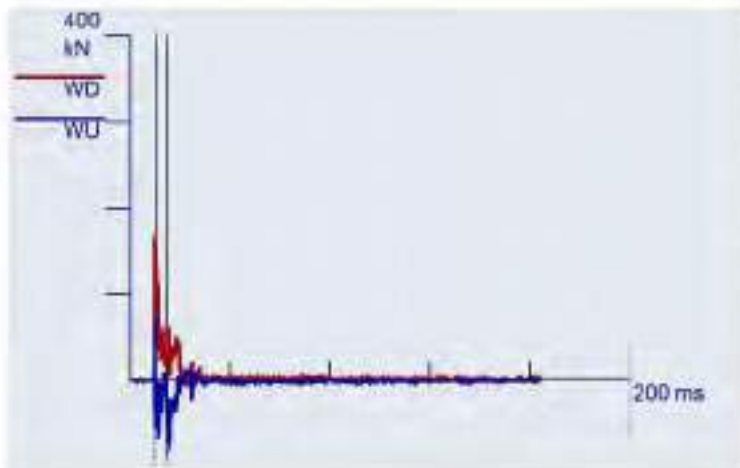
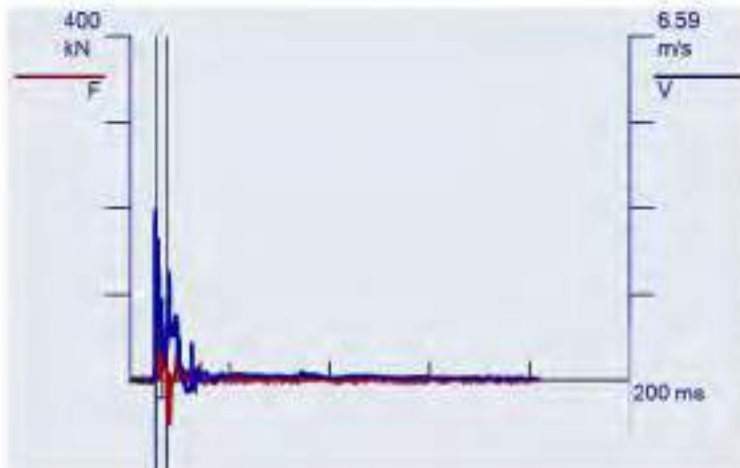
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
 SPT Drop Hammer No.2_1
 BH02 Test 2 at 10.5m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2



BN 21
 09Feb2023 10:46:12 am

CSX 125.3 MPa
 DMX 19 mm
 EFV 341 J
 ETR 71.9 %
 BPM 22.4 bpm
 RAT 0.3
 VMX 3.28 m/s
 FMX 188 kN
 DFN 19 mm
 MEX 606 µE
 EMX 341 J

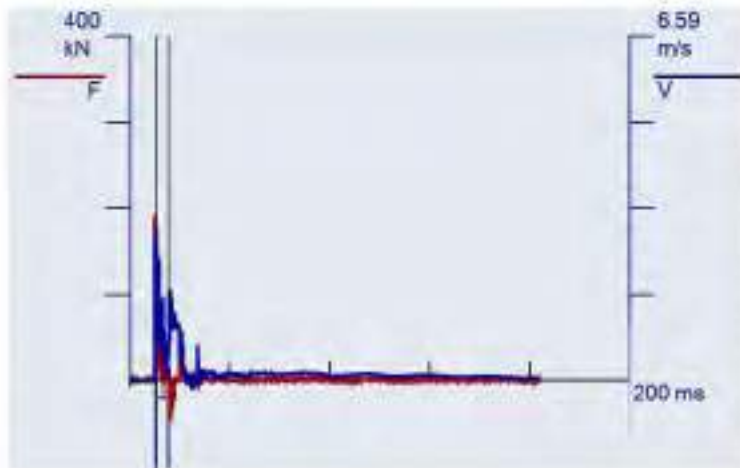
LE 12.2 m
 AR 15.03 cm²
 EM 206843 MPa
 SP 77.3 kN/m³
 WS 5123.0 m/s
 WC 5104.6 m/s
 JC 0.90
 JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1

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2023-02-09 DCN Drilling
SPT Drop Hammer No.2_2
BH02 Test 3 at 12m
PDA Operator: RZ

File Driving Analyzer ® (PDA)
Version: 2022.35.2

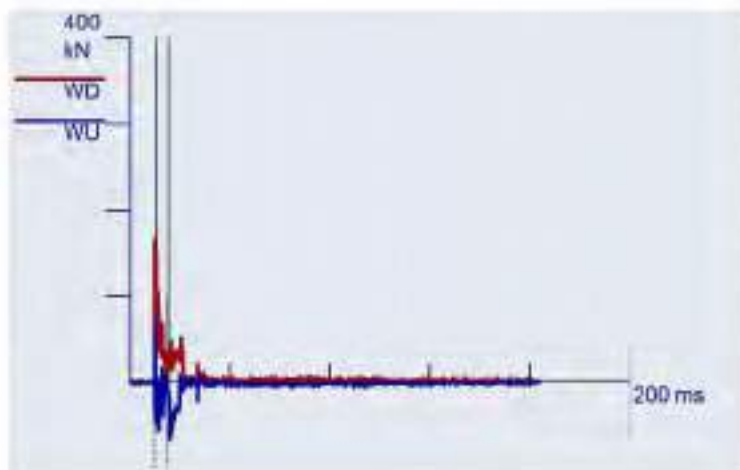


BN 19
09Feb2023 11:19:04 am

CSX 127.9 MPa
DMX 25 mm
EFV 319 J
ETR 67.2 %
BPM 21.6 bpm
RAT 0.6
VMX 2.82 m/s
FMX 192 kN
DFN 25 mm
MEX 618 µE
EMX 319 J

LE 13.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kNm³
WS 5123.0 m/s
WC 5111.9 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling

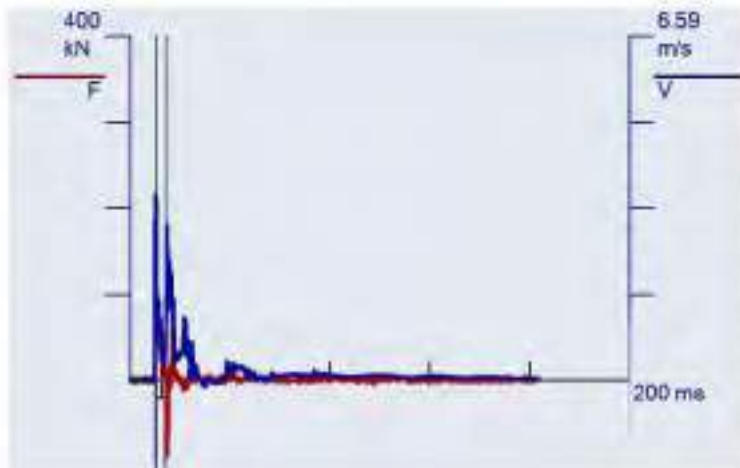
SPT Drop Hammer No.3

BH03 Test 1 at 9m

PDA Operator: RZ

File Driving Analyzer ® (PDA)

Version: 2022.35.2

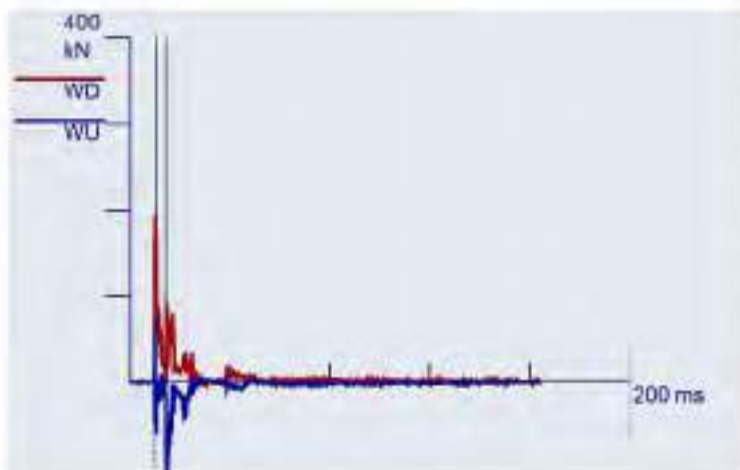


BN 15
09Feb2023 11:35:44 am

CSX 124.9 MPa
DMX 25 mm
EFV 355 J
ETR 74.7 %
BPM 21.2 bpm
RAT 1.1
VMX 3.58 m/s
FMX 188 kN
DFN 25 mm
MEX 604 μ E
EMX 355 J

LE 10.7 m
AR 15.03 cm^2
EM 206843 MPa
SP 77.3 kN/m^3
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

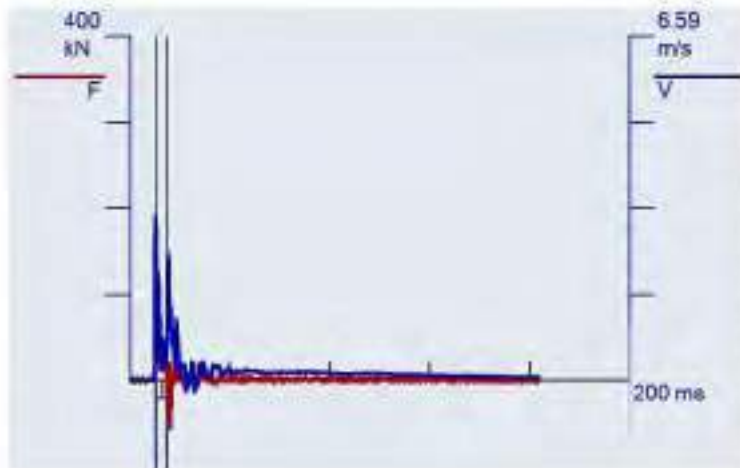
F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
 SPT Drop Hammer No.3_1
 BH03 Test 2 at 10.5m
 PDA Operator: RZ

File Driving Analyzer ® (PDA)
 Version: 2022.35.2

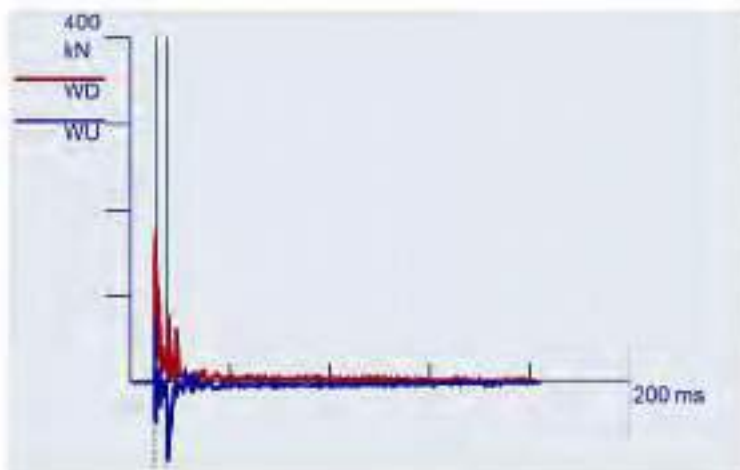


BN 30
 09Feb2023 12:05:14 pm

CSX 110.4 MPa
 DMX 26 mm
 EFV 309 J
 ETR 65.1 %
 BPM 20.3 bpm
 RAT 1.1
 VMX 3.16 m/s
 FMX 166 kN
 DFN 26 mm
 MEX 534 μ E
 EMX 309 J

LE 12.2 m
 AR 15.03 cm^2
 EM 206843 MPa
 SP 77.3 kNm^3
 WS 5123.0 m/s
 WC 5104.6 m/s
 JC 0.90
 JF 1.00

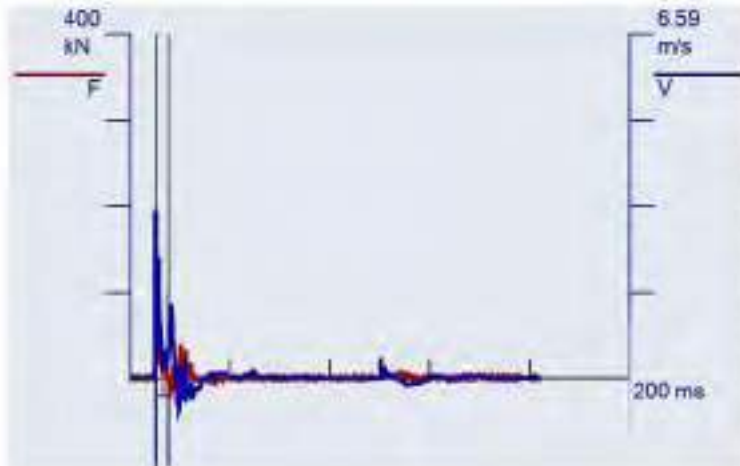
F1: [680NW1] 229.44 PDICAL (1) FF1
 F2: [680NW2] 230 PDICAL (1) FF1
 A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
 A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling
SPT Drop Hammer No.3_2
BH03 Test 3 at 12m
PDA Operator: RZ

File Driving Analyzer ® (PDA)
Version: 2022.35.2

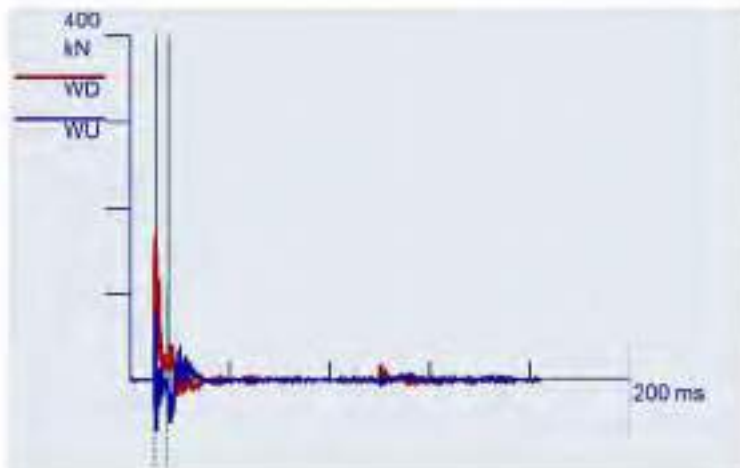


BN 39
09Feb2023 12:29:12 pm

CSX 129.2 MPa
DMX 7 mm
EFV 300 J
ETR 63.2 %
BPM 20.4 bpm
RAT 1.1
VMX 3.14 m/s
FMX 194 kN
DFN 5 mm
MEX 624 µE
EMX 300 J

LE 13.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kNm³
WS 5123.0 m/s
WC 5111.9 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



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2023-02-09 DCN Drilling

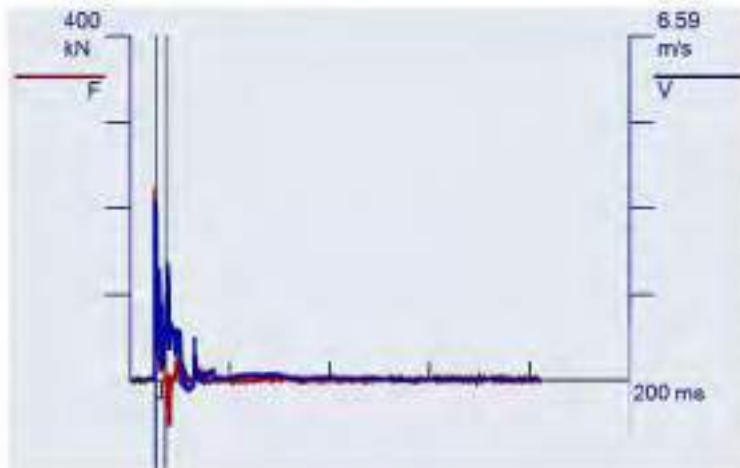
SPT Drop Hammer No.4

BH01 Test 1 at 9m

PDA Operator: RZ

Pile Driving Analyzer ® (PDA)

Version: 2022.35.2

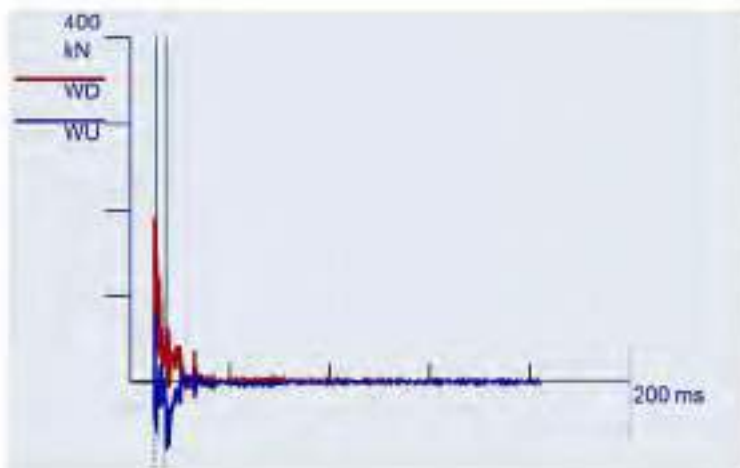


BN 31
09Feb2023 09:11:00 am

CSX 148.6 MPa
DMX 16 mm
EFV 371 J
ETR 78.1 %
BPM 19.9 bpm
RAT 1.1
VMX 3.46 m/s
FMX 223 kN
DFN 16 mm
MEX 719 μ E
EMX 371 J

LE 10.7 m
AR 15.03 cm²
EM 206843 MPa
SP 77.3 kN/m³
WS 5123.0 m/s
WC 5119.6 m/s
JC 0.90
JF 1.00

F1: [680NW1] 229.44 PDICAL (1) FF1
F2: [680NW2] 230 PDICAL (1) FF1
A3 (PR): [K12864] 416.07 mv/6.4v/5000g (1) VF1
A4 (PR): [K12865] 430.944 mv/6.4v/5000g (1) VF1



Appendix F5

Telemetered Groundwater Data Plots

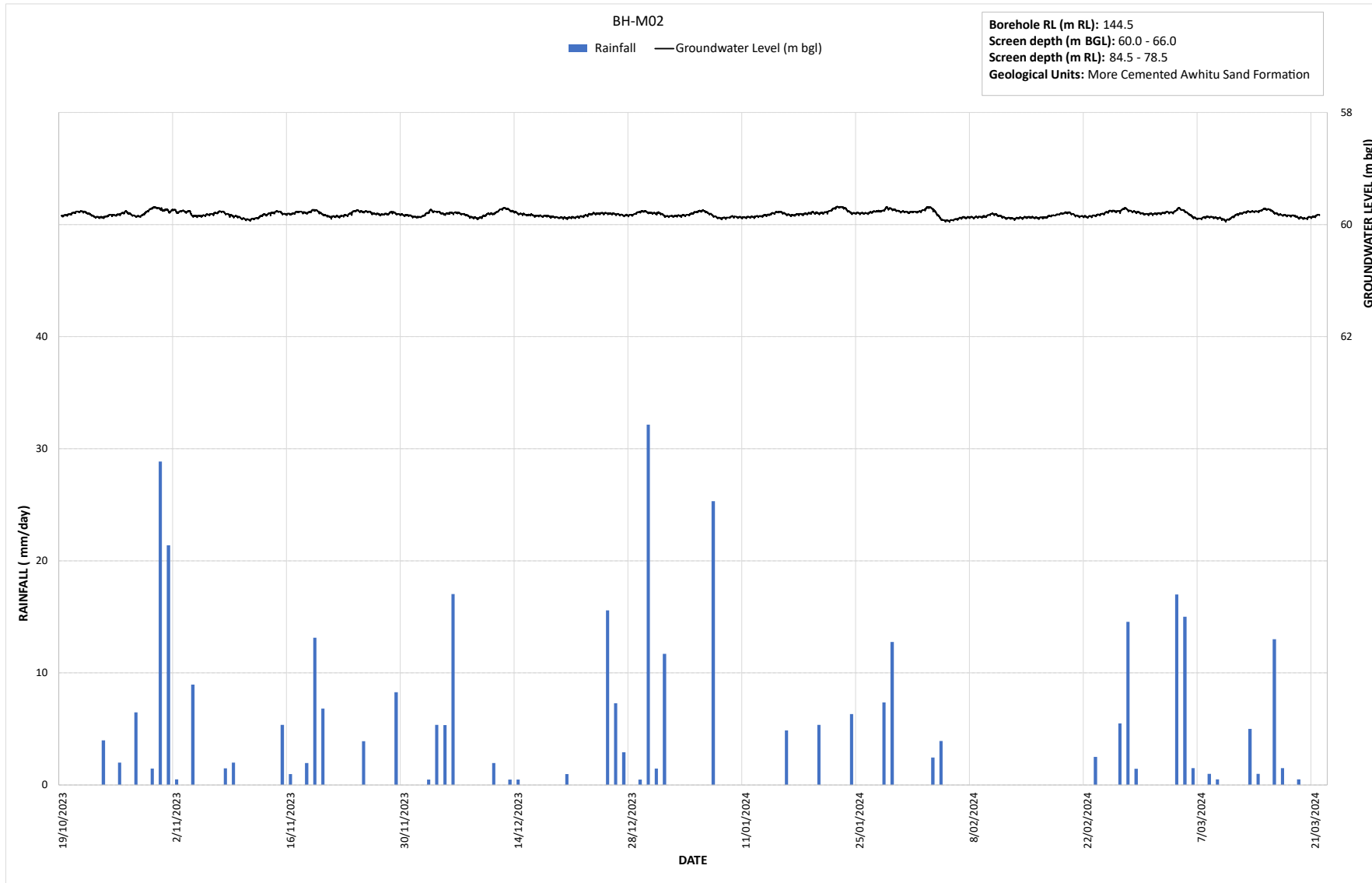


Figure F5-1: Plot of rainfall and telemetered groundwater data from BH-M02. Rainfall data sourced from Auckland Council's Environmental Data Portal

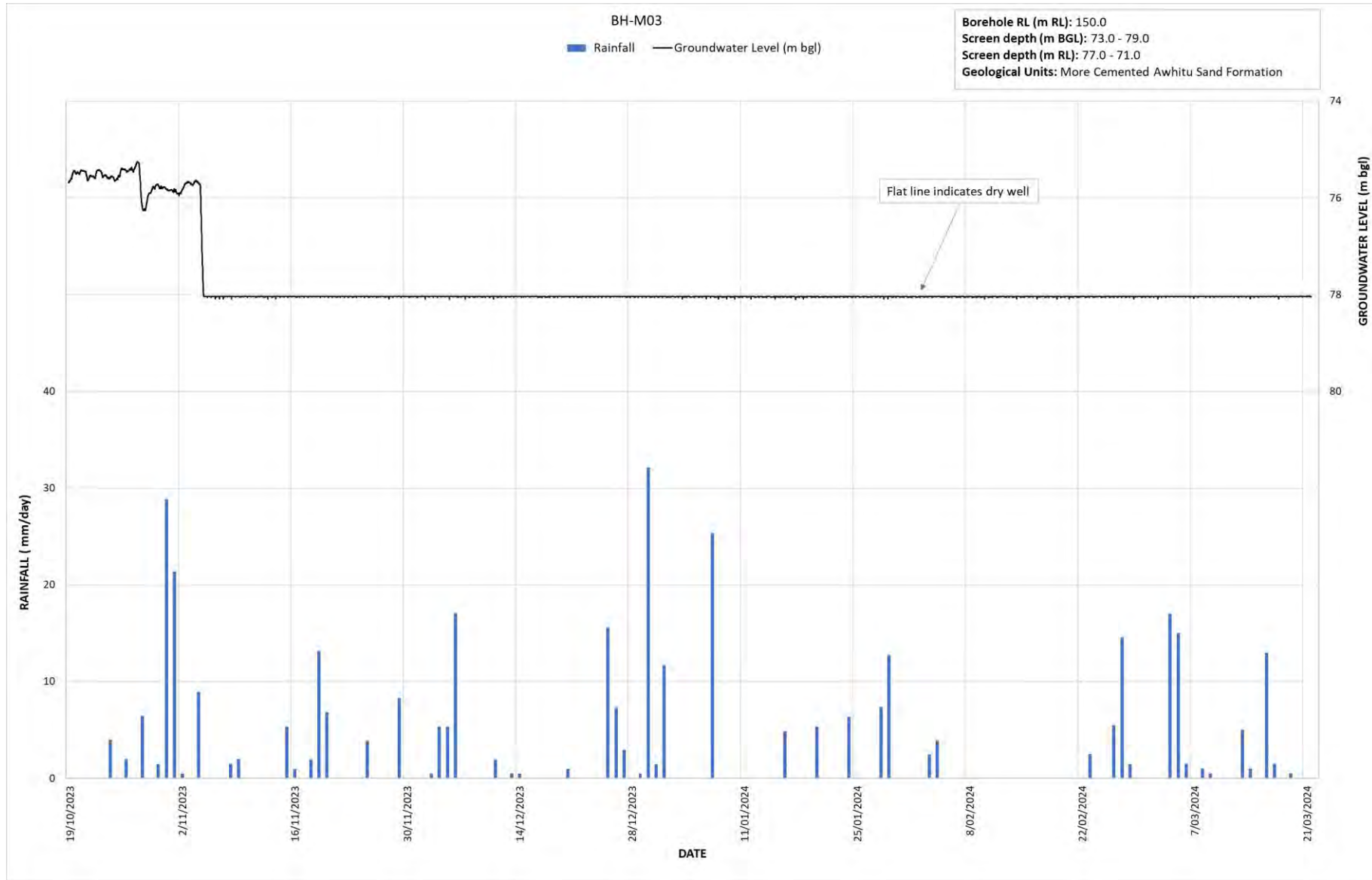


Figure F5-2: Plot of rainfall and telemetered groundwater data from BH-M03. Rainfall data sourced from Auckland Council's Environmental Data Portal

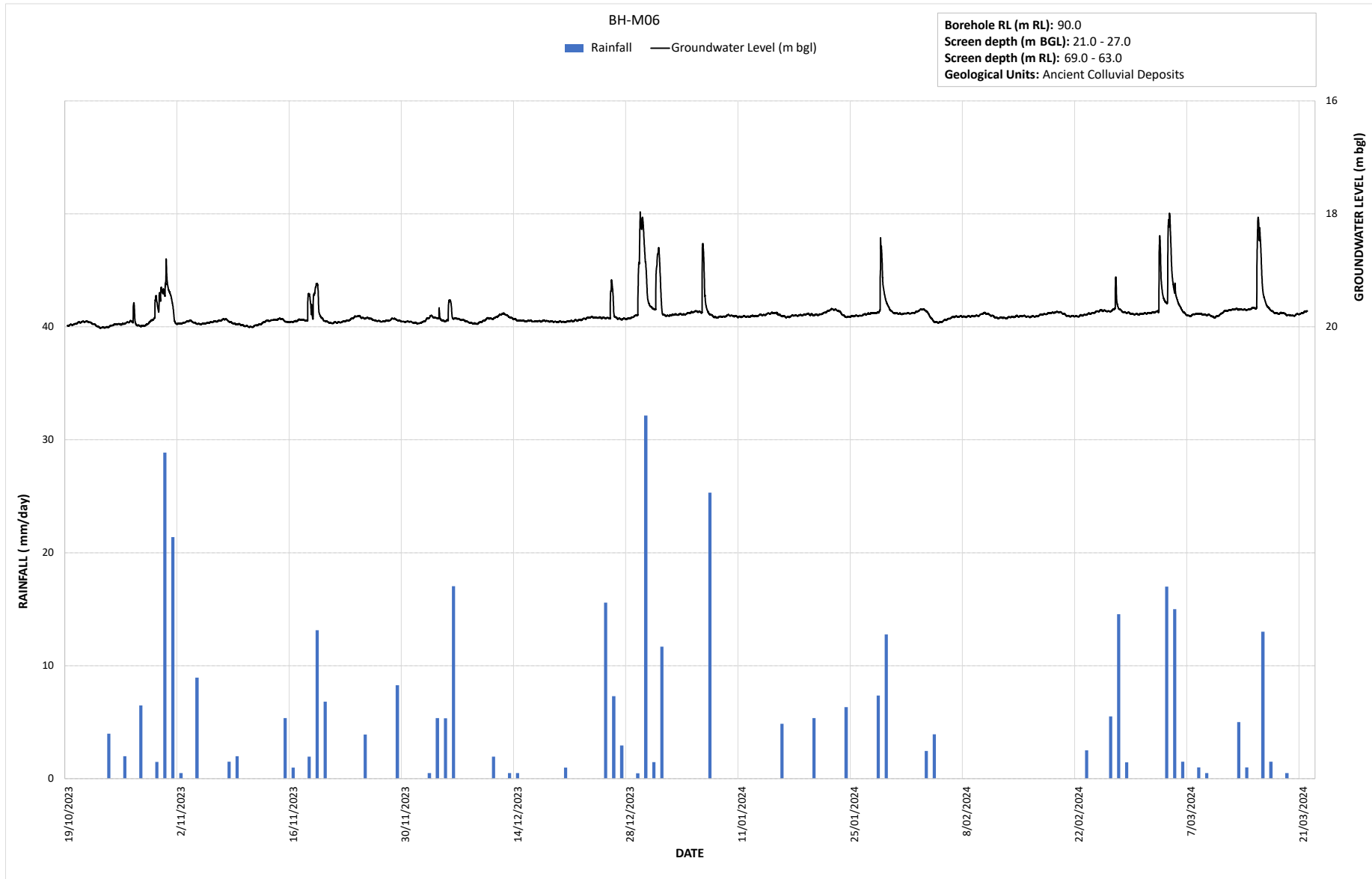


Figure F5-3: Plot of rainfall and telemetered groundwater data from BH-M06. Rainfall data sourced from Auckland Council's Environmental Data Portal

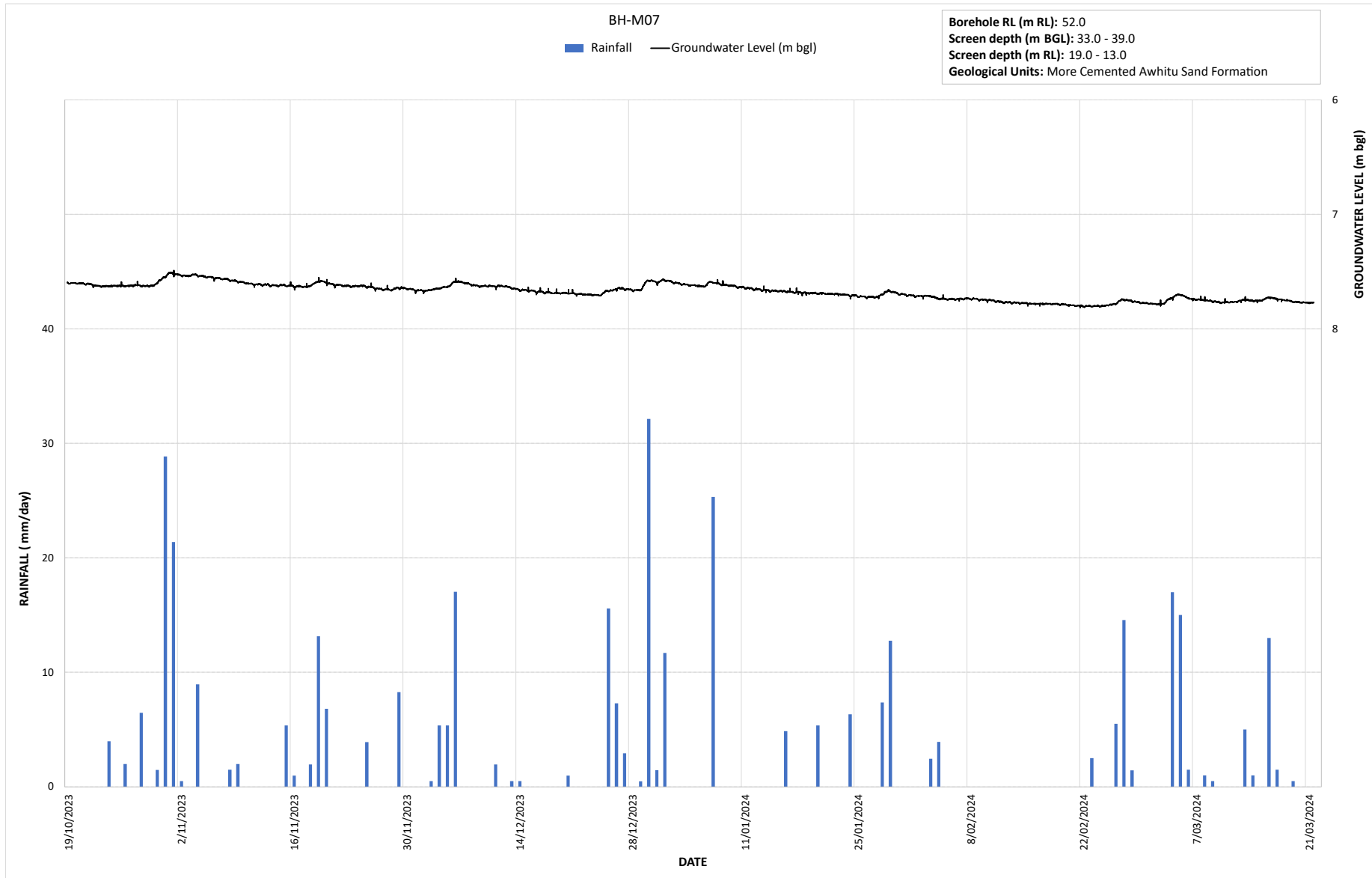


Figure F5-4: Plot of rainfall and telemetered groundwater data from BH-M07. Rainfall data sourced from Auckland Council's Environmental Data Portal