

## REPORT

# TANTANGARA MODIFICATION GEOTECHNICAL REPORT

## S2-FGJV-GEO-GEN-REP-0001

rev D

JULY 2023

## ABSTRACT

Description of ground conditions encountered within the Tantangara area, existing information regarding the geotechnical conditions, recent geotechnical investigations, and mitigation measures that will be implemented to manage the risk of surface depressions reoccurring.

## **Revision Record**

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## 1. INTRODUCTION

## 1.1 PURPOSE AND SCOPE

The purpose of the document is to support the overarching Modification Report, and therefore, the Modification Application seeking approval for construction activities outside the scope of the existing Project Approval.

The scope of this document presents the geotechnical context relating to the recent Tantangara Sinkhole occurrence and provides an overview of the following:

- Geotechnical, geological, geomorphological and geophysical data available, including recent investigations and assessments carried out;
- Root causes analysis of the sink hole;
- Mitigation and remediation measure, to manage the risk of surface depressions from reoccurring; and
- Interpretation and risk associated to the work progress.

## 1.2 DISTRIBUTION AND INTENDED AUDIENCE

This report will be included as an appendix to the overarching Modification Report. The Modification Report will be submitted to the Department of Planning as part of the Modification Approval process.

## 1.3 THIRD PARTY REVIEW

SYSTRA Bamser have carried out a third-party review to independently support this geotechnical report as part of the overarching Modification Report and approvals for the proposed scope of works relating to the Tantangara sink hole.

SYSTRA Bamser specialise in consulting, advisory and project management services on complex tunnelling, trenchless and infrastructure projects.

## 2. BACKGROUND

Snowy Hydro Limited (Snowy Hydro) is constructing a pumped hydro-electric expansion of the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), called Snowy 2.0. Snowy 2.0 is being built by the delivery of two projects: Exploratory Works and Snowy 2.0 Main Works, which commenced in May 2020.

Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Most of the project's facilities will be built underground, with approximately 27 kilometres of concrete-lined tunnels constructed to link the two reservoirs and a further 20 kilometres of tunnels required to support the facility. Intake and outlet structures will be built at both Tantangara and Talbingo Reservoirs. Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,000 MW, and at full capacity will provide approximately 350,000 MWh of large-scale energy storage to the National Electricity Market (NEM). This will be enough to ensure the stability and reliability of the NEM, even during prolonged periods of adverse weather conditions.

Webuild (formerly Salini Impregilo), Clough and Lane have formed the Future Generation Joint Venture (Future Generation) and have been engaged to deliver both Stage 2 of Exploratory Works and Snowy 2.0 Main Works.

## 2.1 CONSTRUCTION ACTIVITIES AND PROGRAM

The Snowy 2.0 Main Works Project includes, but is not limited to, construction of the following:

- Pre-construction preparatory activities including dilapidation studies, survey, investigations, access etc;
- Accommodation camps;
- Construction pads;
- Barge access infrastructure;
- An underground pumped hydro-electric power station complex;
- Water intake structures at Tantangara and Talbingo reservoirs;
- Power waterway tunnels, chambers and shafts, and access tunnels;
- New and upgraded roads to allow ongoing access and maintenance;
- Power, water and communication infrastructure, including:
  - A cable yard to facilitate connection between the NEM electricity transmission network and Snowy 2.0;
  - Permanent auxiliary power connection;
  - Permanent communication cables;
  - Permanent water supply to the underground power station; and
- Post-construction revegetation and rehabilitation.
- Snowy 2.0 Main Works consists of numerous work areas as shown in Figure 2-1, including:
  - Lobs Hole;
  - Marica;
  - Plateau (the area between Marica and Tantangara);
  - Rock Forest;
  - Talbingo; and
  - Tantangara.

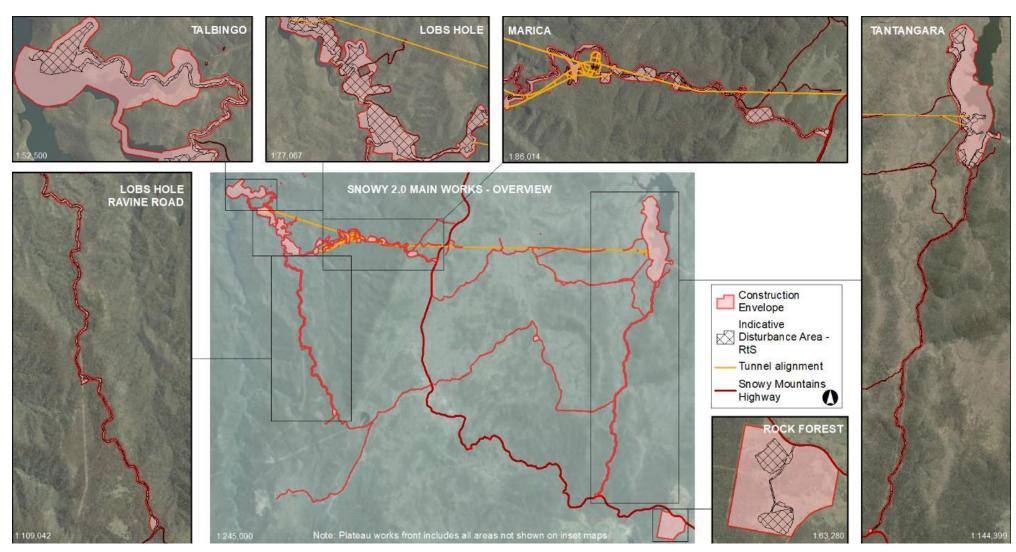


Figure 2-1 Snowy 2.0 Main Works work areas

#### 2.2 PRESENT CONDITIONS

In March 2022, the tunnel boring machine (TBM) operations commenced at the Tantangara Headrace Tunnel (HRT) Adit portal. The Tantangara HRT Adit portal is a temporary tunnel structure being excavated by TBM3 (Florence) and is approximately 907 m long and 11 m in diameter. TBM3 was designed by Herrenknecht. The design was informed by the geotechnical baseline report. The report confirmed the respective alignment consisted of Naturally Occurring Asbestos (NOA) approximately 7 km inside the Tantangara HRT Tunnel (HRT02) and an unlikely occurrence of fault affected zone / weak material, karst phenomena. The design included a single shield TBM capable of operating in two different modes: open mode and closed mode (slurry mode). Open mode is the main mode for excavation and will be used to tunnel through the rock conditions where asbestos contaminated rock is not present. However, open mode excavation is not able to excavate through asbestos containing material and unconsolidated, soil like material. Slurry mode involves modifying the TBM to enable safe excavation through NOA material. Further information on the TBM modes of tunnelling is outlined in Section 5.

Around May 2022, the TBM began encountering adverse geological conditions unsuitable for tunnelling with the current configuration of the TBM. These conditions can be broadly characterised as unstable sub-surface material (further information regarding these geological conditions is outlined in Section 3.1.3). In December 2022, the TBM passed into a fault zone and encountered sandy material with no apparent cohesion at approximately Tunnel Length 146 m. On stalling the cutterhead rotation the sandy material entered the muck chamber of the TBM in an uncontrolled manner, forming an inferred chimney structure above the tunnelling excavations. The available mitigation measure installed on the TBM at the time of the event were not able to treat the unexpected sandy material. The inferred chimney structure created a surface depression (sinkhole) outside the approved construction envelope and disturbance boundary. Upon formation of the sinkhole, TBM operations were suspended. Due to the formation of the sinkhole, remediation works are required, further geotechnical investigations are ongoing, and tunnelling operations may be modified.

The original geological predictions anticipated in the geotechnical baseline report for the Tantangara Headrace Adit Tunnel, indicated a different geological condition than those encountered by the TBM where the sinkhole was formed. Additional faults and poor ground conditions cannot be ruled out in future TBM excavation activities along the tunnel alignments. Areas with potential poor ground conditions may also include Tantangara Headrace Tunnel (HRT01), Tantangara Headrace Tunnel (HRT01-02), Gate Shaft and Tantangara Intake.

## 3. GEOTECHNICAL, GEOLOGICAL AND GEOPHYSICAL DATA

## 3.1 EXISTING GEOTECHNICAL, GEOLOGICAL AND GEOPHYSICAL INFORMATION

## 3.1.1 Regional Topography

The topography of the Project can be broadly characterised into two topographic domains; the high country and rolling slopes on the plateau near Tantangara Reservoir towards the east, and the steep incised valleys of the ravine area, west of the Snowy Mountains Highway towards the Talbingo Reservoir. These two distinct areas are divided by a major regional geological feature, the north-northeast-trending Long Plain Fault, a major structural feature extending from about 25 km north of Brindabella, through Kiandra to just west of Mt Kosciuszko. At the Project, the Long Plain Fault is located just to the west of the Snowy Mountains Highway (GHD, 2022).

The eastern end of the alignment, located adjacent to Tantangara Reservoir, is at an altitude of about 1,233 m. The landscape from Tantangara Reservoir progressing eastward along the alignment toward the Snow Mountains Highway is transacted by three tributaries of the Murrumbidgee River system; namely Gooandra Creek, Tantangara Creek and Nungar Creek. The highest point on the alignment is at Bullocks Hill between Tantangara Creek and Nungar Creek at an altitude of 1,527 m (GHD, 2022). Further information regarding the regional topography is provided in Appendix A.

## 3.1.2 Regional Geology

The following section provides a summary of the regional geology, as outlined in Appendix A. The geology of the project area has been the subject of multiple historical mapping studies by the Snowy Mountains Hydro-Electric Authority, Geological Society of Australia, Bureau of Mineral Resources, and the Geological Survey of NSW.

The project area is located within the Lachlan Fold Belt, a belt of deformed deep and shallow marine sedimentary rocks, cherts and mafic volcanics. The project area has undergone multiple stages of volcanism, metamorphism and deposition and is complexly folded and faulted (GHD, 2022).

Prior to the Late Ordovician period, the project area was located in a deep marine basin close to the edge of a continent resulting in the deposition of quartz-rich sandstones and shales in a turbidite sequence. During the Late Ordovician, mafic volcanism led to the formation of a basic island arc chain extending through the Kiandra Volcanic Field (GHD, 2022).

At the end of the Ordovician through to the Early Silurian, metamorphism of buried sediments and resulting uplift gave rise to weathering and erosion. Eroded material was transported eastwards resulting in the formation of a secondary deep marine sedimentary sequence comprising conglomerate, sandstone, siltstone, and shale. During the Silurian, intrusion of acid volcanics (typically granite and granodiorite) and explosive volcanism (typically dacite, rhyodacite and ignimbrite) occurred throughout large areas of the project region. Subsidence between areas of intruded by acid volcanics allowed for the formation of shallow marine sedimentary basins resulting in deposition of shale, sandstone, and limestone.

In the Devonian, the area was subject to extrusive felsic volcanism (typically rhyolite, rhyodacite and tuff) and deposition of shallow marine to subaerial sediments. Flows from Tertiary-age basaltic volcanism cap many of the hills in the project area.

The Figure 3-1 presents an extract from the Geology of the Snowy 2.0 project area, overlain on NSW Zone 55 East Seamless Geology dataset, 2017.

Major geological structures across the Project Area were developed during the Palaeozoic orogenic events and have involved both folding and faulting. All geological units have been affected by folding and this is most evident in the sedimentary rock sequences. The more notable major folds are west of the Long Plain Fault where the Ravine Beds, Boraig Group and Byron Range Group are folded by several phases of deformation. These folds include large north east trending fold axes, including the syncline intersecting the Waterway Alignment at approximately CH18,030 m. Additional folding trending northwest overprints the northeast trending fold axes creating a complex sequence of bedding in all geological units.

Several weak or major fault affected zones will be crossed by the alignment. Some of them are known and identified in the published geological maps and have been reviewed by the University of Melbourne, some of them intersect the Waterway Alignment as indicated:

- Tantangara Fault: this is a roughly north-south striking reverse fault, dipping east, over 30km in length, and is east of the intake area. It has no direct effect on the Waterway Alignment.
- Jindabyne Thrust: this is a sinistral reverse thrust fault, dipping west, over 10km length but linked to other fault systems further to the south. It is interpreted to intersect the Waterway Alignment at CH 4+ 450 m;
- Unnamed fault: intersecting Waterway Alignment at CH 5,230 m this fault is indicated by a lineament following a stream course. It is assumed to be vertical;
- Boggy Plain Faults: there are two interpreted fault traces;
- Kiandra Fault: initially placed at the contact between the Temperance Formation and Gooandra Volcanics, this fault is now interpreted to follow a distinct lineament along Gooandra Creek;
- Striking NE and dipping steeply west. It is interpreted to intersect the Waterway Alignment at CH 10,900 m;
- Long Plain Faults: there are two interpreted fault traces.

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Figure 3-1 Geology of the Snowy 2.0 project area, overlain on NSW Zone 55 East Seamless Geology dataset, 2017

PERIOD	DESCRIPTION		
TERTIARY	CZuc_g	Tertiary Basalt: alkali olivine basalt deposited during uplift periods (Kiandra and Kosciuszko Uplifts).	
		Kanimblan Folding	
(responsible	for gentle til	ting of the Kelly's Plain Volcanics and fault wrenching in the Boggy Plain Fault)	
	Dby	Byron Range Group: siltstone, quartzite, shale, sandstone, conglomerate & nodular limestone. Shallow Marine – siliciclastic deposits.	
DEVONIAN	Dba	Boraig Group: rhyolite, rhyodacite, tuff, lapilli tuff, feldspathic sandstone, granophyre deposited in shield building volcanic complexes. Terrestrial - extrusive volcanic deposits.	
	Dulk.	Kellys Plain Volcanics: dacite ignimbrite, rhyodacite ignimbrite, tuff, agglomerate, rhyolite; porphyritic monzogranite. Terrestrial – volcaniclastic deposits.	
		Kosciuszko Batholith	
	Sbp <u>i</u> i	Boggy Plain Suite: I-type granitoids; even grained texture, mostly granodiorites and quartz monzogabbros, biotite monzogranite commonly containing hornblende. Shallow crustal - continental I-type deposits. Also S- type granitoids are possible beneath the Tantangara Formation and may intersect the tunnel alignment in at least two locations.	
		Bowning Folding	
(folding of F	Peppercorn F	Formation which were unconformably overlain by Kelly's Plain Volcanics to the north-west of Tantangara Reservoir)	
		Cooleman Plains Group	
	Scpp	Peppercorn Formation: Basal conglomerate, overlain by sandstone, siltstone and cleaved shale, with minor limestone lenses. Shallow Marine – shelf deposits.	
0	Suer	Ravine Beds: Shale, slate, siltstone, conglomerate. Shallow marine shelf deposits.	
SILURIAN		Benambran Folding 2nd Phase	
	(Signif	icant folding event which destroyed a trough leading to the deposition of the Tantangara Formation in a series of anticlines and synclines)	
	Syaa	Yalmy Group Tantangara Formation: sedimentary turbidite sequence, sandstone, siltstone and shale; quartzite. Deep Marine – siliciclastic deposits.	
		Benambran Folding 1st Phase	
(Responsible for folding, uplift and tilting of Ordovician sediments and volcanics)			
arenite, minor agglomerate. Some monzonite, hornblend		<u>Kiandra Group</u> Temperance Formation: Interbedded basaltic tuff, chert, and feldspathic arenite, minor agglomerate. Some monzonite, hornblendite, lamprophyre, quartz monzonite. Deep Marine – volcaniclastic deposits.	
	Ouos	Shaw Hill Gabbro: Gabbro, diorite, metabasic intrusive rock, pyroxenite. Shallow crustal – continental deposits.	

## Table 3-1 Summary of Geological Units

PERIOD	DESCRIPTION		
	Okig	Kiandra Group Gooandra Volcanics: Metabasalt, basalt breccia (emplaced as pillow lavas), amphibolite, chloritic schists, feldspathic sandstone; aphyric and feldspar- phyric basalt, basaltic lava breccia, rhyolite, shale; fine-grained feldspathic siltstone and shale. Typically, deep marine - extrusive volcanic deposits.	
	Oa	Adaminaby Beds: turbidite sequence; sandstone, mudstone, shale; quartzite, quartzitic phyllite, phyllite, slate	
	Oa	Bolton Beds: quartz arenite, siltstone and shale forming distal flysch sequence	

## 3.1.3 Geological knowledge along HRT02 alignment pre sink hole

Prior to TBM tunnelling works commencing along HRT02, the description of the geological unit expected to be encountered at the Tantangara Intake is the Kelly's Plain Volcanics Unit. Figure 3-1 outlines the alignment of the HRT02 tunnel and the corresponding geology. The unit consists of dacite ignimbrite, rhyodacite ignimbrite, tuff, agglomerate and rhyolite, however, typically presents as dacite. The unit is situated at the eastern end of the project alignment and unconformably overlies the Tantangara formation and Peppercorn formations, with the contact dipping shallowly to the east with an irregular surface.

This unit is reported as being gently folded, with cooling volcanic formational surfaces typically dipping less than 15° eastward. Much of the unit has suffered post-depositional alteration in the form of welding, devitrification and mineral alteration. Exposures in the Traces Knob quarry south of the alignment indicate a typical blocky jointed rock mass with a shallow weathering profile of about 5 to 10 m. Columnar jointing is common.

Across project, the Geotechnical Baseline Report anticipates 11 major faults. The Tantangara Fault is the most relevant one in this area. The Tantangara Fault is the closest to the Headrace Adit, outcropping east of the Tantangara intake area, with no direct effect on the Waterway Alignment. It is a NNE (~30° azimuth) trending, east-dipping reverse fault, over 30 km in length, with numerous potential splays and possible subsidiary faults on the footwall (west) side of the fault (GBR, 2019).

Kelly's Plain Volcanics (KPV) is characterized into two sub-ground types, KPV01 and KPV02. KPV01 is characterised by:

- Blocky- massive rock mass with good surface condition,
- Medium strength to very high strength rocks,
- Moderately to intensely metamorphosed,
- Moderately weathered to fresh,
- Abrasive to very abrasive.

KPV02 is characterised by:

- Disturbed/ Seamy to very blocky rock mass with good to fair surface condition,
- Medium strength to very high strength,
- Moderately to intensely metamorphosed,
- Moderately weathered to fresh,
- Abrasive to very abrasive.

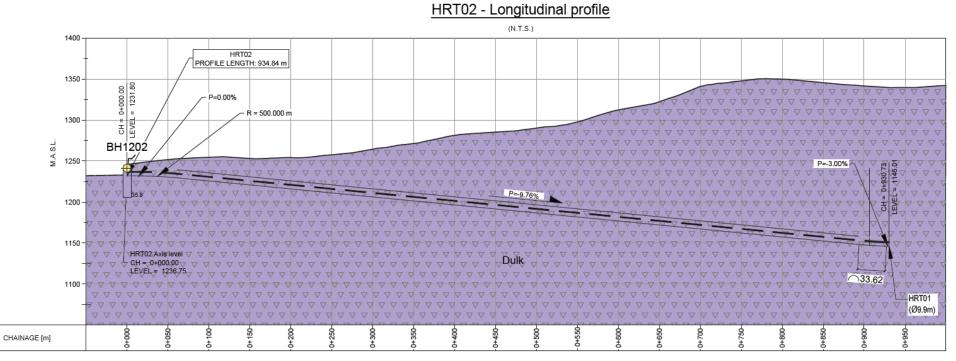


Figure 3-2 Extract from Geomechanical Model; Longitudinal Profile of the HRT02 Tunnel, Doc S2-GEO-GN-GMM-REP-1000

The geotechnical baseline report outlines the geohazards expected in the KPV. The geohazards expected in KPV are summarized as likelihood of occurrence, with definitions of "likely", "possible" and "unlikely":

- "Fault Affected Zone/ Weak Material", "Naturally Occurring Asbestos", "Karst Phenomena", "Intrusive Rocks" are unlikely;
- "High Abrasivity" and "Heterogenous ground/mixed face conditions" are possible;
- Expected unitary steady state inflow: 2-3 l/s/k;
- Problematic transient and steady state heading inflow not expected (i.e., high water inflow).

## 3.2 RECENT GEOTECHNICAL INVESTIGATIONS

Since construction activities commenced at Tantangara, further geotechnical investigations have been undertaken within the project boundary. The following information summarises geological conditions encountered during TBM excavation activities, and the recent investigations including geological mapping, borehole, and seismic surveys.

## 3.2.1 TBM excavation

During TBM excavation, several geological investigations are carried out using the excavated material. Material excavated via the TBM, probe hole material taken from the tunnel head of the excavation face and geological mapping at the excavation face were used as part of the geotechnical assessment. Geotechnical testing of the first 81 m of the Tantangara Adit Tunnel consists of slightly weathered to fresh dacite with a slightly fractured rock mass. The lithology encountered corresponds to Kelly's Plain Volcanics KPV001. After Tunnel Length 81 m, at the start of the fault zone, a weak zone made up of fault breccia and gouge with void recorded at the face. This was followed by significant quantities of fine material and water flowing into the TBM excavation during further advances (raveling ground). This was identified as the fault core.

During the last 70 m in the Tantangara Adit Tunnel, from Tunnel Length 81 m to Tunnel Length 151 m (current TBM position), the excavation was performed through a geological fault zone. The ground encountered was classified mainly as GB12 known as highly heterogenous ground conditions, due to the complexity and frequently changing geological conditions of the excavation face and the presence of voids. The project ground behavior classification is outlined in the geotechnical baseline report. Along these chainages, 10 grouting events were completed to control water ingress and consolidate the ground.

The last tunneling excavation advance in December 2022 in the Tantangara Adit Tunnel, was scheduled to be carried out between approximate Tunnel Length 144.40 m to 146.40 m. However, after 1.5 m of advance, the quantity of material entering the cutter head significantly increased. Due to this increased quantity of spoil entering the excavation chamber at Tunnel Length 145.8 m the excavation was stopped due to ground loss resulting in the sinkhole formation. Section 5 discusses the management measures.

## 3.2.2 Borehole investigations

In addition to geotechnical investigations carried out from the Tantangara Adit, borehole investigations at surface level were also undertaken. Borehole investigations commenced in February 2023 as a result of the sinkhole. The location of the boreholes is outlined in Figure 3-3.

## 3.2.2.1 Surface borehole investigations

Three surface boreholes were carried out adjacent to the sinkhole. BH1411, BH1412 and BH1413 were positioned on an existing track close to the EIS boundary, to the east of the sinkhole, as indicated Figure 3-4 and Figure 3-5. Conditions observed during drilling include outcropping rock visible on the track which appeared fractured and brecciated, as indicated in Figure 3-6 and Figure 4-1.

The results of the boreholes identify multiple zones of core loss, which is generally expected in extremely/ highly weathered and faulted rock mass. The major rock types encountered during core drilling are as follows:

- Extremely weathered / highly weathered (XW/HW) Rhyodacite/Dacite (include weak material with behaviour like soil, very low to low strength, poor to very poor rock mass);
- Moderately weathered (MW) Rhyodacite/Dacite (hard rock);
- Limestone and breccia (hard rock).

Based on the borehole core samples, and the behaviour of the drilling, the rock mass has undergone a vast range of weathering which indicates a large range of strength from low/very low to high/very high up to soil behaviour condition.



#### Legend

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 Paper Size ISO A4

 Image: Size ISO A4
 0

 Sorehole, Tantangara Investigation
 0

 Borehole, Surface Depression Investigation
 Meters

 Borehole, Historic Geotechnical Investigation
 Map Projection: Transverse Mercalor

 Geophysics Line, Surface Depression Investigation
 Map Projection: Transverse Mercalor

 Horizontal Datum: GDA2020
 Grid: GDA2020

 Grid: GDA2020 MGA Zone 55
 Grid: GDA2020 MGA Zone 55



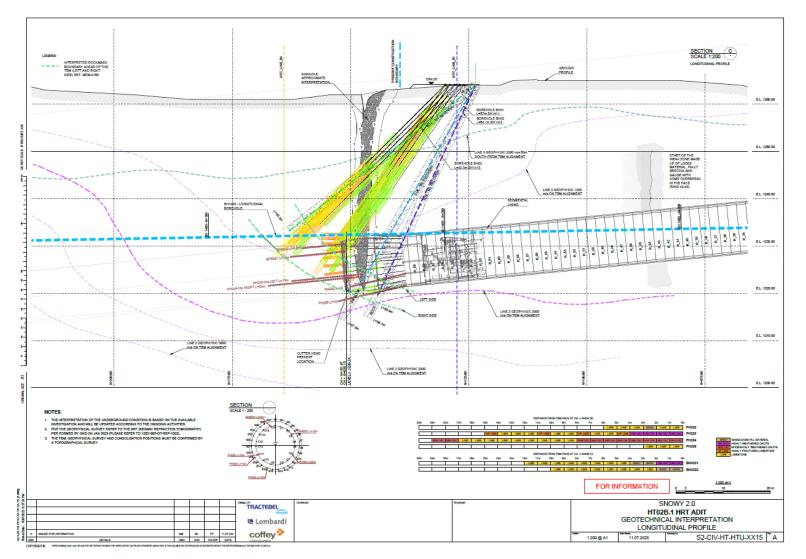


Figure 3-4 Geotechnical Interpretation of the Headrace Tunnel Adit Longitudinal Profile. The dashed green line represents the interpreted hard rockmass boundary ahead of TBM (left and right side).

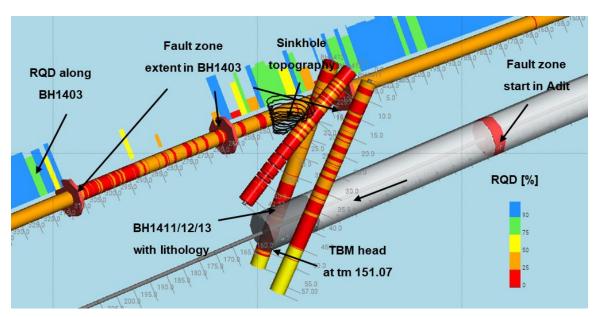


Figure 3-5. 3D view of TBM3, boreholes BH1403/1411/12/13 with the fault zone interpreted and the sinkhole.



Figure 3-6 Brecciated ground on track adjacent to sink hole.

## 3.2.2.2 Long borehole

A sub-horizontal long borehole, BH1403, was carried out parallel to the Tunnel alignment. BH1403 head is positioned adjacent to the TBM spoil stockpile, and was drilled into an east facing, excavated face. The long borehole alignment is outlined in Figure 3-7. The long borehole reached a final length of 866.73 m from the portal in June 2023. The available bore log of BH1403 is provided in Appendix C.

Observed conditions during drilling include adverse geological conditions, consisting of highly/extremely weathered material causing unconsolidated ground conditions which are challenging for TBM excavation activities. This adverse geological condition was encountered for a length of 90 m, from 215 m to 305 m in the sub-horizontal borehole (correlated to Tunnel Length from

81 m to 171 m). Significant core losses were also seen at numerous locations. A potential void from borehole length 215.59 m to 217.33 m (approximately 1.7 m void length), was discovered within the same adverse geological section (Figure 3-7).

After 305 m of borehole length and until the end of the borehole (866.73 m length), the dominant lithology corresponds to slightly weathered rhyodacite which represents a good quality and competent rock mass for TBM excavation activities.

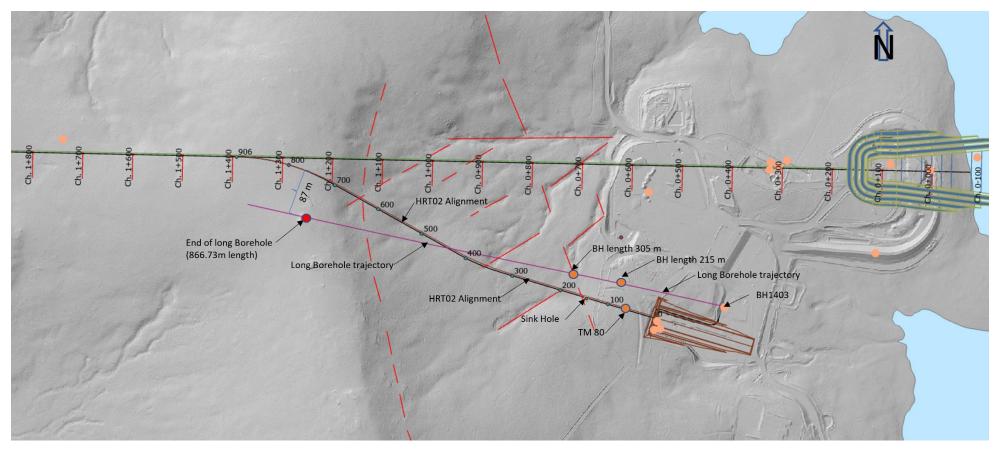


Figure 3-7 BH1403 Long sub-horizontal borehole status Jun 2023

## 3.2.3 Potential of Geological Cavity Presence

Karstic phenomenon could also be present along the Tantangara Headrace Tunnel and Headrace Adit Tunnel. This potential geological condition is based on the calcareous formation and highly weathered limestone identified in the boreholes undertaken from within the TBM, BH1411 & BH1412, and from voids and limestone identified at the Tantangara Gate Shaft boreholes BH1402 & BH1404.

Presence of a void in the path of the tunnel alignment represent a risk for TBM advance. Cavities must be filled before excavation is carried out to minimise the tilt and misalignment of the TBM and to avoid ovalisation of the segmental lining. TBMs can effectively manage karstic conditions if the situation is identified at an early stage of the project and appropriate controls implemented. Further information on karstic phenomenon is outlined in Appendix C.

## 3.2.4 Geophysical Survey

Seismic refraction tomography (SRT) surveys were carried out to map the changes in the P-wave seismic velocity (Vp) of the subsurface, both laterally and by depth. Seismic velocities are controlled by various physical properties and conditions of subsurface material such as density, hardness, elasticity, moisture content, fracturing, presence of cavities and weathering. Appendix C includes further information on the SRT methodology.

When correlated with geological and geotechnical logs of boreholes in proximity to the SRT survey lines, or other directly observed data (e.g., CPT), the P-wave velocity models (Appendix C)

- Allow more comprehensive interpolation of strata between boreholes;
- Assist in establishing depth to competent rock; and
- Highlight zones of anomalous velocities, which can be related to geological features (for example faults, dykes, or fractured zones).

The main objectives of the SRT surveys were to:

- Establish the depth to competent rock in the survey area;
- Identify deeper/shallower areas of soil cover;
- Define higher weathering/fractured zones beneath the footprint of the survey lines; and
- Locate any other significant geophysical anomalies.

Figure 3-8 outlines the locations of the SRT surveys. The SRT surveys were conducted over three timeframes including:

- 20 21 December 2022
- 18 22 January 2023
- 8 February 2023

The SRT results are presented as a two-dimensional (2D) P-wave velocity contour model, with depth sections. Figure 4-2, Figure 4-3 and Figure 4-4 include results of the seismic surveys for SRT Line 01, SRT Line 02 and SRT Line 04, in Section 4. All P-wave seismic velocity models are outlined in Appendix C.

The conceptual interpretation of the seismic results is based on correlation of the P-wave velocity models with the findings of the geotechnical boreholes BH1411 and horizontal BH1403 located in proximity to SRT Line 01, SRT Line 02 and SRT Line 04. The interpretation did not consider other historical boreholes drilled at the Tantangara site due to their distance from the SRT lines and the variable geological profile.

Based on the correlation of P-wave velocities with the findings of the geotechnical boreholes, the conceptual interpreted P-wave (Vp) velocity range of 1,900m/s was derived as the cut-off for transition to slightly weathered (SW) rhyodacite/meta-limestone. Based on this inferred P-wave velocity range, the maximum depth to slightly weathered bedrock below the SRT Line 01 is approximately 48m BGL (below ground level), and approximately 45m (BGL) below the SRT Line 02.

The P-wave velocity range of 1,500-1,900m/s was interpreted as indicating moderately weathered (MW) rhyodacite. The subsurface material with P-wave velocity less than 1,200m/s can be associated with highly/extremely (XW/HW) weathered rock (rhyodacite).



Figure 3-8 Seismic Refraction Tomography Alignment

## 3.2.5 Geomorphological assessment

A Geomorphological assessment was carried out in March 2023 (GHD Appendix B) to understand the geological-geomorphological conditions that led to the development of the sinkhole, including the extent of the geological significance of this zone of difficult ground. The assessment was carried out using geophysical surveys, geological mapping, and geomorphological mapping.

The scope of the assessment involved a desktop review of:

- Two lidar data sets including Tantangara 0.5 m lidar and 1 m lidar dataset that covers the entire Snowy 2.0 scheme, but predates earthworks at Tantangara;
- Previous geological mapping;
- Borehole data for BH2101 and BH1202, including optical televiewer data for a probe hole drilled from the tunnel portal;
- Field mapping carried out in December 2022.

Based on the desktop assessment, geology of the area consists of the following:

- The base of the succession consists of the Silurian sandstone, siltstone, shale, and quartzite of the Tantangara Formation (Syaa);
- The Silurian Peppercorn Formation overlies the Tantangara Formation (Scpp), on a boundary marked by a distinctive basal conglomerate. The conglomerate is overlain by sandstone, siltstone, and cleaved shale, with minor limestone lenses. At outcrop, the conglomerate bears a superficial resemblance to the dacite;
- The Peppercorn Formation is overlain by Devonian dacite (Dulk) of the Kelly's Plain Volcanics. This is described in the stratigraphic database as consisting of dacite ignimbrite, rhyodacite ignimbrite, tuff, agglomerate, rhyolite and a porphyritic monzogranite.

Figure 3-9 shows the mapped units and structure in the NSW seamless geology data base. Modifications include identification of the syncline along the reservoir, identification of NE-trending faults as thrusts in vicinity of BH2101 (Appendix A). Background hill shade is a combination of the pre-earthworks 1 m lidar and the 0.5 m lidar.

Structurally, the sequence west of the reservoir becomes younger eastward (toward the reservoir) and mapping suggests dips of 30-60 degrees to the east in sedimentary rocks measured along a transect largely down Nungar Creek (Figure 3-9 and Figure 3-10). Figure 3-10 identifies the location of two boreholes, BH2101 and BH1202B. These boreholes are representative of the tunnel alignment.

The dacitic rocks of the Kelly's Plain Volcanics form a prominent ridge between Nungar Creek and the portal, referred to as Kelly Ridge. The portal area is located within the dacite, in the youngest exposed part of the sequence. Displacement of the lower surface of the dacite implies that the last slip event on these faults is younger than the dacite and even though the faults are not mapped through the ridge, they should be expected to continue through it.

A major NW-striking fault is mapped on the NW side of the saddle. Like other faults, the fault is not projected through the dacite. However, the geomorphic character of the site suggests that it should be. It is referred to here as the Kelly Fault and the geomorphic evidence for its continuation is described below. If the Kelly Fault is present, it will displace the NE-striking faults that are shown cutting the base of the dacite on the geological map.

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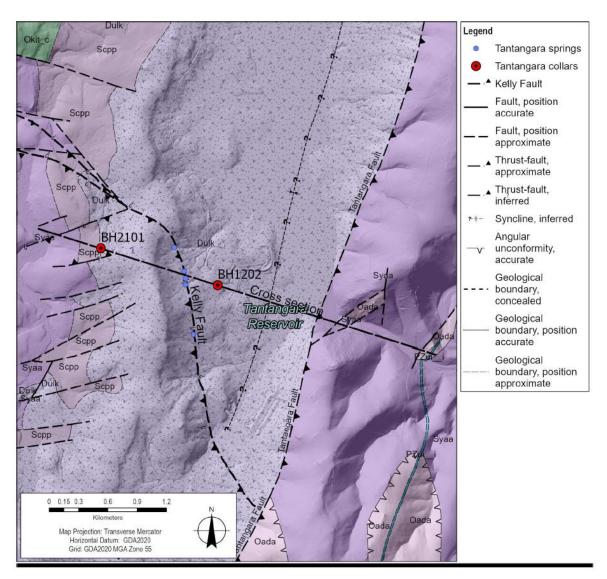


Figure 3-9 Geology of the Tantangara area

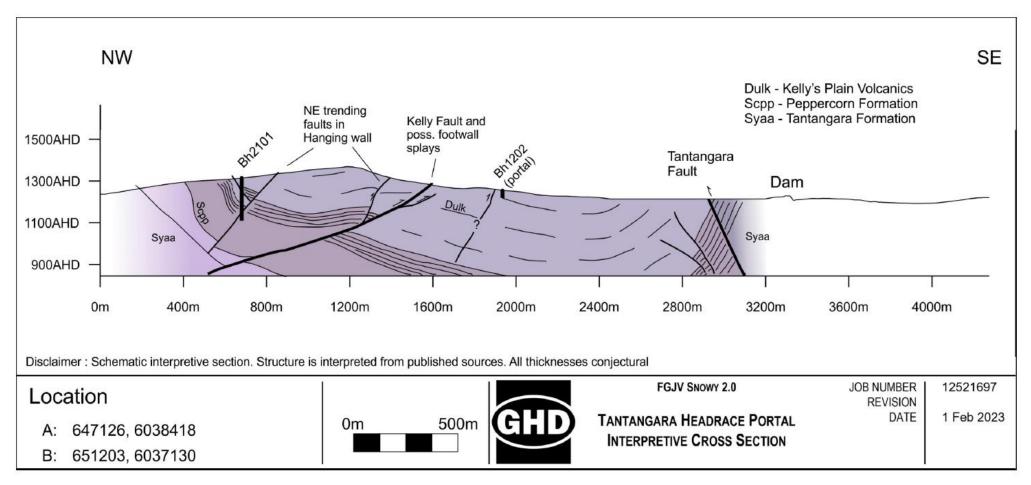


Figure 3-10 Interpretive cross section through BH2101 and BH1202B, crossing the Tantangara Fault at the dam

## Geomorphic observations (GHD Appendix B)

The Tantangara Reservoir lies between a ridge located along its eastern margin, Nungar Ridge, and a lower but prominent dacite ridge on the western side of the reservoir, Kelly Ridge (Figure 3-11). The western side of the Kelly Ridge has smooth textured topography and a relatively gentle slope. Several small outcrops of dacite protrude on the west side of the ridge.

The overall asymmetry of the Kelly Ridge is also similar to the topography that would be expected to develop in regularly west-dipping strata, with a gentle, smooth-textured dip slope to the west and a steep, rough textured scarp slope to the east. A local example of this morphology, known as a hogsback, can be seen on the Nungar Ridge east of the Tantangara Reservoir, where the Tantangara Formation in the hanging wall of the Tantangara Fault dips steeply to the west, creating an asymmetric hogsback with a smooth west face and a steeper east face (Figure 3-11). Although field evidence is lacking, geomorphology suggests that the dacites in the ridge west of the portal dip to the west.

At the eastern toe of the Kelly Ridge, small hills show the same geometry (gentle dip to west, steep dip to east). One example of this asymmetry is the hill into which the portal is excavated, which consists of relatively intact dacite at the toe of a large bulbous lobe that extends to the top of the ridge.

The nature of these blocks is not clear. They have a similar appearance to landslide blocks. BH1202 penetrated 35.8m into the portal dacite and did not report any lithological changes such as crushing, that might be expected if the portal was cut into a landslide block. However, the columnar joints in the portal area are displaced by several centimeters on low angle slicken sided planes, which could be attributable to accelerations during landslide displacement. Those planes are of similar orientation to low-angle NE dipping shear zones recorded in the HRT02 borehole.

Blocks like the portal area may also lie in the footwall of a fault. Northwest of the portal, the Kelly Ridge steps to the east. The change in ridge location is marked by a low saddle in the ridge (Figure 3-11). In the saddle, the 2022 lidar digital elevation model (DEM) shows an apparent 20° SW-dipping foliation in the landscape. A stream that drains northwestwards out of the saddle and into Nungar Creek is occupied by a NW-trending mapped fault zone. This saddle is therefore potentially the location where the 'Kelly Fault' passes through the ridge.

The topography on the eastern side of the ridge is hummocky on multiple scales. A lineament formed by an alignment of water springs or seeps parallels the east side of the Kelly Ridge, west of the portal. The springs mark seepage of water along an erosional contrast with pronounced incision and numerous small-scale landslides below them. Relatively flat-topped alluvial/colluvial deposits have accumulated below the springs, which lack sufficient flow to remove the products of erosion.

Springs commonly align along fault zones and these springs are conjectured to mark the trace of the Kelly Fault, south of the saddle.

The implications of the geomorphodynamic assessment on the TBM operations is provided in Section 5.

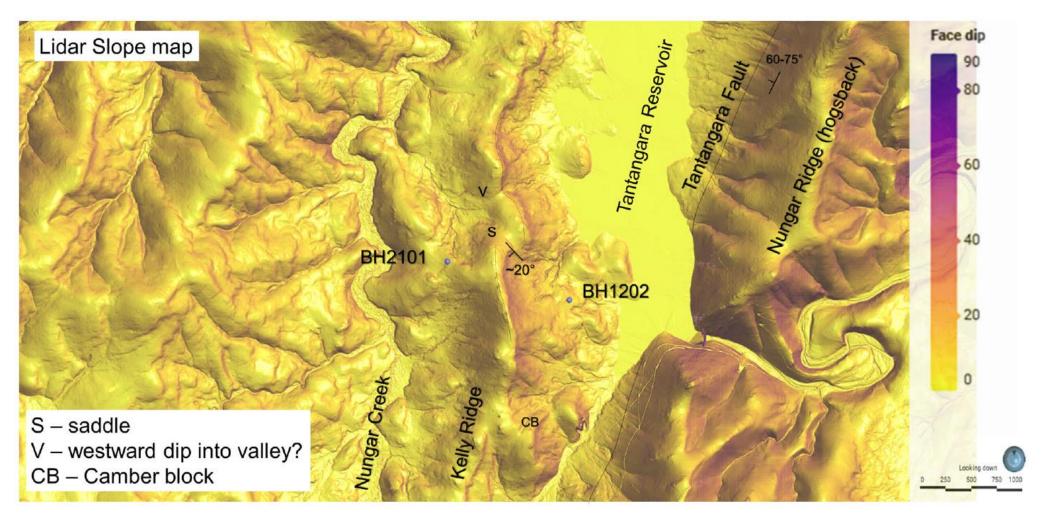


Figure 3-11 Slope map of pre-construction lidar showing topographic features in the region of the headrace portal

## 4. GEOPHYSICAL ASSESMENT

Five velocity anomalies were identified based on the seismic survey data and geotechnical borehole information. The following section presents the identified velocity anomalies, also provided in Appendix C.

## Anomaly 1

A low velocity anomaly with a Vp < 1,900m/s was identified along SRT Line 01 and SRT Line 02. Figure 4-3 presents the low velocity profile identified in SRT Line 02. This anomaly is relatively large and deep and is believed to be associated with the problematic zone of poor ground composed of XW/HW rhyodacite encountered by the TBM. It is also thought to be related to a sinkhole that appeared above the tunnel in mid-December 2022.

A low velocity anomaly was observed along SRT Line 01, characterized by a prominent, cliff-like change in velocity between CH 50 – 70m, see Figure 4-2. The minimum observable extent of this anomaly is 120m between CH 60 – 184m (end of SRT Line 01). It is possible the anomaly extends further north beyond the coverage of SRT Line 01. The inferred maximum depth to the SW bedrock along SRT Line 01 is approximately 48m below ground level.

This anomaly was confirmed through ground truthing with BH1411, which was drilled at approximately 80m seismic line chainage. Core photos of BH1411 are provided in Figure 4-1 and Appendix C.



Figure 4-1 BH1411 Core Photo

Anomaly 1 is also prominently observed on SRT Line 02 (Figure 4-3), where it begins as a drop in velocity between CH 130-150m on the north-eastern side of the line (at the earlier chainages). The end of this anomaly is not clearly observed as the seismic line was surveyed in close proximity to the existing tunnel, which can potentially create a lower velocity area and affect the modelling results. However, a higher velocity inverted zone observed closer to the surface could potentially be associated with an intact rock formation above the tunnel. By correlating this feature with findings from the long horizontal borehole BH1403, the end of Anomaly 1 can be assumed to be at approximately 240m line chainage. Core photos and bore logs of BH1403 are provided in Appendix C. The deepest part (~43 - 45m) of the anomaly was modelled between CH 150 – 180m.

## Anomaly 2

The second anomaly was identified on the velocity model of SRT Line 04. SRT Line 04 has a lower velocity of 2,100 -2,200m/s which features an elongated shape, dipping north at approximately 45 degrees between CH 125-160m, as outlined in Figure 4-4. Analysis of geophysical data, supported by geotechnical information, suggests that Anomaly 2 is likely a part of Anomaly 1, despite the observed discrepancy in seismic velocity.

## Anomaly 3

A localized high velocity Vp > 3,600 m/s feature, located near the surface, was identified as Anomaly 3 on the velocity model of SRT Line 05 between CH 60 and CH 120 m. This anomaly may be attributed to the presence of a rock intrusion with higher strength. Additionally, this anomaly could be linked to the potential geological structures in the surrounding area. At the centre of this anomaly, located at CH 90 m, the depth to the inferred SW rock is approximately 3 m, making it the one of the shallowest points along the entire model. SRT Line 05 survey is provided in Appendix C.

## Anomaly 4

Anomaly 4 was detected on SRT Line 05 between CH 315 and CH 350 m, at an RL of 1205 – 1210 m. It is a localized layer with lower velocity of ~3,900 m/s, situated within a larger zone of higher velocity ~4400 m/s. This anomaly may indicate the presence of a pocket of lower strength rock within a formation of higher strength rock. The centre of this anomaly is located ~35 m below the ground level. SRT Line 05 survey is provided in Appendix C.

## Anomaly 5

Anomaly 5 was detected on SRT Line 05 between CH 490 and CH 545 m, at a depth of 1,210 - 1,220 m RL. It is characterized by a lower velocity intrusion layer with a Vp of approximately 3,900 m/s. This anomaly may be attributed to the presence of a lower strength rock intrusion or a localized change in lithology. SRT Line 05 survey is provided in Appendix C.

#### HEADRACE TUNNEL CORRIDOR ANALYSIS

The Tantangara Headrace Tunnel 01 (HRT01) alignment intersects SRT Line 05 at approximately chainage 212 m of the survey, forming almost right angle. The SRT survey revealed a highly consistent velocity profile, with a gradual increase in P-wave velocity with depth in the area of the proposed HRT01 corridor. The depth to the SW rock interface was inferred to be approximately at 1,228 m RL. These results indicate preferred geotechnical conditions for TBM excavation are present.

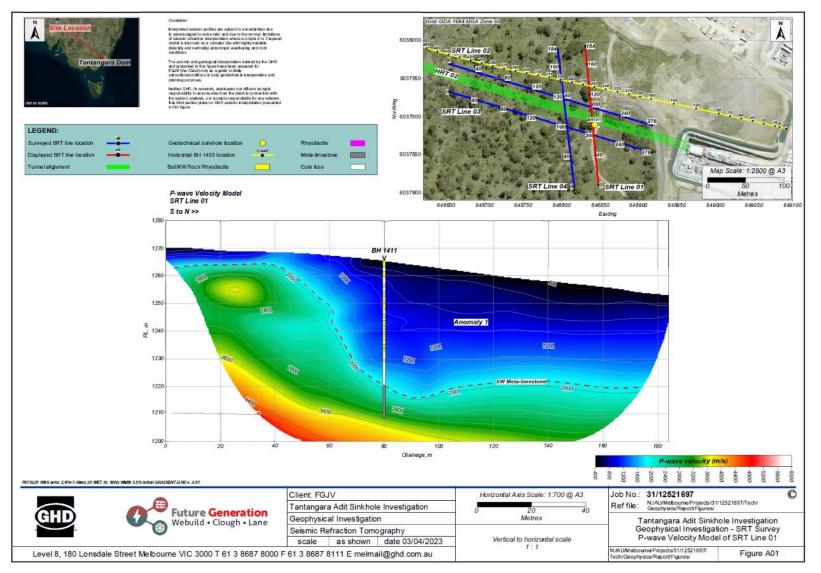


Figure 4-2 SRT Line 01

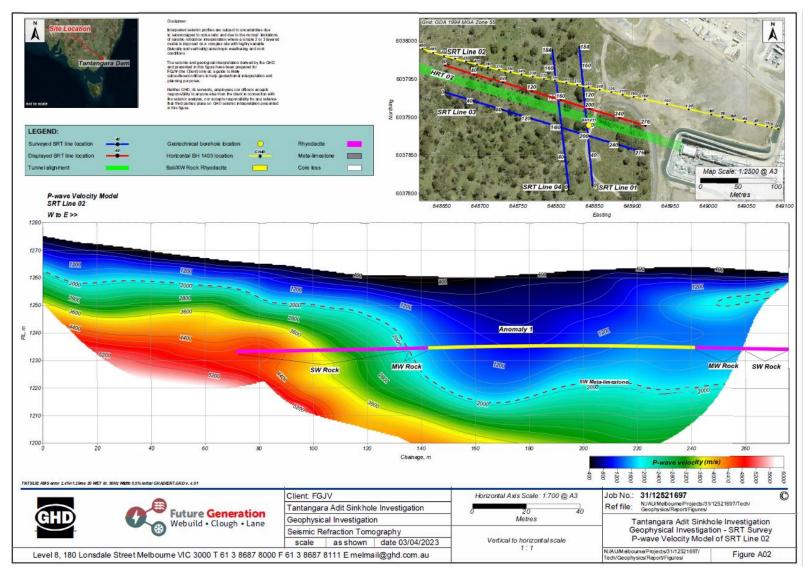


Figure 4-3 SRT Line 02

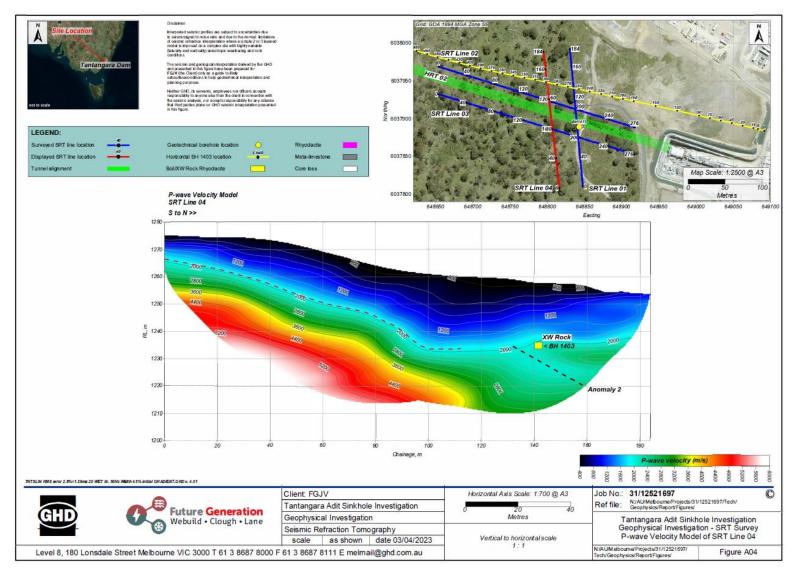


Figure 4-4 SRT Line 04

#### 5. SUMMARY

The geotechnical investigations outlined above, including geomorphological assessments, boreholes, and seismic surveys, indicate differences in rock conditions in the Tantangara area when compared to the GBR. The following section discusses the results of these investigations and the implications for TBM operations.

The challenging ground conditions encountered along the Tantangara Headrace Adit Tunnel may be based on the steepening and local overturning of the Peppercorn Formation, coupled with westward thrusting of the Tantangara Fault. This is further informed by the geology intersected in BH2101 (Appendix A).

It is possible the Kelly Fault may have been caused by either a west dipping fault, a northwest-dipping fault, land sliding, or a combination of all scenarios. The postulated north-striking Kelly Fault may be displacing the NE-striking faults, creating a crush zone at the intersection. Neotectonic displacement on the fault system may have triggered deep seated land sliding in the proximal hanging wall. This is supported by the orientations of shear zones encountered in the HRT02 probe hole.

Landscape development as a function of fault displacement and land sliding has resulted in the development of a granular crush zone overlain by local colluvium, into which the TBM has tunneled. Lidar shows no evidence for active land sliding.

The seismic surveys indicate the challenging ground conditions should not extend for more than approximately 10 - 30 m. Good TBM tunneling ground conditions are expected to be encountered obliquely, beginning in the left wall. However, there is potential for further crush zones and elevated water pressures as the TBM crosses the alignment, of the springs located on the postulated Kelly Fault.

The boreholes have substantially confirmed the information gathered by the geophysical investigations and more detail has been added about the transition between competent rockmass and disturbed XW/HW rhyodacite. According to the borehole BH1403, the total length of this XW/HW rhyodacite (including soil like material), is about 90 m (from 215 m length to 305 m length) and the analysis of the most recent element, specifically the BH performed from the TBM cutterhead and from surface during grouting event, suggest a more rapid transition to the competent rock mass in the next 10-15 m.

#### **Geological Domains**

Based on these findings, there is a demonstrated complex geomechanical scenario that, from a TBM operational point of view, can be split into two main domains:

- Rock behavior
- Soil behavior (rock mass with behavior similar to soil)

In regard to the rock behaviour, the rock conditions do not require additional treatment measures to carry out tunneling activities. In both traditional D&B and in TBM excavation methods the rock response to tunneling is controlled by installation of an appropriate rock support lining and by "stabilization of the excavation front face" when required, as outlined in Figure 5-1. The current Snowy 2.0 applied tunnel construction methodologies can control settlement at the surface, by modifying the TBM from open mode to closed mode. The TBM rock mass consolidation design is attached in Appendix D.

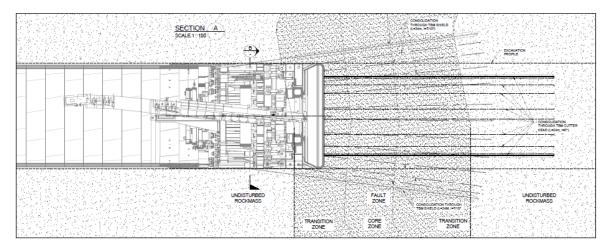


Figure 5-1 TBM open mode consolidation works

In regard to soil behavior, the soil does not provide optimal conditions for carrying out tunneling activities using the TBM in the current Rock configuration in 'open mode'. To effectively control the soil conditions encountered at the Tantangara area, previously unidentified in the GBR, the TBM may be required to be switched from the current "rock mode configuration (open mode)" to the "slurry mode configuration" (closed mode), see Figure 5-2. Section 6 provides further information regarding the management measures that will be implemented to manage the risk of unsuitable ground conditions and seek to prevent future sinkholes.

The ongoing investigation aim to determinate these two behaviors, to configure the TBM in slurry mode or rock behavior mode (open mode). This ability to switch between open and close mode will provide an option to reduce the risk of further sink hole events in case of soil behavior condition will be encountered again. The long borehole which is parallel to the tunnel alignment will indicate the presence of Soil like conditions. As for actual borehole excavation length, no more soil like material is recorded. Based on this as built information, at this stage, the Slurry Mode configuration may be required for the next 50m of excavation only. Moreover, tunnel alignment is going deeper into better rock condition and with the increase of rock cover thickness above the TBM tunnel, the risk of depression at the surface will be unlikely.

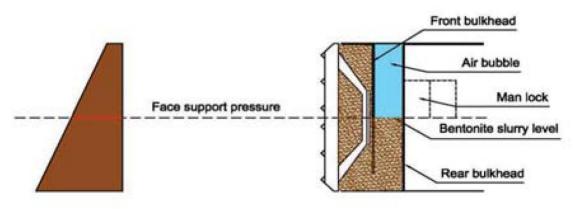


Figure 5-2 Slurry mode pressurisation

#### 6. SINKHOLE DESCRIPTION

The first 81 m of HRT02 consists of slightly weathered to fresh Dacite with a slightly fractured rock mass, the lithology encountered corresponds mainly to Kelly's Plain Volcanics (KPV001). From Tunnel meter (TM) 81 to TM 146, the excavation was performed through a geological fault zone and for the last 12 m, the ground encountered was classified as GB12 due to the complexity and frequently changing geological conditions of the excavation face (typical RMR < 20).

After about 65 m of poor ground condition on 15 December 2022, during the excavation of TBM03/HRT02 (Adit Tunnel), TBM at CH. 0+632,8 (TM146 approximately), intersected a cohesionless sandy material (XW/HW rhyodacite which behaves like soil) which caused a sinkhole with the dimensions of about 10 m to 10 m in width and about 5 m of depth on the surface where the overburden is about 32 m.

The sequence of the events can be explained with the loose and unconsolidated in situ soil conditions, leading to over excavation mainly in the crown area causing further collapse of the loose soil profile above the TBM. This over excavation caused further ground raveling, which progressively eroded to the surface creating the sinkhole (Figure 6-1).

The event was caused mainly by a combination of several factors such as the low cover, the presence of saturated XW/HW rhyodacite which behaves like soil and/or interfaces between this material and hard rock mass (limestone/rhyodacite). A more detailed assessment is presented in the following sections.



Figure 6-1 Position of the sinkhole in the Tantangara construction site area.

#### 6.1 ROOT CAUSES ANALYSIS

This section describes the main causes of the sinkhole formation close to the present TBM position. The formation of the sinkhole is related to the presence of various factors, some of them are related to the alignment, others, to the characteristics of the underground conditions. The risks associated to the characteristics of the underground conditions are related to the rockmass and various unfavourable features that must be present at the congruently. A set of critical features is listed below, for each one of the conditions at the present location:

- **ROCKMASS QUALITY**. The current ground condition is defined as "Fault Zone" composed of XW/HW rhyodacite which behaves like soil, often resulting in loose and unstable ground that often causes reveling ground and overbreak.

- **OVERBURDEN**. The tunnel alignment is currently in a shallow cover stretch. The overburden is about 3 times the diameter of excavation, around 35 m. The presence of a reduced overburden is a necessary condition for the formation of a sinkhole.
- **PRESENCE OF WATER**. The presence of underground water table / saturated ground condition can be unfavourable in decreasing the degree of stability in a fault material.
- PRESENCE OF VOIDS. The presence of voids due to dissolution of limestone can be a
  potentially unfavourable condition providing unpredictable locations of weakness in the
  rockmass.
- **HETEROGENEOUS CONDITIONS AT EXCAVATION FACE**. In the present condition, the heterogeneous condition of the excavation face composed by Fault Zone (XW/HW rhyodacite which behaves like soil) with hard rock mass (limestone/rhyodacite) is a disadvantageous element in the overall stability of the excavation.

The sinkhole at Tantangara was caused by a combination of factors indicated above. A possible further cause could be the increased vibration transmitted to the ground during the TBM excavation due to the heterogeneous face, which featured hard rock on the invert/left side and XW/HW rhyodacite on the crown and right side.

#### 7. MITIGATION AND REMEDIATION MEASURES

As indicated in the previous sections of this report, a number of actions have been undertaken and are still ongoing to improve the knowledge of the underground condition of the area and improve the rockmass conditions and the TBM characteristics to enable the continuation of the works. The main countermeasure options that have been employed or are planned are summarized in the Table 7-1 with additional further options should they be required.

MEASURE	DESCRIPTION	STATUS		
ADDITIONAL INVESTIGATION	The knowledge of the underground conditions is fundamental to drive the decision in the next phase of the excavation.	The campaign included: 5 Geophysical lines, 3 BH from the surface + 1 long BH from the portal area, BH and PH from the TBM. They are described in this report (Section 3).		
LINING STRENGHTENING	The implementation of improvements in the robustness of the segmental lining is advised when facing unexpected conditions.	Additional steel ribs at the intrados were completed and reinforced concrete segments have been used.		
LINING MONITORING	The monitoring of the tunnel lining is of primary importance to understand the effectiveness of the mitigation measures.	The monitoring includes displacement targets, stress control in the segments and in the steel ribs. This is ongoing.		
SURFACE MONITORING	The surface monitoring helps to check the consequence of the operation conducted in the tunnel advancement.	The ground surface has been monitored monthly by drone lidar surveys.		
GROUND CONSOLIDATION	The ground improvement by grout injection is the main remediation measure implemented to increase the stability of the excavation.	An extensive grouting campaign is ongoing from the surface and from the TBM. Preliminary indications show increased ground stability.		

### Table 7-1 Summary of countermeasure options for the continuation of the excavation and risk reduction.

TBM CLOSED MODE	Given the TBM possibility to be converted, the closed mode is included in the active countermeasures for the poor rockmass condition which behaves like soil.	The slurry treatment plant has been assembled and the commissioning process is almost completed. The TBM will be converted to Slurry mode if required.
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#### 7.1 GEOTECHNICAL INVESTIGATION CAMPAIGN

The geotechnical, geological, geomorphological, and geophysical investigation campaigns have been detailed in this report (Section 3). The summary of their results can be found in this report (Section 4 and 5).

The geotechnical survey (destructive and non-destructive investigation from the TBM and from the surface) represents the best element to reduce the risks and improve the reliability of the decision-making process. The investigation carried out provides a significant step forward the interpretation of the underground context.

#### 7.2 TUNNEL LINING STRENGTHENING AND MONITORING

The last installed segmental lining rings have suffered ovalization and cracking due to the presence of poor rockmass which led to the lack of proper backfill. Several countermeasures have been implemented to improve the robustness of the system including the installation of the SC2 segments with conventional reinforced concrete and the implementation of inner steel ribs.

In addition, several monitoring sections have been implemented to check possible evolution of displacement due to an external cause or the TBM thrust required for the advance. The monitoring sections include strain gauges embedded in the segment, displacement target placed on the intrados of the lining and also strain gauges on the steel ribs.

A post-grouting activity is also being executed on site to improve the embedment of the lining and avoid excessive ovalization of the lining.

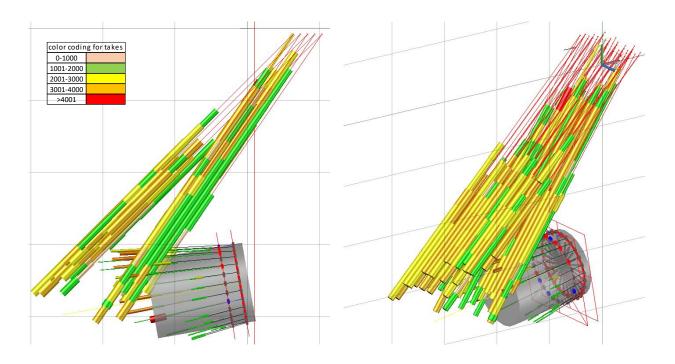
The segment strengthening strategy implemented in the built portion of the tunnel is being effective according to the monitoring. The monitoring will allow for ongoing verification of the interaction between the lining and the surrounding ground.

#### 7.3 GROUND CONSOLIDATION CAMPAIGN

Since that poor and very poor rockmass was encountered in front of the TBM, several rounds of grouting were performed from the TBM during the excavation of the tunnel, around and in front of the shield, to improve the rock mass condition. The interventions can be executed from the cutterhead (RIG1) to reach the excavation face and from dedicated holes in the shield (RIG2) to get the area around the excavation perimeter.

For a more effective ground consolidation, a treatment campaign has been implemented from the surface through grout injections in the available area inside the present construction boundary. The aim of this consolidation is to improve the disturbed zone of the ground matrix sufficiently that material will not fall into the advancing TBM cutting head and to ensure the TBM can successfully restart excavating. Two sets of inclined perforations have been carried out to compensate for the limit imposed by the surface boundary and consolidate the ground in front of a TBM for a larger section.

According to the present information, the sinkhole has been stabilized, predominately by the surface consolidation works. The consolidation measures implemented are effective in controlling propagation of existing sinkhole and, if the treatment is prolonged to cover the extension of the poor rockmass extension, is going to significantly reduce the risk of additional sinkholes.



# Figure 7-1 Consolidation From the surface. The cylinders represent the actual injected grout volume for sake of representation (on the colour scale, the red is associated with a greater amount of volume injected while the green to a smaller amount). The consolidated zone is thus more extended that the area shown in this sketch.

The following section provides a detailed explanation of the consolidation grouting process that takes place from the surface.

The consolidation is achieved by the way of grouting the soft sandy material. The objectives of grouting include:

- Cement the sinkhole matrix sufficiently so that material will not fall into the advancing TBM cutting head;
- Improve safety conditions for working within the TBM, which is required before the TBM can be converted to slurry mode; and
- To grout all the virgin material (soil and soil with rock matrix) sufficiently.

Grouting works consist of several distinctive working phases, including:

- Drilling through the existing ground from surface using a double rotary drilling technique with a Down-the-Hole Hammer (DTH) and outer casing of 152 mm;
- Upon reaching the bottom of the required depth, the inner drill string with the DTH is removed leaving only the outer casing in place;
- Mixing of all grout components, testing of grout parameters and grouting of the subsurface through the end of the outer casing starting with the bottom stage simultaneously with the withdrawal of the outer casing;
- When the grouting criteria for a grouting stage are fulfilled, the outer casing is extracted further opening up the next grouting stage for injection; and
- Extract casing sections incrementally and continue grouting until the entire casing is extracted.

The grout mix to be used for the sinkhole consolidation works is consistent with the mix currently used within the tunnel, outlines the grouting methodology proposed for the consolidation works.

The primary plant and equipment to be used for the works include:

- MC22 crawler mounted drill rig;
- Komatsu 13 tonne excavator for handling casings and drill rods; and
- Sullair 900XHH/1150XH Compressor for operating the DTH.

Figure 7-3 shows the plant and equipment to be used for the drilling works.

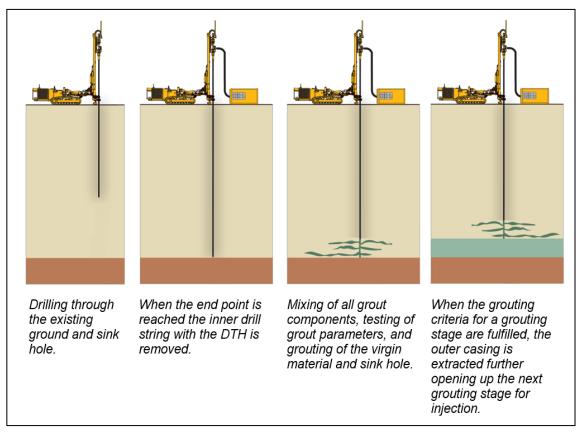


Figure 7-2 Grouting methodology. Due to the environmental boundary restriction, the drilling is done inclined, as shown in Figure 7.1



Figure 7-3 Drill rig and compressor, rod handler and rods

The primary plant and equipment for grouting works includes:

- Sodium silicate system, including a 5 m<sup>3</sup> blending/recirculation tank and recirculation pump to prepare and store the sodium silicate solution;
- Cement-Bentonite Slurry blending/recirculation tank 5m<sup>3</sup> and recirculation pump;
- Comacchio MP600 plunger pumps for delivery of the treatment grout from the mixing station to the drill rig; and
- 25 m<sup>3</sup> water storage tank for mixing the grout.

The grout treatment consists of two components:

- a Cement-Bentonite Slurry is the main component to fill the cavities of the sinkhole, to reduce the permeability and to stabilise the rockfill matrix; and
- a Sodium Silicate Solution is used to control the gelling and setting times of the grout.



Figure 7-4 Sodium silicate system / Cement-Bentonite Slurry blending/recirculation and plunger pump (same system for both mixes)

Consolidation works are currently being undertaken near the TBM cutterhead, from surface level and from within the TBM, inside the approved construction envelope and disturbance boundary. Depending on the outcome of the current works, further consolidation may also be required directly above the TBM, outside the construction envelope.

#### 7.4 SURFACE MONITORING

A detailed monitoring of the surface area was carried out through lidar survey. Monitoring is very important to understand if the mitigation measures taken for the TBM advance are effective. In fact, through the comparison of different lidar surveys it was possible to verify the effectiveness of the consolidations over time, highlighting the progressive reduction of the connection between the underground excavation of the TBM and the subsidence effect on the sinkhole on the surface, until its stabilization.

No significant modification in the sinkhole shape has been recognized in the last 3D survey. It is worth noting that proper remediation of the sinkhole is recommended to limit the interaction with the concrete lining during the period in which the Adit must be available for the headrace construction.

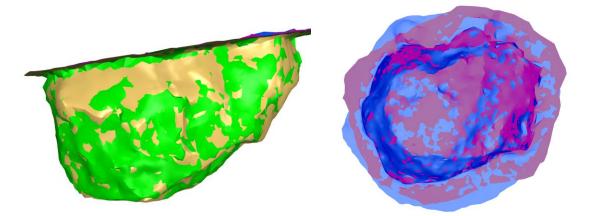


Figure 7-5 Sinkhole 3D survey, the different colour represents the surface of the depression before and after the last advance from TM 150.60 to TM 151.08. It can be noted how only minor differences are recognized between the two surfaces.

#### 7.5 TBM CLOSED MODE

The TBM3 S-1221 (also known as TBM Florence) is a 'multi-Mode machine' which can be converted between 'open' and 'closed' mode, providing the possibility to continue the excavation through a pressurized chamber and utilizing a slurry circuit as primary mucking system. The 'closed' mode configuration is useful for unstable face conditions in coarse grained material with soil behavior. During 'closed mode', the face-support pressure is supplied in part by the slurry, which creates a hydrostatic pressure as a function of its density, and in part by applying air pressure on the slurry. The slurry circuit includes a treatment and a separation plant where the fluid is separated from the excavated material and reintroduced in the pressurized excavation chamber. A summary is presented at Table 7-2.

ITEM	UNDERGROUND CHARACTERISTI CS (MOST SIUTABLE CONDITION)	MUCKING SYSTEM	LINING TYPE	COUNTERMEASU RES FOR FACE INSTABILITY
OPEN MODE	Medium to hard rockmass (Rock Behaviour)	The rock fragments are extracted by an open conveyor belt	The precast concrete lining is assembled inside, and installed behind the TBM shield	The rockmass consolidation can be provided by perforation through the cutterhead and the shield
CLOSED MODE (SLURRY SYSTEM)	Medium strength rockmass to well graded coarse- grained soil (Soil behaviour)	The soil or the mechanically crushed rockmass fragments are extracted via slurry circuit.	The precast concrete lining is assembled inside, and installed behind the TBM shield	A pressure is applied to the excavation face through the slurry fluid

#### Table 7-2 Summary framework of TBM open and closed mode

The possibility to convert the TBM to slurry mode has been implemented by the contractor by the assembly of the slurry treatment plant and remains one of the possible countermeasures to be applied.

To proceed with the necessary modification to the TBM setup for the closed mode, safe access into the cutter head must be ensured. Considering the current available area for surface consolidation, the creation of a consolidated block that covers all areas ahead of the TBM is challneging.

This section provides additional information about the TBM Florence and its slurry system.

TBM Florence will excavate Tantangara Adit and the Headrace Tunnel. Currently TBM Florence is operating in 'open mode'. This configuration can be subject to challenges when facing unconsolidated ground conditions. However, TBM Florence can be modified to slurry mode to change the excavation methodology, depending on the geological conditions.

Surface settlement will be controlled by the TBM operations balancing the pressure of the slurry against the soil pressure. The level pressure to be applied depends on the ground pressure and the hydrostatic pressure, if any. The face-support pressure is in part supplied by the slurry, which creates a hydrostatic pressure as a function of its density, and in part by applying air pressure on the slurry through the overlying "air cushion".

Working in slurry mode, the TBM machine is able to support the excavation face (ie soil condition) by a pressurized, bentonite slurry pumped into the excavation chamber. The slurry is substantially composed of a bentonite suspension in water, with a minor component of additives if necessary. Bentonite is a natural, non-hazardous clay product. The use of bentonite and any additives would be assessed and used in accordance with the Project approved environmental management plans.

The excavation chamber, called the "plenum", is a space between the excavation face and a steel bulkhead (separating the plenum from the remaining part of the TBM), where the excavated material is collected and mixed with the slurry. A pumping system performs the functions of feeding the fresh slurry to, and removing the muck from, the plenum through a pipeline.

In the case of the TBM Florence, a supplementary bulkhead, installed further behind the primary bulkhead, creates a room or an auxiliary chamber, which is divided into two functional compartments. The compressed air in the air cushion can push the slurry to the plenum in front, maintaining it under pressure. The air cushion pressure can be managed through an automatic regulation system. Consequently, it is possible to control the slurry pressure. The air bubble also acts as a compensative "shock absorber" to the unavoidable pressure fluctuations in the plenum.

The balance between inflow and outflow involved in this cycle allows the slurry to be maintained under pressure in the plenum. By the variation of the inflow and/or outflow of the slurry, it is possible to control the face-support pressure value which combats ground loss and the risk of sink hole formation. TBM is equipped with pressure sensors. The pressure measurements are displayed to the operator on the screen in the cabin on-board the TBM to allow him to manage the face-confinement pressure, specifically for stability control.

Moreover, TBM allows us to measure, with sufficient precision, the quantity of extracted material on the conveyor belt system, for comparing it with the theoretical excavated material. Weight balances scales are installed on the belt conveyor that can directly indicate the weight of the extracted material. In the operator cabin, a special screen shall be dedicated to the comparison between the excavated and the extracted quantities.

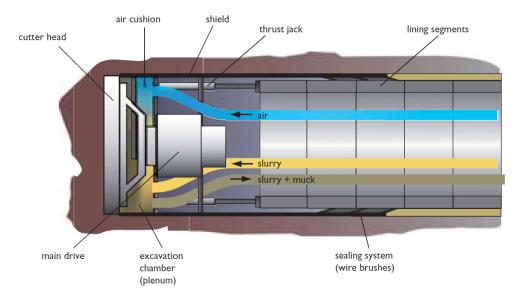


Figure 7-6 TBM slurry mode

#### 8. INTERPRETATIONS AND RISKS ASSOCIATED TO THE WORK PROGRESS

#### 8.1 ASSESSMENT OF THE NEXT TUNNELLING WORKS

The aspects which have been recognized as the most probable cause, listed in Section 6.1, are reassessed, focusing on the continuation of the tunnelling works. These causes can be investigated during the advance to assess the likelihood of poor rockmass ahead of the TBM.

#### 8.1.1 Assessment along HRT02 tunnel (headrace adit):

• **ROCKMASS QUALITY**. The evidence collected by the long borehole 1403, of which the alignment mostly replicates the HRT Adit, shows that poor ground characteristics found between BH length

about 215 m to 305 m (compatible with the sinkhole location) are not recognized in the remaining part of the tunnel.

- **OVERBURDEN**. The shallow overburden condition (usually considered about 3Ø for engineering purposes) which represent an unfavorable element are not present in the second stretch of the HTR02. The cover is quite constant in the next 50 m then increases rapidly; 200 m ahead of the present position cover will reach 70 m and at the end of the adit is about 190 m.
- **PRESENCE OF WATER.** Groundwater presence cannot be excluded in the continuation of the tunnel according to the expected scenario but in association with good rockmass condition and thus low rockmass permeability doesn't represent a point of concern.
- **PRESENCE OF VOIDS.** The presence of limestone, which can be hint of voids in the rockmass, has not been recognized in the long borehole BH1403.
- HETEROGENEOUS CONDITIONS AT EXCAVATION FACE. The presence of contacts between different lithologies can occur along the adit alignment, but the difference in the rockmass behavior is not expected to be significant.

According to the arguments listed, the formation of a sinkhole event in the second part of the Adit is unlikely, mainly due to the increased cover and the rockmass features recognized in borehole BH1403.

The most sensitive area remains the stretch close to the present TBM position (Figure 8-1); the risk can be considerably reduced with an extension of the available area to allow the possibility of further investigations and consolidation works from the surface (about 50 m), the usefulness of which has been proven and with the effectiveness and beneficial effect confirmed by the last advances.

The information on the rockmass condition ahead of the face will be constantly improved during the advancement by the probeholes from the TBM cutterhead (e.g. OTV or Endoscope, drilling parameters, measured the water ingress) to confirm the present scenario and adjust the details of the mitigation measures.

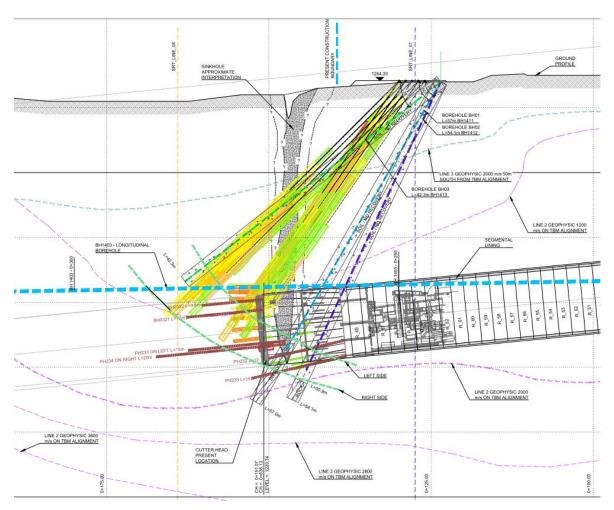


Figure 8-1 Geotechnical profile and consolidation work overlap (for the complete representation, see the attached drawings). The green lines represent the interpreted hard rockmass boundary in the proximity of the TBM cutterhead.

#### 8.1.2 Assessment along HRT01 tunnel:

ROCKMASS QUALITY. Some faults are expected along the alignment due to the wide extension
of the headrace and the heterogeneity of the rockmass, however, none of them has been
recognized by the wide geotechnical campaign executed in the previous survey phases.
Nonetheless the knowledge of the rockmass will constantly be improved by the systematic
probeholes ahead of the excavation face. Optical televiewer (OTV/Endoscope and Drilling
parameters analysis will be the techniques which are going to be implemented).

The standard procedure of approaching a fault is described in the design documents and includes interventions of drainage consolidation in advancement from RIG1 and RIG2 from the TBM and, after the excavation, post-grouting activities (Appendix D).

• OVERBURDEN. The shallow overburden condition (usually considered about 3Ø for engineering purposes) are not present in the TBM HRT01 tunnel; the cover is in the range between 200 m and 400 m for most of the alignment, while the lowest point is at ch.2+500 close to the Nungar creek where the cover is about 115 m. About this particular case, the BH2103, closest available borehole, the at the tunnel depth shows competent rockmass: "META SANDSTONE: fine grained, grey, massive, occasional minor quartz veins, siltstone beds and clasts up to 100 mm, occasional quartz veins up to 15 mm", even if the degree of fracturation is more dispersed than what is found in the BH2102 on the other side if the creek.

In the described high-cover conditions, the formation of a sinkhole is unlikely; however, poor rockmass or fault stretch under high overburden implies other risks for the tunnel construction, such as overbreaks and cavity or loads on the TBM shield and lining.

- PRESENCE OF WATER. In a similar way to what exposed for the second part of the HRT02, the groundwater presence cannot be excluded in the continuation of the tunnel according to the expected scenario included in the geological/geomechanical model, but in association with good rockmass condition and thus low rockmass permeability doesn't represent a point of concern. In the case of fractured rockmass, drainage and post-grouting intervention from the tunnel are foreseen as mitigation measures.
- **PRESENCE OF VOIDS.** The karst phenomena have not been recognized during the characterization phase. If voids are recognized by the probeholes ahead of the TBM, specific injection from the shield and from the cutterhead can be used to avoid TBM tilt or excessive overbreaks.
- HETEROGENEOUS CONDITIONS AT EXCAVATION FACE. The presence of contacts between different lithologies will occur in the tunnel alignment, but if not associated to a fault zone, for which refer to the first point, no specific risk is associated since the rockmass characteristic will not be much different.

In the HRT01 (TBM excavation), according to the arguments listed, the formation of a sinkhole, as described above, is unlikely, mainly because this tunnel will be built under conditions of high overburden. It is worth recalling that poor rockmass condition and/or fault zones are expected along the tunnel as included in the project documentation and geological model (GBR-C and GE05 design package) even if the exact location and characteristics cannot be defined with accuracy since no specific fault zone have been identified through the boreholes.

The knowledge of the rockmass will be constantly improved by the execution of probeholes ahead of the face with a recording of specific information that can anticipate the worsening ground condition (e.g. OTV or endoscope, drilling parameters and measure of water inflow).

Furthermore, in the design documentation, the standard procedure to approach a poor rockmass area is included and implies, the execution of drainages, consolidation from the TBM (through RIG1 and RIG2) before reaching the area of concern and post grouting from the lining after the excavation (Appendix D). The procedure and the treatment of each zone will be possibly refined according to the information collected during the approaching to face the most relevant risk (e.g. overbreaks, water inflow, TBM jamming etc.).

The conversion to slurry mode remains an option among the possible mitigation measures, but its implementation will be evaluated case by case in accordance with the local condition (e.g. characterization of the rockmass with soil behavior, presence of water, extension of the area of concern, possibility to execute the conversion procedure etc.).

#### 9. CONCLUSION

TBM operations commenced at Tantangara Adit portal. Ground conditions encountered at CH 633 (sink hole area) does not reflect the predicted geological setting outlined in the Geotechnical Baseline Report. TBM operations were suspended in December 2022 when a sink hole formed due to unconsolidated sandy material and a shallow over burden profile. In response, further geotechnical investigations were carried out, including boreholes and seismic surveys, in addition to the existing geotechnical investigation plan.

This document presented a brief overview of the situation of the TBM3 summarizing the aspects of geotechnical interpretation of the underground conditions and focusing on the description of the multifaceted strategy for implementation of the mitigation measures. Those measures include the improvement of the rockmass knowledge and the excavation behaviour, the implementation of measures to increase the support robustness and the strength of the most sensitive ground.

Moreover, the analysis of the event cause enables identification of key elements and classification of the present condition in comparison with the next part of the excavation. The review has been applied to the current TBM position, the remaining part of the HRT adit and the continuation of the HRT wet tunnel.

Some general comments are listed in the following:

- a) Several actions have been taken in the current challenging ground condition. The main elements are the lining strengthening, the geotechnical investigations, and the ground consolidation. It is important to underline as the effectiveness of those measures is constantly checked by monitoring.
- b) About the next advances, the excavation may proceed under the consolidated area up to the hard rock ingress. The possibility to improve and extend the consolidation executed from the surface is a key factor in reducing the risks of sinkhole reoccurrence during the TBM advance in the shallow overburden stretch. The closed mode remains an option among the possible mitigation measures, but the conversion to the slurry mode in the current ground condition hasn't yet been possible for safety reasons related with the access to the cutter head.
- c) About the mining continuation for the rest of tunnels, the systematic execution of the probeholes and boreholes from the cutterhead and their interpretation remains a fundamental point for the early assessment the local rockmass condition and implementation of the most suitable countermeasure from the TBM.

#### 10. REFERENCES

GHD. Geotechnical Investigations of the Proposed Snowy 2.0 Development Route – Additional Investigations Factual Report, February 2022.

GHD. Geotechnical Memorandum – Geomorphology and structural geology of the portal area for the Tantangara headrace tunnel, March 2023

GHD. Geotechnical Investigations of the Proposed Snowy 2.0 Development Route – Tantangara Surface Depression, Interim Factual Report May 2023.

Snowy 2.0. Geotechnical baseline report, GBR-C. April 5, 2019.

APPENDIX A – GEOTECHNICAL INVESTIGATIONS OF THE PROPOSED SNOWY 2.0 DEVELOPMENT ROUTE – ADDITIONAL SITE INVESTIGATION FACTUAL REPORT, FEBRUARY 2022



# Geotechnical Investigations of the Proposed Snowy 2.0 Development Route

12521697-GT-REP-0001 – Additional site investigation

Future Generation Joint Venture (FGJV) 09 February 2022



29 Christie Street, Level 2 St Leonards, New South Wales 2065 Australia www.ghd.com



Your ref: PK-096 Our ref: 12521697

09 February 2022

Massimo Franceschi Future Generation Joint Venture (FGJV) 220 Sharp Street Cooma NSW 2630

#### Geotechnical Investigations of the Proposed Snowy 2.0 Development Route

Dear Massimo

GHD is pleased to present the factual report for the geotechnical investigations undertaken for Future Generation Joint Venture, in consultation with their Design Joint Venture (DJV) and Snowy Hydro for the Snowy 2.0 project. These works were carried out between February 2020 and April 2021 in general accordance with GE02 Additional Site Investigations Plan "S2-GEO-GN-GEN-REP-1000\_C.1", and GE02 Geotechnical Investigation Plan – Addendum for PSC "S2-GEO-GN-GEN-REP-3003\_C.1" and incorporated agreed changes during the undertaking of the works.

Regards

**Dean Harris** Technical Director - Engineering Geology

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→ The Power of Commitment

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## **Executive summary**

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.2 and the assumptions and qualifications contained throughout the Report.

GHD are engaged as the Geotechnical Investigation Manager for the Snowy 2.0 Geotechnical Investigation Program (GIP). The scope of work for the GIP has been designed by Future Generation Joint Venture in consultation with Snowy Hydro, to inform their designs for the various tunnels, shafts and caverns associated with the proposed Snowy 2.0 Project, a new hydroelectric scheme linking the Tantangara and Talbingo reservoirs.

The project area is characterised by two topographic domains separated by the Long Plain fault that is located in proximity to the Snowy Mountains Highway. To the east of the highway toward Tantangara Reservoir the land is gently sloping high country plateau; and to the west of the highway are steepening slopes, escarpment ravines, and incised valleys that surround the Talbingo Reservoir. These native landscape characteristics and the existing reservoirs mobilise a gross head of more than 662 metres.

In geological terms the project is located within the Lachlan Fold Belt and comprise stratigraphic units from the Late Ordovician (458.4 Ma) to the Early Devonian (407.6 Ma), comprising variously shallow and deep marine sedimentary sequences, intrusive and extrusive igneous formations, and has been subject to distinct phases of tectonism. The area includes geological units of altered ultramafic volcanic formations that are associated with mineralogy that have the potential to give rise to naturally occurring asbestos.

The GHD scope was to execute a geotechnical investigation comprising some 19 boreholes and about 10,300 metres of drilling. The subsurface investigation broadly comprises the following:

- Predominantly cored geotechnical boreholes;
- Downhole geophysical logging: acoustic televiewer, full wave sonic, gamma and temperature;
- Borehole verticality surveys;
- In-situ stress testing via over coring, hydrojacking and hydrofracture;
- Dilatometer testing
- In-situ permeability testing, via packer testing and drill stem testing;
- Geotechnical and geochemical laboratory testing; and
- Groundwater monitoring instrumentation;

To foster a collaborative approach to the complex ground model an iterative approach to the scope and associated access approvals was put in place. This report contains completed works of Stage 3 of the drilling works, comprising 19 boreholes and representing approximately 10,300 metres of drilling and testing, with boreholes ranging in length from 20 to 2,001 metres.

This report is be read in conjunction with the limitations set out in Section 1.2, General Notes in Appendix A and the assumptions and qualifications contained within the report.



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### Attachments

Refer to Appendix N for complete list of attachments

# 1. Introduction

### 1.1 Purpose of this report

Future Generation Joint Venture (FGJV) have commissioned GHD Pty Ltd (GHD) to undertake a Geotechnical Investigation Program (GIP) that was developed as part of the Snowy 2.0 Detailed Design. The GIP provides geotechnical information that will ultimately assist in informing assessments that will feed into final design. The purpose of this report is to present new factual geotechnical data to FGJV and Snowy Hydro from the recent GIP.

Appendix A provides a summary of the data included in this report and data that has been submitted to FGJV as part of this scope of works.

### 1.2 Scope and limitations

This report has been prepared by GHD for FGJV and may only be used and relied on by FGJV for the purpose agreed between GHD and FGJV as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than FGJV arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.3). GHD disclaims liability arising from any of the assumptions being incorrect.

This report is confidential and is limited to the matters stated in it and subject to the various assumptions, qualifications and limitations explicitly stated within it. This report must be read in its entirety. The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. FGJV and GHD have agreed to a third party reliance regime with respect to this report ("Reliance Regime"). The Reliance Regime is subject to the satisfaction of a number of requirements and certain limitations. Any person who receives a copy of this report and would like to be subject to the Reliance Regime must contact FGJV. If a person is eligible to participate in the Reliance Regime, that person may only rely on this report to the extent of, and as provided for in, the Reliance Regime. For all other persons: (1) GHD does not accept a duty of care or any other legal responsibility whatsoever and however arising in relation to this report; and (2) any person who receives a copy of this report does so on the basis that he or she acknowledges and accepts that he or she may not rely on this report nor on any related information or advice given by GHD.

### 1.3 Assumptions

This report is to be read in conjunction with the Standard Sheets provided in Appendix A.

# 2. Scope of Geotechnical Investigation

### 2.1 Scope of Work

FGJV, in consultation with their Design Joint Venture (DJV) and Snowy Hydro, developed the scope of work for the Snowy 2.0 GIP to further inform their design development. The base scope was detailed in the FGJV Request for Quotation (RFQ) document entitled "Snowy Hydro Limited – Snowy 2.0 – Geotechnical Investigations – Bid No.: PK-096 - Request for Quotation", dated 11 September 2019.

As is usual in the iterative development of a complex ground model a collaborative approach to the scope was put in place. The scope at the date of this report is GE02 Additional Site Investigations Plan "S2-GEO-GN-GEN-REP-1000\_C.1", issued by FGJV to GHD on 12 May 2020, and GE02 Geotechnical Investigation Plan – Addendum for PSC "S2-GEO-GN-GEN-REP-3003\_C.1", issued by FGJV to GHD on 2 November 2020.

The GIP comprised the following:

- The drilling of nominated boreholes (currently 19 boreholes, ranging in length from 20 m to 2,001 m) at the locations nominated;
- In situ testing in the proposed boreholes, including:
  - Water pressure testing (packer testing, Drill Stem Testing (DST));
  - Stress testing (over coring, hydrofracture, hydrojacking)
  - Dilatometer testing;
  - Various downhole surveys;
- Downhole geophysics
- Installation of vibrating wire piezometers and standpipe piezometers
- Laboratory testing of encountered soil, rock, and groundwater;
- Factual reporting of the findings of the site investigations; and
- Set up of shed(s) and storage of drill core.
- Digital Data Delivery

The summary of the scoped boreholes and their status is presented in Table 1. The table provides a summary of borehole completion status, as-built coordinates, elevation, and inclination.

Coordinates are reported in MGA94 (zone 55) and Australian Height Datum (AHD, AUSGEOID 09) as the reference Easting (E), Northing (N), Height (RL) coordinate system. Survey accuracy of the "as-built" borehole coordinates are within +/- 0.05 metres horizontally, and: +/- 0.15 metres vertically. Survey of completed borehole locations was undertaken by Future Generation Joint Venture.

Locations of the boreholes covered by this report are shown on Drawings 12521697-GT-DWG-0001 to 12521697-GT-DWG-0007. Digital data associated with borehole logs, downhole geophysics, downhole survey, downhole and laboratory testing will be issued to Snowy Hydro separately, this is summarised in Appendix N.

The borehole logs attached in the various appendices to this report represent the status of the borehole logs as of the issue of this report. The report has been compiled to include as much up to date information as practicable. All borehole logs have now been finalised, with some previously issued final logs receiving minor revisions. The status changes is shown as the Version Number (V1, V2...etc.).

#### Table 1 Borehole summary table

Borehole ID	Location Description	Status	Borehole Log Status $^{(3)}$	Inclination $(^{\circ})^{(1)}$	Azimuth (°) Mag <sup>(1)</sup>	Drill string length (m) As-built	Easting (m) As-built MGA94 Zone 55	Northing (m) As-built MGA94 Zone 55	Surface RL (m AHD) As-built
BH1201	Tantangara Reservoir	Complete	V3	90*	-	20.47	649755.5	6038147.8	1205.83
BH1202	Tantangara Dry Portal	Complete	V3	90*	-	35.81	648971.6	6037837.3	1254.09
BH3203	Gooandra	Complete	V2	90*	-	400.16	636649.4	6038423.4	1461.60
BH4201	Between Snowy Mountains Highway and Wallaces Creek Trail	Complete	V2	54^	241	485.83	635772.1	6038530.7	1464.22
BH4202	Between Snowy Mountains Highway and Wallaces Creek Trail	Complete	V2	55^	271	501.90	635349.9	6038512.8	1464.02
BH-IPS	Marica Track	Complete	V3	23^	264	2001.38	632503.0	6038539.9	1330.20
BH5202	Marica Track	Complete	V4	90*	-	280.00	632036.0	6038655.5	1261.18
BH5203 <sup>2</sup>	Marica Track	Complete	V3	58^	087	419.81	631300.5	6038742.0	1181.19
BH5203A <sup>2</sup>	Marica Track	Complete	V2	57^	087	512.28	631300.5	6038742.0	1181.19
BH5204	Marica Track	Complete	V4	70^	134	755.48	630823.6	6038956.8	1196.91
BH5206	Marica Track	Complete	V6	90*	-	781.85	630381.8	6039057.9	1158.40
BH5207	Marica Track	Complete	V4	90*	-	783.41	630292.8	6039022.5	1163.80
BH5208	Marica Track	Complete	V2	90*	-	743.85	630190.8	6039112.9	1145.83
BH5209	Marica Track	Complete	V4	90*	-	768.96	630327.0	6039152.6	1149.34
BH5210	Marica Track	Complete	V2	66^	201	825.81	630516.7	6039392.1	1152.40
BH5211	Marica Track	Complete	V2	54^	200	920.38	630512.1	6039412.5	1151.77
BH7201	Talbingo Reservoir	Complete	V3	90*	-	41.25	624256.7	6040723.8	529.99
BH7202	Talbingo Portal	Complete	V1	90*	-	40.61	624366.6	6040743.5	549.25
BH7203	Talbingo Portal	Complete	V4	90*	-	45.20	624656.7	6040562.9	572.40

#### Legend:

\* - Indicates BH were collared as vertical from the surface, however due to natural ground conditions borehole may have deviated from vertical. Please refer to BH verticality survey.

<sup>^</sup> - Downhole survey, weighted average inclination.

Note 1 - Weighted average azimuth and inclination derived from downhole survey data for inclined boreholes calculated using the following method. See Appendix C for full downhole survey data.  $\frac{\mathcal{E}(survey value \times survey increment)}{\mathcal{E}(survey increment)}$ 

Note 2 - BH5203A commenced at a length of 173.43 m from Parent hole, BH5203.

Note 3 - Borehole Status - see explanation of borehole status and version control in Section 2.1 of this report.

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# 3. Site Description

### 3.1 Regional Topography

The topography of the Project can be broadly characterised into two topographic domains; the high country and rolling slopes on the plateau near Tantangara Reservoir towards the east, and the steep incised valleys of the ravine area, west of the Snowy Mountains Highway towards the Talbingo Reservoir. These two distinct areas are divided by a major regional geological feature, the north-northeast-trending Long Plain Fault, a major structural feature extending from about 25 kilometres north of Brindabella, through Kiandra to just west of Mt Kosciuszko, and at the Project is located just to the west of the Snowy Mountains Highway.

The eastern end of the alignment, located adjacent to Tantangara Reservoir, is at an altitude of about 1,233 m. The landscape from Tantangara Reservoir progressing eastward along the alignment toward the Snow Mountains Highway is transected by three tributaries of the Murrumbidgee River system; namely Gooandra Creek, Tantangara Creek and Nungar Creek. The highest point on the alignment is at Bullocks Hill between Tantangara Creek and Nungar Creek at an altitude of 1,527 m.

The alignment immediately to the west of the Snowy Mountains Highway, follows along a track known as the Marica track (including an old trig. point) at an elevation of around 1,400 m. The topography then steps down by two sharp descents to about 1,020 m that forms the crest line of the westward facing escarpment. Below the escarpment and the steep valley slopes lies the Yarrangobilly River (598 m) which flows into the Talbingo Reservoir. Along the Project alignment the route traverses under intervening ridgelines that are up 815 m high, including crossing the Tolbar trail, before descending into Talbingo reservoir at around 513 m.

### 3.2 Regional Geology

The geology of the project area has been the subject of multiple historical mapping studies by the Snowy Mountains Hydro-Electric Authority, Geological Society of Australia, Bureau of Mineral Resources, and the Geological Survey of NSW.

The 1:100,000 Tantangara Geological Series Sheet (Bureau of Mineral Resources, Geology and Geophysics, 1979) provides good coverage of the eastern part of the project area with regional mapping provided on the Geology of the Kosciusko [Kosciuszko] National Park 1:250,000 map sheet (Australian Bureau of Mineral Resources, Geology and Geophysics, 1990). Additional information of the western project area (around Ravine and Talbingo) is provided in "The Geology of NSW" (Packham, 1969).

The project area is located within the Lachlan Fold Belt, a belt of deformed deep and shallow marine sedimentary rocks, cherts and mafic volcanics (Gray, 1997). The project area has undergone multiple stages of volcanism, metamorphism and deposition and is complexly folded and faulted.

The following summary of the geological history of the project area is collated from information provided in the Tectonics of the southeastern Australian Lachlan Fold Belt: structural and thermal aspects (Gray, 1997), the Geology of the Kosciusko [Kosciuszko] National Park 1:250,000 map sheet (Australian Bureau of Mineral Resources, Geology and Geophysics, 1990), and Geology of the Snowy Mountains bibliography (Moye, 1961).

Prior to the Late Ordovician period, the project area was located in a deep marine basin close to the edge of a continent resulting in the deposition of quartz-rich sandstones and shales in a turbidite sequence. During the Late Ordovician, mafic volcanism led to the formation of a basic island arc chain extending through the Kiandra Volcanic Field.

At the end of the Ordovician through to the Early Silurian, metamorphism of buried sediments and resulting uplift gave rise to weathering and erosion. Eroded material was transported eastwards resulting in the formation of a secondary deep marine sedimentary sequence comprising conglomerate, sandstone, siltstone, and shale. During the Silurian, intrusion of acid volcanics (typically granite and granodiorite) and explosive volcanism (typically dacite, rhyodacite and ignimbrite) occurred throughout large areas of the project region. Subsidence between areas of intruded by acid volcanics allowed for the formation of shallow marine sedimentary basins resulting in deposition of shale, sandstone, and limestone.

In the Devonian, the area was subject to extrusive felsic volcanism (typically rhyolite, rhyodacite and tuff) and deposition of shallow marine to subaerial sediments. Flows from Tertiary-age basaltic volcanism cap many of the hills in the project area.

Figure 1 presents an extract from the Geology of the Kosciusko [Kosciuszko] National Park 1:250,000 map sheet.

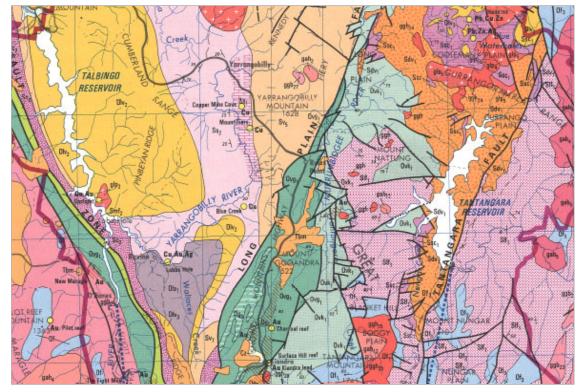


Figure 1 Extract from Geology of the Kosciusko National Park Map (Australian Bureau of Mineral Resources, Geology and Geophysics, 1990)

Table 2 presents a summary of the geological units in the project area (extract from SMEC Geotechnical Investigation Plan (Ref: S2-0704-PLN-012001-B, dated 30 June 2017), prepared using the units from the available published map sheets.

#### Table 2 Summary of Geological Units

Age	Shade	Symbol <sup>(1)</sup>	Symbol (2)	Unit name, rock type	Approximate location in project
Early Devonian	V V V V V V V V V V V V V V V V	Sdv1	Dlk	Kellys Plains Volcanics; acidic volcanics – porphyritic dacite, rhyodacite as ignimbrite, tuff and agglomerate, rare lavas	Intake area, limited in tunnel
Late Silurian		Ssc1	Sme	Cooleman Plains Group, Peppercorn Formation: basal conglomerate, sandstone, shale, chert, minor limestone lenses	
Silurian		Slf1	Sa	<b>Tantangara Formation</b> ; sedimentary turbidite sequence; sandstone, siltstone, shale	Tunnel Ch 0 to 7 km approx.
Ordovician		Ovk1	Otc	<b>Kiandra Group/ Temperance</b> <b>Fm</b> ; basaltic lavas: agglomerate, tuff, sandstone and chert in submarine volcanic chain.	Tunnel Ch 7-9 km approx.
			Otd	<b>Temperance Formation:</b> layered basaltic tuff, chert, feldspathic arenite, minor agglomerate	Tunnel, possibly between Ch 8-9 km
			Oki	<b>Intrusives</b> : monzonite, hornblendite, lamprophyre, quartz monzonite	Tunnel possibly between Ch 7-8 km
	BOGG	Y PLAIN FAU	JLT, KIAN	NDRA FAULT	Approx. Ch 8- 9 km
Ordovician		Ovg1	Ogl	<b>Gooandra Volcanics</b> ; metabasalt, basalt breccia, pillow lavas, amphibolite, chloritic schist, feldspathic sandstone	Tunnel Ch 9.5-14.5 km approx.
		ggh	Dgk	Granite intrusives; <b>Boggy Plain</b> I-Type Suite – granodiorite and quartz monzogabbro, even grained	Tunnel Ch 8-9 km approx.
		Og5		<b>Shaw Hill Gabbro;</b> gabbro, diorite, metabasic intrusives, pyroxenite	Tunnel Ch 7-8 km
		Of1	Oln	<b>Bolton Beds:</b> Quartz arenite, siltstone and shale	Tunnel Ch 7-8 km, possibly south of alignment
Tertiary		Tbm	Dlk	Basalt	Tunnel Ch 12-14km approx. Unlikely at tunnel level
	LONG	PLAIN FAUL	T ZONE	·	Tunnel; c. 14.5 km

Age	Shade	Symbol <sup>(1)</sup>	Symbol (2)	Unit name, rock type	Approximate location in project
Devonian		Dls1		Byron Range Group; sedimentary rock sequence	Top of surge shaft
Devonian		DIv2		<b>Boraig Group</b> ; volcanic and sedimentary rock sequence	Surge Shaft, upper 150 m, approx.
			Unc	conformity	-

Silurian	Ss2	<b>Ravine Group</b> ; massive greywacke siltstone, sandstone, conglomerate, limestone	Tunnel Ch 14.5- 27 km approx., surge shaft, powerhouse cavern

<sup>(1)</sup> Kosciusko National Park 1:250,000 scale map sheet (Australian Bureau of Mineral Resources, Geology and Geophysics, 1990)

<sup>(2)</sup> Tantangara 1:100, 000 Geological Series Sheet (Bureau of Mineral Resources, Geology and Geophysics, 1979).

#### 3.2.1 The geological occurrence of asbestos

The NSW Environment Protection Authority (EPA) website contains guidance relating to managing Naturally Occurring Asbestos (NOA) and refers to Geographic Information System (GIS) maps that have been developed by NSW Trade and Investment (NSW Trade and Investment, 2018). These maps show geographically areas of high, medium and low probability of NOA see Drawing No: 12521697-GT-DWG-0008. This state-wide mapping of NOA in NSW is accompanied by a report explaining the basis of the development of the maps (NSW Trade & Investment, 2015).

Although asbestos and asbestiform minerals may form in a wide range of rock types, large accumulations of such minerals are associated with ultramafic rocks. Ultramafic (or ultrabasic) rocks are typically dark rocks rich in magnesium and iron with relatively low silica and potassium and composed mostly of minerals such as olivine and pyroxene.

The proposed alignment transverses geological units with variously 'no identified', 'low' and 'medium' NOA potential. Below are extracts from the report that accompanies the GIS that explains the context and basis of the classifications.

#### Areas of 'medium' potential for NOA

"Medium potential areas include theoretically less favourable rock types such as sandstones which could include ultramafic material which is high potential. They also include areas of poor outcrop where ultramafic rocks are physically resistant and subtly emergent." (NSW Trade & Investment, 2015)

#### Areas of 'low' potential for NOA

"Areas attributed as low potential for NOA have been determined based on the mineralogy and geological history of the host rocks....Some areas attributed with low potential have been included to account for geological uncertainty where the geology is broadly favourable for NOA to occur." (NSW Trade & Investment, 2015)

#### No identified NOA

"Although NOA does occur outside the areas attributed with potential, any unidentified occurrences would most likely be small." (NSW Trade & Investment, 2015)

The geological units associated with Potential Naturally Occurring Asbestos (pNOA) within the project area are the mafic rocks of the Gooandra Volcanics and Shaw Hill Gabbro. These units may contain host minerals that have been subject to metamorphism and altered to form serpentine ( $Mg_3[Si_2O_5](OH)_4$ ) along with tremolite, lizardite, antigorite and chrysotile that have the potential to form NOA.

Following the identification of pNOA as an issue to be managed during the drilling process, a NOA management plan was developed for the project and is covered in more detail in Section 4.3.

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# 4. Investigation planning activities

### 4.1 Environmental approvals

An Environmental Impact Statement (EIS) has been prepared for Snowy 2.0 Exploratory Works and Main Works and the project determination as Stage Significant Infrastructure was approved by the Minister on 20 May 2020.

- Infrastructure Approval (CSSI 9687) issued for Snowy 2.0 Main Works on 20 May 2020;
- Infrastructure Approval (SSI 9208) issued for Snowy 2.0 Exploratory Works (and the Exploratory Works modifications approved thereafter).

### 4.2 Construction environmental management plan

Following the Infrastructure Approval and approval of FGJV environmental management plans (Future Generation Environmental Management Strategy for Snowy 2.0 – Main Works (Doc No. S2-FGJV-ENV-PLN-0007) and associated environmental management plans), GHD developed its Construction Environmental Management Plan (CEMP). GHD's CEMP determined the systems and controls required to manage activities on a site or area to comply with the approvals. This included details on environmental controls, constraints, incident response, reporting, audit frequency, etc. The CEMP has been prepared to sit under the Future Gen Environmental Management Strategy (EMS).

### 4.3 NOA management plan

As noted in Section 3.2.1 certain areas of the project were identified as having the potential for the occurrence of NOA. The state-wide mapping of NOA in NSW was obtained in GIS format (NSW Trade and Investment, 2018) and overlaid with the proposed drill sites, refer 12521697-GT-DWG-0008. Three boreholes were located within areas determined as medium potential for NOA on the state-wide mapping GIS. Namely boreholes BH3203, BH4201 & BH4202.

GHD developed a NOA Management Plan (Doc. Ref.: 12521697-SF-PLN-0004-0) and personnel working on those drill sites were inducted into its use in order that any potential hazard could be identified and be dealt with in an appropriate manner.

The plan summarised the legislative requirements, definitions of the potential NOA risk ratings, and potential impacts for personnel involved in drilling works. The document provides information on how to set the site up, how to identify potential NOA type minerals, and the response and control measures to isolate materials including core recovery and handling procedures.

For the results of the NOA occurrence during the investigation and the testing undertaken, refer to Section 7 and Appendix M.

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# 5. Geotechnical field investigations

### 5.1 Investigation and testing rationale

Results from a combination of intrusive (drilling), downhole and laboratory testing provided the information to inform the Project design. The background for selecting various investigative techniques is as follows:

- *Borehole drilling* to obtain information (core samples) at proposed tunnel and underground structure elevations and to facilitate downhole/in-situ testing of rock mass conditions;
- *Verticality surveys* to track and correct borehole orientation during drilling and to provide the orientation and position of the boreholes as drilled (generally only used on holes greater than 200 m target length);
- *In-situ stress testing* in-situ stress testing to assess the magnitude and direction of principal stresses using 'overcoring', 'hydrofracture' and 'hydrojacking' techniques;
- *Water pressure* to provide data on the permeability of the rock mass for the design of underground structures using both 'packer testing' and 'drill stem testing';
- Acoustic Televiewer imaging (ATV) to provide in-situ information and an image of the structure of the rock mass, including defect orientations.
- *Temperature logging* to facilitate a study into the impacts of the scheme on thermal gradients and conditions;
- Gamma logging used for correlating between boreholes and lithology;
- *Laboratory testing* to obtain geotechnical and geochemical properties of rock and groundwater that can be used in design; and
- Groundwater monitoring devices to provide regional and local groundwater information (elevations and pressures) to determine design solutions for underground structures and to assess the potential impacts of the scheme on the regional groundwater system.
- Dilatometer testing to determine in-situ modulus values

### 5.2 Boreholes

The scope of the drilling investigation was developed to target specific elements of the scheme. The naming convention for the investigation locations are shown in Table 3.

Series (Borehole)	Area / location / structure
1000	Tantangara intake area
2000	Access shaft and Nungar Creek
3000	Tunnel alignment on Long Plain
4000	Long Plain Fault / Escarpment edge
5000	Surge / pressure shaft / powerhouse
6000	Yarrangobilly River / Tolbar Ridge alignment
7000	Talbingo outlet / intake
8000	Access Tunnel

Table 3. Borehole naming convention

#### 5.2.1 Non-core drilling

In most instances, soil cover was shallow and most of the drilling rigs cored from surface with only limited non-core drilling carried out.

### 5.2.2 Core drilling

Boreholes were drilled to the lengths nominated in the Borehole Schedule revision valid at the time of the drilling. Core drilling was carried out in the following manner:

- 1. Preparatory works prior to coring comprised the excavation of a turkey's nest lined with a plastic tub. For the smaller rigs this was not required to be carried out.
- 2. Following any necessary ground preparation either PWT or HWT casing, as appropriate (with shoe bits), were screwed into the ground. These were then reamed out and casing was advanced during core drilling as required.
- 3. Holes were usually started as PQ3 size and then reduced to HQ3 size at an appropriate time during drilling. Refer Table 4 for nominal drill hole, core sizes and hole volume.
- 4. Boreholes were drilled to the length nominated in the Borehole Schedule revision valid at the time of the drilling unless notified otherwise.
- 5. In-situ testing was undertaken where required in each borehole as the hole progressed and or at the completion of the borehole.
- 6. On completion, where nominated, either open standpipe or vibrating wire piezometer were installed in boreholes.
- 7. Where instrumentation was not installed, the boreholes were grouted to surface. This was carried out by staged grouting from the base of the hole upwards, with grout injected through the drill string and or via tremie tubes when near surface.

Size	Nominal core diameter (mm)	Nominal hole diameter (mm)	Nominal hole volume (litres per metre)
PWT casing	N/A	139.7	15.33
HWT casing	N/A	114.3	10.26
PQ3 coring	83.0	122.6	11.80
HQ3 coring	61.1	96.0	7.24

Table 4 Wireline drilling sizes and nominal core diameter, hole diameter and hole volume

Borehole logs and core photographs are presented in Appendix B, accompanied by an explanation of terms and abbreviations (standard sheets).

### 5.3 Borehole downhole survey

A downhole survey to obtain the 3D 'locational' path of the boreholes was undertaken in nominated boreholes during drilling. Generally, a gyroscopic borehole deviation probe was used to locate the path of the boreholes during drilling. The gyroscopic probe is not influenced by the presence of magnetic rocks.

The path of the boreholes was logged at least every 30 m during drilling. Where deviations were observed then survey intervals were taken more frequently to give the earliest opportunity for the borehole orientation to be corrected. The results from the downhole survey are presented in Appendix C.

### 5.4 Borehole geophysical logging

Borehole geophysical logging involves measuring the physical properties of the surrounding medium with a sensor located in a borehole. The following sections describe the various methods that have been used on the investigation. WellCAD has been used to assimilate and process the data and the consolidated results of the borehole geophysical logging are reported in Appendix D.

### 5.4.1 Acoustic televiewer

Acoustic Televiewer (ATV) imaging was carried out in boreholes nominated in the scope. The ATV scanning was typically undertaken on completion of the coring to generate an image of the borehole walls. The imaging has been processed using WellCAD and inferred geological defects such as joints, partings and shears have been

identified. The geological structures have been interpreted into a plane and the dip and dip direction has been measured and is reported. The inferred structures are oriented to true north and no correction for magnetic declination has been applied. Any thickness measured is indicative only. Depth measurements refer to length down the hole and are approximate.

### 5.4.2 Temperature probe

A continuous log of temperature was carried out in the boreholes nominated in the scope. The temperature was logged ensuring sufficient time for the probe to reach downhole ambient temperatures.

### 5.4.3 Full wave sonic

Full wave sonic logging was carried out in boreholes nominated in the scope. The logging was typically undertaken on completion of the coring. The full wave sonic logs include digital arrival curves for the compressional, shear and tube wave arrivals.

### 5.4.4 Downhole natural gamma

Natural gamma is primarily a lithology tool that measures gamma radiation in the borehole naturally emanating from the rocks. The natural gamma logs are applicable to investigations in both sedimentary and crystalline rocks, particularly for stratigraphic correlation. The downhole gamma probe was run in nominated boreholes.

### 5.5 Permeability testing (packer testing)

Permeability water pressure testing (packer tests) were carried out in boreholes at the frequencies and depths nominated in the scope of work. Either single or double (straddle) packers were used to obtain a measurement of the rock mass permeability characteristics in Lugeon units.

The packer tests can be broadly separated into two methods:

- a. Pneumatic inflation through the bit single packer were used for most holes shallower than 400 m, they were completed during drilling operations as the holes were progressed. Using this method, pressures and flow rates are recorded manually, to determine Lugeon values using gauges on the surface.
- b. For the deeper holes, hydraulically inflated end of string straddle packers were used in the borehole after coring was completed. Data for these tests was recorded using digital gauges on surface and a memory gauge positioned within the test zone.

Test intervals ranged between 3 m and 10 m in length. The results of the packer testing are presented in Appendix E.

### 5.6 Permeability testing (drill stem test)

Pro-Test Pty Ltd (Pro-Test) conducted permeability testing using the Drill Stem Test (DST) method. Appendix E presents the supplied borehole DST reports.

The drill stem permeability tests were conducted using the Pro-Test proprietary system, with a mechanically operated shut in and circulating valves. Tests were generally performed across a 30 m straddle zone, with test zones based on the guidance from FGJV. 75 m straddle zones were used in BH-IPS.

The first stage of the test involves lowering the water level in the hole using compressed air or nitrogen. Once the water level is lowered the packers are inflated and the test interval is sealed off and the test zone is allowed to return to an equilibrium pressure. After equilibrium is reached, a valve sealing the zone is opened and then closed so inflow can take place. Head build up during the valve closure is logged, giving a pressure-time plot suitable for assessment of permeability.

Two or three DSTs were performed in each borehole, with the exception of BH-IPS in which nine DSTs were undertaken. Interpretation of the DST results has been performed by Petro-Tech Central Pty Ltd (Petro-Tech). Results are provided in Appendix E.

### 5.7 In-situ stress testing (overcoring)

SCT Operations Pty Ltd (SCT) conducted In-Situ Stress Test (IST) measurements using the over-core technique. Appendix F presents the results of the over-coring in situ stress testing.

The over-core stress test method adopted consists of a number of stages. The last HQ core run is pulled as normal. A countersink tool is pumped in place of the inner barrel and is used to create a countersink hole by grinding upstanding core away, leaving a cone shaped depression in the rock immediately below the HQ bit face. This countersink drilling is shown on the borehole logs and core photographs as a short (generally 40-50 mm) section of 'core loss' directly above test zones. The countersink is retrieved on wireline and replaced by a LTK48 size core pilot hole drill. This is used to drill an approximately 800 mm long pilot hole. The pilot hole produces a 35.3 mm core sample which is used to assess the likelihood of successful test zones. The LTK48 core is presented in the supplied core photos as a smaller diameter core sample.

Upon review of the LTK48 core sample, and deeming the zone suitable for stress testing, the pilot hole is flushed, and the stress cell assembly is run into the pilot hole. The stress cell is coated with an epoxy resin prior to release. Upon confirmation of the stress cell emplacement the drill string is sealed, and compressed nitrogen gas is injected to provide a back pressure to the flexible walls of the stress cell. This back pressure forces the epoxy resin in contact with the pilot hole wall during curing. The back pressure is maintained during the 4-6 hour curing period.

Once the stress cell is cured in place, the back end module is withdrawn on wireline. The conventional drilling rods are then lowered to the bottom and coring commences over the stress cell. As the bit progresses past the stress cell a change in pilot hole diameter is measured. At the end of the core run the barrel is pulled as normal but with the stress cell inside. When on the surface the stress cell and surrounding core is photographed. A sample of the LTK48 core is taken from site and sent to a laboratory for further testing. Data stored within the stress tool is extracted to a laptop and processed.

### 5.8 In-situ stress testing (hydrofracture)

Pro-Test Pty Ltd (Pro-Test) conducted stress testing measurements using hydrofracture techniques on selected boreholes as part of the Snowy 2.0 project.

This method includes running the standard suite of borehole geophysical logging outlined in Section 5.4, before testing, and either geophysical logging or an impression packer after testing. The downhole geophysics is used to determine strata and fracture characteristics to enable fracture analysis comparing prior and post hydrofracture wall conditions.

Hydrofracture testing was undertaken using an end of drill string packer. The method involves assembling the end of string straddle packers at surface and lowering down the hole on HRQ rods with joint seals. Once the packers are in position at the test interval, they inflate through the pressurised water in the string before allowing flow into the test zone through an automatic injection valve, mitigating the need for additional injection lines.

Once the zone is sealed and isolated using either of the above methods, a hydrofracture pump is used to inject water into the formation while recording flow volumes and pressure data to determine formation breakdown pressure, fracture propagation pressure and fracture closure pressure. The objective is to define the pressure at which the walls of the fracture are just supported by a fluid cushion. This pressure represents the rock stress component normal to the plane of the fracture and is variously referred to as 'closure pressure' or 'shut-in pressure'.

By subjecting the fracture to a series of injection/draining cycles, the magnitude of this principal stress can be determined to a high degree of accuracy. The orientation of the principal stresses is obtained by determining the orientation of the induced fracture using an impression packer system.

Hydrofracture stress testing results are analysed and are reported by Gyro-Services GmbH. Please refer to Appendix F for the borehole in-situ stress testing (hydrofracture) reports.

### 5.9 In-situ stress testing (hydrojacking)

Pro-Test Pty Ltd (Pro-Test) conducted stress testing measurements using hydrojacking techniques on selected boreholes as part of the Snowy 2.0 project.

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Hydrojacking is a technique to estimate the rock stress in fractured rock formation where hydraulic fracturing cannot be applied. Ideally, borehole sections are selected for hydrojacking tests containing numerous fractures of different orientation. They are isolated by a straddle packer system and water is injected into the test section. The injection pressure is increased stepwise while measuring both the pressure and the pump rate until the maximum pump capacity is reached. Such a test is basically an extended Lugeon-test with more steps and typically higher injection pressure.

The objective of hydrojacking tests is to estimate the pressure at which some of the fractures in the test sections open and become fully jacked (fracture walls fully separated). Fracture opening leads to a steep increase in permeability of the rock mass. For stress estimation, it is the jacking pressure that is relevant. It may be somewhat higher than the opening pressure. The fracture opening pressure on the other hand provides a direct simulation of leakage that can occur in an unlined tunnel (Doe & Korbin, 1987).

The concept of hydro jacking is identical to that of hydraulic fracturing when induced fractures are opened to estimate the minimum principal stress. However, it is less certain in hydrojacking tests that the opened fractures planes are oriented normal to the minimum-stress-axis. Generally, fractures supporting the least stress are favoured for opening.

Hydrojacking stress testing results are analysed and are reported by Gyro-Services GmbH. Please refer to Appendix F for the borehole in-situ stress testing (hydrojacking) reports.

## 5.10 Dilatometer testing

Dilatometer testing has been completed on selected bores and are reported by Pro-Test Pty Ltd, Geotechnisches Ingenieurbüro Prof. Fecker & Partner GmbH (GIF) and Gyro-Services GmbH.

Dilatometer tests are used to estimate the stress/strain characteristics of a rock mass in situ - directly in a borehole. The main part of the equipment consists of a dilatometer probe which is equipped with a flexible packer sleeve and is expanded with compressed nitrogen. Three displacement transducers at the centre of the probe measure the expansion of the probe and thus the increase of the borehole diameter. The applied pressure and the resulting dilatation of the borehole are recorded and analysed for in situ characterization of the rock mass.

Six steel pins are screwed in threaded seats in the rubber sleeve, always two arranged diametrically opposed. They enable a direct contact between the displacement transducers and the borehole wall. This enables measurement of borehole deformation with high precision.

Tests are executed in three cycles with a maximum pressure of 3, 6 and 10 MPa while the pressure is increased and lowered stepwise. The first cycle consists of a loading phase and an unloading phase only whereas the subsequent cycles also include a reloading phase to the maximum pressure of the previous cycle. Pressure steps of 0.5 MPa are applied for the first loading phase. Larger pressure differences are applied in the reloading phase and while unloading.

Dilatometer results are analysed and are reported by Gyro-Services GmbH. Please refer to Appendix F for the dilatometer reports.

## 5.11 Vibrating wire piezometer installations

Vibrating wire piezometers were installed in nominated boreholes to design depths as nominated by FGJV. The boreholes were flushed prior to installation. The instruments were inserted via a stainless steel wire rope connected to a steel weight at the end. Instruments, cables and grouting tubes were tied to the steel cable as the package was progressively lowered down the hole. The hole was stage grouted via the grout tubes, ensuring all instruments remained within their operating pressure range. At completion of the instrumentation installation a weatherproof data logger was installed at the collar of the borehole.

Installation depths and instrumentation calibration certificates are presented in Appendix H. In the case of inclined boreholes, this is the length along the borehole.

## 5.12 Foreign material left in ground

The groundwater monitoring standpipe installations and the vibrating wire piezometer installations are documented in the appendices and these installations remain in ground at April 2021. Remaining boreholes were grouted from the base of the borehole upwards via the drill string and / or tremie tubes to inject grout.

Most boreholes had some casing left in ground to maintain collar stability whilst pulling out, running downhole geophysical tools and completing the hole. Further, in some locations, either to advance the boreholes through difficult ground conditions or due to jamming or blockage the of equipment, some boreholes had drilling casing, rods, barrels or other appurtenant equipment left in ground. Refer Table 5 for details.

Table 5 Type and length of foreign material left in ground for each borehole

Borehole ID	Length of foreign material along borehole	Description				
BH1201	Nil	N/A				
BH1202	Standpipe piezometer installed to 35.81 m.					
BH3203	HWT casing to 85.05 m	HWT casing				
	VWP installation. Sensors at 110 m, 200 m & 350 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH4201	HWT casing to 81.57 m	HWT casing				
	VWP installation. Sensors at 382 m & 448 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH4202	HWT casing to 84.03 m	HWT casing				
	VWP installation. Sensors at 282 m & 460 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH-IPS‡	HWT casing to 104.20 m	HWT casing				
BH5202	HWT casing to 33.00 m	HWT casing				
	VWP installation to 230 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5203‡	HWT casing to 173.43 m	HWT casing				
	AW rods between 173.50-181.70 m					
	Dilatometer tool between 181.70-185.40 m					
BH5203A‡	HWT casing to 273.91 m	HWT casing				
	VWP installation. Sensors at 280 m, 350 m & 450 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5204‡	HWT casing to 29.84 m	HWT casing				
	VWP installation. Sensors at 590 m & 690 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5206	HWT casing to 98.36 m	HWT casing				
	VWP installation. Sensors at 600 m & 680 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5207	PQ casing to 53.80 m	PQ casing.				
	VWP installation to 680 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5208	HWT casing to 59.99 m	HWT casing				
	VWP installation. Sensors at 275 m & 525 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5209	HWT casing to 69.16 m	HWT casing.				
	VWP installation. Sensors at 350 m & 650 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH5210‡	HWT casing to 62.83 m	HWT casing				
BH5211‡	HWT casing to 69.02 m	HWT casing				
	HQ and core barrel rods between 695.50 – 735.50 m	12 x 3 m HQ rods. HQ core barrel				
BH7201	Nil	N/A				
BH7202	VWP installation. Sensors at 19.25 m, 24.25 m & 40.20 m	VWP installation consists of steel cable, data cables, pressure sensors and grout.				
BH7203	HWT casing to 4.50 m	HWT casing.				
	Standpipe piezometer installed to 29.50 m.					
	Sand backfill 29.50-45.20 m					

<sup>‡</sup> Denotes inclined borehole

## 6. Geotechnical laboratory testing

## 6.1 Test types

A program of laboratory testing on samples obtained during the investigations assessed and classified the engineering characteristics of the soil and rock.

All core samples have been consolidated and are now stored at the GHD core shed in Polo Flat, NSW. The cores were reviewed in Polo Flat, sub sampled and then dispatched to various GHD and external laboratories around Australia.

The scope of geotechnical, geochemical and groundwater laboratory testing is shown in Table 6, Table 7 and Table 8 below.

Table 6 Geotechnical laboratory testing relevant standards

Test	Standard/Method	Laboratory
Point load testing	AS 4133.4.1-2007	GHD (Polo Flat/ On site)
UCS, Stress / Strain curves, Poisson's Ratio	AS 4133.4.2, AS 4133.4.3.2	GHD (Artarmon/ Marica West)
Moisture content	AS 4133.1.1.1	GHD (Artarmon/ Marica West)
Dry density	AS 4133.2.1.1	GHD (Artarmon/ Marica West)
Tensile strength (indirect, Brazil method)	ISRM – part 2 – Indirect Tensile by the Brazil Test	GHD (Artarmon/ Marica West)
Direct shear testing of joints	ISRM D5607	GHD (Artarmon), BRTS
Swedish Brittleness	BRTS	BRTS
CERCHAR abrasivity index test	ASTM D7625-10	BRTS
Particle density / Porosity	AS 4133.2.1.1	GHD (Artarmon)
Abrasion Value Cutter Steel (AVS)	BRTS Test Method	BRTS
Sievers J-value	BRTS Test Method	BRTS
Petrography (including quartz content)		Hensel Geosciences
X-ray diffraction		Hensel Geosciences
Aggregate soundness-sodium sulphate soundness	AS 1141.24	BRTS
Absorption	AS 4133.1.1.1	BRTS
Rock Triaxial	ASTM D7012	Trilab
Bulk density	AS 1141.4 (AS 2758)	GHD (Artarmon)
Slake durability index	ASTM D4644-08	BRTS
Testing of Stone for Expansive Breakdown	CRD-C 148-69	Boral
Testing of Stone for Expansive Breakdown (Visual Observation)	Gomes & Rodriques (2006)	Boral
Uniaxial Creep	ASTM D7070 - 16	BRTS
Soil classifications	AS 1289.2.1.1, AS 1289.3.4.1, AS 1289.3.1.1, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.6.1	GHD (Artarmon)

Table 7 Geochemical laboratory testing relevant standards

Test	Standard/Method	Laboratory				
Sulphur Content	ALS Analysis method	ALS				
Net Acid Generation	AMD001	Envirolab				
Net Acid Producing	AMD001	Envirolab				
pH/EC	AS 1141.35 INORG-001, AS 1141.35 INORG-002	Envirolab				
Acid Extractable Metals in soil	METALS-020, METALS-021	Envirolab				
Chemical Properties (chloride, pH, sulphate and conductivity)	AS 1289.4.2.1, AS 1289.4.3.1, RMST1010, APHA2510 & 2520-B	Envirolab				
Asbestos ID - Stereo Microscopy & Polarised Light Microscopy (PLM) + Dispersion Staining (DS)	AS 4964-2004, ISO14966-2002, VDI3492-2004	Envirolab				

Table 8 Groundwater laboratory testing relevant standards

Test	Standard/Method	Laboratory
рН	ALS Analysis method	ALS
Electrical Conductivity	ALS Analysis method	ALS
Total Dissolved Solids	ALS Analysis method	ALS
Carbon Dioxide - Free and Total	ALS Analysis method	ALS
Anions	ALS Analysis method	ALS
Alkalinity	ALS Analysis method	ALS
Silica as SiO <sub>2</sub>	ALS Analysis method	ALS
Dissolved Metals by ICP-OES	ALS Analysis method	ALS
Total Metals by ICP-OES	ALS Analysis method	ALS
Dissolved Metals by ICP-MS	ALS Analysis method	ALS
Total Metals by ICP-MS	ALS Analysis method	ALS
Fluoride	ALS Analysis method	ALS
C1 - C4 Hydrocarbon Gases	ALS Analysis method	ALS
Biochemical Oxygen Demand	ALS Analysis method	ALS
Chemical Oxygen Demand	ALS Analysis method	ALS

## 6.2 Test laboratories and sample storage

The following laboratories were used for most of the testing:

- ALS (Canberra ACT)
- Envirolab (Chatswood NSW)
- Envirolab MPL (Perth WA)
- Bamford Rock Testing Services (North Melbourne VIC)
- GHD (Polo Flat, Marica West and Artarmon NSW)
- Hensel Geosciences (Mudgeeraba QLD)
- Trilab (Geebung QLD)
- Boral (Baulkham Hills, NSW)

Details of the relevant testing standards are shown in Table 6 and on the test reports in Appendix I, Appendix J, Appendix K and Appendix M. Remaining rock core, following the removal of samples for testing, are held in storage under cover at Polo Flat. The core shed inventory is labelled and tracked with Quick Response (QR) code

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## 7. Naturally Occurring Asbestos

NOA was identified as a potential hazard that may be encountered during the geotechnical investigation as described in Section 3.2.1. Based on this, Section 4.3 describes the NOA Management Plan (NOAMP) used to manage the hazards that may be associated with potential NOA bearing materials that could be encountered during drilling.

Three borehole locations, BH3203, BH4201 and BH4202 were drilled in areas of medium NOA potential as shown on 12521697-GT-DWG-0008. Systematic sample of rock core samples was undertaken throughout each of the three boreholes. Two samples were also taken from BH-IPS which is not in a zone of know NOA occurrence. These samples were dispatched to a NATA accredited external laboratory for asbestos identification. In parallel drilling mud samples were taken from the sludge within the mud tanks and also dispatched for asbestos identification.

In BH3202, materials were encountered with a fibrous appearance in a rock type that was congruous with the presence of minerals that have the potential to be asbestiform. Procedures and control measures were implemented in accordance with the NOAMP. These controls include specific PPE requirements for personnel on the drill pad, core handling procedures, isolation of rock core and drilling waste muds, and laboratory testing of the core the drilling and the drilling waste mud.

The laboratory performed asbestos identification analysis in bulk materials using Stereo Microscopy & Polarised Light Microscopy (PLM) including Dispersion Staining (DS) in accordance with Envirolab's Test Method One, Asbestos in Bulk Materials, which is based on the guidelines of Australian Standard 4964-2004.

A total of 198 rock core samples and a total of 7 mud samples subject to asbestos identification testing, and of these there were three samples which had unknown mineral fibres detected. The unknown mineral fibres were detected in six samples including BH3203 at 387.20 m (Sample No. BH3203-105), BH4201 at 137.12 m (Sample No. BH4201-71), BH4202 at 34 m (Sample No. BH4202-48), 136.00 m (Sample No. BH4202-07), 162.00 m (Sample No. BH4202-08) and 424 m (Sample No. BH4202-49). These samples were then sent for fibre characterisation using Scanning Electron Microscopy (SEM) and X-Ray diffraction (XRD). This SEM/ XRD analysis allowed for the confirmation of fibre types and morphology, including identification of asbestos fibres from other minerals similar in composition, such as mica (e.g. biotite) or pyroxenes. In the SEM analysis 100 image fields of the specimens were examined and within these field over 100 countable asbestos fibres were observed in some samples. See Figure 2 and Figure 3 for example imagery. The report determines that the elemental composition of the fibre is indicative of asbestiform minerals actinolite (BH3203, BH4201, BH4202) and ferroactinolite (BH4202). The testing is summarised in Table 9 and the laboratory results are presented in Appendix M.

Borehole ID	Sample Type	Number of samples tested	Presence of NOA	Depth of testing (m) along borehole string				
BH3203	Drilling mud (waste)	7	Negative	N/A				
	Rock core	107	Negative	Various between 67.9 – 400.0				
		1	Positive	387.20-387.40				
BH4201	Rock core	49	Negative	Various between 6.9 – 485.0				
		1	Positive	137.12-137.17				
BH4202	Rock core	34	Negative	Various between 17.0 – 500.7				
		4	Positive	34.04-34.10, 136.00-136.13, 162.00-162.08 and 424.33- 424.40				
BH-IPS	Rock Core	2	Negative	672.00-672.10 & 1580.86- 1580.90				

Table 9	Summary	of NOA	testina	carried	out
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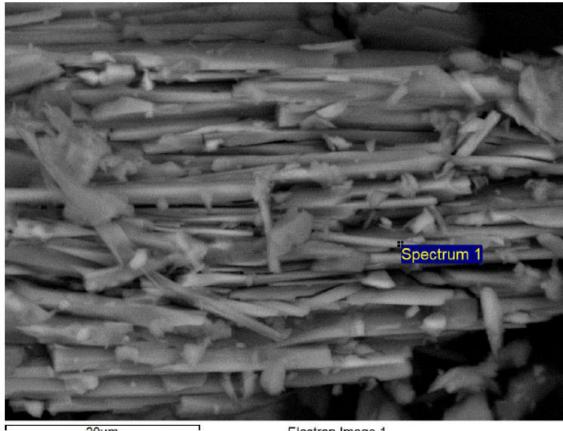
Table 10 summarises data from a selection of image / fields reported due to their higher fibre count, this has been reproduced from the Microanalysis Australia, SEM laboratory report. See Appendix M for the full report.

Table 10 SEM image field fibre count data

Borehole ID	Fibre	Image Field	(mµ) D	L (µm)	Aspect ratio	Major elements	Minor Elements	Morphology	Assigned Mineralogy
BH3203	1	3/1	2.2	11.7	5:1	O, Si	Ca, Mg, Fe	Non-parallel sides	Actinolite
BH3203	2	4/2	1.3	6.3	5:1	O, Si	Ca, Mg, Fe	Parallel sides	Actinolite
BH3203	3	7/2	1.3	9.6	7:1	O, Si	Ca, Mg, Fe	Parallel sides	Actinolite
BH3203	4	8/3	1.1	9.2	8:1	O, Si	Ca, Mg, Fe	Non-parallel sides	Actinolite
BH3203	5	9/3	1.8	6.2	3:1	O, Si	Ca, Mg, Fe	Non-parallel sides	Actinolite
BH3203	6	11/1	1.4	7.3	5:1	O, Si	Ca, Mg, Fe	Non-parallel sides	Actinolite
BH3203	7	13/1	1.7	9.1	5:1	O, Si	Ca, Mg, Fe	Non-parallel sides	Actinolite
BH4201	1	1/1	2.9	28.8	10:1	O, Si	Mg, Fe, Ca, Al	Non-parallel sides	Actinolite
BH4201	2	2/1	2.7	26.9	10:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4201	3	3/1	0.7	6.9	10:1	O, Si	Mg, Fe, Ca, Al	Non-parallel sides	Actinolite
BH4201	4	5/1	1.4	16.1	12:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4201	5	6/1	1.8	12.7	7:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4201	6	7/1	1.7	13.7	8:1	O, Si	Mg, Ca, Fe, Al	Parallel sides	Actinolite
BH4201	7	11/1	1.0	10.0	10:1	O, Si	Mg, Fe, Al, Ca	Non-parallel sides	Actinolite
BH4202	1	2/1	1.4	18.1	13:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	2	2/2	0.8	8.9	11:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	3	3/1	1.4	16.2	12:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	4	5/1	0.7	6.6	9:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	5	6/1	1.4	24.3	17:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	6	8/1	0.8	11.3	14:1	O, Si	Mg, Ca, Fe, Al	Irregular ends	Ferroactinolite
BH4202	7	9/1	0.5	15.2	30:1	O, Si	Mg, Fe, Al, Ca	Irregular ends	Ferroactinolite
BH4202	8	6/1	1.0	6.4	6:1	O, Si	Mg, Fe, Al, Ca	Irregular ends	Ferroactinolite
BH4202	9	7/1	1.6	10.0	6:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	10	9/1	1.6	8.4	5:1	O, Si	Mg, Fe, Ca, Al	Irregular ends	Ferroactinolite
BH4202	11	12/1	1.2	15.7	13:1	O, Si	Mg, Fe, Al, Ca	Irregular ends	Ferroactinolite
BH4202	12	12/2	1.0	18.1	17:1	O, Si	Mg, Al, Fe, Ca	Irregular ends	Ferroactinolite
BH4202	13	13/1	1.7	11.0	6:1	O, Si	Mg, Ca, Fe, Al	Irregular ends	Ferroactinolite
BH4202	14	14/1	0.8	15.0	19:1	O, Si	Mg, Ca, Fe, Al	Irregular ends	Ferroactinolite
BH4202	15	1/1	0.4	13.8	35:1	O, Si	Mg, Ca, Fe, Al	Non-parallel sides	Actinolite
BH4202	16	2/1	1.5	19.5	13:1	O, Si	Mg, Fe, Al, Ca	Non-parallel sides	Actinolite
BH4202	17	4/1	1.1	13.9	13:1	O, Si	Mg, Fe, Al, Ca	Non-parallel sides	Actinolite
BH4202	18	6/1	1.1	7.5	7:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4202	19	7/1	0.8	5.8	7:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4202	20	8/1	0.9	8.4	9:1	O, Si	Mg, Fe, Al, Ca	Parallel sides	Actinolite
BH4202	21	9/1	2.2	9.0	4:1	O, Si	Mg, Ca, Fe, Al	Parallel sides	Actinolite

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Borehole ID	Fibre	Image Field	D (µm)	L (µm)	Aspect ratio	Major elements	Minor Elements	Morphology	Assigned Mineralogy
BH4202	22	1/1	2.5	16.1	6:1	O, Si	Mg, Fe, Al, Ca	Non-parallel sides	Actinolite
BH4202		2/1	0.5	13.7	27:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4202		4/1	3.0	32.2	11:1	O, Si	Mg, Fe, Ca, Al	Parallel sides	Actinolite
BH4202		5/1	1.0	14.0	14:1	O, Si	Mg, Fe, Al, Ca	Parallel sides	Actinolite
BH4202		6/1	1.8	10.1	6:1	O, Si	Mg, Fe, Al, Ca	Parallel sides	Actinolite
BH4202		7/1	1.7	20.5	12:1	O, Si	Mg, Fe, Al, Ca	Parallel sides	Actinolite
BH4202		8/1	1.0	6.7	7:1	O, Si	Mg, Fe, Al, Ca	Parallel sides	Actinolite



20µm

Electron Image 1

Figure 2 SEM image of fibres from sample from BH4202 at 136.00m

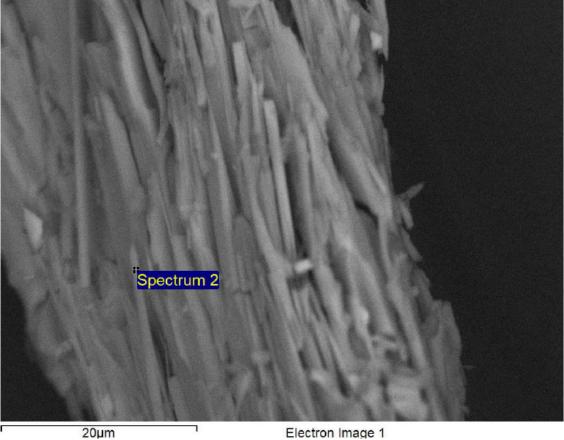


Figure 3

20µm Electron Image 1 SEM image of fibres from sample from BH4202 at 162.00 m

## 8. References

Australian Bureau of Mineral Resources, Geology and Geophysics. (1990). Geology of the Kosciusko [i.e. Kosciuszko] National Park. *1st ed.* Canberra: Bureau of Mineral Resources, Geology and Geophysics.

- Bureau of Mineral Resources, Geology and Geophysics. (1979). TANTANGARA (NSW and ACT) 1:100 000 Geological Map. Commonwealth of Australia.
- Doe, T. W., & Korbin, G. E. (1987). A comparison of hydraulic fracturing and hydraulic jacking stress measurements. *28th US Symposium on Rock Mechanics, Tucson*, p. 282 290.
- Downes, P. M. (2010). Asbestos risk map of NSW. Geological Survey of NSW NSW Trade and Investment.
- Gray, D. R. (1997). Tectonics of the southeastern Australian Lachlan Fold Belt: structural and thermal aspects. In J. -P. Burg, & M. Ford (Eds.), Orogeny Through Time (Vol. 121, pp. 149-177). London: Geological Society, Special Publications. doi:http://dx.doi.org/10.1144/GSL.SP.1997.121.01.11
- Moye, D. G. (1961). *Geology of the Snowy Mountains bibliography.* Cooma: Snowy Mountains Hydro-Electric Authority.
- NSW Trade & Investment. (2015). *Mapping of Naturally Occurring Asbestos in NSW Known and Potential for Occurrence*. Division of Resources & Energy. Sydney: Heads of Asbestos Coordination Authorities. Retrieved May 20, 2018, from

http://www.safework.nsw.gov.au/\_\_data/assets/pdf\_file/0006/56778/WC01788-0715-297174.pdf

NSW Trade and Investment. (2018). *Naturally Occuring Asbestos in NSW*. Retrieved 05 20, 2018, from trade.maps.arcgis:

https://trade.maps.arcgis.com/apps/PublicInformation/index.html?appid=87434b6ec7dd4aba8cb664d8e64 6fb06

Packham, G. H. (1969). The geology of New South Wales. Sydney: Geological Society of Australia.

# Appendices

## Appendix A Investigation summary and standard sheets

Table A.1	Summary	f data hu	borehole and	annondiv
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| Summary of data by                                                   | , porenoie                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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Notes:

- \* Indicates BH were collared as vertical from the surface, however due natural ground conditions borehole may have deviated from vertical. Please refer to BH verticality survey.

- Note 1 Weighted average azimuth and inclination derived from downhole survey data for inclined boreholes calculated using the following method. See Appendix C for full downhole survey data.  $\frac{\Sigma(survey \ value \times survey \ increment)}{\Sigma(survey \ increment)}$ 

- Note 2 Boreholes were redrilled to deviate around foreign material, in-ground at depth, refer to Section 5.12 for further details.

- Note 3 Borehole setup azimuth is the intended (scope) azimuth of the borehole. Borehole set up inclination was steeper than the target (scope) angle to account for anticipated flattening of the borehole with increasing depth.

**GENERAL NOTES** 



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The report contains the results of a geotechnical investigation or study conducted for a specific purpose and client. The results may not be used or relied on by other parties, or used for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the report are excluded unless they are expressly stated to apply in the report.

## TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information. Moreover, the location of test holes should be considered approximate, unless noted otherwise (refer report). Reference should also be made to the relevant standard sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

## GROUNDWATER

Unless otherwise indicated, the water depths presented on the test hole logs are the depths of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater depth may differ from this recorded depth depending on material permeabilities (i.e. depending on response time of the measuring instrument). Further, variations of this depth could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities such as a change is ground surface level. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate surveys, instrumentation techniques and monitoring programmes.

## INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data, often with only approximate locations (e.g. GPS). Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

## **CHANGE IN CONDITIONS**

Local variations or anomalies in ground conditions do occur in the natural environment, particularly between discrete test hole locations or available observation sites. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural processes.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to GHD for appropriate assessment and comment.

## **GEOTECHNICAL VERIFICATION**

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system and/or to conduct monitoring as a result of this natural variability. Allowance for verification by appropriate geotechnical personnel must be recognised and programmed for construction.

## FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate. The estimate is influenced, and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

#### **REPRODUCTION OF REPORTS**

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions must include at least all of the relevant test hole and test data, together with the appropriate Standard Description sheets and remarks made in the written report of a factual or descriptive nature.

Reports are the subject of copyright and shall not be reproduced either totally or in part without the prior written consent of GHD. GHD expressly disclaims responsibility to any person other than the client arising from or in connection with this report.

## **GLOSSARY OF SYMBOLS**



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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											
Symbol	Description	Symbol	Description									
D	Disturbed Sample	R	Rising Head Permeability Test									
В	Bulk Sample	F	Falling Head Permeability Test									
U(50)	Undisturbed Sampled (suffixed by sample size or tube diameter in mm if applicable)	PBT	Plate Bearing Test									
CS	Core Sample (suffixed by diameter in mm)	<b>}</b>	Water Inflow (make)									
ES	Soil sample for environmental sampling		Water Outflow (loss)									
PID	Photoionisation Detector	$\mathbf{\nabla}$	Temporary Water Level									
SPT	Standard Penetration Test (with blows per 0.15m)	V	Final Water Level									
Ν	SPT Value	•	Point Load Test (axial)									
HB/HW	SPT Hammer Bouncing/Hammer Weight	0	Point Load Test (diametric)									
PP/HP	Pocket/Hand Penetrometer (suffixed by value kPa)	PL	Point Load (kPa)									
PK	Packer Test (kPa)	IMP	Impression Device Test									
PZ	Piezometer Installation	РМ	Pressuremeter Test									
SV/VS	Shear Vane Test (suffixed by value in kPa)											

			SOIL S	SOIL SYMBOLS										
Main C	omponents		Minor Components											
	SAND	FILL		sandy sandy vegetation, roots										
000	GRAVEL	SILT	0000	gravelly		silty								
	CLAY	TOPSOIL		clayey		e: Natural soils are generally a abination of constituents, e.g. sandy CLAY								
			ROCK	SYMBOLS										
Sedime	entary					Igneous								
	SANDSTONE	SILTSTONE		CONGLOMERATE		+ + + + + +	GRANITI C ROCK	==	IGNEOUS					
	CLAYSTONE	SHALE		COAL		$\bigotimes$	BASALT IC ROCK		DYKE					

Note: Additional rock symbols may be allocated for a particular project

## NATURAL DEFECTS (Coding)

Defect Type		Orientation							
Jt	Joint		For vertica	For vertical non-oriented core "Dip" angle (eg. 5°) measured relative to horizontal.					
Pt	Parting		For incline	For inclined non-oriented core "Angle" measured relative to core axis.					
SS	Sheared Su	rface	For incline	d orien	ted core "I	)ip" angle	and "Dip Direction" an	gle (eg.	45°/225° mag.).
WSm	Weathered S	Seam	Orientatio	n (con	't)	Rough	ness	Coati	ng
SSm	Sheared Sea	am	VT	Verti	cal	Pol	Polished	Cn	Clean
CSm	Crushed Se	am	HZ or 0°	Horiz	ontal	So	Smooth	Sn	Stained
ISm	Infilled Sean	n	<b>d</b> / °	Degr	ees	Rf	Rough	Ve	Veneer
SZ	Sheared Zone					VR	Very Rough	Со	Coating
VN	Vein					Slk	Slickensided		
Shape						Infilling	g / Common Materials		
Pln	Planar		St	Step	bed	CLAY	Clay	Mi	Micaceous
Cu	Curved Ir		Irreg	ular	Са	Calcite	Mn	Manganese	
Un	Undulating Dis		Dis	Disco	ontinuous	Х	Carbonaceous	Ру	Pyrite
Others						Kt	Chlorite	Qz	Quartz
ОР	Open	CL	Closed	Ti	Tight	Fe	Iron Oxide	MU	Unidentified Mineral



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Soil is described in general accordance with <u>Australian Standard AS 1726-2017</u> (Geotechnical Site Investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines soil as particulate materials that occur in the ground and can be disaggregated or remoulded by hand in air or water without prior soaking. Classification of the soil is undertaken following description.

#### SOIL DESCRIPTION

The soil description includes a) Composition, b) Condition, c) Structure, d) Origin and e) Additional observations. 'FILL', 'TOPSOIL' or a 'MIXTURE OF SOIL AND COBBLES / BOULDERS' (with dominant fraction first) is denoted at the start of a soil description where applicable.

#### a) Soil Composition (soil name, colour, plasticity or particle characteristics, secondary and then minor components)

**Soil Name:** A soil is termed a *coarse grained soil* where the dry mass of sand and gravel particles exceeds <u>65%</u> of the total. Soils with more than <u>35%</u> fines (silt or clay particles) are termed *fine grained soils*. The soil name is made up of the primary soil component (in BLOCK letters), prefixed by applicable secondary component qualifiers. Minor components are applied as a qualifiers to the soil name (using the words 'with' or 'trace').

Particles are differentiated on the basis of size. 'Boulders' and 'cobbles' are outside the soil particle range, though their presence (and proportions) is noted. While individual particles may be designated as silt or clay based on grain size, fine grained soils are characterised as silt or clay based on tactile behaviour or Atterberg Limits, and not the relative composition of silt or clay sized particles.

**Colour:** The prominent colour is noted, followed by (spotted, mottled, streaked etc.) then secondary colours as applicable. Roughly equally proportioned colours are prefixed by (spotted, mottled, streaked etc.). Colour is described in its moist condition, though both wet and dry colours may also be provided if appropriate.

**Plasticity:** Fine grained soils are designated within standard ranges of plasticity based on tactile assessment or laboratory assessment of the Liquid Limit.

**Particle Characteristics:** The particle shape, particle distribution and particle size range within a coarse grained soil is described using standard terms. Particle composition may be described using rock or mineral names, with specific terms for carbonate soils.

**Secondary and Minor Components:** The primary soil is described and modified by secondary and minor components, with assessed ranges as tabulated.

**Carbonate Soils:** Carbonate content can be assessed by use of dilute '10%' HCl solution. Resulting clear sustained effervescence is interpreted as a *Carbonate soil* (approximately >50% carbonate), while weak or sporadic effervescence indicates *Calcareous soil* (< 50% carbonate). No effervescence is interpreted as a noncalcareous soil.

**Organic and Peat Soils:** Where identified, organic content is noted. *Organic soil* (2% to 25% organic matter) is usually identified by colour (usually dark grey/black) and odour (i.e. 'mouldy' or hydrogen sulphide odour). *Peat* (>25% organic matter) is identified by a spongy feel and fibrous texture. Peat soils' decomposition may be described as 'fibrous' (little / no decomposition), '*pseudo-fibrous'* (moderate decomposition) or '*amorphous'* (full decomposition).

Fraction	Compone	ents	Particle Size (mm)
Oversize	BOULDER	S	> 200
Oversize	COBBLES		63 - 200
		Coarse	19 - 63
	GRAVEL	Medium	6.7 -19
Coarse grained		Fine	2.36 - 6.7
soil particles	SAND	Coarse	0.6 - 2.36
		Medium	0.21 - 0.6
		Fine	0.075 - 0.21
Fine grained soil	SILT		0.002 - 0.075
particles	CLAY		< 0.002

av	Limit Range			
ilt Clay				
A	(Non Plastic)			
w Plasticity	≤ 35%			
edium Plasticity	> 35% and ≤ 50%			
gh Plasticity	> 50%			
	A w Plasticity edium Plasticity			

Particle Distribution Terms (Coarse Grained Soils)						
Well graded	good representation of all particle sizes					
Poorly graded	one or more intermediate sizes poorly represented					
Gap graded	one or more intermediate sizes absent					
Uniform	essentially of one size					

Particle Shape Terms (Coarse Grained Soils)					
Rounded	Sub-angular	Flaky or Platy			
Sub-rounded	Angular	Elongated			

Secondary and Minor Comp	onents for (	Coarse Grained Soils
Fines (%) Modifier	Accessory	Modifier

Filles (%)	(as applicable)	coarse (%)	(as applicable)
≤5	'trace silt / clay'	≤ 15	'trace sand / gravel'
> 5, ≤ 12	'with clay / silt'	> 15, ≤ 30	'with sand / gravel'
> 12	prefix 'silty / clayey'	> 30	prefix 'gravelly / sandy'

Secondary and Minor Components for Fine Grained Soils					
% Coarse	Modifier (as applicable)				
≤ <b>15</b>	add <i>"trace sand / gravel"</i>				
> 15, ≤ 30	add <i>"with sand / gravel"</i>				
> 30	prefix soil <i>"sandy / gravelly"</i>				



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#### b) Soil Condition (moisture, relative density or consistency)

**Moisture:** Fine grained soils are described relative to plastic or liquid limits, while coarse grained soils are assessed based on appearance and feel. The observation of seepage or free water is noted on the test hole logs.

Moisture - Coarse Grained Soils			Moisture - Fine Grained Soils			
Term		Tactile Properties	Term		Tactile Properties	
Dry	('D')	Non-cohesive, free running	Moist, dry of plastic limit	('w < PL')	Hard and friable or powdery	
Maiat		Feels cool, darkened colour,	Moist, near plastic limit	('w≈PL')	Can be moulded	
Moist ('M')	tends to stick together	Moist, wet of plastic limit	('w > PL')	Weakened, free water forms on hands with handling		
Wet	('W')	Feels cool, darkened colour, tends to stick together, free	Wet, near liquid limit	('w≈LL')	Highly weakened, tends to flow when tapped	
	water forms when handling	Wet, wet of liquid limit	('w > LL')	Liquid consistency, soil flows		

**Relative Density (Non Cohesive Soils):** The Density Index is inherently difficult to assess by visual or tactile means, and is normally assessed by penetration testing (e.g. SPT, DCP, PSP or CPT) with published correlations. Assessment may be affected by moisture and *in situ* stress conditions. Density Index assessment may be refined by combination of *in situ* density testing and laboratory reference maximum and minimum density ranges.

**Consistency (Cohesive Soils):** May be assessed by direct measurement (shear vane, CPT etc.), or approximate tactile correlations. Cohesive soils include fine grained soils, and coarse grained soils with sufficient fine grained components to induce cohesive behaviour. A 'design shear strength' must consider the mode of testing, the *in situ* moisture content and potential for variations of moisture which may affect the shear strength.

<b>Relative Dens</b>	n-Cohesive Soils)	Consistency (Cohesive Soils)				
Term and (Symbol) Density Index (%)		Term and (Symbol)		Tactile Properties	Undrained Shear Strength	
Very Loose	(VL)	≤ <b>1</b> 5	Very Soft	(VS)	Extrudes between fingers when squeezed	< 12 kPa
Loose	(L)	> 15 and $\leq$ 35	Soft	(S)	Can be moulded by light finger pressure	12 - 25 kPa
Medium Dense	(MD)	> 35 and $\leq$ 65	Firm	(F)	Can be moulded by strong finger pressure	25 - 50 kPa
Dense	(D)	> 65 and ≤ 85	Stiff	(St)	Cannot be moulded by fingers	50 - 100 kPa
Very Dense	(VD)	> 85	Very Stiff	(VSt)	Can be indented by thumb nail	100 - 200 kPa
Consistency assessment can be influenced by moisture variation.			Hard	(H)	Can be indented with difficulty by thumb nail	> 200 kPa
			Friable	(Fr)	Easily crumbled or broken into small pieces by hand	-

## c) Structure (zoning, defects, cementing)

<b>Zoning:</b> The <i>in situ</i> zoning is described using the terms belo <i>'layer'</i> (a continuous zone across the exposed sample) <i>'lens'</i> (a discontinuous layer with lenticular shape)	ow. <i>'Intermixed</i> ' may be used for an irregular arrangement. <i>'pocket</i> ' (an irregular inclusion of different material). <i>'interbedded</i> ' or <i>"interlaminated</i> ' (alternating soil types)
<b>Defects:</b> Described using terms below, with dimension orien <i>'parting'</i> (an open or closed surface or crack sub parallel to layering with little / no tensile strength - open or closed)	ntation and spacing described where practical. <i>'softened zone'</i> (in clayey soils, usually adjacent to a defect with associated higher moisture content)
<i>'fissure'</i> (as per a parting, though not parallel or sub parallel to layering – may include desiccation cracks)	<i>'tube'</i> (tubular cavity, singly or one of a large number, often formed from root holes, animal burrows or tunnel erosion)
'sheared seam' (zone of sub parallel near planar closely spaced intersecting smooth or slickensided fissures dividing the mass into lenticular or wedge shaped blocks)	<i>'tube cast'</i> (an infilled tube – infill may vary from uncemented through to cemented or have rock properties)
'sheared surface' (a near planar, curved or undulating smooth, polished or slickensided surface, indicative of displacement)	<i>'infilled seam'</i> (sheet like soil body cutting through the soil mass, formed by infilling of open defects)
<b>Cementation:</b> Soils may be cemented by various substance gypsum), and the cementing agent shall be identified if prace	

*'weakly cemented'* easily disaggregated by hand in air or water

'moderately cemented' effort required to disaggregate the soil by hand in air or water

Materials extending beyond '*moderately cemented*' are encompassed within the rock strength range. Where consistent cementation throughout a soil mass is identified as a duricrust, it is described in accordance with duricrust rock descriptors. Where alternate descriptors of cementation development are applied for consistency with regional practices or geology, or client requirements, these are outlined separately.



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## d) Origin

An interpretation is provided based on observations of landform, geology and fabric, and may further include assignment of a stratigraphic unit. The use of terms 'possibly' or 'probably' indicates a higher degree of uncertainty regarding the assessed origin or stratigraphic unit. Typical origin descriptors include:

Residual	Formed directly from in situ weathering with no visible structure or fabric of the parent soil or rock.
Extremely weathered	Formed directly from in situ weathering, with remnant and/or fabric from the parent rock.
Alluvial	Deposited by streams and rivers (may be applied more generically as transported by water).
Estuarine	Deposited in coastal estuaries, including sediments from inflowing rivers, streams, and tidal currents.
Marine	Deposited in a marine environment.
Lacustrine	Deposited in freshwater lakes.
Aeolian	Transported by wind.
Colluvial and Slopewash	Soil and rock debris transported down slopes by gravity (with or without assistance of water). Colluvium is typically applied to thicker / localised deposits, and slopewash for thinner / widespread deposits.
TOPSOIL	Surficial soil, typically with high levels of organic material. Topsoils buried by other transported soils are termed <i>'remnant topsoil'</i> . Tree roots within otherwise unaltered soil does not characterise topsoil.
FILL	Any material which has been placed by anthropogenic processes (i.e. human activity).

#### e) Additional Observations

Additional observations may be included to supplement the soil description. Additional observations may consist of notations relating to soil characteristics (odour, contamination, colour changes with time), inferred geology (with delineation of soil horizons or geological time scale) or notes on sampling and testing application (including the reliability, recovery, representativeness, or condition of samples or test conditions and limitations). If the material is assessed to be not representative, terms such as 'poor recovery', 'non-intact', 'recovered as' or 'probably' are applied.

## SOIL CLASSIFICATION

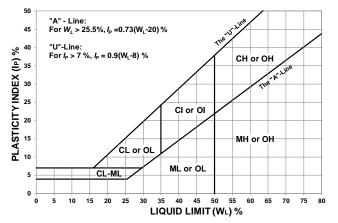
Classification allocates the material within distinct soil groups assigned a two character Group Symbol:

Coarse Grained (sand and gravel:		il coarser than 0.075 mm)	Fine Grained Soils (silt and clay: more than <u>35%</u> of soil finer than 0.075 mm)		
<b>Major Division</b>	Group Symbol Soil Group		Major division	Group Symbol	Soil Group
GRAVEL	GW	GRAVEL, well graded		ML	SILT, low plasticity
(more than half of the coarse fraction is > 2.36 mm)GPGC	GP	GRAVEL, poorly graded	SILT and CLAY	CL	CLAY, low plasticity
	GM	Silty GRAVEL	(low to medium plasticity)	CI	CLAY, medium plasticity
	GC	Clayey GRAVEL		OL	Organic SILT
SAND	SW	SAND, well graded		MH	SILT, high plasticity
(more than half of the coarse fraction is < 2.36 mm)	SP	SAND, poorly graded SILT and CLAY (high plasticity)		СН	CLAY, high plasticity
	SM	Silty SAND	(	ОН	Organic CLAY / SILT
	SC	Clayey SAND	Highly Organic	Pt	PEAT

Coarse grained soils with fines contents between 5% and 12% are provided a dual classification comprising the two group symbols separated by a dash, e.g. for a poorly graded gravel with between 5% and 12% silt fines (poorly graded 'GRAVEL with silt'), the classification is GP-GM.

For the purpose of classification, *poorly graded, uniform,* or *gap graded* soils are all designated as poorly graded. Soils that are dominated by boulders or cobbles are described separately and are not classified.

Classification is routinely undertaken based on tactile assessment with the soil description. Refinement of soil classification may be applied using laboratory assessment, including particle size distribution and Atterberg Limits. Atterberg Limits testing is applied to the sample portion finer than 0.425 mm. Fine grained soil components are assessed on the basis of regions defined within the Modified Casagrande Chart.





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Rock is described in general accordance with <u>Australian Standard AS 1726-2017</u> (Geotechnical site investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines rock as any aggregate of minerals and/or organic materials that cannot be disaggregated by hand in air or water without prior soaking. The rock description and classification distinguishes between rock material, defects, structure and rock mass.

## **ROCK DESCRIPTION AND CLASSIFICATION**

a) Description of rock material (rock name, grain size and type, colour, texture and fabric, inclusions or minor components, moisture content and durability)

**Rock Name:** Simple rock names are used to provide a reasonable engineering description rather than a precise geological classification. The rock name is chosen on the basis of origin, with common types summarised below. Additional, non-exhaustive, terminology is included in AS 1726. Rock names not described within AS 1726 may be adopted, with geological characteristics typically noted within accompanying text.

Grain		Sedimentary						Igneous	
Size	Olastia en Datuital	Carbonate		<b>D</b> ura di attia	E - P - t - d		E de la de		NA - 6' -
(mm)	Clastic or Detrital	Low Porosity	Porous	Pyroclastic	Foliated	Non-Foliated	Felsic	$\leftrightarrow$	Mafic
>2.0	CONGLOMERATE (rounded grains in a finer matrix) BRECCIA (angular or irregular fragments in a finer matrix)	LIMESTONE (Predominantly CaCO <sub>3</sub> ) or	CALCIRUDITE	AGGLOMERATE (rounded grains in a finer matrix) VOLCANIC BRECCIA (angular fragments in a finer matrix)	GNEISS	MARBLE (carbonate) QUARTZITE	GRANITE	DIORITE	GABBRO
2.0- 0.06	SANDSTONE	DOLOMITE (Predominantly	CALCARENITE	TUFF	SCHIST	SERPENTINITE	MICRO- GRANITE	MICRO- DIORITE	DOLERITE
0.06- 0.002	MUDSTONE (mostly silt)	CaMgCO <sub>3</sub> )	CALCISILTITE	Fine grained	PHYLLITE	HORNFELS		ANDESITE	BASALT
<0.002	(silt and clay) CLAYSTONE (mostly clay)	i	CALCILUTITE	TUFF	or SLATE		NITULITE	ANDESITE	DAGALT

Reproduced with modification from Tables 15, 16 and 17, Clause 6.2.3.1, AS 1726-2017, Geotechnical site investigations.

Grain size: For rocks with predominantly sand sized grains the dominant or average grain size is described as follows:

Rock type	Coarse grained	Medium grained	Fine grained
Sedimentary rocks	Mainly 0.6 mm to 2 mm	Mainly 0.2 mm to 0.6 mm	Mainly 0.06 mm (just visible) to 0.2 mm
Igneous and metamorphic rocks	Mainly >2 mm	Mainly 0.06 mm to 2 mm	Mainly <0.6 mm (just visible)

**Colour** assists in rock identification and interpolation. Rock colour is generally described in a *"moist"* condition, using simple terms (e.g. grey, brown, etc.) and modified as necessary by *"pale"*, *"dark"*, or *"mottled"*. Borderline colours may be described as a combination of these colours (e.g. red-brown).

**Texture** refers to the arrangement of, or the relationship between, the component grains or crystals (e.g. porphyritic, crystalline or amorphous).

**Fabric** refers to visible grain arrangement along a preferential orientation or a layering. Fabric may be noted as *"indistinct*" (little effect on strength) or *"distinct*" (rock breaks more easily parallel to the fabric). Common terms include *"massive"* or *"flow banding"* (igneous), *"foliation"* or *"cleavage"* (metamorphic). Sedimentary layering is described as *"bedding"* or (where thickness < 20 mm) *"lamination"*. The typical orientation, spacing or thickness of these structural features can be described directly in millimetres and metres. Further quantification of bedding thickness applied by GHD is as follows:

Bedding Term	Thickness
Very thickly bedded	>2 m
Thickly bedded	0.6 to 2 m
Medium bedded	0.2 to 0.6 m
Thinly bedded	60 to 200 mm
Very thinly bedded	20 to 60 mm
Laminated	6 to 20 mm
Thinly laminated	<6 mm

**Features, Inclusions and Minor Components** are typically only described when those features could influence the engineering behaviour of the rock. Described features may include: gas bubbles in igneous rocks; veins of quartz, calcite or other minerals; pyrite crystals and nodules or bands of ironstone or carbonate; cross bedding in sandstone; clast or matrix support in conglomerates and breccia.

**Moisture content** may be described by the feel and appearance of the rock, as follows: "*dry*" (looks and feels dry), "*moist*" (feels cool, darkened in colour, but no water is visible on the surface), or "*wet*" (feels cool, darkened in colour, water film or droplets visible on the surface). The moisture content of rock cored with water may not represent in situ conditions.

**Durability** of rock samples is noted where there is an observed tendency of samples to crack, breakdown in water or otherwise deteriorate with exposure.



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#### b) Classification of the rock material condition (strength, weathering and/or alteration)

**Estimated Strength** refers to the rock material and not the rock mass. The strength is defined in terms of uniaxial compressive strength (UCS), though is typically estimated by either tactile assessment or Point Load Strength Index ( $Is_{(50)}$ ) (measured perpendicular to planar anisotropy). A correlation between  $Is_{(50)}$  and UCS is adopted for classification, though is not intended for design purposes without appropriate supporting assessment. A field guide follows:

Term ar (Symbo	-	UCS (MPa)	Is <sub>(50)</sub> (MPa)	Field Guide
Very Low	(VL)	0.6 – 2	0.03 - 0.1	Material crumbles under firm blows with sharp end of geological pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm thick can be broken by finger pressure.
Low	(L)	2 - 6	0.1 - 0.3	Easily scored with knife; indentations 1 to 3 mm show in the specimen with firm blows of a geological pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	(M)	6 - 20	0.3 - 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	(H)	20 - 60	1 - 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a geological pick with a single firm blow; rock rings under hammer.
Very High	(VH)	60 - 200	3 -10	Hand specimen breaks with geological pick after more than one blow; rock rings under hammer.
Extremely High	(EH)	>200	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Based on Table 19, Clause 6.2.4.1, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Material with strength less than "very low" is described using soil characteristics, with the presence of an original rock texture or fabric noted if relevant.

**Weathering and Alteration:** The process of weathering involves physical and chemical changes to the rock resulting from exposure near the earth's surface. A subjective scale for weathering is applied as follows:

Weathering Term and (Symbol)		Description
Residual Soil	(RS)	Material has weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered	(XW)	Material has weathered to such an extent that it has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	(HW)	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered	(MW)	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered	(SW)	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	(Fr)	Rock shows no sign of decomposition of individual minerals or colour changes.

Modified based on Table 20, Clause 6.2.4.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Where physical and chemical changes to the rock are caused by hot gases or liquids at depth, the process is called alteration. Unlike weathering, the distribution of altered material may occur at any depth and show no relationship to topography. Where alteration minerals are identified the terms "extremely altered" (XA), "highly altered" (HA), "moderately altered" (MA) and "slightly altered" (SA) can be used to describe the physical and chemical changes described above.



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c) Description of defects (defect type, orientation, roughness and shape, coatings and composition of seams, spacing, length, openness and thickness, block shape)

Defects often control the overall engineering behaviour of a rock mass. AS 1726 defines a defect as "a discontinuity, fracture, break or void in the material or materials across which there is little or no tensile strength". Describing the type, character and distribution of natural defects is an essential part of the description of many rock masses.

Commonly described characteristics of defects within a rock mass include type, orientation, roughness and shape, coatings and composition of seams, aperture, persistence, spacing and block shape.

The degree of detail required for defect descriptions depends on project requirements. All defects judged of engineering significance for the site and project are described individually. Where appropriate, generalised descriptions for less significant, or multiple similar, defects can be provided for delineated parts of rock core or exposures. A general description of delineated defect sets is provided when sufficient orientation data is available.

**Defect Type** is described using the terms summarised below. On core logs, only natural defects across which the core is discontinuous are described (i.e. inferred artificial fractures such as drill breaks are excluded). Incipient defects are described using the relevant texture or fabric terms. Healed defects (those that have been re-cemented by minerals such as chlorite or calcite) are described using the prefix "healed" (e.g. healed joint).

Type and (Syn	nbol)	Description	Diagram
Parting	(Pt)	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed.	
Joint	(Jt)	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or subparallel to layering or to planar anisotropy in the rock material. May be open or closed.	
Sheared Surface	(SS)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.	
Sheared Zone	(SZ)	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
Sheared Seam	(SSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	A Contraction of the second se
Crushed Seam	(CSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.	
Infilled Seam	(ISm)	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.	
Extremely Weathered Seam	(WSm)	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.	Seam

Modified based on Table 22, Clause 6.2.5.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

**Defect Orientation** is recorded as the "dip" (maximum angle of the mean plane, measured from horizontal) and the "dip direction" (azimuth of the dip, measured clockwise from true north). Dip and dip direction is expressed in degrees, with two-digit and three-digit numbers respectively, separated by a slash (e.g. 45/090). For vertical boreholes, the defect dip is measured as the acute angle from horizontal. Rock core extracted from vertical boreholes is generally not oriented, so the dip direction cannot be directly measured. For non-oriented inclined boreholes, a defect "alpha" ( $\alpha$ ) angle is measured as the acute angle from the core axis. For vertical and non-oriented inclined boreholes, the dip direction can sometimes be estimated from the relationship of the defect to a well-defined site structure such as fabric. For oriented inclined boreholes, the measurement of the defect orientation is carried out and recorded in a form suited to the particular device being used and later processed to report true dip and dip direction.



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**Roughness and Shape** of the defect surface combine to have significant influence on shear strength. Standard descriptions and abbreviations include:

Roughness (Symbo		Description
Very Rough	(VR)	Many large surface irregularities (amplitude generally more than 1 mm) Feels like, or coarser than very coarse sand paper.
Rough	(Rf)	Many small surface irregularities (amplitude generally less than 1 mm). Feels like fine to coarse sand paper.
Smooth	(So)	Smooth to touch. Few or no surface irregularities.
Polished	(Pol)	Shiny smooth surface.
Slickensided	(Slk)	Grooved or striated surface, usually polished.

Shape and (S	ymbol)	Description
Planar	(Pln	The defect does not vary in orientation.
Curved	(Cu)	The defect has a gradual change in orientation.
Undulating	(Un)	The defect has a wavy surface.
Stepped	(St)	The defect has one or more well defined steps.
Irregular	(lr)	The defect has many sharp changes of orientation.

Although the surface roughness of defects can be described at small (10-100 mm) scales of observation, the overall shape of the defect surface can usually be observed only at medium (0.1-1 m) and large (>1 m) scale.

Where it is necessary to assess the shear strength of a defect, observations are generally made at multiple scales. Surface roughness may also be characterised by using the joint roughness coefficient (JRC) profiles established by Barton and Choubey (1977). Where large-scale observations are possible, further measurement of defect "waviness" (angle of the asperities relative to the overall dip angle of the plane) is made.

**Coatings and Composition of Seams:** Many defects have surface coatings, which can affect their shear strength. Standard descriptions include:

Coating a (Symbo		Description	Common Minerals and (Symbol)		
Clean	(Cn)	No visible coating.	Clay	(CLAY)	
Stained	(Sn)	No visible coating but surfaces are discoloured.	Calcite	(Ca)	
Veneer	(Ve)	A visible coating of soil or mineral substance, but too thin to be	Carbonaceous	(X)	
veneel (ve)		measured may be patchy.	Chlorite	(Kt)	
		A visible coating up to 1 mm thick. Soil material greater than 1 mm	Iron Oxide	(Fe)	
Coating	(Co)	thick is described using defect terms (e.g. infilled seam). Rock	Micaceous	(Mi)	
		material greater than 1 mm thick is described as a vein (Vn).	Manganese	(Mn)	
The composition of seams are described using soil description terms as given on the Pyrite (P					

The composition of seams are described using soil description terms as given on the SOIL DESCRIPTION AND CLASSIFICATION Standard Sheet. Where possible the mineralogy of coatings is identified. Common mineral coatings include:

**Aperture:** Defects across which there is little or no tensile strength can be either "open" (*Op*) or "closed" (*Cl*). For rock core, the width of the "open" defect is measured whilst still in the core barrel splits. The descriptor "tight" (*Ti*) can only apply to healed or incipient defects (i.e. veins, foliation, etc.).

**Persistence and Spacing** of defects is described directly in millimetres and metres. If the measurement of defect persistence is limited by the extent of the exposure, the end conditions are noted (i.e. 0, 1 or 2 defect ends observed). The spacing between defects of similar orientation (i.e. within a specific defect set) is recorded when possible.

The frequency of defects within rock core can be measured as either: the spacing between successive defects; or the "Fracture Index", which is the number of defects per metre of core.

Spacing Term	Thickness
Very wide	>2 m
Wide	0.6 to 2 m
Medium	0.2 to 0.6 m
Closely	60 to 200 mm
Very closely	20 to 60 mm
Extremely closely	6 to 20 mm

Quartz

(Qz)

#### Block Shape: Where it is considered significant, block shape can be described using the subjective terms as follows:

Block Shape	Description
Polyhedral	Irregular discontinuities without arrangement into distinct sets, and of small persistence.
Tabular	One dominant set of parallel discontinuities, for example bedding planes, with other non-continuous joints; thickness of blocks much less than length or width.
Prismatic	Two dominant sets of discontinuities, approximately orthogonal and parallel, with a third irregular set; thickness of blocks much less than length or width.
Equidimensional	Three dominant sets of discontinuities, approximately orthogonal, with occasional irregular joints, giving equidimensional blocks.
Rhomboidal	Three (or more) dominant, mutually oblique, sets of joints giving oblique-shaped, equidimensional blocks.
Columnar	Several, usually more than three sets of continuous, parallel joints usually crossed by irregular joints; lengths much greater than other dimensions.

Modified based on Table 23, Clause 6.2.5.7, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.



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L = 250 mm

L = 0

L = 0

**RQD** measurement procedure (reproduced from Figure 13, Clause 6.2.9.4, AS 1726-2017, Geotechnical site investigations)

centreline

Extremely weathered

soundness requirement

E

Core run total length = 1.2

does not meet

#### d) Interpreted stratigraphic unit

Stratigraphic units may be interpreted and reported, in accordance with The Australian Stratigraphic Units Database (ASUD). The terms "possibly" or "probably" indicate increased uncertainty in this interpretation.

#### e) Geological structure

After describing the rock material and defects, an interpretation of the nature and configuration of rock mass defects may be presented in logs, charts, 2D sections and 3D models (e.g. dipping strata, folds, unconformities, weathering profiles, defect sets, geological faults, etc.).

#### PARAMETERS RELATED TO CORE DRILLING

Drill Depth and Core Loss: Drilling intervals are shown on GHD Core Log Sheets by depth increments and horizontal marker lines.

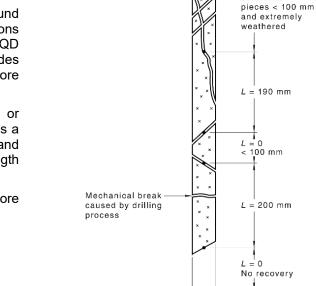
"Core loss", or its inverse "total core recovery" (TCR), is measured as a percentage of the core run. If the location of the core loss is known, or strongly suspected, it is shown in a region of the column bounded by dashed horizontal lines. If unknown, core loss is assigned to the bottom of a core run.

Rock Quality Designation (RQD), described by Deere et al. (1989), may be recorded on GHD Core Log Sheets.

For certain projects, such as tunnelling or underground mining investigations, rock mass ratings or classifications can be required as part of the design process. The RQD forms a component of these rock mass ratings and provides a quantitative estimate of rock mass quality from rock core logs.

The rock core must be "N" sized (nominally 50 mm) or greater for derivation of RQD. The RQD is expressed as a percentage of intact rock core (excluding residual soil and extremely weathered rock) greater than 100 mm in length over the total selected core length.

Deere et al. (1989) recommends measuring lengths of core along the centreline, as shown right.



 $RQD = \frac{250 + 190 + 200}{1000} \times 100\%$ 

1200

= 53%

RQD is expressed as:

$$RQD = \frac{\sum Length \ of \ sound \ core \ pieces > 100 \ mm \ in \ length}{Length \ of \ core \ run} \ x \ 100\%$$

#### **ROCK MASS CLASSIFICATION**

Rock mass classification schemes may be used to represent the engineering characteristics of a rock mass. A large variety of classification schemes have been developed by various authors, ranging from simple to complex. All of the schemes are limited in their application and many rock mass classification systems assume that the rock mass is isotropic, which is rarely the case.

#### References

STANDARDS AUSTRALIA (2017). AS 1726-2017. GEOTECHNICAL SITE INVESTIGATIONS.

BARTON, N. AND CHOUBEY, V. (1977). THE SHEAR STRENGTH OF ROCK JOINTS IN THEORY AND PRACTICE. ROCK MECHANICS 10, 1-54. SPRINGER. DEERE, D.U. AND DEERE, D.W. (1989). ROCK QUALITY DESIGNATION (RQD) AFTER TWENTY YEARS. CONTRACT REPORT GL-89-1. ARMY CORPS OF ENGINEERS. WASHINGTON DC, 1989.

**ORIENTED CORE** 



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The following information is applicable to inclined boreholes with core orientation only.

Core orientation was performed on HQ core in nominated boreholes. Following extraction of the core, core orientation was recorded as a bottom mark with a core orientation line extended up the core as far as practicable. Directional arrows were marked along the orientation line in the downhole direction on each individual piece of core at maximum 1 m spacing.

Core orientation was recorded as alpha and beta angles and core orientation confidence. Core was boxed with the orientation mark visible and centred in the core tray. Where core orientation was not required or possible (e.g. in heavily fractured/disturbed core), alpha angles were recorded on the borehole log with "---" recorded in place of the beta angle.

Definitions of these terms are as follows:

Alpha angle: the acute angle between the core axis and the long axis of the defect (maximum dip angle relative to the core axis) recorded as a two digit number between 0° and 90°.

Beta angle: the angle between the reference line (bottom mark) along the core and the ellipse apical trace (maximum dip vector of the defect plane) measured in a clockwise direction downhole around the core circumference and recorded as a three digit number between 0° and 360°.

Bottom mark: the projected line of the measured lowest point on the core as it would have been in-situ, forming the reference line for structural measurements.

Core orientation confidence (COC): confidence of core orientation for consecutive/adjacent runs is recorded as follows:

Confidence	Notation	Rating	Definition
Confidence 1	(1)	Good	Consecutive runs match within ±015° inclusive, confident bottom mark projection.
Confidence 2	(2)	Medium	Only one adjacent run matches or one differs within ±015°, medium confidence in bottom mark projection.
Confidence 3	(3)	Poor	Adjacent runs mismatch differs by more than ±015°, poor confidence in bottom mark projection.
-	(-)	N/A	Run not able to be oriented or core orientation not performed. Confidence not nominated.

Dip and Dip Direction: Alpha and beta angles are required to be corrected for the dip and azimuth of the borehole to obtain dip and dip direction.

## JOINT ROUGHNESS AND JOINT ALTERATION



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Joint Roughness Number (J<sub>r</sub>) / Joint Alteration Number (J<sub>a</sub>) is based on NGI 2013, Using the Q-system: Rock Mass Classification and Support Design Handbook, NGI, Oslo. Refer to source document for further detail.

Jr and Ja numbers were assigned in accordance with the following:

#### Jr (Joint Roughness Number)

a) Rock-wall contact, and b) Rock-wall contact before 10cm shear movement	ł	c) No rock-wall contact when sheared					
Discontinuous joints	Jr = 4	Zone containing clay minerals thick enough to prevent rock-wall	J <sub>r</sub> = 1.0				
Rough or irregular, undulating	3	contact when sheared					
Smooth, undulating	2	Sandy, gravelly or crushed/sheared zone thick enough to prevent	1.0				
Slickensided, undulating	1.5	rock-wall contact when sheared*					
Rough, irregular, planar	1.5	<ul> <li>Notes:</li> <li>i) Add 1.0 if the mean spacing of the relevant joint set is greater than 3m (dependent on the size of the underground opening)</li> </ul>					
Smooth, planar	1.0						
Slickensided, planar 0.5		с т с,					
Note: i) Description refers to small scale features, and intermediath that order	iate scale features, in	<ul> <li>ii) J<sub>r</sub> = 0.5 can be used for planar slickensided joints having lineations, provided the lineations are orientated in the estimated sliding direction</li> </ul>					

\*Not included in Table 3 of NGI 2013 handbook. Described in NGI 2013 Handbook, Section 4.5.1.

#### $J_a$ (Joint Alteration Number)

Joint	Alteration Number Description	Ja
	a) Rock-wall contact (no clay fillings, only coatings)	
А	Tightly healed, hard non-softening, impermeable filling, i.e. quartz or epidote.	0.75
В	Unaltered joint walls, surface staining only.	1
С	Slightly altered joint walls. Non-softening mineral coatings, sandy particles, clay-free disintegrated rock, etc.	2
D	Silty or sandy-clay coatings, small clay fraction (non-softening)	3
Е	Softening or low friction clay mineral coatings, i.e. kaolinite or mica. Also chlorite, talc, gypsum, graphite, etc., and small quantities of swelling clays.	4
	b) Rock-wall contact before 10cm shear (thin mineral fillings)	
F	Sandy particles, clay-free disintegrated rock, etc.	4
G	Strongly over-consolidated non-softening clay mineral fillings (continuous, but <5mm thickness).	6
Н	Medium or low over-consolidation, softening, clay mineral fillings (continuous, but <5mm thickness).	8
J	Swelling-clay fillings, i.e. montmorillonite (continuous, but <5mm thickness). Value of Ja depends on percent of swelling clay-size particles.	8-12
	c) No rock-wall contact when sheared (thick mineral fillings)	
Κ	Zones or bands of disintegrated or crushed rock. Strongly over-consolidated.	6
L	Zones or bands of clay, disintegrated or crushed rock. Medium or low over consolidation or softening fillings	8
М	Zones or bands of clay, disintegrated or crushed rock. Swelling clay. Ja depends on percent of swelling clay-size particles.	8-12
Ν	Thick continuous zones or bands of clay. Strongly over-consolidated.	10
0	Thick continuous zones or bands of clay. Medium to low over-consolidation.	13
Р	Thick continuous zones or bands with clay. Swelling clay. J₂ depends on percent of swelling clay-size particles.	13-20

## Appendix B Borehole logs and core photographs

Table B.1	Summary of borehole logs and core photos
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Borehole ID	Borehole Log	Current Log Status	Core Photos
BH1201	$\checkmark$	V3	✓
BH1202	✓	V3	✓
BH3203	✓	V2	✓
BH4201	✓	V2	✓
BH4202	✓	V2	✓
BH-IPS	✓	V3	✓
BH5202	✓	V4	✓
BH5203	✓	V3	✓
BH5203A	✓	V2	✓
BH5204	✓	V4	✓
BH5206	✓	V6	✓
BH5207	✓	V4	✓
BH5208	✓	V2	✓
BH5209	✓	V4	✓
BH5210	✓	V2	✓
BH5211	✓	V2	✓
BH7201	✓	V3	✓
BH7202	✓	V1	✓
BH7203	✓	V4	✓

## Appendix C Borehole downhole survey

#### Table C.1 Summary of Downhole Survey Data

Borehole ID	Downhole Survey Data
BH3203	✓
BH4201	✓
BH4202	✓
BH-IPS	✓
BH5202	✓
BH5203	✓
BH5203A	✓
BH5204	✓
BH5206	✓
BH5207	✓
BH5208	✓
BH5209	✓
BH5210	✓
BH5211	✓

The downhole survey data presented in the following appendix reports the values recorded by the individual downhole survey tools as either magnetic or true as indicated. For any tool reporting true values, a conversion to magnetic has been included.

## Appendix D Borehole geophysical logging

#### Table D.1 Summary of borehole geophysical data

Borehole ID	ATV Log	Temperature Log	Natural Gamma	Full Wave Sonic
BH1202	✓	✓		
BH3203	✓	✓	✓	✓
BH4201	✓	✓	✓	✓
BH4202	✓	✓	✓	✓
BH-IPS	✓	✓		
BH5202	✓	✓	✓	✓
BH5203	✓	✓	✓	✓
BH5203A	✓	✓	✓	✓
BH5204	✓	✓	✓	✓
BH5206	✓	✓	✓	✓
BH5207	✓	✓	✓	✓
BH5208	✓	✓	✓	✓
BH5209	✓	✓	✓	✓
BH5210	✓	✓	✓	✓
BH5211	✓	✓	✓	✓
BH7202	✓			
BH7203	✓	✓		

## **DOWNHOLE GEOPHYSICS**



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## STRUCTURE DESCRIPTION:

Downhole Geophysics				Corresponding Structure (Defect) as described in AS1726:2017			
Symbol	Structure Name	Description	Туре	Code	Description		
	Sheared Zone / Undifferentiated Zone	Zone of closely intersecting or undifferentiated structures with a measurable thickness.	Sheared Zone	SZ	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.		
•	Joint	Defect that is not parallel or sub-parallel to layering or planar anisotropy in the rock material (i.e. does not have the same orientation as bedding/foliation/ parting). May have an aperture.	Joint	Jt	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or subparallel to layering or to planar anisotropy in the rock material. May be open or closed.		
•	Parting: Bedding / Foliation	Defect that is parallel or subparallel to the fabric of the rock material. The type of fabric is not differentiated and should not have an aperture.	Parting	Pt	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed.		
•	Sheared Surface	Defect that has little or no tensile strength and shows evidence of shear displacement.	Sheared Surface	SS	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.		
<b>*</b>	Seam	Defect with parallel, sub- parallel or gradational boundaries of measureable thickness which may comprise granular or soil material, or rock fragments.	Sheared Seam	SSm	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.		
			Crushed Seam	CSm	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.		
			Infilled Seam	ISm	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.		
			Extremely Weathered Seam	WSm	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.		
•	Vein	Mineralised body of measurable thickness that may have no relationship to the orientation of the fabric of the host rock	Vein	-	A mineralised body greater than 1 mm thick that has intruded, precipitated or formed within the host rock material following lithification. The orientation of the vein may or may not have a relationship to the fabric of the host material. (not in AS1726: 2017)		
		Symbol       Structure Name         Image: Symbol       Sheared Zone / Undifferentiated Zone         Image: Symbol       Joint         Image: Symbol       Joint         Image: Symbol       Parting: Bedding / Foliation         Image: Symbol       Sheared Surface         Image: Symbol       Seam         Image: Symbol       Seam	Symbol     Structure Name     Description       Image: Structure Name     Zone of closely intersecting or undifferentiated structures with a measurable thickness.       Image: Structure Name     Zone of closely intersecting or undifferentiated structures with a measurable thickness.       Image: Structure Name     Defect that is not parallel or sub-parallel to layering or planar anisotropy in the rock material (i.e. does not have the same orientation as bedding/foliation/ parting). May have an aperture.       Image: Parting: Bedding / Foliation     Defect that is parallel or subparallel to the fabric of the rock material. The type of fabric is not differentiated and should not have an aperture.       Image: Steared Surface     Defect that has little or no tensile strength and shows evidence of shear displacement.       Image: Seam     Defect that has little or no tensile strength and shows evidence of shear displacement.       Image: Seam     Defect with parallel, sub-parallel or gradational boundaries of measureable thickness which may comprise granular or soil material, or rock fragments.       Image: Vein     Wineralised body of measurable thickness that may have no relationship to the orientation of the fabric of the orientation of the fabric of measurable thickness that may have no relationship to the orientation of the fabric of the fabric of the orientation of the fabric of the fabric of the orientation of the fabric of the orientation of the fabric of the fabric of the fabric of the fabric of the or	Symbol         Structure Name         Description         Type           Image: Sheared Zone / Undifferentiated Zone         Zone of closely intersecting or undifferentiated structures with a measurable thickness.         Sheared Zone           Image: Sheared Zone / Undifferentiated Zone         Joint         Defect that is not parallel or sub-parallel to layering or planar anisotropy in the rock material (i.e. does not have the same orientation as bedding/foliation/ parting). May have an aperture.         Joint           Image: Sheared Surface         Defect that is parallel or fabric is not differentiated and should not have an aperture.         Parting           Image: Sheared Surface         Defect that as little or no tensile strength and shows evidence of shear displacement.         Sheared Surface           Image: Seam         Defect with parallel, sub- parallel or gradational boundaries of measureable thickness which may comprise granular or soil material, or rock fragments.         Sheared Seam           Image: Vein         Wein         Mineralised body of measurable thickness that may have no relationship to the orientation of the fabric of the orientation of the fabric of the measurable thickness that may have no relationship to the orientation of the fabric of the orientation of the fabric of the measurable thickness that may have no relationship to the orientation of the fabric of the orien	Symbol         Structure Name         Description         Type         Code           Image: Sheared Zone / Undifferentiated Zone         Zone of closely intersecting or undifferentiated structures with a measurable thickness.         Sheared Zone         SZ           Image: Sheared Zone         Joint         Defect that is not parallel or sub-parallel to layering or planar anisotropy in the rock material (i.e. does not have the same orientation as bedding/foliation/ parting). May have an aperture.         Joint         Jt           Image: Sheared Surface         Defect that is parallel or subparallel to have an aperture.         Parting         Pt           Image: Sheared Surface         Defect that has little or no tensile strength and shows evidence of shear displacement.         Sheared Surface         SS           Image: Sheared Surface         Defect that has little or no tensile strength and shows evidence of shear displacement.         Sheared Surface         SS           Image: Searn         Defect with parallel, sub- parallel or gradutional boundaries of measureable thickness which may comprise granular or soil material, or rock fragments.         Sheared Searn         SSm           Image: Searn         Vein         Mineralised body of measurable thickness that may have no relationship to the orientation of the faith of of         Vein         -		

## ABBREVIATIONS: ACRONYM STANDS FOR

AHD	Australian Height Datum
ATV	Acoustic Televiewer
FWS	Full Waveform Sonic
MAG SUS	Magnetic Susceptibility
MGA	Map Grid of Australia
MN	Magnetic North
NO	Number
OTV	Optical Televiewer
SI	International System of Units

# Appendix E

Permeability testing - Packer testing & drill stem testing (DST)

#### Table E.1 Summary of permeability testing (packer) data

Borehole ID	Number of Tests		Te	Test 1		Test 2		Test 3		Test 4		Test 5		st 6	
BH5202	6	Test Depth (m)	268.00	273.20	265.80	271.00	251.20	256.40	225.80	231.00	211.80	217.00	204.00	209.20	
		Permeability (Lugeons)	0.2 <i>u</i> L	0.2 <i>u</i> L		0.1 <i>u</i> L		<0.1 <i>u</i> L		<0.1 <i>u</i> L		0.3 <i>u</i> L		2.3 <i>u</i> L	
BH7202	6	Test Depth (m)	34.00	40.61	28.50	35.35	23.50	30.35	17.50	24.35	12.00	18.85	7.50	14.35	
		Permeability (Lugeons)	<0.1 <i>u</i> L	<0.1 <i>u</i> L		<0.1 <i>u</i> L		0.1 <i>u</i> L		1.8 <i>u</i> L		2.2 <i>u</i> L			
BH7203	5	Test Depth (m)	11.00	14.40	21.00	27.00	27.00	33.00	33.00	39.00	17.00	39.00			
		Permeability (Lugeons)	Test abar	ndoned	0.6 <i>u</i> L	0.6 <i>u</i> L		·	<0.1 <i>u</i> L		1.6 <i>u</i> L				

#### Table E.2Summary of DST tests

Borehole ID	Number of Test Zones		Test Zone 1	Test Zone 2	Test Zone 3	Test Zone 4	Test Zone 5	Test Zone 6	Test Zone 7	Test Zone 8	Test Zone 9
BH3203	3	Test Depth (m)	198.50 – 228.70	319.00 - 349.20	362.70 - 392.90						
		Hydraulic Conductivity (m/s)	1.01 E-08	3.77 E-06	1.19 E-06						
BH-IPS	9	Test Depth (m)	381.70 - 456.90	501.80 - 577.00	600.00 - 675.20	712.00 - 787.20	834.00 - 909.20	914.00 - 989.20	1055.00 - 1130.20	1237.00 - 1312.20	1400.00 - 1475.20
		Hydraulic Conductivity (m/s)	4.12 E-09	6.32 E-10	1.68 E-08	1.27 E-10	4.54 E-09	1.33 E-07	7.90 E-08	6.98 E-08	1.74 E-10
BH5202	2	Test Depth (m)	232.60 - 247.80	248.60 - 263.80							
		Hydraulic Conductivity (m/s)	1.90 E-07	2.98 E-08							
BH5203A	2	Test Depth (m)	427.00 - 457.25	462.00 - 492.25							
		Hydraulic Conductivity (m/s)	5.98 E-09	5.93 E-09							
BH5204	3	Test Depth (m)	620.00 - 650.20	660.00 - 690.20	710.00 - 740.20						
		Hydraulic Conductivity (m/s)	7.40 E-09	8.60 E-10	7.40 E-08						
BH5206	3	Test Depth (m)	635.00 - 665.20	685.00 - 715.20	730.00 - 760.20						
		Hydraulic Conductivity (m/s)	3.87 E-10	5.27 E-10	2.08 E-10						
BH5207	2	Test Depth (m)	635.00 - 665.20	685.00 - 715.20							
		Hydraulic Conductivity (m/s)	7.05 E-08	1.53 E-10							
BH5208	3	Test Depth (m)	550.00 - 580.20	630.00 - 660.20	702.00 – 732.20						
		Hydraulic Conductivity (m/s)	3.32 E-11	2.23 E-10	6.53 E-09						

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Borehole ID	Number of Test Zones		Test Zone 1	Test Zone 2	Test Zone 3	Test Zone 4	Test Zone 5	Test Zone 6	Test Zone 7	Test Zone 8	Test Zone 9
BH5209	2	Test Depth (m)	635.00 - 665.20	685.00 – 715.20							
		Hydraulic Conductivity (m/s)	5.49 E-09	1.38 E-09							
BH5210	3	Test Depth (m)	688.00 - 718.20	733.00 - 763.20	763.00 - 793.20						
		Hydraulic Conductivity (m/s)	8.27 E-11	3.80 E-13	5.24 E-09						
BH5211	3	Test Depth (m)	783.00 - 813.20	823.00 - 853.20	863.00 - 893.20						
		Hydraulic Conductivity (m/s)	1.86 E-12	1.88 E-09	8.01 E-09						

\* Note: Test depths are lengths along the borehole which does not equate to mbgl in inclined boreholes

## Appendix F

In-situ stress testing (Overcoring, hydrojacking, hydrofracture and dilatometer)

### Table F.1 Summary of in-situ stress testing (overcoring)

Borehole ID	Test Number	Test Depth (top, length along drill string, m)	Overall Confidence in Result				
BH5203	SHL50	398.8	High				
	SHL51	416.9	High				
BH5204	SHL31	682.2	Moderate – High				
	SHL32	712.2	Low - Moderate				
BH5206	SHL26	648.8	High				
	SHL27	694.0	High				
	SHL28	730.2	High				
	SHL29	751.1	High				
BH5207	SHL35	661.3	Very high				
	SHL36	697.2	Very high				
	SHL39	724.2	Low - Moderate				
	SHL41	727.3	Very high				
	SHL43	760.2	Very high				
BH5208	SHL46	192.1	Low – Moderate				
	SHL47	384.1	High				
	SHL48	606.1	High				
	SHL49	734.9	High				
BH5209	SHL40	655.1	High				
	SHL42	691.0	Very high				
	SHL44	724.1	Very high				
	SHL45	766.0	Very high				
BH-IPS	SHL30	385.0	Moderate				
	SHL33	607.1	Moderate				
	SHL34	820.0	High				
	SHL38	1018.0	Moderate				

Table F 2	Cumments of in city stress testing (budgefus sture ? budgeisch)
Table F.2	Summary of in-situ stress testing (hydrofracture & hydrojack)

Borehole ID	Test Type	Depth (top, length along drill string, m)	Depth (bottom, length along drill string, m)				
BH5202	HF	198.50	200.20				
	HJ	236.50	238.20				
	HJ	247.30	249.00				
	HF	259.40	261.10				
BH5203A	HF	406.00	407.75				
	HF	438.20	439.95				
	HF	463.00	464.75				
	HJ	480.10	481.85				
BH5204	HF	719.20	720.90				
	HF	699.50	701.20				
	HF	679.50	681.20				
	HF	659.50	661.20				
BH5206	HF	541.10	542.80				
	HF	551.70	553.40				
	HF	631.20	632.90				
	HF	657.30	659.00				
	HF	668.10	669.80				
	HF	693.70	695.40				
	HF	702.20	703.90				
	HF	720.00	721.70				
	HF	734.70	736.40				
	HF	753.20	754.90				
BH5207	HF	558.00	559.70				
	HF	561.00	562.70				
	HF	651.00	652.70				
	HJ	652.70	654.40				
	HF	678.30	680.00				
	HF	698.20	699.90				
	HF	702.80	704.50				
	HF	727.50	729.20				
	HF	738.00	739.70				
	HJ	741.00	742.70				
BH5208	HF	508.00	509.70				
	HF	540.30	542.00				
	HF	546.20	547.90				
	HF	586.70	588.40				
	HF	606.00	607.70				
	HF	621.80	623.50				
	Attempted HJ	667.00	668.70				
	HF	672.30	674.00				
	HF	684.00	685.70				
	HF	698.00	699.70				

Borehole ID	Test Type	Depth (top, length along drill string, m)	Depth (bottom, length along drill string, m)				
BH5209	HF	500.00	501.70				
	HJ	510.00	511.70				
	HF	649.50	651.20				
	HF	652.70	654.40				
	HF	667.90	669.60				
	HF	699.70	701.50				
	HF	704.30	706.00				
	HF	730.00	731.70				
	HF	748.00	749.70				
	HF	758.00	759.70				
BH5210	HF	697.00	698.70				
	HF	726.00	727.70				
	HF	740.00	741.70				
	HF	754.40	747.10				
	HF	777.00	778.70				
	HJ	784.00	785.70				
BH5211	HF	779.50	781.20				
	HF	793.60	795.30				
	HF	804.50	806.20				
	HF	831.00	832.70				
	HF	836.20	837.90				
	HJ	864.80	866.50				

### Table F.3 Summary of dilatometer testing

Borehole ID	Test depth (m along drill string)	Comment
BH5202	230.50	
	238.10	
	247.60	
	249.70	
	259.90	
	270.50	
BH5203	168.00	Test in casing
	418.55	
BH5203A	412.20	Test in casing
	423.20	
	445.30	
	460.00	
	460.00	Repeat test to identify relaxation of strata
	479.30	
	501.40	
	508.50	
	508.50	Repeat test to identify relaxation of strata
BH5204	636.50	
	657.50	
	679.50	
	689.50	
	699.50	
	710.50	
BH5206	600.50	
	652.50	
	671.50	
	689.50	
BH5207	682.00	
	700.50	
	720.50	
	741.80	
BH5208	199.50	
	199.50	Test repeated
	300.50	
	300.50	Test repeated
	399.50	
	600.50	
	693.50	
BH5209	679.20	
	700.50	
	720.50	
	739.50	

### Appendix G Standpipe piezometer installation diagrams

 Table G.1
 Summary of standpipe construction details

Borehole ID	Construction Date	Base of Borehole (mbgl)	Base of Standpipe (mbgl)	Base of Slotted Interval (mbgl)	Top of Slotted Interval (mbgl)	Top of Filter Pack (mbgl)	Top of Bentonite Plug (mbgl)	Screened Material
BH1202	5/6/20	35.81	35.81	32.81	26.81	19.30	14.80	Rhyodacite
BH7203	18/8/20	45.20	29.50	20.50	11.50	3.00	n/a	Interlaminated siltstone and sandstone

# Appendix H

Vibrating Wire Piezometer installation reports and calibration certificates

Table H.1	Summarv	vibrating	wire	piezometer	installations
1 0010 1111	Gammary	rior a cirry		pro201110101	motunationo

Borehole ID	Number of sensors	Sensor 1 drill string length (m)*	Sensor 1 Serial Number	Sensor 2 drill string length (m)*	Sensor 2 Serial Number	Sensor 3 drill string length (m)*	Sensor 3 Serial Number
BH3203	3	350	S4526	200	S6095	110	S6226
BH4201	2	448	2015212	382	2021634		
BH4202	2	460	2049645	282	S4525		
BH5202	1	230	S4242				
BH5203A	3	450	S4798	350	S4497	280	S6032
BH5204	2	690	2006502	590	2006498		
BH5206	2	680	2006499	600	2009138		
BH5207	1	680	2009141				
BH5208	2	525	2009139	275	S4493		
BH5209	2	650	2009140	350	S5068		
BH7202	3	40.2	S8315	24.2	S8316	19.2	S8317

\* Length along borehole string which does not equate to depth below ground in inclined boreholes

### Appendix I Geotechnical laboratory testing

Table I.1	Sumi	mary of geo	technical la	aboratory te	sting																			
Borehole ID	Point Load Test	UCS with modulus	Moisture content	Tensile Strength (Brazilian method)	Direct Shear Strength	Triaxial	Specific Gravity	CERCHAR Abrasivity Index	Sievers J-value	Swedish Brittleness Number	Abrasion Value Cutter Steel (AVS)	Slake Durability	Aggregate Soundness	Absorption	Petrography	X-ray Diffraction	Uniaxial Creep	Triaxial Creep	Sonic velocity	Electrical resistivity	Ethylene Glycol (CRD-C)	Ethylene Glycol (Visual)	Atterberg limits	Particle size distribution
BH1201	~	2	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
BH1202	✓	4	0	0	3	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0
BH3203	✓	3	0	3	2	9	0	3	3	3	3	3	3	0	4	0	0	0	0	0	0	0	0	0
BH4201	✓	8	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
BH4202	✓	3	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
BH5202	✓	5	0	3	2	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0
BH5203	✓	5	0	3	3	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0
BH5203A	✓	5	0	3	2	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0
BH5204	✓	5	0	3	2	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0
BH5206	✓	35	0	16	26	20	0	0	0	0	0	4	0	0	5	3	4	0	5	5	0	0	0	0
BH5207	✓	10	0	20	6	14	4	0	0	0	0	9	5	0	3	3	0	0	0	0	0	0	0	0
BH5208	✓	35	20	28	6	89	10	0	0	0	0	9	5	0	8	3	0	0	5	5	0	0	0	0
BH5209	✓	10	0	16	8	10	7	0	0	0	0	4	0	0	4	4	3	0	0	0	0	0	0	0
BH5210	✓	19	0	12	11	80	0	0	0	0	0	0	0	0	4	6	2	2	0	0	0	0	0	0
BH5211	✓	48	0	12	0	80	0	0	0	0	0	0	0	0	8	8	3	3	0	0	0	0	0	0
BH7201	1	2	0	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	2	2
BH7203	1	5	0	0	3	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0
BH7202	1	5	0	0	2	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0
BH-IPS	<ul> <li>✓</li> </ul>	43	0	22	0	34	0	10	10	9	9	46	28	0	61	59	0	0	0	0	30	16	9	9

### Appendix J Geochemical testing

### Table J.1 Summary of geochemical laboratory testing

Borehole ID	e ID pH, EC, Chromium reducible sulphur, Net Acid Generation, Net Acid Production, Metals suite (No. of tests)			
BH1201	1	1		
BH1202	2	2		
BH3203	-	3		
BH4201	10	-		
BH4202	5	-		
BH-IPS	10	32		
BH5202	-	5		
BH5203	-	4		
BH5203A	-	5		
BH5204	-	5		
BH5207	-	5		
BH5208	-	5		
BH7201	1	1		
BH7202	1	2		
BH7203	3	3		

### Appendix K Groundwater chemistry testing

 Table K.1
 Summary of groundwater chemistry laboratory testing

Borehole ID	Groundwater Chemistry
BH1202	$\checkmark$
BH7203	$\checkmark$

### Appendix L Groundwater monitoring

 Table L.1
 Summary of groundwater levels at instrument download

Borehole ID	Dip Date	Dip Level (mBTOC)
BH1201	28/05/20	7.46
BH7203	1/09/20	15.15

### Appendix M Naturally occurring asbestos screening results

Table M.1 Summary of naturally occurring asbestos laboratory testing

Borehole ID	Sample type	Test type	Laboratory	Drill string Depth range (m)		Report No.	Result
BH3203	core	ASB-001	Envirolab	67.97	68.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	70.71	70.78	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	73.00	73.07	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	75.82	75.87	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	78.76	78.82	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	81.22	81.34	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	85.33	85.40	259393	No asbestos detected
BH3203	core	ASB-001	Envirolab	84.00	84.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	86.46	86.50	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	91.00	91.09	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	95.60	95.69	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	96.11	96.19	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	103.11	103.21	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	106.93	107.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	108.88	109.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	114.92	115.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	119.00	119.07	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	122.92	123.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	124.92	125.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	129.22	129.31	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	132.58	132.70	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	137.93	138.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	141.00	141.05	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	146.50	146.60	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	151.52	151.60	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	155.57	155.68	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	158.40	158.48	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	163.85	163.92	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	167.08	167.18	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	170.12	170.22	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	173.27	173.36	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	176.39	176.46	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	181.00	181.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	185.91	186.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	188.51	188.62	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	194.92	195.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	199.40	199.51	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	201.48	201.67	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	207.82	208.00	259974	No asbestos detected

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Borehole	Sample	Test type	Laboratory	Drill string Depth		Report No.	Result
ID	type	resttype	Laboratory	range (m)		Report No.	Kesult
BH3203	core	ASB-001	Envirolab	211.00	211.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	213.00	213.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	219.89	220.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	221.03	221.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	227.00	227.14	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	231.85	231.96	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	235.00	235.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	239.93	240.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	240.38	240.43	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	244.53	244.63	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	250.73	250.83	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	254.90	255.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	259.00	259.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	262.90	263.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	266.00	266.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	269.90	270.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	274.93	275.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	277.00	277.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	283.93	284.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	287.00	287.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	288.28	288.35	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	292.09	292.22	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	298.36	298.43	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	303.00	303.06	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	306.00	306.09	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	311.00	311.09	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	314.89	315.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	317.00	317.06	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	322.00	322.07	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	327.93	328.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	330.00	330.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	333.94	334.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	339.29	339.37	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	340.00	340.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	347.00	347.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	350.00	350.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	353.96	354.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	337.00	337.08	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	361.00	361.05	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	364.96	365.00	259974	No asbestos detected

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Borehole ID	Sample type	Test type	Laboratory	Drill string Depth range (m)		Report No.	Result
BH3203	core	ASB-001	Envirolab	371.00	371.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	373.91	374.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	377.00	377.05	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	381.00	381.10	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	387.20	387.40	259867	Unknown mineral fibres detected
		XRD	Greencap	-		40915	Non-asbestiform mineral
		SEM	Microanalysis Australia	-		21-0176-01	Actinolite (see report)
BH3203	core	ASB-001	Envirolab	391.87	392.00	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	393.10	393.22	259974	No asbestos detected
BH3203	core	ASB-001	Envirolab	399.90	400.00	259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	DSC 1-1		259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	DSC 1-2		259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	DSC 2-1		259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	DSC 2-1		259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	DSC 3-1		259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	DSC 3-2		259974	No asbestos detected
BH3203	Mud	ASB-001	Envirolab	QC1		259974	No asbestos detected
BH4201	Core	ASB-001	Envirolab	6.93	7.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	26.85	26.90	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	31.31	31.43	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	51.79	51.86	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	69.00	69.08	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	81.00	81.02	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	100.00	100.04	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	126.00	126.09	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	137.12	137.17	262209	Unknown mineral fibres detected
		SEM	Microanalysis Australia	-		21-0859-03	Actinolite
BH4201	Core	ASB-001	Envirolab	159.93	160.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	174.00	174.11	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	197.47	197.53	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	223.00	223.05	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	244.95	245.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	269.07	269.14	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	295.90	296.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	318.00	318.04	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	335.00	335.09	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	356.00	356.09	263568	No asbestos detected

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Borehole ID	Sample type	Test type	Laboratory	Drill string Depth range (m)		Report No.	Result
BH4201	Core	ASB-001	Envirolab	370.90	371.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	374.00	374.11	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	376.00	376.09	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	381.00	381.08	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	387.54	387.60	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	390.92	391.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	395.88	395.93	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	396.92	397.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	402.00	402.05	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	406.00	406.10	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	409.47	409.55	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	413.00	413.05	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	416.90	417.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	421.39	421.44	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	427.27	427.36	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	428.14	428.18	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	432.00	432.06	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	436.00	436.06	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	443.00	443.09	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	446.00	446.08	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	451.00	451.08	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	455.00	455.09	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	458.00	458.06	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	463.54	463.63	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	467.92	468.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	468.37	468.44	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	473.00	473.05	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	479.95	480.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	481.92	482.00	263568	No asbestos detected
BH4201	Core	ASB-001	Envirolab	484.95	485.00	263568	No asbestos detected
BH4202	Core	ASB-001	Envirolab	17.00	17.08	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	33.40	33.50	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	34.04	34.10	262208	Unknown mineral fibres detected
		XRD	Microanalysis Australia			21_1102_1	No asbestos detected
		SEM	Microanalysis Australia			21-0859-01	Actinolite
BH4202	Core	ASB-001	Envirolab	51.42	51.52	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	70.89	80.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	91.20	91.32	263563	No asbestos detected

Borehole ID	Sample type	Test type	Laboratory	Drill string Depth range (m)		Report No.	Result
BH4202	Core	ASB-001	Envirolab	115.00	115.12	263563	No asbestos detected
BH4202	CoreASB-001Envirolab136.0013	136.13	263563	Unknown mineral fibres detected			
		XRD	Greencap	_		41791	Actinolite not meeting criteria for asbestos fibres
		SEM	Microanalysis Australia			21-0445-01	Ferroactinolite
BH4202	Core	ASB-001	Envirolab	162.00	162.08	263563	Unknown mineral fibres detected
		XRD	Greencap	_		41791	Non asbestiform mineral
		SEM	Microanalysis Australia	-		21-0445-02	Ferroactinolite
BH4202	Core	ASB-001	Envirolab	184.70	184.81	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	211.00	211.06	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	234.00	234.09	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	256.38	256.40	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	283.40	283.52	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	307.00	307.07	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	328.92	329.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	355.36	355.42	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	377.00	377.09	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	401.90	402.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	421.00	421.06	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	424.33	424.40	262208	Unknown mineral fibres detected
		XRD	Microanalysis Australia	-		21_1102_2	No asbestos detected
		SEM	Microanalysis Australia	_		21-0859-02	Actinolite
BH4202	Core	ASB-001	Envirolab	441.73	441.83	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	451.90	452.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	453.00	453.07	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	457.90	458.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	462.59	462.69	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	466.66	466.76	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	468.55	468.73	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	475.91	476.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	476.46	476.56	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	483.91	484.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	486.78	486.86	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	489.75	489.85	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	494.00	494.09	263563	No asbestos detected

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Borehole ID	Sample type	Test type	Laboratory	Drill string Depth range (m)		Report No.	Result
BH4202	Core	ASB-001	Envirolab	498.91	499.00	263563	No asbestos detected
BH4202	Core	ASB-001	Envirolab	500.72	500.82	263563	No asbestos detected
BH-IPS	Core	ASB-001	Envirolab	672.00	672.10	245638	No asbestos detected
		SEM	FibreLab	-		245638-2	No asbestos detected
BH-IPS	Core	ASB-001	Envirolab	1580.86	1580.90	246527	No asbestos detected
		SEM	FibreLab			246527-1	No asbestos detected

### Appendix N Digital deliverables summary

### Table N.1 Summary of deliverables

Document title	Document number	File name	File type
BH1201 - Borehole Log	S2-GEO-BH1201-LOG-REP-0001	S2-GEO-BH1201-LOG-REP-0001.PDF	PDF
BH1202 - Borehole Log	S2-GEO-BH1202-LOG-REP-0001	S2-GEO-BH1202-LOG-REP-0001.PDF	PDF
BH3203 - Borehole Log	S2-GEO-BH3203-LOG-REP-0001	S2-GEO-BH3203-LOG-REP-0001.PDF	PDF
BH4201 - Borehole Log	S2-GEO-BH4201-LOG-REP-0001	S2-GEO-BH4201-LOG-REP-0001.PDF	PDF
BH4202 - Borehole Log	S2-GEO-BH4202-LOG-REP-0001	S2-GEO-BH4202-LOG-REP-0001.PDF	PDF
BH-IPS - Borehole Log	S2-GEO-BH-IPS-LOG-REP-0001	S2-GEO-BH-IPS-LOG-REP-0001.PDF	PDF
BH5202 - Borehole Log	S2-GEO-BH5202-LOG-REP-0001	S2-GEO-BH5202-LOG-REP-0001.PDF	PDF
BH5203 - Borehole Log	S2-GEO-BH5203-LOG-REP-0001	S2-GEO-BH5203-LOG-REP-0001.PDF	PDF
BH5203A - Borehole Log	S2-GEO-BH5203A-LOG-REP-0001	S2-GEO-BH5203A-LOG-REP-0001.PDF	PDF
BH5204 - Borehole Log	S2-GEO-BH5204-LOG-REP-0001	S2-GEO-BH5204-LOG-REP-0001.PDF	PDF
BH5206 - Borehole Log	S2-GEO-BH5206-LOG-REP-0001	S2-GEO-BH5206-LOG-REP-0001.PDF	PDF
BH5207 - Borehole Log	S2-GEO-BH5207-LOG-REP-0001	S2-GEO-BH5207-LOG-REP-0001.PDF	PDF
BH5208 - Borehole Log	S2-GEO-BH5208-LOG-REP-0001	S2-GEO-BH5208-LOG-REP-0001.PDF	PDF
BH5209 - Borehole Log	S2-GEO-BH5209-LOG-REP-0001	S2-GEO-BH5209-LOG-REP-0001.PDF	PDF
BH5210 - Borehole Log	S2-GEO-BH5210-LOG-REP-0001	S2-GEO-BH5210-LOG-REP-0001.PDF	PDF
BH5211 - Borehole Log	S2-GEO-BH5211-LOG-REP-0001	S2-GEO-BH5211-LOG-REP-0001.PDF	PDF
BH7201 - Borehole Log	S2-GEO-BH7201-LOG-REP-0001	S2-GEO-BH7201-LOG-REP-0001.PDF	PDF
BH7202 - Borehole Log	S2-GEO-BH7202-LOG-REP-0001	S2-GEO-BH7202-LOG-REP-0001.PDF	PDF
BH7203 - Borehole Log	S2-GEO-BH7203-LOG-REP-0001	S2-GEO-BH7203-LOG-REP-0001.PDF	PDF
BH1201 - Borehole Log - Raw data	S2-GEO-BH1201-LOG-DAT-0001	S2-GEO-BH1201-LOG-DAT-0001.AGS	AGS
BH1202 - Borehole Log - Raw data	S2-GEO-BH1202-LOG-DAT-0001	S2-GEO-BH1202-LOG-DAT-0001.AGS	AGS
BH3203 - Borehole Log - Raw data	S2-GEO-BH3203-LOG-DAT-0001	S2-GEO-BH3203-LOG-DAT-0001.AGS	AGS
BH4201 - Borehole Log - Raw data	S2-GEO-BH4201-LOG-DAT-0001	S2-GEO-BH4201-LOG-DAT-0001.AGS	AGS
BH4202 - Borehole Log - Raw data	S2-GEO-BH4202-LOG-DAT-0001	S2-GEO-BH4202-LOG-DAT-0001.AGS	AGS
BH-IPS - Borehole Log - Raw data	S2-GEO-BH-IPS-LOG-DAT-0001	S2-GEO-BH-IPS-LOG-DAT-0001.AGS	AGS
BH5202 - Borehole Log - Raw data	S2-GEO-BH5202-LOG-DAT-0001	S2-GEO-BH5202-LOG-DAT-0001.AGS	AGS
BH5203 - Borehole Log - Raw data	S2-GEO-BH5203-LOG-DAT-0001	S2-GEO-BH5203-LOG-DAT-0001.AGS	AGS
BH5203A - Borehole Log - Raw data	S2-GEO-BH5203A-LOG-DAT-0001	S2-GEO-BH5203A-LOG-DAT-0001.AGS	AGS
BH5204 - Borehole Log - Raw data	S2-GEO-BH5204-LOG-DAT-0001	S2-GEO-BH5204-LOG-DAT-0001.AGS	AGS
BH5206 - Borehole Log - Raw data	S2-GEO-BH5206-LOG-DAT-0001	S2-GEO-BH5206-LOG-DAT-0001.AGS	AGS
BH5207 - Borehole Log - Raw data	S2-GEO-BH5207-LOG-DAT-0001	S2-GEO-BH5207-LOG-DAT-0001.AGS	AGS
BH5208 - Borehole Log - Raw data	S2-GEO-BH5208-LOG-DAT-0001	S2-GEO-BH5208-LOG-DAT-0001.AGS	AGS
BH5209 - Borehole Log - Raw data	S2-GEO-BH5209-LOG-DAT-0001	S2-GEO-BH5209-LOG-DAT-0001.AGS	AGS
BH5210 - Borehole Log - Raw data	S2-GEO-BH5210-LOG-DAT-0001	S2-GEO-BH5210-LOG-DAT-0001.AGS	AGS
BH5211 - Borehole Log - Raw data	S2-GEO-BH5211-LOG-DAT-0001	S2-GEO-BH5211-LOG-DAT-0001.AGS	AGS
BH7201 - Borehole Log - Raw data	S2-GEO-BH7201-LOG-DAT-0001	S2-GEO-BH7201-LOG-DAT-0001.AGS	AGS
BH7202 - Borehole Log - Raw data	S2-GEO-BH7202-LOG-DAT-0001	S2-GEO-BH7202-LOG-DAT-0001.AGS	AGS
BH7203 - Borehole Log - Raw data	S2-GEO-BH7203-LOG-DAT-0001	S2-GEO-BH7203-LOG-DAT-0001.AGS	AGS
BH1201 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH1201-LOG-DAT-0002	S2-GEO-BH1201-LOG-DAT-0002.xlsx	xlsx
BH1202 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH1202-LOG-DAT-0002	S2-GEO-BH1202-LOG-DAT-0002.xlsx	xlsx
BH3203 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH3203-LOG-DAT-0002	S2-GEO-BH3203-LOG-DAT-0002.xlsx	xlsx

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Document title	Document number	File name	File type
BH4201 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH4201-LOG-DAT-0002	S2-GEO-BH4201-LOG-DAT-0002.xlsx	xlsx
BH4202 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH4202-LOG-DAT-0002	S2-GEO-BH4202-LOG-DAT-0002.xlsx	xlsx
BH-IPS - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH-IPS-LOG-DAT-0002	S2-GEO-BH-IPS-LOG-DAT-0002.xlsx	xlsx
BH5202 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5202-LOG-DAT-0002	S2-GEO-BH5202-LOG-DAT-0002.xlsx	xlsx
BH5203 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5203-LOG-DAT-0002	S2-GEO-BH5203-LOG-DAT-0002.xlsx	xlsx
BH5203A - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5203A-LOG-DAT-0002	S2-GEO-BH5203A-LOG-DAT-0002.xlsx	xlsx
BH5204 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5204-LOG-DAT-0002	S2-GEO-BH5204-LOG-DAT-0002.xlsx	xlsx
BH5206 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5206-LOG-DAT-0002	S2-GEO-BH5206-LOG-DAT-0002.xlsx	xlsx
BH5207 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5207-LOG-DAT-0002	S2-GEO-BH5207-LOG-DAT-0002.xlsx	xlsx
BH5208 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5208-LOG-DAT-0002	S2-GEO-BH5208-LOG-DAT-0002.xlsx	xlsx
BH5209 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5209-LOG-DAT-0002	S2-GEO-BH5209-LOG-DAT-0002.xlsx	xlsx
BH5210 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5210-LOG-DAT-0002	S2-GEO-BH5210-LOG-DAT-0002.xlsx	xlsx
BH5211 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH5211-LOG-DAT-0002	S2-GEO-BH5211-LOG-DAT-0002.xlsx	xlsx
BH7201 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH7201-LOG-DAT-0002	S2-GEO-BH7201-LOG-DAT-0002.xlsx	xlsx
BH7202 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH7202-LOG-DAT-0002	S2-GEO-BH7202-LOG-DAT-0002.xlsx	xlsx
BH7203 - Borehole Log - Joint Roughness (Jr), Joint Alteration (Ja), Defect Spacing, Fracture Frequency Raw data	S2-GEO-BH7203-LOG-DAT-0002	S2-GEO-BH7203-LOG-DAT-0002.xlsx	xlsx
BH4201 - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH4201-LOG-DAT-0003	S2-GEO-BH4201-LOG-DAT-0003.xlsx	xlsx
BH4202 - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH4202-LOG-DAT-0003	S2-GEO-BH4202-LOG-DAT-0003.xlsx	xlsx
BH-IPS - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH-IPS-LOG-DAT-0003	S2-GEO-BH-IPS-LOG-DAT-0003.xlsx	xlsx
BH5203 - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH5203-LOG-DAT-0003	S2-GEO-BH5203-LOG-DAT-0003.xlsx	xlsx
BH5203A - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH5203A-LOG-DAT-0003	S2-GEO-BH5203A-LOG-DAT-0003.xlsx	xlsx
BH5204 - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH5204-LOG-DAT-0003	S2-GEO-BH5204-LOG-DAT-0003.xlsx	xlsx
BH5210 - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH5210-LOG-DAT-0003	S2-GEO-BH5210-LOG-DAT-0003.xlsx	xlsx
BH5211 - Borehole Log - core orientation alpha/beta angles - Raw data	S2-GEO-BH5211-LOG-DAT-0003	S2-GEO-BH5211-LOG-DAT-0003.xlsx	xlsx
BH4201 - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH4201-LOG-DAT-0004	S2-GEO-BH4201-LOG-DAT-0004.xlsx	xlsx
BH4202 - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH4202-LOG-DAT-0004	S2-GEO-BH4202-LOG-DAT-0004.xlsx	xlsx
BH-IPS - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH-IPS-LOG-DAT-0004	S2-GEO-BH-IPS-LOG-DAT-0004.xlsx	xlsx
BH5203 - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH5203-LOG-DAT-0004	S2-GEO-BH5203-LOG-DAT-0004.xlsx	xlsx
BH5203A - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH5203A-LOG-DAT-0004	S2-GEO-BH5203A-LOG-DAT-0004.xlsx	xlsx
BH5204 - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH5204-LOG-DAT-0004	S2-GEO-BH5204-LOG-DAT-0004.xlsx	xlsx
BH5210 - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH5210-LOG-DAT-0004	S2-GEO-BH5210-LOG-DAT-0004.xlsx	xlsx
BH5211 - Borehole Log - core orientation confidence - Raw data	S2-GEO-BH5211-LOG-DAT-0004	S2-GEO-BH5211-LOG-DAT-0004.xlsx	xlsx
BH1201 - Core Photographs	S2-GEO-BH1201-COR-PHO-0001	S2-GEO-BH1201-COR-PHO-0001.PDF	PDF
BH1202 - Core Photographs	S2-GEO-BH1202-COR-PHO-0001	S2-GEO-BH1202-COR-PHO-0001.PDF	PDF
BH3203 - Core Photographs	S2-GEO-BH3203-COR-PHO-0001	S2-GEO-BH3203-COR-PHO-0001.PDF	PDF
BH4201 - Core Photographs	S2-GEO-BH4201-COR-PHO-0001	S2-GEO-BH4201-COR-PHO-0001.PDF	PDF
BH4202 - Core Photographs	S2-GEO-BH4202-COR-PHO-0001	S2-GEO-BH4202-COR-PHO-0001.PDF	PDF
BH-IPS - Core Photographs	S2-GEO-BH-IPS-COR-PHO-0001	S2-GEO-BH-IPS-COR-PHO-0001.PDF	PDF
BH5202 - Core Photographs	S2-GEO-BH5202-COR-PHO-0001	S2-GEO-BH5202-COR-PHO-0001.PDF	PDF
BH5203 - Core Photographs	S2-GEO-BH5203-COR-PHO-0001	S2-GEO-BH5203-COR-PHO-0001.PDF	PDF
BH5203A - Core Photographs	S2-GEO-BH5203A-COR-PHO-0001	S2-GEO-BH5203A-COR-PHO-0001.PDF	PDF
BH5204 - Core Photographs	S2-GEO-BH5204-COR-PHO-0001	S2-GEO-BH5204-COR-PHO-0001.PDF	PDF

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Document title	Document number	File name	File type
BH5206 - Core Photographs	S2-GEO-BH5206-COR-PHO-0001	S2-GEO-BH5206-COR-PHO-0001.PDF	PDF
BH5207 - Core Photographs	S2-GEO-BH5207-COR-PHO-0001	S2-GEO-BH5207-COR-PHO-0001.PDF	PDF
BH5208 - Core Photographs	S2-GEO-BH5208-COR-PHO-0001	S2-GEO-BH5208-COR-PHO-0001.PDF	PDF
BH5209 - Core Photographs	S2-GEO-BH5209-COR-PHO-0001	S2-GEO-BH5209-COR-PHO-0001.PDF	PDF
BH5210 - Core Photographs	S2-GEO-BH5210-COR-PHO-0001	S2-GEO-BH5210-COR-PHO-0001.PDF	PDF
BH5211 - Core Photographs	S2-GEO-BH5211-COR-PHO-0001	S2-GEO-BH5211-COR-PHO-0001.PDF	PDF
BH7201 - Core Photographs	S2-GEO-BH7201-COR-PHO-0001	S2-GEO-BH7201-COR-PHO-0001.PDF	PDF
BH7202 - Core Photographs	S2-GEO-BH7202-COR-PHO-0001	S2-GEO-BH7202-COR-PHO-0001.PDF	PDF
BH7203 - Core Photographs	S2-GEO-BH7203-COR-PHO-0001	S2-GEO-BH7203-COR-PHO-0001.PDF	PDF
3H1201 - Core Photograph - JPG - 04.81-20.47m	S2-GEO-BH1201-COR-PHO-0002	S2-GEO-BH1201-COR-PHO-0002.zip	zip
BH1202 - Core Photograph - JPG - 02.59-35.81m	S2-GEO-BH1202-COR-PHO-0002	S2-GEO-BH1202-COR-PHO-0002.zip	zip
3H4201 - Core Photograph - JPG - 00.43-485.83m	S2-GEO-BH3203-COR-PHO-0002	S2-GEO-BH3203-COR-PHO-0002.zip	zip
BH4202 - Core Photograph - JPG - 00.35-501.90m	S2-GEO-BH4201-COR-PHO-0002	S2-GEO-BH4201-COR-PHO-0002.zip	zip
BH3203 - Core Photograph - JPG - 00.00-400.16m	S2-GEO-BH4202-COR-PHO-0002	S2-GEO-BH4202-COR-PHO-0002.zip	zip
BH-IPS - Core Photograph - JPG - 01.30-2001.38m	S2-GEO-BH-IPS-COR-PHO-0002	S2-GEO-BH-IPS-COR-PHO-0002.zip	zip
BH5202 - Core Photograph - JPG - 00.37-280.00m	S2-GEO-BH5202-COR-PHO-0002	S2-GEO-BH5202-COR-PHO-0002.zip	zip
3H5203 - Core Photograph - JPG - 00.30-419.81m	S2-GEO-BH5203-COR-PHO-0002	S2-GEO-BH5203-COR-PHO-0002.zip	zip
3H5203A - Core Photograph - JPG - 170.43-512.28m	S2-GEO-BH5203A-COR-PHO-0002	S2-GEO-BH5203A-COR-PHO-0002.zip	zip
3H5204 - Core Photograph - JPG - 00.05-755.48m	S2-GEO-BH5204-COR-PHO-0002	S2-GEO-BH5204-COR-PHO-0002.zip	zip
3H5206 - Core Photograph - JPG - 00.00-781.85m	S2-GEO-BH5206-COR-PHO-0002	S2-GEO-BH5206-COR-PHO-0002.zip	zip
3H5207 - Core Photograph - JPG - 00.00-783.41m	S2-GEO-BH5207-COR-PHO-0002	S2-GEO-BH5207-COR-PHO-0002.zip	zip
3H5208 - Core Photograph - JPG - 00.30-743.85m	S2-GEO-BH5208-COR-PHO-0002	S2-GEO-BH5208-COR-PHO-0002.zip	zip
3H5209 - Core Photograph - JPG - 00.20-768.96m	S2-GEO-BH5209-COR-PHO-0002	S2-GEO-BH5209-COR-PHO-0002.zip	zip
3H5210 - Core Photograph - JPG - 00.30-825.81m	S2-GEO-BH5210-COR-PHO-0002	S2-GEO-BH5210-COR-PHO-0002.zip	zip
3H5211 - Core Photograph - JPG - 00.34-920.38m	S2-GEO-BH5211-COR-PHO-0002	S2-GEO-BH5211-COR-PHO-0002.zip	zip
3H7201 - Core Photograph - JPG - 00.00-41.25m	S2-GEO-BH7201-COR-PHO-0002	S2-GEO-BH7201-COR-PHO-0002.zip	zip
3H7202 - Core Photograph - JPG - 00.36-40.61m	S2-GEO-BH7202-COR-PHO-0002	S2-GEO-BH7202-COR-PHO-0002.zip	zip
3H7203 - Core Photograph - JPG - 00.50-45.20m	S2-GEO-BH7203-COR-PHO-0002	S2-GEO-BH7203-COR-PHO-0002.zip	zip
3H3203 - Downhole Survey	S2-GEO-BH3203-DHS-DAT-0001	S2-GEO-BH3203-DHS-DAT-0001.PDF	PDF
3H4201 - Downhole Survey	S2-GEO-BH4201-DHS-DAT-0001	S2-GEO-BH4201-DHS-DAT-0001.PDF	PDF
3H4202 - Downhole Survey	S2-GEO-BH4202-DHS-DAT-0001	S2-GEO-BH4202-DHS-DAT-0001.PDF	PDF
BH-IPS - Downhole Survey	S2-GEO-BH-IPS-DHS-DAT-0001	S2-GEO-BH-IPS-DHS-DAT-0001.PDF	PDF
3H5202 - Downhole Survey	S2-GEO-BH5202-DHS-DAT-0001	S2-GEO-BH5202-DHS-DAT-0001.PDF	PDF
3H5203 - Downhole Survey	S2-GEO-BH5203-DHS-DAT-0001	S2-GEO-BH5203-DHS-DAT-0001.PDF	PDF
3H5203A - Downhole Survey	S2-GEO-BH5203A-DHS-DAT-0001	S2-GEO-BH5203A-DHS-DAT-0001.PDF	PDF
3H5204 - Downhole Survey	S2-GEO-BH5204-DHS-DAT-0001	S2-GEO-BH5204-DHS-DAT-0001.PDF	PDF
3H5206 - Downhole Survey	S2-GEO-BH5206-DHS-DAT-0001	S2-GEO-BH5206-DHS-DAT-0001.PDF	PDF
3H5207 - Downhole Survey	S2-GEO-BH5207-DHS-DAT-0001	S2-GEO-BH5207-DHS-DAT-0001.PDF	PDF
3H5208 - Downhole Survey	S2-GEO-BH5208-DHS-DAT-0001	S2-GEO-BH5208-DHS-DAT-0001.PDF	PDF
3H5209 - Downhole Survey	S2-GEO-BH5209-DHS-DAT-0001	S2-GEO-BH5209-DHS-DAT-0001.PDF	PDF
BH5210 - Downhole Survey	S2-GEO-BH5210-DHS-DAT-0001	S2-GEO-BH5210-DHS-DAT-0001.PDF	PDF
BH5211 - Downhole Survey	S2-GEO-BH5211-DHS-DAT-0001	S2-GEO-BH5211-DHS-DAT-0001.PDF	PDF

Document title	Document number	File name	File type
BH3203 - Downhole Survey - Raw data	S2-GEO-BH3203-DHS-DAT-0002	S2-GEO-BH3203-DHS-DAT-0002.xlsx	xlsx
BH4201 - Downhole Survey - Raw data	S2-GEO-BH4201-DHS-DAT-0002	S2-GEO-BH4201-DHS-DAT-0002.xlsx	xlsx
BH4202 - Downhole Survey - Raw data	S2-GEO-BH4202-DHS-DAT-0002	S2-GEO-BH4202-DHS-DAT-0002.xlsx	xlsx
BH-IPS - Downhole Survey - Raw data	S2-GEO-BH-IPS-DHS-DAT-0002	S2-GEO-BH-IPS-DHS-DAT-0002.xlsx	xlsx
BH5202 - Downhole Survey - Raw data	S2-GEO-BH5202-DHS-DAT-0002	S2-GEO-BH5202-DHS-DAT-0002.xlsx	xlsx
BH5203 - Downhole Survey - Raw data	S2-GEO-BH5203-DHS-DAT-0002	S2-GEO-BH5203-DHS-DAT-0002.xlsx	xlsx
BH5203A - Downhole Survey - Raw data	S2-GEO-BH5203A-DHS-DAT-0002	S2-GEO-BH5203A-DHS-DAT-0002.xlsx	xlsx
BH5204 - Downhole Survey - Raw data	S2-GEO-BH5204-DHS-DAT-0002	S2-GEO-BH5204-DHS-DAT-0002.xlsx	xlsx
BH5206 - Downhole Survey - Raw data	S2-GEO-BH5206-DHS-DAT-0002	S2-GEO-BH5206-DHS-DAT-0002.xlsx	xlsx
BH5207 - Downhole Survey - Raw data	S2-GEO-BH5207-DHS-DAT-0002	S2-GEO-BH5207-DHS-DAT-0002.xlsx	xlsx
BH5208 - Downhole Survey - Raw data	S2-GEO-BH5208-DHS-DAT-0002	S2-GEO-BH5208-DHS-DAT-0002.xlsx	xlsx
BH5209 - Downhole Survey - Raw data	S2-GEO-BH5209-DHS-DAT-0002	S2-GEO-BH5209-DHS-DAT-0002.xlsx	xlsx
BH5210 - Downhole Survey - Raw data	S2-GEO-BH5210-DHS-DAT-0002	S2-GEO-BH5210-DHS-DAT-0002.xlsx	xlsx
BH5211 - Downhole Survey - Raw data	S2-GEO-BH5211-DHS-DAT-0002	S2-GEO-BH5211-DHS-DAT-0002.xlsx	xlsx
BH1202 - Downhole Geophysical Logging	S2-GEO-BH1202-DHG-REP-0001	S2-GEO-BH1202-DHG-REP-0001.PDF	PDF
BH3203 - Downhole Geophysical Logging	S2-GEO-BH3203-DHG-REP-0001	S2-GEO-BH3203-DHG-REP-0001.PDF	PDF
BH4201 - Downhole Geophysical Logging	S2-GEO-BH4201-DHG-REP-0001	S2-GEO-BH4201-DHG-REP-0001.PDF	PDF
BH4202 - Downhole Geophysical Logging	S2-GEO-BH4202-DHG-REP-0001	S2-GEO-BH4202-DHG-REP-0001.PDF	PDF
BH-IPS - Downhole Geophysical Logging	S2-GEO-BH-IPS-DHG-REP-0001	S2-GEO-BH-IPS-DHG-REP-0001.PDF	PDF
BH5202 - Downhole Geophysical Logging	S2-GEO-BH5202-DHG-REP-0001	S2-GEO-BH5202-DHG-REP-0001.PDF	PDF
BH5203A - Downhole Geophysical Logging	S2-GEO-BH5203A-DHG-REP-0001	S2-GEO-BH5203A-DHG-REP-0001.PDF	PDF
BH5204 - Downhole Geophysical Logging	S2-GEO-BH5204-DHG-REP-0001	S2-GEO-BH5204-DHG-REP-0001.PDF	PDF
BH5206 - Downhole Geophysical Logging	S2-GEO-BH5206-DHG-REP-0001	S2-GEO-BH5206-DHG-REP-0001.PDF	PDF
BH5207 - Downhole Geophysical Logging	S2-GEO-BH5207-DHG-REP-0001	S2-GEO-BH5207-DHG-REP-0001.PDF	PDF
BH5208 - Downhole Geophysical Logging	S2-GEO-BH5208-DHG-REP-0001	S2-GEO-BH5208-DHG-REP-0001.PDF	PDF
BH5209 - Downhole Geophysical Logging	S2-GEO-BH5209-DHG-REP-0001	S2-GEO-BH5209-DHG-REP-0001.PDF	PDF
BH5210 - Downhole Geophysical Logging	S2-GEO-BH5210-DHG-REP-0001	S2-GEO-BH5210-DHG-REP-0001.PDF	PDF
BH5211 - Downhole Geophysical Logging	S2-GEO-BH5211-DHG-REP-0001	S2-GEO-BH5211-DHG-REP-0001.PDF	PDF
BH7202 - Downhole Geophysical Logging	S2-GEO-BH7202-DHG-REP-0001	S2-GEO-BH7202-DHG-REP-0001.PDF	PDF
BH7203 - Downhole Geophysical Logging	S2-GEO-BH7203-DHG-REP-0001	S2-GEO-BH7203-DHG-REP-0001.PDF	PDF
BH1202 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH1202-DHG-DAT-0001	S2-GEO-BH1202-DHG-DAT-0001.csv	csv
BH3203 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH3203-DHG-DAT-0001	S2-GEO-BH3203-DHG-DAT-0001.csv	CSV
BH4201 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH4201-DHG-DAT-0001	S2-GEO-BH4201-DHG-DAT-0001.csv	CSV
BH4202 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH4202-DHG-DAT-0001	S2-GEO-BH4202-DHG-DAT-0001.csv	csv
BH-IPS - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH-IPS-DHG-DAT-0001	S2-GEO-BH-IPS-DHG-DAT-0001.csv	CSV
BH5202 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5202-DHG-DAT-0001	S2-GEO-BH5202-DHG-DAT-0001.csv	CSV
BH5203A - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5203A-DHG-DAT-0001	S2-GEO-BH5203A-DHG-DAT-0001.csv	CSV
BH5204 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5204-DHG-DAT-0001	S2-GEO-BH5204-DHG-DAT-0001.csv	CSV
BH5206 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5206-DHG-DAT-0001	S2-GEO-BH5206-DHG-DAT-0001.csv	CSV
BH5207 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5207-DHG-DAT-0001	S2-GEO-BH5207-DHG-DAT-0001.csv	CSV
BH5208 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5208-DHG-DAT-0001	S2-GEO-BH5208-DHG-DAT-0001.csv	CSV
BH5209 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5209-DHG-DAT-0001	S2-GEO-BH5209-DHG-DAT-0001.csv	CSV

Document title	Document number	File name	File type
BH5210 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5210-DHG-DAT-0001	S2-GEO-BH5210-DHG-DAT-0001.csv	CSV
BH5211 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH5211-DHG-DAT-0001	S2-GEO-BH5211-DHG-DAT-0001.csv	CSV
BH7202 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH7202-DHG-DAT-0001	S2-GEO-BH7202-DHG-DAT-0001.csv	CSV
BH7203 - Downhole Geophysical Logging - Structures - Raw Data	S2-GEO-BH7203-DHG-DAT-0001	S2-GEO-BH7203-DHG-DAT-0001.csv	CSV
BH1202 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH1202-DHG-DAT-0002	S2-GEO-BH1202-DHG-DAT-0002.LAS	LAS
BH3203 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH3203-DHG-DAT-0002	S2-GEO-BH3203-DHG-DAT-0002.LAS	LAS
BH4201 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH4201-DHG-DAT-0002	S2-GEO-BH4201-DHG-DAT-0002.LAS	LAS
BH4202 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH4202-DHG-DAT-0002	S2-GEO-BH4202-DHG-DAT-0002.LAS	LAS
BH-IPS - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH-IPS-DHG-DAT-0002	S2-GEO-BH-IPS-DHG-DAT-0002.LAS	LAS
BH5202 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5202-DHG-DAT-0002	S2-GEO-BH5202-DHG-DAT-0002.LAS	LAS
BH5203A - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5203A-DHG-DAT-0002	S2-GEO-BH5203A-DHG-DAT-0002.LAS	LAS
BH5204 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5204-DHG-DAT-0002	S2-GEO-BH5204-DHG-DAT-0002.LAS	LAS
BH5206 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5206-DHG-DAT-0002	S2-GEO-BH5206-DHG-DAT-0002.LAS	LAS
BH5207 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5207-DHG-DAT-0002	S2-GEO-BH5207-DHG-DAT-0002.LAS	LAS
BH5208 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5208-DHG-DAT-0002	S2-GEO-BH5208-DHG-DAT-0002.LAS	LAS
BH5209 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5209-DHG-DAT-0002	S2-GEO-BH5209-DHG-DAT-0002.LAS	LAS
BH5210 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5210-DHG-DAT-0002	S2-GEO-BH5210-DHG-DAT-0002.LAS	LAS
BH5211 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH5211-DHG-DAT-0002	S2-GEO-BH5211-DHG-DAT-0002.LAS	LAS
BH7203 - Downhole Geophysical Logging - Temperature - Raw data	S2-GEO-BH7203-DHG-DAT-0002	S2-GEO-BH7203-DHG-DAT-0002.LAS	LAS
BH3203 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH3203-DHG-DAT-0003	S2-GEO-BH3203-DHG-DAT-0003.csv	CSV
BH4201 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH4201-DHG-DAT-0003	S2-GEO-BH4201-DHG-DAT-0003.csv	CSV
BH4202 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH4202-DHG-DAT-0003	S2-GEO-BH4202-DHG-DAT-0003.csv	CSV
BH5202 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5202-DHG-DAT-0003	S2-GEO-BH5202-DHG-DAT-0003.csv	CSV
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0003	S2-GEO-BH5203A-DHG-DAT-0003.csv	CSV
BH5204 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5204-DHG-DAT-0003	S2-GEO-BH5204-DHG-DAT-0003.csv	CSV
BH5206 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5206-DHG-DAT-0003	S2-GEO-BH5206-DHG-DAT-0003.csv	CSV
BH5207 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5207-DHG-DAT-0003	S2-GEO-BH5207-DHG-DAT-0003.csv	CSV
BH5208 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5208-DHG-DAT-0003	S2-GEO-BH5208-DHG-DAT-0003.csv	CSV
BH5209 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5209-DHG-DAT-0003	S2-GEO-BH5209-DHG-DAT-0003.csv	CSV
BH5210 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5210-DHG-DAT-0003	S2-GEO-BH5210-DHG-DAT-0003.csv	CSV
BH5211 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5211-DHG-DAT-0003	S2-GEO-BH5211-DHG-DAT-0003.csv	CSV
BH3203 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH3203-DHG-DAT-0004	S2-GEO-BH3203-DHG-DAT-0004.csv	CSV
BH4201 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH4201-DHG-DAT-0004	S2-GEO-BH4201-DHG-DAT-0004.csv	CSV
BH4202 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH4202-DHG-DAT-0004	S2-GEO-BH4202-DHG-DAT-0004.csv	CSV
BH5202 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5202-DHG-DAT-0004	S2-GEO-BH5202-DHG-DAT-0004.csv	CSV
BH5203A - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5203A-DHG-DAT-0004	S2-GEO-BH5203A-DHG-DAT-0004.csv	CSV
BH5204 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5204-DHG-DAT-0004	S2-GEO-BH5204-DHG-DAT-0004.csv	csv
BH5206 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5206-DHG-DAT-0004	S2-GEO-BH5206-DHG-DAT-0004.csv	CSV
BH5207 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5207-DHG-DAT-0004	S2-GEO-BH5207-DHG-DAT-0004.csv	CSV
BH5208 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5208-DHG-DAT-0004	S2-GEO-BH5208-DHG-DAT-0004.csv	CSV
BH5209 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5209-DHG-DAT-0004	S2-GEO-BH5209-DHG-DAT-0004.csv	CSV
BH5210 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5210-DHG-DAT-0004	S2-GEO-BH5210-DHG-DAT-0004.csv	CSV

Document title	Document number	File name	File type
BH5211 - Downhole Geophysical Logging - Natural Gamma Ray - Raw data	S2-GEO-BH5211-DHG-DAT-0004	S2-GEO-BH5211-DHG-DAT-0004.csv	csv
BH3203 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH3203-DHG-DAT-0005	S2-GEO-BH3203-DHG-DAT-0005.tfd	tfd
BH4201 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH4201-DHG-DAT-0005	S2-GEO-BH4201-DHG-DAT-0005.tfd	tfd
BH4202 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH4202-DHG-DAT-0005	S2-GEO-BH4202-DHG-DAT-0005.tfd	tfd
BH5202 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5202-DHG-DAT-0005	S2-GEO-BH5202-DHG-DAT-0005.tfd	tfd
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0005	S2-GEO-BH5203A-DHG-DAT-0005.hed	hed
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0006	S2-GEO-BH5203A-DHG-DAT-0006.hed	hed
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0007	S2-GEO-BH5203A-DHG-DAT-0007.hed	hed
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0008	S2-GEO-BH5203A-DHG-DAT-0008.lgx	lgx
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0009	S2-GEO-BH5203A-DHG-DAT-0009.lgx	lgx
BH5203A - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5203A-DHG-DAT-0010	S2-GEO-BH5203A-DHG-DAT-0010.lgx	lgx
BH5204 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5204-DHG-DAT-0005	S2-GEO-BH5204-DHG-DAT-0005.tfd	tfd
BH5206 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5206-DHG-DAT-0005	S2-GEO-BH5206-DHG-DAT-0005.tfd	tfd
BH5207 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5207-DHG-DAT-0005	S2-GEO-BH5207-DHG-DAT-0005.tfd	tfd
BH5208 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5208-DHG-DAT-0005	S2-GEO-BH5208-DHG-DAT-0005.hed	hed
BH5208 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5208-DHG-DAT-0006	S2-GEO-BH5208-DHG-DAT-0006.hed	hed
BH5208 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5208-DHG-DAT-0007	S2-GEO-BH5208-DHG-DAT-0007.lgx	lgx
BH5208 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5208-DHG-DAT-0008	S2-GEO-BH5208-DHG-DAT-0008.lgx	lgx
BH5209 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5209-DHG-DAT-0005	S2-GEO-BH5209-DHG-DAT-0005.tfd	tfd
BH5210 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5210-DHG-DAT-0005	S2-GEO-BH5210-DHG-DAT-0005.hed	hed
BH5210 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5210-DHG-DAT-0006	S2-GEO-BH5210-DHG-DAT-0006.lgx	lgx
BH5211 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5211-DHG-DAT-0005	S2-GEO-BH5211-DHG-DAT-0005.hed	hed
BH5211 - Downhole Geophysical Logging - Full Wave Sonic - Raw data	S2-GEO-BH5211-DHG-DAT-0006	S2-GEO-BH5211-DHG-DAT-0006.lgx	lgx
BH3203 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH3203-PMT-REP-0001	S2-GEO-BH3203-PMT-REP-0001.PDF	PDF
BH-IPS - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH-IPS-PMT-REP-0001	S2-GEO-BH-IPS-PMT-REP-0001.PDF	PDF
BH5202 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5202-PMT-REP-0001	S2-GEO-BH5202-PMT-REP-0001.PDF	PDF
BH5203A - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5203A-PMT-REP-0001	S2-GEO-BH5203A-PMT-REP-0001.PDF	PDF
BH5204 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5204-PMT-REP-0001	S2-GEO-BH5204-PMT-REP-0001.PDF	PDF
BH5206 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5206-PMT-REP-0001	S2-GEO-BH5206-PMT-REP-0001.PDF	PDF
BH5207 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5207-PMT-REP-0001	S2-GEO-BH5207-PMT-REP-0001.PDF	PDF
BH5208 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5208-PMT-REP-0001	S2-GEO-BH5208-PMT-REP-0001.PDF	PDF
BH5209 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5209-PMT-REP-0001	S2-GEO-BH5209-PMT-REP-0001.PDF	PDF
BH5210 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5210-PMT-REP-0001	S2-GEO-BH5210-PMT-REP-0001.PDF	PDF
BH5211 - Permeability Test - Drill Stem Test (DST)	S2-GEO-BH5211-PMT-REP-0001	S2-GEO-BH5211-PMT-REP-0001.PDF	PDF
BH3203 - Permeability Test - Drill stem test (DST) - Raw Data - Below	S2-GEO-BH3203-PMT-DAT-0001	S2-GEO-BH3203-PMT-DAT-0001.txt	txt
BH3203 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH3203-PMT-DAT-0002	S2-GEO-BH3203-PMT-DAT-0002.txt	txt
BH3203 - Permeability Test - Drill stem test (DST) - Raw Data - Outside	S2-GEO-BH3203-PMT-DAT-0003	S2-GEO-BH3203-PMT-DAT-0003.txt	txt
BH3203 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH3203-PMT-DAT-0004	S2-GEO-BH3203-PMT-DAT-0004.xlsx	xlsx
BH-IPS - Permeability Test - Drill stem test (DST) - Raw data - 1-8 Below	S2-GEO-BH-IPS-PMT-DAT-0001	S2-GEO-BH-IPS-PMT-DAT-0001.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 1-8 Fluid	S2-GEO-BH-IPS-PMT-DAT-0002	S2-GEO-BH-IPS-PMT-DAT-0002.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 1-8 Inflate	S2-GEO-BH-IPS-PMT-DAT-0003	S2-GEO-BH-IPS-PMT-DAT-0003.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 1-8 Outside 1	S2-GEO-BH-IPS-PMT-DAT-0004	S2-GEO-BH-IPS-PMT-DAT-0004.txt	txt

Document title	Document number	File name	File type
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 1-8 Outside 2	S2-GEO-BH-IPS-PMT-DAT-0005	S2-GEO-BH-IPS-PMT-DAT-0005.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 6 5 3 Below	S2-GEO-BH-IPS-PMT-DAT-0006	S2-GEO-BH-IPS-PMT-DAT-0006.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 6 5 3 Fluid	S2-GEO-BH-IPS-PMT-DAT-0007	S2-GEO-BH-IPS-PMT-DAT-0007.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 6 5 3 Outside 1	S2-GEO-BH-IPS-PMT-DAT-0008	S2-GEO-BH-IPS-PMT-DAT-0008.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 6 5 3 Outside 2	S2-GEO-BH-IPS-PMT-DAT-0009	S2-GEO-BH-IPS-PMT-DAT-0009.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 8 9 7 Below	S2-GEO-BH-IPS-PMT-DAT-0010	S2-GEO-BH-IPS-PMT-DAT-0010.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 8 9 7 Fluid	S2-GEO-BH-IPS-PMT-DAT-0011	S2-GEO-BH-IPS-PMT-DAT-0011.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 8 9 7 Outside 1	S2-GEO-BH-IPS-PMT-DAT-0012	S2-GEO-BH-IPS-PMT-DAT-0012.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) - Raw Data - 8 9 7 Outside 2	S2-GEO-BH-IPS-PMT-DAT-0013	S2-GEO-BH-IPS-PMT-DAT-0013.txt	txt
BH-IPS - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH-IPS-PMT-DAT-0014	S2-GEO-BH-IPS-PMT-DAT-0014.xlsx	xlsx
BH5202 - Permeability Test - Drill stem test (DST) - Raw data - Below	S2-GEO-BH5202-PMT-DAT-0001	S2-GEO-BH5202-PMT-DAT-0001.txt	txt
BH5202 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5202-PMT-DAT-0002	S2-GEO-BH5202-PMT-DAT-0002.txt	txt
BH5202 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5202-PMT-DAT-0003	S2-GEO-BH5202-PMT-DAT-0003.txt	txt
BH5202 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5202-PMT-DAT-0004	S2-GEO-BH5202-PMT-DAT-0004.txt	txt
BH5202 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5202-PMT-DAT-0005	S2-GEO-BH5202-PMT-DAT-0005.xlsx	xlsx
BH5203A - Permeability Test - Drill stem test (DST) - Raw data - Below	S2-GEO-BH5203A-PMT-DAT-0001	S2-GEO-BH5203A-PMT-DAT-0001.txt	txt
BH5203A - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5203A-PMT-DAT-0002	S2-GEO-BH5203A-PMT-DAT-0002.txt	txt
BH5203A - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5203A-PMT-DAT-0003	S2-GEO-BH5203A-PMT-DAT-0003.txt	txt
BH5203A - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5203A-PMT-DAT-0004	S2-GEO-BH5203A-PMT-DAT-0004.txt	txt
BH5203A - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5203A-PMT-DAT-0005	S2-GEO-BH5203A-PMT-DAT-0005.xlsx	xlsx
BH5204 - Permeability Test - Drill stem test (DST) - Raw Data -Below	S2-GEO-BH5204-PMT-DAT-0001	S2-GEO-BH5204-PMT-DAT-0001.txt	txt
BH5204 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5204-PMT-DAT-0002	S2-GEO-BH5204-PMT-DAT-0002.txt	txt
BH5204 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5204-PMT-DAT-0003	S2-GEO-BH5204-PMT-DAT-0003.txt	txt
BH5204 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5204-PMT-DAT-0004	S2-GEO-BH5204-PMT-DAT-0004.txt	txt
BH5204 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5204-PMT-DAT-0005	S2-GEO-BH5204-PMT-DAT-0005.xlsx	xlsx
BH5206 - Permeability Test - Drill stem test (DST) - Raw Data - Below	S2-GEO-BH5206-PMT-DAT-0001	S2-GEO-BH5206-PMT-DAT-0001.txt	txt
BH5206 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5206-PMT-DAT-0002	S2-GEO-BH5206-PMT-DAT-0002.txt	txt
BH5206 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5206-PMT-DAT-0003	S2-GEO-BH5206-PMT-DAT-0003.txt	txt
BH5206 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5206-PMT-DAT-0004	S2-GEO-BH5206-PMT-DAT-0004.txt	txt
BH5206 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5206-PMT-DAT-0005	S2-GEO-BH5206-PMT-DAT-0005.xlsx	xlsx
BH5207 - Permeability Test - Drill stem test (DST) - Raw Data - Below	S2-GEO-BH5207-PMT-DAT-0001	S2-GEO-BH5207-PMT-DAT-0001.txt	txt
BH5207 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5207-PMT-DAT-0002	S2-GEO-BH5207-PMT-DAT-0002.txt	txt
BH5207 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5207-PMT-DAT-0003	S2-GEO-BH5207-PMT-DAT-0003.txt	txt
BH5207 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5207-PMT-DAT-0004	S2-GEO-BH5207-PMT-DAT-0004.txt	txt
BH5207 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5207-PMT-DAT-0005	S2-GEO-BH5207-PMT-DAT-0005.xlsx	xlsx
BH5208 - Permeability Test - Drill stem test (DST) - Raw Data - Below	S2-GEO-BH5208-PMT-DAT-0001	S2-GEO-BH5208-PMT-DAT-0001.txt	txt
BH5208 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5208-PMT-DAT-0002	S2-GEO-BH5208-PMT-DAT-0002.txt	txt
BH5208 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5208-PMT-DAT-0003	S2-GEO-BH5208-PMT-DAT-0003.txt	txt
BH5208 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5208-PMT-DAT-0004	S2-GEO-BH5208-PMT-DAT-0004.txt	txt
BH5208 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5208-PMT-DAT-0005	S2-GEO-BH5208-PMT-DAT-0005.xlsx	xlsx
BH5209 - Permeability Test -Drill stem test (DST) - Raw Data - Below	S2-GEO-BH5209-PMT-DAT-0001	S2-GEO-BH5209-PMT-DAT-0001.txt	txt
BH5209 - Permeability Test - Drill stem test (DST) - Raw Data - Fluid	S2-GEO-BH5209-PMT-DAT-0002	S2-GEO-BH5209-PMT-DAT-0002.txt	txt

Document title	Document number	File name	File type
BH5209 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 1	S2-GEO-BH5209-PMT-DAT-0003	S2-GEO-BH5209-PMT-DAT-0003.txt	txt
BH5209 - Permeability Test - Drill stem test (DST) - Raw Data - Outside 2	S2-GEO-BH5209-PMT-DAT-0004	S2-GEO-BH5209-PMT-DAT-0004.txt	txt
BH5209 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5209-PMT-DAT-0005	S2-GEO-BH5209-PMT-DAT-0005.xlsx	xlsx
BH5210 - Permeability Testing - Drill stem Test - Raw data - Below	S2-GEO-BH5210-PMT-DAT-0001	S2-GEO-BH5210-PMT-DAT-0001.txt	txt
BH5210 - Permeability Testing - Drill stem Test - Raw data - Fluid	S2-GEO-BH5210-PMT-DAT-0002	S2-GEO-BH5210-PMT-DAT-0002.txt	txt
BH5210 - Permeability Testing - Drill stem Test - Raw data - Outside	S2-GEO-BH5210-PMT-DAT-0003	S2-GEO-BH5210-PMT-DAT-0003.txt	txt
BH5210 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5210-PMT-DAT-0004	S2-GEO-BH5210-PMT-DAT-0004.xlsx	xlsx
BH5211 - Permeability Testing - Drill stem Test - Raw data - Below	S2-GEO-BH5211-PMT-DAT-0001	S2-GEO-BH5211-PMT-DAT-0001.txt	txt
BH5211 - Permeability Testing - Drill stem Test - Raw data - Fluid	S2-GEO-BH5211-PMT-DAT-0002	S2-GEO-BH5211-PMT-DAT-0002.txt	txt
BH5211 - Permeability Testing - Drill stem Test - Raw data - Outside	S2-GEO-BH5211-PMT-DAT-0003	S2-GEO-BH5211-PMT-DAT-0003.txt	txt
BH5211 - Permeability Test - Drill stem test (DST) – DST Rate Calculation	S2-GEO-BH5211-PMT-DAT-0004	S2-GEO-BH5211-PMT-DAT-0004.xlsx	xlsx
BH5202 - Permeability Testing - Packer Test	S2-GEO-BH5202-PMT-REP-0002	S2-GEO-BH5202-PMT-REP-0002.PDF	PDF
BH7202 - Permeability Testing - Packer Test	S2-GEO-BH7202-PMT-REP-0001	S2-GEO-BH7202-PMT-REP-0001.PDF	PDF
BH7203 - Permeability Testing - Packer Test	S2-GEO-BH7203-PMT-REP-0001	S2-GEO-BH7203-PMT-REP-0001.PDF	PDF
BH1204 - Permeability Testing - Falling Head Test - Raw data	S2-GEO-BH1204-PMT-DAT-0001	S2-GEO-BH1204-PMT-DAT-0001.hproj	hproj
BH1204 - Permeability Testing - Falling Head Test - Raw data	S2-GEO-BH1204-PMT-DAT-0002	S2-GEO-BH1204-PMT-DAT-0002.hproj	hproj
BH1204 - Permeability Testing - Falling Head Test - Raw data	S2-GEO-BH1204-PMT-DAT-0003	S2-GEO-BH1204-PMT-DAT-0003.hproj	hproj
BH5202 - Permeability Testing - Packer Test - Raw data - Below	S2-GEO-BH5202-PMT-DAT-0005	S2-GEO-BH5202-PMT-DAT-0005.txt	txt
BH5202 - Permeability Testing - Packer Test - Raw data - Fluid	S2-GEO-BH5202-PMT-DAT-0006	S2-GEO-BH5202-PMT-DAT-0006.txt	txt
BH5202 - Permeability Testing - Packer Test - Raw data - Outside 1	S2-GEO-BH5202-PMT-DAT-0007	S2-GEO-BH5202-PMT-DAT-0007.txt	txt
BH5202 - Permeability Testing - Packer Test - Raw data - Outside 2	S2-GEO-BH5202-PMT-DAT-0008	S2-GEO-BH5202-PMT-DAT-0008.txt	txt
BH5202 - Hydrofracture Testing	S2-GEO-BH5202-IST-REP-0001	S2-GEO-BH5202-IST-REP-0001.PDF	PDF
BH5203A - Hydrofracture Testing	S2-GEO-BH5203A-IST-REP-0001	S2-GEO-BH5203A-IST-REP-0001.PDF	PDF
BH5204 - Hydrofracture Testing	S2-GEO-BH5204-IST-REP-0001	S2-GEO-BH5204-IST-REP-0001.PDF	PDF
BH5206 - Hydrofracture Testing	S2-GEO-BH5206-IST-REP-0001	S2-GEO-BH5206-IST-REP-0001.PDF	PDF
BH5207 - Hydrofracture Testing	S2-GEO-BH5207-IST-REP-0001	S2-GEO-BH5207-IST-REP-0001.PDF	PDF
BH5208 - Hydrofracture Testing	S2-GEO-BH5208-IST-REP-0001	S2-GEO-BH5208-IST-REP-0001.PDF	PDF
BH5209 - Hydrofracture Testing	S2-GEO-BH5209-IST-REP-0001	S2-GEO-BH5209-IST-REP-0001.PDF	PDF
BH5210 - Hydrofracture Testing	S2-GEO-BH5210-IST-REP-0001	S2-GEO-BH5210-IST-REP-0001.PDF	PDF
BH5211 - Hydrofracture Testing	S2-GEO-BH5211-IST-REP-0001	S2-GEO-BH5211-IST-REP-0001.PDF	PDF
BH5202 - Hydrofracture Testing - Raw data - Below	S2-GEO-BH5202-IST-DAT-0001	S2-GEO-BH5202-IST-DAT-0001.txt	txt
BH5202 - Hydrofracture Testing - Raw data - Fluid	S2-GEO-BH5202-IST-DAT-0002	S2-GEO-BH5202-IST-DAT-0002.txt	txt
BH5202 - Hydrofracture Testing - Raw data - Outside 1	S2-GEO-BH5202-IST-DAT-0003	S2-GEO-BH5202-IST-DAT-0003.txt	txt
BH5202 - Hydrofracture Testing - Raw data - Outside 2	S2-GEO-BH5202-IST-DAT-0004	S2-GEO-BH5202-IST-DAT-0004.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 1-4 Below	S2-GEO-BH5203A-IST-DAT-0001	S2-GEO-BH5203A-IST-DAT-0001.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 1-4 Fluid	S2-GEO-BH5203A-IST-DAT-0002	S2-GEO-BH5203A-IST-DAT-0002.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 1-4 Outside 1	S2-GEO-BH5203A-IST-DAT-0003	S2-GEO-BH5203A-IST-DAT-0003.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 1-4 Outside 2	S2-GEO-BH5203A-IST-DAT-0004	S2-GEO-BH5203A-IST-DAT-0004.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 5-6 Below	S2-GEO-BH5203A-IST-DAT-0005	S2-GEO-BH5203A-IST-DAT-0005.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 5-6 Fluid	S2-GEO-BH5203A-IST-DAT-0006	S2-GEO-BH5203A-IST-DAT-0006.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 5-6 Outside 1	S2-GEO-BH5203A-IST-DAT-0007	S2-GEO-BH5203A-IST-DAT-0007.txt	txt
BH5203A - Hydrofracture Testing - Raw data - 5-6 Outside 2	S2-GEO-BH5203A-IST-DAT-0008	S2-GEO-BH5203A-IST-DAT-0008.txt	txt

Document title	Document number	File name	File type
BH5204 - Hydrofracture Testing - Raw data - Below	S2-GEO-BH5204-IST-DAT-0001	S2-GEO-BH5204-IST-DAT-0001.txt	txt
BH5204 - Hydrofracture Testing - Raw data - Outside 1	S2-GEO-BH5204-IST-DAT-0002	S2-GEO-BH5204-IST-DAT-0002.txt	txt
BH5204 - Hydrofracture Testing - Raw data - Outside 2	S2-GEO-BH5204-IST-DAT-0003	S2-GEO-BH5204-IST-DAT-0003.txt	txt
BH5206 - Hydrofracture Testing - Raw data - Below	S2-GEO-BH5206-IST-DAT-0001	S2-GEO-BH5206-IST-DAT-0001.txt	txt
BH5206 - Hydrofracture Testing - Raw data - Outside 1	S2-GEO-BH5206-IST-DAT-0002	S2-GEO-BH5206-IST-DAT-0002.txt	txt
BH5206 - Hydrofracture Testing - Raw data - Outside 2	S2-GEO-BH5206-IST-DAT-0003	S2-GEO-BH5206-IST-DAT-0003.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 1-8 Below	S2-GEO-BH5207-IST-DAT-0001	S2-GEO-BH5207-IST-DAT-0001.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 1-8 Outside 1	S2-GEO-BH5207-IST-DAT-0002	S2-GEO-BH5207-IST-DAT-0002.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 1-8 Outside 2	S2-GEO-BH5207-IST-DAT-0003	S2-GEO-BH5207-IST-DAT-0003.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 9-10 Below	S2-GEO-BH5207-IST-DAT-0004	S2-GEO-BH5207-IST-DAT-0004.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 9-10 Outside 1	S2-GEO-BH5207-IST-DAT-0005	S2-GEO-BH5207-IST-DAT-0005.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 9-10 Outside 2	S2-GEO-BH5207-IST-DAT-0006	S2-GEO-BH5207-IST-DAT-0006.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 1 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0007	S2-GEO-BH5207-IST-DAT-0007.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 2 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0008	S2-GEO-BH5207-IST-DAT-0008.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 3 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0009	S2-GEO-BH5207-IST-DAT-0009.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 4 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0010	S2-GEO-BH5207-IST-DAT-0010.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 5 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0011	S2-GEO-BH5207-IST-DAT-0011.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 6 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0012	S2-GEO-BH5207-IST-DAT-0012.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 7 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0013	S2-GEO-BH5207-IST-DAT-0013.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 8 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0014	S2-GEO-BH5207-IST-DAT-0014.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 9 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0015	S2-GEO-BH5207-IST-DAT-0015.txt	txt
BH5207 - Hydrofracture Testing - Raw data - 10 Flow Meter Gauge	S2-GEO-BH5207-IST-DAT-0016	S2-GEO-BH5207-IST-DAT-0016.txt	txt
BH5208 - Hydrofracture Testing - Raw data - 1-10 Below	S2-GEO-BH5208-IST-DAT-0001	S2-GEO-BH5208-IST-DAT-0001.txt	txt
BH5208 - Hydrofracture Testing - Raw data - 1-10 Fluid	S2-GEO-BH5208-IST-DAT-0002	S2-GEO-BH5208-IST-DAT-0002.txt	txt
BH5208 - Hydrofracture Testing - Raw data - 1-10 Outside	S2-GEO-BH5208-IST-DAT-0003	S2-GEO-BH5208-IST-DAT-0003.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 1-10 Below	S2-GEO-BH5209-IST-DAT-0001	S2-GEO-BH5209-IST-DAT-0001.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 1-10 Outside 1	S2-GEO-BH5209-IST-DAT-0002	S2-GEO-BH5209-IST-DAT-0002.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 1-10 Outside 2	S2-GEO-BH5209-IST-DAT-0003	S2-GEO-BH5209-IST-DAT-0003.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 1 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0004	S2-GEO-BH5209-IST-DAT-0004.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 2 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0005	S2-GEO-BH5209-IST-DAT-0005.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 3 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0006	S2-GEO-BH5209-IST-DAT-0006.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 4 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0007	S2-GEO-BH5209-IST-DAT-0007.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 5 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0008	S2-GEO-BH5209-IST-DAT-0008.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 6 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0009	S2-GEO-BH5209-IST-DAT-0009.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 7 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0010	S2-GEO-BH5209-IST-DAT-0010.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 8 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0011	S2-GEO-BH5209-IST-DAT-0011.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 9 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0012	S2-GEO-BH5209-IST-DAT-0012.txt	txt
BH5209 - Hydrofracture Testing - Raw data - 10 Flow Meter Gauge	S2-GEO-BH5209-IST-DAT-0013	S2-GEO-BH5209-IST-DAT-0013.txt	txt
BH5210 - Hydrofracture Testing - Raw data - Below	S2-GEO-BH5210-IST-DAT-0001	S2-GEO-BH5210-IST-DAT-0001.txt	txt
BH5210 - Hydrofracture Testing - Raw data - Fluid	S2-GEO-BH5210-IST-DAT-0002	S2-GEO-BH5210-IST-DAT-0002.txt	txt
BH5210 - Hydrofracture Testing - Raw data - Outside	S2-GEO-BH5210-IST-DAT-0003	S2-GEO-BH5210-IST-DAT-0003.txt	txt
BH5210 - Hydrofracture Testing - Raw data - 1 Pump Data	S2-GEO-BH5210-IST-DAT-0004	S2-GEO-BH5210-IST-DAT-0004.csv	CSV

Document title	Document number	File name	File type
BH5210 - Hydrofracture Testing - Raw data - 2 Pump Data	S2-GEO-BH5210-IST-DAT-0005	S2-GEO-BH5210-IST-DAT-0005.csv	csv
BH5210 - Hydrofracture Testing - Raw data - 3 Pump Data	S2-GEO-BH5210-IST-DAT-0006	S2-GEO-BH5210-IST-DAT-0006.csv	CSV
BH5210 - Hydrofracture Testing - Raw data - 4 Pump Data	S2-GEO-BH5210-IST-DAT-0007	S2-GEO-BH5210-IST-DAT-0007.csv	CSV
BH5210 - Hydrofracture Testing - Raw data - 5 Pump Data	S2-GEO-BH5210-IST-DAT-0008	S2-GEO-BH5210-IST-DAT-0008.csv	CSV
BH5210 - Hydrofracture Testing - Raw data - 6 Pump Data	S2-GEO-BH5210-IST-DAT-0009	S2-GEO-BH5210-IST-DAT-0009.csv	csv
BH5211 - Hydrofracture Testing - Raw data - Below	S2-GEO-BH5211-IST-DAT-0001	S2-GEO-BH5211-IST-DAT-0001.txt	txt
BH5211 - Hydrofracture Testing - Raw data - Fluid	S2-GEO-BH5211-IST-DAT-0002	S2-GEO-BH5211-IST-DAT-0002.txt	txt
BH5211 - Hydrofracture Testing - Raw data - Outside	S2-GEO-BH5211-IST-DAT-0003	S2-GEO-BH5211-IST-DAT-0003.txt	txt
BH5211 - Hydrofracture Testing - Raw data - 1 Pump Data	S2-GEO-BH5211-IST-DAT-0004	S2-GEO-BH5211-IST-DAT-0004.csv	CSV
BH5211 - Hydrofracture Testing - Raw data - 2 Pump Data	S2-GEO-BH5211-IST-DAT-0005	S2-GEO-BH5211-IST-DAT-0005.csv	CSV
BH5211 - Hydrofracture Testing - Raw data - 3 Pump Data	S2-GEO-BH5211-IST-DAT-0006	S2-GEO-BH5211-IST-DAT-0006.csv	CSV
BH5211 - Hydrofracture Testing - Raw data - 4 Pump Data	S2-GEO-BH5211-IST-DAT-0007	S2-GEO-BH5211-IST-DAT-0007.csv	CSV
BH5211 - Hydrofracture Testing - Raw data - 5 Pump Data	S2-GEO-BH5211-IST-DAT-0008	S2-GEO-BH5211-IST-DAT-0008.csv	CSV
BH5211 - Hydrofracture Testing - Raw data - 6 Pump Data	S2-GEO-BH5211-IST-DAT-0009	S2-GEO-BH5211-IST-DAT-0009.csv	csv
BH-IPS - Stress Testing - Overcoring	S2-GEO-BH-IPS-IST-REP-0001	S2-GEO-BH-IPS-IST-REP-0001.PDF	PDF
BH5203 - Stress Testing - Overcoring	S2-GEO-BH5203-IST-REP-0001	S2-GEO-BH5203-IST-REP-0001.PDF	PDF
BH5204 - Stress Testing - Overcoring	S2-GEO-BH5204-IST-REP-0002	S2-GEO-BH5204-IST-REP-0002.PDF	PDF
BH5206 - Stress Testing - Overcoring	S2-GEO-BH5206-IST-REP-0002	S2-GEO-BH5206-IST-REP-0002.PDF	PDF
BH5207 - Stress Testing - Overcoring	S2-GEO-BH5207-IST-REP-0002	S2-GEO-BH5207-IST-REP-0002.PDF	PDF
3H5208 - Stress Testing - Overcoring	S2-GEO-BH5208-IST-REP-0002	S2-GEO-BH5208-IST-REP-0002.PDF	PDF
BH5209 - Stress Testing - Overcoring	S2-GEO-BH5209-IST-REP-0002	S2-GEO-BH5209-IST-REP-0002.PDF	PDF
BH-IPS - Stress Testing - Overcoring - Raw Data	S2-GEO-BH-IPS-IST-DAT-0001	S2-GEO-BH-IPS-IST-DAT-0001.xlsx	xlsx
BH5203 - Stress Testing - Overcoring - Raw Data	S2-GEO-BH5203-IST-DAT-0001	S2-GEO-BH5203-IST-DAT-0001.xlsx	xlsx
BH5204 - Stress Testing - Overcoring - Raw Data	S2-GEO-BH5204-IST-DAT-0004	S2-GEO-BH5204-IST-DAT-0004.xlsx	xlsx
BH5206 - Stress Testing - Overcoring - Raw Data	S2-GEO-BH5206-IST-DAT-0004	S2-GEO-BH5206-IST-DAT-0004.xlsx	xlsx
BH5207 - Stress Testing - Overcoring - Raw Data	S2-GEO-BH5207-IST-DAT-0017	S2-GEO-BH5207-IST-DAT-0017.xlsx	xlsx
BH5208 - Stress Testing - Overcoring - Raw Data	S2-GEO-BH5208-IST-DAT-0004	S2-GEO-BH5208-IST-DAT-0004.xlsx	xlsx
BH5209 - Stress Testing - Overcoring - Raw Data	S2-GEO-BH5209-IST-DAT-0014	S2-GEO-BH5209-IST-DAT-0014.xlsx	xlsx
BH5202 - Stress Testing - Dilatometer	S2-GEO-BH5202-IST-REP-0002	S2-GEO-BH5202-IST-REP-0002.PDF	PDF
BH5203/A - Stress Testing - Dilatometer	S2-GEO-BH5203-IST-REP-0002	S2-GEO-BH5203-IST-REP-0002.PDF	PDF
BH5204 - Stress Testing - Dilatometer	S2-GEO-BH5204-IST-REP-0003	S2-GEO-BH5204-IST-REP-0003.PDF	PDF
BH5206 - Stress Testing - Dilatometer	S2-GEO-BH5206-IST-REP-0003	S2-GEO-BH5206-IST-REP-0003.PDF	PDF
BH5207 - Stress Testing - Dilatometer	S2-GEO-BH5207-IST-REP-0003	S2-GEO-BH5207-IST-REP-0003.PDF	PDF
BH5208 - Stress Testing - Dilatometer	S2-GEO-BH5208-IST-REP-0003	S2-GEO-BH5208-IST-REP-0003.PDF	PDF
BH5209 - Stress Testing - Dilatometer	S2-GEO-BH5209-IST-REP-0003	S2-GEO-BH5209-IST-REP-0003.PDF	PDF
3H5202 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5202-IST-DAT-0005	S2-GEO-BH5202-IST-DAT-0005.CSV	CSV
BH5202 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5202-IST-DAT-0006	S2-GEO-BH5202-IST-DAT-0006.CSV	CSV
BH5202 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5202-IST-DAT-0007	S2-GEO-BH5202-IST-DAT-0007.CSV	CSV
BH5202 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5202-IST-DAT-0008	S2-GEO-BH5202-IST-DAT-0008.CSV	CSV
BH5202 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5202-IST-DAT-0009	S2-GEO-BH5202-IST-DAT-0009.CSV	CSV
BH5202 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5202-IST-DAT-0010	S2-GEO-BH5202-IST-DAT-0010.CSV	CSV
BH5203 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203-IST-DAT-0002	S2-GEO-BH5203-IST-DAT-0002.CSV	CSV

Document title	Document number	File name	File type
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0009	S2-GEO-BH5203A-IST-DAT-0009.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0010	S2-GEO-BH5203A-IST-DAT-0010.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0011	S2-GEO-BH5203A-IST-DAT-0011.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0012	S2-GEO-BH5203A-IST-DAT-0012.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0013	S2-GEO-BH5203A-IST-DAT-0013.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0014	S2-GEO-BH5203A-IST-DAT-0014.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0015	S2-GEO-BH5203A-IST-DAT-0015.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0016	S2-GEO-BH5203A-IST-DAT-0016.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0017	S2-GEO-BH5203A-IST-DAT-0017.CSV	CSV
BH5203A - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5203A-IST-DAT-0018	S2-GEO-BH5203A-IST-DAT-0018.CSV	CSV
BH5204 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5204-IST-DAT-0005	S2-GEO-BH5204-IST-DAT-0005.CSV	CSV
BH5204 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5204-IST-DAT-0006	S2-GEO-BH5204-IST-DAT-0006.CSV	CSV
BH5204 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5204-IST-DAT-0007	S2-GEO-BH5204-IST-DAT-0007.CSV	CSV
BH5204 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5204-IST-DAT-0008	S2-GEO-BH5204-IST-DAT-0008.CSV	CSV
BH5204 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5204-IST-DAT-0009	S2-GEO-BH5204-IST-DAT-0009.CSV	CSV
BH5204 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5204-IST-DAT-0010	S2-GEO-BH5204-IST-DAT-0010.CSV	CSV
BH5206 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5206-IST-DAT-0005	S2-GEO-BH5206-IST-DAT-0005.CSV	CSV
BH5206 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5206-IST-DAT-0006	S2-GEO-BH5206-IST-DAT-0006.CSV	CSV
BH5206 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5206-IST-DAT-0007	S2-GEO-BH5206-IST-DAT-0007.CSV	CSV
BH5206 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5206-IST-DAT-0008	S2-GEO-BH5206-IST-DAT-0008.CSV	CSV
BH5207 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5207-IST-DAT-0018	S2-GEO-BH5207-IST-DAT-0018.CSV	CSV
BH5207 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5207-IST-DAT-0019	S2-GEO-BH5207-IST-DAT-0019.CSV	CSV
BH5207 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5207-IST-DAT-0020	S2-GEO-BH5207-IST-DAT-0020.CSV	CSV
BH5207 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5207-IST-DAT-0021	S2-GEO-BH5207-IST-DAT-0021.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0006	S2-GEO-BH5208-IST-DAT-0006.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0007	S2-GEO-BH5208-IST-DAT-0007.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0008	S2-GEO-BH5208-IST-DAT-0008.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0009	S2-GEO-BH5208-IST-DAT-0009.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0010	S2-GEO-BH5208-IST-DAT-0010.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0011	S2-GEO-BH5208-IST-DAT-0011.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0012	S2-GEO-BH5208-IST-DAT-0012.CSV	CSV
BH5208 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5208-IST-DAT-0013	S2-GEO-BH5208-IST-DAT-0013.CSV	CSV
BH5209 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5209-IST-DAT-0015	S2-GEO-BH5209-IST-DAT-0015.CSV	CSV
BH5209 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5209-IST-DAT-0016	S2-GEO-BH5209-IST-DAT-0016.CSV	CSV
BH5209 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5209-IST-DAT-0017	S2-GEO-BH5209-IST-DAT-0017.CSV	CSV
BH5209 - Stress Testing - Dilatometer - Raw Data	S2-GEO-BH5209-IST-DAT-0018	S2-GEO-BH5209-IST-DAT-0018.CSV	CSV
BH1202 - Standpipe Piezometer - Installation record	S2-GEO-BH1202-DHI-REP-0001	S2-GEO-BH1202-DHI-REP-0001.PDF	PDF
BH7203 - Standpipe Piezometer - Installation record	S2-GEO-BH7203-DHI-REP-0001	S2-GEO-BH7203-DHI-REP-0001.PDF	PDF
BH3203 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH3203-DHI-REP-0001	S2-GEO-BH3203-DHI-REP-0001.PDF	PDF
BH4201 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH4201-DHI-REP-0001	S2-GEO-BH4201-DHI-REP-0001.PDF	PDF
BH4202 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH4202-DHI-REP-0001	S2-GEO-BH4202-DHI-REP-0001.PDF	PDF
BH5202 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH5202-DHI-REP-0001	S2-GEO-BH5202-DHI-REP-0001.PDF	PDF

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BH5204 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH5204-DHI-REP-0001	S2-GEO-BH5204-DHI-REP-0001.PDF	PDF
BH5206 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH5206-DHI-REP-0001	S2-GEO-BH5206-DHI-REP-0001.PDF	PDF
BH5207 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH5207-DHI-REP-0001	S2-GEO-BH5207-DHI-REP-0001.PDF	PDF
BH5208 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH5208-DHI-REP-0001	S2-GEO-BH5208-DHI-REP-0001.PDF	PDF
BH5209 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH5209-DHI-REP-0001	S2-GEO-BH5209-DHI-REP-0001.PDF	PDF
BH7202 - Vibrating wire piezometer (VWP) - Installation record	S2-GEO-BH7202-DHI-REP-0001	S2-GEO-BH7202-DHI-REP-0001.PDF	PDF
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BH3203 - Geotechnical Laboratory Test Results	S2-GEO-BH3203-LAB-DAT-0001	S2-GEO-BH3203-LAB-DAT-0001.PDF	PDF
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BH4202 - Geotechnical Laboratory Test Results	S2-GEO-BH4202-LAB-DAT-0001	S2-GEO-BH4202-LAB-DAT-0001.PDF	PDF
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BH5206 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5206-LAB-DAT-0003	S2-GEO-BH5206-LAB-DAT-0003.xlsx	xlsx
BH5206 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5206-LAB-DAT-0004	S2-GEO-BH5206-LAB-DAT-0004.xlsx	xlsx
BH5206 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5206-LAB-DAT-0005	S2-GEO-BH5206-LAB-DAT-0005.xlsx	xlsx
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BH5209 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5209-LAB-DAT-0003	S2-GEO-BH5209-LAB-DAT-0003.xlsx	xlsx
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BH5210 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5210-LAB-DAT-0005	S2-GEO-BH5210-LAB-DAT-0005.xlsx	xlsx
BH5210 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5210-LAB-DAT-0006	S2-GEO-BH5210-LAB-DAT-0006.xlsx	xlsx
BH5210 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5210-LAB-DAT-0007	S2-GEO-BH5210-LAB-DAT-0007.xlsx	xlsx
BH5210 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5210-LAB-DAT-0008	S2-GEO-BH5210-LAB-DAT-0008.xlsx	xlsx

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BH5210 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5210-LAB-DAT-0009	S2-GEO-BH5210-LAB-DAT-0009.xlsx	xlsx
BH5210 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5210-LAB-DAT-0010	S2-GEO-BH5210-LAB-DAT-0010.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0002	S2-GEO-BH5211-LAB-DAT-0002.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0003	S2-GEO-BH5211-LAB-DAT-0003.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0004	S2-GEO-BH5211-LAB-DAT-0004.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0005	S2-GEO-BH5211-LAB-DAT-0005.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0006	S2-GEO-BH5211-LAB-DAT-0006.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0007	S2-GEO-BH5211-LAB-DAT-0007.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0008	S2-GEO-BH5211-LAB-DAT-0008.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0009	S2-GEO-BH5211-LAB-DAT-0009.xlsx	xlsx
BH5211 - Geotechnical Laboratory Test Results - Triaxial Creep - Raw Data	S2-GEO-BH5211-LAB-DAT-0010	S2-GEO-BH5211-LAB-DAT-0010.xlsx	xlsx
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BH1202 - Geochemical Laboratory Test Results	S2-GEO-BH1202-LAB-DAT-0002	S2-GEO-BH1202-LAB-DAT-0002.PDF	PDF
BH3203 - Geochemical Laboratory Test Results	S2-GEO-BH3203-LAB-DAT-0002	S2-GEO-BH3203-LAB-DAT-0002.PDF	PDF
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BH4202 - Geochemical Laboratory Test Results	S2-GEO-BH4202-LAB-DAT-0002	S2-GEO-BH4202-LAB-DAT-0002.PDF	PDF
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BH5203 - Geochemical Laboratory Test Results	S2-GEO-BH5203-LAB-DAT-0002	S2-GEO-BH5203-LAB-DAT-0002.PDF	PDF
BH5203A - Geochemical Laboratory Test Results	S2-GEO-BH5203A-LAB-DAT-0002	S2-GEO-BH5203A-LAB-DAT-0002.PDF	PDF
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BH7201 - Geochemical Laboratory Test Results	S2-GEO-BH7201-LAB-DAT-0002	S2-GEO-BH7201-LAB-DAT-0002.PDF	PDF
BH7202 - Geochemical Laboratory Test Results	S2-GEO-BH7202-LAB-DAT-0002	S2-GEO-BH7202-LAB-DAT-0002.PDF	PDF
BH7203 - Geochemical Laboratory Test Results	S2-GEO-BH7203-LAB-DAT-0002	S2-GEO-BH7203-LAB-DAT-0002.PDF	PDF
BH1201 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH1201-LAB-DAT-0003	S2-GEO-BH1201-LAB-DAT-0003.xls	xls
BH1201 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH1201-LAB-DAT-0004	S2-GEO-BH1201-LAB-DAT-0004.xlsx	xlsx
BH1202 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH1202-LAB-DAT-0003	S2-GEO-BH1202-LAB-DAT-0003.xls	xls
BH1202 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH1202-LAB-DAT-0006	S2-GEO-BH1202-LAB-DAT-0006.xlsx	xlsx
BH3203 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH3203-LAB-DAT-0003	S2-GEO-BH3203-LAB-DAT-0003.xls	xls
BH4201 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH4201-LAB-DAT-0003	S2-GEO-BH4201-LAB-DAT-0003.xlsx	xlsx
BH4202 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH4202-LAB-DAT-0003	S2-GEO-BH4202-LAB-DAT-0003.xlsx	xlsx
BH-IPS - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0003	S2-GEO-BH-IPS-LAB-DAT-0003.xls	xls
BH-IPS - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0004	S2-GEO-BH-IPS-LAB-DAT-0004.xls	xls
BH-IPS - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0005	S2-GEO-BH-IPS-LAB-DAT-0005.xls	xls
BH-IPS - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0006	S2-GEO-BH-IPS-LAB-DAT-0006.xls	xls
BH-IPS - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0007	S2-GEO-BH-IPS-LAB-DAT-0007.xls	xls
BH-IPS - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0008	S2-GEO-BH-IPS-LAB-DAT-0008.xlsx	xlsx
BH-IPS - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0009	S2-GEO-BH-IPS-LAB-DAT-0009.xlsx	xlsx
BH-IPS - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD), Fibre ID - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0010	S2-GEO-BH-IPS-LAB-DAT-0010.xlsx	xlsx
BH-IPS - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH-IPS-LAB-DAT-0011	S2-GEO-BH-IPS-LAB-DAT-0011.xlsx	xlsx

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BH5202 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5202-LAB-DAT-0003	S2-GEO-BH5202-LAB-DAT-0003.xls	xls
BH5203 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5203-LAB-DAT-0003	S2-GEO-BH5203-LAB-DAT-0003.xls	xls
BH5203A - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5203A-LAB-DAT-0003	S2-GEO-BH5203A-LAB-DAT-0003.xls	xls
BH5204 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5204-LAB-DAT-0003	S2-GEO-BH5204-LAB-DAT-0003.xls	xls
BH5207 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5207-LAB-DAT-0005	S2-GEO-BH5207-LAB-DAT-0005.xls	xls
BH5207 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5207-LAB-DAT-0006	S2-GEO-BH5207-LAB-DAT-0006.xls	xls
BH5208 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH5208-LAB-DAT-0003	S2-GEO-BH5208-LAB-DAT-0003.xls	xls
BH7201 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH7201-LAB-DAT-0003	S2-GEO-BH7201-LAB-DAT-0003.xls	xls
BH7201 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH7201-LAB-DAT-0004	S2-GEO-BH7201-LAB-DAT-0004.xlsx	xlsx
BH7201 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH7201-LAB-DAT-0005	S2-GEO-BH7201-LAB-DAT-0005.xlsx	xlsx
BH7202 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH7202-LAB-DAT-0003	S2-GEO-BH7202-LAB-DAT-0003.xlsx	xlsx
BH7202 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH7202-LAB-DAT-0004	S2-GEO-BH7202-LAB-DAT-0004.xlsx	xlsx
BH7203 - Geochemical Laboratory Test Results - Sulfur - Raw Data	S2-GEO-BH7203-LAB-DAT-0003	S2-GEO-BH7203-LAB-DAT-0003.xls	xls
BH7203 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH7203-LAB-DAT-0004	S2-GEO-BH7203-LAB-DAT-0004.xlsx	xlsx
BH7203 - Geochemical Laboratory Test Results - Acid metalliferous drainage (AMD) - Raw Data	S2-GEO-BH7203-LAB-DAT-0007	S2-GEO-BH7203-LAB-DAT-0007.xlsx	xlsx
BH1202 - Groundwater Chemistry	S2-GEO-BH1202-LAB-DAT-0004	S2-GEO-BH1202-LAB-DAT-0004.PDF	PDF
BH7203 - Groundwater Chemistry	S2-GEO-BH7203-LAB-DAT-0005	S2-GEO-BH7203-LAB-DAT-0005.PDF	PDF
BH1202 - Groundwater Chemistry - Raw data	S2-GEO-BH1202-LAB-DAT-0005	S2-GEO-BH1202-LAB-DAT-0005.xls	xls
BH7203 - Groundwater Chemistry - Raw data	S2-GEO-BH7203-LAB-DAT-0006	S2-GEO-BH7203-LAB-DAT-0006.xls	xls
BH1202 - Groundwater Level Monitoring	S2-GEO-BH1202-GRW-REP-0001	S2-GEO-BH1202-GRW-REP-0001.PDF	PDF
BH7203 - Groundwater Level Monitoring	S2-GEO-BH7203-GRW-REP-0001	S2-GEO-BH7203-GRW-REP-0001.PDF	PDF
BH1202 - Groundwater Level Monitoring - Barometric - Raw data	S2-GEO-BH1202-GRW-DAT-0001	S2-GEO-BH1202-GRW-DAT-0001.hobo	hobo
BH1202 - Groundwater Level Monitoring - Level - Raw data	S2-GEO-BH1202-GRW-DAT-0002	S2-GEO-BH1202-GRW-DAT-0002.hobo	hobo
BH7203 - Groundwater Level Monitoring - Barometric - Raw data	S2-GEO-BH7203-GRW-DAT-0001	S2-GEO-BH7203-GRW-DAT-0001.hobo	hobo
BH7203 - Groundwater Level Monitoring - Level - Raw data	S2-GEO-BH7203-GRW-DAT-0002	S2-GEO-BH7203-GRW-DAT-0002.hobo	hobo
BH3203 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH3203-LAB-DAT-0004	S2-GEO-BH3203-LAB-DAT-0004.PDF	PDF
BH3203 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH3203-LAB-DAT-0005	S2-GEO-BH3203-LAB-DAT-0005.xlsx	xlsx
BH3203 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH3203-LAB-DAT-0006	S2-GEO-BH3203-LAB-DAT-0006.xlsx	xlsx
BH3203 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH3203-LAB-DAT-0007	S2-GEO-BH3203-LAB-DAT-0007.xlsx	xlsx
BH4201 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH4201-LAB-DAT-0004	S2-GEO-BH4201-LAB-DAT-0004.PDF	PDF
BH4201 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH4201-LAB-DAT-0005	S2-GEO-BH4201-LAB-DAT-0005.xlsx	xlsx
BH4201 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH4201-LAB-DAT-0006	S2-GEO-BH4201-LAB-DAT-0006.xlsx	xlsx
BH4202 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH4202-LAB-DAT-0004	S2-GEO-BH4202-LAB-DAT-0004.PDF	PDF
BH4202 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH4202-LAB-DAT-0005	S2-GEO-BH4202-LAB-DAT-0005.xlsx	xlsx
BH4202 - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH4202-LAB-DAT-0006	S2-GEO-BH4202-LAB-DAT-0006.xlsx	xlsx
BH-IPS - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH-IPS-LAB-DAT-0013	S2-GEO-BH-IPS-LAB-DAT-0013.PDF	PDF
BH-IPS - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH-IPS-LAB-DAT-0014	S2-GEO-BH-IPS-LAB-DAT-0014.xlsx	xlsx
BH-IPS - Naturally Occurring Asbestos (NOA) - Test Results	S2-GEO-BH-IPS-LAB-DAT-0015	S2-GEO-BH-IPS-LAB-DAT-0015.xlsx	xlsx
Stage 3 Geotechnical Factual Report	S2-GEO-GEN-REP-0010	S2-GEO-GEN-REP-0010.PDF	PDF
Tantangara Coffer Dam Investigation Report	S2-GEO-GEN-REP-0011	S2-GEO-GEN-REP-0011.PDF	PDF
Borehole Location Map Overview - Drawing 0001	S2-GEO-BH-GEN-DWG-0031	S2-GEO-BH-GEN-DWG-0031.PDF	PDF

Document title	Document number	File name	File type
Borehole Location Map - Drawing 0002	S2-GEO-BH-GEN-DWG-0032	S2-GEO-BH-GEN-DWG-0032.PDF	PDF
Borehole Location Map - Drawing 0003	S2-GEO-BH-GEN-DWG-0033	S2-GEO-BH-GEN-DWG-0033.PDF	PDF
Borehole Location Map - Drawing 0004	S2-GEO-BH-GEN-DWG-0034	S2-GEO-BH-GEN-DWG-0034.PDF	PDF
Borehole Location Map - Drawing 0005	S2-GEO-BH-GEN-DWG-0035	S2-GEO-BH-GEN-DWG-0035.PDF	PDF
Borehole Location Map - Drawing 0006	S2-GEO-BH-GEN-DWG-0036	S2-GEO-BH-GEN-DWG-0036.PDF	PDF
Borehole Location Map - Drawing 0007	S2-GEO-BH-GEN-DWG-0037	S2-GEO-BH-GEN-DWG-0037.PDF	PDF
Naturally occurring Asbestos Potential Map	S2-GEO-BH-GEN-DWG-0038	S2-GEO-BH-GEN-DWG-0038.PDF	PDF
Downhole Installation Overview Map	S2-GEO-BH-GEN-DWG-0039	S2-GEO-BH-GEN-DWG-0039.PDF	PDF
Borehole Grouting Details	S2-GEO-GEN-DAT-0001	S2-GEO-GEN-DAT-0001.xlsx	xlsx
Ground Engaging Tools	S2-GEO-GEN-DAT-0002	S2-GEO-GEN-DAT-0002.xlsx	xlsx

# **Appendix O** Factual report revisions change register

#### Table 0.1Summary of report changes

Report revision	ltem No.	Section	Page	Borehole ID	Aconex document name	Documented change
1	1	Contents	iii	-	S2-GEO-GEN-REP-0010	Corrected 'Error! Bookmark no defined' error.
1	2	Contents	iii	-	S2-GEO-GEN-REP-0010	Reference to 'Table 11' updated to 'Table B. 1'
1	3	Contents	iii	-	S2-GEO-GEN-REP-0010	Removed notes relating to 'Table E. 2' and 'Table H. 1'
1	4	1.1	1	-	S2-GEO-GEN-REP-0010	Updated paragraph 2. Reference to BH3202 removed.
1	5	Table 1	3	-	S2-GEO-GEN-REP-0010	BH3202 removed. BH7202 added.
						Version numbers of borehole logs updated
1	6	5.4.1	12		S2-GEO-GEN-REP-0010	Wording updated
1	7	Table 6	17	-	S2-GEO-GEN-REP-0010	Added additional test method
1	8	6.2	18	-	S2-GEO-GEN-REP-0010	GHD (Cooma) changed to GHD (Polo Flat) for consistency
1	9	7	20	-	S2-GEO-GEN-REP-0010	Updated total quantity of tests in paragraph 5.
1	10	Table 9	20	BH4201, BH4202	S2-GEO-GEN-REP-0010	Updated total quantity of tests and positive results.
1	11	Table 10	21	BH4201, BH4202	S2-GEO-GEN-REP-0010	Updated test results
1	12	Appendix A Table A1	27	-	S2-GEO-GEN-REP-0010	Version numbers of borehole logs updated
1	13	Appendix A Table A1	27	BH7202	S2-GEO-GEN-REP-0010	Borehole added to table
1	14	Appendix B	-	BH1201, BH1202, BH3203, BH-IPS, BH5202, BH5203, BH5203A, BH5204, BH5206, BH5207, BH5208, BH5209, BH5210, BH5211, BH7201, BH7203	S2-GEO-BH1201-LOG-REP-0001 S2-GEO-BH1202-LOG-REP-0001 S2-GEO-BH3203-LOG-REP-0001 S2-GEO-BH5202-LOG-REP-0001 S2-GEO-BH5203A-LOG-REP-0001 S2-GEO-BH5204-LOG-REP-0001 S2-GEO-BH5206-LOG-REP-0001 S2-GEO-BH5208-LOG-REP-0001 S2-GEO-BH5209-LOG-REP-0001 S2-GEO-BH5210-LOG-REP-0001 S2-GEO-BH5211-LOG-REP-0001 S2-GEO-BH7201-LOG-REP-0001 S2-GEO-BH7203-LOG-REP-0001 S2-GEO-BH7203-LOG-REP-0001	Corrected error where some point load results overlapped and were unreadab
1	15	Appendix B Table B1	29	-	S2-GEO-GEN-REP-0010	Version numbers of borehole logs updated. BH7202 added
1	16	Appendix B	-	BH4201	S2-GEO-BH4201-LOG-REP-0001 S2-GEO-BH4201-LOG-DAT-0001 S2-GEO-BH4201-LOG-DAT-0002	BH4201 borehole log, AGS file and Joint Roughness (Jr), Joint Alteration (Ja)
1	17	Appendix B	-	BH4202	S2-GEO-BH4202-LOG-REP-0001 S2-GEO-BH4202-LOG-DAT-0001 S2-GEO-BH4202-LOG-DAT-0002	BH4202 borehole log, AGS file and Joint Roughness (Jr), Joint Alteration (Ja)
1	18	Appendix C	-	BH3203	S2-GEO-BH3203-DHS-DAT-0002	Corrected name of tab to 'BH3203'
1	19	Appendix C	-	BH5210	S2-GEO-BH5210-DHS-DAT-0001 S2-GEO-BH5210-DHS-DAT-0002	Remove erroneous survey result from 412 m and 415 m. Removed duplicate 4
1	20	Appendix D	-	-	S2-GEO-GEN-REP-0010	ATV structures legend added
1	21	Appendix D	-	BH1202	S2-GEO-BH1202-DHG-REP-0001	Column headings updated for clarity
1	22	Appendix D	-	BH3203	S2-GEO-BH3203-DHG-REP-0001	Column headings updated for clarity
1	23	Appendix D	-	BH4201	S2-GEO-BH4201-DHG-REP-0001	Column headings updated for clarity

adable
(Ja), defect spacing, fracture frequency raw data added
(Ja), defect spacing, fracture frequency raw data added
cate 420 m survey result.
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Report revision	ltem No.	Section	Page	Borehole ID	Aconex document name	Documented change
1	24	Appendix D	-	BH4202	S2-GEO-BH4202-DHG-REP-0001	Column headings updated for clarity
1	25	Appendix D	-	BH5202	S2-GEO-BH5202-DHG-REP-0001	Column headings updated for clarity
1	26	Appendix D	-	BH5203A	S2-GEO-BH5203A-DHG-REP-0001	Column headings updated for clarity
1	27	Appendix D	-	BH5204	S2-GEO-BH5204-DHG-REP-0001	Column headings updated for clarity
1	28	Appendix D	-	BH5206	S2-GEO-BH5206-DHG-REP-0001	Column headings updated for clarity
1	29	Appendix D	-	BH5207	S2-GEO-BH5207-DHG-REP-0001	Column headings updated for clarity
1	30	Appendix D	-	BH5208	S2-GEO-BH5208-DHG-REP-0001	Column headings updated for clarity
1	31	Appendix D	-	BH5209	S2-GEO-BH5209-DHG-REP-0001	Column headings updated for clarity
1	32	Appendix D	-	BH5210	S2-GEO-BH5210-DHG-REP-0001	Column headings updated for clarity
1	33	Appendix D	-	BH5211	S2-GEO-BH5211-DHG-REP-0001	Column headings updated for clarity
1	34	Appendix H	-	BH3203	S2-GEO-BH3203-DHI-REP-0001	VWP telemetry logger manual added
1	35	Appendix H	-	BH4201	S2-GEO-BH4201-DHI-REP-0001	VWP telemetry logger manual added
1	36	Appendix H	-	BH4202	S2-GEO-BH4202-DHI-REP-0001	VWP telemetry logger manual added
1	37	Appendix H	-	BH5203A	S2-GEO-BH5203A-DHI-REP-0001	VWP telemetry logger manual added
1	38	Appendix H	-	BH5208	S2-GEO-BH5208-DHI-REP-0001	VWP telemetry logger manual added
1	39	Appendix I Table I.1	27	BH4202, BH-IPS, BH5202, BH5206, BH5208, BH5210, BH7201	S2-GEO-GEN-REP-0010	Testing quantities updated
1	40	Appendix I Table I.1	27	BH5211	S2-GEO-GEN-REP-0010	Removed '*' in petrography column indicating testing yet to be completed. All t
1	41	Appendix I	-	BH4201	S2-GEO-BH4201-LAB-DAT-0001	Lithologies on point load test reports updated
1	42	Appendix I	-	BH4202	S2-GEO-BH4202-LAB-DAT-0001	Lithologies on point load test reports updated Petrography reports added
1	43	Appendix I	-	BH5206	S2-GEO-BH5206-LAB-DAT-0001	Slake durability report updated with corrected sample lithologiesDirect shear report 1321 updated to include comment about saw cut samplesPetrography reports added
1	44	Appendix I	-	BH5208	S2-GEO-BH5208-LAB-DAT-0001	Petrography reports added
1	45	Appendix I	-	BH5210	S2-GEO-BH5210-LAB-DAT-0001	Corrected number of triaxial test results in summary table Petrography reports added Uniaxial creep test added
1	46	Appendix I	-	BH5211	S2-GEO-BH5211-LAB-DAT-0002 S2-GEO-BH5211-LAB-DAT-0003	Uniaxial creep test added
1	47	Appendix I	-	BH-IPS	S2-GEO-BHIPS-LAB-DAT-0001	Petrography reports added BH-IPS-53 XRD result added
1	48	Appendix M Table M.1	59, 60	BH4201, BH4202	S2-GEO-GEN-REP-0010	Additional test results added
1	49	Appendix N	-	BH4201	S2-GEO-BH4201-LAB-DAT-0004	NOA test report 262209 and associated SEM report added
1	50	Appendix N	-	BH4201	S2-GEO-BH4201-LAB-DAT-0006	NOA test report 262209 xlsx added
1	51	Appendix N	-	BH4202	S2-GEO-BH4202-LAB-DAT-0004	NOA test report 262208 and associated XRD and SEM report added
1	52	Appendix N	-	BH4202	S2-GEO-BH4202-LAB-DAT-0006	NOA test report 262208 xlsx added
1	53	Appendix N Table N.1	77	BH4201, BH4202	S2-GEO-GEN-REP-0010	NOA test result files added. Documents S2-GEO-BH4201-LAB-DAT-0006 and
1	54	Appendix N Table N.1	77	BH5211	S2-GEO-GEN-REP-0010	Creep test raw data files added
1	55	Appendix O	-	-	S2-GEO-GEN-REP-0010	'Appendix O – Change Register' added
1	56	Appendix P	-	-	S2-GEO-GEN-REP-0010	'Appendix P – Comments Register' added
2	57	Cover letter	-	-	S2-GEO-GEN-REP-0010	Changed name of Addressee

All testing was completed in the initial issue of the report.
les
and S2-GEO-BH4202-LAB-DAT-0006

Report revision	Item No.	Section	Page	Borehole ID	Aconex document name	Documented change
2	58	Executive Summary	i	-	S2-GEO-GEN-REP-0010	Updated number of boreholes, updated number of metres drilled
2	59	Section 1.1	1	-	S2-GEO-GEN-REP-0010	Removed paragraph about ongoing lab testing
2	60	Section 2.1, Bullet point 1	2	-	S2-GEO-GEN-REP-0010	Updated number of boreholes
2	61	Table 1	3	BH4201, BH4202	S2-GEO-GEN-REP-0010	Borehole log version number updated
2	62	Table 1	3	BH7202	S2-GEO-GEN-REP-0010	Details for BH7202 updated
2	63	Table 2	6	-	S2-GEO-GEN-REP-0010	Tertiary basalt (Tbm) added to geology map legend
2	64	Table 5	16	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table
2	65	Table 6	17		S2-GEO-GEN-REP-0010	'Absorption' added as a test method
2	66	Appendix A Table A.1	27	BH4201, BH4202	S2-GEO-GEN-REP-0010	Borehole log version number updated
2	67	Appendix A Table A.1	27	BH7202	S2-GEO-GEN-REP-0010	Details for BH7202 updated
2	68	Appendix B Table B.1	29	BH4201, BH4202	S2-GEO-GEN-REP-0010	Borehole log version number updated
2	69	Appendix B Table B.1	29	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table
2	70	Appendix B	-	BH4201	S2-GEO-BH4201-LOG-REP-0001 S2-GEO-BH4201-LOG-DAT-0001	Updated lithology. Fixed issue where point load results were over printing
2	71	Appendix B	-	BH4202	S2-GEO-BH4202-LOG-REP-0001 S2-GEO-BH4202-LOG-DAT-0001	Updated lithology. Fixed issue where point load results were over printing
2	72	Appendix B		BH-IPS	S2-GEO-BHIPS-LOG-REP-0001 S2-GEO-BHIPS-LOG-DAT-0001	Added note 1067.15 – 1067.30 m about slight alteration. Fixed issue where po
2	73	Appendix B		BH5203 BH5203A BH5204 BH5210 BH5211	S2-GEO-BH5203-LOG-REP-0001 S2-GEO-BH5203A-LOG-REP-0001 S2-GEO-BH5204-LOG-REP-0001 S2-GEO-BH5210-LOG-REP-0001 S2-GEO-BH5211-LOG-REP-0001	Fixed issue where point load results were over printing
2	74	Appendix B	-	BH7202	S2-GEO-BH7202-LOG-REP-0001 S2-GEO-BH7202-LOG-DAT-0001 S2-GEO-BH7202-LOG-DAT-0002 S2-GEO-BH7202-COR-PHO-0001 S2-GEO-BH7202-COR-PHO-0002	BH7202 borehole log, AGS file and Joint Roughness (Jr), Joint Alteration (Ja), Core photos added.
2	75	Appendix D Table D.1	33	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table.
1	76	Appendix D Table D.1	33	BH1202, BH-IPS, BH7203.	S2-GEO-GEN-REP-0010	Gamma and Full Wave Sonic included incorrectly and has been removed from
2	77	Appendix D	-	BH7202	S2-GEO-BH7202-DHG-REP-0001 S2-GEO-BH7202-DHG-DAT-0001	ATV/ OTV plots and structures raw data added
2	78	Appendix E Table E.1	36	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table
2	79	Appendix E	-	BH7202	S2-GEO-BH7202-PMT-REP-0001	Packer testing results added
2	80	Appendix H Table H.1	47	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table
2	81	Appendix H	-	BH7202	S2-GEO-BH7202-DHI-REP-0001	Added VWP calibration certificates
2	82	Appendix I Table I.1	49	-	S2-GEO-GEN-REP-0010	Water absorption test added to table. Removed reference to pending laborator
2	83	Appendix I Table I.1	49	BH5210	S2-GEO-GEN-REP-0010	Updated number of uniaxial creep test results. Updated number of triaxial cree
2	84	Appendix I Table I.1	49	BH5211	S2-GEO-GEN-REP-0010	Updated number of uniaxial creep test results. Updated number of triaxial cree
2	85	Appendix I Table I.1	49	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table
2	86	Appendix I		BH5208	S2-GEO-BH5208-LAB-DAT-0001	Petrography report BH5208-130 photo 'm' caption corrected from '4-5 mm' to '
2	87	Appendix I	-	BH5210	S2-GEO-BH5210-LAB-DAT-0001	Uniaxial creep test and UCS result added for sample BH5210-77 and BH5210

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ere point load results were over printing.
(Ja), defect spacing, fracture frequency raw data added.
from BH1202, BH-IPS & BH7203.
pratory test results
l creep test results.
l creep test results.
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n' to '0.04-0.05 mm'
5210-103. Triaxial creep test results added

Report revision	ltem No.	Section	Page	Borehole ID	Aconex document name	Documented change
2	88	Appendix I	-	BH5210	S2-GEO-BH5210-LAB-DAT-0003	Uniaxial creep raw data files added
					S2-GEO-BH5210-LAB-DAT-0004	
2	89	Appendix I	-	BH5210	S2-GEO-BH5210-LAB-DAT-0005	Triaxial creep raw data files added
					S2-GEO-BH5210-LAB-DAT-0006 S2-GEO-BH5210-LAB-DAT-0007	
					S2-GEO-BH5210-LAB-DAT-0007 S2-GEO-BH5210-LAB-DAT-0008	
2	90	Appendix I	-	BH5211	S2-GEO-BH5211-LAB-DAT-0001	Uniaxial creep test result added for sample BH5211-133. Triaxial creep test re
2	91	Appendix I	-	BH5211	S2-GEO-BH5211-LAB-DAT-0004	Uniaxial creep raw data file added for sample BH5211-133
2	92	Appendix I	-	BH5211	S2-GEO-BH5211-LAB-DAT-0005	Triaxial creep raw data files added
					S2-GEO-BH5211-LAB-DAT-0006	
					S2-GEO-BH5211-LAB-DAT-0007	
					S2-GEO-BH5211-LAB-DAT-0008	
					S2-GEO-BH5211-LAB-DAT-0009 S2-GEO-BH5211-LAB-DAT-0010	
2	93	Appendix I		BH7202	S2-GEO-BH7202-LAB-DAT-0010	Test results added
2	94	Appendix J Table J.1	-	BH7202	S2-GEO-GEN-REP-0010	BH7202 added to table
2	94		51	BH7202 BH7202	S2-GEO-BH7202-LAB-DAT-0002	
2	95	Appendix J	51	BH7202	S2-GEO-BH7202-LAB-DAT-0002 S2-GEO-BH7202-LAB-DAT-0003	Test results added for sulphur content and Acid Mine Drainage
					S2-GEO-BH7202-LAB-DAT-0004	
2	96	Appendix M	-	BH3203	S2-GEO-BH3203-LAB-DAT-0004	Test report 259393 updated to include sample number and depth
					S2-GEO-BH3203-LAB-DAT-0005	
2	97	Appendix N Table N.1	64-77	BH5210, BH5211, BH7202	S2-GEO-GEN-REP-0010	Added digital deliverables for BH5210, BH5211 & BH7202
2	98	Appendix P Table P.1	84-85	-	S2-GEO-GEN-REP-0010	Added Section/ Appendix references to comments
2	99	Appendix P Table P.1	84	Comment 14	S2-GEO-GEN-REP-0010	Response to comment has been updated to reflect current status of testing
2	100	Appendix P Table P.1	86	-	S2-GEO-GEN-REP-0010	Comments 27 – 38 added
2	101	Drawings	-	BH7202	S2-GEO-BH-GEN-DWG-0031	BH7202 added
2	102	Drawings	-	BH7202	S2-GEO-BH-GEN-DWG-0032	BH7202 added
2	103	Drawings	-	BH7202	S2-GEO-BH-GEN-DWG-0035	BH7202 added
2	104	Drawings	-	BH7202	S2-GEO-BH-GEN-DWG-0038	BH7202 added
2	105	Drawings	-	BH7202	S2-GEO-BH-GEN-DWG-0039	BH7202 added
2	106	Borehole grouting details	-	BH7202	S2-GEO-GEN-DAT-0001	BH7202 added
2	107	Ground engaging tools	-	BH5301A – BH5301I, BH7202	S2-GEO-GEN-DAT-0002	Additional boreholes added

results added

# Appendix P Comments register

#### Table P.1Comments register

Item No.	Reference to report /section/ drawing	Reviewed by	Date of comment	Clarification requested	GHD response
1	Section 2.1	FGJV	21/05/2021	All borehole coordinates are in GDA94, not in GDA2020.	Boreholes were surveyed by, and coordinates were provided by, FG. GDA2020.
2	Appendix D	FGJV	21/05/2021	From downhole geophysics there are generally *.tfd and for BH5203A *.hed and *.lgx files. Do these files contain other data which is not in the csv files and how are these files to be opened?	This hole utilised a different tool (which does the same job) to the oth different file type (.hed & .lgx instead of .tfd). Raw data is in the csv fi can be opened with WellCAD software.
3	Section 5.4.1.	FGJV	21/05/2021	According to the GFR report the ATV structure data is referred to magnetic north (MN), i.e. without correction for declination. In the borehole DHG reports (pdf files) however there are graphs with and without declination corrections (graphs labelled "Tadpoles MN", "Tadpoles TN" and "Tadpoles"). Please confirm that all raw data is always referred to magnetic North, MN	PDF files have been updated for clarity in this submission. Tadpoles in True North.
4	Appendix D	FGJV	21/05/2021	The ATV files (pdf files) should always contain the information if the structures' azimuth is referred to True North (TN) or Magnetic North (MN); this information is not present for BH5210 and BH5211.	Noted. PDFs have been updated in this submission.
5	-	FGJV	21/05/2021	Borehole BH3201 is missing. It has been cancelled by SHL for reallocating the budget to the NOA BH4200 series.	Noted
6	-	FGJV	21/05/2021	Borehole BH3202 is missing, access permissions are missing. It has been rescheduled after the winter, starting in September/October 2021.	Noted
7	Appendix C	FGJV	21/05/2021	Borehole Verticality: In the Excel file of BH3203 the tab is named "BH5202"; please clarify.	Tab was labelled incorrectly. This has been revised in this submission
8	Appendix B	FGJV	21/05/2021	Borehole Logs (PDF) - In all logs, in column "SAMPLES & FIELD TESTS" some texts are superimposed and cannot be read	The log template has been amended to resolve this issue. Logs have of the report
9	Appendix B	FGJV	21/05/2021	Borehole logs (AGS) - The files for BH4201 and BH4202 are missing.	BH4201 & BH4202 logs and AGS were not issued with this submission due to pending petrographic reports. They have been issued in the n
10	Appendix B	FGJV	21/05/2021	Borehole logs (Excel files with Jr, Ja, FF): The files for BH4201, BH4202 and BH5203 are missing.	BH4201 & BH4202 were accidently omitted from the submission. The submission. BH5203 was submitted (S2-GEO-BH5203-LOG-DAT-00
11	Appendix D	FGJV	21/05/2021	Borehole Geophysics: TFD files for BH5203A, BH5208, BH5210 and BH5211 are missing.	This hole utilised a different tool (which does the same job) to the oth different file type (.hed & .lgx instead of .tfd). TFD files do not exist fo
12	S2-GEO-GEN-REP- 0010	FGJV	21/05/2021	Groundwater monitoring: Files for BH1204 are missing	Groundwater monitoring was not undertaken for BH1204.
13	Appendix I	FGJV	21/05/2021	Point Load Tests: Generally complete, but missing for BH4201 and BH4202 as data since AGS are missing for those boreholes.	Noted. This has been provided as AGS in this submission.
14	Appendix I	FGJV	21/05/2021	Triaxial test: 10 uniaxial and 9 triaxial creep tests in BH5210 and BH5211 are missing.	Only 5 uniaxial creep tests were missing (BH5210-51, BH5210-77, B 133) at the time of last reporting. These tests were ongoing or not yet submission all uniaxial creep testing is complete and is included in th tests were requested to be undertaken (not 9). Triaxial creep testing the last submission. These tests are now complete and included in th
15	Appendix I	FGJV	21/05/2021	Direct Shear: BH5206 (10 BRTS samples from B21-079 to B21- 088): the certificates for these 10 direct shear tests don't mention the fact that the tested surfaces are saw-cut and not natural discontinuities. Test certificates should be amended.	Noted. These have been amended in this submission
16	Appendix I	FGJV	21/05/2021	Direct shear: In many cases, the presented examples of calculation of phi using a known sig_n are not reproducible using the fit formula proposed in the graphs. BH3203, BH5203, BH5203A, BH7201, BH7203	In the graphs for phi, we provide example phi's with normal stresses, reproduce the same phi's we provide using the normal stress values. combination of the linear and power model's for interpretation of direct if you will, to give this curvi-linear model both the linear function and p at a point on the graph, which is where the 'most appropriate' normal were to plot these 2 separate models alone, you would find that this i Dr Bamford came up with a mathematical method to 'blend' both the and it's this blended model that we use for the example phi and norm
17	Appendix I	FGJV	21/05/2021	Optical petrography: Several petrographic analyses are available but not yet mentioned in the GFR. In total there are 5 available analysis for BH4202 and 1 for BH7201.	Noted. This has been corrected in this submission.

	Status
GJV surveyors in GDA94, not in	Closed
other holes. This tool produces a v file. This is just the native file. Files	Closed
es and csv files provide structures data	Closed
	Closed
	Closed
	Closed
sion.	Closed
we been re-issued with this submission	Closed
ssion as agreed with FGJV, DJV & SHL e next submission	Closed
They have been issued in this next 0002).	Closed
other holes. This tool produces a for these boreholes.	Closed
	Closed
	Closed
BH5210-103, BH5211-107 & BH5211- yet commenced. At the time of this this submission. Only 5 triaxial creep ing had not commenced at the time of this submission.	Closed
	Closed
es, they are likely struggling to es. The graph we provide is the rect shear results, a curvi-linear model d power function are required to meet nal stress value limit comes into. If you is intersection point isn't perfect, thus he linear and power models together, rmal stresses we provide.	Closed
	Closed

Item No.	Reference to report /section/ drawing	Reviewed by	Date of comment	Clarification requested	GHD response	Status
18	Appendix I	FGJV	21/05/2021	X-ray diffraction: 1 XRD tests is available for BH7201 but is not mentioned in the GFR (table I.1).		
19	Appendix I	FGJV	21/05/2021	X-ray diffraction: We counted 59 tests for BH-IPS and additional 18 tests of former boreholes.	Noted. This has been corrected in this submission.	Closed
20	Appendix M	FGJV	21/05/2021	Naturally Occurring Asbestos: One SEM (scanning electron microscopy) test was performed in BH-IPS. The result for this test is represented by a temporary document. A proper laboratory certificate should be amended.	The other boreholes identified Naturally Occurring Asbestos. BH-IPS did not. There are two lab reports for the two samples (RPT 246527 & RPT 245638). These are the final laboratory certificates.	Closed
21	Appendix I	FGJV	21/05/2021	BH5202: Tensile Strength Test - In the GFR 6 test are indicated. We have only 3	GFR corrected to 3 tests for this submission	Closed
22	Appendix I	FGJV	21/05/2021	BH-IPS: GFR indicate only tests performed with the CRD-C procedure (30x). 16 test were performed with other procedure,	Noted. This has been corrected for this submission.	Closed
23	Appendix I	FGJV	21/05/2021	BH-IPS: Petrography - GFR only indicate 59 tests	Noted. This has been corrected for this submission.	Closed
24	Appendix M	FGJV	21/05/2021	BH-IPS: SEM-EDS test no final report as in other boreholes. We also have only 1 test.	The other boreholes identified Naturally Occurring Asbestos. BH-IPS did not. There are two lab reports for the two samples (RPT 246527 & RPT 245638). These are the final laboratory certificates.	Closed
25	Appendix I	FGJV	21/05/2021	BH5202: Direct Shear Tests: Only constant values	All of the parameters requested at the time were provided.	Closed
26	Appendix I	FGJV	21/05/2021	BH5204: Direct Shear Tests: Only constant values	All of the parameters requested at the time were provided.	Closed
27	Figure 1	SHL	30/04/2021	The legend for the map appears to be missing (e.g. Tertiary basalt is not included in the legend, but appears on the map)	Unit 'Tbm' added to legend in Table 2	Closed
28	Appendix B	SHL	6/05/2021	BH-IPS (1036 - 1041 m): Logged as sandstone - texture of rock in core photos - phenocrysts visible, suggests felsic volcanic rock type	Appears similar to the litharenite in sample BH-IPS-191 which has lithic fragments of volcanic derivation. Sandstone is an appropriate description for such a material. No change	Closed
29	Appendix B	SHL	6/05/2021	BH-IPS (1042 – 1043 m): Felsic volcanic dykes (?) not logged	We do not believe that this is a dyke. It appears to be altered conglomerate. No change.	Closed
30	Appendix B	SHL	6/05/2021	BH-IPS (942 – 948.2 m): Logged as sandstone - texture of rock in core photos - phenocrysts visible, suggests felsic volcanic rock type	Appears similar to the litharenite in sample BH-IPS-191 which has lithic fragments of volcanic derivation. Sandstone, coarse grained is an appropriate description for such a material. No change	Closed
31	Appendix B	SHL	6/05/2021	BH-IPS (1067.2 – 1067.4 m): Possible dyke/intrusion - see chill margins not mentioned in log	We do not believe that this is a dyke. It appears to be a conglomerate, a small portion of which has been altered. Note added about alteration between 1067.15 - 1067.30 m.	Closed
32	Appendix I	SHL	12/05/2021	BH5208: Sample BH5208-13. Upper photograph caption states dye absorption of 4-5 mm. Caption also states the length of the side of the photograph is 1.6 mm for scale.	This should be '0.04-0.05 mm' as per the front page of the report. Lab report has been updated.	Closed
33	Appendix C	SHL	13/05/2021	BH5210: TN/ MN not stated	This was corrected in Revision B issued on 13/08/2021	Closed
34	Appendix C	SHL	13/05/2021	BH5211: TN/MN not stated	This was corrected in Revision B issued on 13/08/2021	Closed
35	Appendix M	SHL	11/08/2021	BH3203: No sample depth / sample number not in report	Should be sample BH3203-11 85.33-85.40 m. Updated lab report included in Appendix M	Closed
36	Appendix M	SHL	26/08/2021	BH-IPS: No sample depth with sample number 264638-2; where is original lab report?	That is the original lab report. The depths are provided in Envirolab report 245638 which accompanies the NOA report.	Closed
37	Appendix I	SHL	17/09/2021	BH-IPS sample 188 @ 989 m: description is for a conglomerate / breccia, but name of rock type says rhyolitic ignimbrite	The thin section has been taken through a clast, therefore both descriptions are correct. No change required.	Closed
38	Appendix I	SHL	27/10/2021	BH4202 PET @ 488 m (sample 39) does not include names for the 2 lith types. Discussed and acknowledge attempts to obtain lith names from Dr Hans unsuccessful	Adding two lithology names to the report was requested by GHD, but refused by the lab	Closed



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APPENDIX B – TECHNICAL MEMORANDUM, GEOMORPHOLOGY AND STRUCTURAL GEOLOGY OF THE PORTAL AREA FOR THE TANTANGARA HEADRACE TUNNEL, MARCH 2023



# **Technical Memorandum**

#### March 7, 2023

То	Samantha Ross	Contact No.	0451829247			
Copy to	Daniel Jones Email		Brendan.duffy@ghd.com			
From	Dr Brendan Duffy Project N		12521697			
Project Name	FGJV Snowy 2.0 - Tantangara					
Subject	Geomorphology and structural geology of the portal area for the Tantangara headrace tunnel					

#### **Revision Table**

Revision	Section	Description Change	Authorised by
А	-	Initial Issue	DJ
В	1-5	Updates following FGJV comments	DJ

#### 1. Introduction

The Headrace tunnel boring machine (TBM) encountered difficult ground near the portal west of Tantangara Reservoir. The difficult conditions, which led to development of a surface depression, had not been recorded or inferred during previous investigations. Further work was planned to evaluate the extent and geological significance of this zone of difficult ground, including geophysical surveys, geological mapping and geomorphological mapping. Specifically, FGJV requested a morphodynamic assessment of an area close to the HRT02 tunnel as shown in Figure 1, with a goal of identifying structural lineaments and landslides, active or otherwise.

This Technical Memorandum is provided as an interim output under our agreement with FGJV. It is provided to foster discussion in relation to technical matters associated with the project and should not be relied upon in any way.

The Power of Commitment

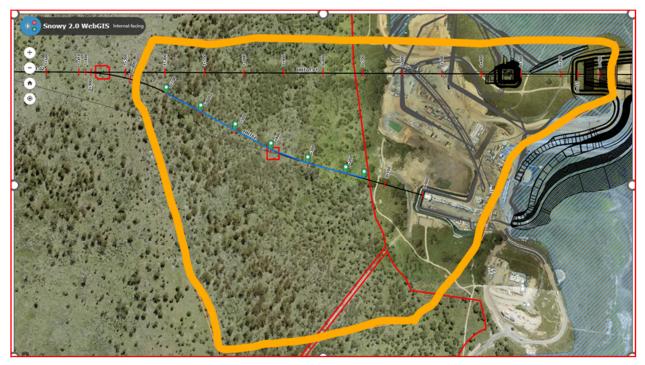


Figure 1 Area of morphodynamic assessment requested by FGJV

Morphodynamics is the process by which morphology affects hydrodynamics in such a way as to influence the further evolution of the morphology itself. It is a commonly used term in coastal geomorphology, where cliffs, beaches and wave-cut platforms affect the wave climate and that feeds back into the geomorphic evolution of the coastline. In the Tantangara context, within the area indicated, morphodynamics is essentially a term for structural control on drainage. However, landscape evolution occurs at much larger spatial scales than the area of interest and understanding the evolution of a ridge-bounded landscape such as the area of the HRT02 portal requires a much larger view of the landscape. In this larger context, morphodynamics includes all aspects of the interaction between faults, drainage and topography.

#### 1.1 Purpose of this Memorandum

This memorandum provides a preliminary assessment of the nature of this ground, in accordance with the proposal set out in DJV technical memorandum S2-DJV-TEC-MEM-0101, dated 23.09.2022. This memorandum is intended to set out coherent arguments for the nature of the difficult ground based on a morphodynamic assessment informed by the combination of geophysical surveys, geological and geomorphological mapping. The report is strongly interpretive and should not be relied upon in any way or for any purpose, other than to foster discussion and facilitate planning.

#### 1.2 Scope and limitations

#### 1.2.1 Scope

The scope of this work included:

Desktop review -

- Two lidar datasets were reviewed:
  - o Tantangara 0.5 m lidar provided by FGJV
  - 1 m lidar dataset that covers the entire Snowy2.0 scheme (same lidar as used in Quigley and Duffy, 2018) but predates earthworks at Tantangara.
- Previous geological mapping was reviewed, particularly the 1974 Tantangara mapsheet (Owen et al., 1974).

- Borehole data were examined for BH2101 and BH1202. Additionally, OTV data was examined for a probe hole drilled from the tunnel portal.
- A full day of field mapping was conducted in December 2022 by Samantha Ross and Brendan Duffy to look for field evidence of faulting and landsliding.

#### 1.2.2 Limitations

This technical memorandum has been prepared by GHD for FGJV. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose. It is not intended for circulation or incorporation into other documents. The matters discussed in this memorandum are limited to those specifically detailed in the memorandum and are subject to any limitations or assumptions specially set out.

If this Technical Memorandum is required to be accessible in any other format this can be provided by GHD upon request and at an additional cost if necessary.

The opinions, conclusions and any recommendations in this memorandum are based in part on information obtained from specific mapped point data, including structural measurements and geophysical data. No new drilling was undertaken in support of this assessment. Although this memorandum interprets between the points, site conditions at other parts of the site may be different from the site conditions found at the specific mapping points.

Investigations undertaken in respect of this memorandum are further constrained by the particular site conditions, such as the location of buildings, services, vegetation, controlled access areas (e.g., the tunnel). As a result, not all relevant site features and conditions may have been identified in this memorandum.

#### 2. Methods

Lidar for the study area was examined using Global Mapper and Leapfrog Works software. Desktop reconnaissance identified several features of interest and these were examined during field mapping in December 2022. Mapping focused on:

- identification of the location and displacement sense of faults proximal to the portal area.
- Examination of a linear alignment of erosional features parallel to the slope and NW of the portal.

Field data was compared with existing geological maps, including the NSW seamless geology of the area, and a hand-drawn map of the area by Owen et al. (1974). A suitable area was identified based on the desktop and field investigations and a small Leapfrog Works Model was developed within that area, to best illustrate the complexity of the geology.

The 2017 lidar was subtracted from the 2022 lidar using the comparison tool in Global Mapper v24.0 to assess landscape changes over that timescale.

# 3. Geology and geomorphology of the headrace tunnel portal area

#### 3.1 Structural geology

In general terms, the geology of the area consists of three major units.

1. The base of the succession consists of the Silurian sandstone, siltstone, shale and quartzite of the Tantangara Formation (Syaa - Figure 2).

- 2. The Silurian Peppercorn Formation (Scpp Figure 2) overlies the Tantangara Formation, on a boundary marked by a distinctive basal conglomerate. The conglomerate is overlain by sandstone, siltstone and cleaved shale, with minor limestone lenses. At outcrop, the conglomerate bears a superficial resemblance to the dacite.
- 3. The Peppercorn Formation is overlain by Devonian dacite (Dulk Figure 2) of the Kelly's Plain Volcanics. This is described in the stratigraphic database as consisting of dacite ignimbrite, rhyodacite ignimbrite, tuff, agglomerate, rhyolite and a porphyritic monzogranite.

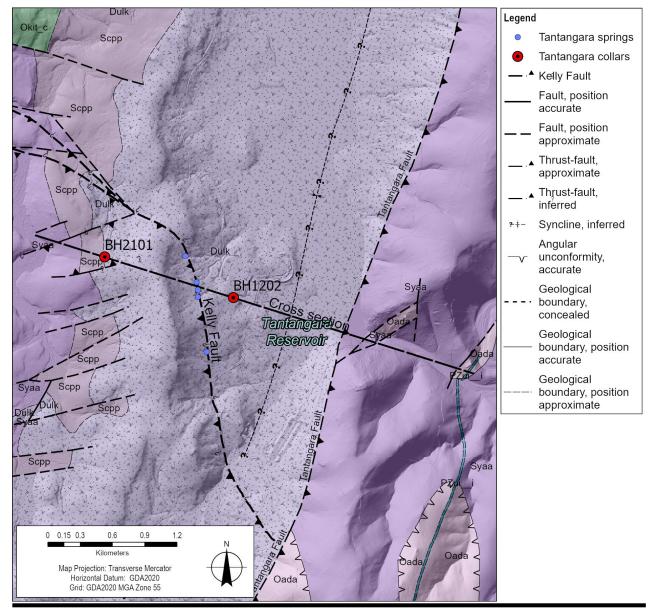


Figure 2 Geology of the Tantangara area, showing the mapped units and structure in the NSW seamless geology database (NSW Government, 2018). Modifications include identification of the syncline along the reservoir, identification of NE-trending faults as thrusts in vicinity of BH2101, addition of Kelly Fault. Background hillshade (lit from NW) is a combination of the pre-earthworks 1m lidar and the FGJV 0.5 m lidar.

Structurally, the sequence west of the reservoir becomes younger eastward (toward the reservoir) and mapping by Owen et al. (1974) suggests dips of 30-60 degrees to the east in sedimentary rocks measured along a transect largely down Nungar Creek (Figure 2 and Figure 3). This is consistent with GHD's field observations, with the exception that we observe the basal conglomerate of the Peppercorn Formation to be locally overturned. Displacements in the basal conglomerate allow numerous NW and (predominantly) small ENE trending faults to be identified. The seamless geology dataset, based largely on Owen et al. (1974), terminates these faults, particularly the ENE trending faults, either side of the Peppercorn

Formation. This is presumably because of difficulty mapping their extension in poor exposure of relatively homogenous rocks, largely covered by scrubby alpine vegetation.

The dacitic rocks of the Kelly's Plain Volcanics form a prominent ridge between Nungar Creek and the portal, which we refer to here as the Kelly Ridge. We discuss the significance of the ridge further below. The portal area is located within the dacite, in the youngest exposed part of the sequence. Displacement of the lower surface of the dacite implies that the last slip event on these faults is younger than the dacite and even though the faults are not mapped through the ridge, they should be expected to continue through it.

East of the Tantangara reservoir, the probable neotectonic Tantangara Fault thrusts westwards, placing steeply west-dipping Tantangara Formation rocks over the younger dacites (Figure 3). Local windows of Ordovician Adaminaby Group rocks expose the base of the Tantangara Formation on the eastern (hanging wall) side of the Tantangara Fault, implying that it has hosted substantial slip. The fold structure in the footwall of the Tantangara Fault is not recorded on geological maps but would be expected to form a syncline along the alignment of the reservoir (Figure 3). This implies that the dacites would dip moderately to steeply westward as a result of drag by the hanging wall of the fault.

A major NW-striking fault is mapped by Owen et al. (1974) on the NW side of the saddle. Like other faults mapped by Owen et al. (1974), the fault is not projected through the dacite. However, the geomorphic character of the site suggests that it should be. It is referred to here as the Kelly Fault and the geomorphic evidence for its continuation is described below. If the Kelly Fault is present, it will displace the NE-striking faults that are shown cutting the base of the dacite on the geological map.

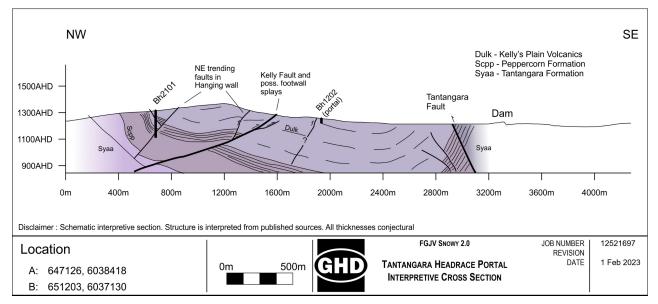


Figure 3 Interpretive cross section through BH2101 and BH1202, crossing the Tantangara Fault at the dam. Thicknesses are indicative only in the absence of drill data. For section location see Figure 2.

#### 3.2 OTV data from HRT2 borehole

The OTV data from the probe hole adjacent to the portal contains numerous shear zones. These can be classified into three groups.

- 1) A gently northeast dipping set, similar to the fractures that displace the columnar jointing in the portal wall.
- 2) A moderately to steeply west dipping set, striking parallel to the Kelly Range and the postulated Kelly Fault.
- 3) A gently to moderately south-southeast dipping set that strikes parallel to the ENE striking faults mapped by Owen et al. (1974).

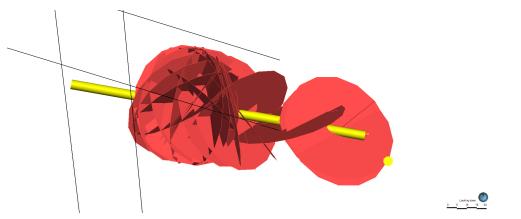


Figure 4 Top-down view of structural discs showing the orientations of shear zones recorded in the HRT02 probe hole.

#### 3.3 Geomorphic observations

The Tantangara Reservoir lies between a ridge located along its eastern margin (the Nungar Ridge – Owen et al. 1974) and a lower but prominent dacite ridge on the western side of the reservoir (the Kelly Ridge – Figure 5). The western side of the Kelly Ridge has smooth textured topography and a relatively gentle slope. Several small outcrops of dacite protrude on the west side of the ridge. In the lidar imagery, these appear to be flat-lying to slightly west-dipping, although that relationship is difficult to confirm in the field.

The east side of the Kelly ridge, close to the portal, is steeper than the west side and forms the most prominent scarp in terms of individual slope height and dip within 5 km west of the reservoir (Figure 5). A distinct break in slope marks the central part of the eastern slope. A distinct double saddle lowers the ridgeline north of the portal. The northern saddle forms where the Kelly Ridge is incised by a valley that forms a west-pointing vee shape in the scarp above the break in slope. This suggest that the dacite dips west. The overall asymmetry of the Kelly Ridge is also similar to the topography that would be expected to develop in regularly west-dipping strata, with a gentle, smooth-textured dip slope to the west and a steep, rough textured scarp slope to the east. A local example of this morphology, known as a hogsback, can be seen on the Nungar Ridge east of the Tantangara Reservoir, where the Tantangara Formation in the hanging wall of the Tantangara Fault dips steeply to the west (Owen et al., 1974), creating an asymmetric hogsback with a smooth west face and a steeper east face (Figure 5). Although field evidence is lacking, geomorphology suggests that the dacites in the ridge west of the portal dip to the west.

At the eastern toe of the Kelly Ridge, small hills show the same geometry (gentle dip to west, steep dip to east). One example of this asymmetry is the hill into which the portal is excavated, which consists of relatively intact dacite at the toe of a large bulbous lobe that extends to the top of the ridge.

The nature of these blocks is not clear. They have similar appearance to landslide blocks. BH1202 penetrated 35.8 m into the portal dacite and did not report any lithological changes such as crushing, that might be expected if the portal was cut into a landslide block. However, the columnar joints in the portal area are displaced by several centimeters on low angle slickensided planes, which could be attributable to accelerations during landslide displacement. Those planes are of similar orientation to low-angle NE dipping shear zones recorded in the HRT02 borehole (Figure 4)

Blocks like the portal area may also lie in the footwall of a fault. Northwest of the portal, the Kelly Ridge steps to the east. The change in ridge location is marked by a low saddle in the ridge (Figure 5). In the saddle, the 2022 FGJV lidar DEM shows an apparent 20° SW-dipping foliation in the landscape. A stream that drains northwestwards out of the saddle and into Nungar Creek is occupied by a NW-trending mapped fault zone (Owen et al. 1974). This saddle is therefore potentially the location where the 'Kelly Fault' (as named above) passes through the ridge.

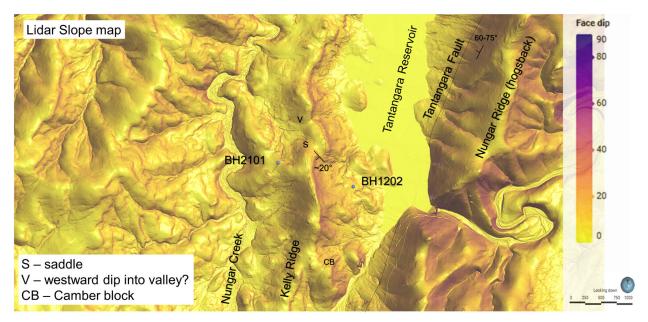


Figure 5 Slope map of pre-construction lidar showing topographic features in the region of the headrace portal.

The topography on the eastern side of the ridge is hummocky on multiple scales. A lineament formed by an alignment of water springs or seeps parallels the east side of the Kelly Ridge, west of the portal (Tantangara springs - Figure 2). The springs mark seepage of water along an erosional contrast with pronounced incision and numerous small-scale landslides below them. Relatively flat-topped alluvial/colluvial deposits have accumulated below the springs, which lack sufficient flow to remove the products of erosion.

Springs commonly align along fault zones and these springs are conjectured to mark the trace of the Kelly Fault, south of the saddle.

#### 3.4 Multi-temporal imagery

#### 3.4.1 Landscape change from multi-temporal lidar

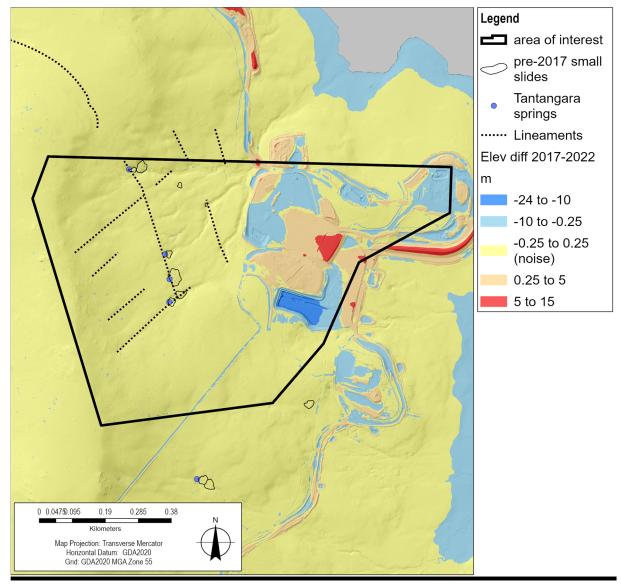
Differencing of multi-temporal lidar datasets can provide a measure of landscape change (Duffy et al., 2013). The 2017 lidar (1m pixels) was subtracted from the 2022 FGJV lidar (0.5m pixels) to assess the activity of areas of landsliding (Figure 6). Observed landscape change was all related to cut and fill activity on the site. Outside of the site works, changes were less than ±0.25 m, which is the range of noise between two different resolution, gridded lidar datasets, collected in different seasons with differing amounts of ground cover. A small area of apparent 0.7 m subsidence within a small, spring-related landslide west of the portal is not matched by downslope uplift. The anomaly appears to be caused by incomplete removal of treefall returns in the 2017 lidar DEM. The datasets differenced here both pre-date the subsidence above the TBM and provide no insight in that regard.

#### 3.4.2 Other multi-temporal imagery

The following points do not indicate the need for further analysis of multi-temporal imagery.

a) Landslides in Australia, including in the Snowy Mountains, commonly appear geomorphically youthful at 1m lidar resolution for decades to centuries. The pre-project lidar does not show geomorphically youthful landslides in the area of interest, except for the small slides associated with the springs. There is therefore little to gain from analysis of satellite or aerial imagery collected over the last few decades.

- b) As indicated above, differential lidar shows that even the small spring landslides have not moved since 2018. These are of such small scale and located under a sparse canopy so their activity rates would not be resolvable with satellite or aerial imagery.
- c) Large scale lateral slope deformation in this area would resolve on the differential lidar as a coherent signal of differential vertical displacement parallel with the ridge. While pre-cursory deformation could be resolvable at mm to cm-scale by using persistent or distributed scatterer analyses of satellite altimetry radar (SAR) stacks (Roberts et al., 2019), the cost of that analysis would be high and GHD cannot provide that service in-house. The lack of any hint of displacement on the differential lidar, coupled with the lack of incidence of large-scale slope failures in the area more broadly, does not indicate a requirement for SAR analysis.



Data source: Created by:bduffy. Lidar sources - 2017 Snowy Hydro neotectonic assessment: 2022 Tantanoara lidar provided by FGJV

Figure 6 Elevation difference between 2017 and 2022 in the area of the Tantangara portal. The datasets differenced here both pre-date the subsidence above the TBM. The difference shows no evidence for movement at any scale within the area of interest.

#### 3.5 Lineament analysis

FGJV requested an identification of structural lineaments and accompanied that request with their interpretation of lineaments in the area of interest. Some of these lineaments are shown in Figure 6. Lineaments like these, particularly the NE trending lineaments, need to be treated with caution. The aspect

of the slope on which these lineaments occur, measured on a 30m resampled lidar dem, is toward the northeast and the northeast-trending lineaments are thus directed down the average slope. Faults with a northeast strike are mapped west of the Kelly Ridge but it is not clear how these lineaments would manifest on a colluvium-covered slope. The other principal lineament orientation is toward the NW, consistent with the Kelly Fault. The presence of springs aligned along this lineament orientation implies lithological control on hydrogeology. Reorientation of streams into the NW alignment downslope from the springs implies a lithological control that is probably fault related. This lineament projects close to the current location of the TBM.

#### 3.6 Geophysics

The P-wave seismic refraction tomography surveys provide useful insight into the 3D distribution of rock strength.

Where the geophysical lines pass parallel to or across the tunnel, they exhibit prominent p-wave splitting, with slower P-waves across the tunnel due to the presence of the void (Figure 7A). P-wave speed reduction extends a full tunnel diameter into the adjacent rock due to destressing.

Beyond the tunnel face, there is no splitting of P-waves at the intersection of SRT03 and SRT04 (Figure 7B). Both show steep velocity gradients and high near-surface velocities consistent with strong rock.

The intersection of SRT02 (tunnel parallel) and SRT04 (tunnel perpendicular but beyond tunnel face) shows P-wave splitting with low velocity parallel to the tunnel (Figure 7C), implying the presence of a structure perpendicular to the tunnel and parallel to the Kelly Ridge (velocities are generally higher along structures and slower across structures). However, Comparison of SRT02 and SRT03 (both tunnel parallel) shows a velocity step that trends subparallel to the tunnel. The step is approximately aligned with the NE-striking faults mapped by Owen et al. (1974).

Within the limits imposed by velocity changes arising from tunnel excavation, the observed velocities are consistent with blocks of intact rock bounded by low velocity, fractured rock, with major discontinuities aligned approximately NS and NE-SW.

The interpolated velocity changes along the tunnel alignment are shown in Figure 8.

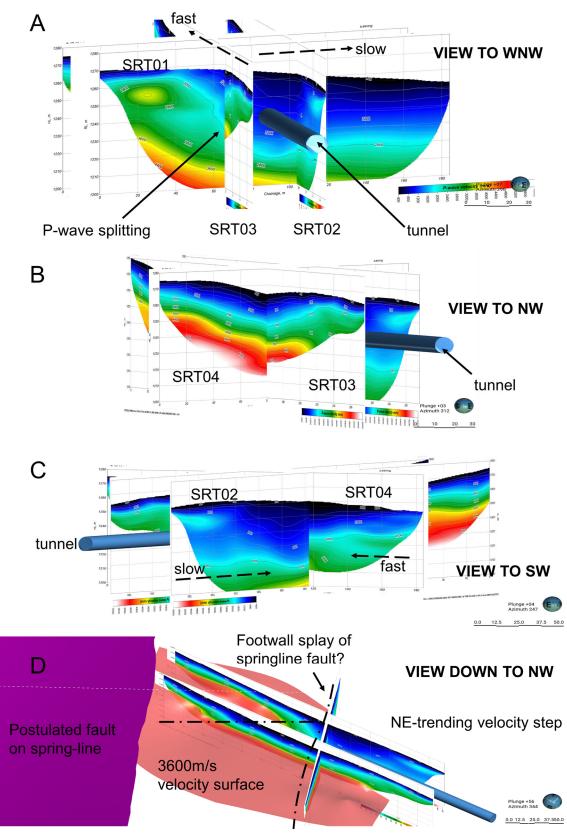


Figure 7. Interpreted P-wave seismic refraction tomography profiles.

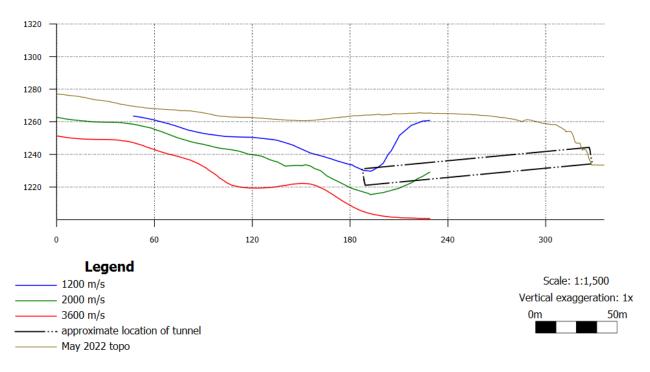


Figure 8 Interpolated velocity structure along the tunnel alignment. Note that some interpretation is involved in attempting to account for the velocity changes caused by tunnelling.

#### 3.7 Integrated interpretation

The eastward thrusting implied by the steepening and local overturning of the Peppercorn Formation, coupled with westward thrusting of the Tantangara Fault, sets up several scenarios that have the potential to explain the difficult ground at the portal site. These scenarios can be further informed by the geology intersected in BH2101.

The scenarios are as follows:

1) A west dipping fault (informally referred to here as the Kelly Fault) passes through the saddle north of the portal and strikes parallel to the ridge. A fault like this serves to relieve stresses applied by the eastward thrusting that steepens the Peppercorn Formation. The fault itself may be shallow and rooted in the bedding of the Peppercorn formation, or it may be a footwall splay of the neotectonic Jindabyne Thrust, located a few km southwest of the portal site (Quigley and Duffy, 2018). The latter seems more likely if the fault has formed a significant thickness crush zone.

A west dipping Kelly Fault would explain the line of springs along the east side of the ridge, as well as the ridge morphology. If this fault is present, the strand marked by springs does not pass through the difficult ground, but a footwall splay may do so. Siltstones of the Peppercorn Formation may be present in the fault zone, depending on the amount of slip and the geometry of the dipping contacts.

- 2) A northwest-dipping fault passes through the ridge and just north of the portal. A fault is mapped in approximately the correct position west of the Kelly Ridge, and a similar fault displaces the Peppercorn/dacite contact in BH2101. If this fault is responsible, there is no evidence that it displaces the ridgeline. It would serve to explain some elements of the P-wave velocity anomalies, particularly the apparent NW-side-up step in velocity across lines SRT02 and SRT03.
- 3) Landsliding may have resulted in detached blocks of dacite sliding down the east side of the ridge. If this is the case, the scale is large enough that BH1202 at the portal did not intersect the base of the portal block. Large scale landsliding like this typically results from strong shaking and would suggest the presence of a local fault.

4) Preferred option - All three of the options above may have contributed to the development of the site. The postulated north-striking Kelly Fault may be displacing the NE-striking faults, creating a crush zone at the intersection. Neotectonic displacement on the fault system may have triggered deep seated landsliding in the proximal hanging wall. This is supported by the orientations of shear zones encountered in the HRT02 probe hole (Figure 4).

### 4. Conclusion

It seems likely that landscape development as a function of fault displacement and landsliding, has resulted in the development of a granular crush zone overlain by local colluvium, into which the TBM has tunnelled. Lidar differencing (2022 [pre-sinkhole] minus 2017) shows no evidence for active landsliding.

The P-wave velocities suggest that the difficult ground presently encountered should not extend for more than another few 10s of meters. If the interpretation of the SRT surveys is correct, the good ground will be encountered obliquely, beginning in the left wall. However, FGJV should be aware of the potential for further crush zones and elevated water pressures as the TBM crosses the alignment of the springs located on the postulated Kelly Fault. A drillhole located west of the spring alignment, on the track that crosses the range, at around 648640E, 6037445N, 1311 elev, would be likely to prove or disprove the Kelly Fault within 80-100 m and provide confidence in its geotechnical characteristics.

Regards

**Dr Brendan Duffy** Technical Director - Geology

### 5. References

- Duffy, B., Quigley, M.C., David Barrell, Van Dissen, R., Timothy Stahl, Sébastien Leprince, Craig McInnes, Eric Bilderback, 2013. Fault kinematics and surface deformation across a releasing bend during the 2010 M<sub>W</sub> 7.1 Darfield, New Zealand, earthquake revealed by differential LiDAR and cadastral surveying. GSA Bulletin 125, 420–431. https://doi.org/10.1130/B30753.1
- NSW Government, 2018. NSW Seamless Geology https://datasets.seed.nsw.gov.au/dataset/5d6e177a-9a78-490c-a570-47c38bbb4399.
- Owen, M., Gardner, D.E., Wyborn, D., Saltet, J., Shackleton, M.S., 1974. Geology of the Tantangara 1:100,000 sheet area, Australian Capital Territory and New South Wales. Record 1974/176.
- Quigley, M., Duffy, B., 2018. Tectonic setting and neotectonic faulting within the Snowy 2.0 project area Final report. Dr Quigs Geological Hazard Consulting.
- Roberts, N.J., Rabus, B.T., Clague, J.J., Hermanns, R.L., Guzmán, M.-A., Minaya, E., 2019. Changes in ground deformation prior to and following a large urban landslide in La Paz, Bolivia, revealed by advanced InSAR. Nat. Hazards Earth Syst. Sci. 19, 679–696. https://doi.org/10.5194/nhess-19-679-2019

## APPENDIX C – GEOTECHNICAL INVESTIGATIONS OF THE PROPOSED SNOWY 2.0 DEVELOPMENT ROUTE – TANTANGARA SURFACE DEPRESSION, MAY 2023



# Geotechnical Investigations of the Proposed Snowy 2.0 Development Route

12521697-GT-REP-1005 - Tantangara **Surface Depression** 

Future Generation Joint Venture (FGJV) 1 May 2023



**The Power of Commitment** 

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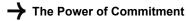
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- Appendix B Standard notes & explanation sheets
- Appendix C Borehole Logs
- Appendix D Core Photos

Appendix E Borehole downhole survey

Appendix F Geophysics Report

# 1. Introduction

## 1.1 Purpose of this report

Snowy 2.0 teams are monitoring a surface depression that has emerged above the headrace tunnel at Tantangara. GHD were engaged by Future Generation Joint Venture (FGJV) to undertake geotechnical investigations in the vicinity of this surface depression to help inform the design and construction team in developing mitigations. The works were completed under existing contract for geotechnical investigations for Snowy 2.0.

The investigation has been conducted to meet the scope as per the various briefs and Notifications of Change listed below:

- NOC-0138: geophysical profile perpendicular to HRT02, morphodynamical assessment of Tantangara adit
- NOC-0144: sub-horizontal drilling
- NOC-0147: emergency geophysics at Tantangara HRT02
- NOC-0149: extension of emergency geophysical survey at Tantangara HRt02
- NOC-0152: three boreholes around the Tantangara surface depression area

## 1.2 Scope and limitations

This report has been prepared by GHD for SLC Snowy Hydro Joint Venture trading under the business name Future Generation JV (FGJV) in accordance with the contractor activities as expressly set out in the Professional Services Contract for Geotechnical Investigations of the Proposed Snowy 2.0 Development Route (dated 14/02/2020) and as set out in section 1.1 of this report.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in this report and are otherwise subject to the technical scope.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Unless otherwise noted, GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The contents of this report are based on assumptions made by GHD described in this report. Where these assumptions are subject to change then those changes should be considered in the context of this report.

## 1.3 Assumptions

GHD have relied on the information provided by FGJV in respect to the geotechnical site investigations, the subject of this report.

This report is to be read in conjunction with the Standard Sheets provided in Appendix B

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# 2. Scope of geotechnical investigation

The scope included drilling of four boreholes and laboratory testing as shown in Table 2.1. Geophysical surveys were also conducted, as detailed in Appendix F.

The scope of reporting includes:

- Factual data from the field, including detailed engineering borehole logs with accompanying core photographs,
- Laboratory testing (Point load testing, other testing to be confirmed).

Coordinates are reported in GDA2020 (zone 55) and Australian Height Datum (AHD, AUSGEOID 09) as the reference Easting (E), Northing (N), Height (RL) coordinate system. Survey accuracy of the "as-built" borehole coordinates are within +/- 0.05 metres horizontally, and: +/- 0.15 metres vertically. Survey of completed borehole locations was undertaken by Future Generation Joint Venture.

Locations of the boreholes covered by this report are shown on Drawings 12521697-GT-DWG-0008.

The borehole logs attached in the various appendices to this report represent the status of the borehole logs as of the issue of this report. The report has been compiled with information obtained to date and will be subject to future revisions once laboratory testing is completed.

Borehole ID	Location Description	Status	Borehole Log Status	Inclination (°) / Azimuth (°)	Drill string length (m)	Easting (m) GDA2020 Zone 55	Northing (m) GDA2020 Zone 55	Surface RL (m AHD)
BH1403	Tantangara Adit	In Progress	Draft	1/282	513*	649091.60	6037884.33	1236.49
BH1411	Tantangara Surface Depression	Complete	Pending	60/285	57.03	648842.55	6037889.06	1264.98
BH1412	Tantangara Surface Depression	Complete	Pending	65/285	54.12	648847.67	6037904.91	1263.03
BH1413	Tantangara Surface Depression	Complete	Pending	38/285	42.32	648844.75	6037896.97	1264.26

Table 2.1Drilling scope summary

\*Hole depth at the time of writing

# 3. Site investigation

## 3.1 Boreholes

### 3.1.1 Investigation methodology

The boreholes have been drilled using a track mounted drill rig, either an LM190 or an LF130.

The fieldwork phase of the investigation was carried out commencing February 2023 and is ongoing. Fieldwork was supervised on a full-time basis by an engineering geologist or geotechnical engineer from GHD, who was responsible for setting up the rig on FGJV marked locations, logging the encountered strata, conducting in-situ testing and collecting soil and rock samples. The logging was carried out in general accordance with AS 1726:2017.

## 3.1.2 Core Drilling

Boreholes were advanced using PQ3, HQ3 and/or NQ3 coring methods depending on ground conditions encountered (Table 3.1).

Size	Nominal core diameter (mm)	Nominal hole diameter (mm)	Nominal hole volume (litres per metre)
PWT casing	N/A	139.7	15.33
HWT casing	N/A	114.3	10.26
PQ3 coring	83.0	122.6	11.80
HQ3 coring	61.1	96.0	7.24
NQ3 coring	45.0	75.7	4.50

Table 3.1 Wireline drilling sizes and nominal core diameter, hole diameter and hole volume

The upper portion of boreholes BH1411, BH1412, BH1413 were grouted. The lower part of these boreholes remains un-grouted due to extensive water loss meaning grouting not feasible. BH1403 is ongoing and is therefore not yet grouted.

### 3.1.3 Non-core drilling

To control the hole trajectory of BH1403, navigational drilling was required. During this style of drilling, no core is recovered.

## 3.1.4 Observed conditions during drilling

The sites were set up inside the FGJV designated areas under their project access requirements in place at the time of access.

BH1403 was positioned adjacent to the TBM spoil stockpile, and drilled into an east facing, excavated face (Figure 3.1). Nearby cuttings at the Tantangara Adit portal encountered moderately to highly weathered rhyodacite (Figure 3.2).

BH1411, BH1412 and BH1413 were positioned on an existing track close to the EIS boundary, to the east of the surface depression (Figure 3.3). The surrounding vegetation was grassy with small heath shrubs and sparse trees. Outcropping rock visible on the track appeared fractured and brecciated (Figure 3.4).



Figure 3.1 BH1403 drill site setup



Figure 3.2 Cutting at Tantangara Adit portal in moderately weathered rhyodacite.



Figure 3.3 BH1411 site setup adjacent to surface depression



Figure 3.4 Brecciated ground on track adjacent to surface depression

## 3.2 Borehole downhole survey

A downhole survey to obtain the 3D 'locational' path of the boreholes was undertaken in nominated boreholes during drilling. Generally, a gyroscopic borehole deviation probe was used to locate the path of the boreholes during drilling. The gyroscopic probe is not influenced by the presence of magnetic rocks.

The path of the boreholes was logged at least every 30 m during drilling. To monitor more closely the trajectory of BH1403, surveys were completed every 15m. Where deviations were observed then survey intervals were taken more frequently to give the earliest opportunity for the borehole orientation to be corrected. The results from the downhole survey are presented in Appendix E.

## 3.3 Borehole geophysical logging

Borehole geophysical logging involves measuring the physical properties of the surrounding medium with a sensor located in a borehole. Due to poor ground conditions encountered in BH1411, BH1412 and BH1413, the holes were not imaged due to the risk of tool loss. To replace the planned downhole geophysical imaging a pipe camera was mobilized to site and one of the holes was reviewed with an endoscopic camera. Refer Section 3.4.

## 3.4 Endoscope imaging

In the absence of borehole geophysical logging results, BH1411 was instead imaged with an endoscope camera to investigate zones of 'no core'. A typical endoscope camera image of these 'no core' zones reported in BH1411 is shown in Figure 3.5. A video recording of the endoscope inspection has previously been provided to FGJV via a 'Large File Transfer'.

6



### 10:40:48 30-MAR-2023

5.84m

Figure 3.5

Endoscope image of BH1411 at 40.34m (5.84m beyond casing at 34.5m)

#### Foreign material left in ground 3.5

Table 3.2 Type and length of foreign material left in ground for each borehole

Borehole ID	Length of foreign material along borehole	Description
BH1403	PWT casing to 9.52 m*	PWT casing
	HWT casing to 304.50 m*	HWT casing
BH1411	Nil	N/A
BH1412	HQ and core barrel at between 19.4-26.54 m	1 x 3 m HQ rod. HQ core barrel
BH1413	Nil	N/A

\*Correct at the time of writing, borehole in progress. Material may be removed on completion of drilling.

#### 3.6 **Geophysical Survey**

A geophysical survey was conducted around the surface depression, and across the HRT01 alignment. The Geophysical Report can be found in full in Appendix F.

## 3.7 Subsurface conditions

The borehole logs and core photographs are provided Appendix C and Appendix D respectively.

The geotechnical logs should be read in conjunction with the Standard Notes in Appendix B that explain the terms, abbreviations and symbols used on the logs, and the interpretation and limitations of the logging and laboratory testing procedures.

## 4. Laboratory testing

Point load tests were completed on the collected rock core samples. Point load test results are included on the borehole logs. At the time of writing, no other samples have been scheduled for laboratory testing.

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# Appendices

## Appendix A Drawings



#### Legend

- Borehole, Tantangara Investigation
- Borehole, Surface Depression Investigation
- Borehole, Historic Geotechnical Investigation ۲
- Geophysics Line, Surface Depression Investigation
- Geophysics Line, Historic Investigation





Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 55



Future Generation JV Snowy 2.0 Geotechnical Investigation 12521697-GT-DWG-0008 **Tantangara Surface Depression** 

Project No. 12521697 Revision No. A Date 01/05/2023

**FIGURE 1** 

**Investigation Plan** Data source: Geophysics lines, GHD 2023; Boreholes, GHD 2023; Aerial Imagergy, MetroMap 18/02/2022 . Created by: sross2

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## Appendix B Standard notes & explanation sheets



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Soil is described in general accordance with <u>Australian Standard AS 1726-2017</u> (Geotechnical Site Investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines soil as particulate materials that occur in the ground and can be disaggregated or remoulded by hand in air or water without prior soaking. Classification of the soil is undertaken following description.

#### SOIL DESCRIPTION

The soil description includes a) Composition, b) Condition, c) Structure, d) Origin and e) Additional observations. 'FILL', 'TOPSOIL' or a 'MIXTURE OF SOIL AND COBBLES / BOULDERS' (with dominant fraction first) is denoted at the start of a soil description where applicable.

#### a) Soil Composition (soil name, colour, plasticity or particle characteristics, secondary and then minor components)

**Soil Name:** A soil is termed a *coarse grained soil* where the dry mass of sand and gravel particles exceeds <u>65%</u> of the total. Soils with more than <u>35%</u> fines (silt or clay particles) are termed *fine grained soils*. The soil name is made up of the primary soil component (in BLOCK letters), prefixed by applicable secondary component qualifiers. Minor components are applied as a qualifiers to the soil name (using the words 'with' or 'trace').

Particles are differentiated on the basis of size. 'Boulders' and 'cobbles' are outside the soil particle range, though their presence (and proportions) is noted. While individual particles may be designated as silt or clay based on grain size, fine grained soils are characterised as silt or clay based on tactile behaviour or Atterberg Limits, and not the relative composition of silt or clay sized particles.

**Colour:** The prominent colour is noted, followed by (spotted, mottled, streaked etc.) then secondary colours as applicable. Roughly equally proportioned colours are prefixed by (spotted, mottled, streaked etc.). Colour is described in its moist condition, though both wet and dry colours may also be provided if appropriate.

**Plasticity:** Fine grained soils are designated within standard ranges of plasticity based on tactile assessment or laboratory assessment of the Liquid Limit.

**Particle Characteristics:** The particle shape, particle distribution and particle size range within a coarse grained soil is described using standard terms. Particle composition may be described using rock or mineral names, with specific terms for carbonate soils.

**Secondary and Minor Components:** The primary soil is described and modified by secondary and minor components, with assessed ranges as tabulated.

**Carbonate Soils:** Carbonate content can be assessed by use of dilute '10%' HCl solution. Resulting clear sustained effervescence is interpreted as a *Carbonate soil* (approximately >50% carbonate), while weak or sporadic effervescence indicates *Calcareous soil* (< 50% carbonate). No effervescence is interpreted as a noncalcareous soil.

**Organic and Peat Soils:** Where identified, organic content is noted. *Organic soil* (2% to 25% organic matter) is usually identified by colour (usually dark grey/black) and odour (i.e. 'mouldy' or hydrogen sulphide odour). *Peat* (>25% organic matter) is identified by a spongy feel and fibrous texture. Peat soils' decomposition may be described as 'fibrous' (little / no decomposition), '*pseudo-fibrous'* (moderate decomposition) or '*amorphous'* (full decomposition).

Fraction	Compone	ents	Particle Size (mm)
<b>0</b>	BOULDERS		> 200
Oversize	COBBLES		63 - 200
		Coarse	19 - 63
	GRAVEL	Medium	6.7 -19
Coarse grained		Fine	2.36 - 6.7
soil particles	SAND	Coarse	0.6 - 2.36
		Medium	0.21 - 0.6
		Fine	0.075 - 0.21
Fine grained soil	SILT		0.002 - 0.075
particles	CLAY		< 0.002

av	Limit Range	
· · · · · · · · · · · · · · · · · · ·	Limit Range	
A	(Non Plastic)	
w Plasticity	≤ 35%	
edium Plasticity	> 35% and ≤ 50%	
gh Plasticity	> 50%	
	A w Plasticity edium Plasticity	

Particle Distribution Terms (Coarse Grained Soils)					
Well graded	good representation of all particle sizes				
Poorly graded	one or more intermediate sizes poorly represented				
Gap graded	one or more intermediate sizes absent				
Uniform	essentially of one size				

Particle Shape Terms (Coarse Grained Soils)					
Rounded	Sub-angular	Flaky or Platy			
Sub-rounded Angular Elongated					

Secondary and Minor Components for Coarse Grained Soils					
Fines (%) Modifier	Accessory	Modifier			

Filles (%)	(as applicable)	coarse (%)	(as applicable)
≤5	'trace silt / clay'	≤ 15	'trace sand / gravel'
> 5, ≤ 12	'with clay / silt'	> 15, ≤ 30	'with sand / gravel'
> 12	prefix 'silty / clayey'	> 30	prefix 'gravelly / sandy'

Secondary and Minor Components for Fine Grained Soils				
% Coarse	Modifier (as applicable)			
≤ <b>15</b>	add <i>"trace sand / gravel"</i>			
> 15, ≤ 30	add <i>"with sand / gravel"</i>			
> 30	prefix soil <i>"sandy / gravelly"</i>			



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#### b) Soil Condition (moisture, relative density or consistency)

**Moisture:** Fine grained soils are described relative to plastic or liquid limits, while coarse grained soils are assessed based on appearance and feel. The observation of seepage or free water is noted on the test hole logs.

Moisture - Coarse Grained Soils		Coarse Grained Soils	Moisture - Fine Grained Soils			
Term		Tactile Properties	Term		Tactile Properties	
Dry	('D')	Non-cohesive, free running	Moist, dry of plastic limit	('w < PL')	Hard and friable or powdery	
Maiat	Feels cool, d	Feels cool, darkened colour,	Moist, near plastic limit	('w≈PL')	Can be moulded	
Moist ('M')	tends to stick together	Moist, wet of plastic limit	('w > PL')	Weakened, free water forms on hands with handling		
Wet	('W')	Feels cool, darkened colour, tends to stick together, free	Wet, near liquid limit	('w≈LL')	Highly weakened, tends to flow when tapped	
	water forms when handling	Wet, wet of liquid limit	('w > LL')	Liquid consistency, soil flows		

**Relative Density (Non Cohesive Soils):** The Density Index is inherently difficult to assess by visual or tactile means, and is normally assessed by penetration testing (e.g. SPT, DCP, PSP or CPT) with published correlations. Assessment may be affected by moisture and *in situ* stress conditions. Density Index assessment may be refined by combination of *in situ* density testing and laboratory reference maximum and minimum density ranges.

**Consistency (Cohesive Soils):** May be assessed by direct measurement (shear vane, CPT etc.), or approximate tactile correlations. Cohesive soils include fine grained soils, and coarse grained soils with sufficient fine grained components to induce cohesive behaviour. A 'design shear strength' must consider the mode of testing, the *in situ* moisture content and potential for variations of moisture which may affect the shear strength.

Relative Density (Non-Cohesive Soils)			Consistency (Cohesive Soils)				
Term and (Symbol) Density Index (%)		Term and (Symbol)		Tactile Properties	Undrained Shear Strength		
Very Loose	(VL)	≤ <b>1</b> 5	Very Soft	(VS)	Extrudes between fingers when squeezed	< 12 kPa	
Loose	(L)	> 15 and $\leq$ 35	Soft	(S)	Can be moulded by light finger pressure	12 - 25 kPa	
Medium Dense	(MD)	> 35 and $\leq$ 65	Firm	(F)	Can be moulded by strong finger pressure	25 - 50 kPa	
Dense	(D)	> 65 and ≤ 85	Stiff	(St)	Cannot be moulded by fingers	50 - 100 kPa	
Very Dense	(VD)	> 85	Very Stiff	(VSt)	Can be indented by thumb nail	100 - 200 kPa	
Consistency assessment can be influenced by moisture variation.		Hard	(H)	Can be indented with difficulty by thumb nail	> 200 kPa		
		Friable	(Fr)	Easily crumbled or broken into small pieces by hand	-		

#### c) Structure (zoning, defects, cementing)

<b>Zoning:</b> The <i>in situ</i> zoning is described using the terms belo <i>'layer'</i> (a continuous zone across the exposed sample) <i>'lens'</i> (a discontinuous layer with lenticular shape)	ow. <i>'Intermixed</i> ' may be used for an irregular arrangement. <i>'pocket</i> ' (an irregular inclusion of different material). <i>'interbedded</i> ' or <i>"interlaminated</i> ' (alternating soil types)
<b>Defects:</b> Described using terms below, with dimension orien <i>'parting'</i> (an open or closed surface or crack sub parallel to layering with little / no tensile strength - open or closed)	ntation and spacing described where practical. <i>'softened zone'</i> (in clayey soils, usually adjacent to a defect with associated higher moisture content)
<i>'fissure'</i> (as per a parting, though not parallel or sub parallel to layering – may include desiccation cracks)	<i>'tube'</i> (tubular cavity, singly or one of a large number, often formed from root holes, animal burrows or tunnel erosion)
'sheared seam' (zone of sub parallel near planar closely spaced intersecting smooth or slickensided fissures dividing the mass into lenticular or wedge shaped blocks)	<i>'tube cast'</i> (an infilled tube – infill may vary from uncemented through to cemented or have rock properties)
'sheared surface' (a near planar, curved or undulating smooth, polished or slickensided surface, indicative of displacement)	<i>'infilled seam'</i> (sheet like soil body cutting through the soil mass, formed by infilling of open defects)
<b>Cementation:</b> Soils may be cemented by various substance gypsum), and the cementing agent shall be identified if prace	

*'weakly cemented'* easily disaggregated by hand in air or water

'moderately cemented' effort required to disaggregate the soil by hand in air or water

Materials extending beyond '*moderately cemented*' are encompassed within the rock strength range. Where consistent cementation throughout a soil mass is identified as a duricrust, it is described in accordance with duricrust rock descriptors. Where alternate descriptors of cementation development are applied for consistency with regional practices or geology, or client requirements, these are outlined separately.



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#### d) Origin

An interpretation is provided based on observations of landform, geology and fabric, and may further include assignment of a stratigraphic unit. The use of terms 'possibly' or 'probably' indicates a higher degree of uncertainty regarding the assessed origin or stratigraphic unit. Typical origin descriptors include:

Residual	Formed directly from in situ weathering with no visible structure or fabric of the parent soil or rock.
Extremely weathered	Formed directly from in situ weathering, with remnant and/or fabric from the parent rock.
Alluvial	Deposited by streams and rivers (may be applied more generically as transported by water).
Estuarine	Deposited in coastal estuaries, including sediments from inflowing rivers, streams, and tidal currents.
Marine	Deposited in a marine environment.
Lacustrine	Deposited in freshwater lakes.
Aeolian	Transported by wind.
Colluvial and Slopewash	Soil and rock debris transported down slopes by gravity (with or without assistance of water). Colluvium is typically applied to thicker / localised deposits, and slopewash for thinner / widespread deposits.
TOPSOIL	Surficial soil, typically with high levels of organic material. Topsoils buried by other transported soils are termed <i>'remnant topsoil'</i> . Tree roots within otherwise unaltered soil does not characterise topsoil.
FILL	Any material which has been placed by anthropogenic processes (i.e. human activity).

#### e) Additional Observations

Additional observations may be included to supplement the soil description. Additional observations may consist of notations relating to soil characteristics (odour, contamination, colour changes with time), inferred geology (with delineation of soil horizons or geological time scale) or notes on sampling and testing application (including the reliability, recovery, representativeness, or condition of samples or test conditions and limitations). If the material is assessed to be not representative, terms such as 'poor recovery', 'non-intact', 'recovered as' or 'probably' are applied.

#### SOIL CLASSIFICATION

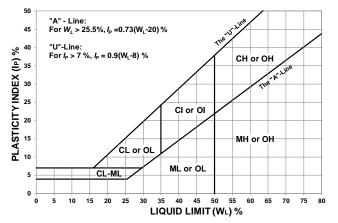
Classification allocates the material within distinct soil groups assigned a two character Group Symbol:

Coarse Grained (sand and gravel:		il coarser than 0.075 mm)	Fine Grained Soils (silt and clay: more than <u>35%</u> of soil finer than 0.075 mm)		
<b>Major Division</b>	Group Symbol Soil Group		Major division	Group Symbol	Soil Group
GRAVEL	GW	GRAVEL, well graded		ML	SILT, low plasticity
(more than half of the coarse fraction is > 2.36 mm)GPGC	GP	GRAVEL, poorly graded	SILT and CLAY	CL	CLAY, low plasticity
	GM	Silty GRAVEL	(low to medium plasticity)	CI	CLAY, medium plasticity
	GC	Clayey GRAVEL		OL	Organic SILT
SAND	SW	SAND, well graded		MH	SILT, high plasticity
(more than half of the coarse fraction is < 2.36 mm)	SP	SAND, poorly graded SILT and CLAY (high plasticity)		СН	CLAY, high plasticity
	SM	Silty SAND	(	ОН	Organic CLAY / SILT
	SC	Clayey SAND	Highly Organic	Pt	PEAT

Coarse grained soils with fines contents between 5% and 12% are provided a dual classification comprising the two group symbols separated by a dash, e.g. for a poorly graded gravel with between 5% and 12% silt fines (poorly graded 'GRAVEL with silt'), the classification is GP-GM.

For the purpose of classification, *poorly graded, uniform,* or *gap graded* soils are all designated as poorly graded. Soils that are dominated by boulders or cobbles are described separately and are not classified.

Classification is routinely undertaken based on tactile assessment with the soil description. Refinement of soil classification may be applied using laboratory assessment, including particle size distribution and Atterberg Limits. Atterberg Limits testing is applied to the sample portion finer than 0.425 mm. Fine grained soil components are assessed on the basis of regions defined within the Modified Casagrande Chart.





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Rock is described in general accordance with <u>Australian Standard AS 1726-2017</u> (Geotechnical site investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines rock as any aggregate of minerals and/or organic materials that cannot be disaggregated by hand in air or water without prior soaking. The rock description and classification distinguishes between rock material, defects, structure and rock mass.

#### **ROCK DESCRIPTION AND CLASSIFICATION**

a) Description of rock material (rock name, grain size and type, colour, texture and fabric, inclusions or minor components, moisture content and durability)

**Rock Name:** Simple rock names are used to provide a reasonable engineering description rather than a precise geological classification. The rock name is chosen on the basis of origin, with common types summarised below. Additional, non-exhaustive, terminology is included in AS 1726. Rock names not described within AS 1726 may be adopted, with geological characteristics typically noted within accompanying text.

Grain		Sedimentary						Igneous	
Size	Olastia en Datuital	Carbonate		<b>D</b> ura di attia	E - P - t - d		E de la de		NA - 6' -
(mm)	Clastic or Detrital	Low Porosity	Porous	Pyroclastic	Foliated	Non-Foliated	Felsic	$\leftrightarrow$	Mafic
>2.0	CONGLOMERATE (rounded grains in a finer matrix) BRECCIA (angular or irregular fragments in a finer matrix)	LIMESTONE (Predominantly CaCO <sub>3</sub> ) or	CALCIRUDITE	AGGLOMERATE (rounded grains in a finer matrix) VOLCANIC BRECCIA (angular fragments in a finer matrix)	GNEISS	MARBLE (carbonate) QUARTZITE	GRANITE	DIORITE	GABBRO
2.0- 0.06	SANDSTONE	DOLOMITE (Predominantly	CALCARENITE	TUFF	SCHIST	SERPENTINITE	MICRO- GRANITE	MICRO- DIORITE	DOLERITE
0.06- 0.002	MUDSTONE (mostly silt)	CaMgCO <sub>3</sub> )	CALCISILTITE	Fine grained	PHYLLITE	HORNFELS		ANDESITE	BASALT
<0.002	(silt and clay) CLAYSTONE (mostly clay)	i	CALCILUTITE	TUFF	or SLATE		NITULITE	ANDESITE	DAGALT

Reproduced with modification from Tables 15, 16 and 17, Clause 6.2.3.1, AS 1726-2017, Geotechnical site investigations.

Grain size: For rocks with predominantly sand sized grains the dominant or average grain size is described as follows:

Rock type	Coarse grained	Medium grained	Fine grained
Sedimentary rocks	Mainly 0.6 mm to 2 mm	Mainly 0.2 mm to 0.6 mm	Mainly 0.06 mm (just visible) to 0.2 mm
Igneous and metamorphic rocks	Mainly >2 mm	Mainly 0.06 mm to 2 mm	Mainly <0.6 mm (just visible)

**Colour** assists in rock identification and interpolation. Rock colour is generally described in a *"moist"* condition, using simple terms (e.g. grey, brown, etc.) and modified as necessary by *"pale"*, *"dark"*, or *"mottled"*. Borderline colours may be described as a combination of these colours (e.g. red-brown).

**Texture** refers to the arrangement of, or the relationship between, the component grains or crystals (e.g. porphyritic, crystalline or amorphous).

**Fabric** refers to visible grain arrangement along a preferential orientation or a layering. Fabric may be noted as *"indistinct*" (little effect on strength) or *"distinct*" (rock breaks more easily parallel to the fabric). Common terms include *"massive"* or *"flow banding"* (igneous), *"foliation"* or *"cleavage"* (metamorphic). Sedimentary layering is described as *"bedding"* or (where thickness < 20 mm) *"lamination"*. The typical orientation, spacing or thickness of these structural features can be described directly in millimetres and metres. Further quantification of bedding thickness applied by GHD is as follows:

Bedding Term	Thickness
Very thickly bedded	>2 m
Thickly bedded	0.6 to 2 m
Medium bedded	0.2 to 0.6 m
Thinly bedded	60 to 200 mm
Very thinly bedded	20 to 60 mm
Laminated	6 to 20 mm
Thinly laminated	<6 mm

**Features, Inclusions and Minor Components** are typically only described when those features could influence the engineering behaviour of the rock. Described features may include: gas bubbles in igneous rocks; veins of quartz, calcite or other minerals; pyrite crystals and nodules or bands of ironstone or carbonate; cross bedding in sandstone; clast or matrix support in conglomerates and breccia.

**Moisture content** may be described by the feel and appearance of the rock, as follows: "*dry*" (looks and feels dry), "*moist*" (feels cool, darkened in colour, but no water is visible on the surface), or "*wet*" (feels cool, darkened in colour, water film or droplets visible on the surface). The moisture content of rock cored with water may not represent in situ conditions.

**Durability** of rock samples is noted where there is an observed tendency of samples to crack, breakdown in water or otherwise deteriorate with exposure.



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#### b) Classification of the rock material condition (strength, weathering and/or alteration)

**Estimated Strength** refers to the rock material and not the rock mass. The strength is defined in terms of uniaxial compressive strength (UCS), though is typically estimated by either tactile assessment or Point Load Strength Index ( $Is_{(50)}$ ) (measured perpendicular to planar anisotropy). A correlation between  $Is_{(50)}$  and UCS is adopted for classification, though is not intended for design purposes without appropriate supporting assessment. A field guide follows:

Term ar (Symbo	-	UCS (MPa)	Is <sub>(50)</sub> (MPa)	Field Guide
Very Low	(VL)	0.6 – 2	0.03 - 0.1	Material crumbles under firm blows with sharp end of geological pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm thick can be broken by finger pressure.
Low	(L)	2 - 6	0.1 - 0.3	Easily scored with knife; indentations 1 to 3 mm show in the specimen with firm blows of a geological pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	(M)	6 - 20	0.3 - 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	(H)	20 - 60	1 - 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a geological pick with a single firm blow; rock rings under hammer.
Very High	(VH)	60 - 200	3 -10	Hand specimen breaks with geological pick after more than one blow; rock rings under hammer.
Extremely High	(EH)	>200	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Based on Table 19, Clause 6.2.4.1, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Material with strength less than "very low" is described using soil characteristics, with the presence of an original rock texture or fabric noted if relevant.

**Weathering and Alteration:** The process of weathering involves physical and chemical changes to the rock resulting from exposure near the earth's surface. A subjective scale for weathering is applied as follows:

Weathering Term and (Symbol)		Description
Residual Soil	(RS)	Material has weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered	(XW)	Material has weathered to such an extent that it has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	(HW)	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered	(MW)	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered	(SW)	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	(Fr)	Rock shows no sign of decomposition of individual minerals or colour changes.

Modified based on Table 20, Clause 6.2.4.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Where physical and chemical changes to the rock are caused by hot gases or liquids at depth, the process is called alteration. Unlike weathering, the distribution of altered material may occur at any depth and show no relationship to topography. Where alteration minerals are identified the terms "extremely altered" (XA), "highly altered" (HA), "moderately altered" (MA) and "slightly altered" (SA) can be used to describe the physical and chemical changes described above.



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c) Description of defects (defect type, orientation, roughness and shape, coatings and composition of seams, spacing, length, openness and thickness, block shape)

Defects often control the overall engineering behaviour of a rock mass. AS 1726 defines a defect as "a discontinuity, fracture, break or void in the material or materials across which there is little or no tensile strength". Describing the type, character and distribution of natural defects is an essential part of the description of many rock masses.

Commonly described characteristics of defects within a rock mass include type, orientation, roughness and shape, coatings and composition of seams, aperture, persistence, spacing and block shape.

The degree of detail required for defect descriptions depends on project requirements. All defects judged of engineering significance for the site and project are described individually. Where appropriate, generalised descriptions for less significant, or multiple similar, defects can be provided for delineated parts of rock core or exposures. A general description of delineated defect sets is provided when sufficient orientation data is available.

**Defect Type** is described using the terms summarised below. On core logs, only natural defects across which the core is discontinuous are described (i.e. inferred artificial fractures such as drill breaks are excluded). Incipient defects are described using the relevant texture or fabric terms. Healed defects (those that have been re-cemented by minerals such as chlorite or calcite) are described using the prefix "healed" (e.g. healed joint).

Type and (Syn	nbol)	Description	Diagram
Parting	(Pt)	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed.	
Joint	(Jt)	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or subparallel to layering or to planar anisotropy in the rock material. May be open or closed.	
Sheared Surface	(SS)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.	
Sheared Zone	(SZ)	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
Sheared Seam	(SSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	A Contraction of the second se
Crushed Seam	(CSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.	
Infilled Seam	(ISm)	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.	
Extremely Weathered Seam	(WSm)	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.	Seam

Modified based on Table 22, Clause 6.2.5.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

**Defect Orientation** is recorded as the "dip" (maximum angle of the mean plane, measured from horizontal) and the "dip direction" (azimuth of the dip, measured clockwise from true north). Dip and dip direction is expressed in degrees, with two-digit and three-digit numbers respectively, separated by a slash (e.g. 45/090). For vertical boreholes, the defect dip is measured as the acute angle from horizontal. Rock core extracted from vertical boreholes is generally not oriented, so the dip direction cannot be directly measured. For non-oriented inclined boreholes, a defect "alpha" ( $\alpha$ ) angle is measured as the acute angle from the core axis. For vertical and non-oriented inclined boreholes, the dip direction can sometimes be estimated from the relationship of the defect to a well-defined site structure such as fabric. For oriented inclined boreholes, the measurement of the defect orientation is carried out and recorded in a form suited to the particular device being used and later processed to report true dip and dip direction.



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**Roughness and Shape** of the defect surface combine to have significant influence on shear strength. Standard descriptions and abbreviations include:

Roughness (Symbo		Description
Very Rough	(VR)	Many large surface irregularities (amplitude generally more than 1 mm) Feels like, or coarser than very coarse sand paper.
Rough	(Rf)	Many small surface irregularities (amplitude generally less than 1 mm). Feels like fine to coarse sand paper.
Smooth	(So)	Smooth to touch. Few or no surface irregularities.
Polished	(Pol)	Shiny smooth surface.
Slickensided	(Slk)	Grooved or striated surface, usually polished.

Shape and (S	ymbol)	Description
Planar	(Pln	The defect does not vary in orientation.
Curved	(Cu)	The defect has a gradual change in orientation.
Undulating	(Un)	The defect has a wavy surface.
Stepped	(St)	The defect has one or more well defined steps.
Irregular	(lr)	The defect has many sharp changes of orientation.

Although the surface roughness of defects can be described at small (10-100 mm) scales of observation, the overall shape of the defect surface can usually be observed only at medium (0.1-1 m) and large (>1 m) scale.

Where it is necessary to assess the shear strength of a defect, observations are generally made at multiple scales. Surface roughness may also be characterised by using the joint roughness coefficient (JRC) profiles established by Barton and Choubey (1977). Where large-scale observations are possible, further measurement of defect "waviness" (angle of the asperities relative to the overall dip angle of the plane) is made.

**Coatings and Composition of Seams:** Many defects have surface coatings, which can affect their shear strength. Standard descriptions include:

Coating a (Symbo		Description	Common Minerals and (Symbol)		
Clean	(Cn)	No visible coating.	Clay	(CLAY)	
Stained	(Sn)	No visible coating but surfaces are discoloured.	Calcite	(Ca)	
Veneer	(Ve)	A visible coating of soil or mineral substance, but too thin to be	Carbonaceous	(X)	
veneel (ve)		measured may be patchy.	Chlorite	(Kt)	
		A visible coating up to 1 mm thick. Soil material greater than 1 mm	Iron Oxide	(Fe)	
Coating	(Co)	thick is described using defect terms (e.g. infilled seam). Rock	Micaceous	(Mi)	
		material greater than 1 mm thick is described as a vein (Vn).	Manganese	(Mn)	
The composition of seams are described using soil description terms as given on the Pyrite (P					

The composition of seams are described using soil description terms as given on the SOIL DESCRIPTION AND CLASSIFICATION Standard Sheet. Where possible the mineralogy of coatings is identified. Common mineral coatings include:

**Aperture:** Defects across which there is little or no tensile strength can be either "open" (*Op*) or "closed" (*Cl*). For rock core, the width of the "open" defect is measured whilst still in the core barrel splits. The descriptor "tight" (*Ti*) can only apply to healed or incipient defects (i.e. veins, foliation, etc.).

**Persistence and Spacing** of defects is described directly in millimetres and metres. If the measurement of defect persistence is limited by the extent of the exposure, the end conditions are noted (i.e. 0, 1 or 2 defect ends observed). The spacing between defects of similar orientation (i.e. within a specific defect set) is recorded when possible.

The frequency of defects within rock core can be measured as either: the spacing between successive defects; or the "Fracture Index", which is the number of defects per metre of core.

Spacing Term	Thickness
Very wide	>2 m
Wide	0.6 to 2 m
Medium	0.2 to 0.6 m
Closely	60 to 200 mm
Very closely	20 to 60 mm
Extremely closely	6 to 20 mm

Quartz

(Qz)

#### Block Shape: Where it is considered significant, block shape can be described using the subjective terms as follows:

Block Shape	Description
Polyhedral	Irregular discontinuities without arrangement into distinct sets, and of small persistence.
Tabular	One dominant set of parallel discontinuities, for example bedding planes, with other non-continuous joints; thickness of blocks much less than length or width.
Prismatic	Two dominant sets of discontinuities, approximately orthogonal and parallel, with a third irregular set; thickness of blocks much less than length or width.
Equidimensional	Three dominant sets of discontinuities, approximately orthogonal, with occasional irregular joints, giving equidimensional blocks.
Rhomboidal	Three (or more) dominant, mutually oblique, sets of joints giving oblique-shaped, equidimensional blocks.
Columnar	Several, usually more than three sets of continuous, parallel joints usually crossed by irregular joints; lengths much greater than other dimensions.

Modified based on Table 23, Clause 6.2.5.7, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.



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L = 250 mm

L = 0

L = 0

**RQD** measurement procedure (reproduced from Figure 13, Clause 6.2.9.4, AS 1726-2017, Geotechnical site investigations)

centreline

Extremely weathered

soundness requirement

E

Core run total length = 1.2

does not meet

#### d) Interpreted stratigraphic unit

Stratigraphic units may be interpreted and reported, in accordance with The Australian Stratigraphic Units Database (ASUD). The terms "possibly" or "probably" indicate increased uncertainty in this interpretation.

#### e) Geological structure

After describing the rock material and defects, an interpretation of the nature and configuration of rock mass defects may be presented in logs, charts, 2D sections and 3D models (e.g. dipping strata, folds, unconformities, weathering profiles, defect sets, geological faults, etc.).

#### PARAMETERS RELATED TO CORE DRILLING

Drill Depth and Core Loss: Drilling intervals are shown on GHD Core Log Sheets by depth increments and horizontal marker lines.

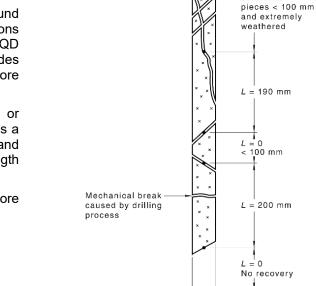
"Core loss", or its inverse "total core recovery" (TCR), is measured as a percentage of the core run. If the location of the core loss is known, or strongly suspected, it is shown in a region of the column bounded by dashed horizontal lines. If unknown, core loss is assigned to the bottom of a core run.

Rock Quality Designation (RQD), described by Deere et al. (1989), may be recorded on GHD Core Log Sheets.

For certain projects, such as tunnelling or underground mining investigations, rock mass ratings or classifications can be required as part of the design process. The RQD forms a component of these rock mass ratings and provides a quantitative estimate of rock mass quality from rock core logs.

The rock core must be "N" sized (nominally 50 mm) or greater for derivation of RQD. The RQD is expressed as a percentage of intact rock core (excluding residual soil and extremely weathered rock) greater than 100 mm in length over the total selected core length.

Deere et al. (1989) recommends measuring lengths of core along the centreline, as shown right.



 $RQD = \frac{250 + 190 + 200}{1000} \times 100\%$ 

1200

= 53%

RQD is expressed as:

$$RQD = \frac{\sum Length \ of \ sound \ core \ pieces > 100 \ mm \ in \ length}{Length \ of \ core \ run} \ x \ 100\%$$

#### **ROCK MASS CLASSIFICATION**

Rock mass classification schemes may be used to represent the engineering characteristics of a rock mass. A large variety of classification schemes have been developed by various authors, ranging from simple to complex. All of the schemes are limited in their application and many rock mass classification systems assume that the rock mass is isotropic, which is rarely the case.

#### References

STANDARDS AUSTRALIA (2017). AS 1726-2017. GEOTECHNICAL SITE INVESTIGATIONS.

BARTON, N. AND CHOUBEY, V. (1977). THE SHEAR STRENGTH OF ROCK JOINTS IN THEORY AND PRACTICE. ROCK MECHANICS 10, 1-54. SPRINGER. DEERE, D.U. AND DEERE, D.W. (1989). ROCK QUALITY DESIGNATION (RQD) AFTER TWENTY YEARS. CONTRACT REPORT GL-89-1. ARMY CORPS OF ENGINEERS. WASHINGTON DC, 1989.

**ORIENTED CORE** 



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The following information is applicable to inclined boreholes with core orientation only.

Core orientation was performed on HQ core in nominated boreholes. Following extraction of the core, core orientation was recorded as a bottom mark with a core orientation line extended up the core as far as practicable. Directional arrows were marked along the orientation line in the downhole direction on each individual piece of core at maximum 1 m spacing.

Core orientation was recorded as alpha and beta angles and core orientation confidence. Core was boxed with the orientation mark visible and centred in the core tray. Where core orientation was not required or possible (e.g. in heavily fractured/disturbed core), alpha angles were recorded on the borehole log with "---" recorded in place of the beta angle.

Definitions of these terms are as follows:

Alpha angle: the acute angle between the core axis and the long axis of the defect (maximum dip angle relative to the core axis) recorded as a two digit number between 0° and 90°.

Beta angle: the angle between the reference line (bottom mark) along the core and the ellipse apical trace (maximum dip vector of the defect plane) measured in a clockwise direction downhole around the core circumference and recorded as a three digit number between 0° and 360°.

Bottom mark: the projected line of the measured lowest point on the core as it would have been in-situ, forming the reference line for structural measurements.

Core orientation confidence (COC): confidence of core orientation for consecutive/adjacent runs is recorded as follows:

Confidence	Notation	Rating	Definition
Confidence 1	(1)	Good	Consecutive runs match within ±015° inclusive, confident bottom mark projection.
Confidence 2	(2)	Medium	Only one adjacent run matches or one differs within ±015°, medium confidence in bottom mark projection.
Confidence 3	(3)	Poor	Adjacent runs mismatch differs by more than ±015°, poor confidence in bottom mark projection.
-	(-)	N/A	Run not able to be oriented or core orientation not performed. Confidence not nominated.

Dip and Dip Direction: Alpha and beta angles are required to be corrected for the dip and azimuth of the borehole to obtain dip and dip direction.

## JOINT ROUGHNESS AND JOINT ALTERATION



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Joint Roughness Number (J<sub>r</sub>) / Joint Alteration Number (J<sub>a</sub>) is based on NGI 2013, Using the Q-system: Rock Mass Classification and Support Design Handbook, NGI, Oslo. Refer to source document for further detail.

Jr and Ja numbers were assigned in accordance with the following:

#### Jr (Joint Roughness Number)

a) Rock-wall contact, and b) Rock-wall contact before 10cm shear movement	ł	c) No rock-wall contact when sheared	
Discontinuous joints	Jr = 4	Zone containing clay minerals thick enough to prevent rock-wall	J <sub>r</sub> = 1.0
Rough or irregular, undulating	3	contact when sheared	
Smooth, undulating	2	Sandy, gravelly or crushed/sheared zone thick enough to prevent	1.0
Slickensided, undulating	1.5	rock-wall contact when sheared*	
Rough, irregular, planar	1.5	Notes:	
Smooth, planar	1.0	<ul> <li>i) Add 1.0 if the mean spacing of the relevant joint set is greater than the size of the underground opening)</li> </ul>	n 3m (dependent on
Slickensided, planar	0.5	о т с,	
Note: i) Description refers to small scale features, and intermediath that order	iate scale features, in	<li>ii) J<sub>r</sub> = 0.5 can be used for planar slickensided joints having lineation lineations are orientated in the estimated sliding direction</li>	is, provided the

\*Not included in Table 3 of NGI 2013 handbook. Described in NGI 2013 Handbook, Section 4.5.1.

#### $J_a$ (Joint Alteration Number)

Joint	Alteration Number Description	Ja
	a) Rock-wall contact (no clay fillings, only coatings)	
А	Tightly healed, hard non-softening, impermeable filling, i.e. quartz or epidote.	0.75
В	Unaltered joint walls, surface staining only.	1
С	Slightly altered joint walls. Non-softening mineral coatings, sandy particles, clay-free disintegrated rock, etc.	2
D	Silty or sandy-clay coatings, small clay fraction (non-softening)	3
Е	Softening or low friction clay mineral coatings, i.e. kaolinite or mica. Also chlorite, talc, gypsum, graphite, etc., and small quantities of swelling clays.	4
	b) Rock-wall contact before 10cm shear (thin mineral fillings)	
F	Sandy particles, clay-free disintegrated rock, etc.	4
G	Strongly over-consolidated non-softening clay mineral fillings (continuous, but <5mm thickness).	6
Н	Medium or low over-consolidation, softening, clay mineral fillings (continuous, but <5mm thickness).	8
J	Swelling-clay fillings, i.e. montmorillonite (continuous, but <5mm thickness). Value of Ja depends on percent of swelling clay-size particles.	8-12
	c) No rock-wall contact when sheared (thick mineral fillings)	
Κ	Zones or bands of disintegrated or crushed rock. Strongly over-consolidated.	6
L	Zones or bands of clay, disintegrated or crushed rock. Medium or low over consolidation or softening fillings	8
М	Zones or bands of clay, disintegrated or crushed rock. Swelling clay. Ja depends on percent of swelling clay-size particles.	8-12
Ν	Thick continuous zones or bands of clay. Strongly over-consolidated.	10
0	Thick continuous zones or bands of clay. Medium to low over-consolidation.	13
Р	Thick continuous zones or bands with clay. Swelling clay. J₂ depends on percent of swelling clay-size particles.	13-20



LIENT : F ROJECT : S	uture Generatio	n JV			HOLE NO:	BH1403
OCATION : T					SHEET : 1 OF 47	Version: A
OSITION : E	: 649091.6, N:	037884.3 (GDA2020 / 55) SURFACE RL :	1236.49 (AHD)	AN	GLE FROM HORIZO	NTAL: 1° TO 282°
IG TYPE : LF			ACTOR : Deepcore	00 /5 :	DRILLER : JL/RE	
ATE STARTEI ASING DIAME		ATE COMPLETED : DATE LOGGED : 2 BARREL (Length) : 3.0 m	1/2/23 LOGGED BY : BIT : Series 6-12m/		TH/MTG/JL/EIØHECK BIT CONDITION	
DRILLI		MATERIAL			NATURAL DEF	
	sts (	DESCRIPTION	Estimated P Strength Is <sub>(50)</sub> MPa		Spacing (mm) Defe	Additional Data ct type, alpha, beta,
WATER WATER (%)	SAMPLES & FIELD TESTS DEPTH (m)	OF         Description           ROCK NAME: grain size, colour, fabric, textu           inclusions or minor components, moisture, dur           START CORING AT 0.00m	Ire, e O-Diametral	D (%) ects/r e run	(core or roughness coating,	s, shape, composition aperture or thickness ghness, joint alteration
<ul> <li>100% TCR</li> <li>3.06</li> <li>100% TCR</li> <li>3.06</li> <li>100% TCR</li> <li>3.06</li> <li>100% TCR</li> <li>6.27</li> <li>100% TCR</li> <li>6.27</li> <li>100% TCR</li> </ul>	1.82m d=0.71 2.03m a=0.82 3.30m 3.45m+8 a=0.15 	RHYODACITE: medium to coarse grained, orange-b massive          •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •         •       •	HW 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	83         75         85         63           7.4         6.9         5.6         4.9	1       0.96, I, IS         1       1.01, J, H         1       1.30, WSm,         1       1.30, WSm,         1       1.46, J, 45'         1       1.46, J, 45'         1       1.46, J, 45'         1       1.90, J, 41'         1       2.25, J, 37'         1       2.25, J, 37'         2.98, J, 48'       3.40, J, 15'         1       3.24, J, 38'         1       3.24, J, 38'         1       3.24, J, 38'         1       3.40, J, 15'         1       5.40, J, 1	<ul> <li>-, -, (-), So, Pin, Mn Sn, 1, 1</li> <li>-, -, (-), So, Pin, Mn Sn, 3, 1</li> <li>-, -, (-), RJ, Un, Mn Sn, 3, 1</li> <li>-, -, (-), So, Pin, Mn Sn, 1, 1</li> <li>-, -, (-), So, Un, Mn Sn, 3, 1</li> <li>-, -, (-), So, Un, Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Mn Sn, 2, 1</li> <li>-, -, (-), RJ, Un, Mn Sn, 1, 1</li> <li>-, -, (-), RJ, Un, Mn Sn, 1, 1, 1</li> <li>-, -, (-), RJ, Un, Mn Sn, 1, 5, 1</li> <li>-, -, (-), So, Un, Mn Sn, 2, 1, Fe S</li> <li>-, -, (-), So, Un, Mn Sn, 1, 5, 1</li> <li>-, -, (-), So, Un, Mn Sn, 1, 1, Fe S</li> <li>-, -, (-), So, Un, Mn Sn, 1, 1, Fe S</li> <li>-, -, (-), So, Un, Mn Sn, 1, 1, Fe S</li> <li>-, -, (-), So, Un, Mn Sn, 2, 1, Fe S</li> <li>-, -, (-), So, Un, Mn Sn, 1, 1, Fe S</li> <li>-, -, (-), So, Un, Mn Sn, 2, 1, Fe S</li> <li>-, -, (-), So, Un, Nn Sn, 1, 1, Fe S</li> <li>-, -, (-), So, Un, Fe Sn, 3, 1</li> <li>-, -, (-), So, Un, Fe Sn, 3, 1</li> <li>-, -, (-), So, Un, Fe Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn Sn, 2, 1</li> <li>-, -, (-), So, Un, Fe Mn</li></ul>

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COUNTING         E 64/001-6, N. 6037884.3 (GDA/020 / S5)         SURFACE RL.         126.49 (AHD)         ANGLE FROM HORIZONTAL: 4" T           NG TYPE:         L/F00         MOUNTING: Track         CONTRACTOR         DELLER:         JURIADWG           NG TYPE:         JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG           NG TYPE:         JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG           NG TYPE:         JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG           NG JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG           NG JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG           NG JURIADWG         DAULER:         JURIADWG         DAULER:         JURIADWG		Future Generation JV			HOLE I	NO: BH1403	3
BC TYPE:         DOULTING:         Track         CONTRACTOR:         Deporte         DULLER:         DULER:         DULLER:         DULER:							A
ATTE DI STUZZE DATE COMPLETED :         DATE CLAGGED : 21/223         LOGGED P: 10/23         DATE CAMPLETED :: Now           ASIND DAMEETE :         DATE CLAUGHT : Series PLANTEND :         DATE CLAUGHT : Series PLANTEND :: Now         DIT CONDITION :: Now           DORLING         Image: Series PLANTEND :: Image: Series PLANTEND :         DESCRPTION :         Estimated :         DESCRPTION :           CORRESS :         State :         State :         PLANTEND :: Image: Series PLANTEND :: Image:	OSITION	E: 649091.6, N: 6037884.3 (GDA2020 / 55) SURFACE RL :	: 1236.49 (AHD)	AN	GLE FROM	HORIZONTAL: 1° TO 2	282°
ASIND DMATTER: : PWT         BARREL (Length) : 3.0 m         BT : Series 6-1270:10         C TOTAL         C TOT			•	00.00			
Dellung         Material         Material         Material           000000000000000000000000000000000000							
UNITEDE         UNITEDESCRIPTION (CR)         UNITEDESC							
1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000 <td< td=""><td></td><td></td><td></td><td>Pa 🕞</td><td>Spacing (mm)</td><td>Additional Data</td><td></td></td<>				Pa 🕞	Spacing (mm)	Additional Data	
1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000       1000	& Additives WATER	ROCK NAME: grain size, colour, fabric, te agained the second field of the second fiel	vture, urability	EH RQD (%) Defects/m core run		(core orientation confider roughness, shape, compos coating, aperture or thick joint roughness, joint alter	nce) sitior
		RHYODACITE: medium to coarse grained, grey to grey-brown, porphyritic, massive to indistinctly flow at 50° at, with iron and manganese staining, particu along defects (continued)	b HW HW	6 4			, 1, 1
		$\frac{1}{6}$ 8.50m $+ \cdot +$	MW       300			8.26, Jt, 50°,, (-), Rf, Un, Fe Mn, 3, 1,	
				0 0		8.81, Jt, 40°,, (-), Rf, Pln, Fe Mn Sn, 1	1.5, 1
		9. <u>0</u> - · + · - + · +		2.			
10000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000         1000 <t< td=""><td></td><td></td><td></td><td>8 0</td><td></td><td> 9.30, Jt, 0°,, (-), Rf, Un, Fe Mn Sn, 3,</td><td>,1</td></t<>				8 0		9.30, Jt, 0°,, (-), Rf, Un, Fe Mn Sn, 3,	,1
		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			📓		
10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 100000 10000 10000 10000 10000 10000 10000 10000 10000 10000		7_   - + + + + <sup>6</sup> 9.94m + + + 9.997m ≥ 10.0		<u>+</u> + + + + +		9.81, Jt, 40°,, (-), Rf, Pin, Fe Sn, 1.5,	1
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0 <td></td> <td></td> <td></td> <td></td> <td></td> <td> 10.27, Jt, 40°,, (-), Rf, Un, Fe Sn, 3, 1</td> <td>1</td>						10.27, Jt, 40°,, (-), Rf, Un, Fe Sn, 3, 1	1
1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1 <td></td> <td></td> <td></td> <td></td> <td></td> <td> 10.60, Jt, 50°,, (-), Rf, Un, Fe Sn, 3, 1</td> <td>1</td>						10.60, Jt, 50°,, (-), Rf, Un, Fe Sn, 3, 1	1
13.00 100% 100% 100% 100%       12.0 1.00% 1.00% 100%       12.0 1.00% 1.00% 1.00%       12.0 1.00% 1.00%       10.0 1.00% 1.00%       10.0 1.00% 1.00%       10.0 1.00% 1.00%       10.0 1.00%       10.		$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		93 5.5		— 10.84, Jt, 80°,, (-), Rf, Un, Fe Mn Sn, 10.89, Jt, 85°,, (-), Rf, Pin, Fe Mn Sn, 10.94, Jt, 60°,, (-), Rf, Un, Fe Mn Sn,	, 3, 1 , 1.5, 1 , 3, 1
$ \begin{array}{c} 22 \\ 32 \\ 33 \\ 36 \\ 36 \\ 36 \\ 36 \\ 36 \\$			SW			— 11.30, Jt, 45°,, (-), Rf, Fin, Fe Mn Sn, — 11.42, Jt, 45°,, (-), Rf, Un, Fe Mn Sn, — 11.54, Jt, 80°,, (-), Rf, Un, Fe Mn Sn, — 11.65, Jt, 70°,, (-), Rf, Un, Fe Mn Sn,	, 3, 1 , 3, 1
12.40       - + + + + + + + + + + + + + + + + + + +	Water L		MW                           			11.97, Jt, 40°,, (-), Rf, Pin, Fe Mn Sn, 12.09, Jt, 45°,, (-), Rf, Pin, Fe Mn Sn, 12.15, Jt, 45°,, (-), Rf, Un, Fe Mn Sn,	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		6 <u> </u>				12.31, Jt, 20°,, (-), Rf, Pin, Fe Mn Sn, 12.33, Jt, 35°,, (-), Rf, Pin, Fe Mn Sn, 	5, 1
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		d=2.62   13.0 .	                     d	64 11.2		12.66, Jt, 30°,, (-), Rt, Im, Fe Sn, 1.5 12.68, Jt, 30°,, (-), Rt, Ir, Fe Mn Sn, 3 12.73, Jt, 70°,, (-), Rt, Pin, Fe Sn, 1.5 12.85, Jt, 30°,, (-), Rt, Ir, Fe Mn Sn, 3	5, 1 3, 1 5, 1 3, 1
13.93m       - + + + + + + + + + + + + + + + + + + +						13.12, Jt.44°, (·), Rt. Un, Fe Sn, 3, 1 13.12, Jt.40°, (·), Rt Un, Fe Sn, 3, 1 13.17, Jt.40°, (·), Rt Un, Fe Sn, 3, 1 13.22, Jt.70°, (·), Rt Pin, Fe Sn, 1.5 13.35, Jt.50°, (·), Rt, Pin, Fe Mn Sn,	1 1 5, 1
15.39       14.0       + + +         15.39       - + + +					- I I 🕅 I I	13.58, Jt, 50°,, (-), Rf, Pin, Fe Mn Sn, 13.62, Jt, 75°,, (-), Rf, Un, Fe Mn Sn, 13.83, Jt, 70°,, (-), Rf, Un, Fe Mn Sn,	, 3, 1
15.00m     -     +     +     +     -     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     + <td< td=""><td></td><td>13.93m  </td><td></td><td></td><td></td><td>∽ 13.85, Jt, 55°,, (-), Rf, Un, Fe Mn Sn,</td><td>3, 1</td></td<>		13.93m				∽ 13.85, Jt, 55°,, (-), Rf, Un, Fe Mn Sn,	3, 1
15.06m     15.06m     -+++     -+++     -+++     -+++     -+++     -+++     -+++     -+++     -+++     -+++     -+++     -+++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -++++     -+++++     -+++++     -+++++     -+++++     -+++++     -+++++     -+++++     -+++++     -++++++     -++++++     -++++++     -++++++     -+++++++     -++++++++     -++++++++++++++++++++++++++++++++++++				97 5.2		14.30, Jt, 45°,, (-), Rf, Pin, Fe Mn Sn, 14.40, Jt, 35°,, (-), Rf, Un, Fe Sn, 3, 1 14.55, Jt, 30°,, (-), Rf, Ir, Fe Mn Sn, 3	1
15:39         -         +         +         +         -         -         +         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         - <td></td> <td>15.06m 15.0 + + +</td> <td></td> <td></td> <td></td> <td>—— 14.79, Jt, 40°,, (-), Rt, Ir, Fe Mn Sn, 3 —— 14.93, Jt, 50°,, (-), Rt, Un, Fe Mn Sn,</td> <td></td>		15.06m 15.0 + + +				—— 14.79, Jt, 40°,, (-), Rt, Ir, Fe Mn Sn, 3 —— 14.93, Jt, 50°,, (-), Rt, Un, Fe Mn Sn,	
		9 - · · + · 9 - · · + ·				15.19, Jt, 82°,, (-), Rf, Un, Cn, 3, 1	
$ \begin{vmatrix} 100\% \\ TCR \\ - \cdot + \cdot \\ - + + \cdot \\ - + - + - + - + - + - + - + - + - + -$							
1     1     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     + <td></td> <td></td> <td></td> <td></td> <td></td> <td> 15.92, Jt, 50°,, (-), Rf, Un, Cn, 3, 1</td> <td></td>						15.92, Jt, 50°,, (-), Rf, Un, Cn, 3, 1	

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			ture Ge lowy 2.0		n JV						HOLE	NO:	BH1403
			intangar								SHEET : 3	OF 47	Version: A
POSI	TION	: E:	649091	.6, N: 6	037884	4.3 (GDA2020 / 55) SURFACE RL : 1236.4	19 ( <i>F</i>	AHD)		AN	GLE FROM	HORIZON	ITAL: 1° TO 282
		: LF1		<u> </u>		DUNTING : Track CONTRACTO		•	<u> </u>	(D)	DRILLER		
			ER : F			DMPLETED : DATE LOGGED : 21/2/23 NRREL (Length) : 3.0 m		OGGED BY : : Series 6-12m			BIT CON		
AOI		RILLIN		VVI	D/-	MATERIAL	ы	. Selles 0-1211		,		RAL DEFI	
ROGF	RESS	-	ŝ					Estimated			Spacing		Additional Data
Casing & Additives	WATER	HILL (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture, inclusions or minor components, moisture, durability	Weathering	Strength Is <sub>(50)</sub> MPa •- Axial O-Diametral ····································	(%) Qi	Defects/m/ core run	20 1000 1000 1000 1000	(core orie roughness, coating, a	t type, alpha, beta, entation confidence) shape, composition aperture or thickness hness, joint alteration
		100% TCR			+ · + + + · + · + + · +	RHYODACITE: medium to coarse grained, grey to grey-brown, porphyritic, massive to indistinctly flow banded at 50° <b>a</b> , with iron and manganese staining, particularly along defects <i>(continued)</i>	MW					16.30, Jt, 80°	r,, (-), Rf, Un, Fe Mn Sn, 3, 1 r,, (-), Rf, Un, Fe Mn Sn, 3, 1
	SS				+ • + • + • + • + + • + + • +		HW					rock fragmen	',, (-), Rf, Un, CLAY Co, 3, 4, Is ',, (-), Rf, Pin, CLAY Co, 1.5, 4
	- 0% Water LOSS			17 <u>.0</u> - - -	· + · + · + · + · · + · + · + · + ·		XW HW		94	2.5		17.14, WSm, 10	70°,, (-), Un, CLAY, 160 mm,
				- - - - - 18.0	+ • + • + • + + • + • + • + + • + + • + + • +							— 17.65, Jt, 20°	r,, (-), Rf, Un, Fe Mn Sn, 3, 1
		18.17 100% TCR		la a a a a a a a a a a a a a a a a a a	+ + + + + + + + + + + +							18.30, Jt, 5°, CLAY Ve	',, (-), Rf, Un, Fe Mn Sn, 3, 1 , (-), Rf, Un, Fe Mn Sn, 3, 1, 60°,, (-), Un, CLAY, 100 mm, nents
				- - - 19.0	+ • + • + • + • + • + • + • +								°,, (-), Rf, Un, CLAY, 4 mm, 1, ',, (-), Rf, Un, Fe Sn, 3, 1
	LOSS –				· + · + · + · + · · + · + · + · + ·	medium plasticity, fine to medium grained sand, with fine to	xw					19.09, Jt, 58°	',, (-), Rf, Un, Fe Sn, 3, 1
NG				20.0	$+ \cdot + + + + + + + + + + + + + + + + + +$	medium, sub-angular gravel			22	4.9		19.77, WSm, 8, rock fragm	60°,, (-), Rf, Ir, CLAY, 60 mm, ents
CASING					· + · + · + · + · + · + · +	20.30m RHYODACITE: medium to coarse grained, stained grey to grey brown, massive, porphyritic, with iron and manganese	нw					fragments 20.23, Jt, 1°, 20.29, Jt, 70° 20.38, Jt, 2°,	(-), Rf, Ir, CLAY, 140 mm, 1, 9, rc , (-), Rf, Un, Fe Sn, 3, 1 ',, (-), Rf, Un, Fe Sn, 3, 1 , (-), Rf, Un, Fe Sn, 3, 1
		21.00		21.0	+ + + + + + + + + + + + + + + + + +	staining, particularly along defects						20.59, Jt, 1°,	r,, (-), Rf, Un, Fe Mn Sn, 3, 1 , (-), Rf, Un, Fe Mn Sn, 3, 1 r,, (-), Rf, Un, Fe Mn Sn, 3, 1 DB
	Å	100% TCR			· + · + · + · + · + · +							21.11, Jt, 60° 21.13, Jt, 58° 21.26, Jt, 80°	',, (-), Rf, Un, Fe Mn Sn, 3, 1 ',, (-), Rf, Un, Fe Mn Sn, 3, 1 ',, (-), Rf, Un, Fe Mn Sn, 3, 1 ',, (-), Rf, Un, Fe Mn Sn, 3, 1 50°,, (-), Rf, Un, Fe Mn Co,
				22.0	+ • + • + • + • + • + • + • +							21.66, WSm, 1, 9, Fe Sn	r,, (-), Rf, Un, Fe Mn Sn, 3, 1 20°,, (-), Rf, Ir, CLAY, 130 mn
	Water LOSS				· + · + + · + · + · + + · + + · + + · +		MW			5		22.13, Jt, 67° 22.30, Jt, 22°	',, (-), Rf, Un, Fe Mn Sn, 3, 1 ',, (-), Rf, Un, Fe Mn Sn, 3, 1 ',, (-), Rf, Un, Fe Mn Sn, 3, 1
				23 <u>.0</u>	· + · + · + · + · + · + · + ·				87	7.2		22.68, Jt, 30° 22.75, Jt, 38°	r,, (-), Rf, Un, Fe Mn Sn, 3, 1 r,, (-), Rf, Cu, Fe Mn Sn, 1.5, 1 r,, (-), Rf, Un, Fe Mn Sn, 3, 1 r,, (-), Rf, Un, Fe Mn Sn, 3, 1 r,, (-), Rf, Un, Fe Mn Sn, 3, 1
			<b>23.25m</b> <b>23:39:61</b> a=1.08		+ • + • + • + + • + • + • + + • + • + • +							(DB?) 23.33, Jt, 60°	', 075°, (2), Rf, Un, Fe Sn, 3, 1, ', 097°, (2), Rf, Pin, Fe Sn, 1.5, 1 ', 258°, (2), Rf, Un, Fe Sn, 3, 1
					+ • + • + • + • + • + • • + • +							23.67, Jt, 27°	, 068°, (2), Rf, Un, Fe Sn, 3, 1 , 180°, (2), Rf, Un, Fe Sn, 3, 1 , 245°, (2), Rf, Un, Fe Sn, 3, 1
			Sheets	s for	GHD	GHD Lvl 2 29 Christie Street, St Leonards NSW 2065 Aus	etroli	2				Job No.	521697

RIG TYPE : DATE STAR CASING DIA DR ROGRESS SWILL SUBJECT CASING DIA DR ROGRESS SWILL SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT SUBJECT S	: E: 6 : LF13 RTED : AMETE RILLING	5.03m a=3.79	6, N: 603 23 DAT WT		REL (Length) : 3.0 m DESC ROCK NAME: grain s clusions or minor com RHYODACITE: mediun	DATE LOGGED : 21 MATERIAL CRIPTION ize, colour, fabric, textur ponents, moisture, dura	ACTOR : //2/23 BIT re, bility ey to MW	Estima Strength the strength th	BY : 5 5-12m/s ated S <sub>(50)</sub> MPa	SR/PN/	DRILLEF TH/MTG/JL/ BIT CON NATU Spacing (mm) R Q Q Q Q Q R Q Q Q Q R Q Q Q Q R Q Q Q Q	HORIZON R : JL/RD/ /EMHECKE NDITION : JRAL DEFE JRAL DEFE // Defect (core orie roughness, coating, a joint roug) -24.07, Jt.28° -24.18, Jt.44°	ED BY: New
RIG TYPE : DATE STAR CASING DIA DR ROGRESS SWIND DR ROGRESS SWIND DR ROGRESS SWIND DR ROGRESS SWIND DR ROGRESS	LF13 RTED : AMETE RILLING (%) ED DRILL DRILL DEPTH 100% TCR 24.20 100% TCR	30 ER : 21/2/2 ER : P G *STANAL Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther Souther So	23 DAT WT DEPTH (m) DEPTH (m)		INTING : Track IPLETED : REL (Length) : 3.0 m DESC ROCK NAME: grain s clusions or minor com RHYODACITE: medium grey brown, massive, pr	CONTRA DATE LOGGED : 21 MATERIAL CRIPTION ize, colour, fabric, textur ponents, moisture, dura to coarse grained, stained grr prypyritic, with iron and mangar	ACTOR : //2/23 BIT re, bility ey to MW	Estima Strength the strength th	BY : 5 5-12m/s ated S <sub>(50)</sub> MPa	7 RQD (%) 919 X/N3 2 Defects/m/ 919 X/N3 2 Core run	DRILLEF TH/MTG/JL/ BIT CON NATU Spacing (mm) R Q Q Q Q Q R Q Q Q Q R Q Q Q Q R Q Q Q Q	R : JL/RD/ /EMHECKE NDITION : JRAL DEFE JRAL DEFE (core orie roughness, coating, a joint rougi -24.07, JL 28° -24.18, JL 44°	/WG ED BY : New ECTS Additional Data t type, alpha, beta, entation confidence), shape, composition aperture or thickness hness, joint alteration ',080°, (2), R, Un, Fe Mn Sn, 3, 1 ',278°, (2), R, Un, Fe Mn Sn, 3, 1
ATE STAR ASING DIA DR ROGRESS SWINDER SUBJECT	RTED : AMETE RILLING (%) ES DEPTH 100% TCR 24.20 100% TCR 24.20 100%	5.03m 5.94m	DEPTH(m) Level (m)		PLETED : REL (Length) : 3.0 m DESC ROCK NAME: grain s clusions or minor com RHYODACITE: medium grey brown, massive, pr	DATE LOGGED : 21 MATERIAL CRIPTION ize, colour, fabric, textur ponents, moisture, dura	I/2/23 BIT re, sbility ey to MW	Estima Strength Is 0-Diar 100 Joint 100 Joint	BY : 5 5-12m/s ated S <sub>(50)</sub> MPa	7 RQD (%) 919 2 Defects/m/ 919	TH/MTG/JL BIT CON NATU Spacing (mm) R 0 0 000 R 0 0000 R 0 0000 R 0 00	/EMHECKE NDITION : JRAL DEFect (core orie roughness, coating, a joint rougi -24.07, Jt, 28° -24.18, Jt, 44°	ED BY : New ECTS Additional Data t type, alpha, beta, entation confidence) shape, composition aperture or thickness hness, joint alteratio ,080°, (2), R(, Un, Fe Mn Sn, 3, ,278°, (2), R(, Un, Fe Mn Sn, 3,
ASING DIA	AMETE RILLING (%) 20 DERIL DEPTH 100% TCR 24.20 100% TCR 24.20 100%	5.03m a=3.79	DEPTH(m) Level (m)		REL (Length) : 3.0 m DESC ROCK NAME: grain s clusions or minor com RHYODACITE: mediun grey brown, massive, pr	MATERIAL CRIPTION ize, colour, fabric, textur ponents, moisture, dura to coarse grained, stained grr prphyritic, with iron and mangar	BIT re, ability ey to MW	Estima Strength Is O-Diam	5-12m/s ated s <sub>(50)</sub> MPa	7 RQD (%) 919 2 Defects/m/ 919	BIT CON NATL Spacing (mm) (mm)	JRAL DEFE Defect (core orie roughness, coating, a joint rougl - 24.07, JL 28° - 24.18, JL 44°	New ECTS Additional Data t type, alpha, beta, entation confidence), shape, compositior aperture or thickness hness, joint alteratio ,000°, (2), Rt, Un, Fe Mn Sn, 3, ,278°, (2), Rt, Un, Fe Mn Sn, 3,
	RILLING (%) 201 DEPTH 100% TCR 24.20 100% TCR 24.20 25 25 25 25 25 25 25 25 25 25	5.03m 5.94m	DEPTH (m)		DESC ROCK NAME: grain s clusions or minor com RHYODACITE: mediun grey brown, massive, pr	CRIPTION ize, colour, fabric, textur ponents, moisture, dura to coarse grained, stained gr prphyritic, with iron and mangan	re, ability ey to MW	Estima Strength Is O-Diar Jos	ated S <sub>(50)</sub> MPa	7 RQD (%) 2 Defects/m/	NATL Spacing (mm)	JRAL DEFE Defect (core orie roughness, coating, a joint rougl - 24.07, JL 28° - 24.18, JL 44°	ECTS Additional Data t type, alpha, beta, entation confidence) shape, compositior aperture or thickness hness, joint alteratic '000°. (2), Rt, Un, Fe Mn Sn, 3, '278°, (2), Rt, Un, Fe Mn Sn, 3,
	(%) 20 DRILL DEPTH 100% TCR 24.20 100% TCR 24.20 25	SITER STREET STR		+ • + + •	ROCK NAME: grain s clusions or minor com RHYODACITE: medium grey brown, massive, pr	CRIPTION ize, colour, fabric, textur ponents, moisture, dura to coarse grained, stained gr prphyritic, with iron and mangan	ey to MW	Strength Is O-Diam JOS Strength Is O-Diam JOS Strength Is O-Ax O-Diam JOS	s <sub>(50)</sub> MPa	2 4	Spacing (mm) 00 00 00 00 00 00 00 00 00 00 00 00 00 00	Defect (core orie roughness, coating, z joint rougl 24.07, Jt, 28°, 24.18, Jt, 44°,	Additional Data t type, alpha, beta, entation confidence), shape, composition aperture or thickness; hness, joint alteratic '000°, (2), Rt, Un, Fe Mn Sn, 3, ',278°, (2), Rt, Un, Fe Mn Sn, 3,
	100% TCR 24.20 100% TCR 25	5.03m a=3.79 5.94m		+ • + + •	ROCK NAME: grain s clusions or minor com RHYODACITE: medium grey brown, massive, pr	ize, colour, fabric, textur ponents, moisture, dura to coarse grained, stained gra prphyritic, with iron and mangar	ey to MW	Strength Is O-Diam JOS Strength Is O-Diam JOS Strength Is O-Ax O-Diam JOS	s <sub>(50)</sub> MPa	2 4	(mm)(mm)	Defect (core orie roughness, coating, a joint rough 	t type, alpha, beta, entation confidence), s hape, composition aperture or thickness hness, joint alteratic ',000°, (2), Rt, Un, Fe Mn Sn, 3, ',278°, (2), Rt, Un, Fe Mn Sn, 3,
	100% TCR 24.20 100% TCR 25	5.03m a=3.79 5.94m		+ • + + •	grey brown, massive, po	orphyritic, with iron and mangar	ey to MW			2 4		24.07, Jt, 28°,	°, 080°, (2), Rf, Un, Fe Mn Sn, 3, °, 278°, (2), Rf, Un, Fe Mn Sn, 3,
2	25	a=3.79 5.94m		+ • + • + + • + + • + + • +								1	
2	25	5.94m	- +- + -	- • <del>-   </del>								25.12, Jt, 22°,	°, 240°, (3), Rf, Pin, Mn Sn, 1.5, 1 °, 255°, (3), Rf, Ir, Fe Sn, 3, 1 °, 085°, (3), Rf, Pin, Fe Mn Sn, 1.1
2		d=0.27	+ + + 26.0 + +	+ + + + + + + + + + + + + + + + + + +						88 4.6		25.64, Jt, 65°, 25.73, Jt, 59°, 1	<sup>1</sup> , 100°, (3), Rf, Pin, Fe Sn, 1.5, 1 <sup>1</sup> , 170°, (3), Rf, Un, Fe Mn Sn, 3, 120°, (3), Rf, Pin, Fe Mn Sn, 1 <sup>2</sup> , 095°, (3), Rf, Un, Fe Mn Sn, 3,
2	27	7.10m										26.31, Jt, 38°, 26.70, Jt, 76°, 26.75, Jt, 38°, 26.82, Jt, 47°, 26.91, Jt, 42°	r, 082°, (3), Rf, Un, Fe Mn Sn, 3, r, 115°, (3), Rf, Un, Fe Mn Sn, 3, , 285°, (3), Rf, Un, Fe Mn Sn, 3, , 120°, (3), Rf, Un, Fe Mn Sn, 3, , 310°, (3), Rf, Un, Fe Mn Sn, 1.
	27.26 100% TCR	7.457n a=3.04	- + - + - + - + - + - + 28.0	<pre> + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + • + + + + • + + + + • + + + +</pre>								27.82, Jt, 10°,	", 076° , (3), Rf, Un, Fe Mn Sn, 3, ", 080° , (3), Rf, Un, Fe Mn Sn, 3,
CASING				· · + · · · · · · · · · · · · · · · · ·						86 5.8		28.17, Jt, 0°, ( 28.28, Jt, 63°, 1 28.60, Jt, 20°,	<sup>°</sup> , 085°, (3), Rf, Un, Fe Mn Sn, 3, 010°, (3), Rf, Un, Fe Mn Sn, 3, 1 <sup>°</sup> , 110°, (3), Rf, Pin, Fe Mn Sn, 1. <sup>°</sup> , 016°, (3), Rf, Un, Fe Mn Sn, 3,
			29 <u>.0</u> + 29 <u>.0</u> + + + + + + + + +	<pre> + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • + + • +</pre>								28.93, Jt, 40°, 29.06, Jt, 37° 29.12, Jt, 60°, 29.38, Jt, 40°,	<ol> <li>260°, (3), Rf, Ir, Fe Mn Sn, 3, 1</li> <li>085°, (3), Rf, Ir, Fe Mn Sn, 3, 1</li> <li>155°, (3), Rf, Un, Fe Mn Sn, 3, 1</li> <li>155°, (3), Rf, Un, Fe Mn Sn, 3, 100°, (3), Rf, Un, Fe Mn Sn, 3,</li> <li>105°, (3), Rf, Un, Fe Mn Sn, 3,</li> <li>115°, (3), Rf, Un, Fe Mn Sn, 3,</li> </ol>
1	30.00 100% TCR											29.67, Jt, 64°, 29.72, WSm, 5 mm, 3, 8	<sup>1</sup> , 115 <sup>o</sup> , (3), Rf, Un, Fe Mn Sn, 3, (048 <sup>o</sup> , (3), Rf, Un, Fe Mn Sn, 3, (140 <sup>o</sup> , (3), Rf, Un, Fe Mn Sn, 3, (140 <sup>o</sup> , (3), Rf, Un, Fe Mn Sn, 3, (14 <sup>o</sup> , (3), Rf, Un, Fe Mn Sn, 3, (13 <sup>o</sup> , 110 <sup>o</sup> , (3), Rf, Un, CLAY, core damaged during dniling
			-++ + + -++ -++ -++ -++ -++ -++ -++	+ + + + + +						95 2.2		4, rock fragme	°,, (-), Rf, Pln, CLAY Co, 1.5, 4
				+ + + + +			sw						?,, (-), Rt, Pin, Fe Mn Sn, 1.5, 1
		04	02.0	+ •				Lii				31.96, Jt, 45°,	<sup>o</sup> ,, (-), Rf, Pln, Fe Mn Sn, 1.5, 1
See Stand details of			s for 📕	âHD	GHD	et, St Leonards NSW 206	2E A	lie.				Job No.	521697

File: 12521697 BH1403 4 OF 47

RIG TYPE DATE STA CASING D	I : E:	-	ra Adit										E NO:	BH1403
RIG TYPE DATE STA CASING D D		640004										SHEET	: 5 OF 47	Version: A
DATE STA CASING D D	: : LF′		1.6, N: 603		4.3 (GDA2020 / 55)	SURFACE R					A			NTAL: 1° TO 282°
ASING D			/23 DAT		OUNTING : Track	DATE LOGGED	NTRACTO			v · (			ler : jl/re /jl/eiøheck	
D					RREL (Length) : 3.0 m	DATE LOOGED			Series 6-					
POGRESS	RILLIN					MATERIAL							ATURAL DEF	
	(%)	å TS			DESC	RIPTION		a	Estimate Strength Is		/	Spacing (mm)		Additional Data t type, alpha, beta,
Casing & Additives WATER	DRILL DEPTH	SAMPLES & FIELD TESTS	DEPTH (m)	POG	ROCK NAME: grain s inclusions or minor com	ize, colour, fabric,		erir	- Axial O-Diametra O-Diametra O-Diametra		RQD (%) Defects/m/	20 COLE IUI 20 100 300 300	(core or roughness	ientation confidence), s, shape, composition aperture or thickness ghness, joint alteratior
	DEPTIM 100% JCR 32.23 100% TCR 33.35 100% TCR 36.32	0 L 32.11m 32.4665 d=7.76 35.04m d=4.92 35.31m a=2.86		· · + · + · + · + · + · + · + · + · + ·	RHYODACITE: mediun grey brown, massive, p staining, particularly alo	orphyritic, with iron and		SW			96 100 95 F		3 - 32.30, J, 44 - 32.62, J, 5 - 32.62, J, 5 - 32.62, J, 3 - 32.62, J, 3 - 32.62, J, 3 - 32.97, J, 3 - 33.12, J, 3 - 33.90, J, 44 - 33.95, J, 7 - 1 - 44.06, J, 6 - 34.53, J, 7 - 34.75, J, 7 - 34.75, J, 7 - 34.75, J, 7 - 35.52, J, 5 - 35.52, J,	<ol> <li>(11) THESS, JOINT ENTERSON, JOINT</li></ol>
CASIN - 0% Water L	39.22 100% TCR	38.95m 38.97m a=2.35		+ •	39.05-39.20m, moderat	ely altered.					93 91 48 59		3 6,47, J, 3 3 6,67, J, 3 3 6,67, J, 3 3 6,69, J, 4 3 6,95, J, 7 3 7,15, J, 6 3 7,15, J, 6 3 7,15, J, 6 3 7,12, J, 4 3 7,21, J, 4 3 8, 9, J, 5 3 8, 89, J, 5 3 8, 89, J, 5 3 8, 9, J, 5 3 9, 9, 0, J, 4 3 39, 69, J, 3 3 9, 9, 0, J, 4 3 39, 69, J, 3 3 1, 1, 6 3 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	<ul> <li>*, 237*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 113*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 140*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 278*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 030*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 138*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 124*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 160*, (3), Ri, Un, Fe Sn, 3, 1</li> <li>*, 160*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 367*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 265*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 265*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 265*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 267*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 267*, (3), Ri, Un, Fe Mn Sn, 3, 1</li> <li>*, 267*, (3), Ri, Pin, CLAY Ve, 15, 1</li> <li>*, 310*, (3), Ri, Pin, Fe Sn, 15, 1</li> <li>*, -, (-), RI, Pin, Fe Sn, 15, 1</li> </ul>
			40.0 - •	· + + ·	_									°,, (-), Rf, Pln, Cn, 1.5, 1
See Sta letails (			s for	HD	GHD Lvl 2 29 Christie Stree	-+ 0+1	N 0005 5						Job No	2521697

File: 12521697 BH1403 5 OF 47

			iture Ge nowy 2.0		n JV				HOLE NO:	BH1403
			antangai						SHEET : 6 OF 47	Version: A
OSI	TION	I : E:	649091	.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.49 (AHD)		AN	GLE FROM HORIZO	ONTAL: 1° TO 282
		: LF1		00 5		DUNTING : Track CONTRACTOR : Deepcore	00,0		DRILLER : JL/F	
			): 21/2/ FER : F			DMPLETED :         DATE LOGGED : 21/2/23         LOGGED BY : \$           ARREL (Length) : 3.0 m         BIT : Series 6-12m/5		PN/I	H/MTG/JL/ENDHEC BIT CONDITION	
		RILLIN				MATERIAL			NATURAL DE	
	RESS	(%)	å TS			DESCRIPTION 말 Estimated Strength Is <sub>(50)</sub> MPa		>	Spacing (mm) Def	Additional Data ect type, alpha, beta,
Casing & Additives	н	TCR (9	SAMPLES &	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture, inclusions or minor components, moisture, durability	RQD (%)	ects/m	(core roughne	prientation confidence ss, shape, composition
& Ad	WATER	DRILL DEPTH	SAM FIEL	DEP	GRA LOG	inclusions or minor components, moisture, durability	RQI	Defe	R R P R R P joint ro	g, aperture or thickness ughness, joint alteration
		100% TCR	40,06m d=1.79	_	+ • + • • <b>+</b> •	RHYODACITE: medium to coarse grained, stained grey to SW       O			:: <b>⊠</b> :	75°,, (-), Rf, Ún, Cn, 3, 1 65°, 330°, (3), Rf, Un, Fe Sn, 3, 1
					+ • +	staining, particularly along defects (continued)			40.24, Jt	30°, 315°, (3), Rf, Un, Fe Sn, 3, 1
					+ • +				🗰 40.52, Jt	38°, 060°, (3), Rf, Ir, Fe Sn, 3, 1
					+ • +					
				41.0	+ • + • + • •	40.90-41.25m, slightly to moderately altered.			40.91, C	63°, 148°, (3), Rf, Pln, Fe Sn, 1.5, 1 Sm, 63°, 148°, (3), Pln, 5 mm, 1, 4,
				-	+ • +		93	4.8	V rock	77°, 188°, (3), Rf, Pln, Fe Sn, 1.5, 1
					+ • + • + •				41.21, Jt	85°, 100°, (3), Rf, Un, Fe Sn, 3, 1
					+ • + • + •					78°, 072°, (3), Rf, Un, Fe Sn, 3, 1
					+ • + • + •					
			41.95m	-	+ • + • + •				41.86, Jt	84°, 110°, (3), So, Pln, Fe Sn, 1, 1 45°, 135°, (3), Rf, Un, Fe Sn, 3, 1
		42.15	a=1.07	42. <u>0</u>	+ • + • + •					
		100% TCR			+ • + • + •				¦¦ ₿	50°, 300°, (3), Rf, Pln, Fe Sn, 1.5, 1
					+ • + • + •				42.43, Jt	58°, 280°, (3), Rf, Pln, Cn, 1.5, 1 65°, 125°, (3), Rf, Un, Fe Sn, 3, 1
					+ • + •				42.55, Jt	90°, 125°, (3), Rf, Un, Fe Sn, 3, 1 80°, 080°, (3), Rf, Un, Fe Sn, 3, 1
			42.94m		+ • + • + •					85°, 070°, (3), Rf, Un, Fe Sn, 3, 1
			42.94m 4219806 a=6.24	43 <u>.0</u>	+ • + •					
					+ • + • + •				43.22, Jt	33°, 282°, (3), Rf, Un, Fe Sn, 3, 1
					+ • + •				43.35, Jt	85°, 105°, (3), Rf, Un, Cn, 3, 1
					+ • + • + •			2		75°, 134°, (3), Rf, Pln, Fe Sn, 1.5, 1
	- sso				+ • + • + •		89	4.2		
	_			44. <u>0</u>	+ · + · - + ·					
Ö	10% Water				+ • + • + • + •					10°, 010°, (3), Rf, Ir, Fe Sn, 3, 1
					+ • + • + • + •				44.33, Jt	80°, 190°, (3), Rf, Un, Fe Sn, 3, 1
					+ • + • + • +					
					- + + - 4					
				45. <u>0</u>	+ + + + + + +				44.95, Jt	18°, 143°, (3), Rf, Un, Fe Sn, 3, 1 18°,, (-), Rf, Un, Fe Sn, 3, 1
		45.24			· + · +				45.00-45	10, Recovered as rock fragments
		100% TCR			· • + • + • +					
					• + • • + • +				# 45.51, Jt	35°, 130°, (2), Rf, Un, Fe Sn, 3, 1
			<b>45.69m</b> a=5.14		· · + · + · +					740 4050 (0) 5111 5 5 5
			45.95m d=2.43	46.0	· • + • + • +					74°, 105°, (2), Rf, Un, Cn, 3, 1
					· · + · + · +					
					• + • + + • +				46.32, Jt	80°, 088°, (2), Rf, Un, Fe Sn, 3, 1 47°, 260°, (2), Rf, Un, Fe Sn, 3, 1
					· • + • + • +				тт 🕅 т I	47°, 260°, (2), Rf, Un, Fe Sn, 3, 1 65°, 335°, (2), Rf, Un, Cn, 3, 1
					· · + · + · +	46.70-47.03m, moderately altered.	91	5.2		60°, 110°, (2), Rf, Un, Fe Sn, 3, 4,
				47.0	· • + • + • +				CLAY Cc 46.84, Jt	65°, 120°, (2), Rf, Un, Fe Sn, 3, 1
					• + • + + • +			e		68°, 015°, (2), Rf, Pln, CLAY Co, 1.5 70°, 135°, (2), Rf, Pln, CLAY Ve, 1.5
					• + • + + • +					65°, 135°, (2), Rf, Un, Fe Sn, 3, 1
					· + · + + · +					
					· · + · + · +				47.67, Jt	40°, 165°, (2), Rf, Un, Fe Sn, 3, 1
					· • + • + • +					
LL See	Sta	ndard	Sheet	48.0 s for	+ .	GHD			47.95, Jt	10°, 143°, (2), Rf, Ir, Fe Sn, 3, 1
			reviati		GHD	Lvl 2 29 Christie Street, St Leonards NSW 2065 Australia T: 61 2 9462 4700 F: 61 2 9462 4710 E: sInmail@ghd.com				2521697

File: 12521697 BH1403 6 OF 47

			ture Ge lowy 2.0	eneratio	on JV							HOLE	NO:	BH1403
			intangai									SHEET : 7	OF 47	Version: A
POSI	TION	: E:	649091	.6, N: 6	6037884	4.3 (GDA2020 / 55)	SURFACE RL : 1	1236.49 (	(AHD)		ANG	GLE FROM	HORIZON	ITAL: 1° TO 282°
RIG T	YPE	: LF1	30		M	OUNTING : Track			: Deepcore			DRILLER	: JL/RD	/WG
						OMPLETED :	DATE LOGGED : 2		LOGGED BY		PN/T			
CASI			ER : F	PWT	BA	ARREL (Length) : 3.0 m	MATERIAL	BIT	: Series 6-12	m/S16			DITION :	
ROGF		RILLIN							Estimated			NA I U Spacing	RAL DEFI	ECTS Additional Data
& Additives	WATER	HER (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG		RIPTION ize, colour, fabric, textu ponents, moisture, dura			ен <sup>-10</sup> в RQD (%)	Defects/m/ core run	(mm)	Defect (core origon roughness, coating, a joint roug	t type, alpha, beta, entation confidence) shape, composition aperture or thickness hness, joint alteratio
CASING	- 0% Water LOSS	50.72 100% TCR 51.34 100% 52.41 100% 53.47 100%	49.06m 49(90)R a=6.65		· · · · · · · · · · · · · · · · · · ·	grey brown, massive, p staining, particularly alo	rphyritic, with iron and manga ng defects <i>(continued)</i>			100         95         79         95         91	0.9 2.8 6.5 5.4 5.2		<ul> <li>48.54, J, 78'</li> <li>48.86, J, 48'</li> <li>48.96, J, 54'</li> <li>49.92, J, 15'</li> <li>49.49, J, 49'</li> <li>49.44, J, 29'</li> <li>49.69, J, 60'</li> <li>49.93, J, 12'</li> <li>49.97, J, 45'</li> <li>50.16, J, 26'</li> <li>50.53, J, 53'</li> <li>50.54, 50.92,</li> <li>51.06, J, 33'</li> <li>51.24, J, 48'</li> <li>51.25, J, 45'</li> <li>51.58, J, 84'</li> </ul>	, 035°, (3), Rf, Un, Fe Sn, 3, 1 , 032°, (3), Rf, Un, Fe Sn, 3, 1 , 060°, (3), Rf, Un, Mn Sn, 3, 1 , 340°, (3), Rf, Un, Fe Mn Sn, 3, 1
		TCR	53.94m 59:91?m4 a=5.11	- - - 54. <u>0</u> -	+ • + • + • + • + • + • + • + + • + • + • +					100	0			
		54.34 100% TCR		- - - - - - - - - - - - - - - - - - -	· + · + · + · +									, 180°, (2), Ri, Pin, Fe Sn, 1.5, 1 , 110°, (2), Ri, Un, Fe Sn, 3, 1 , 110°, (2), Ri, Un, Fe Sn, 3, 1
					$+ \cdot + + + + + + + + + + + + + + + + + +$					96	3.3			
See	Sta		Sheet	56.0 s for ons	GHD	GHD Lvl 2 29 Christie Stree				a		<u> 183</u>	Job No.	521697

			uture Ge nowy 2.0		on JV				HOLE NO:	BH1403
			antanga						SHEET : 8 OF 4	7 Version: A
POS	TION	I : E:	649091	.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.49 (AHD)	_	AN	GLE FROM HORIZ	ONTAL: 1° TO 282
rig T	TYPE	: LF′	130		M	DUNTING : Track CONTRACTOR : Deepcore	-		DRILLER : JL	RD/WG
									H/MTG/JL/ENDHE	
JASI		DIAMET	FER : F	- 1 1	BA	\RREL (Length) : 3.0 m BIT : Series 6-12m/S MATERIAL	516		BIT CONDITIO NATURAL D	
ROGI	RESS					Estimated			Spacing	Additional Data
asing Additives	WATER	TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture, inclusions or minor components, moisture, durability	ND (%)	Defects/m/ core run	(core roughn	efect type, alpha, beta, orientation confidence ess, shape, composition ng, aperture or thicknes
& AB	A NA	DRILL DEPTH 100% TCR	I∀ Ш ഗ Ш 56⊾03m 56⊎05m7	DEI	+ • +	inclusions or minor components, moisture, durability Z U U U U U U U U U U U U U U U U U U	RG	ΩÖ	≈	oughness, joint alteration
					· · + · + · + · · + ·	staining, particularly along defects (continued)				Jt, 80°, 155°, (2), Rf, Pln, Fe Sn, 1.5, 1 Jt, 49°, 160°, (2), Rf, Ir, Fe Sn, 3, 1 SS, 10°, 336°, (2), Sik, Un, Fe Mn Sn,
					+ • + • + • + • +		96	3.3		
			57.03m	57. <u>0</u>	· · + · + · + · · + ·			.,	1.5,1	SS, 10°, 290°, (2), Slk, Un, Fe Mn Sn,
		57.35	57.03m 57406m d=2.55		+ • + • + • + • +				0.5, 1	SS, 32°, 130°, (2), Slk, Pln, Fe Mn Sn, Jt, 68°, 335°, (2), Rf, Pln, Fe Sn, 1.5, 1 Jt, 10°, 083°, (2), Rf, Un, Fe Sn, 3, 1
		100% TCR			· · + · + · + · · + ·					, , <del>( )</del> ,
					+ • + • • + • + • + • • + •				 	Jt, 80°,, (-), Rf, Pln, Fe Sn, 1.5, 1
				58. <u>0</u>	· · + · + · + · · + · + · +					
					+ • + • • + • + • + • • + •					Jt, 22°,, (-), Rf, Un, Fe Sn, 3, 1
					+ • + • • + • • • + •					Jt, 30°,, (-), Rf, Pln, Fe Mn Sn, 1.5, -
				59. <u>0</u>	+ - + - + + -		94	2.7	58.82	Jt, 40°,, (-), Rf, Un, Fe Mn Sn, 3, 1
					+ • + • + • • + • +					
					· · + · + · +					
0					+ • + • • + • + • +					
- CASING	10% Water I			60 <u>.0</u>	· · + · + · + · · + ·				60.03	Jt, 48°,, (3), Rf, Un, Cn, 3, 1 Jt, 19°, 283°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 48°, 073°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 25°, 236°, (3), Rf, Un, Fe Sn, 3, 1
	10	60.32 100% TCR			+ • + • + • + + • +					, , (-),
					· · + · + · + · · + ·					
				61 <u>.0</u>	+ • + • • + • + • +					Jt, 66°, 046°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 64°, 104°, (3), Rf, Un, Fe Sn, 3, 1
					· · + · + · + · · + ·				61.22	Jt, 68°, 037°, (3), Rf, Un, Fe Sn, 3, 1
					+ • + • + • + • +					Jt, 57°, 070°, (3), Rf, Un, CLAY Co, 3,
					· · + · + · + · · + ·		92	4.3	Fe Sn 61.71 61.75 61.82	Sand Jt, 55°, 040°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 31°, 022°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 70°, 014°, (3), Rf, Un, Cn, 3, 1
			62.05m 62!08m a=2.6	62 <u>.0</u>	+ • + • + • + • +				61.86	Jt, 54°, 023°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 82°, 203°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 85°, 022°, (3), Rf, Un, Cn, 3, 1
					· · + · + · + · · + ·					
					+ • + • + • + • +					Jt, 87°, 015°, (3), Rf, Un, Fe Sn, 3, 1 Jt, 74°, 340°, (3), Rf, St, Fe Sn, 5, 1
				63 <u>.0</u>	· · + · + · + · · + ·				62.94	Jt, 90°,, (-), Rf, Un, Fe Sn, 3, 1
		63.31			+ • + • + • • + • +					
		100% TCR			· · + · + · + · · + ·					
			63.94m		+ • + • + • • + • +		94	3.6	                 	Jt, 69°, 190°, (3), Rf, Pln, Fe Sn, 1.5, 1
 See			63.94m 63!97#6 Sheet		GH	GHD Lvl 2 29 Christie Street, St Leonards NSW 2065 Australia			Job I	₀. 12521697

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JECT : Snowy 2.0	r						HOLE N	NU.	BH1403
ATION : Tantanga							SHEET : 9	OF 47	Version: A
TION : E: 64909	I.6, N: 603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.4	<b>19</b> (,	AHD)		ANG	GLE FROM	HORIZON	ITAL: 1° TO 282
YPE : LF130		OUNTING : Track CONTRACTO		•	_		DRILLER		
STARTED : 21/2				LOGGED BY :					
NG DIAMETER :   DRILLING	-vvi BA	ARREL (Length) : 3.0 m MATERIAL	BIL	: Series 6-12m	S16		BIT CON	DITION: RAL DEFI	
				Estimated			Spacing		Additional Data
WATER SSS Had TCR (%) FIELD TESTS	j ⊒ j	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture,	Weathering	Strength Is <sub>(50)</sub> MPa • Axial • Diametral	(%	/m/s	(mm)	(core ori	type, alpha, beta, entation confidence
MATER MATER SAMPLE	DEPTH (m) GRAPHIC LOG	inclusions or minor components, moisture, durability	'eath		gD (	Defects/m/ core run	20 40 300 1000	coating, a	shape, composition aperture or thicknes
BRILL DEPTH         DRILL の止           100%         a=1.46		RHYODACITE: medium to coarse grained, stained grey to	≤ MW	S - I M I M I M I M I M I M I M I M I M I	2	Οŭ		joint roug	hness, joint alteratio
TCR	+ • + •	grey brown, massive, porphyritic, with iron and manganese staining, particularly along defects <i>(continued)</i>							
								64.61, Jt, 35°	, 080°, (3), Rf, Un, Fe Sn, 3, 1
		64.75-74.95m, slightly to moderately altered.							, 080°, (3), Rf, Un, Fe Sn, 3, 1 , 210°, (3), Rf, Un, Fe Sn, 3, 1 , 295°, (3), Rf, Un, Fe Sn, 3, 1
	65. <u>0</u> - · + ·								, , ,
		H -			L+	9		65.05, Jt, 22°	, 025°, (3), Rf, Un, Fe Sn, 3, 1
					94	3.6			
		<u> </u>							
		<u> </u>						65.68, Jt, 21°	, 207°, (3), Rf, Un, Fe Sn, 3, 1
		•						65.75. Jt. 34°	, 359°, (3), Rf, Un, Fe Sn, 3, 1 , 300°, (3), Rf, Un, Fe Sn, 3, 1
		•						65.98, Jt, 1°,	000°, (3), Rf, Un, Fe Sn, 3, 1
	_ + • +								DB
66.38		66.20-66.50m, slightly altered.			$\vdash$	$\square$		← 66.22, Jt, 13° ← 66.32, Jt, 20°	, 000°, (3), Rf, Pln, Fe Sn, 1.5, 1 , 000°, (3), Rf, Pln, Fe Sn, 1.5, 1
100% TCR		•							
		•							0048 (0) 27 0 5 11 0
								06.84, Jt, 23° 1	, 284°, (3), Rf, Cu, Fe Mn Sn, 1.
	07. <u>0</u>   + + +   + + +	•							, 292°, (3), Rf, St, Fe Sn, 3, 1
					100	2			, , <u>.</u> ,, o, , o oi, o, i
					Ē	~		67 53 4 000	0520 (2) PELL F A A .
								ο / .53, Jt, 80°	, 253°, (3), Rf, Un, Fe Sn, 3, 1
								67.82, Jt, 74°	, 240°, (3), Rf, Un, Fe Sn, 3, 1
- 67.94m 1 ap 67!97 84 a=1.85	68. <u>0</u> - + +								, 255°, (3), Rf, Un, Fe Sn, 3, 1
× 68.26									
100% TCR						$\square$		68.39, Jt, 74°	, 000°, (2), Rf, Pln, Fe Sn, 1.5, 1
									, 155°, (2), Rf, Un, Fe Sn, 3, 1 , 135°, (2), Rf, Ir, Fe Sn, 3, 1
	69.0	H -							, 135 , (2), Rî, Iî, Fe Sn, 3, 1 , 118°, (2), Rî, Iî, Fe Sn, 3, 1
	$\begin{vmatrix} 09.0 \\ + \cdot + \end{vmatrix}$	•						co 17	
		H -							, 125°, (2), Rf, Pln, Fe Sn, 1.5, 1 , 318°, (2), Rf, Cu, Fe Sn, 1.5, 1
		H							
		<u> </u>							
		<u> </u>			88	3.4			
70.05m		·							
70:07m a=4.92	<u> </u> +·+	•							
		•						70.40	1100 (0) DELL E C C .
		•						—— / U.42, Jt, 34°	, 115°, (2), Rf, Un, Fe Sn, 3, 1
		•						70.65, Jt, 68°	, 078°, (2), Rf, Un, Fe Sn, 3, 1
	$\begin{vmatrix} + \cdot + \cdot \\ - + \cdot + \end{vmatrix}$	•						70.87, Jt, 62°	, 148°, (2), Rf, Un, Fe Sn, 3, 1
	71 <u>.0</u> · + ·	•						71.05, Jt, 72°	, 330°, (2), Rf, Un, Fe Sn, 3, 1
71.21		•			$\vdash$	$\left  - \right $			
TCR									
					10	1.8		71.53, Jt, 42°	, 341°, (2), Rf, Un, Fe Sn, 3, 1
	<u>}</u> ·+·				ľ		i i i 🔛 🛛		
	72.0 - + -	<u> </u>							
Standard Sheet			+ + + + + + 72.0 + + s for GHD	+ + + + + + 72.0 + + s for GHD	-+++     -+++       +++     -+++       -+++     -+++       72.0     ++       S for     GHD	1     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     + <td><math display="block">\begin{bmatrix} 1 &amp; + &amp; + &amp; + \\ + &amp; + &amp; + &amp; + \\ \hline 72.0 &amp; - &amp; + &amp; + \\ \hline 8 &amp; \text{ for } \qquad </math></td> <td><math display="block">\begin{bmatrix} 1 &amp; + &amp; + &amp; + \\ + &amp; + &amp; + &amp; + \\ \hline 72.0 &amp; - &amp; + &amp; + \end{bmatrix}</math></td> <td><math display="block"> \begin{array}{c} 1 + 1 + 1 \\ 1 + 1 + 1 \\ 2 + 2 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1</math></td>	$\begin{bmatrix} 1 & + & + & + \\ + & + & + & + \\ \hline 72.0 & - & + & + \\ \hline 8 & \text{ for } \qquad $	$\begin{bmatrix} 1 & + & + & + \\ + & + & + & + \\ \hline 72.0 & - & + & + \end{bmatrix}$	$ \begin{array}{c} 1 + 1 + 1 \\ 1 + 1 + 1 \\ 2 + 2 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1 \\ 72.0 + 1$

File: 12521697 BH1403 9 OF 47

			nowy 2.0	eneration	on JV				HOLE	NO: BH1403
			antanga						SHEET :	10 OF 47 Version: A
POSI	TION	I : E:	649091	I.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.49	(AHD)	AN	IGLE FROM	HORIZONTAL: 1° TO 282
		: LF′				DUNTING : Track CONTRACTOR	. ,		DRILLER	R : JL/RD/WG
					ATE CO	DMPLETED : DATE LOGGED : 21/2/23	LOGGED BY :	SR/PN/	TH/MTG/JL	/Endhecked by :
CASI			ER : F	PWT	BA		T : Series 6-12m	/S16		NDITION : New
ROGF	_	RILLIN				MATERIAL	Estimated	+	NATU Spacing	JRAL DEFECTS Additional Data
		(%):	SAMPLES & FIELD TESTS	Ê	с	DESCRIPTION				Defect type, alpha, beta, (core orientation confidence)
Casing & Additives	WATER	TCR (%)	VPLE LD TE	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture, inclusions or minor components, moisture, durability		RQD (%) Defects/m/ core run		roughness, shape, composition coating, aperture or thickness
&C &G	AN N	DRILL DEPTH	SAI	DE	-LOC				100 30 0 40 100 100	joint roughness, joint alteration
		100% TCR			+ • + • + • -	RHYODACITE: medium to coarse grained, stained grey to grey brown, massive, porphyritic, with iron and manganese	w	1.8		72.07, Jt, 72°, 090°, (2), Rf, Un, Fe Sn, 3, 1
		72.34		-{	+ • +	staining, particularly along defects (continued)		$  \overset{\cdot}{ }  $		
		84% TCR		_	- · + · + - · + ·					
					+ • +					70.70.00 100 100 100
				]	- • + • + • +					72.76, SS, 43°,, (-), Slk, Un, Fe Sn, 4, 1, Dl 72.88, SS, 3°,, (-), Slk, Un, Fe Sn, 4, 1, DlS
				73. <u>0</u>	· · + · + · +					
					- • + • + • +					
				1	· + • + + • +					73.34, Jt, 61°, 210°, (2), So, Pin, CLAY Ve, 1,
				-	- + + - + • +			83 2.6		
					- + -					73.65, Jt, 23°, 181°, (2), Rf, Un, Fe Sn, 3, 1
				74 0	+ • + • + •					
				74. <u>0</u>	+ • + • • + •					74.07, Jt, 28°,, (-), So, Un, Fe Sn, 2, 1
					+ • +	74.28m				ļ
					$\bigvee$	CORE LOSS 0.36m (74.28-74.64)				
		74.64		_	$\bigtriangleup$	74.64m				ļ
		100% TCR			+ + +	RHYODACITE: fine to medium grained, grey green, F massive, porphyritic, with multiple very closely to closely	r			
				75 <u>.0</u>	+ • +	spaced healed defects, randomly oriented, with moderately widely spaced quartz veins <1-5mm, randomly		89		
		75.5-			+ + +	oriented, with <1% pyrite				75.10, Jt, 22°, 286°, (3), So, Un, CLAY Ve, 2, Ca Co
		75.25 100%			· · + · + · +			$\vdash$		
		TCR			- • + • + • +					
				-	••+•					
	- SSO				+ - + - '					
				76. <u>0</u>	- • + •					
- CASING	10% Water L				+ • + • + • -					
	É			-	+ • + • • <b>+</b> •					
				-	+ • + • • <b>+</b> •					
					+ • + • • <b>+</b> •			0 0		
					+ • +			100		76.90, Jt, 19°, 187°, (3), Rf, Un, CLAY Ve, 3,
			77.13m	77.0	+ • +					
			774 <b>166</b> a=3.56		- • + • + • + - • + •					77.21, SS, 55°, 100°, (3), Slk, Pln, CLAY Co, 0.5, 4
					+ + +					
					· · + · + · +					
			77.77m 77d#2085	-{	- • + • + • +					77.70, SS, 64°, 138°, (3), Slk, Cu, CLAY Ve, 0.5, 1
			77:180 A5 a=4.75	78.0	- • + • + • +					
				-	· + • + + • +					
		78.33	78.24m 78:28m a=3.04		- + + + + + +					78.21, SS, 71°, 078°, (3), Slk, Un, Ca Ve, 1.5
		100% TCR			- · + ·					78.53, SS, 48°, 140°, (3), Slk, Pln, Ca Ve, 0.5
					- • <del>+</del> •					1, CLAY
				1	+ • +					
				79. <u>0</u>	+ • + • • <b>+</b> •					
					+ • +			88		
				-	+ • +			<b> </b> ~  <sup>-</sup>		· · · · · · · · · · · · · · · · · · ·
				_	+ • +					
					- · + · + · +					
					- • + • + • +					
			<u>.</u>	80.0	· · + ·					Lah Na
500	Sta	ndard	Sheet	s for	GHI	GHD				Job No.

LOCATION I: Turkingura Anit         DEFIT: 10: 49 (41)         DEFIT: 10: 49 (41)           DERITON I: E: 6440918, N. 60270814, S(GDAD2015)         SURFACE RL: 12:02: 49 (41)         ONLER: 1: 12:02: 49 (41)           R0D TYPE: I: F1: 20         MOUNTING: 1: Track         CONTRACTOR I: 12:02: 49 (40)         DELER: 1: 12:02: 49 (41)           R0D TYPE: I: F1: 20         MOUNTING: 1: Track         CONTRACTOR I: 12:02: 49 (40)         DELER: 1: 10:02: 10:02           R0D TYPE: I: F1: 30         MOUNTING: 1: Track         CONTRACTOR I: 12:02: 40 (40)         DELER: 1: 10:02: 10:02           CASING DAMETER: I: WIT         BARBEL (Longh): 3:0 m         BIT: Sense 6-12:01:03         BIT: Sense 6-12:01:08         DECONDUCIES I: WIT           TORING: Signal Si	DLIEN PROJ		iture Ge nowy 2.0		on JV				HOLE N	<b>O</b> :	BH1403
NOTIFIE         Line         DOULTING         Track         CONTRACTOR         Description         DULLER         DULER         DULLER         DULER <thd< th=""><th>-0CA</th><th>N : Ta</th><th>antangai</th><th>a Adit</th><th></th><th></th><th></th><th></th><th>SHEET : 11</th><th>OF 47</th><th>Version: A</th></thd<>	-0CA	N : Ta	antangai	a Adit					SHEET : 11	OF 47	Version: A
DATE STARTED : 21/223       DATE COMPLETED : DATE LOGGED 7: 21/223       LOGGED 7: SPMTHMERGULEERECOMD IV: New         DSND DATE FIT: PWT       BARREL (Length) : 3.0 m       BIT Sense 4-Char365       BIT Control Complex (Pace 200)         DBLING       MATERIAL       MATERIAL       NATURAL DEFECTS         DBLING       MATERIAL       NATURAL DEFECTS         DESCRIPTION       DESCRIPTION       BIT Sense 4-Char365       BIT Sense 4-Char365         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4-Char365       BIT Sense 4-Char365       DATE SOURCE COMPLETED : Complex (Pace 200)         BIT Sense 4-Char365       BIT Sense 4				.6, N: 6				ANG			
SANKE DAMETER:         EWT         Declaration         Difference         Difference <thdifference< th="">         Difference         Difference</thdifference<>				23 D4			SR/	PN/T			
BOORDESIDE         End         End         End         End         Specify and the set of the set											
Bit Mark		 RILLIN	-								
100%         100%         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 </td <td></td> <td>TCR</td> <td>SAMPLES &amp;</td> <td>JEPTH (m)</td> <td>BRAPHIC OG</td> <td>DESCRIPTION ROCK NAME: grain size colour fabric texture B Strength Is<sub>(50)</sub>MPa</td> <td>RQD (%)</td> <td>Defects/m/ core run</td> <td>(mm) r</td> <td>Defect (core orie oughness, coating, a</td> <td>type, alpha, beta, entation confidence) shape, composition aperture or thickness</td>		TCR	SAMPLES &	JEPTH (m)	BRAPHIC OG	DESCRIPTION ROCK NAME: grain size colour fabric texture B Strength Is <sub>(50)</sub> MPa	RQD (%)	Defects/m/ core run	(mm) r	Defect (core orie oughness, coating, a	type, alpha, beta, entation confidence) shape, composition aperture or thickness
		 81.00 100% TCR 84.10 100% TCR 886.84 100%	82.05m 82(09)H a=0.76		+       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +	RHYODACITE: fine to medium grained, grey green, massive, porphylitic, with multiple very closely to closely spaced healed defects, randomly oriented, with moderately with <1% pyrite (continued) 80.60-81.40m, slightly to moderately altered.	88 64	1.9 1.9		<ul> <li>CHOLZ, SS, 50</li> <li>O.5, 1</li> <li>BO, 33, SSm, 2</li> <li>4 mm, 0.5, 6,</li> <li>CLAY, 0.5, 8,</li> <li>B1 30, JI, 25*</li> <li>B1 30, JI, 25*</li> <li>B1 30, JI, 40*</li> <li>CLAY Ve</li> <li>B3 70, JI, 68*</li> <li>B3 55, SS, 13</li> <li>Ca + KIVE</li> <li>B3 90-84.00,</li> <li>B4 88, JI, 37*</li> <li>B4 88, JI, 37*</li> <li>B5, 04, JI, 85*</li> <li>B6, 52, JI, 28*</li> <li>B6, 70-86.80,</li> <li>B6, 70-86.80,</li> </ul>	<ul> <li><sup>+</sup>, 044<sup>+</sup>, (3), Sk, Pin, CLAY Ve, 24<sup>+</sup>, 090<sup>+</sup>, (3), Sk, Pin, CLAY, Sandy CLAY</li> <li>SSm, 55<sup>+</sup>, 095<sup>+</sup>, (3), Sik, Pin, Sandy CLAY, rock fragments</li> <li>108<sup>+</sup>, (3), Rf, Pin, Fe Sn, 1.5, 1, 108<sup>+</sup>, (3), Rf, Pin, Fe Sn, 1.5, 3, 124<sup>+</sup>, (3), Rf, Pin, Fe Sn, 1.5, 1, 124<sup>+</sup>, (3), Rf, Pin, Fe Sn, 1.5, 1, 124<sup>+</sup>, (3), Rf, Pin, Fe Sn, 1.5, 1, 108, recovered as rock fragments</li> <li>078<sup>+</sup>, (3), Rf, Pin, Cn, 3, 1, 128<sup>+</sup>, (3), Rf, Pin, Cn, 1.5, 1, 128<sup>+</sup>, (3), Rf, Pin, Cn, 1.5, 1, 118<sup>+</sup>, (3), Rf, Pin, Cn, 3, 1</li> </ul>
			Sheet reviati		GHE	GHD Lvl 2 29 Christie Street, St Leonards NSW 2065 Australia T: 61 2 9462 4700 F: 61 2 9462 4710 E: slnmail@ghd.com			J	ob No. 12	521697

	СТ	: Sn	ture Ge owy 2.0	)									HOLE	<b>NO:</b> 12 OF 47	BH1403 Version: A
			ntangar		202202			2 40 1				A			
				.0, IN: t		4.3 (GDA2020 / 55) DUNTING : Track	SURFACE RL : 1230 CONTRACT			ore		AIN		R : JL/RD	NTAL: 1° TO 282 /WG
				23 D		MPLETED :	DATE LOGGED : 21/2/		· · ·		SR/	PN/T		/ENDHECK	
			ER : F			RREL (Length) : 3.0 m				s 6-12m/				NDITION :	
	DR	ILLIN	G				MATERIAL		_				NAT	JRAL DEF	ECTS
& Additives		TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain :	CRIPTION size, colour, fabric, texture, nponents, moisture, durabili	Weathering	Strength	mated I Is <sub>(50)</sub> MPa <sup>Axial</sup> iametral	D (%)	Defects/m/ core run	Spacing (mm)	(core ori roughness	Additional Data t type, alpha, beta, entation confidence , shape, composition
& Additive WATER		DRILL DEPTH	SAM FIEL	DEP				Fr	, , , , ,		RQD	Defe	100 30 100 30 100 100 100		aperture or thicknes hness, joint alteration
- CASING - - 10% Water LOSS -		39.90 00% TCR 90.77 00% TCR	88.95m 88996## a=6.7		* · * · * · * · * · * · * · * · * · * ·	massive, porphyritic, w spaced healed defects					95 100 98 98	3 2 0 1.3		90.50, Jt, 30 89.55, Jt, 0° 89.78, Jt, 53 92.05, Jt, 65 92.05, Jt, 65 92.47, Jt, 46 92.70, Jt, 68 93.09, Jt, 75 93.09, Jt, 75 93.74, Jt, 64 94.48, Jt, 64 94.48, Jt, 64 94.48, Jt, 64 94.5, SS, 31 95.28, SS, 1 Sericite Ve 95.30, Jt, 48	<ul> <li><sup>a</sup>, 046<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 085<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 026<sup>a</sup>, (3), Rf, Ir, Cn, 3, 1</li> <li><sup>a</sup>, 310<sup>a</sup>, (3), Rf, Un, Ca, Ve, 1.5, 1</li> <li><sup>a</sup>, 012<sup>a</sup>, (3), Rf, Un, Ca, Ve, 1.5, 1</li> <li><sup>a</sup>, 012<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 077<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 050<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 329<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 329<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 132<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 132<sup>a</sup>, (3), Rf, Un, Cn, 3, 1</li> <li><sup>a</sup>, 132<sup>a</sup>, (3), Rf, Un, Cn, 15, 1</li> <li><sup>a</sup>, 077<sup>a</sup>, (3), So, Pin, Co, 1, 2, 1</li> <li><sup>a</sup>, 085<sup>a</sup>, (3), So, Un, Kt Co, 2, 2, 1</li> </ul>
			95.94m 95!97fi1	96.0	- • + •									1	
			Sheet: reviati		GHD	GHD	eet, St Leonards NSW 2065 A	lietrol	ia					Job No.	
etall	15 01	app	cripti	ONS	$\square$	T: 61 2 9462 4700	F: 61 2 9462 4710 E: slr	∿usti'dl mail@	ia ahd con	ı				12	2521697

File: 12521697 BH1403 12 OF 47

	JECT	: Sr	iture Ge nowy 2.0	)	n JV							HOLE		BH1403
			antangai										13 OF 47	Version: A
		I : E: : LF1		.6, N: 6		4.3 (GDA2020 / 55) DUNTING : Track	SURFACE RL : 123 CONTRAC		,	ore	AN		M HORIZON ER : JL/RD/	TAL: 1° TO 282°
-				23 D/		MPLETED :	DATE LOGGED : 21/2/				SR/PN/			
ASI	NG D	DIAMET	ER : F	PWT	BA	RREL (Length) : 3.0 m	I	BIT	: Series	6-12m/	S16	BIT CC	NDITION :	New
		RILLIN	IG				MATERIAL						URAL DEFI	
Casing & Additives	WATER	(%) DEPTH 100% 7CR 96.29 100% 7CR	PELD TESTS	DEPTH (m)	+ · + · + · + · + · + · + · + GRAPHIC • + • + • + • + • + • + • + • + • + • +	ROCK NAME: grain s inclusions or minor com RHYODACITE: fine to massive, porphyritic, w spaced healed defects moderately widely spac oriented, with <1% pyri	riate alteration along healed	Fr	Strength	Axial	(% l/s u		Defec: (core ori- roughness, coating, a joint roug 96.62, Jt. 15' Sericle Ve 96.62, Jt. 15' Sericle Ve 96.63, Jt. 25' Sericle Ve 96.64, Jt. 22' Sericle Ve 96.84, Jt. 22' Ve 96.84, Jt. 22' Ve	Additional Data type, alpha, beta, entation confidence) shape, compositior perture or thickness hness, joint alteratio (052°, (3), So, Un, KI Ve, 2, 1, ,20°, (3), Sk, Un, KI Co, 15, 2, ,31°, (3), Sk, Pin, KI Co, 0, 5, 2 ,330°, (3), So, Un, 2, 1, Sencile ,062°, (3), So, Un, KI Ve, 2, 1,
		98.82 100% TCR	98.95m 98:8946 99:05hi 99:02-bi 99:02-bi	98.0 							5.9		97.26, tJ, 26 Sericite Ve 97.33, SS, 37 Qz Ve, Serici 97.74, tJ, 66 97.88, tJ, 50 97.88, tJ, 50 97.94, tJ, 59 Sericite Ve 98.52, tJ, 43 Sericite Ve 98.52, tJ, 43 Sericite Ve 98.52, tJ, 40 Sericite Ve 98.52, tJ, 40 Sericite Ve 99.55, SJ, 44 Sericite Ve 99.55, SJ, 44 Sericite Ve 99.55, SJ, 45 Sericite Ve 99.71, tJ, 50 Sericite Ve 99.07, tJ, 28 Sericite Ve	, 085°, (3), So, St, Kt Ve, 2, 1, )B?) , 355°, (3), Slk, Pln, Kt Ve, 0.5, 1,
CASING		100.63				99.50-100.00m, quartz thick, oriented at 20° <b>a</b> .	: veins approximately 10-15mm				88 4.4		Sericite Ve	, 120°, (3), So, Un, Kt Ve, 2, 1, °, 110°, (3), So, Un, Kt Ve, 2, 1, °, 120°, (3), So, Un, 2 °, 120°, (3), So, Un, Kt Ve, 2, 1, °, 120°, (3), So, Un, Kt Ve, 2, 1,
		TCR 102.35	102.04m 102.08n d=5.34	101 <u>.0</u> 							96 4.1		00.00, JL 20 Sericite Ve 100.80, JL 90 101.08, JL 54 101.63, JL 55 101.84, JL 35 102.06, JL 63 Ve 102.23, JL 35 Sericite	<ol> <li>*, 130°, (3), So, Un, Kt Ve, 2, 1,</li> <li>*, -, (3), Rf, Un, Kt Ve, 3, 1</li> <li>*, 115°, (3), Rf, Un, Kt Ve, 3, 1</li> <li>*, 210°, (3), Rf, Un, Cn, 3, 1</li> <li>*, 344°, (3), Rf, Pin, Cn, 1.5, 1</li> <li>*, 180°, (3), Rf, Un, Ve, 3, 1, Sericite</li> <li>*, 248°, (3), Rf, Un, Ve, 3, 1,</li> </ol>
		100% TCR	<b>102.83m</b> <b>102.86</b> € d=0.88	103.0	$\begin{array}{c} \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot &$			sw			99 2.7		Sericite	°, 102°, (3), Rf, Pin, Ve, 1.5, 1, , Fe Sn °, 113°, (3), Rf, Un, Fe Sn, 3, 1 °, 297°, (3), Rf, Un, Fe Sn, 3, 1
_⊥_ See	Sta	ndard	Sheet	104.0 <b>s for</b>		GHD							Job No.	
			reviati		GIP	Lvl 2 29 Christie Stre	eet, St Leonards NSW 2065 / F: 61 2 9462 4710 E: slr	Austral	ia					521697

File: 12521697 BH1403 14 OF 47

		: Fu	iture Ge nowy 2.0										HOLE	NO:	BH1403
			antangai										SHEET :	15 OF 47	Version: A
OSIT	ION	: E:	649091	.6, N:	6037884	4.3 (GDA2020 / 55)	SURFACE RL : 12	36.49 (	AHD)			AN	GLE FROM	/ HORIZON	NTAL: 1° TO 282°
		: LF′				OUNTING : Track	CONTRA		· ·					R : JL/RD	
						MPLETED :	DATE LOGGED : 21/								
ASIN		RILLIN	FER : F		DP	RREL (Length) : 3.0 m	MATERIAL	DII	. Serie	s 6-12m	1310			NDITION : URAL DEF	
ROGRI	_									mated			Spacing		Additional Data
Casing & Additives	WATER	TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain s	CRIPTION size, colour, fabric, texture aponents, moisture, dural			h Is <sub>(50)</sub> MPa - Axial Diametral S	RQD (%)	Defects/m/ core run	<sup>20</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup>300</sup> <sup></sup>	(core ori roughness	t type, alpha, beta, entation confidence) , shape, composition aperture or thickness inness, joint alteratio
	- 10% Water LOSS	DRILL DEPTH           100% TCR           110.11           100% TCR           115.13           100% TCR           117.31           100% TCR           117.90           100% TCR           117.90           100% TCR           117.90           100% TCR	4 <u>o</u> <u>L</u> 112.64m 112.65m a=5.54 117.93m 117.85m d=0.87	<u> </u>		massive, porphyritic, w spaced healed defects	medium grained, grey green, ith multiple very closely to closely , randomly oriented, with sed quartz veins <1-5mm, rando te <i>(continued)</i>	, sw			96         100         88         89         100         92	4.3         0         7.5         6.1         4.1         4.2		Sencile Ve 112.24, Jt, 5 Sericite Ve 112.72, Jt, 4 Sericite Ve 112.72, Jt, 4 Sericite Ve 113.04, Jt, 2 Sericite Ve 113.04, Jt, 2 Sericite Ve 113.04, Jt, 2 113.04, Jt, 2 113.04, Jt, 2 113.05, IS, 1 113.42, Jt, 5 113.45, IT3, 1 100 mm, 1, 6 114.09, Jt, 7 114.09, Jt, 7 114.09, Jt, 7 114.09, Jt, 7 114.09, Jt, 7 115.20, Jt, 4 115.35, Jt, 3 115.42, Jt, 6 115.40, Jt, 6 115.40, Jt, 6 115.40, Jt, 6 115.40, Jt, 3 116.64, Jt, 4 117.90, Jt, 3 117.90, Jt, 4 118.25, Jt, 2 118.90, Jt, 2 118.90, Jt, 4 119.09, Jt, 4 110.05, Jt, 2 110.05, Jt, 2 110.	<ol> <li>21°, 250°, (3), Sik, Un, Fe Sn, 1,5</li> <li>5°, 249°, (3), So, Pin, Fe Sn, 1, 1</li> <li>4°, 087°, (3), Rf, Ir, Fe Sn, 3, 1</li> <li>4°, 087°, (3), Rf, Ir, Fe Sn, 3, 1</li> <li>7°, 280°, (3), Rf, Pin, Fe Sn, 1, 5, 1</li> <li>5°, 282°, (3), Rf, Pin, Fe Sn, 1, 1</li> <li>5°, 282°, (3), Rf, Un, Fe Sn, 3, 1</li> <li>8°, 094°, (3), R, St, Fe Sn, 3, 1</li> <li>8°, 094°, (3), Rf, Un, Fe Sn, 1, 5, 1</li> <li>5°, -(A), Rf, In, Fe Sn, 1, 5, 1</li> <li>5°, -(A), Rf, In, Fe Sn, 3, 1</li> <li>3°, -(-), Rf, Pin, Fe Sn, 1, 5, 1</li> <li>5°, -(-), Rf, Un, Fe Sn, 3, 1</li> <li>5°, -(-), Rf, In, Fe Sn, 3, 1</li> <li>5°, -(-), Rf, In, Fe Sn, 3, 1</li> <li>5°, -(-), So, Pin, Fe Sn, 1, 1</li> </ol>
				-	- • <del>+</del> • + • +						94	3.4			
				120.0	- • + •		vith vugs up to 40mm, possibly							2	25°, 172°, (3), Slk, Pln, Fe Co, 0.
			Sheet		GHD	GHD	et Stlennarde NSW 200	5 Auetro	lia					Job No.	504007
eta			oreviati scripti		<b>S</b>	T: 61 2 9462 4700	eet, St Leonards NSW 206 F: 61 2 9462 4710 E: s			n				12	521697

	JECT	: Sn	iture Ge lowy 2.0	)	on JV							HOLE		BH1403			
			Intanga										16 OF 47	Version: A			
		1 : E: : LF1		I.6, N: 6		4.3 (GDA2020 / 55) DUNTING : Track	SURFACE RL : 12		AHD) Deepcore		AN		M HORIZON	TAL: 1° TO 282°			
				/23 D.		MPLETED :	DATE LOGGED : 21/2		LOGGED B	Y : S	R/PN/						
			ER : F			RREL (Length) : 3.0 m			: Series 6-1				NDITION :				
		RILLIN	IG	_			MATERIAL		1				URAL DEFI				
& Additives	WATER	DEPTH LCK (%)	STEELD TESTS	DEPTH (m)	+ GRAPHIC • -LOG +	ROCK NAME: grain s inclusions or minor com resulted from shearing	CRIPTION size, colour, fabric, texture pponents, moisture, durab		Estimate Strength Is <sub>(50)</sub> • - Axial • - Diametral 10, 5, 6, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,	MPa	RQD (%) Defects/m/ core run	Spacing (mm)	Defect (core orie roughness, coating, a joint roug	Additional Data type, alpha, beta, entation confidence) shape, composition aperture or thickness hness, joint alteratio			
		TCR 120.43 100% TCR	a=0.3		- · + · + · + - · + · + · + - · + · + · +	massive, porphyritic, w spaced healed defects	medium grained, grey green, ith multiple very closely to closely r, andomly oriented, with ced quartz veins <1-5mm, random te <i>(continued)</i>				94 3.4		1 120.22-120.4	6°, 251°, (3), Sik, Pin, Fe Sn, 0.5 3, DB °, 312°, (3), So, Pin, Fe Sn, 1, 1			
				- 121. <u>0</u> - -	+ · + - · + · + · + - · + · + · +						100 2.7			°, 105°, (3), So, Pln, Fe Sn, 1, 1 9°, 058°, (3), Sik, Pln, Fe Sn, 0.5			
				122.0	+ • + • + • + •								121.85, Jt, 63 Sericite Ve	°, 046°, (3), So, Pln, Fe Sn, 1, 1,			
		122.26 100% TCR			- · + · + · + - · + · + · + - · + · + · + + · + - · + ·						95 6.3		1, Sericite Ve 122.34, Jt, 36 122.46, SS, 2 1, Sericite Ve 122.50, SS, 4 1 122.75, SS, 3	°, 240°, (1), So, Pin, Fe Sn, 1, 1 6°, 311°, (1), Sik, Pin, Fe Sn, 0. 6°, 288°, (1), Sik, Pin, Fe Sn, 0. 1°, 310°, (1), Sik, Pin, Fe Sn, 0.			
		123.05 100% TCR		- 123 <u>.0</u> - - -	+ · + - · + · + · + - · + · + · + - · + · + · + - · + ·								1, Sericite Ve 122.85, Jt, 76 Sericite Ve	°, 351°, (1), So, Un, Fe Sn, 2, 1 5°, 047°, (1), Sik, Un, Kt Ve, 1.5			
	10% Water LOSS				+ • + • + • + • + • + • + • + • + • + •						100		123.97, SS, 2 1, Sericite Ve	7°, 091°, (1), Sik, Pin, Fe Sn, 0.			
	-	124.84	_	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$							°, 032°, (1), So, Pin, Fe Sn, 1, 1						
		TCR							125 <u>0</u> + · · · + · + - · + - · + - · + - · +	· · + · + + · + · + · + ·	124.87m, quartz vein, :	33°, thickness up to 30mm.					
			<b>125.95m</b> <b>125198km</b> a=9.77	- 126.0 -	- · + · + · + - · + · + · + - · + · + · + + · +						3.1		Sericite Ve 126.26, Jt, 19	°, 279°, (1), So, Pln, Kt Ve, 1, 1, °, 269°, (1), So, Un, Kt Ve, 2, 1,			
		126.44 100% TCR		- - - - 127.0	+ • + • + • + • + • + • • + • + • + • + • • + •								Sericite Ve	°, 065°, (1), So, Pin, Kt Ve, 1, 1			
					· + · · + · + · +						97 2.9		Sericite Ve 127.27, Jt, 53 CLAY Ve 127.31, Jt, 50 Sericite Ve	, uos , (1), so, Prin, Kt Ve, 1, 1, °, 047°, (1), Rf, Pin, Kt Ve, 1.5, 1 °, 355°, (1), Rf, Pin, Kt Ve, 1.5, 1 °, 135°, (1), Rf, Pin, Kt Ve, 1.5, 1			
		127.81 100%			· · + · + · +						96 3.8						
⊥⊥ Sec	Sta	TCR ndard	Sheet	128.0 s for	· · + ·	GHD				SS	~   m		Job No.				
			reviati		GID	Lvl 2 29 Christie Stre	et, St Leonards NSW 2065		ia					521697			

RO.I			iture Ge iowy 2.0		on JV		HC	DLE N	NO:	BH1403
			intanga				SHE	ET : 1	7 OF 47	Version: A
OSI	TION	: E:	649091	I.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.49 (AHD)	ANGLE F	ROM	HORIZON	TAL: 1° TO 282
		: LF1		100 -		DUNTING : Track CONTRACTOR : Deepcore			: JL/RD/	
			ER : F			DMPLETED:         DATE LOGGED:         21/2/23         LOGGED BY:         SR/PI           ARREL (Length):         3.0 m         BIT:         Series 6-12m/S16			DITION :	
		RILLIN				MATERIAL			RAL DEFE	
ROGR	RESS	(%	å			DESCRIPTION 문 Strength Is,‱MPa	Spac (mr	cing m)		Additional Data type, alpha, beta,
Casing & Additives	WATER	HILD TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture, inclusions or minor components, moisture, durability	100 core run 100 40 Lun	,	(core orie roughness, coating, a	ntation confidence shape, composition perture or thickness ness, joint alteration
2.8	>	DEPTH 100% TCR 128.33	ഗ ഥ 128-മ32n 128-മ6%n	-	· + · + - · + ·	RHYODACITE: fine to medium grained, grey green, massive, porphyritic, with multiple very closely to closely spaced healed defects, randomly oriented, with			128.16, SS, 38	°, 253°, (1), Sik, Pin, Kt Ve, 0.5 , 025°, (1), So, Pin, Fe Sn, 1, 1
		100% TCR			- · + · + · + · + · + · +	moderately widely spaced quartz veins <1-5mm, randomly			120.10, 0, 00	, uzə , (1), du, r iii, r e dii, i, i
				-	+ • + • + • +	128.58m, quartz vein, 3mm, 25° <b>g</b> .				
				129 <u>.0</u> -	- • + • + • + - • + • + • +		0		129.10, SS, 53 1, Sericite Ve	°, 302°, (1), Slk, Pln, Kt Ve, 0.
					- · + · + · + - · + ·					
			129.95m	120.0	- · + · + · +	130.00m				
		130.19 100%	129.97m a=0.48	130. <u>0</u> -	+ + + + • + • • + •	RHYODACITE: medium to coarse grained, grey green, massive, porphyritic, with multiple very closely to closely spaced healed defects, randomly oriented, with moderately widely spaced quartz veins <1-5mm, randomly				
		TCR			- • + • + • +	oriented, with 1% pyrite 130.20-130.85m, closely spaced quartz veins up to 5mm, 25°a.			130.35, Jt, 65°	, 355°, (1), Rf, Ir, Fe Sn, 3, 1
				131.0	+ • + - • + • - • + •				131.00 ₩ 254	, 150°, (1), Rf, Pin, Fe Sn, 1.5,
				-	+ • + • • + •		8.7           		Sericite Ve	,, (.,,, i o on, ho,
					- · + · + · + - · + ·				131.55, Jt, 27°	, 232°, (1), Rf, Un, Fe Sn, 3, 1
SING	Water LOSS —	131.94 100%		- 132. <u>0</u>	- · + · + · + - · + ·				131.87, Jt, 40° Sericite Ve	, 290°, (1), Rf, Pin, Fe Sn, 1.5,
CASING		TCR			- • + • + • + - • + •				Sericite Ve	, 322°, (1), So, Pln, Kt Ve, 1, 1, °, 302°, (1), Sik, Pln, Fe Sn, 0.
					- · + · + · + - · + ·				132.51, Jt, 45° Sericite Ve 132.59, SS, 38 1, Sericite Ve	, 184°, (1), So, Pln, Fe Sn, 1, 1 °, 338°, (1), Slk, Pln, Fe Sn, 0
		132.91 100% TCR		133. <u>0</u>	- • + • + • + - • + •				L 132.61, SS, 32 Sericite Ve	°, 146°, (1), So, Un, Fe Sn, 2,
					+ • + - • + • + • +		0.7		Sericite Ve	°, 142°, (1), So, Pin, Fe Sn, 1,
		133.62 100% TCR	133.64m 136.67m d=2.89		+ • + • • + • • • + •				Sericite Ve 133.71, Jt, 80° 0.5, 1	, 328°, (1), So, Un, Fe Sn, 2, 1 , 020°, (2), Slk, Pln, CLAY Ve,
				134. <u>0</u>	+ • + •				1, CLAY Ve 	°, 165°, (2), Slk, Pln, Fe Sn, 0. , 092°, (2), So, Pln, Fe Sn, 1, 1 °, 089°, (2), Slk, Pln, Fe Sn, 0.
					- • + • + • + - • + • + • +				1, CLAY Ve	
					- · + · + · + - · + ·		י         		13/ 22 = 000	320° (2) So 110 141/0 9 4
				135. <u>0</u>	- · + · + · + - · + ·				Fe Ve	, 320°, (2), So, Un, Kt Ve, 2, 1, , 110°, (2), Rf, Un, Fe Sn, 3, 1,
		135.33 100% TCR			- • + • + • +				Ve	, 080°, (2), Rf, Pln, Fe Sn, 1.5,
			405 5-		+ • + • • + • • • + •	2	ייי     מ 		135.88, Jt, 80°	,, (-), Rf, Un, Fe Sn, 3, 1, Kt , 085°, (3), Rf, Un, Fe Sn, 3, 1,
Ш		ndard	135.95m 136=98m Sheet	136.0	+ • +	GHD Lvl 2 29 Christie Street, St Leonards NSW 2065 Australia			Job No.	

PRO			iture Ge nowy 2.0		on JV							HOLE	NO:	BH1403
OC	AT IO	N : Ta	antangai	ra Adit								SHEET :	18 OF 47	Version: A
				.6, N: (		4.3 (GDA2020 / 55)	SURFACE RL : 1236		/		AN			ITAL: 1° TO 282
		E : LF1		- 20		OUNTING : Track	CONTRACT DATE LOGGED : 21/2/2			00			R : JL/RD	
			ER : F			OMPLETED: ARREL (Length) : 3.0 m	DATE LOGGED . 21/2/2		LOGGED BY : Series 6-12n				NDITION :	
		ORILLIN					MATERIAL	BII	. 001100 0 1211				JRAL DEFI	
ROGI	RESS		a S			5500			Estimated Strength Is <sub>(50)</sub> MF	2		Spacing (mm)		Additional Data
Casing & Additives	WATER	HE TCR (%)	SAMPLES &	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain size	RIPTION ze, colour, fabric, texture, oonents, moisture, durabili	Weathering	●- Axial O - Diametral 10, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	RQD (%)	Defects/m/ core run	20 300 100 100 100	(core orie roughness, coating, a	shape, composition shape, composition aperture or thickness hness, joint alteration
- CASING -	- 10% Water LOSS	100% TCR 138.36 100% TCR 142.86 100% TCR	a=7.49 138.15m 1387.84n a=5.27		- · + · + - · + · +	massive, porphyritic, with spaced healed defects, r moderately widely space oriented, with <1% pyrite	d quartz veins <1-5mm, randomly	SW		94 97 94	1.3 2.7 5		136.40, Jt, 84 Ve 136.51, Jt, 45 136.86, Jt, 64 136.89, Jt, 90 136.95, Jt, 60 137.07, Jt, 35 CLAY Ve 137.23, Jt, 90 137.24, Jt, 76 138.06, Jt, 66 CLAY Ve 138.25, Jt, 40 138.25, Jt, 40 139.18, Jt, 18 139.37, Jt, 35 140.03, Jt, 85 140.16, Jt, 55 140.38, Jt, 75 140.38, Jt, 75 141.13, Jt, 30 141.14, Jt, 30 141.62, S5, 2 142.30, Jt, 52 Sericite 143.34, Jt, 47 143.34, Jt, 47	<ul> <li>*, 310°, (3), Rť, Un, Fe Sn, 3, 1</li> <li>*, 025°, (3), Rť, Un, Kt Ve, 3, 1</li> <li>*, 036°, (3), Rť, Un, Kt Ve, 3, 1</li> <li>*, 036°, (3), Rť, Un, Kt Ve, 3, 1</li> <li>*, 030°, (3), Rť, Un, Fe Sn, 3, 1</li> <li>*, 030°, (3), Rť, Un, Fe Sn, 3, 1, Kt</li> <li>*, 030°, (3), Rť, Un, Fe Sn, 3, 1, Kt</li> <li>*, 030°, (3), Rť, Un, Fe Sn, 3, 1, Kt</li> <li>*, 030°, (3), Rť, Un, Fe Sn, 3, 1, Kt</li> <li>*, 030°, (3), Rť, Un, Fe Sn, 1, 5, 1</li> <li>*, 130°, (3), Rť, Un, Fe Sn, 1, 5, 1</li> <li>*, 170°, (3), Rť, Un, Fe Sn, 1, 5, 1</li> <li>*, 170°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 160°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 160°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (3), Rť, Pin, Fe Sn, 1, 5, 1</li> <li>*, 285°, (2), So, Un, Kt Ve, 2, 1, 1</li> </ul>
			143.63m 143.65m d=7.44 144.00m	  144.0	+ • + - • + • - • + • + • + - • + •					94	2.1			°, 243°, (2), Rf, Pin, Fe Sn, 1.5,
			Sheet reviati	s for	GHI	GHD	t, St Leonards NSW 2065 A	untral					Job No.	521697

LIEI			iture Ge nowy 2.0	eneratio	n JV				HOLE	NO:	BH1403
			antangai						SHEET :	19 OF 47	Version: A
POSI	TION	I : E:	649091	I.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.49 (AHD)	)	AN	GLE FROM	HORIZON	TAL: 1° TO 282
		E : LF1				OUNTING : Track CONTRACTOR : Dee	•			R : JL/RD/	
			): 21/2/ TER : F				GED BY : Series 6-12m/S			ENDITION :	
101		RILLIN		VV I	DF	MATERIAL		10		JRAL DEFE	
Rogi	RESS	2	a su				Estimated		Spacing		Additional Data
asing Additives	WATER	편 로 TCR (%)	SAMPLES &	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain size, colour, fabric, texture,	ngth Is <sub>(50)</sub> MPa ●- Axial O-Diametral	RQD (%) Defects/m/ core run	<sup>62 6 6</sup> 00 00 00 00 00 (mm)	(core orie roughness, coating, a	type, alpha, beta, entation confidence) shape, composition perture or thickness
0.00	>	DEPTH 100% TCR 144.27 100%	<u>்</u> பட 14த்றதுள்			RHYODACITE: medium to coarse grained, grey green, massive, porphyritic, with multiple very closely to closely spaced healed defects, randomly oriented, with moderately widely spaced quartz veins <1-5mm, randomly		94 F		Joint rougi	nness, joint alteratio
		TCR			· · + · + · + · · + · + · +	oriented, with <1% pyrite (continued)				CLAY Ve. (DE	°, 025°, (2), Rf, Un, Fe Sn, 3, 1, !?)
				- 145 <u>.0</u>	· · + · + · + · · + · + · +	144.96m, quartz vein, 5mm thick, 80° <b>c</b> .				Ve, Sericite 144.88, Jt, 80 Ve, Sericite	°, <sup>′</sup> 095°, (2), Rf, Un, Fe Sn, 3, 1, °, 052°, (2), Rf, Un, Kt Ve, 3, 1, I °, 200°, (2), Rf, Un, 3, 1, Sericite
					+ • + • • + • + • +	145.25m, set of 3 quartz veins, 3mm thick, 80° <b>a</b> .		82 3.8			
				- - 146. <u>0</u>	+ • + • • + • + • + • • + •	145.90-149.30m, slightly to moderately chlorite altered.		3.8		145.84, Jt, 26 4, Ca Co, Sn, 145.88, Jt, (2)	°, 275°, (2), Rf, Pln, CLAY Co, 1 white staining? , Rf, Pln, Fe Sn, 1.5, 1
					· · + · + · + · · + · + · +					146.16, Jt, (2)	, Rf, Pin, Cn, 1.5, 1 , Rf, Pin, Fe Sn, 1.5, 1 , Rf, Pin, Fe Sn, 1.5, 1
		146.88			· · + · + · + · · + · + · +					146.61, Jt, 47 146.68, Jt, 47 146.73, Jt, 47	°, 280°, (2), Rf, Un, Cn, 3, 1 °, 280°, (2), Rf, Un, Cn, 3, 1 °, 280°, (2), Rf, Un, Cn, 3, 1
		100% TCR		147. <u>0</u> -	+ • + • • + • + • +						ered as rock fragments, 170mm °,, (-), Rf, Un, Fe Sn, 3, 1
		147.71			+ • + • • + • + • + • • + •			3.6		147.55, Jt, 36	°,, (-), Rf, Un, Fe Sn, 3, 1 °,, (-), Rf, Ir, Fe Sn, 3, 1
- CASING	10% Water LOSS -	100% TCR 148.19		148.0	+ • +	147.70-147.90m, with quartz veins up to 10mm.		2.1		148.10, Jt, 40 Ve	°, 135°, (2), Rf, Un, 3, 1, Sericite
	10%	100% TCR	148.25m 148:29m a=2.8		· · + · + · + · · + · + · +						°, 310°, (2), Rf, Un, Fe Sn, 3, 1
				- - - 149. <u>0</u>	+ · + · + · + · · + · · · + ·			96 3.1		148.85, Jt, 18	°, 110°, (2), Rf, Ir, Fe Sn, 3, 1 °, 260°, (2), Rf, Un, Fe Sn, 3, 1 °, 280°, (2), Rf, Un, Mn Sn, 3, 1
					+ · + · + · + · + · + · + · + ·			3		149.14, Jt, 19	°, 110°, (2), Rf, Un, Kt Ve, 3, 1
		149.79			· · + · + · + - · + · + · +						
		TCR		150 <u>.0</u>	+ + + + + + + + + + + +					150.10, SS, 4 Sericite	3°, 100°, (1), Slk, Un, Ve, 1.5, 1
					+ • + • + • + • + • + •						
				- 151. <u>0</u>	+ • + + • + • + • + + • +			0.5			
					· · + · + · + · · + · + · +						
		151.81 100% TCR	151.90m 151.90m a=9.87	152.0	+ • + • • + • + • +			100		151.82, SS, 4 Sericite	4°, 290°, (1), Sik, Un, Ve, 1.5, 1
		ndard	Sheet previati	s for	GHI	GHD Lvl 2 29 Christie Street, St Leonards NSW 2065 Australia				Job No.	521697

File: 12521697 BH1403 19 OF 47

			uture Ge nowy 2.0	eneratic า	on JV						HOLE	<b>10</b> :	BH1403
			antanga								SHEET : 2	0 OF 47	Version: A
POS	ITIO	N : E:	64909	1.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.4	49 (	AHD)		AN	GLE FROM	HORIZON	TAL: 1° TO 282
		E : LF				OUNTING : Track CONTRACTO		•				: JL/RD/	
						DMPLETED : DATE LOGGED : 21/2/23		LOGGED BY :					
JAS			TER : I	2001	BA	ARREL (Length) : 3.0 m MATERIAL	BH	: Series 6-12m	1516			DITION : RAL DEFE	
ROG	RESS							Estimated			Spacing		Additional Data
		TCR (%)	SAMPLES & FIELD TESTS	E)	<u>0</u>	DESCRIPTION ROCK NAME: grain size, colour, fabric, texture,	ering	Strength Is <sub>(50)</sub> MPa	n %	/u/s	(mm)	(core orie	type, alpha, beta, intation confidence)
asing Additives	WATER	TCI	MPL ELD 1	DEPTH (m)	GRAPHIC LOG	inclusions or minor components, moisture, durability	Weathering		gD (	Defects/m/ core run		roughness, coating, a	shape, composition perture or thickness
s'a	Ś	DRILL DEPTH	SAS	B		RHYODACITE: medium to coarse grained, grey green,	Š SW	8 7 7 7 7 7 7 7 7	Ĕ	Δŭ	100 30 00 10 50 50 50 50 50 50 50 50 50 50 50 50 50	152.04, SS, 4	ness, joint alteratio (°, 296°, (1), Sik, Un, Ve, 1.5, 1
		TCR			+ • + • <b>+</b> •	massive, porphyritic, with multiple very closely to closely spaced healed defects, randomly oriented, with	300	liii 🎆			i i 🐰 i	Sericite	
					+ • + • + • •	moderately widely spaced quartz veins <1-5mm, randomly oriented, with <1% pyrite (continued)						152.32, SS, 4 Sericite	3°, 274°, (1), Slk, Un, Ve, 1.5, 1
					+ • +								
					+ • +				100	6.			
				-	+ • +				Ì				
		1	153.07m d=5.02	153. <u>0</u>	- • + • + • +	·							
		1	153.21m a=6.94		- • + • + • +	153.20m, possible flow banding at 25° <b>a</b> .							
		153.41	-		· · + · + · +	Containing possible norr building at 20 %.				Ц		- 153 /6 14 000	
		58% TCR			+ - + - +								°,, (-), Rf, Un, Fe Sn, 3, 1 °,, (-), Rf, Pin, Fe Sn, 1.5, 1
		1		-	+ • + + • +				-			153.71-153 9	), DB, highly weathered, pieces
	SS –	1		154.0	+ · +	153.90m			48	2.4		recovered	., _,
	er LO;	1			$\times$	CORE LOSS 0.35m (153.90-154.25)							
	10% Water LOSS	154.25 100%	-		$ \land  $	154.25m						40.00	
	- 10%	100% TCR			+ • + • • <b>+</b> •	RHYODACITE: medium to coarse grained, grey green, massive, porphyritic, with multiple very closely to closely spaced healed defects, randomly oriented, with widely	SW					154.33, SS, 3	2°,, (-), Slk, Un, Kt Ve, 1.5, 1
					+ • + • + •	spaced quartz veins, randomly oriented, with <1% pyrite 154.25m, slightly altered chlorite.						154.54, Jt, 44	°,, (-), Rf, Un, Fe Sn, 3, 1
					+ · + - • <b>+</b> ·						i i 🎇 i i	154.71, Jt, 74	²,, (-), Rf, Un, Cn, 3, 1
				155.0	+ • +							154.95, Jt, 42	°,, (-), Rf, Un, Fe Sn, 3, 1
				-	+ • +						i i i 📓		
					+ + +				92	2.9			
					- · + · + · +								°,, (-), Rf, Un, Cn, 3, 1 °,, (-), Rf, Un, Cn, 3, 1
					· · + · + · +								
				-	· · + · + · +								
SING				156. <u>0</u>	· · + ·								
		156.29			- • + • +								
	X	100%	-		- · + ·					$\vdash$		450.40	
		TCR		-	- • + •				100	1.8		100.43, Jt, 41	°,, (-), Rf, Cu, Ve, 1.5, 1, Serio
		1			+ • + • • <b>+</b> •				Ĕ	[~			
		156.86 100%	156.94m		+ • + • • + •				-	$\vdash$			
		TCR	156.97/m a=7.7	157 <u>.0</u>	+ • +	4							
		1		-	+ • +								
		1			+ • +							157.41, Jt, 29	°,, (-), Rf, Un, Ve, 3, 1, Sericit
		1			+ • +								
		1			- • <b>+</b> • + • +								
	- SSC	1		158.0	· · + · + · +								°,, (-), Rf, Ir, Ve, 3, 1, Sericite
	0-5% Water LOSS	1			· · + · + · +				95	2.8			<sup>2</sup> ,, (-), Rf, Un, Fe Sn, 3, 1 <sup>2</sup> ,, (-), Rf, Un, Fe Sn, 3, 1
	<b>5% W</b> έ	1			· · + · + · +				.				
	- 6				+ - + • +								
		1			- • + • + •						📓		
					- + -								<sup>2</sup> ,, (-), Rf, Un, Ve, 3, 1, Sericit <sup>2</sup> ,, (-), Rf, Ir, Ve, 3, 1, Sericite
		1		159.0	- · + ·							158.94, Jt, 70	<sup>o</sup> ,, (-), Rf, Ir, Ve, 3, 1, Sericite
		1			+ • + • • + •								
		159.39			+ · + - · + ·						📓		
		100% TCR	]		+ • +					$\square$			
					+ • +				100	8			
		1		-	- • + • + • +	- -			<b></b>	2		159.77, Jt, 52	<sup>e</sup> ,, (-), Rf, Un, Ve, 3, 1, Sericit
		 	   Chart	160.0	· · + ·						1 1 1 1 1 1 1 1 1	Job No.	
	ະ ວໄ		l Sheet previat		GII	GHD Lvl 2 29 Christie Street, St Leonards NSW 2065 Au							521697

RIG TYPE : DATE STAR CASING DIA DR ROGRESS Several A C CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA DR ROGRESS CASING DIA CASING DIA DR ROGRESS CASING DIA CASING CASING DIA CASING CASING DIA CASING CASING DIA CASING CASING CASING CASING CASING CASING CASING CASING CA	: E: 64 : LF130 RTED : AMETE RILLING (%) % DRILL DRILL DRILL DRILL 100% TCR 160.81 100% 166	49091.( 0 21/2/2 R : P\ S SUBJES SUBJES S S S S S S S S S S S S S	6, N: 60 3 DA WT (E) HLd30 	MC TE CC BA	ROCK NAME: grain s inclusions or minor com RHYODACITE: mediur massive, porphyritic, w spaced healed defects	SURFACE RL : 1236. CONTRACT( DATE LOGGED : 21/2/2 MATERIAL CRIPTION ize, colour, fabric, texture, ponents, moisture, durability n to coarse grained, grey green, th multiple very closely to closely randomly oriented, with widely indomly oriented, with <1% pyrite	OR : 3 l BIT	,	n/S16	ects/m/ e run	Gle From Drillei Th/Mtg/jl Bit com	R : JL/RD/ /EØHECKE NDITION : JRAL DEFE Defect (core oria roughness, coating, a	ED BY: New
RIG TYPE : DATE STAR CASING DIA DR ROGRESS SUBURY SUBURY I I I I I I I I I I I I I I I I I I I	: LF13 RTED : AMETE RILLING (%) X DRILL DRILL DRILL DRILL DRILL 100% TCR 160.81 100% 160.81 100% 160.81 100% 160.81 100% 160.81 100% 160.81 100% 160.81 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 100% 10%	0 21/2/2 R : P\ S SUBLES & SUBLES & SUB	3 DA WT (W) HLdgd 	MC BA BA + + + + + + + + + + + + + + + + + + +	DUNTING : Track DMPLETED : RREL (Length) : 3.0 m DES( ROCK NAME: grain s inclusions or minor com RHYODACITE: mediur massive, porphyritic, w spaced healed defects spaced quartz veins, ra	CONTRACTO DATE LOGGED : 21/2/2 MATERIAL CRIPTION size, colour, fabric, texture, ponents, moisture, durability n to coarse grained, grey green, th multiple very closely to closely randomly oriented, with widely	Meathering K	Deepcore LOGGED BY : Series 6-12r Estimated Strength Is <sub>(50</sub> MI	n/S16	PN/T	DRILLEI H/MTG/JL BIT CON NATU Spacing (mm)	R : JL/RD/ /EØHECKE NDITION : JRAL DEFE Defect (core oria roughness, coating, a	WG D BY : New ECTS Additional Data t type, alpha, beta, entation confidence) shape, composition aperture or thickness
DATE STAR CASING DIA DR ROGRESS Sensibility DR ROGRESS Sensibility DIA DR DR DR DR DR DR DR DR DR DR DR DR DR	RTED : AMETE RILLING (%) E DRILL DRILL DRILL DRILL DRILL 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160.81 160	21/2/2 R : P\ S S S S S S S S S S S S S	DEPTTH (m)	BA           BA           BA           Image: State of the s	MPLETED : RREL (Length) : 3.0 m DES( ROCK NAME: grain s inclusions or minor corr RHYODACITE: mediur massive, porphyritic, w spaced healed defects spaced quartz veins, ra	DATE LOGGED : 21/2/2 MATERIAL CRIPTION ize, colour, fabric, texture, ponents, moisture, durability n to coarse grained, grey green, th multiple very closely to closely randomly oriented, with widely	Meathering K	Estimated Strength Is <sub>(50)</sub> MF	n/S16		H/MTG/JL BIT CON NATU Spacing (mm)	/EMHECKE NDITION : JRAL DEFE Defect (core orie roughness, coating, a	D BY : New ECTS Additional Data t type, alpha, beta, entation confidence) shape, compositior aperture or thickness
CASING DIA DR ROGRESS Saving Bar Saving Bar	AMETE RILLING (%) CD DERLL DEPTH 100% TCR 160.81 100% 161.52 100%	R : P/ SWBLES & SAMPLES & FIELD TESTS FIELD TESTS	DEPTTH (m)	PA + + + + + + + + + GRAPHIC + + + + + + + + + + + + + + + + + + +	RREL (Length) : 3.0 m DES( ROCK NAME: grain s inclusions or minor com RHYODACITE: mediur massive, porphyritic, w spaced healed defects spaced quartz veins, ra	MATERIAL CRIPTION ize, colour, fabric, texture, ponents, moisture, durability n to coarse grained, grey green, th multiple very closely to closely randomly oriented, with widely	Weathering	: Series 6-12r Estimated Strength Is <sub>(50)</sub> MR	n/S16		BIT CON NATU Spacing (mm)	JRAL DEFE	New ECTS Additional Data t type, alpha, beta, entation confidence) shape, compositior aperture or thickness
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Cashig R Additives 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100% TCR 160.81 100% TCR 161.52 100%	60.94m 30-989n	- - - - - - - - - - - - - - - - - - -	+ · + · + · + · + · + + · + · + · + · + · + · + · + · + · +	ROCK NAME: grain s inclusions or minor com RHYODACITE: mediur massive, porphyritic, w spaced healed defects spaced quartz veins, ra	ize, colour, fabric, texture, ponents, moisture, durability n to coarse grained, grey green, th multiple very closely to closely randomly oriented, with widely	-	Strength Is <sub>(50)</sub> MF	RQD (%)	Defects/m/ core run	(mm)	Defect (core orie roughness, coating, a	t type, alpha, beta, entation confidence) shape, compositior aperture or thickness
11 11 11 11 11 11 11 11 11 11 11 11 11	100% TCR 160.81 100% TCR 161.52 100%	60.94m 30-989n	- - - - - - - - - - - - - - - - - - -	+ · + · + · + · + · + + · + · + · + · + · + · + · + · + · +	ROCK NAME: grain s inclusions or minor com RHYODACITE: mediur massive, porphyritic, w spaced healed defects spaced quartz veins, ra	ize, colour, fabric, texture, ponents, moisture, durability n to coarse grained, grey green, th multiple very closely to closely randomly oriented, with widely	-	- Axial	EH RQD (%)	Defects/n core run	20 300 1000	(core orie roughness, coating, a	entation confidence) shape, compositior aperture or thickness
11 11 11 11 11 11 11 11	100% TCR 160.81 100% TCR 161.52 100%	60.94m 30-989n	- - - - - - - - - - - - - - - - - - -	+ · + · + · + · + · + + · + · + · + · + · + · + · + · + · +	massive, porphyritic, w spaced healed defects spaced quartz veins, ra	th multiple very closely to closely , randomly oriented, with widely	-						
11	100% TCR 161.52 100%	307.98Pn	161. <u>0</u> -						100	2.8		160.41, Jt, 46	5°,, (-), Rf, Un, Ve, 3, 1, Sericite 5°,, (-), Rf, Un, Ve, 3, 1, Sericite °,, (-), Rf, Un, Ve, 3, 1, Sericite
11	100%		+	+ · + · + · + · + · + ·					100	0			
1	162 24			· + · + · + + · + + · + + · + + · +					100	1.4		161.86, Jt, 74	I°, —, (-), Rf, Un, Fe Sn, 3, 1
NG	162.21 100% TCR			$+ \cdot + + \cdot +$	163.70-163.97m, with a up to 10mm	juartz and calcite veins, 20-58° $lpha$			100	£			
1	165.32 100% TCR	54.80m 9483∰ d=5.18		$+ \cdot + + \cdot +$								—— 164.55, Jt, 64	1°,, (-), Rf, Un, Fe Sn, 2, 1 1°,, (-), Sik, Un, Fe Sn, 1.5, 1 1°,, (-), Rf, Un, Fe Sn, 3, 1
				$+ \cdot + \cdot$					66	2.5			r°,, (-), Rf, Un, Fe Sn, 3, 1 r°,, (-), Rf, Un, Sn, 3, 1, Sericite
	16 16 16 16 16 16 7.73	66.95m 861989 a=7.41		$\cdot + \cdot +$								167.57, Jt, 50 (DB?)	1°,, (-), Rf, Un, Sn, 3, 1, Sericite 1°,, (-), Rf, Un, Sn, 3, 1, Sericite
1	100% TCR		168.0	$\cdot$ + $\cdot$ + $\cdot$ + $\cdot$ + $\cdot$	GHD				96	2.3		Job No.	2°,, (-), Rf, Un, Fe Sn, 3, 1 2°,, (-), Rf, Un, Fe Sn, 3, 1 1°,, (-), Rf, Un, Sn, 3, 1, Sericite

File: 12521697 BH1403 21 OF 47

DLIEN PRO			nowy 2.0	neratio	on JV							HOLE	NO:	BH1403
			antangai									SHEET :	22 OF 47	Version: A
POSI		I : E:	649091	.6, N: 6	603788	4.3 (GDA2020 / 55)	SURFACE RL : 1236.4	49 (/	AHD)	_	ANG	GLE FROM	HORIZON	ITAL: 1° TO 282
rig t	YPE	: LF1	130		M	OUNTING : Track	CONTRACTO	)R :	Deepcore			DRILLE	R : JL/RD	/WG
						OMPLETED :	DATE LOGGED : 21/2/23		LOGGED BY :					
CASI			ER : F	PWT	BA	ARREL (Length) : 3.0 m		BIT	: Series 6-12m/	S16			NDITION :	
ROGF		RILLIN					MATERIAL		Estimated			NA I Spacing	URAL DEF	ECTS Additional Data
& Additives	WATER	TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain siz	RIPTION ze, colour, fabric, texture, onents, moisture, durability	Weathering	Strength Is <sub>(50)</sub> MPa • Axial O-Diametral	RQD (%)	Defects/m/ core run	(mm)	Defec (core ori roughness	t type, alpha, beta, entation confidence) , shape, compositior aperture or thickness
0.00	M	DRILL DEPTH 100% TCR	S/	- - - - - -	+ · + • + · + + · + • + · +	massive, porphyritic, with spaced healed defects, ra	to coarse grained, grey green, multiple very closely to closely andomly oriented, with widely domly oriented, with <1% pyrite	SW		8	Δŭ	2000 2000 2000 2000 2000 2000 2000 200	168.03, Jt, 40	hness, joint alteratio °,, (-), Rf, Un, Fe Sn, 3, 1 J°,, (-), Rf, Un, Fe Sn, 3, 1
				- - - - - - - - - - - - - - - - - - -	· · + · + · · + · + · · + · + · · + · + · · + · +					96	2.3			
				- - - 170. <u>0</u> - - - -	· · + · + · · + · + · · + · + · · + · + · · + · +									3°,, (-), Rf, Un, Cn, 3, 1
		170.82 100% TCR	<b>170.91m</b> 1 <b>70.95m</b> a=6.47	171 <u>.0</u>	+ · + + · +	170.45-170.85m, slightly	altered.						- 170.54, Jt, 7 - 170.68, Jt, 7 - 171.09, Jt, 6 - 171.31, Jt, 6	<ol> <li>, (·), Rf, Un, Ve, 3, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Un, Ve, 3, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Un, Ve, 3, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Cu, Ve, 1.5, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Cu, Ve, 3, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Un, Ve, 3, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Un, Ve, 3, 1, Seriolit <sup>(*)</sup>,, (·), Rf, Un, Ve, 3, 2, Seriolit</li> </ol>
CASING	0-5% Water LOSS		<b>172.05m</b> <b>172.09m</b> d=2.81	- - - - - - - - - - - - - - - - - - -	· · + · + · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · · + · · · + · · · + · · · + · · · + · · · + · · · + · · · · · · · · · · · · · · · · · · · ·					100	2.4		172.20, Jt, 69	3°,, (-), Rf, Un, Ve, 3, 1, Sericit
					+ + + + + + + + + + + + + + + + + + +	173.00m, with very closel quartz healed defects, sh	y spaced, randomly oriented, eared with offset.						Sericite	36*,, (-), Sik, Un, Ve, 1.5, 1, 36*,, (-), Sik, Un, CLAY Ve, 1.£
		173.79 100% TCR		- - - - - - - - - - - - - - - - - - -	· · + · + · · + · + · · + · + · · + · + · · + · +								1 Soricito	34°,, (-), Sik, Pin, CLAY Ve, 0.5 59°,, (-), Sik, Ve, 1.5, 1, Sericite
			<b>174.91m</b> 1 <b>74:94</b> m d=4.19		· · + · + · · + · + · · + · + · · + · + · · + · +					96	7		174.91, SS, 7 Sericite	20°,, (-), Sik, Un, Qz Ve, 1.5, 1
				-	· • + • + • +									
				176.0	$\cdot \cdot + \cdot$								š	
0.00	Sta	ndard	Sheet	s for	GHI	GHD							Job No.	

	JECT	:Sr	iture Ge nowy 2.0	)								HOLE		BH1403
			antangar						( <del>.</del>				23 OF 47	Version: A
		N : E: E : LF1		.6, N: 6		I.3 (GDA2020 / 55) OUNTING : Track	SURFACE RL :		(AHD) : Deepcore		AN		R : JL/RD	ITAL: 1° TO 282°
			): 21/2/	23 D/	-	MPLETED :	DATE LOGGED :		LOGGED BY	: SR	'PN/1			
١SI	NG E		FER : F	PWT	BA	RREL (Length) : 3.0 m		BI	T : Series 6-12	2m/S16	i	BIT CO	NDITION :	New
	D	RILLIN	IG				MATERIAL					NAT	URAL DEFI	ECTS
& Additives	WATER SS	HIR TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC -LOG <u>-</u> .	ROCK NAME: grain s inclusions or minor com	ponents, moisture, d	urability teas			Defects/m/ core run	Spacing (mm)	Defect (core orig roughness, coating, a	Additional Data t type, alpha, beta, entation confidence) shape, compositior aperture or thickness hness, joint alteratio
		100% TCR 176.81			$+ \cdot + \cdot$	massive, porphyritic, wi spaced healed defects,	n to coarse grained, grey gr th multiple very closely to cl randomly oriented, with vic indomly oriented, with <1%	losely dely	V                                     	96	2		176.40, Jt, 60	°,, (-), So, Un, Fe Sn, 2, 1 <sup>1°,</sup> , (-), So, Pin, Fe Sn, 1, 1 7°,, (-), Sik, Un, Ve, 1.5, 1,
		100% TCR 177.03 100% TCR		177 <u>.0</u>	+ • + • + • + • • + • • • + • + • + • • + •					100	0		Sericite	18°,, (-), Sik, Un, Ve, 1.5, 1,
					· · + · + + · + · · + · + · · + · + · · + · +	178.00-178.20m, poten	tial flow banding at 55° <b>0</b> .						Fe Sn	°,, (-), So, Pin, CLAY Ve, 1, 1, 1°,, (-), Sik, Un, Fe Sn, 1.5, 1
			178.93m 178.96ñ a=3.26		· · + · + · · + · +					100	3.3		1 178.90, SS, 8 1 179.19, Jt, 45 179.32, Jt, 67	<sup>1°</sup> , 309°, (3), Rf, Un, Fe Mn Sn, 3 0°, 146°, (3), Sik, Un, Fe Sn, 1.5 °, 312°, (3), Rf, Un, Fe Sn, 3, 1 °, 180°, (3), Rf, Un, Fe Sn, 3, 1 °, 317°, (3), Rf, Un, Fe Sn, 3, 1
ONICAU		180.07 100% TCR		- - - - - - - - - - - - - - - - - - -		180.20-183.00m, bands	s of ironstaining and alterat	ion.					179.83, Jt, 28	<sup>1°</sup> , 331°, (3), Rf, Pin, Fe Sn, 1.5, <sup>1°</sup> , 083°, (3), Rf, Un, Fe Mn Sn, <sup>1</sup> <sup>1°</sup> , 335°, (3), Rf, Un, Fe Sn, 3, 1 <sup>1°</sup> , 161°, (3), Rf, Un, Fe Mn Sn, <sup>1</sup>
		181.23		- - - - 181.0	+ + + + + + + +					94	5.2		1 180.57, Jt, 37 180.68, Jt, 59	<ol> <li>(101°, (3), Rť, Un, Fe Mn Sn, 3, 1</li> <li>(-, (-), Rť, Un, Fe Mn Sn, 3, 1</li> <li>(-, (-), Rť, Pin, Fe Sn, 1.5, 1</li> <li>(-, -, (-), Rť, Un, Fe Sn, 3, 1</li> <li>(3) DR</li> </ol>
		100% TCR	181.95m 18⊭98m a=1.82		$+ \cdot + + + + + + + + + + + + + + + + + +$	181.20-182.60m, poten	ttial flow banding at 60° <b>α</b> .						L 181.35, Jt, 52 1 1 1 181.45, Jt, 49 181.75, Jt, 60	e", 112°, (2), Rf, Un, Fe Mn Sn, 3 °, 260°, (2), Rf, Pin, Fe Sn, 1.5, °, 276°, (2), Rf, Un, Fe Sn, 3, 1 °, 776°, (2), Rf, Un, Fe Sn, 3, 1
		183.10		- - - - - - - - - - - - - - - - - - -	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$					66	4.8			*, 110*, (2), R(, Un, Fe Sn, 3, 1 *, 145*, (2), R(, Un, Fe Sn, 3, 1 *, 260*, (2), R(, Un, Fe Sn, 3, 1 *, 280*, (2), R(, Un, Fe Sn, 3, 1 *, 210*, (2), Sk, Un, Fe Sn, 1.5
		100% TCR	183.92m 18319699		$+ \cdot + + + + + + + + + + + + + + + + + +$					96	3.6		183.37, Jt, 60	<sup>1°</sup> , 005°, (2), Rf, Ir, Fe Sn, 3, 1 <sup>1°</sup> , 299°, (2), Rf, Un, Fe Sn, 3, 1 <sup>1°</sup> , 309°, (2), Rf, Cu, Fe Sn, 1.5, <sup>1°</sup> , 328°, (2), Rf, Un, Fe Sn, 3, 1
let	ails	of abb	Sheet oreviati scripti	ons	GHD	<b>GHD</b> Lvl 2 29 Christie Stre	et, St Leonards NSW : F: 61 2 9462 4710				<u>ı (</u>		Job No. 12	521697

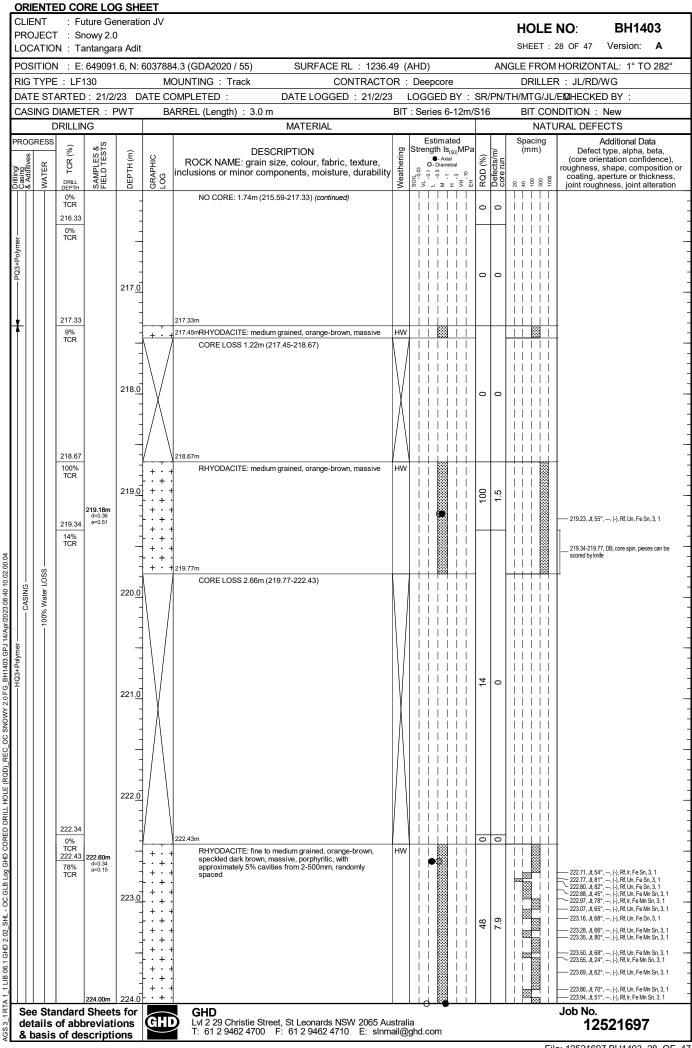
	ECT	: Sn	ture Ge owy 2.0	)	n JV								HOLE		BH1403
			ntangar										SHEET :		Version: A
				.6, N: 6		4.3 (GDA2020 / 55)	SURFACE RL :		,			ANG			TAL: 1° TO 282°
		: LF1		23 0		OUNTING : Track	DATE LOGGED : 2	RACTOR :	· ·		SR/	PN/TI		r: Jl/RD/ /En214HECKE	
			ER : F			RREL (Length) : 3.0 n			: Series 6					NDITION :	
		RILLIN					MATERIAL							JRAL DEFI	
ROGR	ESS	(%)	& TS	_					Estima Strength Is				Spacing (mm)		Additional Data
& Additives	WATER	DENTL DEPTH	SAMPLES &	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain	CRIPTION size, colour, fabric, text nponents, moisture, du	ture 📴	ixA-⊕ america 30E-00 7 -0.3 9 -0.1 9 -0.10 9 -0.1 9 -0.10	al	RQD (%)	Lerects/m/ core run	100 00 00 00 00 00 00 00 00 00 00 00 00	(core orie roughness, coating, a	type, alpha, beta, entation confidence) shape, composition aperture or thickness hness, joint alteration
		100% TCR	a=9.44	-	+ · + · · + · + · + ·	massive, porphyritic, v spaced healed defects	im to coarse grained, grey gre vith multiple very closely to clo s, randomly oriented, with wide andomly oriented, with <1% p	een, SW osely ely							°, 315°, (2), Rf, Un, Ve, 3, 1,
					+ • + • + • + + • +	(					96	3.6			°, 299°, (2), Rf, Un, Fe Sn, 3, 1 °, 319°, (2), Rf, Un, Fe Sn, 3, 1
	-	185.06 100% TCR 185.11		185. <u>0</u> - -	+ + + + + + + + + + + + + + + + + + +						<u>100</u>	0		185.12, SS, 7 1	1°, 200°, (3), Sik, Un, Fe Sn, 1.
		100% TCR		-	· · + · + · + · · + · + · +						100	4.5			°, 010°, (3), So, Un, Fe Sn, 2, 1 °, 340°, (3), Rf, Un, Fe Sn, 3, 1
		185.78 100% TCR 186.22	<b>186.04m</b> <b>186.08</b> m d=10.91	- 186. <u>0</u>	+ • + • + • + • + • + • + • + • + • + •						100	2.3			
		100% TCR			+ • + • + • + • + • + • + • +										°, 315°, (3), Rf, Un, Fe Sn, 3, 1 °, 111°, (3), Rf, Un, Cn, 3, 1
				- 187. <u>0</u>	· · + · + · + · · + · + · +									186.83, Jt, 29 1 186.91, WSm 10 mm, 1, 10	
				- - -	+ • + • + • + • + • + • + • +										°, 085°, (3), Rf, Un, Fe Sn, 3, 1 °, 315°, (3), Rf, Un, Fe Sn, 3, 1 °, 076°, (3), Rf, Un, Fe Sn, 3, 1 °, 316°, (3), Rf, Un, Fe Sn, 3, 1
SING	ater LOSS			- - - 188. <u>0</u>	· · + · + · + - · + · + · + - · + ·	187.59m, moderately	weathered.	MW			06	5.4			°, 042°, (3), Rf, Un, Fe Sn, 3, 1
CASING	0-5% Water				+ • + • + • + • + • + • + + • +									—— 188.26, Jt, 48	°, 300°, (3), Rf, Un, Fe Sn, 3, 1 °, 302°, (3), Rf, Un, Fe Sn, 3, 1 °, 340°, (3), Rf, Ir, Fe Sn, 3, 1
					· · + · + · + - · + · + · + + · +									188.75, Jt, 11 1	°, 101°, (3), Rf, Un, Fe Sn, 3, 1 °, 017°, (3), Rf, Un, Fe Mn Sn, 3 °, 039°, (3), Rf, Un, Fe Sn, 3, 1
		189.36	190 45	189 <u>.0</u> - -	+ · + · + · + · + · + ·									- 188.98. Jt. 29	°, 077°, (3), Rf, Un, X Co, 3, 2 °, 150°, (3), Rf, Un, Fe Mn Sn, 3
		100% TCR	189.45m d=7.25 189.85m a=2.45		· · + · + · + - · + · + · +	100 00	9mm thick 75°-							—— 189.73, Jt, 56	°, 225°, (3), Rf, Ir, Fe Sn, 3, 1 °, 043°, (3), Rf, Ir, Fe Sn, 3, 1
			a-2.45	190. <u>0</u> - -	+ · + · + · + · + · + ·	189.80m, quartz vein,	onnitunon, / 3 <b>4</b> .			1				(DB?)	°, 049°, (3), Rf, Un, Fe Sn, 3, 1, °, 019°, (3), Rf, Un, Fe Sn, 3, 1
					· · + · + · + · · + · + · +						100	4.2			°, 180°, (3), Rf, Un, Fe Sn, 3, 1 °, 108°, (3), Rf, Un, Fe Sn, 3, 1
				191. <u>0</u> 	+ · + + · + · + · + • + ·									1	1°, 197°, (3), Slk, Un, Fe Sn, 1 °, 290°, (3), Rf, Un, Fe Sn, 3, 1
		191.76			· · + · + · + · · + · + · +									191.35, SS, 1	5°, 180°, (3), Slk, Un, Fe Sn, 1 °, 210°, (3), Rf, Un, Fe Sn, 3, 1
			Sheets		+ + + + + +	GHD	eet, St Leonards NSW 2				81	5.6		Job No.	521697

File: 12521697 BH1403 24 OF 47

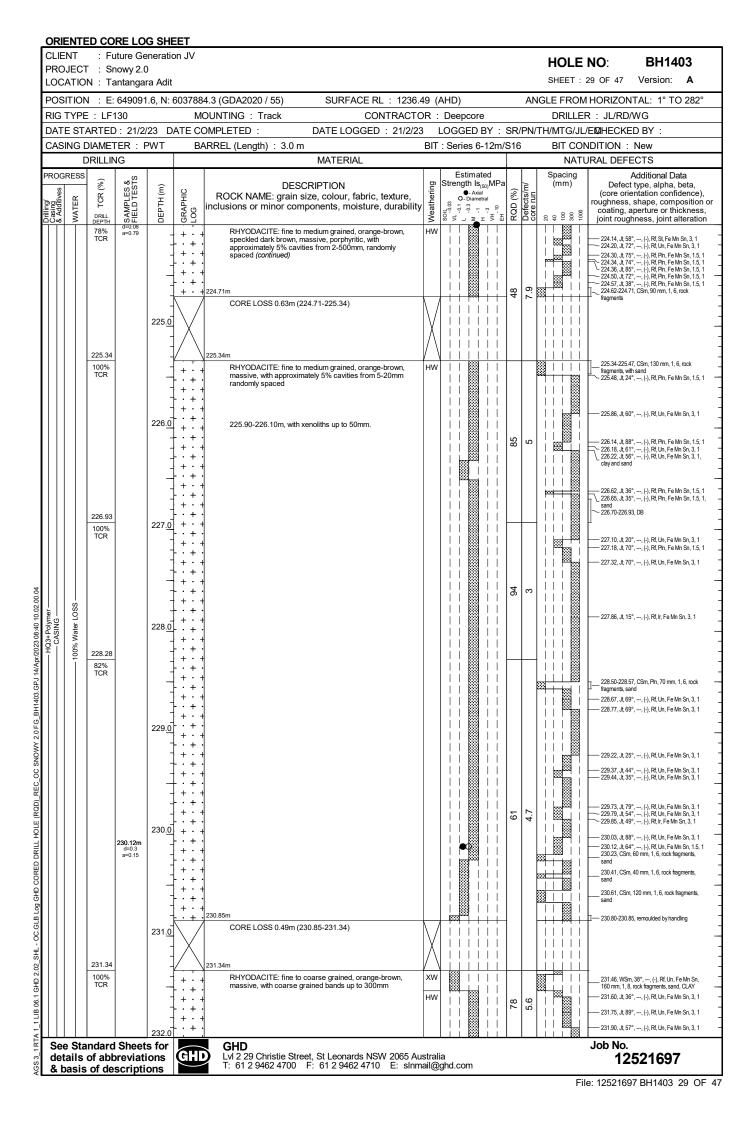
DLIEN PROJ			nowy 2.0	eneratio )	11.5 v					HOLE N	10:	BH1403
			intangai							SHEET : 2	5 OF 47	Version: A
				I.6, N: 6		. ,	ERL: 1236.49 (A		AN			TAL: 1° TO 282
		: LF1		/23 D			CONTRACTOR : GED : 21/2/23 L	Deepcore OGGED BY :	SR/PN/		: JL/RD/	
			ER : F			RREL (Length) : 3.0 m		: Series 6-12m/		BIT CONI		
	D	RILLIN	IG			MATERIAL				NATU	RAL DEFE	CTS
ROGR	ESS	(%)	s & STS	Ê		DESCRIPTION	<u>م</u> :	Estimated Strength Is <sub>(50)</sub> MPa	2	Spacing (mm)		Additional Data type, alpha, beta,
Casing & Additives	WATER		SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain size, colour, fat inclusions or minor components, mois	bric, texture,	•- Axial 0- Diametral 0 - Diametral 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 -	RQD (%) Defects/m/ core run	20 40 300 1000	roughness, coating, a	entation confidence shape, compositio perture or thicknes nness, joint alteratio
		DEPTH 100% TCR	012	-	+ · + - · + · + · +	RHYODACITE: medium to coarse graineo massive, porphyritic, with multiple very clo spaced healed defects, randomly oriented spaced quartz veins, randomly oriented, w	d, grey green, MW sely to closely d, with widely					°,, (-), Rf, Un, Fe Sn, 3, 1 25°,, (-), Rf, Un, 10 mm, 1, 6 s, sand
					- · + · + · + - · + · + · +	(continued)			81 5.6		192.38, Jt, 39° 192.41, CSm, fragments, san	°,, (-), Rf, Un, Fe Sn, 3, 1 °,, (-), Rf, Un, Fe Sn, 3, 1 52°,, (-), Rf, Un, 1, 6, rock d °,, (-), Rf, Un, Fe Sn, 3, 1 °,, (-), Rf, Cu, Fe Sn, 1.5, 1
		193.20		- 193 <u>.0</u>	+ · + - · + · + · +		HW					5, CSm, Slk, 120 mm, 1, 8, rock
	-	100% TCR	193.49m 193.53m a=4.74		+ • + • • + • + • +		MW				drilling 193.31, SS, 36 Sericite	nd, trace clay, remoulded by 6°, 220°, (2), Slk, Un, Ve, 1.5, 1 °, 290°, (2), Rf, Un, Fe Sn, 3, 1,
			a=4.74	- - -	+ · + - · + · + · +						Sericite Ve 193.66, Jt, 62° 193.73, SS, 48 0.5, 1	°, 106°, (2), Rf, Un, Fe Sn, 3, 1 8°, 224°, (2), Slk, Pln, CLAY Ve
				194. <u>0</u> - -	+ • + • • + • + • +		sw		95 4.2		— 193.96, Jt, 74°	°, 230°, (2), Rf, Un, Fe Sn, 3, 1
					+ · + - · + · + · +				<b>1</b>			
				195. <u>0</u>	+ • + • • + • + • + • • + •		MW SW				194.87, Jt, 63°	°, 228°, (2), Rf, Un, Fe Sn, 3, 1 °,, (2), Rf, Un, Fe Sn, 3, 1, 4°, 224°, (2), Slk, Un, Fe Sn, 1
		195.33 100% TCR			+ • + • • + • + • + • • + •							°, 254°, (2), Rf, Un, Fe Sn, 3, 1 2°, 310°, (1), Slk, Un, Fe Sn, 1.
		ION			+ • + • • + • + • + • • + •	195.80-196.46m. with xenoliths. closely st	naced > 60mm					°, 280°, (1), Rf, Un, Fe Sn, 3, 1
	0-5% Water L		<b>196.03m</b> <b>196.05</b> %n d=1.59	196.0	- · + · + · + - · + · + · + ·		MW					°, —, (-), Rf, Un, Fe Sn, 3, 1 °, 260°, (1), Rf, Un, Fe Sn, 3, 1
					- · + · + · + - · + · + · +		sw					
				- 197. <u>0</u>	- · + · + · + - · + · + · +				100 2.4			
					- · + · + · + - · + · + · +							
					• + • + + • + • + • - + • + • + • -							°, 272°, (1), Rf, Pln, Fe Sn, 1.5,
		198.27		198. <u>0</u> -	+ · + - · + · + · + - · + ·	198.16-198.44m, 5-200mm xenoliths, ran						°, 264°, (1), Rf, St, Fe Sn, 3, 1 °, 069°, (1), Rf, Un, Fe Mn Sn,
		100% TCR	198.37m 198.44m a=5.91		+ • + • + • - + • + • + •	198.20-200.30m, slightly to moderately alt	.ci cu				1	°, 280°, (1), Rf, Un, Fe Mn Sn, °, 256°, (1), Rf, Un, Fe Sn, 3, 1
				199. <u>0</u>	+ • + • + • - + • + • + • + • +						198.82, Jt, 56° 1.5, 1	°, 269°, (1), Rf, Un, Fe Sn, 3, 1
					· · + · + · + - · + · + · +				93 3.7			°, 240°, (1), Rf, Un, Fe Sn, 3, 1 90°,, (-), Rf, Un, 50 mm, 1, s
					· · + · + · + - · + · + · +							
			Sheet previati		GH	GHD Lvl 2 29 Christie Street, St Leonards				<u> </u>	Job No.	521697

RO			iture Ge nowy 2.0		on JV							HOLE	NO:	BH1403
			antangai									SHEET :	26 OF 47	Version: A
OSI	ITION	N : E:	649091	.6, N: 6	603788	4.3 (GDA2020 / 55)	SURFACE RL : 1236	.49 (	AHD)		AN	GLE FROM	HORIZON	ITAL: 1° TO 282
		E : LF1		-		DUNTING : Track			•		/ <b>D</b>		R : JL/RD	
			): 21/2/ FER : F			OMPLETED : ARREL (Length) : 3.0 m	DATE LOGGED : 21/2/2		LOGGED BY				ENDITION :	
ASI					DF	KREL (Lengur) . 3.0 m	MATERIAL	DII	. Series 0-121		)		JRAL DEFI	
ROGI	RESS								Estimated			Spacing		Additional Data
Casing & Additives	WATER	HILL TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain siz	RIPTION ze, colour, fabric, texture, onents, moisture, durabilit	Weathering	Strength Is <sub>(50)</sub> M • Axial O-Diametral 100 5 5 5 5 5 5 5 5 5 5 5 5 5	۵۵ (%) ۵۵ (%)	Defects/m/ core run	000 00 00 00 00 00 00 00 00 00 00 00 00	(core orie roughness, coating, a	t type, alpha, beta, entation confidence shape, composition aperture or thickness hness, joint alteration
		TCR		- - - - - - - - - - - - - - - - - - -	- · + · + - · + · +	spaced healed defects, r	n multiple vēry closely to člosely andomly oriented, with widely domly oriented, with <1% pyrite			93	3.7		—— 200.32, Jt, 28 —— 200.52, Jt, 33	<sup>e°</sup> , 100 <sup>e°</sup> , (1), Rf, Un, Fe Sn, 3, 1 <sup>e°</sup> , 083 <sup>e°</sup> , (1), Rf, Un, Fe Sn, 3, 1 <sup>e°</sup> , 268 <sup>e°</sup> , (1), Rf, Un, Fe Sn, 3, 1 <sup>e°</sup> , 258 <sup>e°</sup> , (1), Rf, Un, Fe Sn, 3, 1
		201.27 100% TCR		- - - - - - - - - - - - - - - - - - -	- · + · + - · + · +								1.5, 1	<sup>1°</sup> , 269°, (1), Rf, Pin, Fe Min Sn, <sup>1°</sup> , 038°, (1), Rf, Ir, Fe Sn, 3, 1
			202.92m 202.96m a=6.77	- - - - - - - - - - - - - - - - - - -	+ · + · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · + · · · + · · · + · · · + · · · + · · · · · · · · · · · · · · · · · · · ·	From 203.10m, 2-15mm spaced.	black phenocrysts, randomly			96	3.9		1 202.54, Jt, 40 1 202.58, Jt, 40 1	°, 288°, (1), Rf, Un, Fe Mn Sn, 3 °, 059°, (1), Rf, Un, Fe Mn Sn, 3 °, 059°, (1), Rf, Un, Fe Mn Sn, 3 °, 274°, (1), Rf, Un, Fe Sn, 3, 1
CASING		204.35			- · + · + - · + · +								203.58, Jt, 88 203.65, Jt, 76 203.76, Jt, 70 203.88, Jt, 36	°, 048°, (1), Rt, Un, Fe Sn, 3, 1 °, 029°, (1), Rt, Un, Fe Sn, 3, 1 °, 247°, (1), Rt, Un, Fe Sn, 3, 1 °, 269°, (1), Rt, Un, Fe Sn, 3, 1 °, 102°, (1), Rt, Un, Fe Sn, 3, 1 °, 304°, (1), Rt, Un, Fe Sn, 3, 1
		100% TCR		205.0	+ • + + • +								204.65, Jt, 15	°, 180°, (2), Rt, Un, Fe Sn, 3, 1 °, 015°, (2), Rt, Un, Fe Sn, 3, 1 °, 145°, (2), Rt, Un, Fe Sn, 3, 1
			205.60m 205.64m a=6.38	- - - 206.0	+ + + + + + + + + + + + + + + + + + + +					95	4.3		~ 205.49, Jt, 66	1°, 053°, (2), Rf, Un, Fe Sn, 3, 1 1°, 217°, (2), Rf, Un, Fe Sn, 3, 1 1°, 252°, (2), Rf, Un, Fe Sn, 3, 1
					· + · · + · + · +								206.62, Jt, 55	<ol> <li>", 061°, (2), Rf, Un, Fe Sn, 3, 1</li> <li>", 229°, (2), Rf, Ir, Fe Sn, 3, 1</li> <li>", 238°, (2), Rf, Ir, Fe Sn, 3, 1</li> <li>", 089°, (2), Rf, Un, Fe Sn, 3, 1</li> </ol>
		207.38 100% TCR 207.66 100% TCR	207.42m 207.50m a=1.45		- · + · + - · + · +		h orange iron staining, with I healed defects, randomly	HW		80 100	0.8 0		207.23, Jt, 42 207.36, Jt, 18 207.50-207.6	<sup>10</sup> , 080°, (2), Rf, Un, Fe Sn, 3, 1 <sup>10</sup> , 010°, (2), Rf, Pin, Fe Sn, 1.5, <sup>10</sup> , 052°, (2), Rf, Un, Fe Sn, 3, 1 <sup>10</sup> , 160 mm, dnilling induced core illing wedge off)
			Sheet Sheet		GHI	GHD Lvl 2 29 Christie Stree	t, St Leonards NSW 2065 A 5: 61 2 9462 4710 E: slnr				<u>1 [</u>		Job No. 12	521697

CLIENT PROJECT OCATIO	Γ:Sn	-	)	n JV							LE NO: T : 27 OF 47	BH1403 Version: A
		-		037884	1.3 (GDA2020 / 55)	SURFACE RL : 1	1236.49 (	(AHD)				ONTAL: 1° TO 282°
			-,		OUNTING : Track			: Deepcore			LLER : JL/R	
					MPLETED :	DATE LOGGED : 2		LOGGED BY				
ASING [			2001	BA	RREL (Length) : 3.0 m	MATERIAL	BH	: Series 6-12	m/S16		CONDITION	
ROGRESS							_	Estimated		Spac	ing	Additional Data
& Additives WATER	HILL (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG		CRIPTION size, colour, fabric, textu ponents, moisture, dura	ability Seat		(%) cts/r	uu) <sup>100</sup> <sup>100</sup> <sup>100</sup> <sup>100</sup> <sup>100</sup> <sup>100</sup> <sup>100</sup> <sup>100</sup>	(core roughne coating joint ro	ect type, alpha, beta, orientation confidence) ss, shape, composition g, aperture or thickness ughness, joint alteratio
- CASING	211.44 100% TCR 214.46 100%	211.19m 21年92m a=0.41 215.48m d=0.24	209 <u>.0</u> 211. <u>0</u> 211. <u>0</u> 211. <u>0</u> 211. <u>0</u> 211. <u>0</u> 	+     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     +     + <th>massive, porphyritic, wi spaced healed defects, spaced quartz veins, ra (continued) 210.36m, multiple very up to 60mm.</th> <th>n to carse grained, grey gree th multiple very closely to closely indomly oriented, with &lt;1% pyr closely to closely spaced xenc closely to closely spaced xenc 3.59-217.33)</th> <th>ely y ite</th> <th></th> <th></th> <th></th> <th>I       J       fagment         I       209.24, 5         I       -       209.24, 5         I       -       fagment         I       -       fagment     &lt;</th> <th>09.21, CSm, (-), 130 mm, 1, 8, rock, s, sand matinx, trace clay SI, 66<sup>7</sup>,, (-), Sik, Pin, Fe Sn, 0.5, 1 10.36, 380 mm, drilling induced core- s (drilling wedge off) multiple healed SS, 39°, 130°, (2), Sik, Un, Fe Sn, 3, 1 1, 61°, 088°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), Sik, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 25°, 343°, (2), RI, Un, Fe Sn, 3, 1 1, 24°, 063°, (3), RI, Ir, Fe Sn, 3, 1 1, 25°, 044°, (3), RI, Ir, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1</th>	massive, porphyritic, wi spaced healed defects, spaced quartz veins, ra (continued) 210.36m, multiple very up to 60mm.	n to carse grained, grey gree th multiple very closely to closely indomly oriented, with <1% pyr closely to closely spaced xenc closely to closely spaced xenc 3.59-217.33)	ely y ite				I       J       fagment         I       209.24, 5         I       -       209.24, 5         I       -       fagment         I       -       fagment     <	09.21, CSm, (-), 130 mm, 1, 8, rock, s, sand matinx, trace clay SI, 66 <sup>7</sup> ,, (-), Sik, Pin, Fe Sn, 0.5, 1 10.36, 380 mm, drilling induced core- s (drilling wedge off) multiple healed SS, 39°, 130°, (2), Sik, Un, Fe Sn, 3, 1 1, 61°, 088°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), Sik, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 1, 10°, (2), RI, Un, Fe Sn, 3, 1 1, 25°, 343°, (2), RI, Un, Fe Sn, 3, 1 1, 24°, 063°, (3), RI, Ir, Fe Sn, 3, 1 1, 25°, 044°, (3), RI, Ir, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1 1, 25°, 204°, (3), RI, Un, Fe Sn, 3, 1
			216.0									
See Sta	ndard	Sheet			GHD		I				Job No	
		reviati		GHD	Lvl 2 29 Christie Stre	et, St Leonards NSW 20	65 Austra	lia				2521697

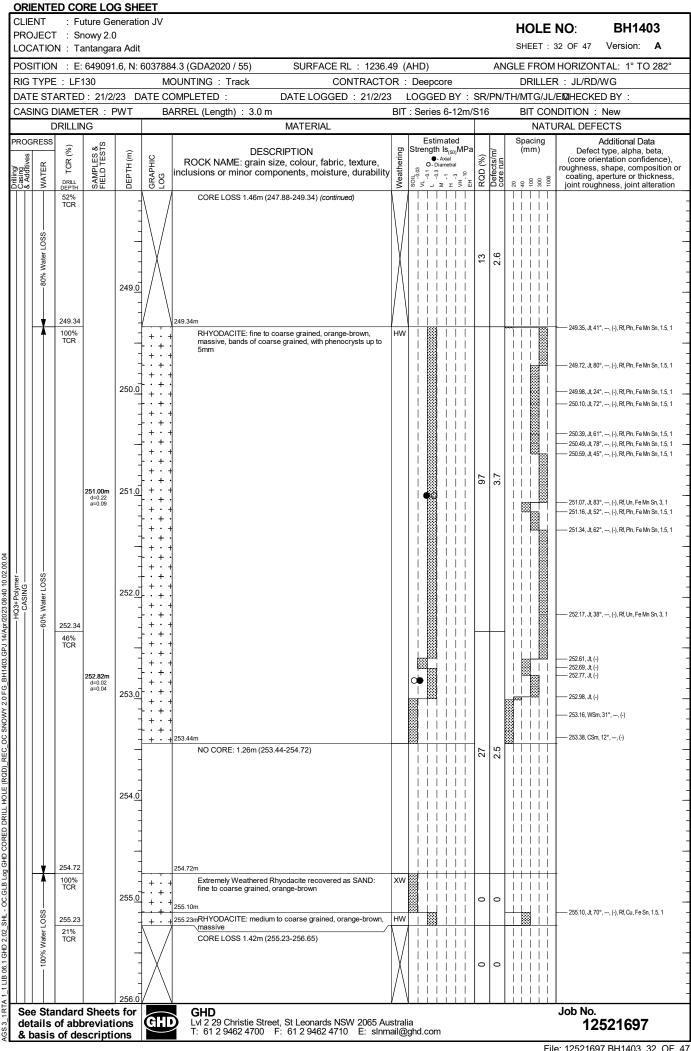


File: 12521697 BH1403 28 OF 47



RO		:Sr	uture Ge nowy 2.(	)									E NO:	BH1403
			antanga										: 30 OF 47	Version: A
		N : E: E : LF'		I.6, N: 6		4.3 (GDA2020 / 55) DUNTING : Track	SURFACE RL		(AHD) : Deepcore		A		m horizon Er : jl/rd	NTAL: 1° TO 282°
				/23 D/		OMPLETED :	DATE LOGGED :		•		SR/PN			
١S	ING E		FER : F	PWT	BA	RREL (Length) : 3.0 m		В	T : Series 6-	12m/\$	S16	BIT C	ONDITION :	New
	0	DRILLIN	١G				MATERIAL					NA	TURAL DEF	-
& Additives	WATER	TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DES( ROCK NAME: grain s inclusions or minor com			Estimate Strength Is <sub>(5</sub> O-Diametri S <sup>©</sup> -	₀)MPa	RQD (%) Defects/m/	Spacing (mm)	Defec (core ori roughness	Additional Data t type, alpha, beta, entation confidence) , shape, compositior aperture or thickness hness, joint alteratic
		100% TCR		-	+ • + • • + • + • +		coarse grained, orange-bro rained bands up to 300mm	wn, H	W				232.20, Jt, 32 CLAY Co	2°,, (-), Rf, Pln, Fe Mn Sn, 1.5,
					- · + · + · + - · + · + · +			X H					130 mm, 1, 6	n, 59°,, (-), Rf, Pln, Fe Mn Sn, i, CLAY, rock fragments
	100% Water LOSS —			233.0	+ • + • • + • + • + • • + •					  	78 5.6			4°,, (-), Rf, Pin, Fe Mn Sn, 1.5, 3°,, (-), Rf, Pin, Fe Mn Sn, 1.5,
	100% V				+ • + • + • + • + • + • + • +								233.24, Jt, 44 233.27, Jt, 58 233.33, Jt, 58 233.59, WSn	5,, (-), Rf, Pin, Fe Mn Sn, 1.5, 5°,, (-), Rf, Pin, Fe Mn Sn, 1.5, 5°,, (-), Rf, Pin, Fe Mn Sn, 1.5, n, 62°,, (-), Rf, Pin, Fe Mn Sn, , stiff CLAY, rock fragments
				 234. <u>0</u>	- · + · + · + - · + · + · +								233.71, Jt, 50	)°,, (-), Rf, Ir, Fe Mn Sn, 3, 1 )°,, (-), Rf, Pln, Fe Mn Sn, 1.5,
		234.31 100% TCR			- · + · + · + - · + · + · +								234.17, CSm 15 mm, 1.5, I	ı, 65°,, (-), VR, Pin, Fe Mn Sn, 6, rock fragments
				235.0	+ • + • • + • + • + • • + •								   234.75, Jt, 48	3°,, (-), Rf, Pin, Fe Mn Sn, 1.5, 5°,, (-), Rf, Cu, Fe Mn Sn, 1.5, 4°,, (-), Rf, Un, Fe Mn Sn, 3, 1
			235.03m d=0.2 a=0.08	-	- · + · + · + - · + · + · +								CLAY Ve 235.22, Jt, 75 235.31, Jt, 68	5°,, (-), Rf, Pln, Fe Mn Sn, 1.5, 5°,, (-), Rf, Pln, Fe Mn Sn, 1.5, 3°,, (-), Rf, Pln, Fe Mn Sn, 1.5, 3°,, (-), Rf, Pln, Fe Mn Sn, 1.5,
					+ • + + • +						89 6.3			2°,, (-), Rf, Un, Fe Mn Sn, 3, 1 5°,, (-), Rf, Pin, Fe Mn Sn, 1.5, 3°,, (-), Rf, Pin, Fe Mn Sn, 1.5, 2°, 260°, (3), Rf, Pin, Fe Mn Sn, 2°, 264°, (3), Rf, Pin, Fe Mn Sn,
					+ · + + · +	236.65m RHYODACITE: coarse	grained, orange-brown, ma	assive					236.23, Jt, 6( 1.5, 1 236.40, Jt, 2' 236.48, Jt, 2( 1.5, 1 236.48, Jt, 2( 1.5, 1 236.67, Jt, 4( 1 236.92, Jt, 6( 1.5, 1	5°, 276°, (3), Rť, Pin, Fe Mn Sn, 1°, 280°, (3), Rť, Pin, Fe Mn Sn, 3°, 262°, (3), Rť, Pin, Fe Mn Sn, 9°, 260°, (3), Rť, Un, Fe Mn Sn, 3°, 075°, (3), Rť, Cu, Fe Mn Sn,
	X	237.34 100% TCR			- · + · + · + - · + · + · +	237.11m, 25mm grey x	enolith with shallow cavities						237.05, Jt, 7( 1 237.15, Jt, 6; 1 237.22, Jt, 5( 1	9°, 172°, (3), Rf, Un, Fe Mn Sn, <sup>,</sup> 7°, 320°, (3), Rf, Un, Fe Mn Sn, <sup>,</sup> 9°, 141°, (3), Rf, Un, Fe Mn Sn, <sup>,</sup>
			<b>237.88m</b> d=0.38 a=0.69	238.0	+ • + + • +						83 7.2		1 237.67, Jt, 33 237.67, Jt, 34 237.79, Jt, 64 1 237.87, Jt, 75 1, 5, 1 238.06, Jt, 45 1 238.17, Jt, 44	5°, 016°, (3), Rf, Un, Fe Mn Sn, 3 5°, 035°, (3), Rf, Un, Fe Mn Sn, 3 5°, 127°, (3), Rf, Un, Fe Mn Sn, 3°, 198°, (3), Rf, Pin, Fe Mn Sn, 3°, 141°, (3), Rf, Un, Fe Mn Sn, 3°, 3°, 141°, (3), Rf, Un, Fe Mn Sn, 5°, 256°, (3), Rf, Pin, Fe Mn Sn, 5°, 148°, (3), Rf, Un, Fe Mn Sn, 5°, 148°, (3), Rf, Un, Fe Mn Sn, 5
	95% Water LOSS	238.72 100% TCR			+ • + • • + • + • + • • + • + • +	238.63m, 45mm grey x	enolith with cavity.						1.5, 1 238.32, Jt, 4' 1 238.46, Jt, 32 1 238.82-238.9	1°, 129°, (3), Rf, Un, Fe Mn Sn, 1°, 309°, (3), Rf, Un, Fe Mn Sn, 3 2°, 054°, (3), Rf, Un, Fe Mn Sn, 3 30, DB
				239.0	- · + · + - · + · +	239.48-239.54m, altere	d, bleached.				91 5.5		238.93, Jt, 4' 1 238.96, Jt, 3' 1 239.15, Jt, 8' 1 239.40, Jt, 4' 1.5, 1 239.51, Jt, 6' 1.5, 1 1.5, 1 239.51, Jt, 6' 1.5, 1 1.5, 1	<sup>19</sup> , <sup>1</sup> G8 <sup>+</sup> , (3), Rf, Un, Fe Mn Sn, <sup>3</sup> , 210 <sup>+</sup> , (3), Rf, Un, Fe Mn Sn, <sup>3</sup> , <sup>9</sup> , 210 <sup>+</sup> , (3), Rf, Un, Fe Mn Sn, <sup>4</sup> , <sup>1</sup> , 115 <sup>+</sup> , (3), Rf, Pn, Fe Mn Sn, <sup>4</sup> , <sup>9</sup> , 205 <sup>+</sup> , (3), Rf, Pn, Fe Mn Sn, <sup>3</sup> , <sup>9</sup> , 065 <sup>+</sup> , (3), Rf, Un, Fe Mn Sn, <sup>1</sup> , <sup>9</sup> , 065 <sup>+</sup> , (3), Rf, Un, Fe Mn Sn, <sup>1</sup> , <sup>1</sup>
et	ails	of abb	l Sheet previati scripti	ions	GH	<b>GHD</b> Lvl 2 29 Christie Stre T: 61 2 9462 4700	et, St Leonards NSW F: 61 2 9462 4710	2065 Austr	alia	<u>i i</u>			Job No. 12	521697

	JECT	: Sr	uture Ge nowy 2.0 antangar	)										HOLE	<b>NO</b> : 31 OF 47	BH1403 Version: A
			-		6037884	1.3 (GDA2020 / 55)	SURFACE RL :	1236.49 (	AHD	)			ANG			NTAL: 1° TO 282°
		: LF1		- ,		OUNTING : Track		RACTOR :							R : JL/RD	
						MPLETED :	DATE LOGGED : 2						PN/T			
ASI		RILLIN	FER : F	2001	BA	RREL (Length) : 3.0 m	MATERIAL	BH	: Sei	ies 6-1	12m/s	516			NDITION : URAL DEF	
OGF	RESS		-							stimate				Spacing	_	Additional Data
& Additives	WATER	HE TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESC ROCK NAME: grain s inclusions or minor com				igth Is <sub>(50)</sub> ●-Axial D-Diametra S	, I	RQD (%)	Defects/m/ core run	(mm)	(core or roughness coating, joint roug	t type, alpha, beta, entation confidence) , shape, compositior aperture or thickness phness, joint alteratio
		100% TCR 240.27 30%		-	+ • + •	RHYODACITE: coarse (continued)	grained, orange-brown, mas	ssive HW				91	6.5		240.05, Jt, 2 1 240.15, Jt, 5	4°, 254°, (3), Rf, Un, Fe Mn Sn, 3 1°, 305°, (3), Rf, Un, Fe Mn Sn, 3 °, 250°, (3), Rf, Un, Fe Mn Sn, 3,
		TCR			+ • + • + • + • • + •											81, DB 7°,, (-), Rf, Ir, Fe Mn Sn, 3, 1 8°,, (-), Rf, Un, Fe Mn Sn, 3, 1 9°,, (-), Rf, Un, Fe Mn Sn, 3, 1
			<b>241.00m</b> d=0.21 a=0.04	241. <u>0</u> -	+ • + • + • + • + • + •	241.19m CORE LOSS 2.15m (24	11 19-243 34)		•				_			9°,, (-), Rf, Un, Fe Mn Sn, 3, 1 5°,, (-), Rf, Un, Fe Mn Sn, 3, 1
				- - -		20112 2000 2. 1011 (24										
	sso1			 242. <u>0</u>								27	1.3			
				-   -	$\left  \right $											
				- - 243.0												
		243.34		-	/ /	243.34m RHYODACITE: fine to o	coarse grained, orange-brow	vn. HW							243.34-243.	47, DB
		TCR			+ • + • + • + • + • + • + • +	massive						87	4.8		L 243.52, CSr sand 243.67, Jt, 7	n, 90 mm, 1, 6, rock fragments, 2°,, (-), Rf, Un, Fe Mn Sn, 3, 1
CASING		044.00		244. <u>0</u> - -	· · + · + · + · · + · + · +							w	4		50 mm, 1, 10 244.13, Jt, 5	n, 74°,, (-), Rf, Un, Fe Mn Sn, ), stiff CLAY and sand 5°,, (-), Rf, Pln, Fe Mn Sn, 1.5, 5°,, (-), Rf, Pln, Fe Mn Sn, 1.5,
	X	244.39 100% TCR			+ · + • + · + · + • + · + · +								_		sand	n, 48°,, (-), Rf, Un, 5 mm, 3, 4, 5°,, (-), Rf, Pin, Fe Mn, 1.5, 1 3°,, (-), Rf, Pin, Fe Mn, 1.5, 1 8°,, (-), Rf, Pin, Fe Mn, 1.5, 1
				245. <u>0</u>	· · + · + · + · · + · + · +										244.95, Jt, 7	8°,, (-), Rt, Pin, Fe Mn, 1.5, 1 1°,, (-), Rt, Ir, Fe Mn, 3, 1 2°,, (-), Rt, Ir, Fe Mn Sn, 3, 1 n, 76°,, (-), Rt, Ir, 20 mm, 1, 6,
	- 99% Water LOSS				· · + · + · + · · + · + · + · · + ·						     	69	5.8		госк тадте 245.34, Jt, 2	nts, sand 3°,, (-), Rf, Un, Fe Mn Sn, 3, 1 4°,, (-), Rf, Un, Fe Mn Sn, 3, 1
				246. <u>0</u>	+ • + • + • + • + • + • + • +										245.83, WS rock fragme	n, 85°,, (-), Rf, Ir, 20 mm, 1, 6,
	X	246.28 52% TCR			+ + + + + + + + + + + + + + + +											5°,, (-), Rf, Pin, Fe Mn, 1.5, 1 4°,, (-), Rf, Un, Fe Mn, 3, 1 1°,, (-), Rf, Ir, Fe Mn, 3, 1
	OSS			- - 247. <u>0</u>	+ • + • + • + • + • • + •											1°,, (-), Rf, Ir, Fe Mn, 3, 1 9°,, (-), Rf, Ir, Fe Mn, 3, 1
	— 80% Water LOSS				+ • + • + • + • + • + • + • +							13	2.6		247.45, WS	0°,, (-), Rf, Pin, Fe Mn, 1.5, 1 n, 55°,, (-), Rf, Pin, 120 mm, 1
					$\begin{array}{c} \cdot + \cdot \\ + \cdot + \\ \cdot \cdot + \cdot \\ + \cdot + \\ \end{array}$	247.88m					         		*	¥ <u>+</u> ,       	rock fragmer 247.58, Jt, 5 247.66, Jt, 5	nts, sand 4°,, (-), Rf, Pln, Fe Mn Sn, 1.5, 5°,, (-), Rf, Pln, Fe Mn Sn, 1.5, 80, remoulded by handling
⊥⊥ iee	Sta	ndard	Sheets	248.0 s for	$\leq$	CORE LOSS 1.46m (24	7.88-249.34)								Job No.	
			oreviati scripti	ons	GHD	Lvl 2 29 Christie Stree	et, St Leonards NSW 2 F: 61 2 9462 4710 E			om						2521697



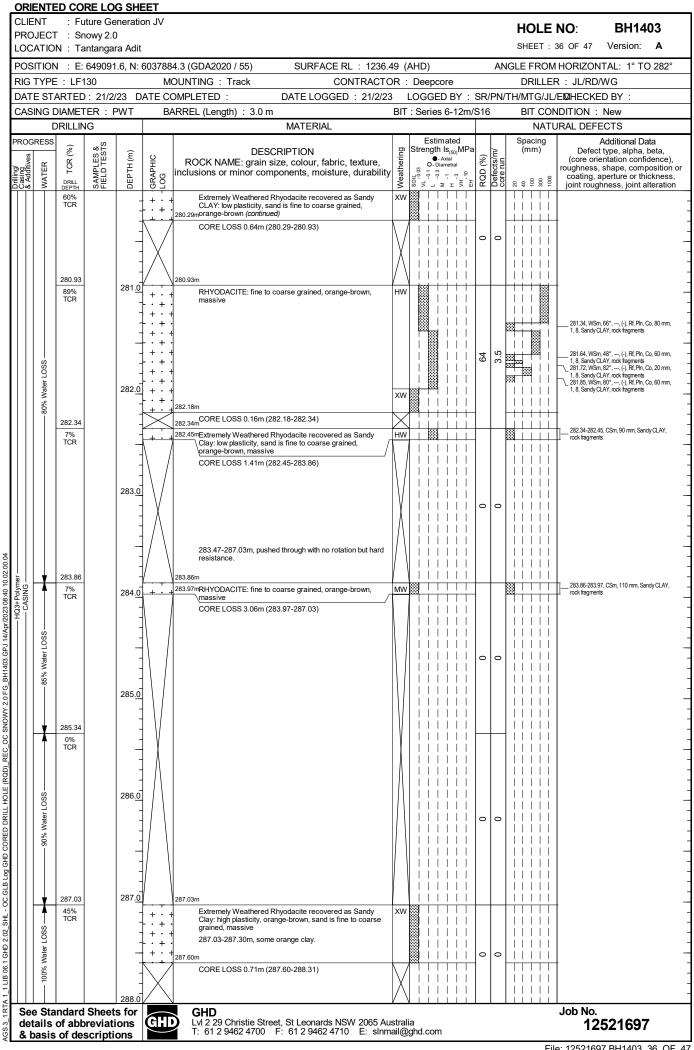
File: 12521697 BH1403 32 OF 47

RO		T : S	uture G nowy 2.	0											NO:	BH140	
			antanga												33 OF 47	Version:	
		N : E E : LF		1.6, N:		34.3 (GDA2020 / 55)	SURFACE RL : 123		,			AN				TAL: 1° TO 2	282°
				ח 2/2 <u>3</u>		OUNTING : Track OMPLETED :	CONTRAC DATE LOGGED : 21/2			-	SR	/PN/1			R:JL/RD/ EKØHECKE		
			TER :			ARREL (Length) : 3.0 m				ies 6-12r					IDITION :		
		DRILLI	NG				MATERIAL						١	NATU	IRAL DEFE	CTS	
& Additives 0	WATER SS	TCR (%)	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCR ROCK NAME: grain siz inclusions or minor compo	e, colour, fabric, texture,	eri	Stren	stimated gth Is <sub>(50)</sub> MF ●- Axial D- Diametral	QD (%)	Defects/m/ core run	Spaci (mm	ר) ו	Defect (core orie roughness, coating, a	Additional Data type, alpha, be intation confide shape, compose perture or thick	eta, ence) sition aness
8.7	Ŵ	DRILL DEPTH 21%	SA	B	<u> </u>	CORE LOSS 1.42m (255.	23-256.65) (continued)	Š	S ≯	_ ≥ ± ≩	Ξœ	бö	10 49 50	ĕ₽ TT	joint rough	ness, joint alte	ratio
	100% Water LOSS	257.02 100% TCR 257.87 69% TCR	-			256.65m	vodacite recovered as Clayey	xw									
	V	260.94 79% TCR		260. <u>0</u> - - - - - - - - - - - - - - - - - - -		260.00m CORE LOSS 0.94m (260 260.94m Extremely Weathered Rh CLAY: low plasticity, sand orange-brown, massive, p	rodacite recovered as Sandy is fine to coarse grained,	xw					1 1 1				
	95% Water LOSS				F • + •	261.74m, 15mm grey quai					0	0					
			d Shee			263.30m CORE LOSS 0.64m (263 263.94m GHD	30-263.94)								Job No.		
<b></b>	ails	of ab	brevia	tions	GH	<ul> <li>Lvl 2 29 Christie Street,</li> </ul>	St Leonards NSW 2065 61 2 9462 4710 E: sli	Australi	ia						12	521697	

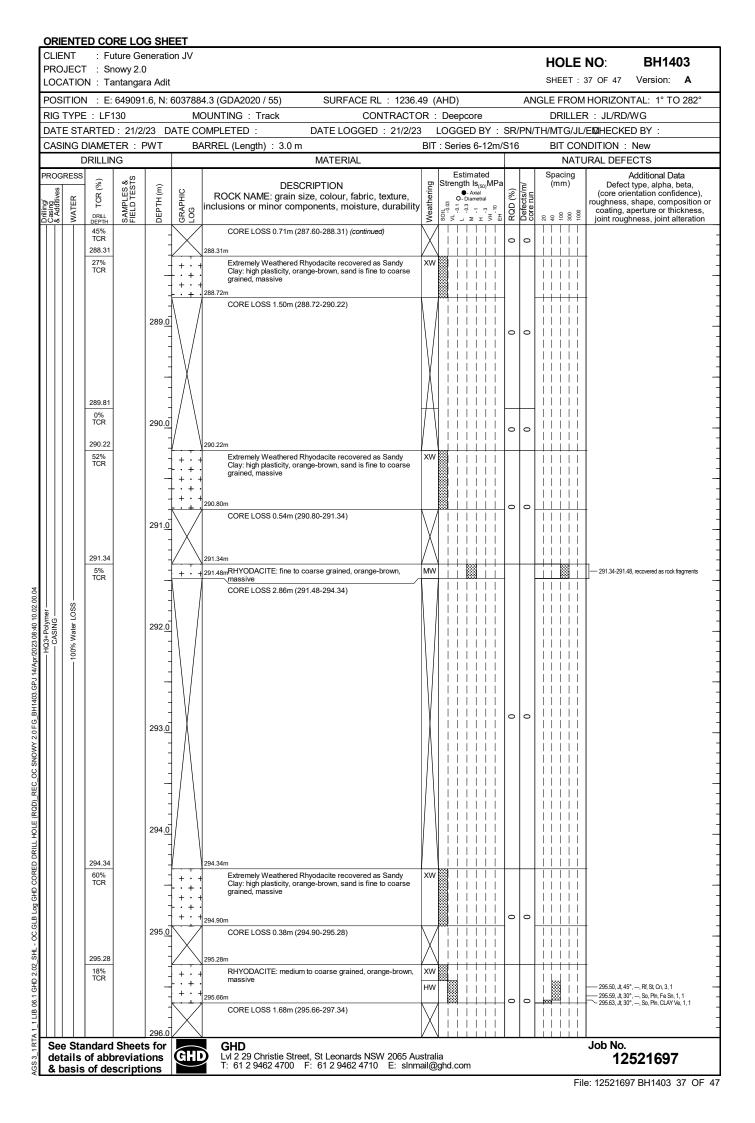
Bit of the state of t		JEC	т : S	nowy 2	2.0	tion JV										<b>NO</b> :	BH14	
PYPE         L1930         MOUNTING:         Track         CONTRACTOR:         Despose         DPRLIER:         JUNCH           ND DMETER:         PVT         DARBEL (unright)::::::::::::::::::::::::::::::::::::				-					1000.40		<b>`</b>							
STATED 21/223         DATE LOGED 1: 21/23         LOGED 1V: SRPATHATCULTEREFECTENTY:           DNUMETER:         NATURAL DEFECTS         NATURAL DEFECTS           DNUMETER:         DESCRPTION (MATERIAL STATES)         NATURAL DEFECTS           DNUMETER:         DESCRPTION (MATERIAL STATES)         DESCRPTION (MATERIAL STATES)         NATURAL DEFECTS           DESCRPTION (MATERIAL STATES)         DESCRPTION (MATERIAL STATES)        DESCR					91.0, N								Ar					J 202
DUMUNE IF:         PW         BARREL (Langh) : 3.0 m         BIT Cancer S10         BIT CANCIN LOW           DEMULTION         NUMUNE DEFECTS         PM         Defecting PDA A         PM					2/23							′: SF	R/PN/					
Basel Big Big Big Big Big Big Big Big Big Big								n										
Bit of the second of the control of the con		l	DRILLI	NG				MATERIAL							NAT	URAL DE	FECTS	
1       170       1       1       1       1       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0		RESS	%)	& TS			DES		6				/		acing nm)	Defe		
1105         201.00         111.00         111.00         111.00           201.00         201.00         201.00         111.00         111.00         111.00           1100         201.00         201.00         111.00         111.00         111.00           1100         201.00         111.00         111.00         111.00         111.00           1100         201.00         111.00         111.00         111.00         111.00           1100         111.00         111.00         111.00         111.00         111.00           1100         110.00         110.00         110.00         110.00         110.00           1100         110.00         110.00         110.00         110.00         110.00           1100         110.00         110.00         110.00         110.00         110.00           1100         110.00         110.00         110.00         110.00         110.00           1100         110.00         110.00         110.00         110.00         110.00           1100         110.00         110.00         110.00         110.00         110.00           1100         110.00         110.00         110.00         110.00	& Additives	WATER	DRILL DEPTH	SAMPLES	DEPTH (m)	GRAPHIC LOG	ROCK NAME: grain inclusions or minor co	size, colour, fabric, text	ture, rability		Axial     Diametral	ен <sup>-10</sup> ЕН (%)	Defects/m core run	20		(core o roughnes	rientation confi s, shape, com , aperture or th	dence) positior ickness
B01 M000 W         201.00 W         207.00 W					265.		Extended vocations     fine to coarse grained	, orange-brown (continued)										
10%			267.00				CORE LOSS 1.62m (	265.40-267.02)					0					
100%       - + +       + +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +			100%	<u>-</u>			Extremely Weathered						0					
TCR       269.0       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       + + +       +	ÍL	¥.	268.66	5		$\left\{\begin{array}{c} + \\ + \end{array}\right\}$	• +					!						
270.31       -++       ++       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +       +	- casing	75% Water LOSS		_		$1 + \cdot + $	· · · + · · + · · + · · + · · · · · · ·		XW				0 0					
49%       TCR       CORE LOSS 0.78m (270.37-271.15)       I I I I I I I I I I I I I I I I I I I		_ <b>\</b>	270.3			$1 \cdot +$												
V     271.430     -     +     ·     +     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     ·     · <t< td=""><td></td><td>% Water LOSS</td><td>49%</td><td></td><td>271</td><td></td><td>CORE LOSS 0.78m ( 271.15m</td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td></t<>		% Water LOSS	49%		271		CORE LOSS 0.78m ( 271.15m						0					
V     271.83     - + · +     RHYODACITE: fine to coarse grained, grey, with randomly oriented dark brown stripes     MW     - + · +     - + · +     - 271.57, Jt 60°, -, (·), Rt Ph, Fe Sn, 3, 1       V     271.83     - · · + · +     - + · +     - + · +     - + · +     · + · +       75%     - · + · +     - + · · +     · + · +     · + · +       TCR     272.0     - + · +     · + · +		1005			1		CLAV: low placticity f	ing to coorce grained	nuy XVV		i i i i	i						
75%         -         +         +         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -           -		Ì				+++	+ RHYODACITE: fine 1	ve o coarse grained, grey, with	MW	× 							60°,, (-), Rf, Pln. Fe S	Sn, 3, 1
75%         -         +         +         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -           -			-			] + .	+									, 04		
	╞	╁		1			+					1 0	~			271.80, Jt,	20°,, (-), Rf, Pln, Fe S	Sn, 1.5, 1
autority and the second s			TCR	4 6 4		0 <u>- · +</u>						n N	-   N			loh N-		
ails of abbreviations LVI 2 29 Christie Street, St Leonards NSW 2065 Australia T: 61 2 9462 4700 F: 61 2 9462 4710 E: shmail@ghd.com 12521697	ee et:					લ	GHD Lvl 2 29 Christie Str	eet, St Leonards NSW 2	065 Austra	lia								7

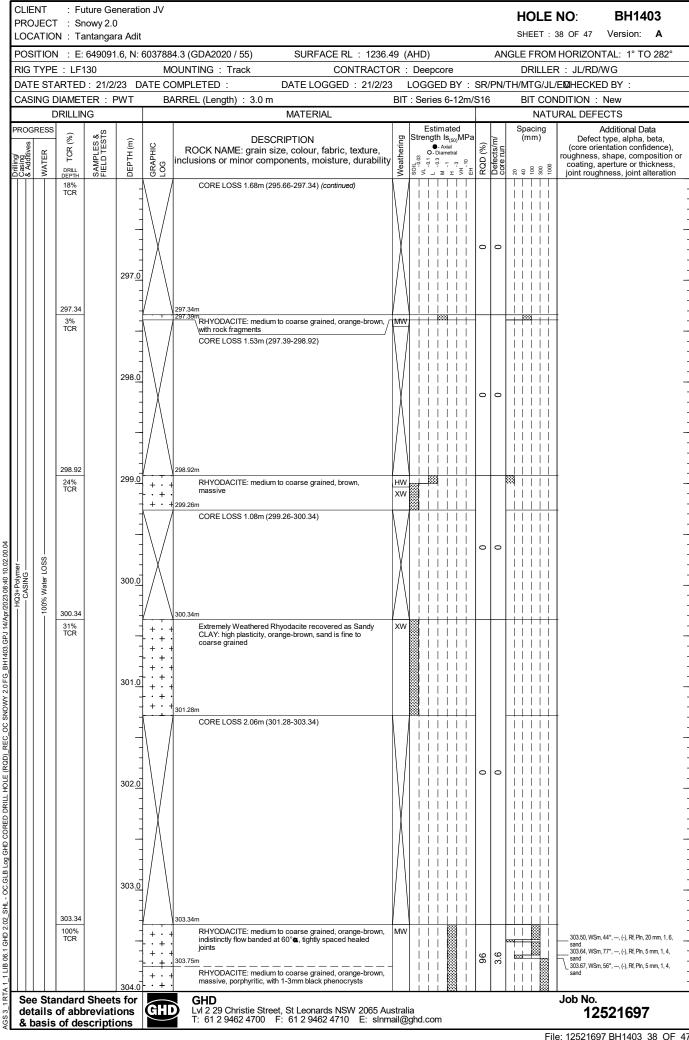
					on JV								HC	DLE	NO:	BH1403
			-										SHE	ET :	35 OF 47	Version: A
POS	TION	: E:	649091	.6, N: 6	603788	4.3 (GDA2020 / 55) SURFACE RL : 1236.	49 (/	AHE	))			AN	GLE F	RON	I HORIZO	NTAL: 1° TO 282
									· ·							
PROJECT : Snowy 2.0 LOCATION : Trantangara Adit SHET : 35 OF 47 Vet POSITION : E: 6490916, N: 6037884.3 (GDA2020 / 55) SURFACE RL : 1236.49 (AHD) ANGLE FROM HORIZONTAL: RIG TYPE : LF130 MOUNTING : Track CONTRACTOR : Deepcore DRLLER : JURDWG DATE STARTED : 21/2/23 DATE COMPLETED : DATE LOGGED : 21/2/23 LOGGED BY : SR/PN/TH/MTG/JLEØHECKED BY CASING DIAMETER : PWT BARREL (Length) : 3.0 m BIT : Series 6-12m/S16 BIT CONDITION : New ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of 2m/S16 BIT CONDITION : New ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of 2m/S16 BIT CONDITION : New ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of the GS R # # # # ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of the GS R # # # # ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of the GS R # # # # ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of the GS R # # # # ROCK NAME: grain size, colour, fabric, texture, Inclusions or minor components, moisture, durability if the series of the GS R # # # # ROCK NAME: grain size, colour, fabric, texture, ROCK NAME: grain size, colour, fabric, te																
					07						., 5 10		וט			
	RESS	(%	å ïTS			DESCRIPTION	ŋ				a	2			Def	Additional Data ect type, alpha, beta,
Casing & Additives	WATER		SAMPLES FIELD TES	DEPTH (m	3RAPHIC -0G	ROCK NAME: grain size, colour, fabric, texture,	Weatherin		0 - Di	Axial ametral	(%)	Defects/m core run		,	(core o roughnes	prientation confidence s, shape, compositio aperture or thicknes ughness, joint alteratio
		75%	0,12	-	+ • + • • <b>+</b> •	RHYODACITE: fine to coarse grained, grey, with randomly oriented dark brown stripes (continued)	нw								272.17, C	Sm, 60 mm, 1, 6, sand, rock
	75% Wate				· • + • + • +	270.07	-				28	2.7			272.50, C	Sm, 340 mm, 1, 6, sand, rock
		272.95		-	$\mathbf{X}$	CORE LOSS 0.28m (272.67-272.95)	X								1	
		27% TCR		273.0		orange-brown	xw									
	er LOSS —			-	$\setminus$	CORE LOSS 0.80m (273.24-274.04)	$\mathbb{N}$				0	0				
	- 60% Wati				$\left  \right $											
		100%		274.0		RHYODACITE: fine to coarse grained, orange-brown,	/ \  xw								+	
	Ţ	274.49									0	2.2				
					+ • + • • + •		HW				0	5.3				, 44°,, (-), Rf, Un, Co, 3, 2, sand , 62°,, (-), Rf, Un, Co, 3, 2, sand
	sso-	275.06 83% TCR		275 <u>.0</u>			xw					$\left  \right $	-+~4 -     		2. 1.00, 0	,,.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	80% Water LOSS	ION			+ • + • + • + • +		нw									
Đ	8				· · + · + · + · · + · + · +	276.02m					0	0				15 00 mm 11 11 1 m
- CASING		276.10		276. <u>0</u>	$\mathbf{\mathbf{x}}$	275.92m CORE LOSS 0.18m (275.92-276.10) 276.10m	$\mathbf{X}$			+ + +	1				275.83-27	'5.92, remoulded by handling
20 		100% TCR			<pre></pre>	RHYODACITE: fine to coarse grained, orange-brown, massive, porphyritic, with 5-10mm quartz phenocrysts	xw		+ +		1				1	
					+ • + + • + • • + • + • +		HW									
					+ • + • • + • • • + •	276 84m 25mm guartz shanaan st					0	2.6				
				277.0	+ • + • • + • + • +	276.84m, 25mm quartz phenocryst.	xw									
	<u>ه</u>				$+ \cdot +$											
	75% Water LOSS	277.63 95%			+ • + • + • +						$\vdash$	$\left  - \right $	ŢŢ.			
	% Wat	TCR			- + + - + - +											
	75			278. <u>0</u>	+ • + • + • + + • +											
					· + · + + · +											
					• + • + • +				ļļ		0	0	į.			
					· + · +							[ ]				
					· • + • + • +											
				279.0	· · + · + · + · · + ·	279.26m										
	¥	279.34 60%				279.34m CORE LOSS 0.08m (279.26-279.34)	XW				-				279.34, o	ore spin, "moulding" in sand
	80% Water LOSS	TCR			+ • + • • + • + • + • • + •	Extremely Weathered Rhyodacite recovered as Sandy CLAY: low plasticity, sand is fine to coarse grained, orange-brown					0	0				
	·80% V			280.0	+ · + · • + ·											
	Sta	ndard	Sheet	-	GH	GHD	1	699							Job No	).

File: 12521697 BH1403 35 OF 47



File: 12521697 BH1403 36 OF 47





**ORIENTED CORE LOG SHEET** 

File: 12521697 BH1403 38 OF 47







	P HOPPER	DATE 28/04/2023	
Tantangara NSW	S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	cale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE No 1/16	





TITLE FUTURE GENERATION JV	P HOPPER	DATE 28/04/2023	
Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	Scale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE № 2/16	





TITLE FUTURE GENERATION JV		DATE 28/04/2023	
Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	Scale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE № 3/16	





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE <u></u>सः 28/04/2023 Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1403 4/16





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE GH 28/04/2023 Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1403 5/16





		DATE 28/04/2023	i
Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	Scale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE № 6/16	





	P HOPPER	DATE 28/04/2023	
Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	i
SNOWY 2.0	SCALE Not To S	cale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE № 7/16	



SNOWY 2.0 Core Photo - BH1403 DATE: 28/02/23

P HOPPER	DATE 28/04/2023	
CHECKED S ROSS	DATE 28/04/2023	
SCALE Not To S	Scale	A4
PROJECT № 12521697	FIGURE No 8/16	





	P HOPPER	DATE 28/04/2023	
FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	Scale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE № 9/16	





		DATE 28/04/2023	
FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	Scale	A4
Core Photo - BH1403	PROJECT No 12521697	FIGURE № 10/16	





GHD	TITLE FUTURE GENERATION JV Tantangara NSW SNOWY 2.0 Core Photo - BH1403	P HOPPER	DATE 28/04/2023	
		CHECKED S ROSS	DATE 28/04/2023	
		Not To Scale		A4
		PROJECT № 12521697	FIGURE No 11/16	

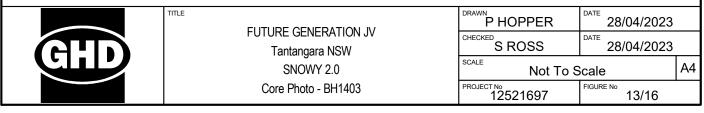




VICTOR 11 LILE 06.1 GHD 20	TITLE FUTURE GENERATION JV Tantangara NSW SNOWY 2.0 Core Photo - BH1403	P HOPPER	DATE 28/04/2023	
		CHECKED S ROSS	DATE 28/04/2023	
		Not To Scale		A4
		PROJECT № 12521697	FIGURE № 12/16	











		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 14/16	





			DATE 28/04/2023	
	FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 15/16	





			DATE 28/04/2023	
	FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
GIND	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 16/16	



DATE: 03/03/23

PROJECT: Snowy 2.0 PROJECT No: 12521697 GHD BOREHOLE No: BHI403 DEPTH: 07 103 104 TITLE GH

FUTURE GENERATION JV Tantangara NSW SNOWY 2.0 Core Photo - BH1403

102.0-105.0m

P HOPPER	DATE 28/04/2023	
CHECKED S ROSS	DATE 28/04/2023	
SCALE Not To S	scale	A4
PROJECT № 12521697	FIGURE No 1/18	





		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
GIND		SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 2/18	

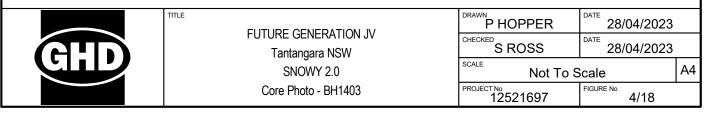




			DATE 28/04/2023	
	FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 3/18	











FUTURE GENERATION JV Tantangara NSWP HOPPER28/04/2023CHECKED S ROSSDATE 28/04/2023SCALESCALE	DATE
Tantangara NSW S ROSS 28/04/2023	'PER 28/04/2023
SNOWY 2.0 State Not To Scale	
Core Photo - BH1403         PROJECT №         FIGURE №         5/18	





		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 6/18	





		P HOPPER	DATE 28/04/2023	
GID	Tantangara NSW	S ROSS	DATE 28/04/2023	A4
	SNOWY 2.0 Core Photo - BH1403	Not To S PROJECT № 12521697	5cale FIGURE № 7/18	A4





		P HOPPER	DATE 28/04/2023	
	FUTURE GENERATION JV Tantangara NSW	S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 8/18	





			DATE 28/04/2023	
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
		SCALE Not To S	scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 9/18	





			DATE 28/04/2023	
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 10/18	

	PROJECT: Snowy 2.0 DATE: 10 /03/23
CHD	PROJECT No: 12521697
GHD	BOREHOLE No: BHI403
2	DEPTH: 159.0-162.0 m
RHI403	159.39
159	
160	
	161.52
101	



			DATE 28/04/2023	
		S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 11/18	



	P HOPPER	DATE 28/04/2023	
FUTURE GENERATION JV Tantangara NSW	S ROSS	DATE 28/04/2023	
SNOWY 2.0	SCALE Not To S	1	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE No 12/18	

вничоз 168

169

170





			DATE 28/04/2023	
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
		SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 13/18	





		P HOPPER	DATE 28/04/2023	
		CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 14/18	



DATE: 13/03/23

0.6



FUTURE GENERATION JV
Tantangara NSW
SNOWY 2.0
Core Photo - BH1403

PROJECT: Snowy 2.0

PROJECT No: 12521697

BOREHOLE No: BHI403

DEPTH:

TITLE

186.0-189.0M

P HOPPER	DATE 28/04/2023	
CHECKED S ROSS	DATE 28/04/2023	
SCALE Not To S	Scale	A4
PROJECT № 12521697	FIGURE № 15/18	

0.8





			DATE 28/04/2023	
		S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 16/18	

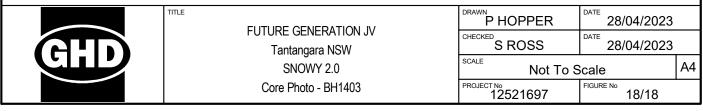




		P HOPPER	DATE 28/04/2023	
	FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale A	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 17/18	





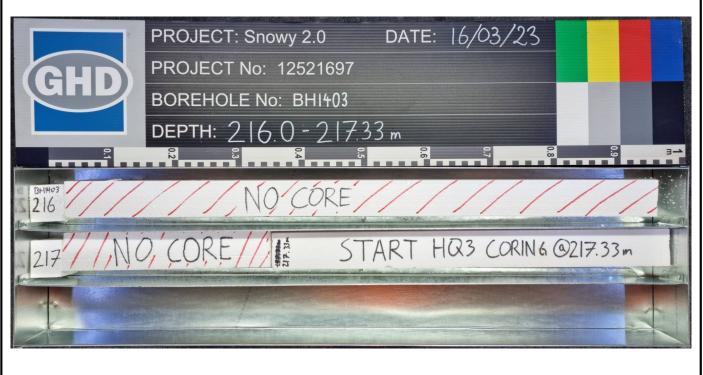






GHD	FUTURE GENERATION JV	P HOPPER	DATE 28/04/2023	
		S ROSS	DATE 28/04/2023	A4
	SNOWY 2.0 Core Photo - BH1403	Not To S PROJECT № 12521697	FIGURE № 1/14	A4





GHD		P HOPPER	DATE 28/04/2023		
		CHECKED S ROSS	DATE 28/04/2023		
			SCALE Not To S	scale	A4
		Core Photo - BH1403	PROJECT № 12521697	FIGURE No 2/14	









TITLE

FUTURE GENERATION JV Tantangara NSW SNOWY 2.0 Core Photo - BH1403

_			
	P HOPPER	DATE 28/04/2023	
	CHECKED S ROSS	DATE 28/04/2023	
	SCALE Not To S	Scale	A4
	PROJECT № 12521697	FIGURE No 4/14	





GHD		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	S ROSS	DATE 28/04/2023	
		SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 5/14	





GHD	FUTURE GENERATION JV Tantangara NSW SNOWY 2.0	P HOPPER	DATE 28/04/2023	
		S ROSS	DATE 28/04/2023	
			FIGURE No	A4
		12521697	6/14	



Ð



Ð			DATE 28/04/2023
	Tantangara NSW SNOWY 2.0	CHECKED S ROSS	DATE 28/04/2023
		PROJECT № 12521697	FIGURE No 7/14





			DATE 28/04/2023		
_1 LIB 00		Tantangara NSW	S ROSS	DATE 28/04/2023	
	SNOWY 2.0	Not To Scale		A4	
		Core Photo - BH1403	PROJECT № 12521697	FIGURE № 8/14	



Tantangara NSW

SNOWY 2.0

Core Photo - BH1403

SCALE

PROJECT № 12521697

28/04/2023

9/14

Not To Scale

FIGURE No

A4

н.





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE 28/04/2023 GH Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1403 10/14



	PROJECT: Snowy 2.0 DATE:	21/03/23	
CHD	PROJECT No: 12521697		
GHU	BOREHOLE No: BH 1403		
	DEPTH:284.0-288.0 m		
2	0.6 0.5 0.4	0.8	9 3-4
BHIM03 284-	RE-LOSS / 1.37m /2	83.97-285.34m)	////
285	28 534 CORI	LOSS/	1.69m//
286	1/ ////////////////////////////////////	//////	/////
287 287.03		CORE LOSS	0.7/m 287.60
Part - Constant			
		P HOPPER	DATE 28/04/2023
CID	FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023
	SNOWY 2.0	SCALE Not To	
	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 11/14







GHD		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	S ROSS	DATE 28/04/2023	A4
	SNOWY 2.0 Core Photo - BH1403	Not To S PROJECT № 12521697	FIGURE № 13/14	A4





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE 28/04/2023 6 Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1403 14/14





GHD	FUTURE GENERATION JV	P HOPPER	DATE 28/04/2023	
		CHECKED S ROSS	DATE 28/04/2023	
		SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 1/14	









GHD		P HOPPER	DATE 28/04/2023
	FUTURE GENERATION JV	CHECKED S ROSS	DATE 28/04/2023
	SNOWY 2.0	SCALE Not To S	Scale A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 3/14

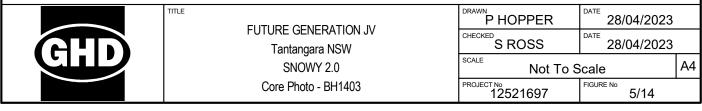




		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	S ROSS	DATE 28/04/2023	
	SNOWY 2.0	Not To S	Scale	A4
	Core Photo - BH1403	PROJECT No 12521697	FIGURE № 4/14	











		P HOPPER	DATE 28/04/2023	
	FUTURE GENERATION JV Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 6/14	





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE 28/04/2023 9 Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1403 7/14

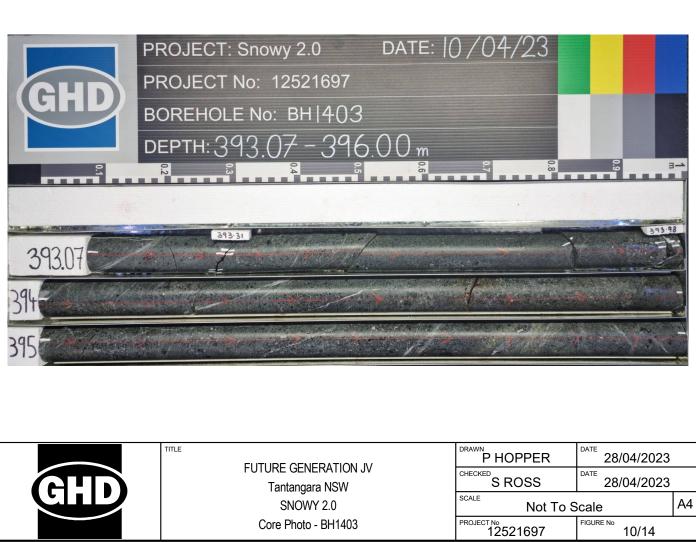




	PROJECT: Snowy 2.0 DATE: 02 / 04/23
GHD	PROJECT No: 12521697
GIL	BOREHOLE No: BH 403
	DEPTH: 375.33 - 381.34m
	0.3 0.4 0.2
	NO CORE (NAVI DRILLING)
380.17	
381 - 201	381.34 m
	NO CORE (NAVI DRILLING)













GH



Tantangara NSW

SNOWY 2.0

Core Photo - BH1403

SCALE

PROJECT № 12521697

28/04/2023

12/14

Not To Scale

FIGURE No

A4





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE 28/04/2023 GH Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1403 13/14





ТІТ	TLE FUTURE GENERATION JV	P HOPPER	DATE 28/04/2023	
âHD	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale A	4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 14/14	





		P HOPPER	DATE 28/04/2023	
GHD	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
		SCALE Not To S	cale	A4
	Core Photo - BH1403	PROJECT № 12521697	FIGURE No 1/8	



 PROJECT: Snowy 2.0
 DATE: 14/04/23

 PROJECT No: 12521697

 BOREHOLE No: BH1403

 DEPTH: 440.0 - 444.0m

 BOREHOLE NO: BH1403

 DEPTH: 440.0 - 444.0m

GHD			DATE 28/04/2023	
	Tantangara NSW SNOWY 2.0	CHECKED S ROSS	DATE 28/04/2023	
		Not To S		A4
	Core Photo - BH1403	12521697	2/8	





	TITLE FUTURE GENERATION JV	P HOPPER	DATE 28/04/2023	
(HID)	Tantangara NSW	S ROSS	DATE 28/04/2023	
	SNOWY 2.0 Core Photo - BH1403	Not To S PROJECT № 12521697	FIGURE No 3/8	A4





		P HOPPER	DATE 28/04/2023		
	Tantangara NSW	S ROSS	DATE 28/04/2023		
	SNOWY 2.0	Not To S	Scale	A4	
- 00H		Core Photo - BH1403	PROJECT № 12521697	FIGURE № 4/8	





	P HOPPER	DATE 28/04/2023	
Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	-
SNOWY 2.0	SCALE Not To S	scale	A4
Core Photo - BH1403	PROJECT № 12521697	FIGURE № 5/8	

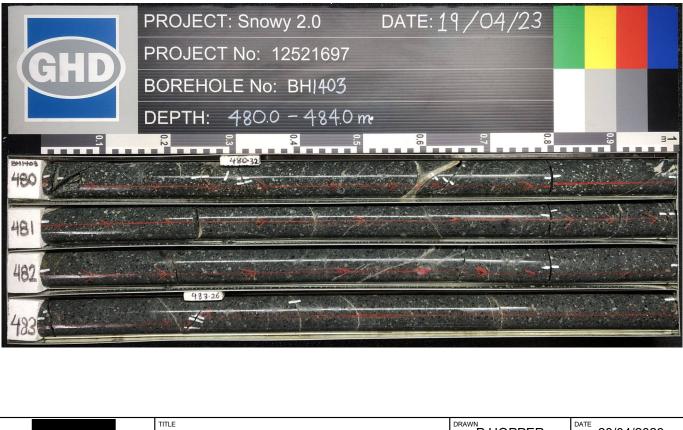




Core Photo - BH1403

6/8





6.1 GHD 2		P HOPPER	DATE 28/04/2023	
1_1 LIB 06.1	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
1 RTA 1	SNOWY 2.0	Not To S	Scale	A4
AGS 3_	Core Photo - BH1403	PROJECT № 12521697	FIGURE № 7/8	



	PROJECT: Snowy 2.0 DATE: 24/03/23
OUR	PROJECT No: 12521697
ЧПО	BOREHOLE No: BH1411
	DEPTH: 40-80m
	0.6 0.6 0.6 0.6
вніціі	
5	CORE LOSS 2.9m
6 /	CORE LOSS
71/	CORE LOSS

		DATE 28/04/2023		
GHD	FUTURE GENERATION JV Tantangara NSW SNOWY 2.0	CHECKED S ROSS SCALE Not To S	DATE 28/04/2023	A4
	Core Photo - BH1411	PROJECT № 12521697	FIGURE No 1/8	







		P HOPPER	DATE 28/04/2023	
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
GIND	SNOWY 2.0	Not To S	Scale	A4
	Core Photo - BH1411	PROJECT № 12521697	FIGURE No 3/8	



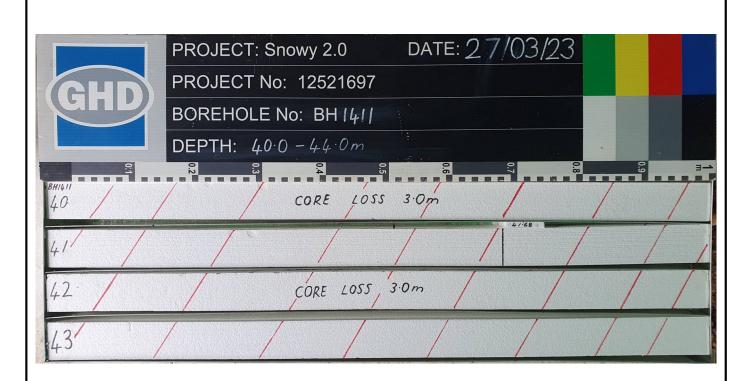


	P HOPPER	DATE 28/04/2023		
	Tantangara NSW	CHECKED S ROSS	DATE 28/04/2023	
	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1411	PROJECT No 12521697	FIGURE № 4/8	



	PROJECT: Snowy 2.0 DATE: 2	7/03/23	
CUD	PROJECT No: 12521697		
ЧПР	BOREHOLE No: BH [4]		
	DEPTH: 36.0 - 40.0m		
2	0.6	0.8	8 3-4
BH11411 36			
37	CORE LOSS 2.13m		
38	38:51		1
39	CORE LOSS 3.0m	. /	11
	TITLE		DATE

FUTURE GENERATION JV Tantangara NSW SNOWY 2.0		DATE 28/04/2023
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	Core Photo - BH1411	PROJECT № 12521697	FIGURE № 7/8

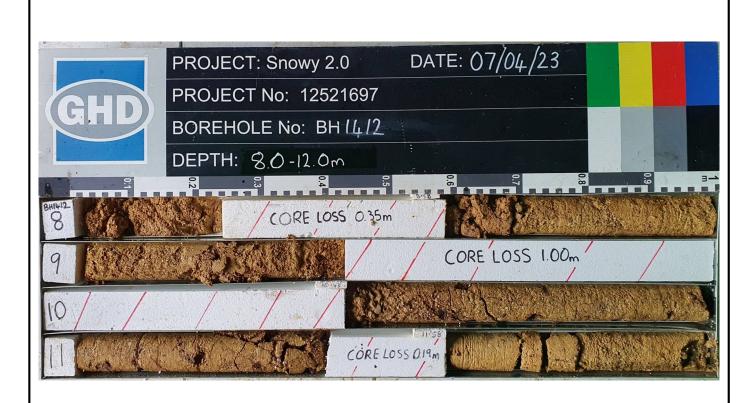


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	SNOWY 2.0	SCALE Not To S	Scale	A4
	Core Photo - BH1411	PROJECT № 12521697	FIGURE № 8/8	



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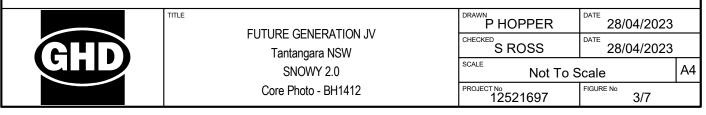
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SNOWY 2.0

Core Photo - BH1412

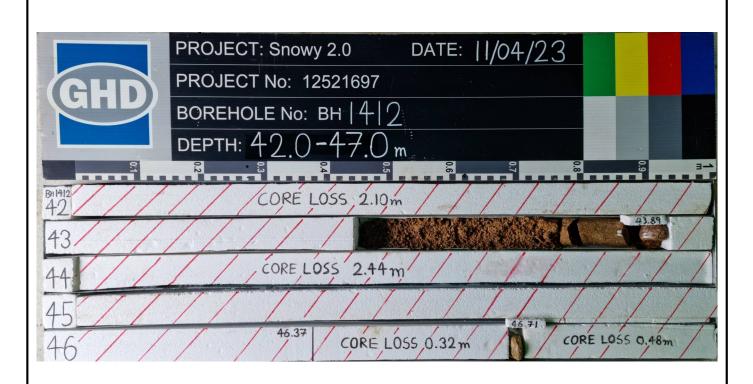
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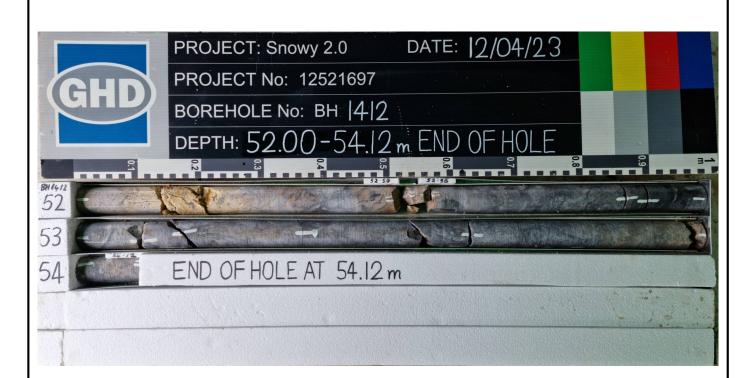
FIGURE No

5/7

PROJECT № 12521697



PROJECT No: 12521697 BOREHOLE No: BH [4]2 DEPTH: 470-52.0m BHI412 47 CORE LOSS 0.48m CORE LOSS 1.94m CORE LOSS 1.94m CORE LOSS 0.52m 50 51	n		
		DATE 28/04/2023	
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FUTURE GENERATION JV Tantangara NSW SNOWY 2.0 Core Photo - BH1412	P HOPPER	DATE 28/04/2023 DATE 28/04/2023	
	SCALE Not To S	Scale	A4
	Core Photo - BH1412	PROJECT No 12521697	FIGURE № 7/7





P HOPPER TITLE DATE 28/04/2023 FUTURE GENERATION JV CHECKED S ROSS DATE 28/04/2023 9 Tantangara NSW SCALE A4 SNOWY 2.0 Not To Scale PROJECT № 12521697 FIGURE No Core Photo - BH1413 1/5







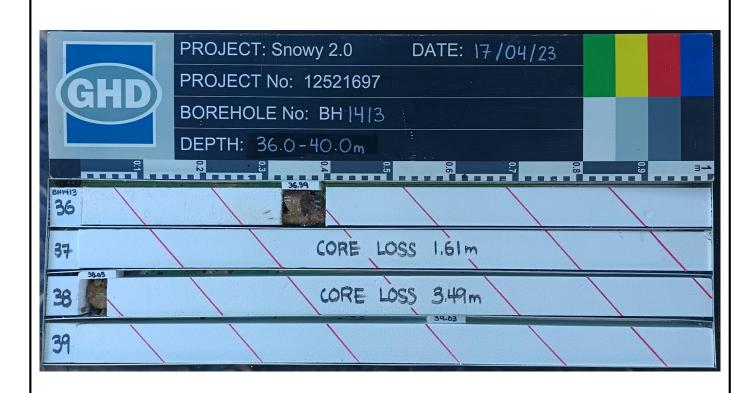
	PROJECT: Snowy 2.0 DATE: 15/04/23
(GHD)	PROJECT No: 12521697
	BOREHOLE No: BH1413 DEPTH: 20.0 - 24.0m
20.92 20	CORE LOSS 0.71m
21	21-63
22	
23	CORE LOSS 2.70m

i.					
	GHD		P HOPPER	DATE 28/04/2023	
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		Core Photo - BH1413	PROJECT № 12521697	FIGURE № 3/5	





	TITLE FUTURE GENERATION JV	P HOPPER	DATE 28/04/2023	
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	SNOWY 2.0	Not To S	scale	A4
	Core Photo - BH1413	PROJECT № 12521697	FIGURE No 4/5	



GHD	PROJECT No: 12521697 BOREHOLE No: BH  4 3 DEPTH: 40.0-42.32m End of Ho B B B B B B B B B B B B B B B B B B B	E AT 42.	
GHD	TITLE FUTURE GENERATION JV Tantangara NSW SNOWY 2.0 Core Photo - BH1413	DRAWN P HOPPER CHECKED S ROSS SCALE Not To S PROJECT NO 12521697	DATE 28/04/2023 DATE 28/04/2023 Scale A: FIGURE NO 5/5



#### BH1403 Downhole Survey

Capture #	Downhole Depth (m)	Surveyed Inclination (°)	Surveyed Azimuth (raw °)	Mag/True	Azimuth (magnetic)
1	0	1.00	(14W ) 282.00	TRUE	269.70
2 9		1.48	281.92	TRUE	269.62
3	15	1.87	282.09	TRUE	269.79
4	30	2.03	281.86	TRUE	269.56
5	45	1.56	281.92	TRUE	269.62
6	60	1.21	281.94	TRUE	269.64
7	75	0.86	281.61	TRUE	269.31
8	90	0.69	281.74	TRUE	269.44
9	120	0.14	281.74	TRUE	269.44
10	150	0.10	281.20	TRUE	268.90
11	180	-0.92	281.42	TRUE	269.12
12	195	-1.26	281.08	TRUE	268.78
13	210	-1.40	281.31	TRUE	269.01
14	225	-1.10	281.34	TRUE	269.04
15	240	-0.50	281.34	TRUE	269.04
16	255	0.23	281.12	TRUE	268.82
17	270	0.61	280.94	TRUE	268.64
18	285	0.91	280.77	TRUE	268.47
19	300	1.74	281.18	TRUE	268.88
20	315	1.24	280.67	TRUE	268.37
21	330	1.17	280.65	TRUE	268.35
22	345	0.97	280.17	TRUE	267.87
23	360	0.97	280.84	TRUE	268.54
24	375	0.97	280.47	TRUE	268.17
25	380	1.99	280.58	TRUE	268.28
26	384	2.57	280.53	TRUE	268.23
27	387	2.86	280.74	TRUE	268.44
28	393	3.27	280.92	TRUE	268.62
29	405	3.07	280.21	TRUE	267.91
30	420	2.58	280.69	TRUE	268.39
31	432	1.87	280.92	TRUE	268.62
32	444	1.39	280.96	TRUE	268.66
33	456	1.15	281.71	TRUE	269.41
34	468	0.80	279.74	TRUE	267.44
35	483	0.47	280.00	TRUE	267.70
36	494	1.71	280.44	TRUE	268.14
37	507	3.69	280.64	TRUE	268.34
38	513	4.40	280.37	TRUE	268.07





# Tantangara Adit Geophysical Investigation Report

**Future Generation Joint Venture** 

13 April 2023



Project name Document title		Snowy 2.0 Geotechnical Investigation									
		Tantangara Adit Geophysical Investigation Report									
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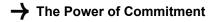
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## 1. Introduction

Future Generation Joint Venture (FGJV) engaged GHD to undertake a geophysical investigation using the Seismic Refraction Tomography (SRT) method in the area of Tantangara HRT adit locations. The purpose of this geophysical investigation was twofold: first, to assess the subsurface conditions in two key areas, and second, to supplement the ongoing intrusive geotechnical investigation. The first survey area was located near a recent surface depression that developed above the tunnel boring machine (TBM) launched at Tantangara Adit for HRT02. The second survey area was across the HRT01 alignment. The ultimate goal of the survey was to update the geological model in the selected areas of the HRT and adit locations at Tantangara.

#### 1.1 Purpose of this report

The purpose of this report is to inform the site geological model and tunnel design on the findings and an interpretation (based on current available geotechnical information) of the SRT survey.

### 1.2 Survey objectives

The overarching purpose of the seismic refraction tomography survey was to map the changes in the P-wave seismic velocity (Vp) of the subsurface, both laterally and by depth. Seismic velocities are controlled by various physical properties and conditions of subsurface material such as density, hardness, elasticity, moisture content, fracturing, presence of cavities and weathering.

When correlated with geological and geotechnical logs of boreholes in proximity to the SRT survey lines, or other directly observed data (e.g., CPT), the P-wave velocity models:

- Allow more comprehensive interpolation of strata between boreholes;
- Assist in establishing depth to competent rock; and

 Highlight zones of anomalous velocities, which can be related to geological features (for example faults, dykes or fractured zones).

The main objectives of the SRT survey were to:

- Establish the depth to competent rock in the survey area;
- Identify deeper/shallower areas of soil cover;
- Define higher weathering/fractured zones beneath the footprint of the survey lines; and
- Locate any other significant geophysical anomalies.

#### 1.3 Scope of works

The scope of works comprised the acquisition of five (5) SRT lines, with a total coverage of 1,656 lineal metres as well as processing and interpreting the data and reporting on the results.

#### 1.4 Limitations

This report: has been prepared by GHD for FGJV and may only be used and relied on by FGJV for the purpose and objectives agreed between GHD and FGJV as set out in Section 1.1 and 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than FGJV arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

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

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## 2. Site location

The investigation site is located on the western side of Tantangara Reservoir, specifically to the west of the Tantangara TBM Adit, NSW. Figure 1 presents the locations of surveyed SRT lines in relation to geotechnical boreholes directly relevant to the geophysical survey lines.

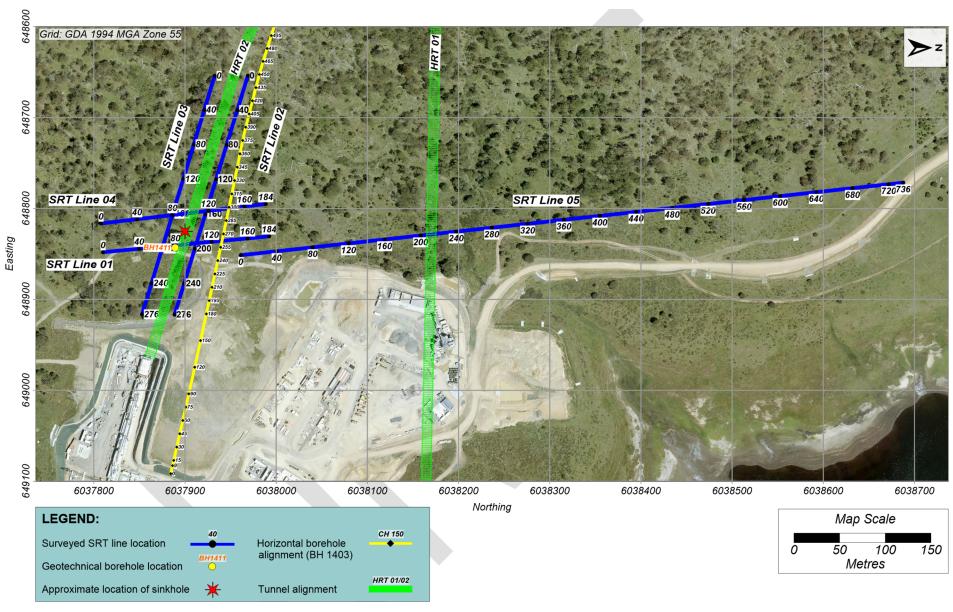


Figure 1 Geophysical survey location map

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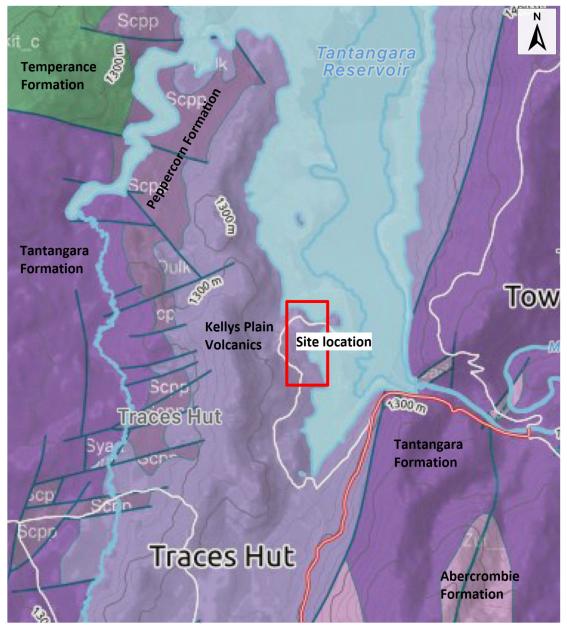
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## 2.1 Site geology

The site is situated within the Kellys Plain Volcanics (Lower Devonian), a geological formation primarily composed of pyroclastic rocks, including dacite ignimbrite, rhyodacite ignimbrite, tuff, agglomerate, and rhyolite. The Kellys Plain Volcanics are situated amidst the Lower Silurian Tantangara Formation, which is predominantly composed of sandstone, siltstone, shale, and quartzite. The location of the site is shown on the extract from the NSW Bedrock Geological Map (Trilobite solutions) in Figure 2 below.

Based on the geotechnical boreholes drilled near the geophysical survey area, it has been observed that there is a presence of rhyodacite rock with different degrees of weathering. This rhyodacite rock is found to be overlying a slightly weathered meta-limestone/limestone of the Peppercorn Formation.





Extract from NSW Bedrock Geology Map (Source: https://trilobite.solutions/maps)

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## 3. Geophysical method overview

The Seismic Refraction Tomography (SRT) method is based on the measurement of the travel times of seismic waves refracted at the interfaces between subsurface strata of different velocity. The seismic waves typically measured with the seismic refraction technique are P-waves and the first arrival of the P-waves are used in the tomography analysis.

Primary Body waves (P-waves – with velocity Vp) are compressional waves that are longitudinal in nature. Pwaves are pressure waves that travel faster than other seismic waves through the earth, and so arrive at seismograph stations first, hence the name "Primary". These waves can travel through any type of material, including fluids. Seismic velocities are controlled by rock hardness, variable lithology, anisotropy, density, elasticity and moisture content, fracturing, presence of cavities and weathering.

Seismic energy is provided by a source ('shot') located on the surface at a known distance from, or within, the linear array of geophones. For shallow applications, the shot is normally provided by a sledgehammer and a striker plate weight drop or small explosive charges (i.e. explosives in a borehole or a blank shotgun cartridge) in land seismic surveys, or either an airgun, boomer, pinger or sparker in marine surveys. Energy radiates out from the shot point, either traveling directly through the upper layer (direct arrivals) or travelling down to and then laterally along higher velocity layers (refracted arrivals) before returning to the surface. This energy is detected on the surface using a linear array (or spread) of geophones spaced at regular intervals (Figure 3).

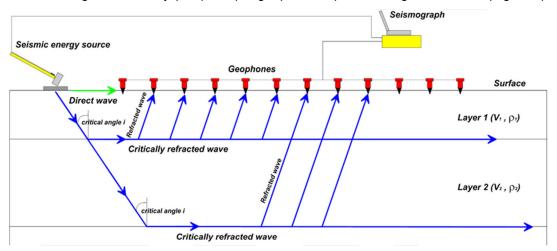


Figure 3 Seismic refraction principles

Beyond a certain distance from the shot point, known as the "crossover distance", the refracted signal is observed as a first-arrival signal at the geophones. In practice, the seismic velocity may continuously vary with depth and laterally, with effectively a very large number of layers with complex velocity variations. In order to map the lateral variations, several shots are employed at different positions at both ends of, and within, each seismic spread of geophones. Analysis of the travel-times of the direct and refracted waves provides information on this complex, continuous variation in seismic velocity both with depth and laterally as approximated by many velocity layers of variable lateral velocity or many model "blocks" of constant velocity.

To address such velocity complexity, GHD processes acquired refraction data with the industry standard tomographic inversion process. Rayfract® refraction tomography software used by GHD allows reliable imaging of subsurface velocity structure including faults, strong lateral velocity variation and other velocity anomalies. The smooth inversion tomographic method is based on physically realistic modelling of first break propagation for P-wave surveys. The software performs refraction forward modelling and back-projects traveltime residuals along wave paths also known as Fresnel volumes (Watanabe, 1999) instead of conventional rays. This increases the numerical robustness of the inversion. A smooth minimum-structure and artefact-free 1D starting model is determined automatically directly from the seismic traveltime data by horizontally averaging DeltatV (Wiechert-Herglotz) method 1D velocity-depth profiles along the seismic line. The starting model is then refined with 2D WET (Wavepath Eikonal Traveltime) inversion (Schuster and Quintus-Bosz, 1993). The WET process undergoes several iterations (usually up to 30 iterations), adjusting separately the velocities of each model block until the

theoretical travel time curves closely match the actual field travel time curves. The process imposes a continuous variation of velocity with depth. Results of this WET inversion of the data are presented as 2D sections defining the computed distribution of P-wave velocity with depth, consistent with the observed travel-time data. The primary applications of seismic refraction are for determining the depth to sedimentary and weathered bedrock layers, the depth to the water table and the variability of bedrock velocity and structure. Due to the dependence of seismic velocity on the elasticity and density of the material through which the seismic energy is passing, seismic refraction surveys provide an indirect measure of material strengths and can consequently be used as one of the parameters in assessing rock rippability, rock hardness and rock quality and therefore rock defects (weathering, faults, fracturing etc.).

## 4. Geophysical data acquisition

The geophysical investigation (SRT survey) was conducted over three periods: between 20 - 21 December 2022, 18 – 22 January 2023, and 8 February 2023. A GHD geophysics field crew attended the site and was responsible for survey organisation, data collection, and ensuring compliance with quality and safety systems.

#### 4.1 Survey statistics

The SRT survey consisted of five (5) seismic lines providing a total coverage of 1,656 lineal metres within the area of investigation. The location of the survey lines is shown in Figure 1. Table 1 below shows the basic seismic survey information and statistics.

SRT Line Name	Start Easting	Start Northing	End Easting	End Northing	No. of Spreads	No. of Seismic Shots	Line Length (m)
SRT Line 01	648848.0	6037810.1	648830.6	6037992.3	2	35	184
SRT Line 02	648653.9	6037968.9	648916.7	6037888.6	3	52	276
SRT Line 03	648654.0	6037932.5	648916.4	6037852.9	3	52	276
SRT Line 04	648816.4	6037807.9	648795.0	6037988.6	2	35	184
SRT Line 05	648851.3	6037961.2	648771.5	6038687.6	8	148	736
Total		-			18	322	1656

 Table 1
 SRT survey coordinates and statistics

Note: GDA 94 MGA Zone 55

#### 4.2 Survey layout

The seismic lines spread and shot (seismic source) geometry was determined based on the survey objectives and likely ground conditions.

The SRT survey acquisition geometry for investigation site is presented in Table 2.

 Table 2
 SRT survey acquisition geometry

SRT Survey Parameter	Unit (all lines)
Number of geophones (receivers) per single spread	24
Distance between geophones	4 metres
Length of single spread	92 metres
Overlap between adjacent spreads	1 geophone
Average number of shot locations (sources) per single spread	18
Distance between shot locations within each spread	8 metres
Min distance between source and receiver	2 metres
Max distance between source and receiver	138 metres

Note: The maximum distance between receiver and source is a major determinant of the investigation depth.

The detail spread and shot (seismic source) geometry is listed in tables in 0.

### 4.3 Survey equipment

The seismic acquisition was performed using a Seismic Source – DaqLink-3, 24-channel, digital enhancement seismograph connected to a Panasonic Tough Book laptop computer. A RT Clark (4.5 Hz) geophone array of 24 geophones connected by 1 x 24-channel receiver cable, was used in the survey. Seismic data acquired in the survey was saved in the SEG-2 universal seismic digital data format (Pullan, 1990). A sampling rate of 0.125 milliseconds was used with a recording length of 0.5 seconds.

#### 4.4 Seismic data acquisition procedure

The geophones connected to the seismic cable, were planted into the ground at the proposed seismic line alignments, where possible, along the stretched and fixed measure tape.

The seismic shots were acquired using a 12 kg sledgehammer and an aluminium striker plate as the seismic source. In cases where the hammer-acquired shots needed extra energy, a 20 kg sledgehammer was used with minimum of 5, to up to 25 hits were recorded until a desirable signal to noise ratio was achieved (Figure 4). Individual shots were recorded, and optimal post-survey stacking was carried out prior to processing.



Figure 4 Seismic data acquisition (SRT Line 01)

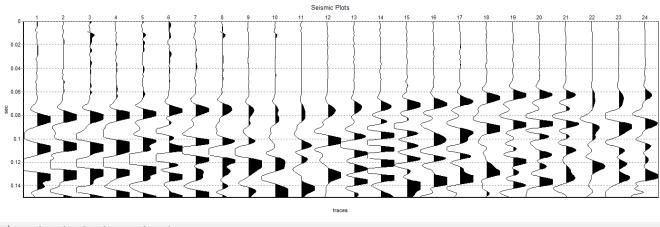
Upon completion of the seismic survey, the start and end location of the line was surveyed using the Trimble ProXRS RTK GPS system with an activated VBS signal. The system lateral accuracy is +-1.5 metres. The information on elevations (RL) along the acquired SRT lines was extracted from the available DTM dataset (estimated vertical accuracy is 0.2 m).

### 4.5 Infield data QA/QC

Seismic data quality (i.e. signal to noise S/N ratio) was improved by the vertical stacking of seismic records. This procedure offsets the limitations of the seismic source energy (sledgehammer and a striking plate) and decreases the influence of noise (vibrations) on seismic data. Additionally, considerable data redundancy was built into the acquisition geometry to ensure, that the results reflected the true subsurface response rather than noise-induced artefacts.

Despite conducting the survey during the nightshift, the location of the site, near the working site meant that geophones were still sometimes affected by vibrations generated by various sources (mostly heavy machinery). The field geophysicist was responsible for real-time quality assurance and quality control (QA/QC) of seismic records. When the data quality was deemed inadequate, a period of recording standby was commenced with intermittent testing of the signal strength until acceptable recording conditions prevailed. Based on a generally observed high S/N ratio in the data, the overall acquired seismic dataset can be characterized as of good quality.

Figure 5 below shows an example of the seismic record data quality for the longest off shot where distance between farthest receiver (channel 24) and source is 138 metres. The first P-wave arrivals can be clearly seen on all acquired 24 channel records.



Comment Record Info | Plot Info | Status | Errors | Communication | Network | TANT\_L5\_SRT\_4m\_Spread\_6\_Shot\_+46m

Figure 5 Example of an acquired seismic record – SRT Line 05, Shot 113 long-off shot +46 m

## 5. Seismic data processing

Rayfract 4.01 software was used to process the seismic data using the seismic refraction tomography processing technique. The processing steps included:

- Picking first P-wave arrivals.
- Calculating 1D-gradient initial velocity model.
- Calculated initial velocity model then was used for the final data inversion using the Wavepath Eikonal Traveltime (WET - Schuster and Quintus-Bosz, 1993) algorithm. Model with 20 WET iterations was selected for the final presentation.
- The final seismic P-wave velocity model figures were generated using Golden Software Surfer 15 gridding software.
- Datamine Discover (Discover 3D) software was used to present the seismic models in 3D view

A sample of a seismic record and the picked first break time versus distance of the geophone from the source plot from the processing steps involved, is presented in Figure 6.

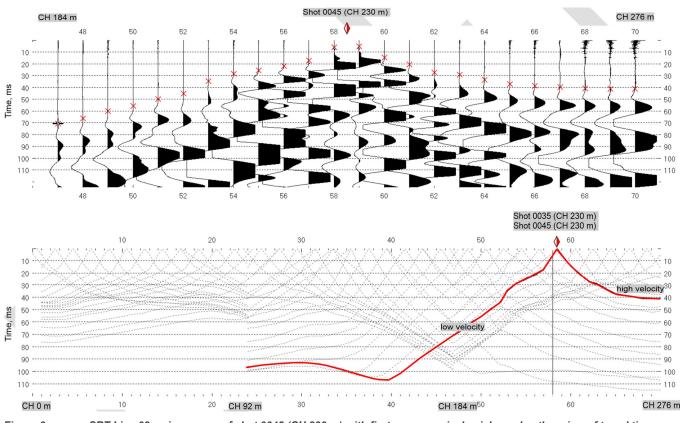


Figure 6 SRT Line 02, seismogram of shot 0045 (CH 230 m) with first p-wave arrivals picks and gather view of travel time curves of shot 0035, and shot 0045 (CH 230 m)

The high-level of quality of the data enabled high confidence in the first arrivals picking and, therefore, confidence in the initial velocity calculation. The model's RMS error (indicator of convergence between the modelled and picked travel time curves) varies from 2.4% to 4.1 % (average 3.0%) indicating a robust level of convergence given the nature of the velocity variation on site (volcanic geology).

This document is in draft form. The contents, including any opinions, conclusions or recommendations contained in, or which may be implied from, this draft document must not be relied upon. GHD reserves the right, at any time, without notice, to modify or retract any part or all of the draft document. To the maximum extent permitted by law, GHD disclaims any responsibility or liability arising from or in connection with this draft document.

## 6. Geophysical survey results

This section of the report presents the results and an interpretation of the SRT survey conducted at the Tantangara Adit site, based on available information at the time of reporting. The position of the SRT lines in relation to geotechnical boreholes is presented in Figure 1.

SRT results are presented as two-dimensional (2D) P-wave velocity contour model, depth sections.

The P-wave seismic velocity models are presented as figures in Appendix A of this report. The seismic velocity models have unique figure numbers (Figure A01 to Figure A05). For each 2D seismic velocity model, the corresponding survey line is shown in red on the location inset map (top right corner in each figure), along with the seismic line chainage indicators set at 40 metre increments. The figures are presented in A3 page landscape format with a scale displayed at the bottom of the figures within the title box of each figure. The seismic lines orientation is indicated in the top left corner of the velocity model.

For convenience the SRT Line 05 model is also presented in the same scale as other "sinkhole" lines in Figure A06 to Figure A08.

The survey traverses were imported and integrated (stitched together) in (Datamine Discover) Discover 3D software to facilitate overall interpretation. Stitched 3D plots of the seismic results are presented in Figure A09 to Figure A17 in 0.

In the seismic velocity model, different P-wave seismic velocity values are presented within a custom designed dynamic range starting from lower P-wave velocities, shown as 'colder' or blue colours, to more intense, "warmer" colour ranges (i.e. yellow, red, white) representing higher p-wave velocities. As such, warmer colours represent a corresponding increase in material velocity/ density (i.e. seismic impedance). All 2D P-wave velocity models are presented with an identical dynamic range colour scheme (Vp = 400-6000 m/s). Geotechnical borehole simplified graphic logs with a lithology, weathering description are shown (along with the borehole offset distance) where present and close to the seismic line to enable a sensible comparison of borehole and seismic results.

The interpretation in this section of the report is limited to drawing attention to the presence of seismic velocity features for their correlation with the available geological information and subsequent borehole information. Where appropriate, potential lithological or structural interpretations are proposed to provide possible explanations for these features. The interpretations in this Section are preliminary and are not intended to be definitive. Further investigation and analysis by a suitably qualified and experienced engineering geologist or geotechnical engineer is required, utilising additional existing data or data from any of the current boreholes and testing data and any geotechnical investigations in the future as necessary.

The main objectives of the SRT survey were to establish the depth to competent rock in the survey area, identify deeper/ shallower areas of soil cover, define higher weathering/ fractured zones beneath the footprint of the survey lines (findings presented in Section 6.1), and to locate any other significant geophysical anomalies (findings presented in Section 6.2).

The limitations of the SRT survey method and results are summarised in Section 7.

#### 6.1 SRT interpretative notes

The conceptual interpretation of the seismic results was based on correlation of the P-wave velocity models with the findings of the geotechnical boreholes BH1411 and horizontal BH1403 (drilled in March 2023) located in proximity to SRT Line 01, SRT Line 02 and SRT Line 04. The interpretation did not consider other historical boreholes drilled at the Tantangara site due to their distance from the SRT lines and the variable geological profile.

Based on the correlation of P-wave velocities with the findings of the available geotechnical boreholes at the time of this report, the conceptual interpreted P-wave (Vp) velocity range of 1,900 m/s was derived as the cut-off for transition to slightly weathered (SW) rhyodacite/meta-limestone. Based on this inferred P-wave velocity range, the maximum depth to SW bedrock below the SRT Line 01 is approximately 48 m BGL (below ground level), and approximately 45 m (BGL) below the SRT Line 02.

The inferred SW rhyodacite/meta-limestone boundary is shown on the P-wave velocity sections (Appendix A) as a red dashed line.

The P-wave velocity range of 1,500-1,900 m/s was interpreted as indicating moderately weathered (MW) rhyodacite.

Based on published literature and experience in analysing geophysical data collected in similar geological conditions and taking into consideration recent geotechnical information from the site the subsurface material with P-wave velocity less than 1,200 m/s can be associated with highly/extremely (XW/HW) weathered rock (rhyodacite). It is important to note that certain ground conditions, such as saturation or compaction, which are typically associated with a certain depth of strata occurrence, can cause the velocity of XW/HW rock to overlap with the MW rock velocity range. Therefore, the models only show the inferred boundary for top of SW rock.

#### 6.1.1 HRT01 corridor analysis

The proposed HRT01 alignment intersects SRT Line 05 at approximately chainage 212 m, forming an almost right angle. For convenience, the approximate area of the intersection of the proposed HRT01 alignment with the SRT Line 05 (20 m wide) is shown on the derived velocity model as a black dashed polygon.

The velocity model revealed a highly consistent velocity profile, with a gradual increase in P-wave velocity with depth in the area of the proposed HRT01 corridor. The depth to the SW rock interface was inferred to be approximately at 1,228 m RL. The HRT01 investigation area is limited by the seismic line extent.

#### 6.2 Geophysical anomalies

After analysing resultant seismic models, five velocity anomalies were identified and subsequently interpreted based on available geotechnical information. The list below presents the identified velocity anomalies in the order of their inferred significance for the project.

#### 6.2.1 Velocity anomaly 1

A low velocity anomaly with a Vp < 1,900 m/s was identified along SRT Line 01 and SRT Line 02. This anomaly is relatively large and deep and is believed to be associated with the problematic zone of poor ground composed of XW/HW rhyodacite encountered by the TBM. It is also thought to be related to a sinkhole that appeared above the tunnel in mid-December 2022.

A low velocity anomaly was observed along SRT Line 01, characterized by a prominent, cliff-like change in velocity between CH 50 - 70 m. A minimum observable extent of this anomaly is 120 meters between CH 60 - 184 m (end of SRT Line 01). It is possible that the anomaly extends further north beyond the coverage of SRT Line 01. The inferred maximum depth to the SW bedrock along SRT Line 01 is approximately 48 meters below ground level. This anomaly was confirmed through ground truthing with BH1411, which was drilled at approximately 80 m seismic line chainage.

Anomaly 1 is also prominently observed on SRT Line 02, where it begins as a drop in velocity between CH 130-150 m on the north-eastern side of the line (at the earlier chainages). The end of this anomaly is not clearly observed as the seismic line was surveyed in close proximity to the existing tunnel, which can potentially create a lower velocity area and affect the modelling results. However, a higher velocity inverted zone observed closer to the surface could potentially be associated with an intact rock formation above the tunnel. By correlating this feature with findings from horizontal BH1403, the end of Anomaly 1 can be assumed to be at approximately 240 m line chainage. The deepest part (~43 - 45 m) of the anomaly was modelled between CH 150 – 180 m.

#### 6.2.2 Velocity anomaly 2

Anomaly 2 was identified on the velocity model of SRT Line 04 as a lower velocity (Vp 2,100 -2,200 m/s) feature with an elongated shape, dipping north at approximately 45 degrees between CH 125-160 m. The location of Anomaly 2 coincides with a section of Anomaly 1 that was identified on SRT Line 02. However, Anomaly 2 exhibits a slightly higher velocity at their intersection point. The discrepancy in velocity observed in this area can be explained by the relatively narrow width of Anomaly 1 in the north-south direction at this location, which cannot be

resolved by modelling. Analysis of geophysical data, supported by geotechnical information, suggests that Anomaly 2 is likely a part of Anomaly 1, despite the observed discrepancy in seismic velocity.

#### 6.2.3 Velocity anomaly 3

A localized high velocity (Vp > 3,600 m/s) feature, located near the surface, was identified as Anomaly 3 on the velocity model of SRT Line 05 between CH 60 and CH 120 m. This anomaly may be attributed to the presence of a rock intrusion with higher strength. Additionally, this anomaly could be linked to the potential geological structures in the surrounding area. At the centre of this anomaly, located at CH 90 m, the depth to the inferred SW rock is approximately 3 metres, making it the one of the shallowest points along the entire model.

#### 6.2.4 Velocity anomaly 4

Anomaly 4 was detected on SRT Line 05 between CH 315 and CH 350 m, at an RL of 1205 - 1210 m. It is a localized layer with lower velocity (Vp ~3,900 m/s), situated within a larger zone of higher velocity (Vp ~4400 m/s). This anomaly may indicate the presence of a pocket of lower strength rock within a formation of higher strength rock. The centre of this anomaly is located ~35 m below the ground level.

#### 6.2.5 Velocity anomaly 5

Anomaly 5 was detected on SRT Line 05 between CH 490 and CH 545 m, at a depth of 1,210 - 1,220 m RL. It is characterized by a lower velocity intrusion layer with a Vp of approximately 3,900 m/s. This anomaly may be attributed to the presence of a lower strength rock intrusion or a localized change in lithology.

### 6.3 Summary

Based on the analysis of both the 2D and 3D P-wave velocity models and its correlation with available geotechnical boreholes and the limitations of the seismic refraction tomography method (Section 7), the following conclusions and findings are made:

- It appears that the investigation site exhibits a variable velocity distribution both laterally and with depth. This suggests that the subsurface of the site comprises rock, specifically SW meta-limestone overlain by rhyodacite of varying strength and fracture state. Additionally, there is a soil layer present with variable thickness, density, and saturation.
- The inferred top boundary of SW rock (rhyodacite/meta-limestone) is shown on the P-wave velocity sections as a red dashed line.
- Major velocity Anomaly 1 and 2, which can be associated with a large and deep area of "weak" lower density material, were identified in SRT Lines 01, 02, and 03 models – sinkhole area lines. The vertical and lateral extents of this "weak" area were inferred based on the correlation of geophysical results with available geotechnical information.
- Velocity anomalies 3, 4, and 5 were observed below the 1,900 m/s velocity contour, indicating markedly
  different ground conditions compared to those observed within Anomaly 1.
- Relatively uniform velocities were modelled within the proposed HRT01 area in the SRT Line 05 model indicating a consistent weathering profile.

To further refine the interpretation of geophysical results, the following measures are recommended for consideration:

- Undertaking additional geotechnical drilling along the surveyed seismic line, SRT Line 05, to a depth of
  approximately 60 meters, has the potential to confirm the inferred SW rock cut-off velocity contour. This would
  enable a more accurate analysis of the geological conditions present in the area.
- Conducting an electrical resistivity imaging survey along SRT Line 05 could prove highly advantageous in identifying lateral lithological boundaries and geological faults. By utilizing this technique, it may be possible to obtain a more comprehensive understanding of the subsurface geological conditions in the area. Due to the fact that the surveyed seismic line has already been cleared of vegetation and this type of survey does not

necessitate the cessation of heavy machinery activity, completing this task should prove to be highly efficient. Therefore, it is likely that the survey can be carried out in a timely and productive manner.

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## 7. Limitations associated with SRT survey

The computed initial velocity model may sometimes be constrained by processing artefacts caused by unfavourable seismic signal to noise ratios or in some cases from strong lateral variations in geotechnical properties (i.e. density, velocity/ seismic impedance) of the subsurface material. The artefacts generated because of these effects, are sometimes hard to be completely smoothed or eliminated with the subsequent WET inversion process. The competence of the resulted velocity model in the detection of vertical velocity inversion zones strongly depends on the size, relative position and depth of these zones, as well as geophone spacing, and shot geometry.

The main limitations of the seismic refraction method in general and with respect to the seismic coverage of this site, are summarised below:

- Low seismic signal to noise ratio (poor quality data) can create artefacts in the resulted P-wave velocity model (generally not applicable for this survey).
- Vertical velocity inversions (the presence of a low velocity layer/zone below high velocity layer/zone) may not be clearly imaged on derived P-wave velocity model.
- Vertical resolution and accuracy of the P-wave velocity model decreases with depth.
- The WET inversion process imposes a smooth variation of velocity with depth, and this may mask either or both the presence of intermediate property layers such as MW rhyodacite between HW and SW rhyodacite and also sharp transitions in geotechnical properties of soil/rock layers. The velocity model may imply a gradation in velocity rather than sharp step(s) in velocity with depth.
- Seismic velocity models are not unique, but mathematically derived models consistent with the travel-time data. It is possible that other models may fit the travel time data within the 3.0% fitting error margin.
- It should be noted that the interpretation of the geophysical results is based solely on the analysis of two
  geotechnical boreholes drilled in the area. Therefore, it is important to exercise caution when drawing
  conclusions from these results, as they may not fully represent the geological conditions across the entire
  area. Further exploration and analysis may be required to gain a more comprehensive understanding of the
  subsurface geology.

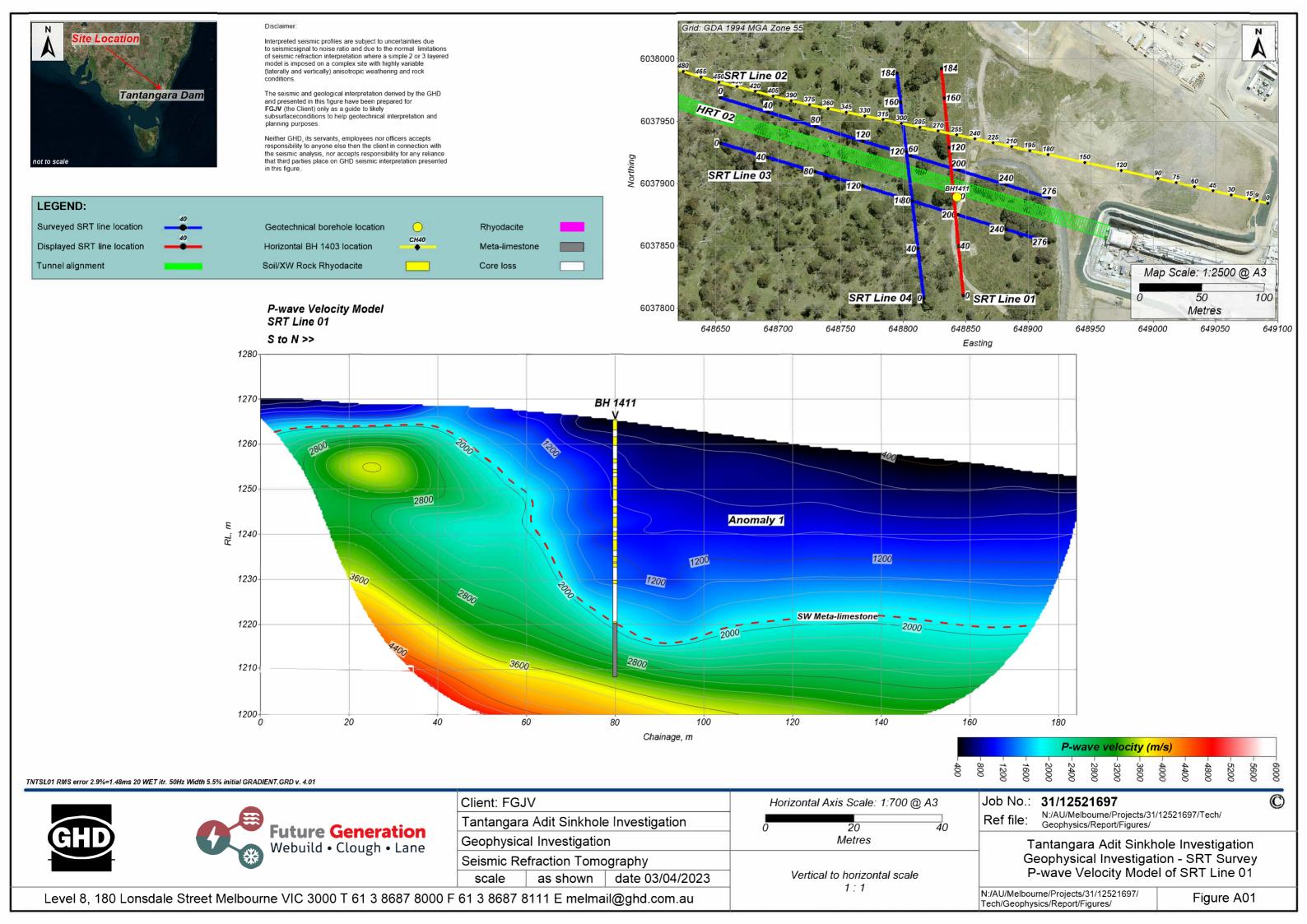
It is important to recognise that the condition of the rock mass, including strength and degree of fracturing, cannot be directly quantified by the results of a seismic survey alone and has to be considered in conjunction with overall geotechnical investigation results, geotechnical sampling, and interpretation.

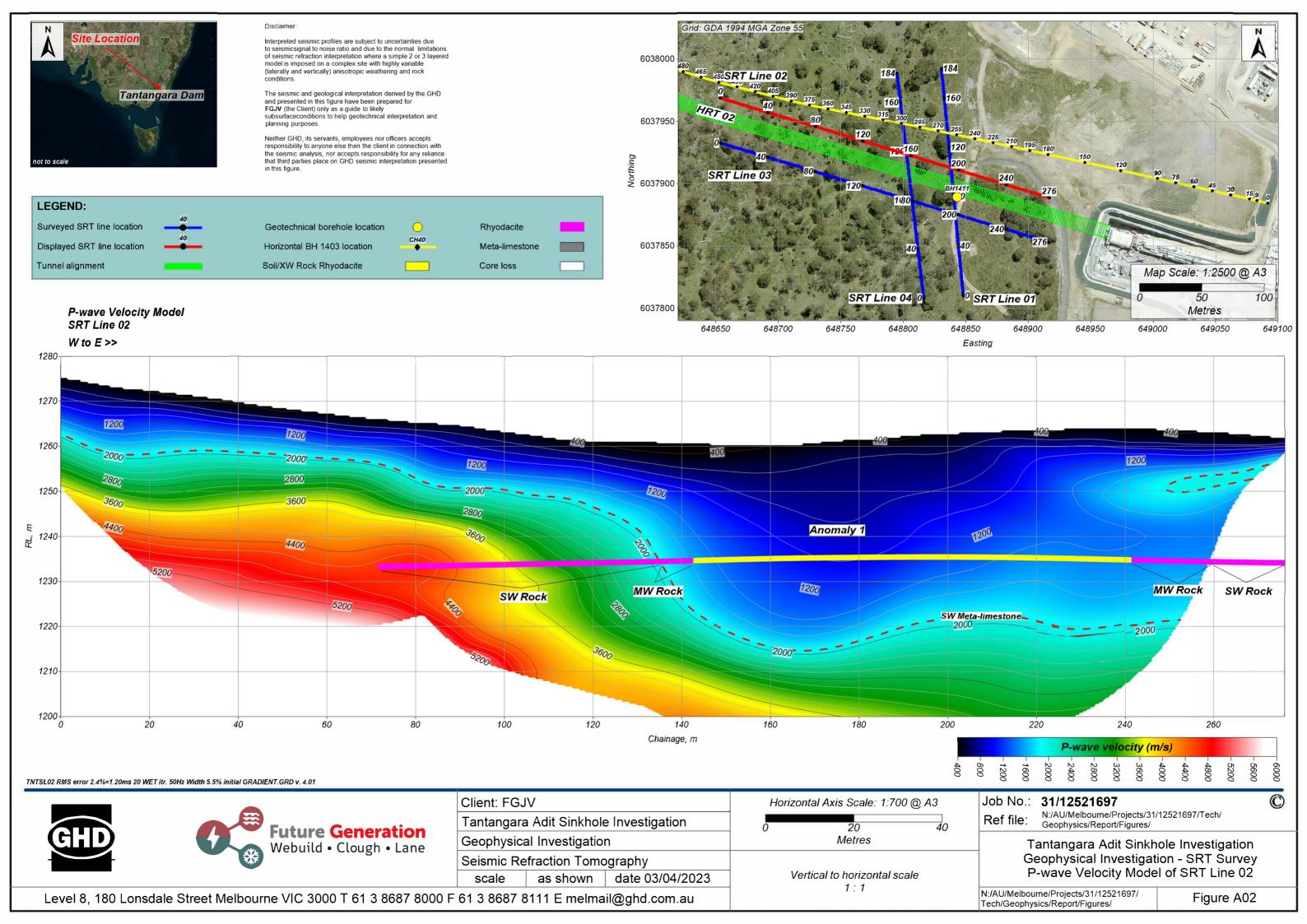
## 8. References

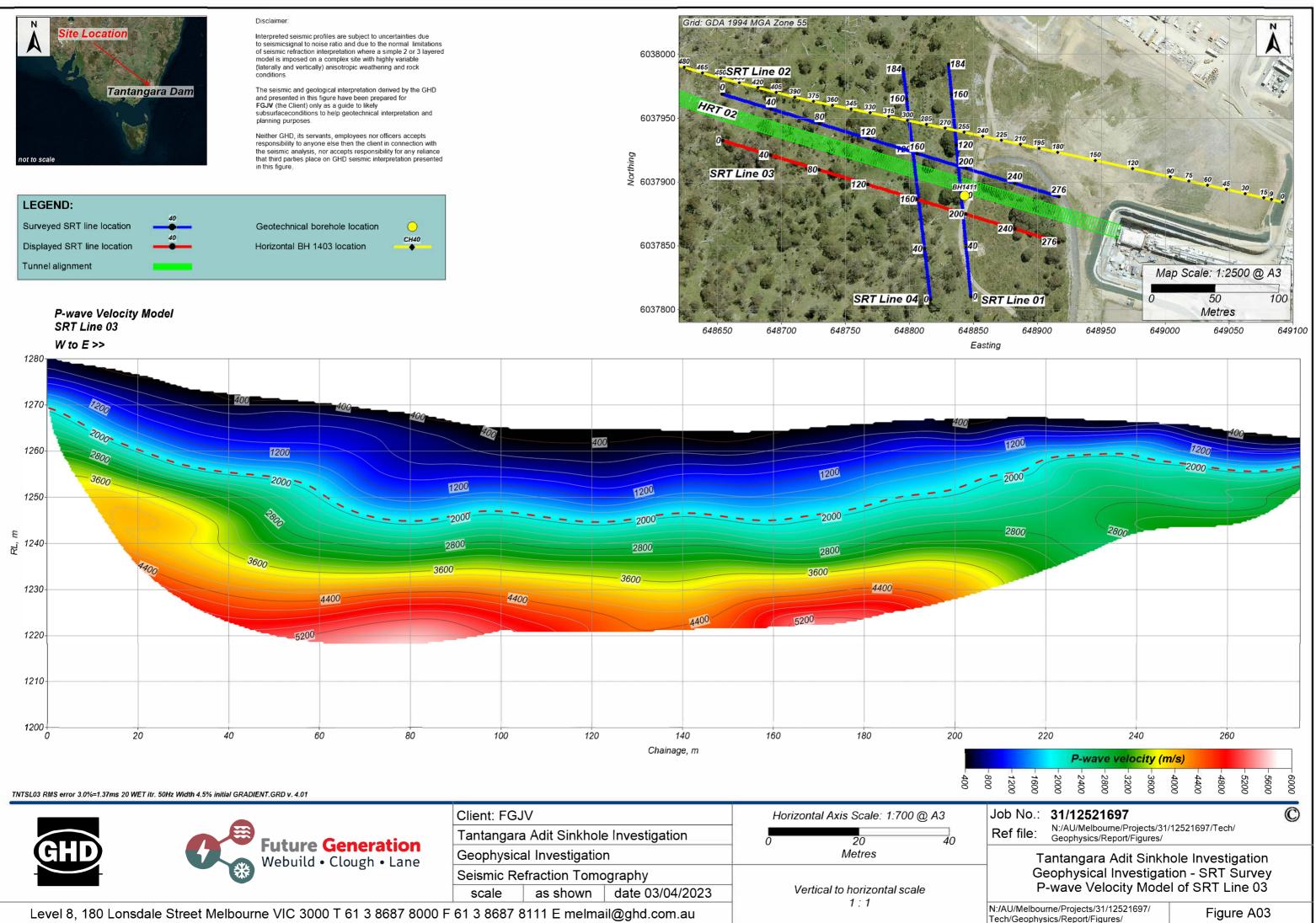
- 1. Extract from NSW Bedrock Geology Map (https://trilobite.solutions/maps)
- Gebrande, H. and Miller, H., 1985. Refraktionsseismik (in German), in Bender, F., ed., Angewandte Geowissenschaften II. Ferdinand Enke, Stuttgart; pp. 226-260. ISBN 3-432-91021-5.
- 3. http://www.seismicsource.com/ (field equipment)
- 4. Pullan, S. E., 1990. Recommended standard for seismic (/radar) files in the personal computer environment: Geophysics, 55, no. 09, 1260-1271.
- 5. Rayfract software. <u>https://rayfract.com</u> (processing software)
- 6. Schuster, G. and Quintus-Bosz, A, 1993. Wavepath Eikonal Traveltime inversion: Theory. Geophysics 58(9), pp1248-1387, Sep 1993. <u>https://doi.org/10.1190/1.1443514</u>
- 7. Borehole logs of BH1403 and BH1411. Ongoing geotechnical investigation conducted by GHD.

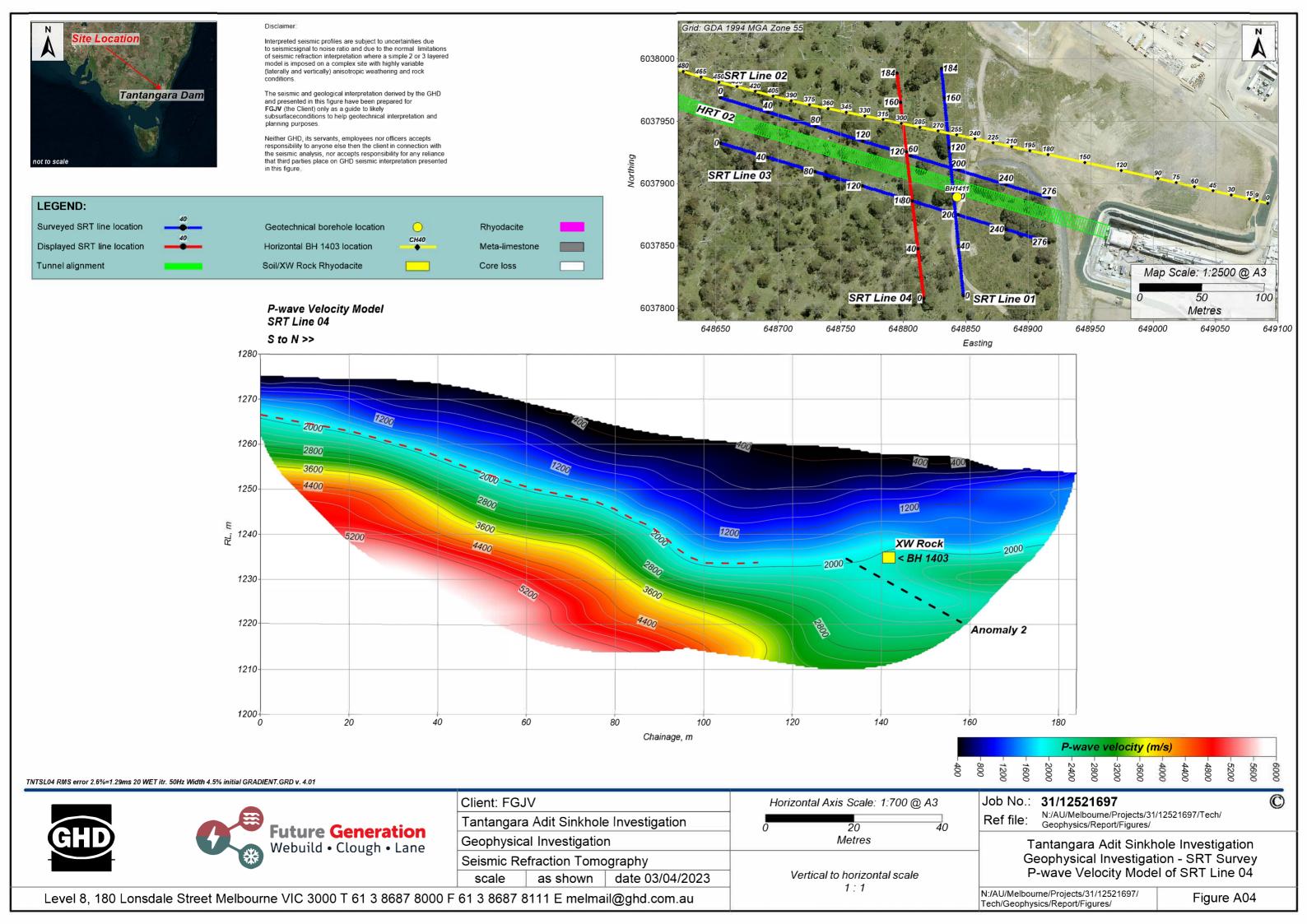
# Appendices

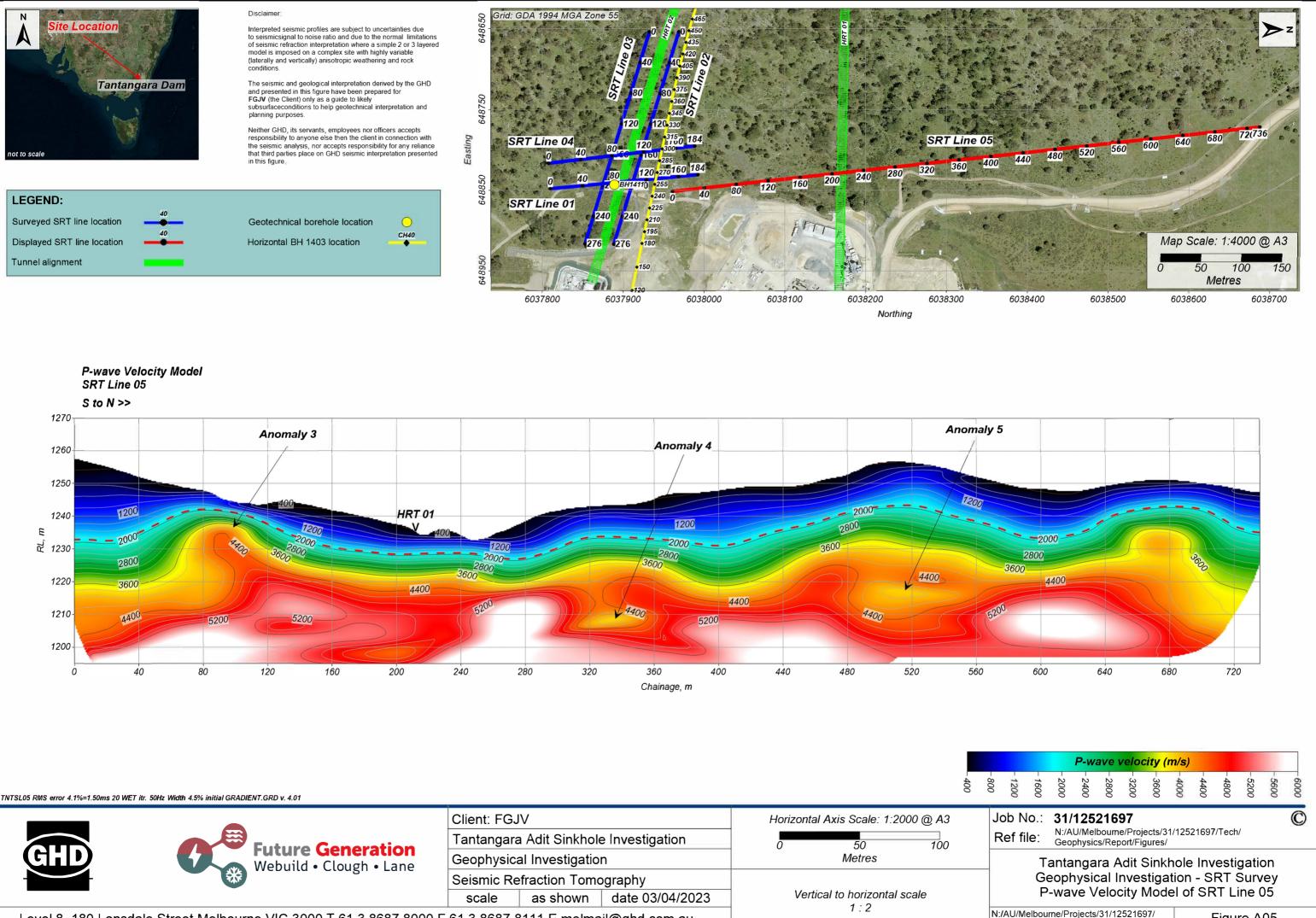
# **Appendix A** SRT survey results

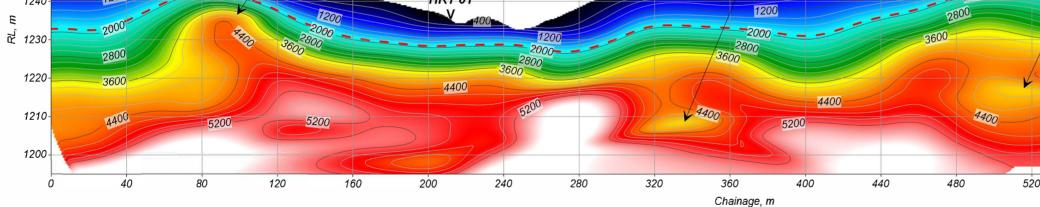








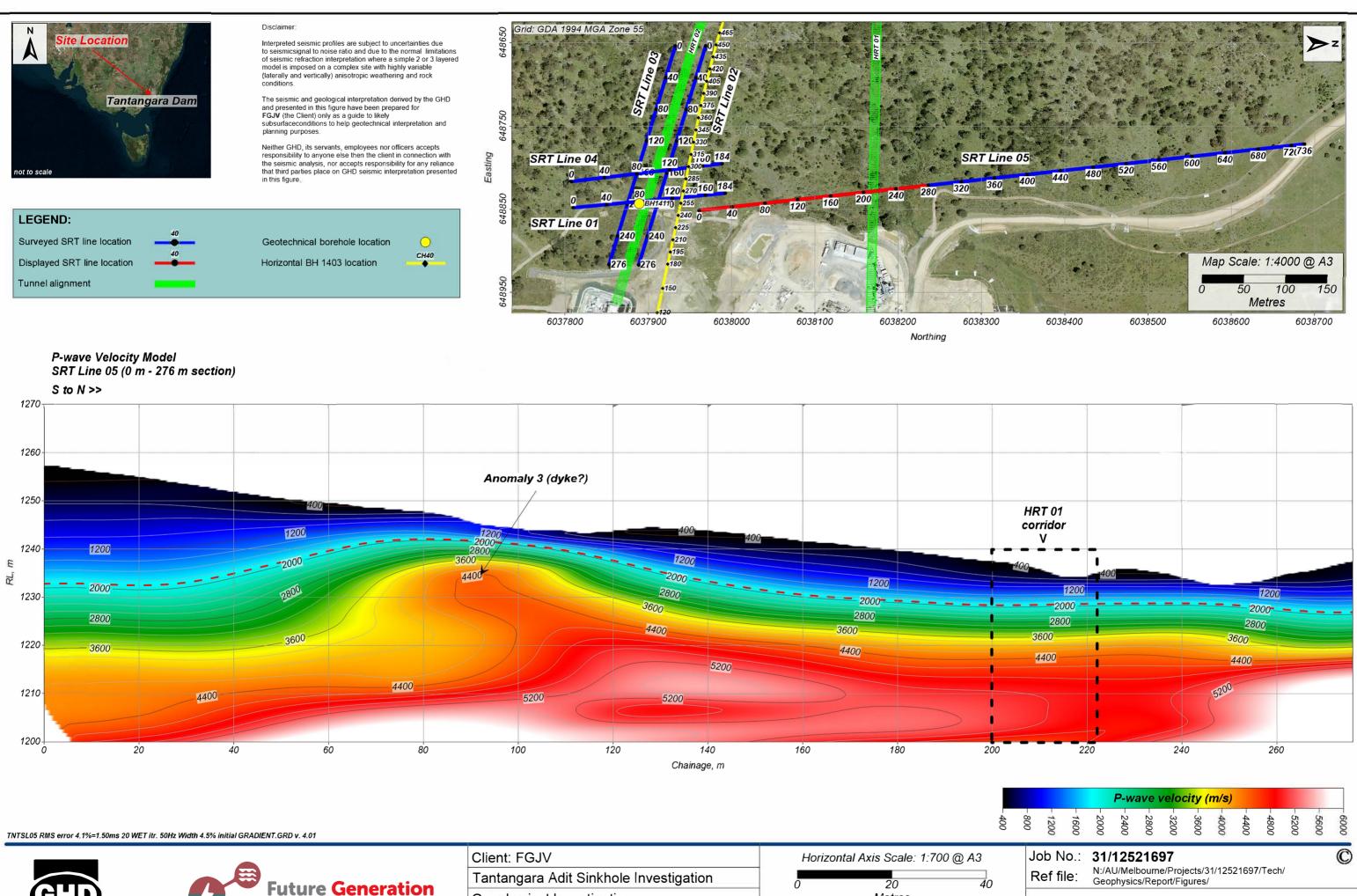




TNTSL05 RMS error 4.1%=1.50ms 20 WET itr. 50Hz Width 4.5% initial GRADIENT.GRD v. 4.01 Level 8, 180 Lonsdale Street Melbourne VIC 3000 T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au

Tech/Geophysics/Report/Figures/

Figure A05



date 03/04/2023 scale as shown Level 8, 180 Lonsdale Street Melbourne VIC 3000 T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au

Webuild • Clough • Lane

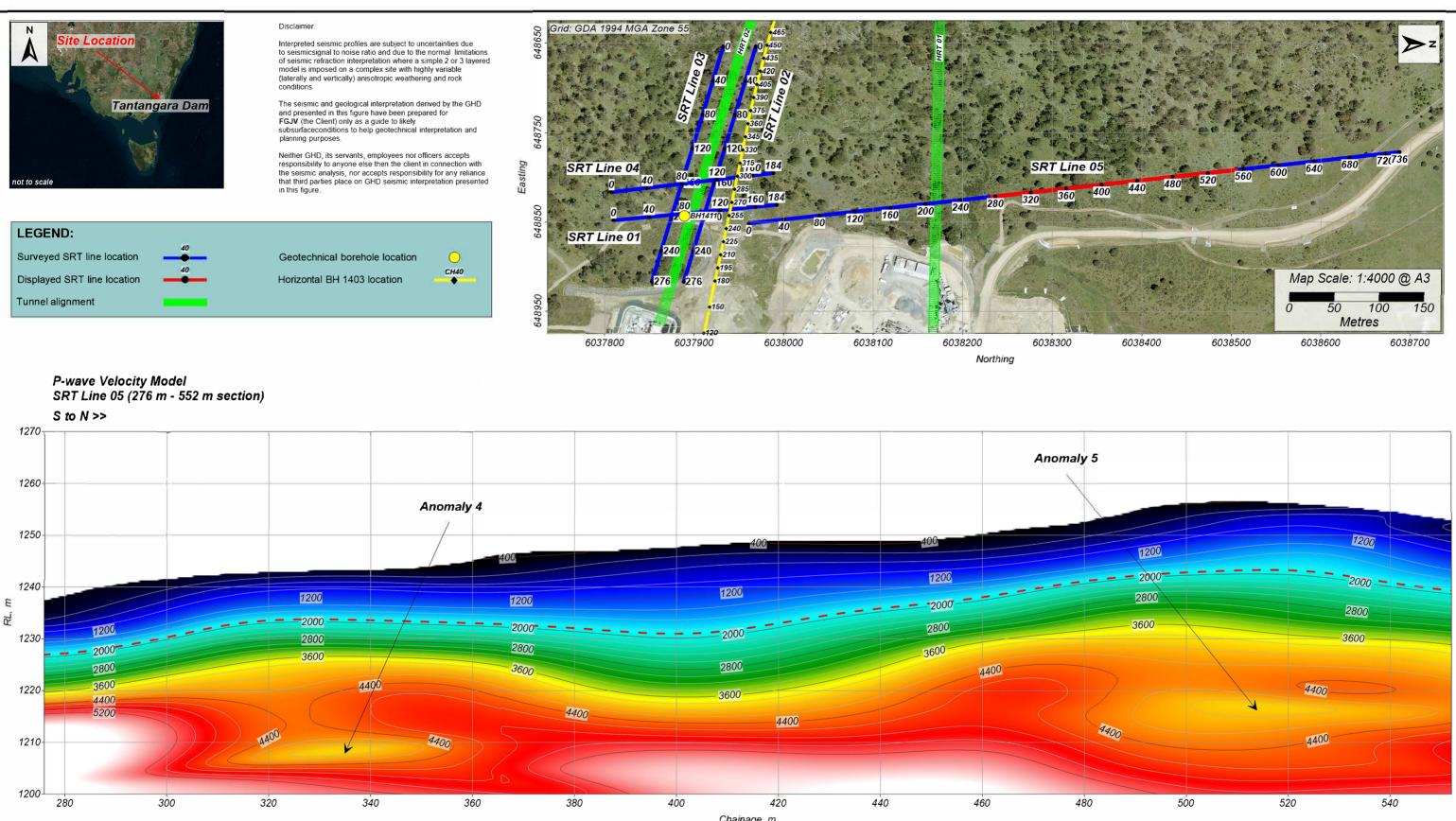
Geophysical Investigation

Seismic Refraction Tomography

Vertical to horizontal scale 1:1

Metres

	P-wave velocity (m/s)													
	- 800	- 1200	- 1600	- 2000	- 2400	- 2800	- 3200	- 3600	- 4000	- 4400	- 4800	- 5200	-5600	6000
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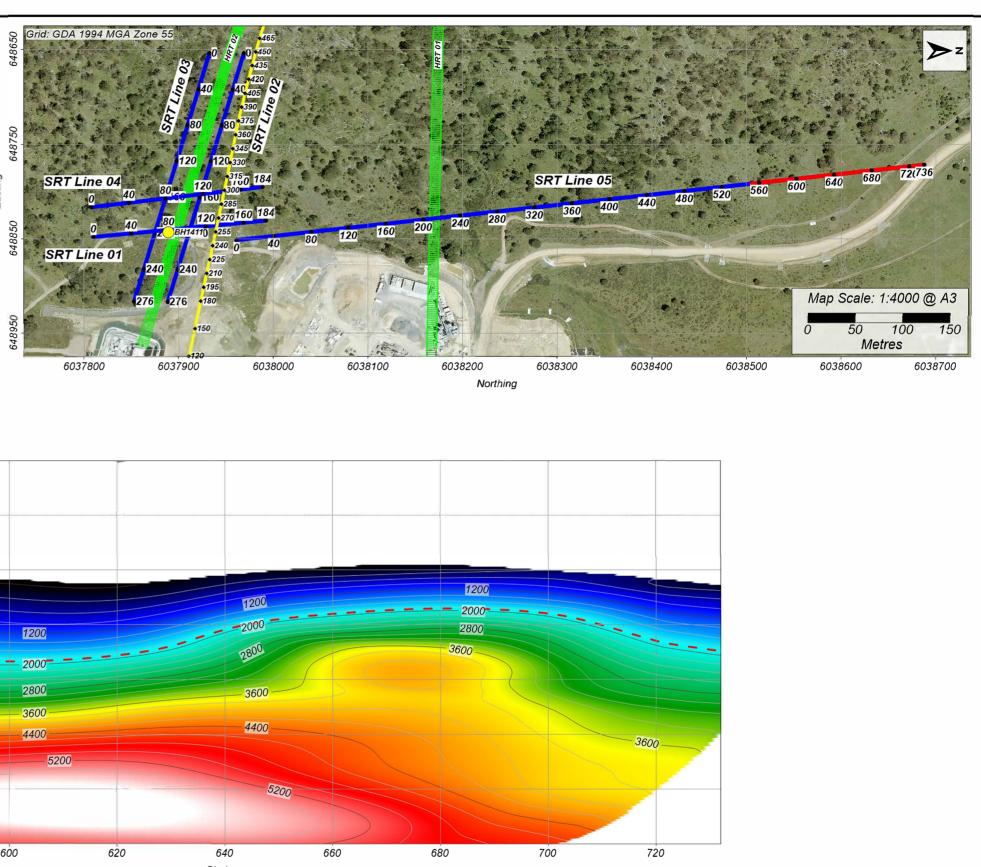


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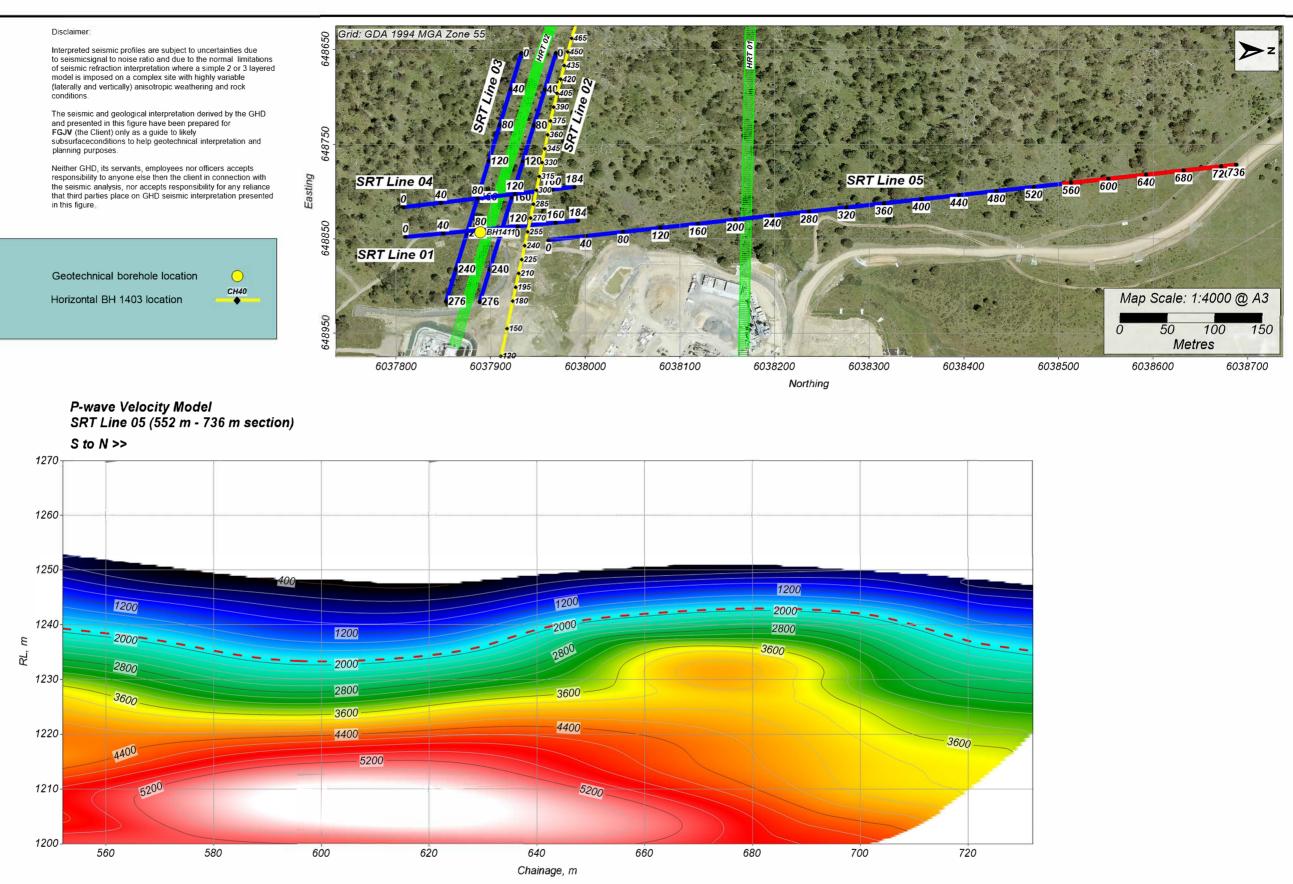
TNTSL05 RMS error 4.1%=1.50ms 20 WET itr. 50Hz Width 4.5% initial GRADIENT.GRD v. 4.01 Client: FGJV Horizontal Axis Scale: 1:700 @ A3 Tantangara Adit Sinkhole Investigation 40 n 20 Future Generation Metres Geophysical Investigation Webuild • Clough • Lane Seismic Refraction Tomography Vertical to horizontal scale date 03/04/2023 scale as shown 1:1 Level 8, 180 Lonsdale Street Melbourne VIC 3000 T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au

P-wave velocity (m/s)														
000	- 800	- 1200	- 1600	- 2000	- 2400	- 2800	- 3200	- 3600	- 4000	- 4400	- 4800	- 5200	- 5600	6000
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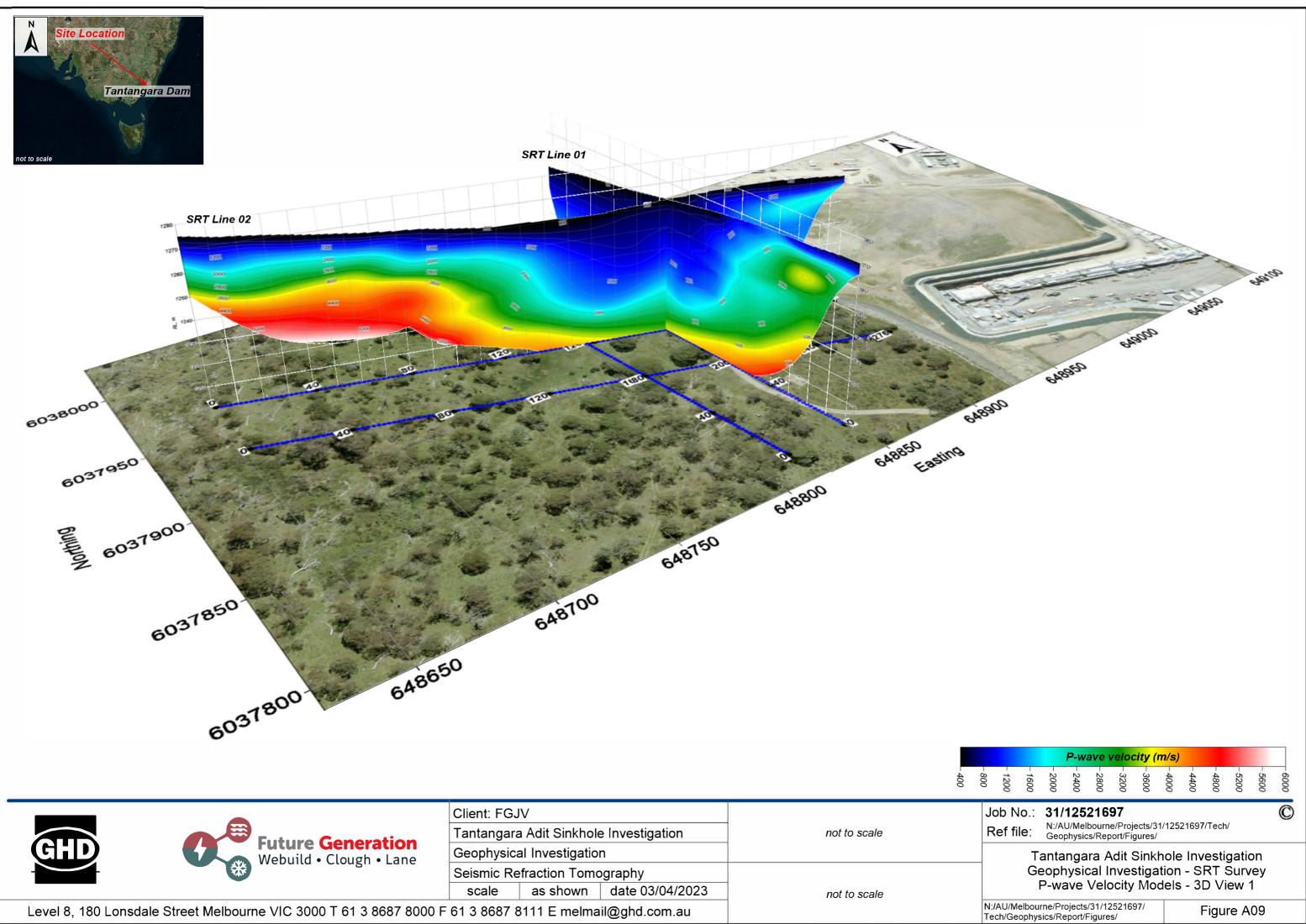




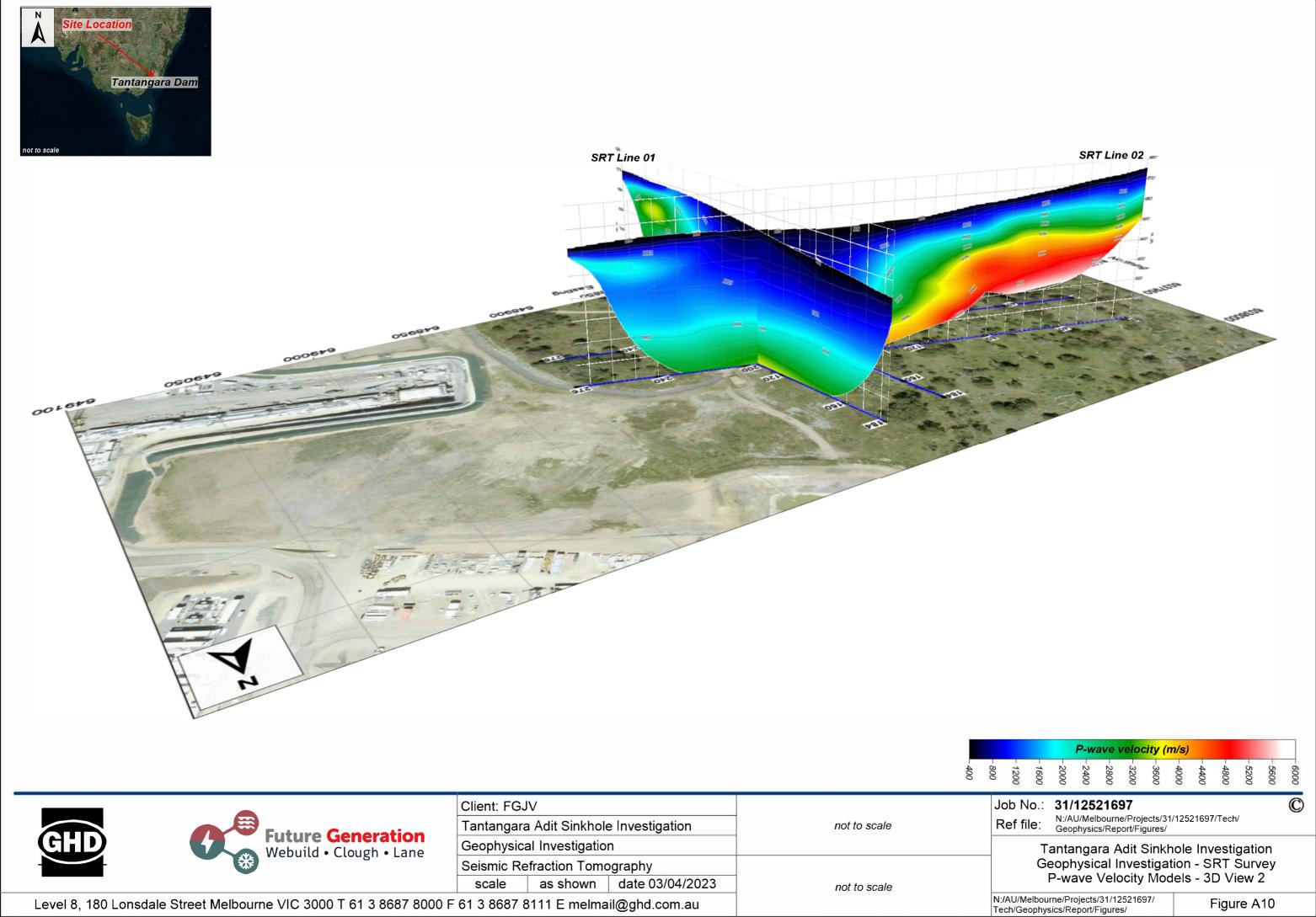
LEGEND: Surveyed SRT line location  $\bigcirc$ Geotechnical borehole location Displayed SRT line location Horizontal BH 1403 location Tunnel alignment



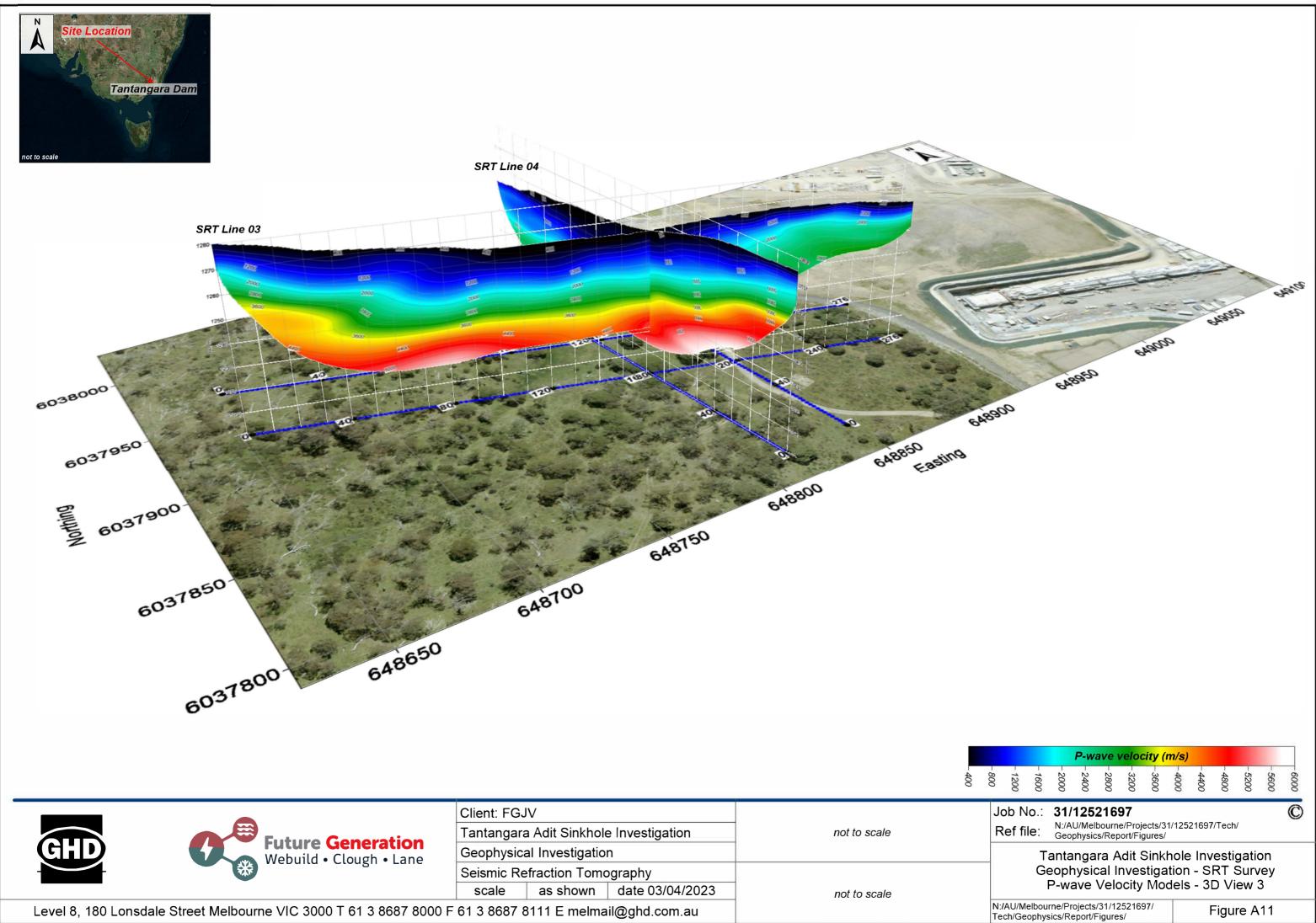
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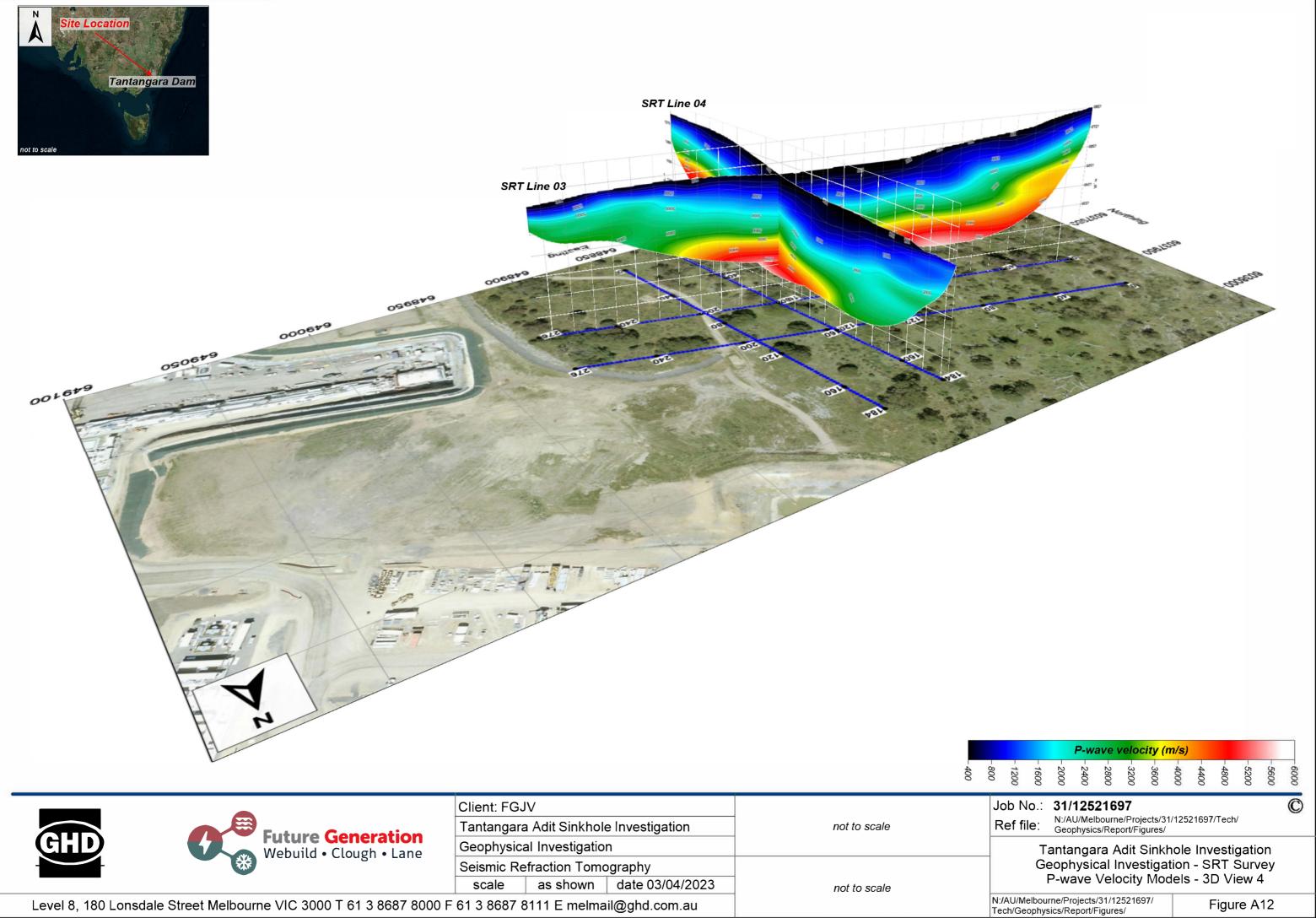


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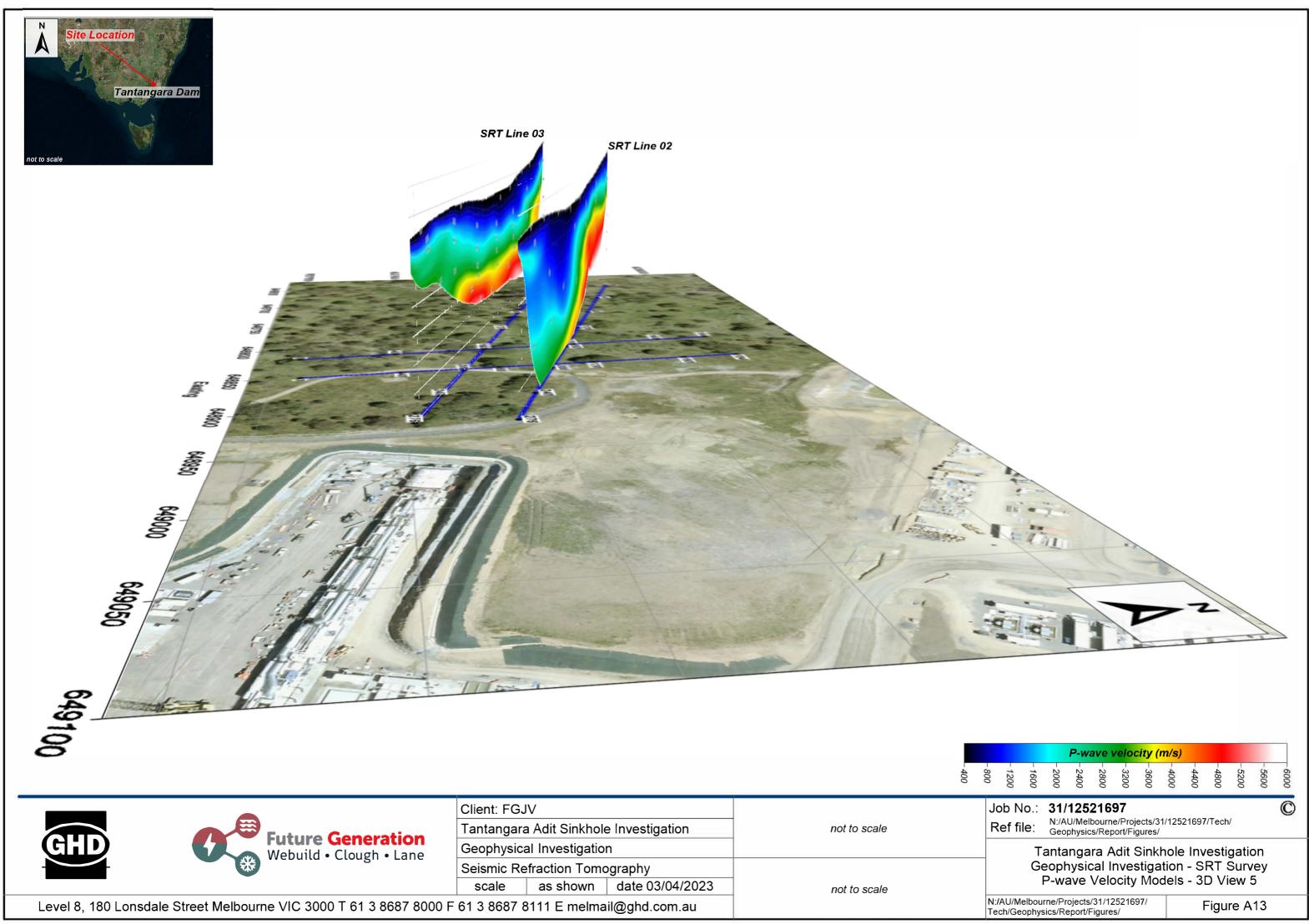


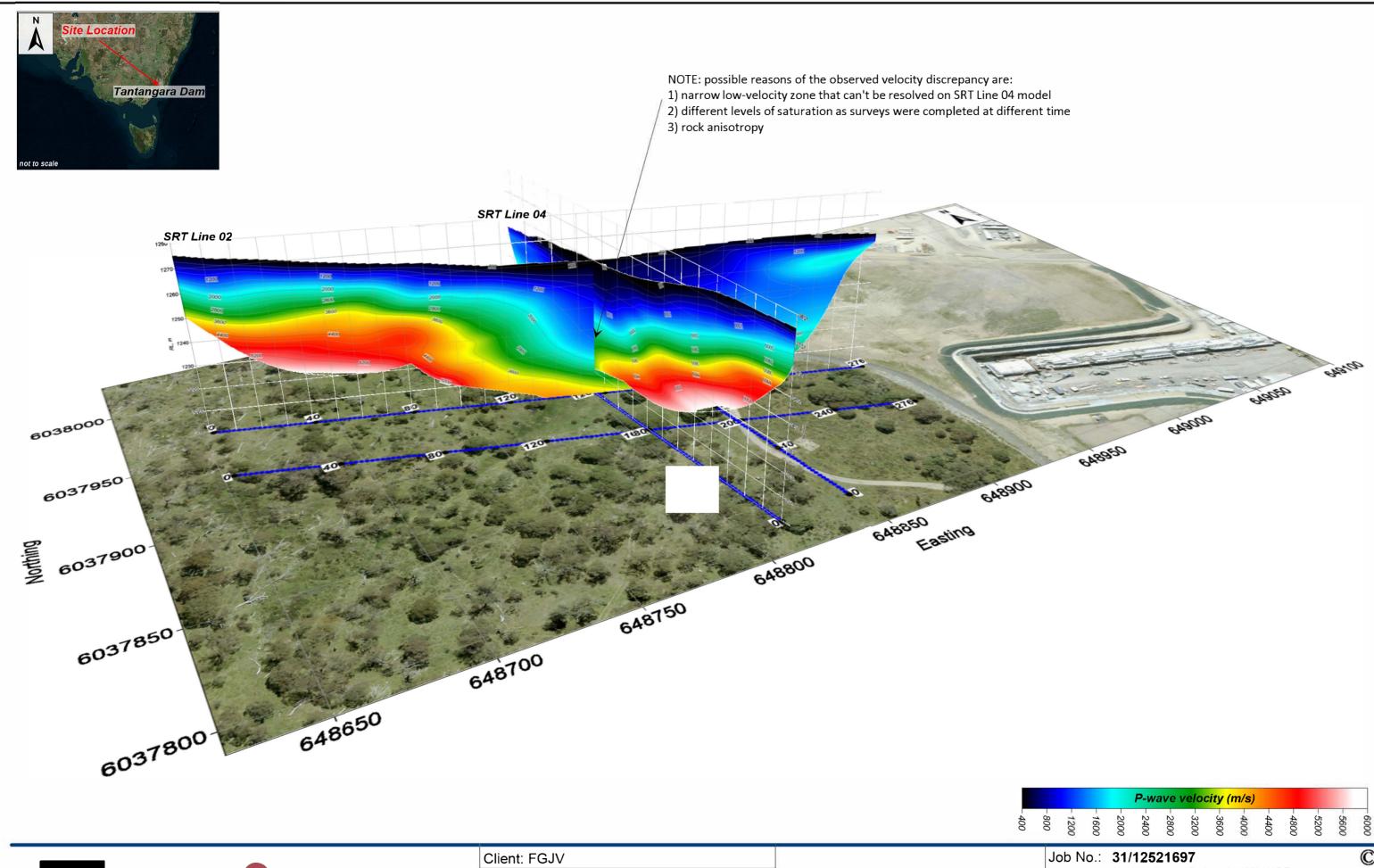
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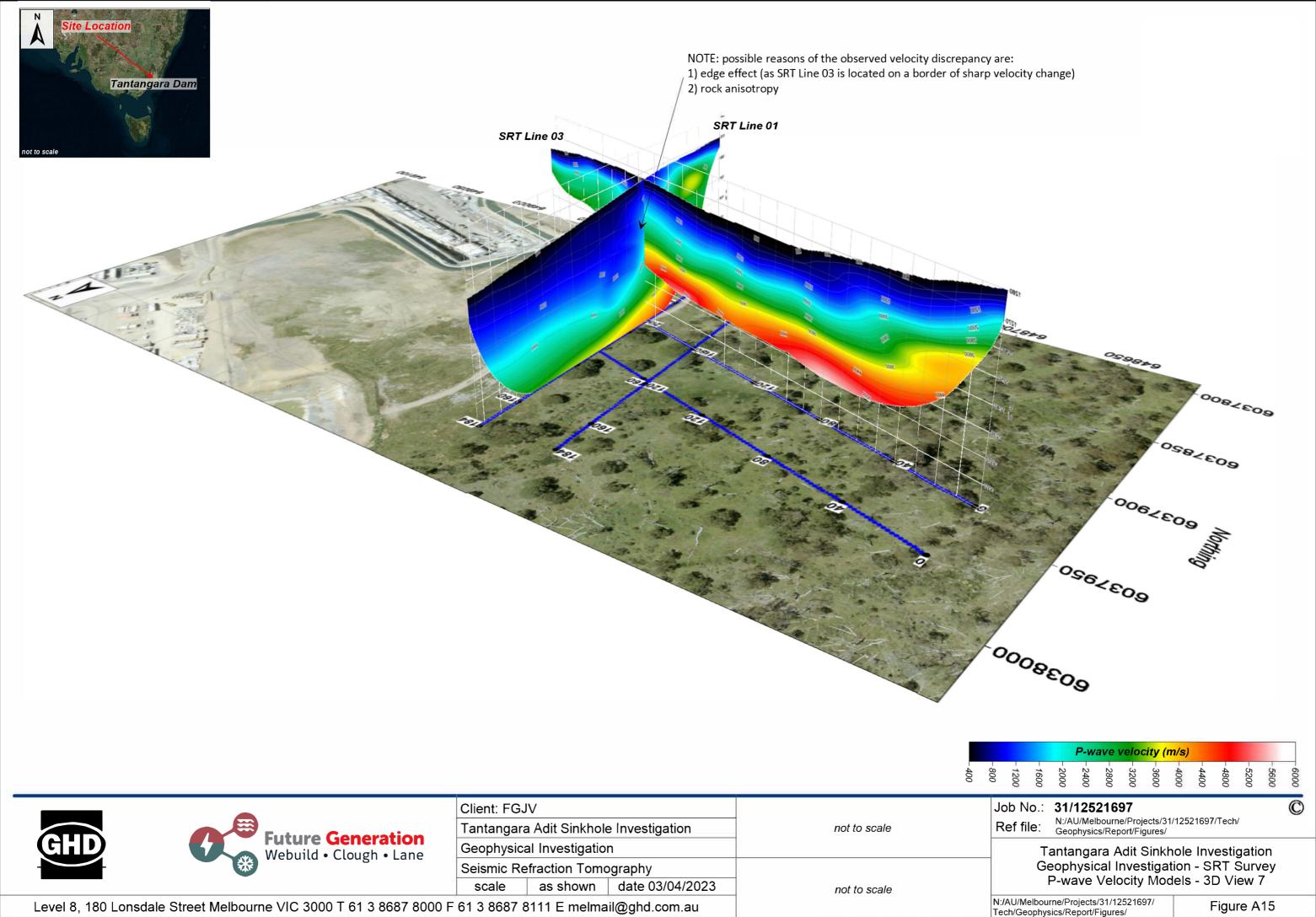


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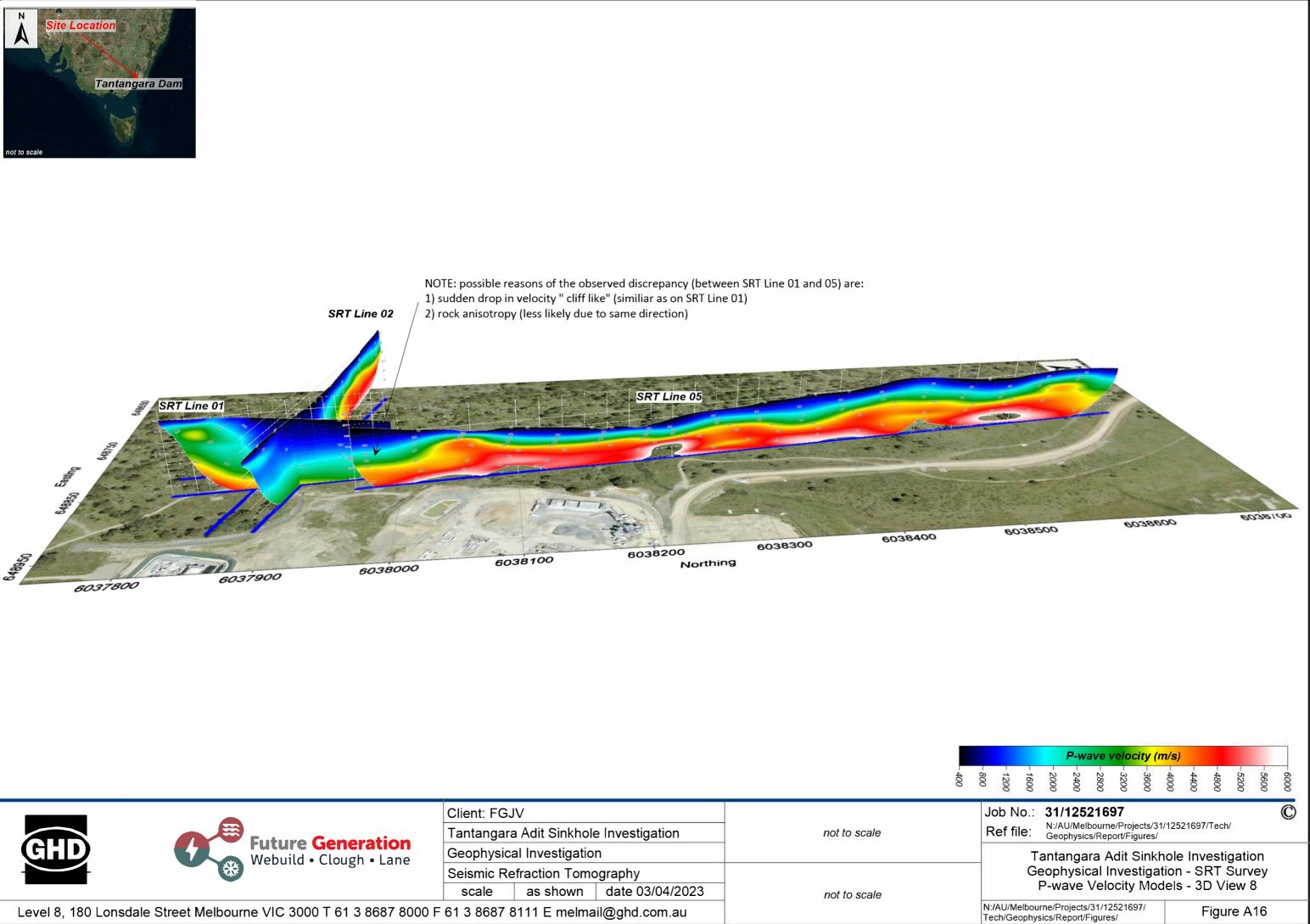


U			400	<i>P-wave velocity (m/s)</i> <i>P-wave velocity (m/s)</i> - 3200 - 2400 - 1200 - 800	- 5600 - 5200 - 4800 - 4400
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Figure A15



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NOTE: possible reasons of the observed discrepancy (between SRT Line 01 and 05) are: 1) sudden drop in velocity "cliff like" (similiar as on SRT Line 01) 2) rock anisotropy (less likely due to same direction)



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# **Appendix B** SRT survey acquisition geometry

TANT_SRT_Line_01	4	0.125	0.5		Observer:	Oleg Ermakov	v										
LineID	Geophone	Sampling	Record	Total	Shot Name.	Cransed	# Geophone	Shot_Rel_P	Layout_Start	Layout_End	Shot_Absolute	Shot No.		File Name	Layout_St.	Shot_Pos	Comments
LineiD	spacing (m)	Rate (ms)	Length (sec)	Samples	Shot_warne.	Spread	overlap	osition(m)	(m)	(m)	_Position	Shot_No.		File Name	(St.No.)	(St.No.)	Comments
						4			0	00							
						1			0	92							
TANT SRT Line 01	4	0.125	0.5	4000	Shot0001	1	1	-30	0	92	-30	Shot0001	.sg2	Shot0001.sg2	1	-6.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0002	1	1	-2	0	92	-2	Shot0002	.sg2	Shot0002.sg2	1	0.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0003	1	1	6	0	92		Shot0003	.sg2	Shot0003.sg2	1	2.5	
TANT SRT Line 01	4	0.125	0.5		Shot0004	1	1	14	0	92		Shot0004		Shot0004.sg2	1	4.5	
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TANT_SRT_Line_01	4	0.125	0.5		Shot0006	1	1	30	0	02		Shot0006		Shot0006.sg2	1	8.5	
TANT_SRT_Line_01	4	0.125	0.5		Shot0007	1	1	38	0	92		Shot0007		Shot0007.sg2	1	10.5	
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TANT_SRT_Line_01	4	0.125	0.5		Shot0009	1	1	54	0	92		Shot0009		Shot0009.sg2	1	14.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0010	1	1	62	0	92	62	Shot0010	.sg2	Shot0010.sg2	1	16.5	
TANT SRT Line 01	4	0.125	0.5		Shot0011	1	1	70	0	92		Shot0011	.sg2	Shot0011.sg2	1	18.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0012	1	1	78	0	92	78	Shot0012	.sg2	Shot0012.sg2	1	20.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0013	1	1	86	0	92	86	Shot0013	.sg2	Shot0013.sg2	1	22.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0014	1	1	94	0	92	94	Shot0014	.sg2	Shot0014.sg2	1	24.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0015	1	1	106	0	92	106	Shot0015	.sg2	Shot0015.sg2	1	27.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0016	1	1	122	0	92	122	Shot0016		Shot0016.sg2	1	31.5	
TANT_SRT_Line_01	4	0.125	0.5		Shot0017	1	1	138	0	92		Shot0017	.sg2	Shot0017.sg2	1	35.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0018	1	1	154	0	92	154	Shot0018	.sg2	Shot0018.sg2	1	39.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0019	2	1	-46	92	184	46	Shot0019	.sg2	Shot0019.sg2	24	12.5	
TANT SRT Line 01	4	0.125	0.5	4000	Shot0020	2	1	-30	92	184	62	Shot0020	.sg2	Shot0020.sg2	24	16.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0021	2	1	-14	92	184	78	Shot0021	.sg2	Shot0021.sg2	24	20.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0022	2	1	-2	92	184	90	Shot0022	.sg2	Shot0022.sg2	24	23.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0023	2	1	6	92	184	98	Shot0023	.sg2	Shot0023.sg2	24	25.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0024	2	1	14	92			Shot0024	.sg2	Shot0024.sg2	24	27.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0025	2	1	22	92	184	114	Shot0025	.sg2	Shot0025.sg2	24	29.5	
TANT SRT Line 01	4	0.125	0.5	4000	Shot0026	2	1	30	92	184	122	Shot0026	.sg2	Shot0026.sg2	24	31.5	
TANT SRT Line 01	4	0.125	0.5	4000	Shot0027	2	1	38	92	184	130	Shot0027	.sg2	Shot0027.sg2	24	33.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0028	2	1	46	92	184	138	Shot0028	.sg2	Shot0028.sg2	24	35.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0029	2	1	54	92			Shot0029	.sg2	Shot0029.sg2	24	37.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0030	2	1	62	92	184	154	Shot0030	.sg2	Shot0030.sg2	24	39.5	
TANT SRT Line 01	4	0.125	0.5	4000	Shot0031	2	1	70	92	184	162	Shot0031	.sg2	Shot0031.sg2	24	41.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0032	2	1	78	92	184	170	Shot0032	.sg2	Shot0032.sg2	24	43.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0033	2	1	86	92	184	178	Shot0033	.sg2	Shot0033.sg2	24	45.5	
TANT SRT Line 01	4	0.125	0.5	4000	Shot0034	2	1	94	92	184	186	Shot0034	.sg2	Shot0034.sg2	24	47.5	
TANT_SRT_Line_01	4	0.125	0.5	4000	Shot0035	2	1	122	92	184	214	Shot0035	.sg2	Shot0035.sg2	24	54.5	

ANT_SRT_Line_02	4	0.125	0.5		Observer:	Oleg Ermakov	/										
LineID	Geophone spacing (m)	Sampling Rate (ms)	Record Length (sec)	Total Samples	Shot_Name.	Spread	# Geophone overlap	Shot_Rel_P osition(m)	Layout_Start (m)	Layout_End (m)	Shot_Absolute _Position	Shot_No.		File Name	Layout_St. (St.No.)	Shot_Pos (St.No.)	Comments
						1			0	92							
ANT SRT Line 02	4	0.125	0.5	4000	Shot0001	1	1	-6	0	92	-6	Shot0001	.sq2	Shot0001.sg2	1	-0.5	
ANT SRT Line 02	4	0.125	0.5	4000	Shot0002	1	1	-2	0	92	-2	Shot0002		Shot0002.sg2	1	0.5	
ANT SRT Line 02	4	0.125	0.5	4000	Shot0003	1	1	6	0	92	2 6	Shot0003		Shot0003.sg2	1	2.5	
ANT SRT Line 02	4	0.125	0.5	4000	Shot0004	1	1	14	0	92	2 14	Shot0004	.sg2	Shot0004.sg2	1	4.5	
NT SRT Line 02	4	0.125	0.5	4000	Shot0005	1	1	22	0	92	22	Shot0005	.sg2	Shot0005.sg2	1	6.5	
NT SRT Line 02	4	0.125	0.5	4000	Shot0006	1	1	30	0	92	30	Shot0006	.sg2	Shot0006.sg2	1	8.5	
ANT_SRT_Line_02	4	0.125	0.5	4000	Shot0007	1	1	38	0	92	2 38	Shot0007	.sg2	Shot0007.sg2	1	10.5	
ANT_SRT_Line_02	4	0.125	0.5	4000	Shot0008	1	1	46	0	92	2 46	Shot0008	.sg2	Shot0008.sg2	1	12.5	
ANT_SRT_Line_02	4	0.125	0.5	4000	Shot0009	1	1	54	0	92	2 54	Shot0009	.sg2	Shot0009.sg2	1	14.5	
ANT_SRT_Line_02	4	0.125	0.5	4000	Shot0010	1	1	62	0	92	62	Shot0010	.sg2	Shot0010.sg2	1	16.5	
NT SRT Line 02	4	0.125	0.5	4000		1	1	70	0	92		Shot0011	.sg2	Shot0011.sg2	1	18.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0012	1	1	78	0	92		Shot0012	.sg2	Shot0012.sg2	1	20.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0013	1	1	86	0	92		Shot0013		Shot0013.sg2	1	22.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0014	1	1	94	0	02		Shot0014		Shot0014.sg2	1	24.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0015	1	1	106	0	02		Shot0015		Shot0015.sg2	1	27.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0016	1	1	122	0			Shot0016		Shot0016.sg2	1	31.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0017	1	1	130	0			Shot0017	J	Shot0017.sg2	1	33.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0018	1	1	138	0	<u>.</u>		Shot0018	.sg2	Shot0018.sg2	1	35.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0019	2	1	-30	92			Shot0019	J	Shot0019.sg2	24	16.5	
NT SRT Line 02	4		0.5		Shot0020	2	1	-2	92			Shot0020	.sg2	Shot0020.sg2	24	23.5	
NT_SRT_Line_02	4	0.125	0.5		Shot0021	2	1	6	92			Shot0021		Shot0021.sg2	24	25.5	
NT_SRT_Line_02	4	0.125	0.5		Shot0022	2	1	14	92			Shot0022		Shot0022.sg2	24	27.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0023	2	1	22	92			Shot0023		Shot0023.sg2	24	29.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0024	2	1	30	92			Shot0024		Shot0024.sg2	24	31.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0025	2	1	38	92			Shot0025	J	Shot0025.sg2	24	33.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0026	2	1	46	92			Shot0026		Shot0026.sg2	24	35.5	
ANT SRT Line 02	4	0.125	0.5		Shot0027	2	1	54	92			Shot0027	.sg2	Shot0027.sg2	24	37.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0028	2	1	62	92			Shot0028	.sg2	Shot0028.sg2	24	39.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0029	2	1	70	92			Shot0029	.sg2	Shot0029.sg2	24	41.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0030	2	1	78	92			Shot0030	.sg2	Shot0030.sg2	24	43.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0031	2	1	86	92			Shot0031	.sg2	Shot0031.sg2	24	45.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0032	2	1	94	92			Shot0032	.sg2	Shot0032.sg2	24	47.5	
ANT_SRT_Line_02	4	0.125	0.5		Shot0033	2	1	106	92			Shot0033	.sg2	Shot0033.sg2	24	50.5	
NT SRT Line 02	4	0.125	0.5		Shot0034	2	1	122	92			Shot0034	.sg2	Shot0034.sg2	24	54.5	
NT_SRT_Line_02	4		0.5		Shot0035	2	1	138	92			Shot0035	<u>v</u>	Shot0035.sg2	24	58.5	
NT_SRT_Line_02	4		0.5		Shot0036	3	1	-54	184			Shot0036		Shot0036.sg2	47	33.5	
NT_SRT_Line_02	4	0.125	0.5		Shot0037	3	1	-30	184			Shot0037		Shot0037.sg2	47	39.5	
NT_SRT_Line_02	4	0.125	0.5		Shot0038	3	1	-14	184			Shot0038		Shot0038.sg2	47	43.5	
NT_SRT_Line_02	4		0.5		Shot0039	3	1	-2	184			Shot0039		Shot0039.sg2	47	46.5	
NT_SRT_Line_02	4	0.125	0.5		Shot0040	3	1	6	184			Shot0040		Shot0040.sg2	47	48.5	
NT SRT Line 02	4	0.125	0.5		Shot0041	3	1	14	184			Shot0041		Shot0041.sg2	47	50.5	
NT_SRT_Line_02	4	0.125	0.5		Shot0042	3	1	22	184			Shot0042	J	Shot0042.sg2	47	52.5	
ANT SRT Line 02 ANT SRT Line 02	4	0.125	0.5		Shot0043 Shot0044	3	1	30 38	184 184			Shot0043 Shot0044		Shot0043.sg2	47	54.5	
	4		0.5			3	1		184				J	Shot0044.sg2	47	56.5	
ANT_SRT_Line_02 ANT_SRT_Line_02	4	0.125	0.5		Shot0045 Shot0046	3	1	46 54	184			Shot0045 Shot0046	.sg2	Shot0045.sg2 Shot0046.sg2	47	58.5	
	4		0.5			3	1	54				Shot0046	J		47	60.5 62.5	
ANT_SRT_Line_02 ANT_SRT_Line_02	4	0.125	0.5		Shot0047 Shot0048	3	1	62	184 184			Shot0047 Shot0048	.sg2 .sg2	Shot0047.sg2 Shot0048.sg2	47	62.5	
NT SRT_Line_02	4	0.125	0.5		Shot0048 Shot0049	3	4	70	184			Shot0048 Shot0049	.sgz .sa2	Shot0048.sg2 Shot0049.sg2	47	66.5	
NT SRT_Line_02	4	0.125	0.5		Shot0049 Shot0050	3	4	78	184			Shot0049 Shot0050	J	Shot0049.sg2 Shot0050.sg2	47	68.5	
INT SRT Line 02	4	0.125	0.5		Shot0050 Shot0051	3	1	94	184	276		Shot0050 Shot0051	.sg2 .sg2		47	70.5	
	4	0.125	0.5	4000	31000001	3		94	184	276	278	31000001	.sg∠	Shot0051.sg2	47	10.5	

TANT_SRT_Line_03	4	0.125	0.5	5	Observer:	Oleg Ermako	v										
LineID	Geophone spacing (m)	Sampling Rate (ms)	Record Length (sec)	Total Samples	Shot_Name.	Spread	# Geophone overlap	Shot_Rel_P osition(m)	Layout_Start (m)	Layout_End (m)	Shot_Absolute _Position	Shot_No.		File Name	Layout_St. (St.No.)	Shot_Pos (St.No.)	Comments
						1			0	92							
ANT SRT Line 03	4	0.125	0.5	4000	Shot0001	1	1	2	0	92	2	Shot0001	.sa2	Shot0001.sg2	1	1.5	
TANT SRT Line 03	4	0.125	0.5		Shot0002	1	1	6	0	92		Shot0002		Shot0002.sq2	1	2.5	
TANT SRT Line 03	4	0.125	0.5	4000	Shot0003	1	1	14	0	92	14	Shot0003	.sq2	Shot0003.sg2	1	4.5	
TANT SRT Line 03	4	0.125	0.5	4000	Shot0004	1	1	22	0	92	22	Shot0004	.sg2	Shot0004.sg2	1	6.5	
TANT_SRT_Line_03	4	0.125	0.5	4000	Shot0005	1	1	30	0	92	30	Shot0005	.sg2	Shot0005.sg2	1	8.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0006	1	1	38		92	38	Shot0006	.sg2	Shot0006.sg2	1	10.5	
TANT_SRT_Line_03	4	0.120	0.5		Shot0007	1	1	46		92		Shot0007	<u> </u>	Shot0007.sg2	1	12.5	
TANT_SRT_Line_03	4		0.5		Shot0008	1	1	54		92		Shot0008		Shot0008.sg2	1	14.5	
TANT_SRT_Line_03	4	0.120	0.5		Shot0009	1	1	62		92		Shot0009		Shot0009.sg2	1	16.5	
TANT_SRT_Line_03	4		0.5		Shot0010	1	1	70		92		Shot0010	<u> </u>	Shot0010.sg2	1	18.5	
TANT SRT Line 03	4	0.125	0.5		Shot0011	1	1	78		92		Shot0011		Shot0011.sg2	1	20.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0012	1	1	86	0	92		Shot0012		Shot0012.sg2	1	22.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0013	1	1	94	0	92		Shot0013	.sg2	Shot0013.sg2	1	24.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0014	1	1	106		92		Shot0014		Shot0014.sg2	1	27.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0015	1	1	118		92		Shot0015	.sg2	Shot0015.sg2	1	30.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0016	1	1	138	0	92		Shot0016		Shot0016.sg2	1	35.5	
TANT_SRT_Line_03 TANT_SRT_Line_03	4	0.125	0.5		Shot0017	2	1	-30 -14				Shot0017 Shot0018		Shot0017.sg2	24 24	16.5 20.5	
	4				Shot0018	2	1						<u> </u>	Shot0018.sg2			
TANT_SRT_Line_03	4		0.5		Shot0019	2	1	-2				Shot0019		Shot0019.sg2	24	23.5	
TANT SRT Line 03 TANT SRT Line 03	4		0.5		Shot0020 Shot0021	2		6 14				Shot0020 Shot0021	.sg2 .sg2	Shot0020.sg2 Shot0021.sg2	24 24	25.5 27.5	
	4					2	1										
TANT_SRT_Line_03 TANT_SRT_Line_03	4	0.120	0.5		Shot0022 Shot0023	2	1	22 26				Shot0022 Shot0023	.sg2 .sg2	Shot0022.sg2 Shot0023.sg2	24 24	29.5 30.5	
TANT_SRT_Line_03	4	0.120	0.5		Shot0023	2	1	38				Shot0023		Shot0023.sg2 Shot0024.sg2	24	33.5	
TANT_SRT_LINE_03	4	0.125	0.5		Shot0025	2	1	46				Shot0025		Shot0024.sg2 Shot0025.sg2	24	35.5	
TANT SRT Line 03	4		0.5		Shot0025	2	1	40 54				Shot0025 Shot0026		Shot0025.sg2 Shot0026.sg2	24	37.5	
TANT_SRT_Line_03	4		0.5		Shot0020	2	1	62				Shot0020 Shot0027		Shot0020.sg2 Shot0027.sg2	24	39.5	
TANT SRT Line 03	4		0.5		Shot0027	2	1	70				Shot0027 Shot0028	.sg2	Shot0027.sg2 Shot0028.sg2	24	41.5	
TANT SRT Line 03	4	0.125	0.5		Shot0029	2	1	78				Shot0020	.sg2	Shot0029.sg2	24	43.5	
TANT SRT Line 03	4	0.125	0.5		Shot0030	2	1	86				Shot0030	.sg2	Shot0030.sg2	24	45.5	
TANT SRT Line 03	4	0.125	0.5		Shot0031	2	1	94	92			Shot0031	.sg2	Shot0031.sg2	24	47.5	
TANT SRT Line 03	4	0.125	0.5		Shot0032	2	1	106				Shot0032	.sg2	Shot0032.sg2	24	50.5	
TANT SRT Line 03	4	0.125	0.5		Shot0033	2	1	122				Shot0033		Shot0033.sq2	24	54.5	
TANT SRT Line 03	4	0.125	0.5		Shot0034	2	1	138				Shot0034		Shot0034.sq2	24	58.5	
TANT SRT Line 03	4		0.5		Shot0035	3	1	-46				Shot0035	Ū	Shot0035.sg2	47	35.5	
TANT SRT Line 03	4		0.5		Shot0036	3	1	-30		-		Shot0036		Shot0036.sq2	47	39.5	-
TANT SRT Line 03	4		0.5		Shot0037	3	1	-14				Shot0037		Shot0037.sg2	47	43.5	
TANT SRT Line 03	4		0.5		Shot0038	3	1	-2				Shot0038		Shot0038.sq2	47	46.5	
TANT SRT Line 03	4		0.5		Shot0039	3	1	6		276		Shot0039		Shot0039.sg2	47	48.5	
TANT SRT Line 03	4		0.5		Shot0040	3	1	14	184	276		Shot0040		Shot0040.sg2	47	50.5	
TANT SRT Line 03	4	0.125	0.5		Shot0041	3	1	22	184	276		Shot0041		Shot0041.sg2	47	52.5	
TANT_SRT_Line_03	4	0.125	0.5	4000	Shot0042	3	1	30	184	276	214	Shot0042	.sg2	Shot0042.sg2	47	54.5	
TANT SRT Line 03	4	0.125	0.5		Shot0043	3	1	38		276		Shot0043	.sg2	Shot0043.sg2	47	56.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0044	3	1	46				Shot0044	.sg2	Shot0044.sg2	47	58.5	
TANT_SRT_Line_03	4	0.125	0.5	4000	Shot0045	3	1	54	184	276	238	Shot0045	.sg2	Shot0045.sg2	47	60.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0046	3	1	62		276		Shot0046	.sg2	Shot0046.sg2	47	62.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0047	3	1	70		276		Shot0047	.sg2	Shot0047.sg2	47	64.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0048	3	1	78	184			Shot0048	.sg2	Shot0048.sg2	47	66.5	
TANT_SRT_Line_03	4	0.125	0.5		Shot0049	3	1	86		276		Shot0049	.sg2	Shot0049.sg2	47	68.5	
TANT SRT Line 03	4	0.120	0.5		Shot0050	3	1	94				Shot0050	.sg2	Shot0050.sg2	47	70.5	
TANT_SRT_Line_03	4	0.125	0.5			3	1	100	184	276		Shot0051	.sg2	Shot0051.sg2	47	72	
TANT SRT Line 03	4	0.125	0.5	4000	Shot0052	3	1	110	184	276	294	Shot0052	.sq2	Shot0052.sg2	47	74.5	

TANT_SRT_Line_04	4	0.125	0.5		Observer:	Oleg Ermakov	/										
LineID	Geophone	Sampling	Record	Total	Shot Name.	Spread	# Geophone	Shot_Rel_P	Layout_Start	Layout_End	Shot_Absolute	Shot No.		File Name	Layout_St.	Shot_Pos	Comments
LilieiD	spacing (m)	Rate (ms)	Length (sec)	Samples	Shot_Name.	Spread	overlap	osition(m)	(m)	(m)	_Position	SHUL_NO.		File Marile	(St.No.)	(St.No.)	Comments
						1			0	92							
TANT SRT Line 04	4	0.125	0.5	4000	Shot0001	1	1	-30	0	92	-30	Shot0001	.sg2	Shot0001.sg2	1	-6.5	
TANT_SRT_Line_04	4	0.125			Shot0002	1	1	-14	0	92	-14	Shot0002	.sg2	Shot0002.sg2	1	-2.5	
TANT_SRT_Line_04	4	0.125		4000	Shot0003	1	1	-2	0	92	-2	Shot0003	.sg2	Shot0003.sg2	1	0.5	
TANT SRT Line 04	4	0.125			Shot0004	1	1	6	0	92		Shot0004		Shot0004.sg2	1	2.5	
TANT_SRT_Line_04	4	0.125			Shot0005	1	1	14	0	92		Shot0005		Shot0005.sg2	1	4.5	
TANT_SRT_Line_04	4	0.125			Shot0006	1	1	22	0	02		Shot0006		Shot0006.sg2	1	6.5	
TANT_SRT_Line_04	4	0.125	0.5		Shot0007	1	1	30	0	92		Shot0007		Shot0007.sg2	1	8.5	
TANT_SRT_Line_04	4	0.125			Shot0008	1	1	38	0	92		Shot0008		Shot0008.sg2	1	10.5	
TANT_SRT_Line_04	4	0.125			Shot0009	1	1	46	0	92		Shot0009		Shot0009.sg2	1	12.5	
TANT_SRT_Line_04	4	0.125			Shot0010	1	1	54	0	92		Shot0010		Shot0010.sg2	1	14.5	
TANT SRT Line 04	4	0.125			Shot0011	1	1	62	0	02		Shot0011		Shot0011.sg2	1	16.5	
TANT_SRT_Line_04	4	0.125			Shot0012	1	1	70	0	92		Shot0012		Shot0012.sg2	1	18.5	
TANT_SRT_Line_04	4	0.125			Shot0013	1	1	78	0	92		Shot0013		Shot0013.sg2	1	20.5	
TANT_SRT_Line_04	4	0.125			Shot0014	1	1	86	0	92		Shot0014		Shot0014.sg2	1	22.5	
TANT_SRT_Line_04	4	0.125			Shot0015	1	1	94	0	92		Shot0015		Shot0015.sg2	1	24.5	
TANT_SRT_Line_04	4	0.125			Shot0016	1	1	106	0	92		Shot0016		Shot0016.sg2	1	27.5	
TANT_SRT_Line_04	4	0.125			Shot0017	1	1	122	0	92		Shot0017		Shot0017.sg2	1	31.5	
TANT_SRT_Line_04	4	0.125			Shot0018	1	1	138	0	92	138	Shot0018	.sg2	Shot0018.sg2	1	35.5	
TANT_SRT_Line_04	4	0.125	0.5		Shot0019	2	1	-30	92	184	62	Shot0019	.sg2	Shot0019.sg2	24	16.5	
TANT SRT Line 04	4	0.125	0.5	4000	Shot0020	2	1	-14	92	184	. 78	Shot0020	.sg2	Shot0020.sg2	24	20.5	
TANT_SRT_Line_04	4	0.125		4000	Shot0021	2	1	-2	92			Shot0021	.sg2	Shot0021.sg2	24	23.5	
TANT_SRT_Line_04	4	0.125			Shot0022	2	1	6	92			Shot0022		Shot0022.sg2	24	25.5	
TANT_SRT_Line_04	4	0.125			Shot0023	2	1	14	92			Shot0023	.sg2	Shot0023.sg2	24	27.5	
TANT_SRT_Line_04	4	0.125			Shot0024	2	1	22	92			Shot0024	.sg2	Shot0024.sg2	24	29.5	
TANT_SRT_Line_04	4	0.125	0.5	4000	Shot0025	2	1	30	92	184	122	Shot0025	.sg2	Shot0025.sg2	24	31.5	
TANT_SRT_Line_04	4	0.125			Shot0026	2	1	38	92			Shot0026		Shot0026.sg2	24	33.5	
TANT SRT Line 04	4	0.125	0.5	4000	Shot0027	2	1	46	92	184	138	Shot0027	.sg2	Shot0027.sg2	24	35.5	
TANT_SRT_Line_04	4	0.125			Shot0028	2	1	54	92			Shot0028		Shot0028.sg2	24	37.5	
TANT_SRT_Line_04	4	0.125			Shot0029	2	1	62	92			Shot0029		Shot0029.sg2	24	39.5	
TANT_SRT_Line_04	4	0.125	0.5		Shot0030	2	1	70	92	184	162	Shot0030	.sg2	Shot0030.sg2	24	41.5	
TANT_SRT_Line_04	4	0.125			Shot0031	2	1	82	92			Shot0031	.sg2	Shot0031.sg2	24	44.5	
TANT_SRT_Line_04	4	0.125	0.5	4000	Shot0032	2	1	86	92	184	178	Shot0032	.sg2	Shot0032.sg2	24	45.5	
TANT_SRT_Line_04	4	0.125	0.5	4000	Shot0033	2	1	94	92	184	186	Shot0033	.sg2	Shot0033.sg2	24	47.5	
TANT SRT Line 04	4	0.125			Shot0034	2	1	104	92			Shot0034		Shot0034.sg2	24	50	
TANT_SRT_Line_04	4	0.125	0.5	4000	Shot0035	2	1	122	92	184	214	Shot0035	.sg2	Shot0035.sg2	24	54.5	

TANT_SRT_Line_05	4	0.125	0.5		Observer:	Oleg Ermakov	/										
LineID	Geophone	Sampling	Record	Total	Shot Name.	Spread	# Geophone	Shot_Rel_P	Layout_Start	Layout_End	Shot_Absolute	Shot No.		File Name	Layout_St.	Shot_Pos	Comments
LineiD	spacing (m)	Rate (ms)	Length (sec)	Samples	Shot_wame.	Spread	overlap	osition(m)	(m)	(m)	Position	Shot_No.		File Name	(St.No.)	(St.No.)	Comments
						1			0	92							
ANT SRT Line 05	4	0.125	0.5	4000	Shot0001	1	1	-30	C	92	-30	Shot0001	.sg2	Shot0001.sq2	1	-6.5	
ANT SRT Line 05	4	0.125	0.5	4000		1	1	-12	C	92		Shot0002	.sg2	Shot0002.sg2	1	-2	
ANT_SRT_Line_05	4	0.125	0.5	4000	Shot0003	1	1	-2	C	92	-2	Shot0003	.sg2	Shot0003.sg2	1	0.5	-
ANT SRT Line 05	4	0.125	0.5	4000	Shot0004	1	1	6	C	92		Shot0004	.sg2	Shot0004.sg2	1	2.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		1	1	14	C	92		Shot0005	.sg2	Shot0005.sg2	1	4.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		1	1	22	C	92		Shot0006	.sg2	Shot0006.sg2	1	6.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		1	1	30	C	92		Shot0007	.sg2	Shot0007.sg2	1	8.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		1	1	38	0	92		Shot0008	.sg2	Shot0008.sg2	1	10.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		1	1	46	0	92		Shot0009	.sg2	Shot0009.sg2	1	12.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		1	1	54 62		92		Shot0010 Shot0011	.sg2	Shot0010.sg2	1	14.5 16.5	
TANT SRT Line 05	4	0.125	0.5	4000		1	1	62 70				Shot0011 Shot0012	.sg2 .sg2	Shot0011.sg2 Shot0012.sg2	1	16.5	
TANT_SRT_LINe_05	4	0.125	0.5	4000		1	1	70	0	02		Shot0012	.sg2	Shot0012.sg2	1	20.5	
TANT_SRT_LINE_05	4	0.125	0.5	4000		1	1	86	0			Shot0013	.sg2	Shot0013.sg2	1	20.3	
TANT_SRT_Line_05	4	0.125	0.5	4000		1	1	94	0	-		Shot0014 Shot0015	.sg2	Shot0015.sg2	1	24.5	
TANT SRT Line 05	4	0.125	0.5	4000		1	1	104	C			Shot0016	.sg2	Shot0016.sg2	1	27	
TANT SRT Line 05	4	0.125	0.5	4000		1	1	122	C	-		Shot0017	.sg2	Shot0017.sg2	1	31.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0018	1	1	138	C	92	138	Shot0018	.sg2	Shot0018.sg2	1	35.5	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	-46	92	184		Shot0019	.sg2	Shot0019.sg2	24	12.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0020	2	1	-30	92	2 184	62	Shot0020	.sg2	Shot0020.sg2	24	16.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0021	2	1	-14	92	184	78	Shot0021	.sg2	Shot0021.sg2	24	20.5	
ANT_SRT_Line_05	4	0.125	0.5	4000	Shot0022	2	1	-2	92	184	90	Shot0022	.sg2	Shot0022.sg2	24	23.5	
TANT_SRT_Line_05	4		0.5	4000		2	1	6	92			Shot0023	.sg2	Shot0023.sg2	24	25.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		2	1	14	92			Shot0024	.sg2	Shot0024.sg2	24	27.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		2	1	22	92			Shot0025	.sg2	Shot0025.sg2	24	29.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		2	1	30	92			Shot0026	.sg2	Shot0026.sg2	24	31.5	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	38	92			Shot0027	.sg2	Shot0027.sg2	24	33.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		2	1	46	92			Shot0028	.sg2	Shot0028.sg2	24	35.5	
TANT_SRT_Line_05	4	0.125	0.5 0.5	4000 4000		2	1	54 62	92 92			Shot0029 Shot0030	.sg2	Shot0029.sg2 Shot0030.sg2	24 24	37.5 39.5	
TANT_SRT_Line_05 TANT_SRT_Line_05	4	0.125	0.5	4000		2	1	62 70	92			Shot0030	.sg2 .sg2	Shot0030.sg2 Shot0031.sg2	24	39.5 41.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		2	1	70	92			Shot0032	.sg2	Shot0032.sg2	24	43.5	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	86	92			Shot0033	.sg2	Shot0033.sg2	24	45.5	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	94	92			Shot0034	.sg2	Shot0034.sg2	24	40.0	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	106	92			Shot0035	.sq2	Shot0035.sg2	24	50.5	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	122	92			Shot0036	.sq2	Shot0036.sg2	24	54.5	
TANT SRT Line 05	4	0.125	0.5	4000		2	1	138	92			Shot0037	.sg2	Shot0037.sg2	24	58.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0038	3	1	-46	184		138	Shot0038	.sg2	Shot0038.sg2	47	35.5	,
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0039	3	1	-30	184		154	Shot0039	.sg2	Shot0039.sg2	47	39.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		3	1	-14	184			Shot0040	.sg2	Shot0040.sg2	47	43.5	
ANT SRT Line 05	4	0.125	0.5	4000		3	1	-2	184			Shot0041	.sg2	Shot0041.sg2	47	46.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		3	1	6	184			Shot0042	.sg2	Shot0042.sg2	47	48.5	
ANT SRT Line 05	4	0.125	0.5	4000		3	1	14	184			Shot0043	.sg2	Shot0043.sg2	47	50.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		3	1	22	184			Shot0044	.sg2	Shot0044.sg2	47	52.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		3	1	30	184 184			Shot0045 Shot0046	.sg2	Shot0045.sg2	47	54.5 56.5	
ANT_SRT_Line_05	4	0.125	0.5 0.5	4000		3	1	38 46	184			Shot0046 Shot0047	.sg2 .sa2	Shot0046.sg2 Shot0047.sg2	47	56.5 58.5	
ANT_SRT_LINE_05	4	0.125	0.5	4000		3	1	40 54	184			Shot0047	.sgz .sg2	Shot0047.sg2 Shot0048.sg2	47	58.5 60.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		3	1	62	184			Shot0049	.sg2	Shot0049.sg2	47	62.5	
ANT SRT Line 05	4	0.125	0.5	4000		3	1	70	184			Shot0050	.syz .sa2	Shot0050.sg2	47	64.5	
ANT SRT Line 05	4	0.125	0.5	4000		3	1	78	184			Shot0051	.sg2	Shot0051.sg2	47	66.5	
ANT SRT Line 05	4		0.5	4000		3	1	86	184			Shot0052	.sg2	Shot0052.sg2	47	68.5	
ANT SRT Line 05	4	0.125	0.5	4000		3	1	94	184			Shot0053	.sg2	Shot0053.sg2	47	70.5	
ANT SRT Line 05	4	0.125	0.5	4000		3	1	106	184			Shot0054	.sg2	Shot0054.sg2	47	73.5	
ANT_SRT_Line_05	4	0.125	0.5	4000		3	1	122	184			Shot0055	.sg2	Shot0055.sg2	47	77.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0056	3	1	138	184	276	322	Shot0056	.sg2	Shot0056.sg2	47	81.5	
TANT SRT Line 05	Δ	0.125	0.5	4000	Shot0057	4	1	-46	276	368	230	Shot0057	.sg2	Shot0057.sg2	70	58.5	

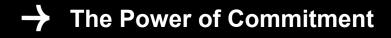
TANT SRT Line 05	4	0.125	0.5	4000	Shot0058	4	1 -30	276	368	246 Shot0058	.sd2	Shot0058.sg2	70	62.5	
TANT SRT Line 05	4	0.125	0.5		Shot0059	4	1 -14	276	368	262 Shot0059	.sq2	Shot0059.sg2	70	66.5	
TANT SRT Line 05	4	0.125	0.5		Shot0060	4	1 -2	276	368	274 Shot0060	.sg2	Shot0060.sg2	70	69.5	
TANT SRT Line 05	4	0.125	0.5		Shot0061	4	1 6	276	368	282 Shot0061	.sa2	Shot0061.sg2	70	71.5	
TANT SRT Line 05	4	0.125	0.5		Shot0062	4	1 14	276	368		.sg2	Shot0062.sg2	70	73.5	
TANT SRT Line 05	4	0.125	0.5		Shot0063	4	1 22	276	368	298 Shot0063	.sq2	Shot0063.sg2	70	75.5	
TANT SRT Line 05	4	0.125	0.5		Shot0064	4	1 30	276	368	306 Shot0064	.sg2	Shot0064.sg2	70	77.5	
TANT SRT Line 05	4	0.125	0.5	4000		4	1 38	276	368	314 Shot0065	.sg2	Shot0065.sg2	70	79.5	
TANT SRT Line 05	4	0.125	0.5	4000		4	1 46	276	368	322 Shot0066	.sg2	Shot0066.sg2	70	81.5	
TANT SRT Line 05	4	0.125	0.5			4	1 54	276	368	330 Shot0067	.sg2	Shot0067.sg2	70	83.5	
TANT SRT Line 05	4	0.125	0.5			4	1 62	276	368	338 Shot0068	.sgz .sa2	Shot0068.sg2	70	85.5	
TANT SRT Line 05	4	0.125	0.5		Shot0069	4	1 70	276	368	346 Shot0069	.sg2	Shot0069.sg2	70	87.5	
TANT_SRT_LINE_05	4	0.125	0.5		Shot0070	4	1 70	276	368	354 Shot0070	.sgz .sa2	Shot0070.sg2	70	89.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0071	4	1 78	276	368			Shot0070.sg2	70	91.5	
TANT_SRT_LINE_05	4	0.125	0.5		Shot0072	4	1 80	276	368	370 Shot0072	.sg2 .sa2	Shot0077.sg2	70	91.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0072 Shot0073	4	1 94	276	368	382 Shot0073	.sgz .sg2	Shot0072.sg2 Shot0073.sg2	70	93.5 96.5	
TANT_SRT_LINE_05	4	0.125	0.5			4	1 100	276	368	398 Shot0074			70	90.5	
	4					4		276			.sg2	Shot0074.sg2			
TANT_SRT_Line_05	4	0.125	0.5			4	1 138	¢	368	414 Shot0075	.sg2	Shot0075.sg2	70	104.5	
TANT_SRT_Line_05	4	0.125	0.5			5	1 -46	368	460	322 Shot0076	.sg2	Shot0076.sg2	93	81.5	
TANT_SRT_Line_05	4	0.125	0.5			5	1 -30	368	460	338 Shot0077	.sg2	Shot0077.sg2	93	85.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0078	5	1 -14	368	460	354 Shot0078	.sg2		93	89.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0079	5	1 -2	368	460		.sg2	Shot0079.sg2	93	92.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0080	5	1 6	368	460	374 Shot0080	.sg2	Shot0080.sg2	93	94.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0081	5	1 14	368	460	382 Shot0081	.sg2	Shot0081.sg2	93	96.5	
TANT SRT Line 05	4	0.125	0.5			5	1 22	368	460	390 Shot0082	.sg2	Shot0082.sg2	93	98.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		5	1 30	368	460	398 Shot0083	.sg2	Shot0083.sg2	93	100.5	
TANT SRT Line 05	4	0.125	0.5			5	1 38	368	460	406 Shot0084	.sg2	Shot0084.sg2	93	102.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0085	5	1 46	368	460	414 Shot0085	.sg2	Shot0085.sg2	93	104.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		5	1 54	368	460	422 Shot0086	.sg2	Shot0086.sg2	93	106.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		5	1 62	368	460	430 Shot0087	.sg2	Shot0087.sg2	93	108.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0088	5	1 70	368	460	438 Shot0088	.sg2	Shot0088.sg2	93	110.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0089	5	1 78	368	460	446 Shot0089	.sg2	Shot0089.sg2	93	112.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0090	5	1 86	368	460	454 Shot0090	.sg2	Shot0090.sg2	93	114.5	
TANT SRT Line 05	4	0.125	0.5			5	1 94	368	460	462 Shot0091	.sg2	Shot0091.sg2	93	116.5	
TANT_SRT_Line_05	4	0.125	0.5			5	1 106	368	460	474 Shot0092	.sg2	Shot0092.sg2	93	119.5	
TANT_SRT_Line_05	4	0.125	0.5			5	1 122	368	460	490 Shot0093	.sg2	Shot0093.sg2	93	123.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0094	5	1 138	368	460	506 Shot0094	.sg2	Shot0094.sg2	93	127.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0095	6	1 -46	460	552	414 Shot0095	.sg2	Shot0095.sg2	116	104.5	
TANT_SRT_Line_05	4	0.125	0.5			6	1 -30	460	552	430 Shot0096	.sg2	Shot0096.sg2	116	108.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0097	6	1 -14	460	552	446 Shot0097	.sg2	Shot0097.sg2	116	112.5	
TANT SRT Line 05	4	0.125	0.5		Shot0098	6	1 -2	460	552	458 Shot0098	.sg2	Shot0098.sg2	116	115.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		6	1 6	460	552	466 Shot0099	.sg2	Shot0099.sg2	116	117.5	
TANT_SRT_Line_05	4	0.125	0.5			6	1 14	460	552	474 Shot0100	.sg2	Shot0100.sg2	116	119.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0101	6	1 22	460	552	482 Shot0101	.sg2	Shot0101.sg2	116	121.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0102	6	1 30	460	552	490 Shot0102	.sg2	Shot0102.sg2	116	123.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0103	6	1 38	460	552		.sg2	Shot0103.sg2	116	125.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0104	6	1 46	460	552	506 Shot0104	.sg2	Shot0104.sg2	116	127.5	
TANT SRT Line 05	4	0.125	0.5		Shot0105	6	1 54	460	552	514 Shot0105	.sg2	Shot0105.sg2	116	129.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0106	6	1 62	460	552	522 Shot0106	.sg2	Shot0106.sg2	116	131.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		6	1 70	460	552	530 Shot0107	.sg2	Shot0107.sg2	116	133.5	
TANT_SRT_Line_05	4	0.125	0.5	4000		6	1 78	460	552	538 Shot0108	.sg2	Shot0108.sg2	116	135.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0109	6	1 86	460	552	546 Shot0109	.sg2	Shot0109.sg2	116	137.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0110	6	1 94	460	552	554 Shot0110	.sg2	Shot0110.sg2	116	139.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0111	6	1 106	460	552	566 Shot0111	.sg2	Shot0111.sg2	116	142.5	
TANT SRT Line 05	4	0.125	0.5		Shot0112	6	1 122	460	552	582 Shot0112	.sg2	Shot0112.sg2	116	146.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0113	6	1 138	460	552		.sg2	Shot0113.sg2	116	150.5	
TANT SRT Line 05	4	0.125	0.5		Shot0114	7	1 -46	552	644	506 Shot0114	.sg2	Shot0114.sg2	139	127.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0115	7	1 -30	552	644	522 Shot0115	.sg2	Shot0115.sg2	139	131.5	
TANT_SRT_Line_05	4	0.125	0.5		Shot0116	7	1 -14	552	644		.sg2	Shot0116.sg2	139	135.5	
TANT_SRT_Line_05	4	0.125	0.5			7	1 -2	552	644	550 Shot0117	.sg2	Shot0117.sg2	139	138.5	
TANT SRT Line 05	4	0.125	0.5			7	1 6	552	644	558 Shot0118	.sg2	Shot0118.sg2	139	140.5	
				4000	Shot0119	7	1 14	552	644	566 Shot0119	.sg2	Shot0119.sg2	139	142.5	
TANT_SRT_Line_05	4	0.125	0.5			/									
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0120	7	1 22	552	644	574 Shot0120	.sg2	Shot0120.sg2	139	144.5	
	4 4 4			4000 4000		7 7 7 7									

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TANT_SRT_Line_05	4	0.125	0.5		Shot0123	7	1	46	552	644			Shot0123.sg2		150.5	1
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0124	7	1	54	552	644	606 Shot01	24 .sg2	Shot0124.sg2	139	152.5	1
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0125	7	1	62	552	644	614 Shot01	25 .sg2	Shot0125.sg2	139	154.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0126	7	1	70	552	644	622 Shot01	26 .sg2	Shot0126.sg2	139	156.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0127	7	1	78	552	644	630 Shot01	27 .sg2	Shot0127.sg2	139	158.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0128	7	1	86	552	644	638 Shot01	28 .sq2	Shot0128.sg2	139	160.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0129	7	1	94	552	644	646 Shot01	29 .sg2	Shot0129.sg2	139	162.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0130	7	1	106	552	644	658 Shot01	30 .sg2	Shot0130.sg2	139	165.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0131	7	1	122	552	644	674 Shot01	31 .sg2	Shot0131.sg2	139	169.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0132	7	1	138	552	644	690 Shot01	32 .sg2	Shot0132.sg2	139	173.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0133	8	1	-46	644	736	598 Shot01	33 .sq2	Shot0133.sg2	162	150.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0134	8	1	-30	644	736	614 Shot01	34 .sg2	Shot0134.sg2	162	154.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0135	8	1	-14	644	736	630 Shot01	35 .sq2	Shot0135.sg2	162	158.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0136	8	1	-2	644	736	642 Shot01	36 .sg2	Shot0136.sg2	162	161.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0137	8	1	6	644	736	650 Shot01	37 .sg2	Shot0137.sg2	162	163.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0138	8	1	14	644	736	658 Shot01	38 .sg2	Shot0138.sg2	162	165.5	1
TANT SRT Line 05	4	0.125	0.5	4000	Shot0139	8	1	22	644	736	666 Shot01	39 .sg2	Shot0139.sg2	162	167.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0140	8	1	30	644	736	674 Shot01	40 .sg2	Shot0140.sg2	162	169.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0141	8	1	38	644	736	682 Shot01	41 .sg2	Shot0141.sg2	162	171.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0142	8	1	46	644	736	690 Shot01	42 .sg2	Shot0142.sg2	162	173.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0143	8	1	54	644	736	698 Shot01	43 .sg2	Shot0143.sg2	162	175.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0144	8	1	62	644	736	706 Shot01	44 .sg2	Shot0144.sg2	162	177.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0145	8	1	70	644	736		45 .sg2	Shot0145.sg2	162	179.5	
TANT_SRT_Line_05	4	0.125	0.5	4000	Shot0146	8	1	78	644	736	722 Shot01	46 .sg2	Shot0146.sg2	162	181.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0147	8	1	86	644	736	730 Shot01	47 .sg2	Shot0147.sg2	162	183.5	
TANT SRT Line 05	4	0.125	0.5	4000	Shot0148	8	1	90	644	736	734 Shot01	48 .sg2	Shot0148.sg2	162	184.5	



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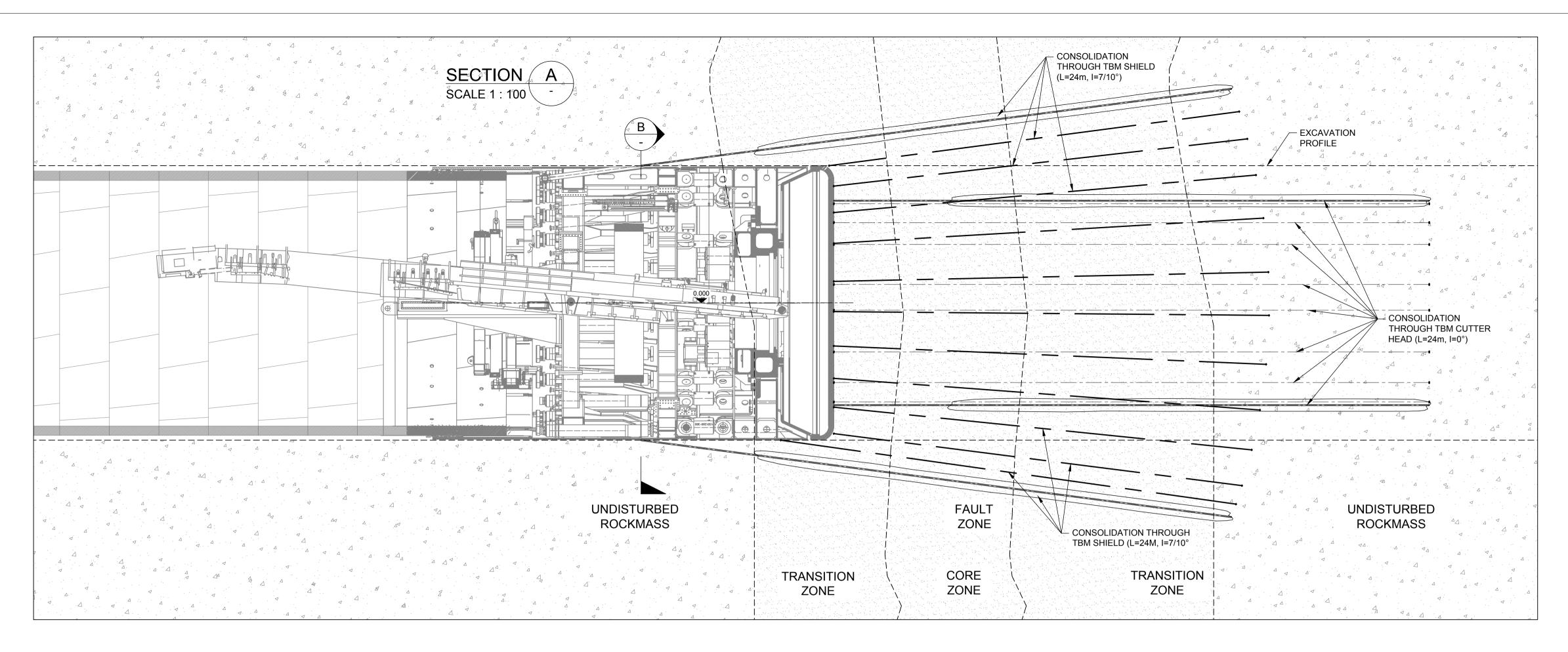


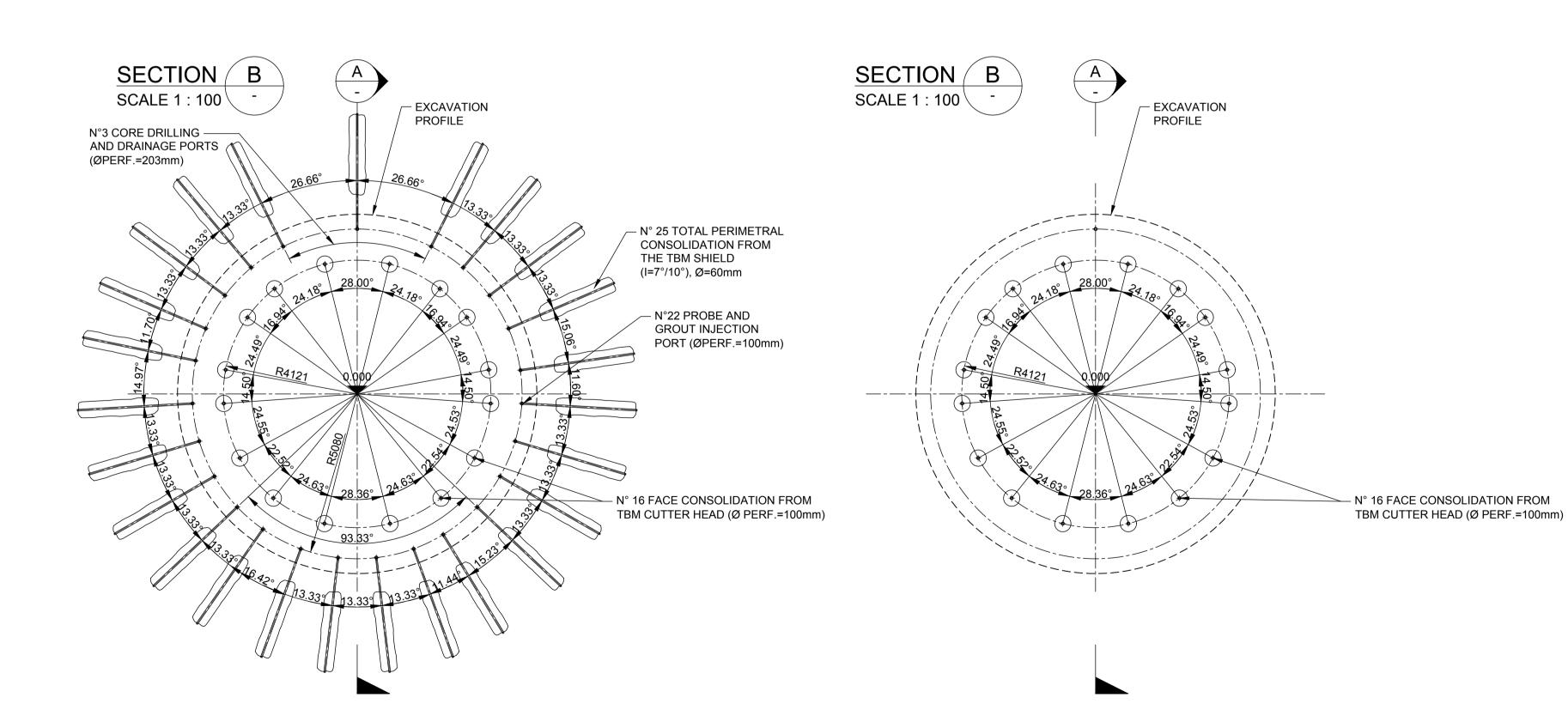


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APPENDIX D – SNOWY 2.0HT02B.1 - HT & TT ADIT TUNNELS ROCKMASS CONSOLIDATION EXECUTION PHASES







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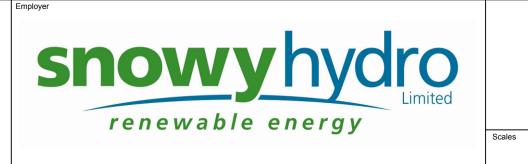
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### **TECHNICAL NOTES**

- 2. INVESTIGATION TECHNIQUES AHEAD OF THE FACE, OR BY SIGNIFICANT WORSENING OF GROUND CONDITIONS.
- GEOMETRICAL SCHEME SHOWN IN THE DRAWING.
- THE GEOLOGICAL INVESTIGATION AHEAD THE EXCAVATION FACE.
- 5. DRAINAGE HOLES DURING THE EXCAVATION ARE ALWAYS ASSOCIATED WITH THE CONSOLIDATION. THE BOREHOLE FOR PVC PIPE AND PVC DRAINAGE BEFORE TO REMOVE THE STEEL CASING.
- CONSOLIDATIONS, IN TBM3 THEY WILL BE N. 25.

PRE-GROUT / POST GROUT	START CRITERIA	STOP CRITERIA
HYDRAULIC TRIGGERS	<ul> <li>SUDDEN WATER INFLOW FROM A PROBE HOLE IS RECORDED TO BE HIGHER OR EQUAL TO THE FOLLOWING VALUES:</li> <li>IN CASE OF PERFORMANCE CLASS 1: 2.0 L/s</li> <li>IN CASE OF PERFORMANCE CLASS 2: 0.5 L/s</li> <li>IN CASE OF PERFORMANCE CLASS 3: 0.3 L/s</li> </ul>	<ul> <li>WATER INFLOW FROM THE PROBE HOLE DRILLED AFTER THE INJECTION IS RECORDED TO BE LOWER THAN THE FOLLOWING VALUES:</li> <li>IN CASE OF PERFORMANCE CLASS 1: 2.0 L/s</li> <li>IN CASE OF PERFORMANCE CLASS 2: 0.5 L/s</li> <li>IN CASE OF PERFORMANCE CLASS 3: 0.3 L/s</li> </ul>
GROUND CONDITION TRIGGERS	<ul> <li>GROUND BEHAVIOUR IS RECOGNIZED TO BE GB9.</li> <li>PRESENCE OF FAULT ZONE</li> <li>UNSTABLE, SATURATED GROUND AHEAD OF THE FACE IS INDICATED BY PROBE HOLES OR ANY OTHER GROUND INVESTIGATION TECHNIQUES, OR BY SIGNIFICANT WORSENING OF GROUND CONDITIONS.</li> </ul>	<ul> <li>GROUTING CAN BE CONSIDERED ACCEPTABLE ONCE REACHING ONE OF THE FOLLOWING GROUTING VALUES:</li> <li>MAXIMUM PRESSURE (P<sub>max</sub>) = EQUIVALENT TO 1.2* WATER PRESSURE AT THE GROUTING LOCATION, AS PER THE HYDROGEOLOGICAL PROFILE SHOWN IN THE DRAWING S2-GEO-GN-HGM-2032, THUS GOING FROM 50 TO 60 BAR ALONG THE MAT/CT17.</li> <li>MAXIMUM VOLUME OF GROUT INJECTED (V<sub>max</sub>) OF MICROFINE CEMENT = 300 L/metre</li> </ul>

## FOR CONSTR



1:100 @ A1

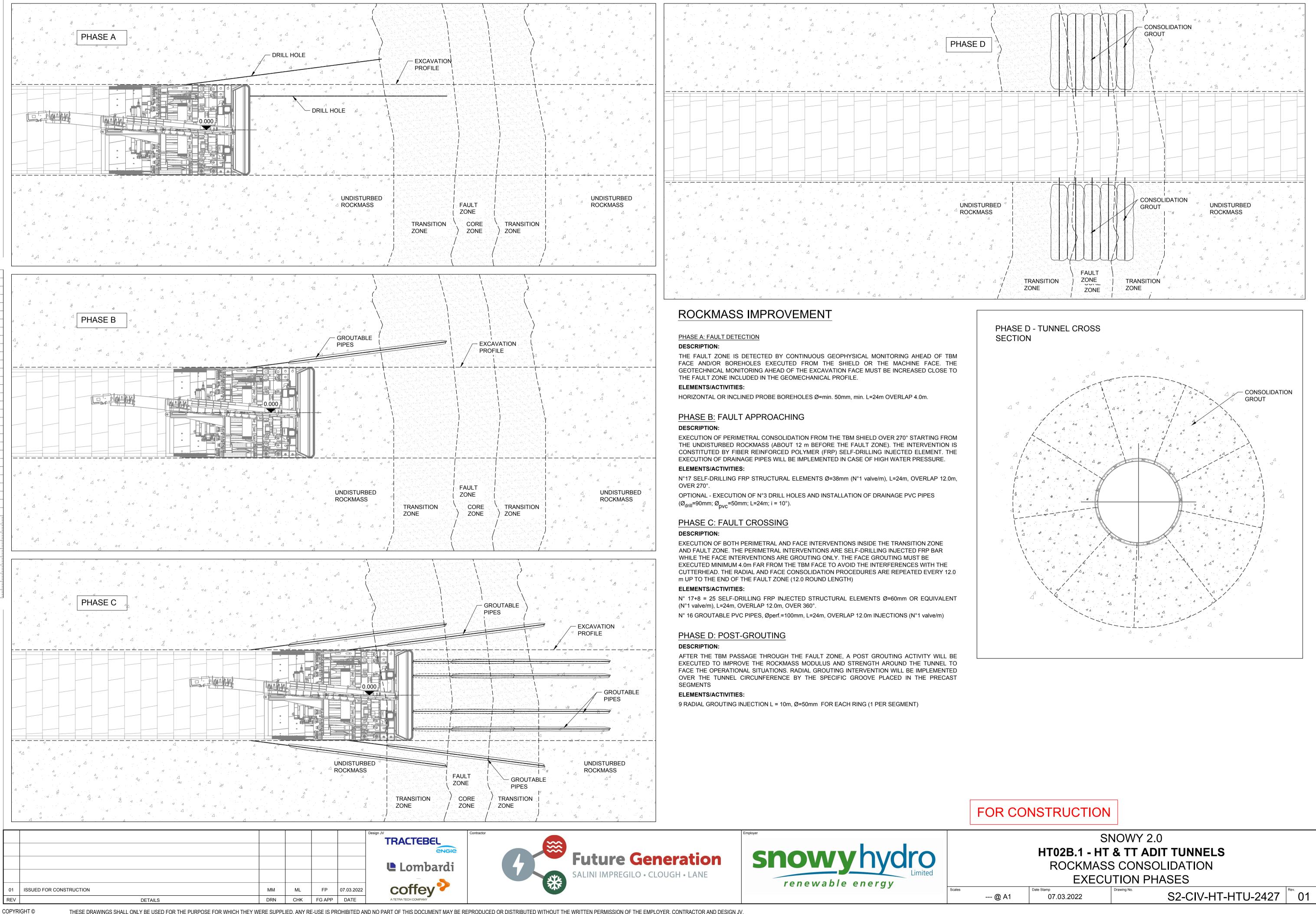
PRECONSOLIDATION INTERVENTIONS ARE TRIGGERED WHEN TBM PASS THROUGH FAULT ZONES OR GROUND BEHAVIOUR IS RECOGNIZED TO BE GB9. PREGROUTING IS ALSO NEEDED WHEN UNSTABLE, SATURATED GROUND AHEAD OF THE FACE IS INDICATED BY PROBE HOLES OR ANY GROUND 3. THE CONSOLIDATION FIELD WILL BE EXECUTED THROUGH THE DRILLINGS ACROSS THE TBM SHIELD AND CUTTERHEAD, ACCORDING TO THE

4. THE LENGTH OF THE CONSOLIDATION SHALL BE MODIFIED IF NECESSARY, ACCORDING TO THE GEOLOGICAL CONDITION FACED AND THE RESULTS OF

PIPE MUST BE EXECUTED WITH A PROTECTIVE STEEL CASING IN ORDER TO AVOID THE COLLAPSE OF THE HOLE. THE PVC PIPE MUST BE INSERTED

6. THE NUMBER AND THE LOCATION OF THE PROBE PORTS DEPEND ON THE TYPE OF TBM WHICH THEY REFER. TBM1 WILL HAVE N. 27 PERIMETRAL

	-		1.1 (0.1)						
RUCTION		0 10	<u>1:1 (A1)</u> 50		100 mm				
SNOWY 2.0									
HT02B.1 - HT & TT ADIT TUNNELS									
ROCKMASS CONSOLIDATION									
TYPICAL SECTIONS									
Date Stamp 07.03.2	2022	g No.	S2-CIV-HT-	-HTU-2426	Rev. 01				



5 5 CIV ted

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