TailCon Projects Consulting

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Black Cat Syndicate

Bulong Gold Project

Fingals TSF – Geotechnical Design of Dry-Stack Tailings Trial

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1 INTRODUCTION

1.1 Project Background

Black Cat Syndicate (Black Cat) owns the Bulong Gold Project (BGP), located approximately 47 km south-east (approximate location coordinate based on MGA94 datum: 395,150 m Easting, 6,573,770 m Northing) of Kalgoorlie-Boulder, Western Australia comprising the existing Fingals Fortune, Baguss, and Futi Baguss open mine pits that have since being backfilled with tailings. Located adjacent to these pits is the existing above-ground Fingals Tailings Storage Facility (TSF). Black Cat proposes to excavate in-situ tailings from the three (3) surrounding pits and dry-stack the tails onto Fingals TSF. It is understood that the three (3) pits contain up to approximately 750,000 m^3 tailings (Baguss: 301,700 m^3; Futi-Baguss: 356,200 m^3; Fingals Fortune: 115,200 m^3). Google satellite imagery illustrating the general arrangement of the pits and Fingals TSF is presented in Figure 1-1 below.

Upon dry-stacked placement of all the excavated tailings onto Fingals TSF, Black Cat intend to cap the dry-stacked tailings surface with non-acid-forming (NAF) fresh basalt rocks derived as mine waste from mine pit development works.

Prior to execution of the above works, Black Cat proposes to undertake a tailings dry-stacking trial, on Fingals TSF, with the placement of a total of 115,200 m^3 of dry-stacked tailings at a thickness not exceeding 1 m. This trial is intended to evaluate the geotechnical strength response of the dry-stacked tailings material, throughout both dry and wet season, and also to evaluate the feasibility of dry-stacking tailings higher in a geotechnically stable manner. This report details the findings of geotechnical engineering design work that TailCon has undertaken for the proposed tailings dry-stacking trial on Fingals TSF.

1.2 Referenced Information

Black Cat provided TailCon Project Consulting (TailCon) with the following information for review:

- Technical note prepared by Peter O'Bryan & Associates, dated 16th May 2025, and titled "BULONG GOLD PROJECT FINGALS OPEN PIT WASTE DUMP, ZOI & TSF EXTENSION DESIGN REVIEW".
- Report prepared by CMW Geosciences (CMW), dated 4th April 2022, and titled "FINGALS TAILINGS STORAGE FACILITY, GEOTECHNICAL INVESTIGATION AND ASSESSMENT REPORT" (CMW doc. no.: PER2021-0406AB). This document is attached in Appendix A of this report.
- Report prepared by Geoanalytica, dated 21st September 2021, and titled "Futi Bagus In-pit Tailings Storage Facility, Geotechnical Cutback Design Assessment" (Geoanalytica doc. no.: LMGAU0012-REP-001). This document is attached in Appendix B of this report.

The following regulatory guidelines have also been referenced for the preparation of this report:

- Australian National Committee of Large Dams (ANCOLD) 2019 *Guidelines for design of dams and appurtenant structures for earthquake*.
- Australian National Committee on Large Dams (ANCOLD) 2019 *Guidelines on Tailings Dams - Planning, Design, Construction, Operation and Closure*.
- Australian Standard AS1726:2017 *Geotechnical site investigation*.

- Western Australia Department of Mines and Petroleum (now referred to as Department of Energy, Mines, Industry Regulation and Safety, DEMIRS) August 2015 *Guide to the preparation of a design report for tailings storage facilities (TSF)*.
- Western Australia Department of Mines and Petroleum (now referred to as Department of Energy, Mines, Industry Regulation and Safety, DEMIRS) 2013 *Code of Practice – Tailings storage facilities in Western Australia*.

Figure 1-1: General arrangement of Fingals TSF and surrounding open mine pits in-filled with tailings

2 SITE CONDITION

2.1 Current Fingals TSF condition

The current TSF is composed of a single 5 m high earth fill impoundment embankment constructed from mine waste clay material sourced from nearby material borrow areas, with embankment batters graded at 1V:3H, and has been filled with tailings up to 0.5 m below the embankment crest. The in-situ tailings surface is overlain by a capping layer formed utilizing mine waste clay materials. The capped tailings surface area is approximately 10 ha, with a surface perimeter of approximately 1.3 km.

The physical material index properties and geotechnical shear behaviour of both TSF embankment fill and impounded tailings material, based on interpretation of relevant data contained in the referenced documents, are summarised as follows:

1. The existing TSF impoundment embankment and capping layer construction is anticipated to have utilized soil material similar to stockpiled mine waste clays that CMW inspected (Appendix A), which are composed of sandy gravelly CLAY material possessing variably low to high plasticity. The entire TSF embankment fill, including impounded tailings, is dry and therefore is expected to geotechnically behave in a drained and liquefaction-resistant manner.
2. In-situ tailings are composed of SILT material of low plasticity and are dry. Considering the in-situ tailings surface has already been capped with mine waste clay material, as discussed above, the in-situ tailings are anticipated to remain sufficiently dry at all times and is therefore expected to geotechnically behave in a drained and liquefaction-resistant manner.

On the above basis, the geotechnical shear strength of both in-situ tailings and mine waste clay material can be defined under the Mohr-Coulomb failure criterion, represented by the effective drained friction angle ϕ’ and apparent cohesion c’ parameters. Interpreted parameter magnitude for both material are summarized as follows:

1. Laboratory consolidated undrained triaxial test (CUTX) test data contained within the Geoanalytica report (Appendix B), on fine-grained tailings material collected from the Futi Baguss pit and is of similar material composition to that impounded within Fingals TSF (test undertaken on samples consolidated to match in-situ density state), indicate ϕ’ = 26° and c’ = 22.5 kPa to be representative.
2. Based on past project experience involving field nuclear densitometer measurements of mine waste material placed for TSF embankment construction, including undertaking of large-scale laboratory shear box testing and consolidated undrained triaxial (CUTX) tests based on the measured density state, experimentally-measured Mohr-Coulomb shear resistance stress response for such material can be represented by ϕ’ – c’ combination ranging from 30° - 10 kPa on the Lower Bound, increasing to 40° - 75 kPa on the Upper Bound. The Lower Bound range is typically associated with residual/oxide waste material, similar to that of mine waste clay material encountered on the TSF and stockpile, whereas the Upper Bound range is associated with fresh rock material i.e. non-acid-forming (NAF) fresh basalt mine waste rocks that Black Cat propose to use for dry-stacked tailings batter capping (also referred to as ‘armour’ in this report).

2.2 In-pit Tailings Condition

Tailings currently impounded within the three (3) pits, based on geotechnical site investigation data contained within the referenced Geoanalytica document, are anticipated to be composed of variably coarse-grained and fine-grained tailings.

The interpreted physical material index properties and geotechnical shear behaviour of both tailings material, under as-is in-pit state, are summarised as follows:

1. The intersected coarse-grained tailings material is composed predominantly of silty SAND material, with the silt being of low plasticity, whereas the sands are fine-grained and its particle angularity is subrounded to sub-angular. This tailings material possesses an in-situ moisture content of generally less than 10%, with a liquid limit of approximately 30%, plasticity index of ~7%, in-situ dry density ranging between 1.6 and 1.65 t/m^3, specific gravity of around 3 t/m^3, and as such can be deemed to be sufficiently desaturated (estimated degree of saturation S_r ~40%) and dry to always geotechnically shear in a drained and liquefaction-resistant manner (S_r threshold to initiate undrained behaviour is > 65%).
2. The intersected fine-grained tailings material is composed predominantly of SILT material of high plasticity. This tailings material possesses an in-situ moisture content and liquid limit of approximately 40% and 50% respectively, plasticity index of ~18%, in-situ dry density of approximately 1.3 t/m^3, specific gravity of around 2.9 t/m^3, and can be deemed to be near full saturation (S_r > 90%) such that it is anticipated to geotechnically shear in an undrained manner during dry-stack handling works. Disregarding the near full saturation condition, this tailings material contain sufficient plasticity and fine soil particle size distribution grading, based on interpretation as per recommendations in Commentary C3.4.3 of the referenced ANCOLD (2019) guideline, such that it can be deemed to be liquefaction-resistant under as-is in-pit state.

The interpreted geotechnical shear behaviour of both tailings material, upon excavation removal from the pits and placement onto Fingals TSF, are summarised as follows:

1. Coarse-grained tailings material is anticipated to remain dry (and potentially drier due to exposure to environment during excavation and transportation) and still geotechnically shear in a drained liquefaction-resistant manner upon placement onto Fingals TSF.
2. Fine-grained tailings material is anticipated to be sufficiently saturated as to geotechnically shear in an undrained manner during excavation and transportation from the pits. To mitigate the potential of this tailings material to undergo undrained geotechnical shear behaviour and instead retain its drained liquefaction-resistant geotechnical shear behaviour, the excavated tailings material must be conditioned to lower its moisture content from ~40% to ≤ 27.5%; this corresponds to S_r ≤ 65% and is generally accepted as the maximum S_r value at which soils can still be deemed to geotechnically shear in a drained manner.

   The fine-grained tailings material, under in-situ moisture content of ~40% with S_r > 90%, is also likely to liquefy during truck transportation to Fingals TSF; past project experience indicates that tailings must be conditioned to ensure its moisture content is limited to not exceed 15% to mitigate transportation-induced liquefaction.

   Conditioning of fine-grained tailings material is therefore required to (i) facilitate transportation to Fingals TSF without liquefying it enroute, and (ii) ensure it is sufficiently desaturated so as to still geotechnically shear in a drained and liquefaction-resistant manner upon placement onto Fingals TSF, and shall be undertaken via the following approaches:

   a) Spreading out excavated fine-grained tailings material, on open flat ground in approximately 400 mm horizontal loose lifts, to enable sufficient solar desiccation and evaporative drying until it can be transported with haul trucks without undergoing liquefaction. Transportation trials can be undertaken to determine at what moisture content can the excavated tailings material be transported without liquefying; and / or

   b) Co-mixing 1 parts fine-grained tailings material : 3 parts coarse-grained tailings material in tonnage terms to ensure the overall tailings mass possess moisture content ≤ 15%.

The drained geotechnical shear strength of the overall excavated tailings mass conditioned to the above requirements is anticipated to be dictated by that of the fine-grained tailings portion, with dry-stacked tailings likely to possess similar strength to that of its in-pit state under earthwork machinery traffic compaction, however tailings material located closer to the batter can potentially be of lower strength due to limited trafficking by earthwork machinery for safety considerations. The drained geotechnical shear strength of the overall dry-stacked tailings mass, as defined under the Mohr-Coulomb failure criterion, is deemed appropriate to be conservatively represented by the effective drained friction angle $\phi' = 26°$ and $c' = 10$ kPa referencing laboratory CUTX data contained in the Geoanalytica report.

Past project experience indicates the achievable dry-stacked density of excavated in-pit tailings will be similar or greater to that of its current as-is in-pit state, under earthwork machinery traffic compaction, during placement onto Fingals TSF. On this basis, a material bulking factor = 1.0 is deemed to be appropriate (i.e. volume of in-pit tailings = volume of dry-stacked tailings onto Fingals TSF).

2.3 Groundwater Condition

The entire Fingals TSF is deemed to be dry.

The entire tailings body impounded within the Futi-Baguss pit, down to the pit base of approximately 50 m depth below existing ground surface, is indicated by interpretive findings contained within the Geoanalytica report to be sufficiently dry such that groundwater is not present; likewise, the absence of groundwater can be expected for tailings impounded within the adjacent Baguss pit.

Natural groundwater is indicated to likely be absent within the Fingals pit, when it was still in operating condition, based on publicly-available documents published by the WA Department of Environmental Regulation (DER) (DER file no.: 2012/006865). Observed water presently within the pit is therefore anticipated to be merely ponded water derived from rain runoff collection, with Google Earth Map satellite imagery indicating this pond to have been gradually shrinking over time since 2018.

2.4 Seismicity

Seismic parameters relevant for geotechnical TSF engineering assessments are generally the bedrock peak ground acceleration (PGA) and moment wave magnitude (M_w), with the adopted parameter magnitude chosen in accordance with the design earthquake Annual Exceedance Probability (AEP) to be considered for the proposed TSF development. The minimum design earthquake AEP requirement is dictated the TSF failure consequence category classification, both of which are evaluated in accordance with the ANCOLD (2019) guideline.

The design bedrock PGA and M_w value has been interpreted based on the Geoscience Australia 2018 *National Seismic Hazard Assessment (NSHA) for Australia* document including complementary record catalogue, for different AEP (based on safety evaluation earthquake condition) and ANCOLD TSF failure consequence categories, and are summarised in Table 2-1 below.

The ANCOLD Dam Failure Consequence Category classification for the proposed tailings dry-stacking works on Fingals TSF has been assigned as “Very Low”, based on Consequence Category assessment finding in Section 3.2 of this report, on which basis TailCon have adopted a design PGA = 0.090g for geotechnical engineering design work covered by this report.

Table 2-1 Design earthquake parameters

ANCOLD TSF failure consequence category	Minimum AEP consideration	PGA (g)	M_w
High A / Extreme	10,000	7.0	0.540
High B	5,000	7.0	0.339
High C	2,000	7.0	0.205
Significant	1,000	7.0	0.137
Very Low / Low	500	7.0	0.090

2.5 Climatic Condition

The ANCOLD Dam Spill Consequence Category classification for the proposed tailings dry-stacking works on Fingals TSF has been assigned as "Very Low", based on assessment finding in Section 3.2 of this report, on which basis there is no need to take into considering wet season and storm water storage allowance for the proposed works as per ANCOLD (2019) guideline requirements.

On the above basis, climatic conditions of the Fingals TSF site are not deemed to be relevant for geotechnical engineering design work covered by this report, as such have not been interpreted.

3 TSF DESIGN

3.1 General Configuration

The proposed dry-stacked placement of excavated in-pit tailings onto the existing capped tailings surface of Fingals TSF, with tailings batter limited to be no steeper than 1V:3H as per existing TSF embankment batter profile, will require the total dry-stacked tailings stockpile height to extend up to 9.5 m above the existing TSF embankment crest (achieved final dry-stacked tailings surface area of ~7 ha) in order to store up to 750,000 m^3 of excavated in-pit tailings. This document however only considers the placement of 115,200m^3 of dry-stacked tailings up to no higher than 1 m above the existing TSF embankment crest, with the feasibility for higher stacking contingent on undertaking of performance evaluation requirements stipulated in Section 6 of this report.

Prior to commencement of tailings dry-stacking works, the following preparatory earthworks must first be undertaken:

1. Existing capping surface of Fingals TSF must be graded, in the downward gradient at a minimum inclination of ≥ 2% towards the TSF periphery, to facilitate rainwater infiltration outflow from the TSF. Where low points are identified on the capping surface, which can result in water ponding and potential saturation of surrounding tailings, these low points shall be filled with mine waste clay material and graded as per above requirement.
2. A mine waste rock windrow shall be placed at a minimum distance of ≥ 10 m and along the entire Fingals TSF embankment downstream toe periphery. The windrow shall be constructed from mine waste rock material up to a minimum height of 1.5 m above the existing ground surface.
3. An exclusion zone, in which mine light vehicles (LVs) and personnel are restricted from entering, shall be put in place encompassing the area between the aforementioned mine waste rock windrow and Fingals TSF embankment downstream toe periphery.

Typical Fingals TSF embankment cross-section illustrating the above preparatory earthworks, before tailings dry-stacking works can commence, is presented in Figure 3-1 below.

Upon completion of above preparatory earthworks, tailings dry-stacking on Fingals TSF can commence based on the following operational constraints that must be complied with:

1. Dry-stacked tailings must be placed at a batter no steeper than 1V:3H.
2. Dry-stacked tailings must be placed in 500mm horizontally-continuous layers.
3. Tailings must be conditioned as per requirements set out in Section 2.2 of this report, specifically where fine-grained tailings are encountered within the pits, to ensure the overall tailings mass remain sufficiently desaturated and can therefore geotechnically shear in a drained and liquefaction-resistant manner at all times.
4. A minimum 3 m wide fresh rock armour is to be placed over the dry-stacked tailings batter, with the armour surface to be graded at no steeper than 1V:3H and is placed flush with the existing TSF embankment batter surface. Armour placement must be undertaken progressively, as tailings is being dry-stacked, to ensure exposed dry-stacked tailings batter do not exceed 1 m height at any one time.
5. Dry-stacked tailings must be graded at a minimum ≥ 2% downward gradient towards the batter edges, in order to channel runoff out of the TSF, and prevent rainwater ponding on the dry-stacked tailings surface that may result in underlying tailings saturation (and introduce risk of liquefaction susceptibility).
6. The maximum dry-stacked tailings crest edge must be limited to not exceed 1 m measured from the existing TSF embankment crest, with feasibility of higher dry-stacking height to be evaluated via performance evaluation requirements specified in Section 6 of this report.
7. Earthwork machinery that can operate on the dry-stacked tailings surface shall comply with requirements set out in Section 4 of this report.

An illustration of the above operational constraints on a typical Fingals TSF embankment cross-section is presented in Figure 3-2 below.

Figure 3-1: Preparatory earthworks requirement on Fingals TSF before commencement of tailings dry-stacking works

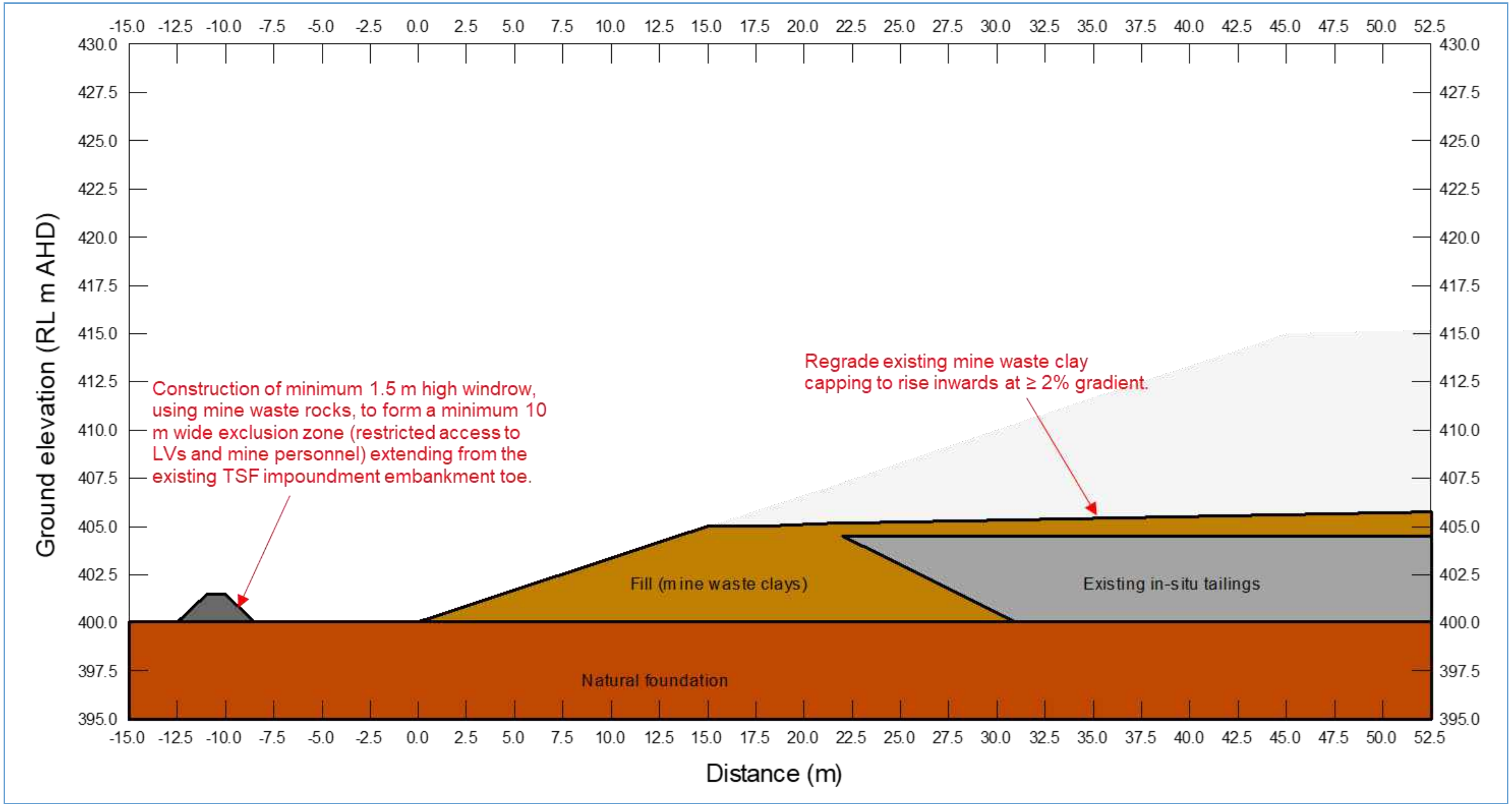
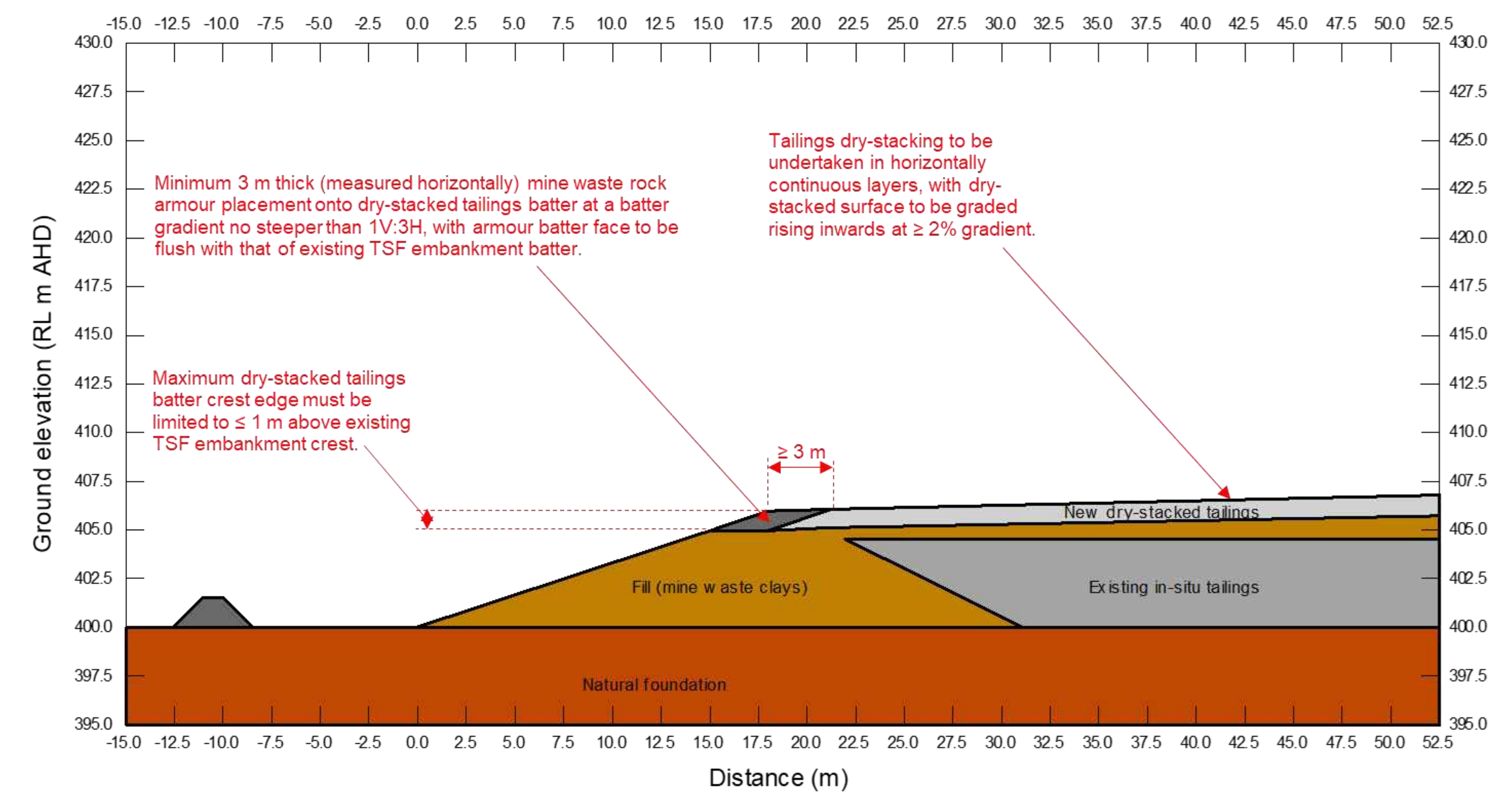


Figure 3-2: Operational requirements during tailings dry-stacking works on Fingals TSF



3.2 Failure Consequence Category Classification

3.2.1 DEMIRS hazard rating

Evaluation of the hazard rating for the proposed tailings dry-stacking exercise on Fingals TSF has been undertaken in accordance with the DEMIRS guideline criteria as per Table 3-1 and Table 3-2, and takes into consideration the following:

1. Final dry-stacked tailings stockpile height does not exceed 9.5 m above the existing TSF embankment crest with the current proposed lift height of 1.0 m above the existing TSF;
2. Placement of mine waste rock windrows surrounding Fingals TSF, as per Section 3.1 of this report, to form an exclusion zone restricting mine LV and personnel access; and
3. Ensuring tailings dry state, as per co-mixing requirements set out in Section 2.2 of this report, such that it geotechnically shear in a drained and liquefaction-resistant manner at all times.

On the above basis, TailCon deems it appropriate to assign a hazard rating of "Category 1" to encompass the proposed dry-stacking exercise.

Table 3-1 DEMIRS hazard rating system applicable to TSFs in Western Australia

Type of impact or damage	Hazard rating		
	High	Medium	Low
	Extent or severity of impact or damage		
Loss of human life or personal injury	Loss of life or injury is possible	Loss of life or injury is possible although not expected	No potential for loss of life or injury
Adverse human health due to direct physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil, air)	Long-term human exposure is possible, and permanent or prolonged adverse health effects are expected	The potential for human exposure is limited, and temporary adverse health effects are possible	No potential for human exposure
Loss of assets due to direct physical impact or contamination of the environment (e.g. chemical or radioactive pollution of water, soil, or air)	Loss of numerous livestock is possible	Loss of some livestock is possible	Limited or no potential for loss of livestock
	Permanent loss of assets (e.g. commercial, industrial, agricultural, and pastoral assets, public utilities, and infrastructure, mine infrastructure) is possible and no economic repairs can be made	Temporary loss of assets is possible and economic repairs can be made	Limited or no potential for destruction or loss of assets
	Loss of TSF storage capacity is possible and repair is not practicable	Loss of TSF storage capacity is possible and repair is practicable	Insignificant loss of TSF storage capacity is possible

Type of impact or damage	Hazard rating		
	High	Medium	Low
	Extent or severity of impact or damage		
Damage to items of environmental, heritage or historical value due to direct physical impact or contamination of the environment (e.g. chemical or radioactive pollution of water, soil, or air)	Permanent or prolonged damage to the natural environment (including soil, and surface and ground water resources) is possible	Temporary damage to the natural environment is possible	Limited or no potential for damage to the natural environment
	Permanent or prolonged adverse effects on flora and fauna are possible	Temporary adverse effects on flora and fauna are possible	Limited or no potential for adverse effects on flora and fauna
	Permanent damage or loss of items of heritage or historical value is possible	Temporary damage of items of heritage or historical value is possible	Limited or no potential for damage of items of heritage or historical value

Table 3-2 DEMIRS matrix of hazard ratings and heights used to derive TSF categories in Western Australia

Maximum embankment or structure height	Hazard rating		
	High	Medium	Low
> 15 m	Category 1	Category 1	Category 1
5 - 15 m	Category 1	Category 2	Category 2
< 5 m	Category 1	Category 2	Category 3

3.2.2 ANCOLD consequence category

Consequence category assessment has been undertaken for the proposed tailings dry-stacking exercise on Fingals TSF, in accordance with ANCOLD (2019) criteria as per Table 3-3 and Table 3-4, and takes into consideration the following:

1. On the basis the in-pit tailings are conditioned into a sufficiently dry and desaturated state prior to placement onto Fingals TSF, as per requirements set out in Section 2.2 of this report, any geotechnical failure in the dry-stacked tailings batter is likely limited to only surficial soil slumping that is constrained by the proposed mine waste rock windrows;
2. The delineation of an exclusion zone between the proposed mine waste rock windrow and toe of the existing Fingals TSF embankment, is anticipated to minimize the Population at Risk (PAR) to < 1; and
3. Mine personnel operating earthwork machinery on Fingals TSF undergo appropriate training in compliance with requirements set out in Section 4 of this report.

An ANCOLD Severity Level of "Minor" is deemed to be appropriate on the above basis, and combined with an anticipated PAR < 1, TailCon has adopt a Dam Failure and Environmental Spill Consequence Category of "Very Low" for the proposed tailings dry-stacking works on Fingals TSF.

Table 3-3 ANCOLD Severity Level Impacts assessment

Damage type	Minor	Medium	Major	Catastrophic
Infrastructure (dam, houses, commerce,	< $10M	$10M-$100M	$100M-$1B	>$1B

Damage type	Minor	Medium	Major	Catastrophic
farms, community)				
Business importance	Some restrictions	Significant impacts	Severe to crippling	Business dissolution, bankruptcy
Public health	< 100 people affected	100-1000 people affected	<1000 people affected for more than one month	> 10,000 people affected for over one year
Social dislocation	< 100 person or < 20 business months	100-1000 person months or 20-200 business months	> 1000 person months or > 200 business months	> 10,000 person months or numerous business failures
Impact Area	< 1 km2	< 5km^2	< 20km^2	> 20km^2
Impact Duration	< 1 (wet) year	< 5 years	< 20 years	> 20 years
Impact on natural environment	Damage limited to items of low conservation value (e.g., degraded or cleared land, ephemeral streams, non-endangered flora, and fauna). Remediation possible.	Significant effects on rural land and local flora & fauna. Limited effects on: Item(s) of local & state natural heritage. Native flora and fauna within forestry, aquatic and conservation reserves, or recognised habitat corridors, wetlands, or fish breeding areas.	Extensive rural effects. Significant effects on river system and areas A & B. Limited effects on: Item(s) of National or World natural heritage. Native flora and fauna within national parks, recognised wilderness areas, RAMSAR wetlands and nationally protected aquatic reserves. Remediation difficult.	Extensively affects areas A & B. Significantly affects areas C & D. Remediation involves significantly altered ecosystems.

Table 3-4 ANCOLD recommended consequence category

Population at Risk (PAR)	Severity of Damage and Loss			
	Minor	**Medium**	**Major**	**Catastrophic**
< 1	Very Low	Low	Significant	High C
≥ 1 to < 10	Significant	Significant	High C	High B
≥ 10 to 100	High C	High C	High B	High A
≥ 100 to 1000	-	High B	High A	Extreme
≥ 1000	-	-	Extreme	Extreme

3.3 Geotechnical Stability

Geotechnical slope stability assessment has been undertaken, based on a deterministic Factor of Safety (FoS_{slope}) approach, to evaluate compliance of the proposed tailings dry-stacking works detailed in Section 3.1 against FoS_{slope} requirements stipulated in the ANCOLD (2019) guideline. The assessment has been undertaken considering the following soil stress state:

- Static operating condition in which minimum required FoS_{slope} ≥ 1.5.
- Seismic earthquake condition in which minimum required FoSslope ≥ 1.0 to 1.2.
- Assessment considers the maximum dry-stacked tailings geometry illustrated in Figure 3-2 above.
- Dry-stacked tailings are conditioned, as per requirements set out in Section 2.2, such that it is sufficiently desaturated during placement on Fingals TSF to geotechnically shear in a drained liquefaction-resistant manner.
- The entire Fingals TSF, including proposed dry-stacked tailings, remain sufficiently dry such that a phreatic surface does not form on the above basis.
- A pseudo-static evaluation approach has been undertaken, on the above basis where the dry-stacked tailings and underlying Fingals TSF will still geotechnically shear in a drained liquefaction-resistant manner, to evaluate the final dry-stacked tailings geometry under seismic soil stress conditions. This approach defines the seismic condition as a horizontal acceleration coefficient k_h, which TailCon has conservatively equated with PGA = 0.090g as per Section 2.4 of this report.
- Earthwork machinery working on the dry-stacked tailings surface is modelled as an equivalent uniformly-distributed load (UDL) of 20 kPa, spread over a 3.5m width to simulate articulated dumper trucks as per Section 4, and does not encroach closer than 5 m from the rock armour platform crest edge.

The adopted drained geotechnical soil shear strength parameters for the assessment, based on interpretive findings presented in Section 2.1 and 2.2 of this report, is summarized in

Table 3-5 Input geotechnical soil shear strength parameters

Fingals TSF soil body	Bulk unit weight, γ_b (kN/m^3)	Mohr-Coulomb parameters	
		ϕ' (°)	c' (kPa)
In-situ tailings	17	26	20
New dry-stacked tailings	17	26	10
Mine waste clays (existing embankment fill, tailings capping layer)	18.5	30	10
Mine waste rocks (windrow, dry-stacked tailings capping)	19	40	10
Natural foundation soils	19	30	10

FoS_{slope} is estimated based on the Limit Equilibrium Morgenstern-Price method of slices, utilising the commercial analysis software Geostudio SLOPE/W 2012.

The assessment indicates that the proposed final dry-stacked tailings profile on top of Fingals TSF is anticipated to possess sufficient geotechnical stability in compliance with ANCOLD FoS_{slope} requirements. SLOPEW output illustrating the critical geotechnical failure mode, including predicted ANCOLD-compliant FoS_{slope}, is presented in Figure 3-3 and Figure 3-4 below.

Figure 3-3: SLOPEW output – Final dry-stacked tailings profile overlying Fingals TSF and under static soil stress conditions

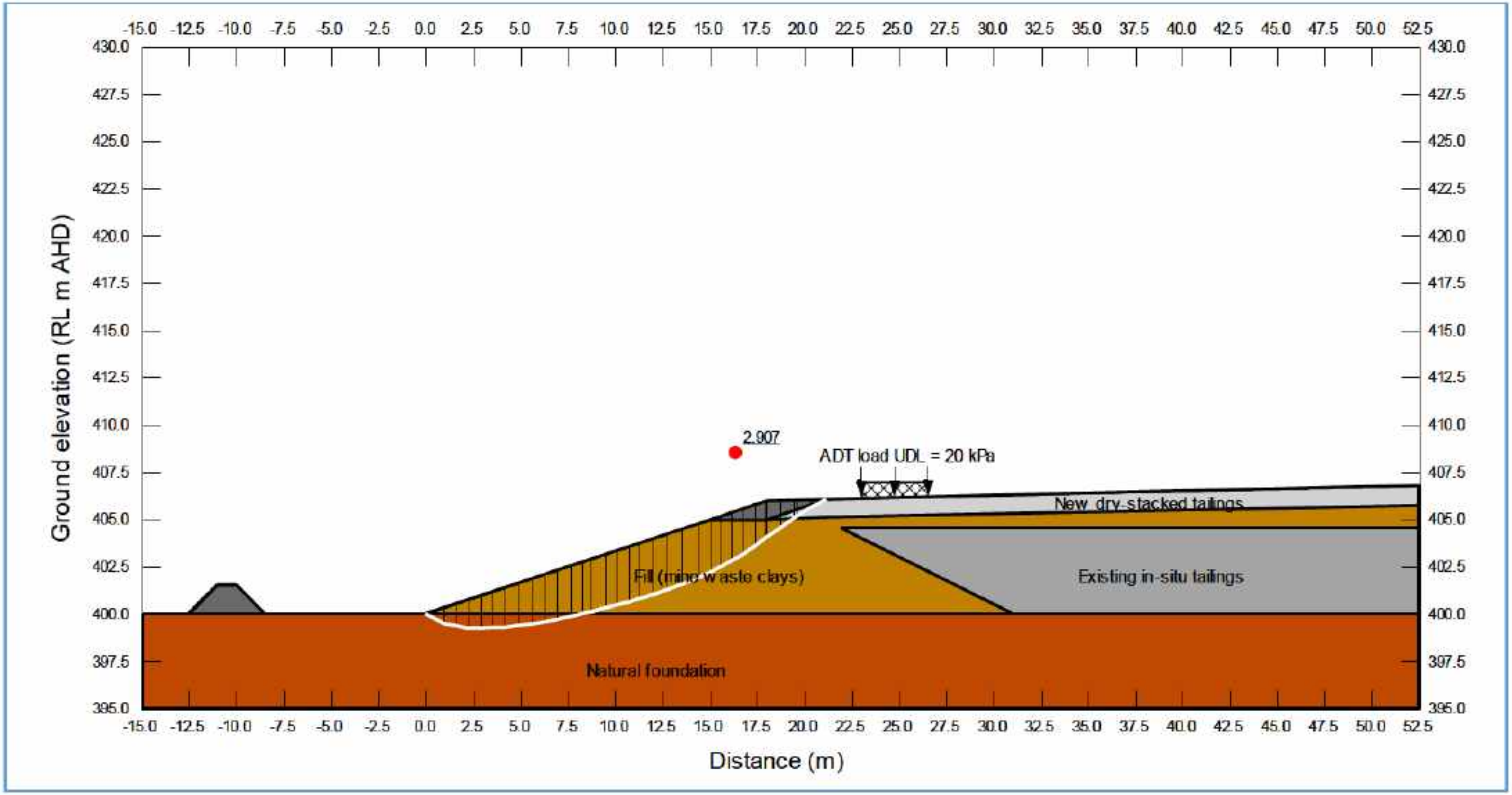
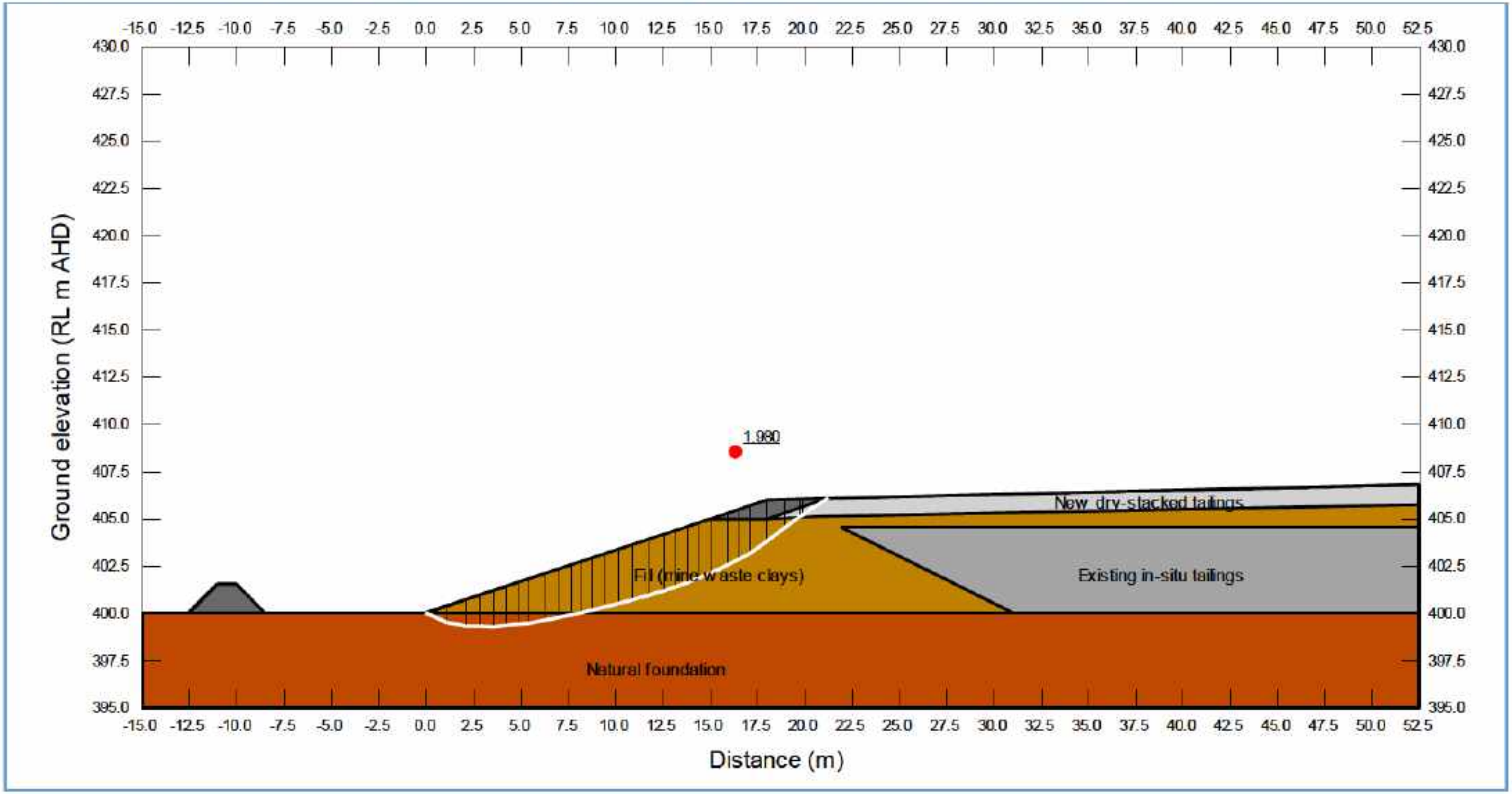


Figure 3-4: SLOPEW output – Final dry-stacked tailings profile overlying Fingals TSF and under seismic soil stress conditions



4 EARTHWORK MACHINERY TRAFFICABILITY

The trafficability of different types of earthwork machinery over dry-stacked tailings placed over Fingals TSF has been evaluated on the basis of the maximum allowable tyre / track ground-bearing pressure $q_{b,all}$ that the tailings can geotechnically support. The $q_{b,all}$ estimation has been undertaken based on the following assumptions, utilising GSI data and interpretive findings contained in referenced Geoanalytica document:

- $q_{b,all}$ = ultimate ground-bearing capacity q_{ult} divided by a bearing Factor of Safety $FoS_{bearing}$ = 2.0.
- q_{ult} = Analytical equation based on classical Terzaghi's Bearing Capacity Theory, utilizing Mohr-Coulomb parameters for dry-stacked tailings as per Table 3-5.

The estimated $q_{b,all}$ for tyre / tracks traversing across the proposed dry-stacked tailings surface is 200 kPa, as such the type of recommended earthwork machinery that can traverse across the surface is limited to the following:

- Large dozers (i.e. CAT D9 to CAT D11 or equivalent).
- Articulated dumper trucks (ADTs) limited to a payload capacity not exceeding 40T (i.e. Doosan Moxy DA40 or equivalent). Larger ADTs (i.e. CAT 777) might be considered, however, the use of the larger equipment will be subject to inspecting and approving the performance on the existing tailings surface, by TailCon.

The following operational constraints must however be complied with when operating the above earthworks machinery on the dry-stacked tailings surface:

- Where practicable ADTs shall not encroach any closer than 5 m from the crest edge of the dry-stacked tailings surface.
- Dozers are allowed to encroach up to the crest edge of the dry-stacked tailings surface, however shall only do so in the movement direction perpendicular to the crest edge alignment.

5 CONSTRUCTION CONSIDERATIONS

5.1 General

Where practicable, the proposed mining operation should be executed in the warmer weather where the high temperatures will assist in drying the exposed tailings surface during the cutback operations and placement of the excavated tailings.

Care needs to be exercised such that were the surface the tailings is to be accessed by vehicles; the access is spread across a wide area to avoid pumping residual moisture to the surface of the tailings. Accessing the tailings via a single route where multiple vehicles pass over one area must be avoided.

Care should be taken to ensure that vehicle access observe and stay outside the designated traffic limits close to the crest of tailings batter slope.

5.2 Execution Plan

This report sets out the geotechnical assessment for the proposed tailings dry stacking works to be undertaken on Fingals TSF. It is assumed that detailed mining procedures and operations for remining of in-pit tailings within Baguss, and Baguss pit for the proposed tailings dry-stacking works, which are not part of the scope of our work, will be developed by Black Cat for execution of the proposed in-pit tailings remining works.

This report will need to be supplemented with an execution plan prepared as a guide to mining staff in the execution, operation, and management of the proposed Baguss, and Baguss pit expansion. The execution plan must provide full details of (a) all works to be undertaken as part of the operation and (b) geotechnical testing requirements as outlined in this report.

The plan must be circulated to all personnel involved with the project development and execution, and provide the following:

1. A step-by-step description of each facet of the work, what are the potential risks and the management controls for each risk.
2. The limitations for the operation of the earthworks equipment imposed by geotechnical tailings ground-bearing capacity assessment findings detailed in this report must be clearly understood by all those involved in the execution of the work.
3. Geotechnical shear vane testing data must be made available prior to commencement of each shift such that any developments from the previous shift are noted and work stopped if adverse conditions, which is anything outside the expected 'normal range,' are noted/recorded. Where adverse conditions detrimental to the work are noted work in the areas impacted must be suspended, or modified plans developed which will allow safe execution of activities to proceed where conditions allow.

TailCon shall not be liable in any respect whatsoever for any damage or failure in the mining operations resulting from failure of the Owner, its servants or agents, to develop and comply with the provisions of the Execution Plan, yet to be developed, for proposed mining work to be undertaken within Fingals Fortune, Baguss, and Baguss pit.

6 DRY-STACKED TAILINGS PERFORMANCE EVALUATION

To evaluate the feasibility of dry-stacking tailings onto Fingals TSF up to the maximum required height of 9.5 m above the 5m high existing TSF (final height of 14.5 m), as stipulated in Section 3.1 to stockpile all tailings currently impounded within the surrounding Fingals Fortune, Baguss, and Futi Baguss open mine pits, performance evaluation of the proposed 1 m tailings dry-stacking (as per Figure 3-2) is required to be undertaken with respect to the following:

- The geotechnical shear dilatancy response of the placed tailings material (is it liquefaction-susceptible contractive or liquefaction-resistant dilative); and
- Tailings degree of saturation at depth, accounting for both rainfall and evaporative conditions, and whether it can remain sufficiently desaturated to always act geotechnically in a liquefaction-resistant drained manner.

The following works shall be undertaken, on the proposed 1 m dry-stacked tailings surface, for the performance evaluation:

1. Push in two (2) U75 Shelby tube samplers into the tailings at one spot, with the 1st sampler to extract samples from the top 0.5 m of tailings extending below the surface, and the 2nd sampler to extract samples from tailings located 0.5 m to 1.0m below the tailings surface. This exercise shall be repeated at a minimum of six (6) locations randomly selected over the tailings surface.
2. Nuclear densitometer measurements shall be undertaken in conjunction (and adjacent) to the above sampling exercise, the measurements to be undertaken at the 0.2 m and 0.7 m depth below the tailings surface.
3. All the filled tube samplers shall be sent to a NATA-accredited geotechnical soil testing laboratory in Kalgoorlie (and E-Precision in Perth) for the following evaluation:

4. Kalgoorlie: Particle size distribution grading with hydrometer measurement, Atterberg Limits testing, and moisture content measurement at 0.25 m sample depth interval.
5. E-Precision: CSL line testing on at least four (4) of the tube samplers.
6. Items 1 and 2 above shall preferably be executed within 3 weeks from completion of tailings dry-stacking exercise, and another time through the winter season (June ideally), to evaluate the seasonal tailings moisture content variation.
7. Laboratory and fieldwork test data from the above exercise shall be provided to TailCon for evaluation.

APPENDIX A Referenced CMW Geoscience Document

4 April 2022

FINGALS TAILINGS STORAGE FACILITY
MOUNT MONGER, WA

GEOTECHNICAL INVESTIGATION AND ASSESSMENT REPORT

Black Cat (Bulong) Pty Ltd

PER2021-0406AB Rev 0

PER2021-0406AB		
Date	Revision	Comments
28 March 2022	A	Issued for Client's Review
4 April 2022	0	Final Report

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Figures

Appendices

1 INTRODUCTION

CMW Geosciences Pty Ltd (CMW) was authorised by Black Cat (Bulong) Pty Ltd (BC8) to carry out a geotechnical investigation of two former Tailings Storage Facility's located at Fingals Gold Mine, Mount Monger, WA. The work was commissioned by way of purchase order (PO #20500155 dated 27 January 2022). The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced PER2021-0406AA Rev 1 dated 27 January 2022.

From our understanding Black Cat wishes to relocate the tailings from two former In-pit Tailings Storage Facilities to an existing paddock TSF and cap the constructed landform with waste material. From Google Earth imagery, the tailings area on the paddock TSF is approximately 10 ha and the facility is nominally 5 m high. Pit cut-backs will be performed on the former in-pit TSFs (Bagus, Futi-Bagus, Fingals) with the waste from the cut-backs placed on top of an existing waste dump.

The purpose of this report is to describe the investigation carried out, the ground conditions encountered and to provide a geotechnical assessment of the proposed landform covered with waste, the concept design for tailings placement, capping of existing TSF, condition of existing TSF and stability analysis results.

2 SITE DESCRIPTION

The Fingals Mining Centre is located 40 km east of Kalgoorlie, and 8 km south west of the Majestic Mining area, at the southern end of the Kurnalpi Terrane, on the western limb of the regional Bulong Anticline. The main deposits within the area include Fingals Fortune and Fingals East and these lie at similar stratigraphic positions on either limb of the Mt Monger anticline. The host geology is basalt with mineralisation being controlled by NW structures and sericite altered felsic intrusions.

A site layout plan is displayed on Figure 1 below:

Figure 1: Fingals Open Pit Mine with the existing TSF in the northeast.

3 FIELD INVESTIGATION

3.1 General

The field investigation was carried out between 10th and 11th of February 2022. The fieldwork was carried out under the direction of CMW Geosciences Pty Ltd in general accordance with AS1726 (2017), Geotechnical Site Investigations. The scope of fieldwork completed was as follows:

- Undertake a walkover inspection of the site to assess the general landform and site conditions of the two former open pit mines, existing TSF and proposed waste material;
- Five test pits, denoted TP01 to TP05, were excavated in the location of the existing TSF using an 8 tonne CAT 308 excavator to depths of up to 4.0 m to assess the subsurface conditions. Representative bulk samples from excavated spoil were taken for subsequent laboratory testing. Engineering logs and photographs of the test pits are presented in Appendix B; and,
- An additional two test pits from within the "Waste Dump" were excavated to depths of up to 2.0 m to collect samples of 'Mine Waste' for further laboratory testing.

The approximate locations of the respective investigation sites referred to above are shown on the attached Site Plan (Figure No. 2). Test locations were measured using handheld GPS to an accuracy of ±5 m.

3.2 Fingals TSF Site Inspection

During the geotechnical investigation an inspection of the Fingals TSF was conducted. Observations included the TSF surface which was presumed to be in relatively good condition. There was no evidence of slumping or degradation of the TSF landform. There were sumps that had been excavated as part of a drilling program in the TSF area with some access tracks around the perimeter and in the centre of the TSF where a sump was located. A scattering of localised grasses and small trees were also identified.

The batters were also inspected. The northern batter had gravels and cobbles interbedded on the face of the batter, likely as an erosion protection measure. There were also localised grasses growing within the faces. No evidence of any major erosion was observed. The eastern, southern, and western batters had evidence of water flow with meandering erosion gullies running down the face of batters leading into a larger channel at the base that likely diverted water away from TSF. A grouping of localised grasses could be seen occupying this larger channel along the eastern batter (Photo 5). It is recommended that the erosion gullies are repaired by backfilling with competent waste rock to create 'drop structures' for drainage of the landform.

Site photographs of this inspection are presented in Appendix A.

3.3 Test Pits

Test pits were excavated using an 8 tonne CAT 308 excavator. Test pits were located at positions to provide a general coverage of the existing Tailings Storage Facility and to assess the mine waste material from the waste dump adjacent the open pit mine.

The purpose of the test pits was to provide a geotechnical assessment of the ground conditions underlying the existing paddock TSF and to identify possible capping material from the waste dump.

The test pits were also used to obtain bulk disturbed samples collected for laboratory testing. The test pits were backfilled with material excavated from the pits and compacted with the excavator bucket and tracks. Test pit logs and photographs are included in Appendix B.

4 LABORATORY TESTING

Laboratory testing were generally carried out in accordance with the requirements of the current edition of AS 1289 (where applicable). Where a test was not covered by an Australian standard, a local or international standard was adopted and noted on the laboratory test certificate.

All testing was scheduled by CMW and carried out by or under the direction of Western Geotechnical and Laboratory Services, a NATA registered Testing Authority.

The extent of testing carried out to provide the geotechnical parameters required for this study are presented in Appendix C and summarised in Table 1.

Table 1: Laboratory Test Schedule Summary

Type of Test	Test Method	Quantity
Particle Size Distribution	AS1289.3.6.1	4
Atterberg limits	AS1289.3.1.1, 3.2.1, 3.3.1	4
Standard Compaction	AS1289.5.1.1	4
Triaxial Compression Test (CU)	AS 1289.6.4.2	1

5 TSF FOUNDATION GROUND MODEL

Published geological maps (Ref. Kurnalpi, Sheet SH 51-10: Geological Survey of Western Australia) depict the land as being underlain by a combination of colluvium gravels, sand, and silt as sheetwash or talus as well as laterite and other reworked materials. There is also potential for some basalt deposits including doleritic and feldspar-phyric layers and lenses and mafic schist.

5.1 Subsurface Conditions of TSF

The ground conditions encountered at the TSF can be generalised according to the following subsurface sequence:

MINE WASTE: SANDY CLAY — Dry, medium to high plasticity clay; red brown; sand, fine to medium grained, subangular to subrounded; trace to with gravel, fine to coarse grained, subangular to subrounded; trace roots and rootlets (capping layer); overlying,

TAILINGS: SILT — Less than to greater than plastic limit, low to medium plasticity silt; dark green/ dark brown; with gravel, fine to medium grained, subrounded to subangular; trace sand. With some interbedded dark green silty sand.

The distribution of these units is summarised in Table 2.

Table 2: Summary of Tailings Stratigraphy			
Description	Depth to base of layer (m BGL)		
	Minimum	Maximum	Average
MINE WASTE: SANDY CLAY	0.4	0.5	0.45
TAILINGS: SILT	>4.0		

Test pit logs and photographs along with summary information of each location is provided in Appendix B.

5.2 Mine Waste Material

During the field investigation, CMW assessed the waste dump material which Black Cat plans to use as capping material for the tailings once relocated. Two samples for laboratory testing were collected. A summary of the existing TSF test pits is presented in Table 3 below.

Table 3: Summary of Mine Waste Samples					
Location ID	Sample Depth	Material Description	Easting MGA1994 Zone50	Northing MGA1994 Zone50	Termination Depth (m)
Mine Waste 1	1.0 – 2.0	SANDY SILT	394317	6573121	2.0
Mine Waste 2	0.5 – 1.5	SANDY SILT	394200	6573214	2.0

5.3 Groundwater

Groundwater was not encountered during the investigation.

5.4 Laboratory Test Results

5.4.1 Soil Classification

Results of the soil classification laboratory tests for samples taken from TSF are presented in Appendix C and summarised in Table 4 below.

Table 4: Summary of Laboratory Tests Results

Location ID	TP02 (0.5 – 1.0m)	TP05 (1.5 – 2.0m)	Mine Waste 1 (1.0 – 2.0m)	Mine Waste 2 (0.5 – 1.5m)
Gravel, %	0	16	17	27
Sand, %	7	4	27	23
Fines, %	93	80	56	50
LL, %	30	37	51	52
PL, %	25	26	33	34
PI, %	5	11	18	18
LS, %	2.0	3.0	6.0	5.0
OMC, %	26.0	21.5	18.5	16.5
SMDD, t/m^3	1.58	1.68	1.66	1.75

Note: Gravel, Sand and Fines percentages are by weight, LL = Liquid Limit, PL = Plasticity Limit, PI = Plasticity Index, LS = Linear Shrinkage, OMC = Optimum Moisture Content, OMC = optimum moisture content, SMDD = Standard Maximum Dry Density.

The results of the testpit sampling (TP02 and TP05) indicate the tailings are a low to medium plasticity silt (ML). The sampling indicates the mine waste is a high plasticity sandy silt (MH). The sampled mine waste material will likely be susceptible to erosion if placed on external TSF batters. Erosion resistant materials will need to be located to cap the new TSF landform batters. The sampled mine waste material may be placed on the top surface of the new TSF as part of rehabilitation.

Reference to the GeoAnalytica (2021) report indicates that tailings sampled from the in-pit TSFs had similar properties to the tailings sampled by CMW. The maximum dry densities reported by GeoAnalytica were 1.51 t/m^{3}and 1.55 t/m^3, for coarse (sandy) tailings samples (21%-25% passing 75 micron).

5.4.2 Triaxial Test

Results from the single stage Consolidated Undrained (CU) Triaxial test from the sample taken from TP02 at the TSF are presented in Appendix C and summarised in Table 5 below. These results were utilised in the stability analyses.

The angle of internal friction of 30^o obtained from the CMW testing was between the interpreted angle of internal frictions report in the GeoAnalytica (2021) report of 26^o (fine tailings – 99% fines) and 40^o (coarse tailings - 21%-25% fines).

Table 5: Summary of Soil Triaxial Laboratory Test Result														
Location ID	**Depth Range (m)**	**Height (mm)**	**Diameter (mm)**	**L/D Ratio**	**Initial Moisture (mm)**	**Final Moisture (mm)**	**Bulk Density (t/m^3)**	**Dry Density (t/m^3)**	**Stage 1 & 2**		**Stage 1 & 3**		**Stage 2 &3**	
									C' (kPa)	**Φ (degrees)**	**C' (kPa)**	**Φ (degrees)**	**C' (kPa)**	**Φ (degrees)**
TP02	0.5 to 1.0	125.87	61.80	2.04	26.72	30.65	1.91	1.50	30.16	29.68	36.66	26.57	49.03	24.70

6 CONCEPT DESIGN

6.1 Design Criteria

BC8 estimates the following tailings material volumes for relocation onto the existing TSF landform: Bagus- 301,700 m^3; Futi-Bagus - 356,200 m^3; Fingals - 115,200 m^3. The overall density is estimated at around 1.6 to 1.65 t/m^3.

Based on the above, an estimated 750,000 m^3 will be disposed on top of the TSF or 7.5 m x 100,000 m^2.

Non-acid forming fresh basalt rock will be used in the covering of the final TSF landform. It is understood that the Stage 3 pit development will produce a total of 1,294,600 bcm or 3,624,880 tonnes of mine waste material.

6.2 Discussion and Recommendation

The tailings from the in-pit tailings storages will be relocated from the pit and placed on top of the existing above ground paddock TSF. The existing TSF will be raised by approximately 7.5 m by stacking the tailings on top of the existing TSF. The new TSF landform will have a downstream slope of 1(V):3(H) and be capped with 1.0 m thick rockfill mine waste layer on the top surface and downstream slopes. The total height of the finished facility will be between 10 m and 15 m high. Figure 2 attached at the back of this report shows the proposed construction details and design geometry of the new TSF landform.

The following works are recommended as part of construction of the new TSF landform:

- As part of preparation works, the surface of the TSF will be stripped of any deleterious material and proof rolled as directed by a Geotechnical Engineer.
- The ‘tailings stack’ is then constructed by paddock dumping tailings on the surface of the TSF.
- The tailings material is then spread and placed in 0.5 m layers with a dozer and traffic compacted with the servicing mine fleet. Water is added as necessary for compaction and dust suppression. A water cart should be available to conduct dust suppression.
- Initial standard compaction and in situ moisture content of the tailings should be established early on the project using compaction trials to confirm that the targeted dry density is reached. The stacked tailings should be tested for insitu density early in the landform construction to ascertain whether the tailings have received sufficient compaction using the work methods proposed. The target dry density is a minimum of 1.6 t/m^3 (dry) (i.e. approximately 95% of SMDD). At this stage use of vibratory rollers is not proposed.
- A 1.0 m thick mine rockfill mine waste is progressively used as a batter capping layer to create a robust and structure that is not susceptible to erosion. A minimum thickness of 0.5 m of mine waste should be placed on the top of the TSF landform. Approximately 100,000 m^3 of mine waste capping will be required.
- Timing of the works should be scheduled in order to meet the tailings storage volume requirements and integrated with the ongoing mine planning to ensure that adequate volumes of mine waste material for use in rehabilitation.
- The intent is that the placed tailings be capped progressively. Potentially the tailings could be exposed in the medium term (to several months). However it should not be exposed during wetter parts of the year (i.e. when high intensity rainfall occurs) in order to prevent erosion due to rainfall runoff.

7 STABILITY ANALYSIS

7.1 Method of Analysis

Stability analyses were undertaken to assess the stability of the new TSF landform with a nominal height of 12.5 m (5 m of existing embankment and 7.5 m of stacked mine waste). The analyses were undertaken in general accordance with ANCOLD (2019).

The computer software package 'Slide' was utilised to undertake the analyses. Slide is a two-dimensional slope stability program for evaluating the safety factor of circular and non-circular failure surfaces in soil and rock slopes. The stability of the slip surfaces for static and post-seismic cases were assessed using vertical slice limit equilibrium methods. The simplified Bishop method and GLE/Morgenstern-Price method was used in the analyses of the non-circular failures.

The following cases were examined in the stability analyses:

Case 1: Static Analysis - Downstream failure of the TSF with a 12.5 m embankment height under drained condition based on limit equilibrium method.

Case 2: Static Analysis – As for Case 1, but with undrained condition.

Case 3: Static Analysis – As for Case 1, but with post-seismic condition, with 20% reduction in strength parameters for the tailings and existing embankment.

The phreatic surface adopted in all cases were conservative, with the assumption that there is a phreatic surface that draws down to the upstream toe of the existing embankment.

It should be noted that the existing TSF embankments and foundations are considered to be resistant to liquefaction due to mechanical compaction of the former and sufficient foundation preparation of the latter. However, the newly placed tailings may be susceptible to liquefaction if not sufficiently compacted.

7.2 Parameters

The stability analyses of the embankment were carried out using the effective stress condition (c, φ) with a conservatively estimated piezometric line. The undrained parameters were estimated based on testpit observations. Table 3 provides a summary of the strength parameters used in the stability analyses.

Table 6: Summary of Strength Parameters				
Material Type	**Bulk Density (kN/m³)**	**Drained Parameter**		**Undrained Parameters**
		Cohesion c/ (kPa)	**Friction Angle φ/ (degrees)**	**Cohesion Su/ (kPa)**
Compacted Tailings	16	0	36	75
Mine Waste (Rockfill)	20	10	40	-
Deposited Tailings	15	0	30	0.2 σ'v
Existing Embankment	19	5	35	-
Foundation (Sandy Clay)	18	5	32	-
Foundation (Silt)	19	10	28	-

7.3 Results of the Stability Analyses

The results of the stability analyses for the various cases were examined with a conservative phreatic line and a summary is provided in Table 7 below. The computer printouts are presented in Appendix D.

Table 7: Results of Stability Analyses		
Case	**Factor of Safety**	**Recommended Minimum Factors of Safety***
1: Drained	2.11	1.5
2: Undrained	2.20	1.5
3: post-seismic	1.92	1.0-1.2

*Note: Recommended factors of safety in accordance with ANCOLD (2019).

The stability analyses indicate adequate factors of safety were achieved for the drained and post-seismic conditions when compared with the recommended minimum factors of safety in ANCOLD (2019).

The concept design for the TSF is robust with factors of safety against embankment failure likely to be greater than the minimum requirements (i.e. FoS around 1.5 or above for normal operating conditions).

8 CLOSURE

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

This report has been prepared for use by Black Cat (Bulong) Pty Ltd in relation to the Fingals TSF project in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than Black Cat (Bulong) Pty Ltd and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

For and on behalf of
CMW Geosciences Pty Ltd

[redacted]

Distribution: 1 copy to Black Cat (Bulong) Pty Ltd (electronic)
Original held by CMW Geosciences Pty Ltd

References:

GeoAnalytica (2021) report, *'Futi Bagus In-pit Tailings Storage Facility Geotechnical Cutback Design Assessment'*, prepared for Black Cat Syndicate Limited

ANCOLD (2019) '*Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure'*.

Figures

LEGEND:

- TP01 TEST PIT LOCATION
- MW01 MINE WASTE SAMPLE LOCATION

NOTES:

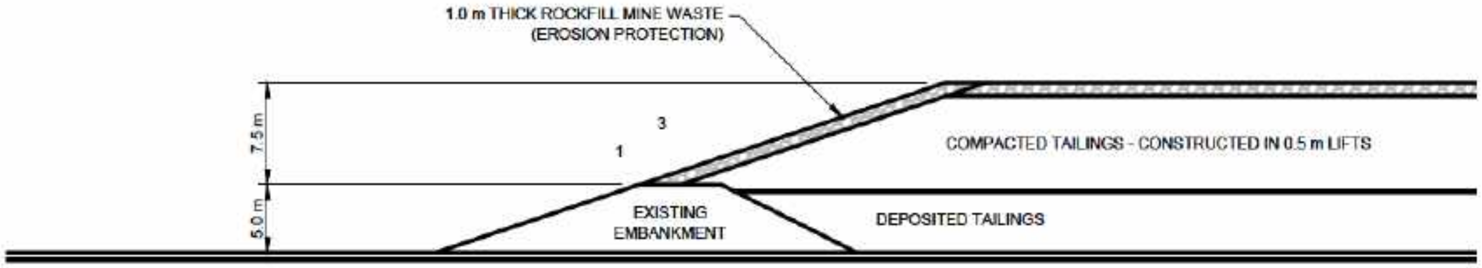
1. AERIAL FROM BING MAPS.

0 75 150 225 300 375 m

1:7500

CMW Geosciences

CLIENT: BLACK CAT SYNDICATE LTD	DRAWN: DE	PROJECT: PER2021-0406
PROJECT: FINGALS TSF ASSESSMENT MOUNT MONGER, WA	CHECKED: MO	FIGURE: 02
	REVISION: A	SCALE: 1:7500
TITLE: SITE INVESTIGATION PLAN	DATE: 15.02.22	SHEET: A3 L



CMW Geosciences	CLIENT: **BLACK CAT SYNDICATE LTD**	DRAWN: DE	PROJECT: PER2021-0406
	PROJECT: **FINGALS TSF ASSESSMENT MOUNT MONGER, WA**	CHECKED: SW	FIGURE: 03
		REVISION: A	SCALE: NTS
	TITLE: **SECTION - DESIGN CONCEPT**	DATE: 25.03.22	SHEET: A3 L

Appendix A
Site Photographs

Figure 3: Fingals TSF surface.

Figure 4: Fingals TSF looking North.

Figure 5: Fingals TSF looking East.

Appendix B
Test Pit Logs

TEST PIT LOG - TP01

Client: Black Cat Syndicate Ltd
Project: Fingals TSF Assessment
Location: Mount Monger, WA
Project: PER2021-0406
Date: 10/02/2022

CMW Geosciences

1:30 Sheet 1 of 1

Logged by: Mitchell Owen | Position: E.395183m N.6573654m | Plant: 8t CAT 308 excavator
Checked by:Chris Hogg | Elevation: | Contractor: Saltbush Contracting | Dimensions : 0.60m x 5.00m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
				0.00–0.50		MINE WASTE: SANDY CLAY: medium to high plasticity; red brown; sand, fine to medium grained, subangular to subrounded; trace gravel; trace roots and rootlets.	D		
				0.50–3.00		FILL: SILT : low to medium plasticity; dark green; trace sand. With interbedded bands of dark brown silty sand.	<PL		
				3.00		Test pit terminated at 3.00 m			

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP02

Client: Black Cat Syndicate Ltd
Project: Fingals TSF Assessment
Location: Mount Monger, WA
Project: PER2021-0406
Date: 10/02/2022

CMW Geosciences

1:30 Sheet 1 of 1

Logged by: Mitchell Owen	Position: E.395262m N.6573860m	Plant: 8t CAT 308 excavator	
Checked by:Chris Hogg	Elevation:	Contractor: Saltbush Contracting	Dimensions : 0.60m x 5.00m

Groundwater	Samples & Insitu Tests Depth	Samples & Insitu Tests Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
						MINE WASTE: SANDY CLAY: medium to high plasticity; red brown; sand, fine to medium grained, subangular to subrounded; with gravel, fine to coarse grained, subangular to subrounded; trace roots and rootlets.	D		
	0.5 - 1.0	B				FILL: SILT: low to medium plasticity; dark green; trace sand. With interbedded bands of dark brown silty sand.	<PL		
				1		*... from 1.00m to 1.30m, with interbedded pale grey*			
				2		*... at 2.00m, becoming dark brown with dark green*			
				3		Test pit terminated at 3.00 m			
				4					

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP03

Client: Black Cat Syndicate Ltd
Project: Fingals TSF Assessment
Location: Mount Monger, WA
Project: PER2021-0406
Date: 10/02/2022

CMW Geosciences

1:30 Sheet 1 of 1

Logged by: Mitchell Owen	Position: E.394980m N.6573996m	Plant: 8t CAT 308 excavator	
Checked by:Chris Hogg	Elevation:	Contractor: Saltbush Contracting	Dimensions : 0.60m x 5.00m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
	0.0 - 0.4	B				MINE WASTE: SANDY CLAY: medium to high plasticity; red brown; sand, fine to medium grained, subangular to subrounded; with gravel, fine to coarse grained, subangular to subrounded; trace roots and rootlets.	D		
				1, 2		FILL: SILT: low to medium plasticity; dark green; trace sand. With interbedded bands of dark brown silty sand.	<PL		
				3, 4		Test pit terminated at 3.00 m			

Termination Reason: Target depth reached
Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP04

Client: Black Cat Syndicate Ltd
Project: Fingals TSF Assessment
Location: Mount Monger, WA
Project: PER2021-0406
Date: 10/02/2022

CMW Geosciences

1:30

Sheet 1 of 1

Logged by: Mitchell Owen	Position: E.394979m N.6573802m	Plant: 8t CAT 308 excavator	
Checked by:Chris Hogg	Elevation:	Contractor: Saltbush Contracting	Dimensions : 0.60m x 5.00m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
						MINE WASTE: SANDY CLAY: medium to high plasticity; red brown; sand, fine to medium grained, subangular to subrounded; trace gravel; trace roots and rootlets.	D		
				1 2 3		FILL: SILT: low to medium plasticity; dark brown; trace sand. With interbedded bands of dark brown silty sand.	≈PL		
				4		Test pit terminated at 3.50 m			

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP05

Client: Black Cat Syndicate Ltd
Project: Fingals TSF Assessment
Location: Mount Monger, WA
Project: PER2021-0406
Date: 10/02/2022

CMW Geosciences

1:30 Sheet 1 of 1

Logged by: Mitchell Owen	Position: E.395133m N.6573841m	Plant: 8t CAT 308 excavator	
Checked by:Chris Hogg	Elevation:	Contractor: Saltbush Contracting	Dimensions : 0.60m x 5.00m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
				0 – 0.5		MINE WASTE: SANDY CLAY: medium to high plasticity; red brown; sand, fine to medium grained, subangular to subrounded; trace gravel.	D		
	1.5 - 2.0	B		0.5 – 4.0		FILL: SILT: low to medium plasticity; dark brown; with gravel, fine grained, subangular to subrounded; trace gravel. With interbedded bands of dark brown silty sand.	≈PL		
						... at 3.50m, becoming pale yellow brown	>PL		
				4		Test pit terminated at 4.00 m			

Termination Reason: Target depth reached
Remarks: Backfilled.

Appendix C
Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2637_1_PI
Project:	Fingals TSF	*Sample No.*	WG22.2637
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	Mine Waste 2 0.5 - 1.5m	*Date Tested:*	22/02/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**52**
AS 1289.3.2.1	**Plastic Limit (%)**	**34**
AS 1289.3.3.1	**Plasticity Index (%)**	**18**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**5.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Cracked**

Comments:

[redacted]

Date: 23/February/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2634_1_PI
Project:	Fingals TSF	*Sample No.*	WG22.2634
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	TP02 0.5 - 1.0m	*Date Tested:*	22/02/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.2	**Liquid Limit (%)**	**30**
AS 1289.3.2.1	**Plastic Limit (%)**	**25**
AS 1289.3.3.1	**Plasticity Index (%)**	**5**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**2.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen**	**Cracked**

Comments:

[redacted]

Date: 23/February/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1

Client:	CMW Geosciences	*Ticket No.*	S5508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2635_1_PI
Project:	Fingals TSF	*Sample No.*	WG22.2635
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	TP05 1.5 - 2.0m	*Date Tested:*	22/02/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method: Sampled by Client, Tested as Received

History of Sample: Oven Dried <50°C

Method of Preparation: Dry Sieved

AS 1289.3.1.2	Liquid Limit (%)	37
AS 1289.3.2.1	Plastic Limit (%)	26
AS 1289.3.3.1	Plasticity Index (%)	11
AS 1289.3.4.1	Linear Shrinkage (%)	3.0
AS 1289.3.4.1	Length of Mould (mm)	250
AS 1289.3.4.1	Condition of Dry Specimen	Cracked

Comments:

[redacted]

Date: 23/February/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2636_1_PI
Project:	Fingals TSF	*Sample No.*	WG22.2636
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	Mine Waste 1 1.0 - 2.0m	*Date Tested:*	22/02/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{0}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**51**
AS 1289.3.2.1	**Plastic Limit (%)**	**33**
AS 1289.3.3.1	**Plasticity Index (%)**	**18**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**6.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

[redacted]

Date: 23/February/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

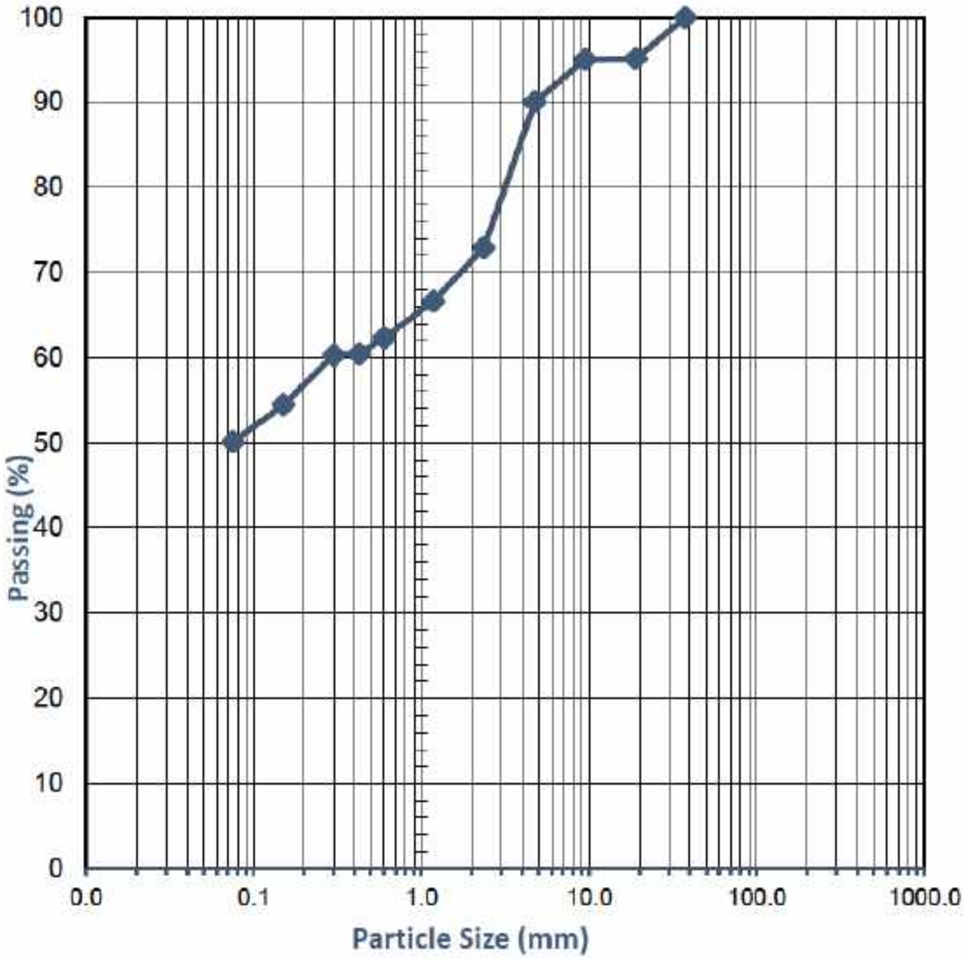
TEST REPORT - AS 1289.3.6.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2637_1_PSD
Project:	Fingals TSF	*Sample No.*	WG22.2637
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	Mine Waste 2 0.5 - 1.5m	*Date Tested:*	17-02-2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	95
9.5	95
4.75	90
2.36	73
1.18	67
0.600	62
0.425	60
0.300	60
0.150	54
0.075	50



Comments:

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Date: 18-February-2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

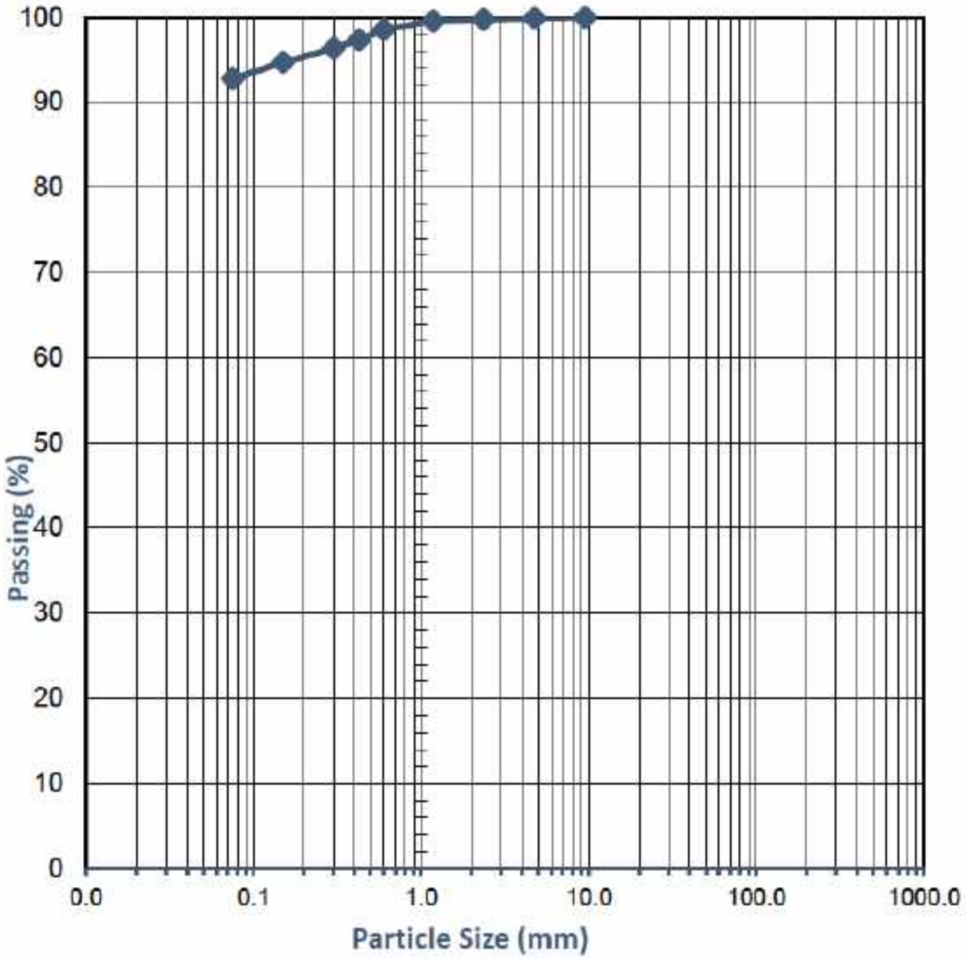
TEST REPORT - AS 1289.3.6.1

Client:	CMW Geosciences	*Ticket No.*	S5508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2634_1_PSD
Project:	Fingals TSF	*Sample No.*	WG22.2634
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	TP02 0.5 - 1.0m	*Date Tested:*	21/02 - 22/02/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	100
1.18	100
0.600	99
0.425	97
0.300	96
0.150	95
0.075	93



Comments:

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

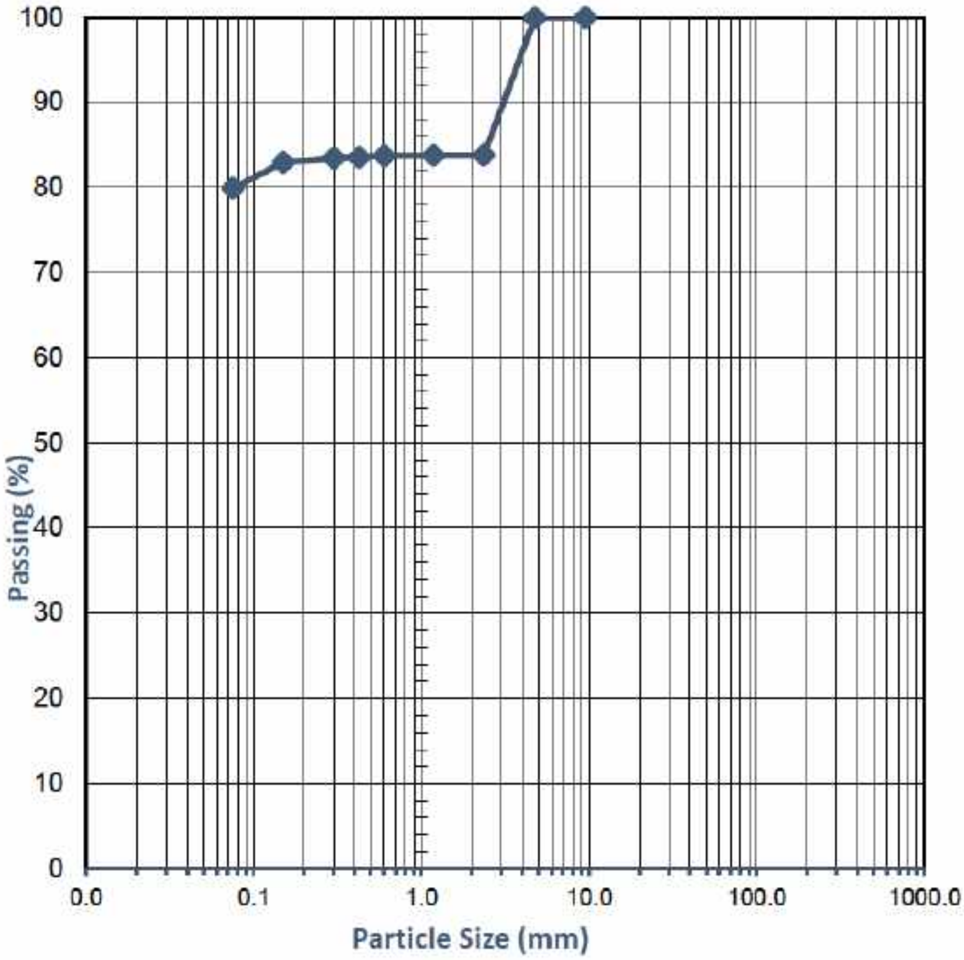
TEST REPORT - AS 1289.3.6.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2635_1_PSD
Project:	Fingals TSF	*Sample No.*	WG22.2635
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	TP05 1.5 - 2.0m	*Date Tested:*	21/02 - 22/02/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	84
1.18	84
0.600	84
0.425	84
0.300	83
0.150	83
0.075	80



Comments:

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SOIL | AGGREGATE | CONCRETE | CRUSHING

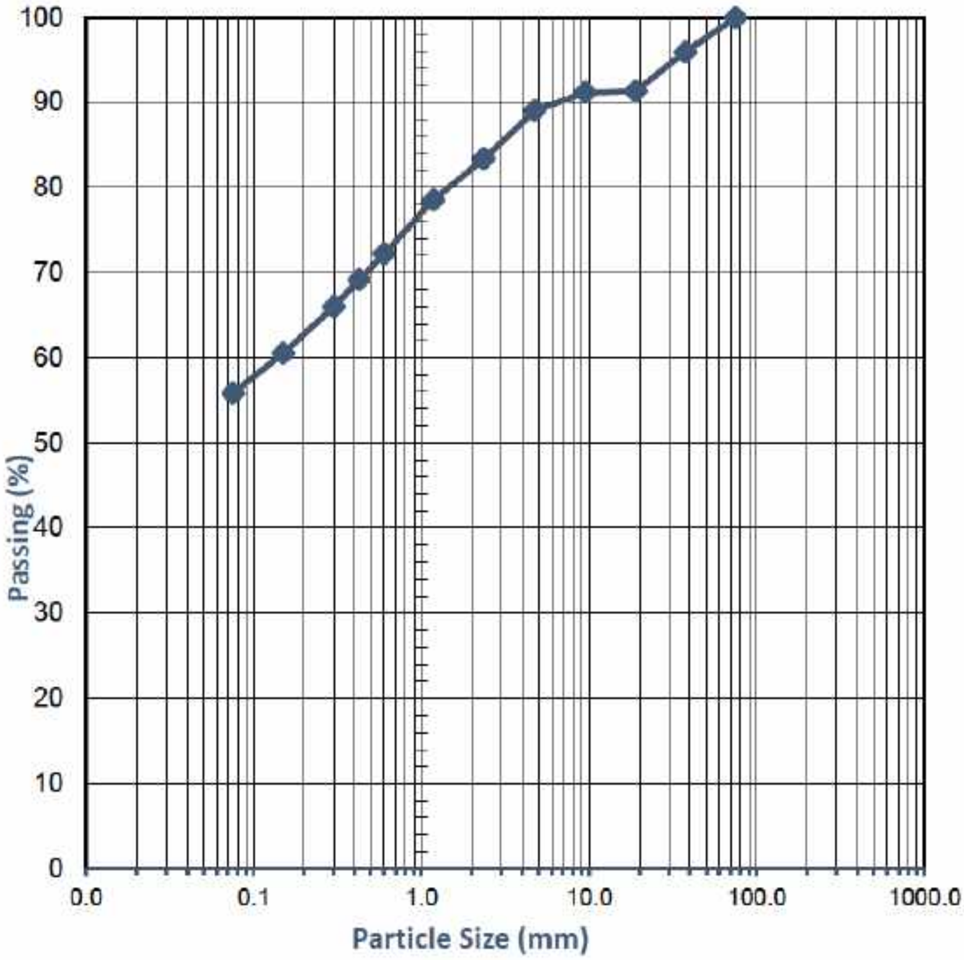
TEST REPORT - AS 1289.3.6.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2636_1_PSD
Project:	Fingals TSF	*Sample No.*	WG22.2636
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	Mine Waste 1 1.0 - 2.0m	*Date Tested:*	21/02 - 22/02/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	100
37.5	96
19.0	91
9.5	91
4.75	89
2.36	83
1.18	79
0.600	72
0.425	69
0.300	66
0.150	61
0.075	56



Comments:

[redacted]

Date: 22/February/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.1.1

Client:	CMW Geosciences	*Ticket No.*	55508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2637_1_SMDD
Project:	Fingals TSF	*Sample No.*	WG22.2637
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	Mine Waste 2 0.5 - 1.5m	*Date Tested:*	17-02-2022

TEST RESULTS - Standard Maximum Dry Density

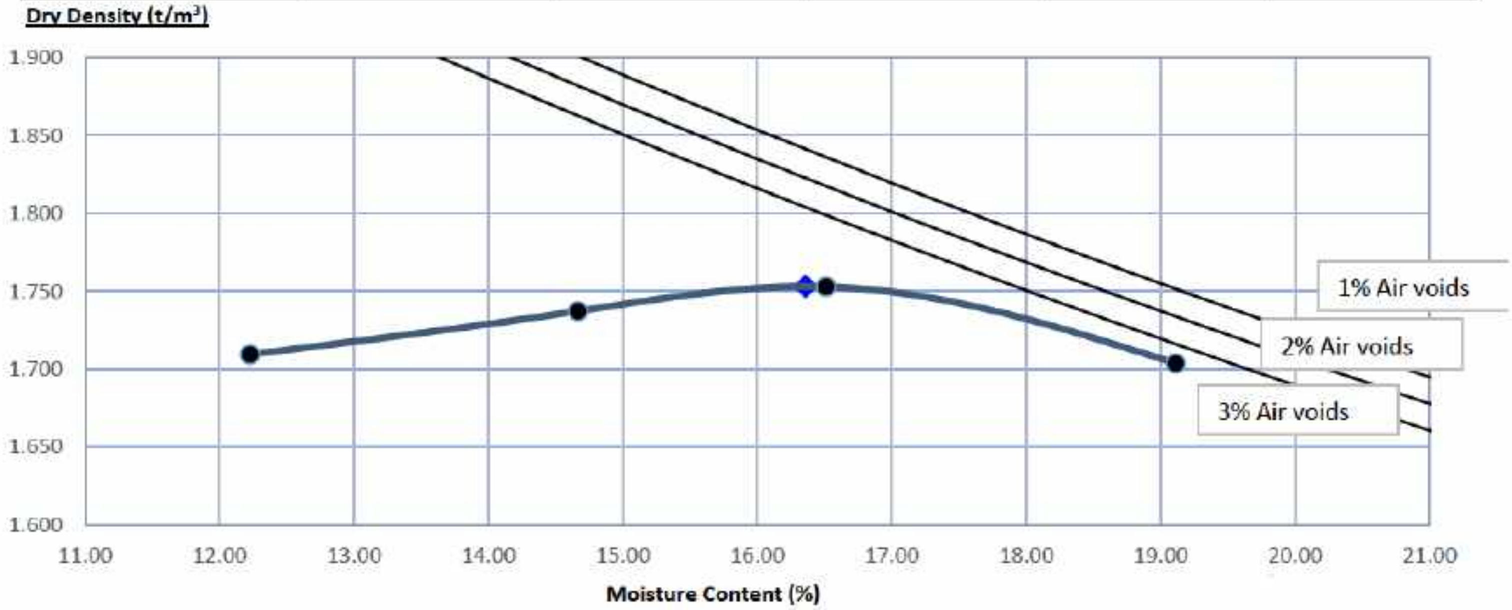
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **25 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**12.2**	**14.7**	**16.5**	**19.1**	
Dry Density (t/m³)	**1.709**	**1.737**	**1.753**	**1.704**	



Standard Maximum Dry Density (t/m³) **1.75**

Optimum Moisture Content (%) **16.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.673 t/m³*

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.1.1

Client:	CMW Geosciences	*Ticket No.*	S5508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2634_1_SMDD
Project:	Fingals TSF	*Sample No.*	WG22.2634
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	TP02 0.5 - 1.0m	*Date Tested:*	17-02-2022

TEST RESULTS - Standard Maximum Dry Density

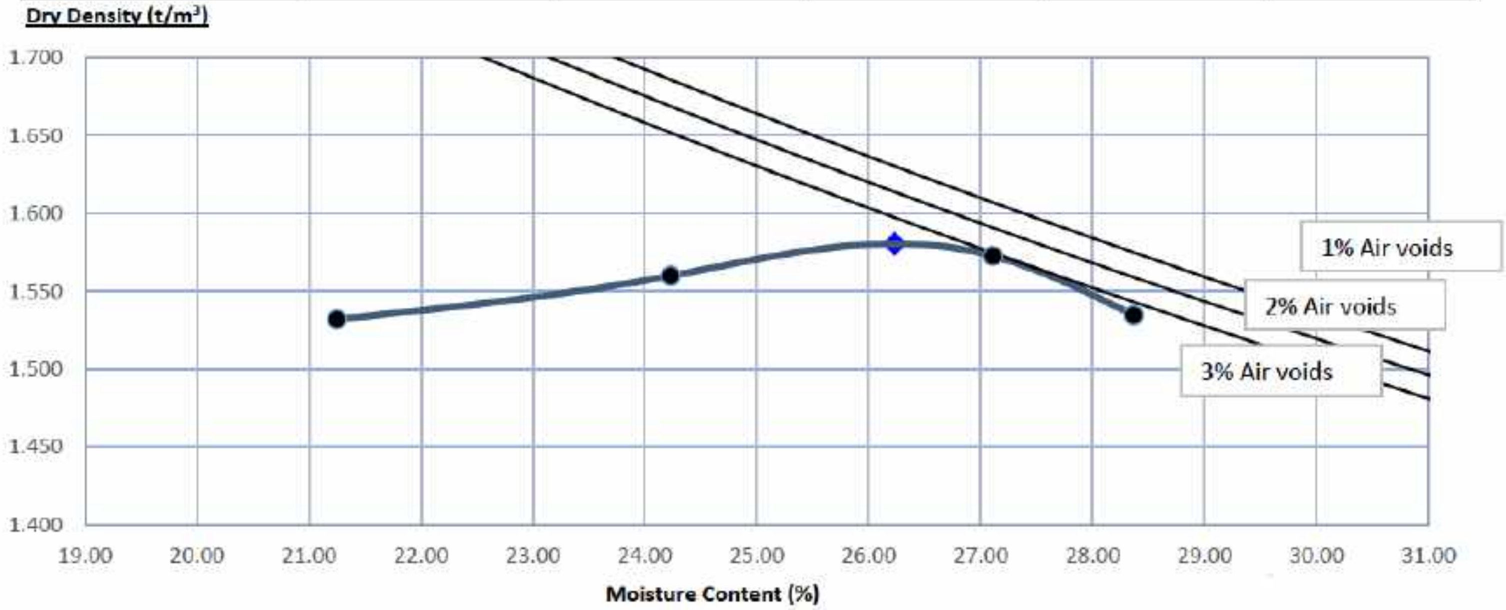
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **24 hours**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	21.2	24.2	27.1	28.4	
Dry Density (t/m^3)	1.532	1.560	1.573	1.535	



Standard Maximum Dry Density (t/m^3) **1.58**

Optimum Moisture Content (%) **26.0**

Comments: The above air void lines are derived from a calculated apparent particle density of 2.899 t/m^3

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.1.1

Client:	CMW Geosciences	*Ticket No.*	S5508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2635_1_SMDD
Project:	Fingals TSF	*Sample No.*	WG22.2635
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	TP05 1.5 - 2.0m	*Date Tested:*	18-02-2022

TEST RESULTS - Standard Maximum Dry Density

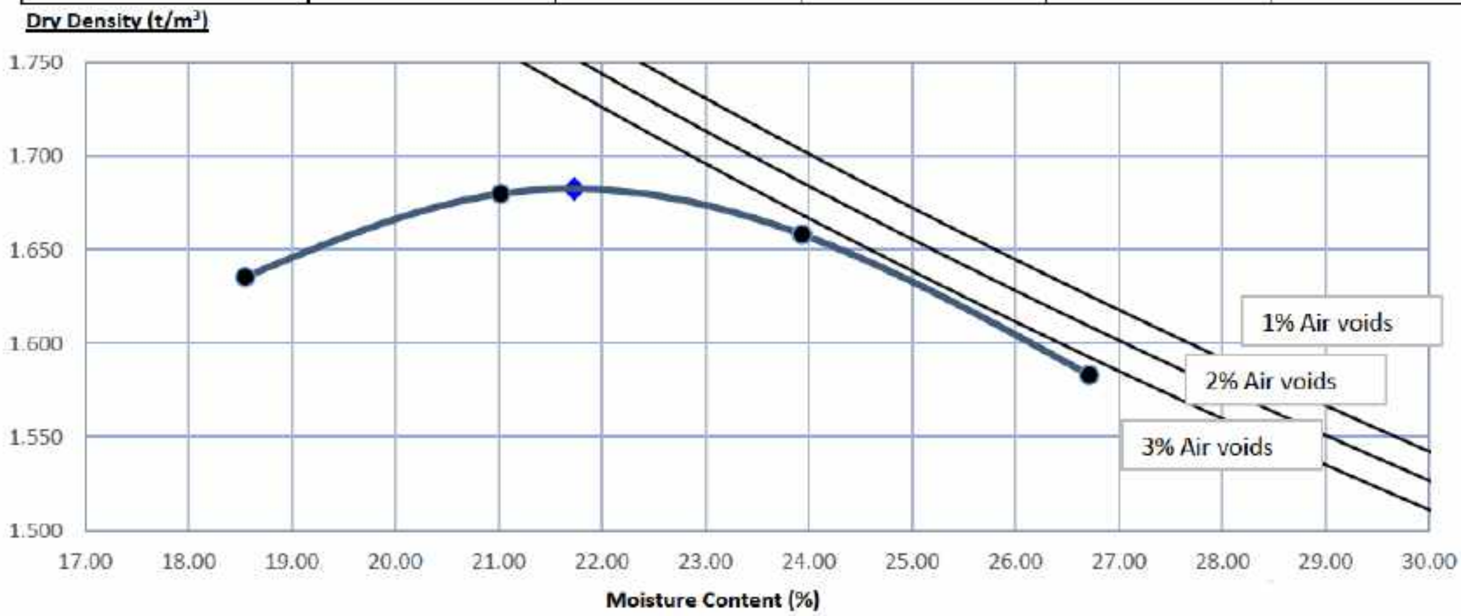
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **48 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**18.5**	**21.0**	**23.9**	**26.7**	
Dry Density (t/m³)	**1.635**	**1.680**	**1.658**	**1.583**	



Standard Maximum Dry Density (t/m³) **1.68**

Optimum Moisture Content (%) **21.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.925 t/m³*

[redacted]

Date: 21-February-2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.1.1

Client:	CMW Geosciences	*Ticket No.*	S5508
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG22.2636_1_SMDD
Project:	Fingals TSF	*Sample No.*	WG22.2636
Location:	Not Specified	*Date Sampled:*	Not Specified
Sample Identification:	Mine Waste 1 1.0 - 2.0m	*Date Tested:*	17-02-2022

TEST RESULTS - Standard Maximum Dry Density

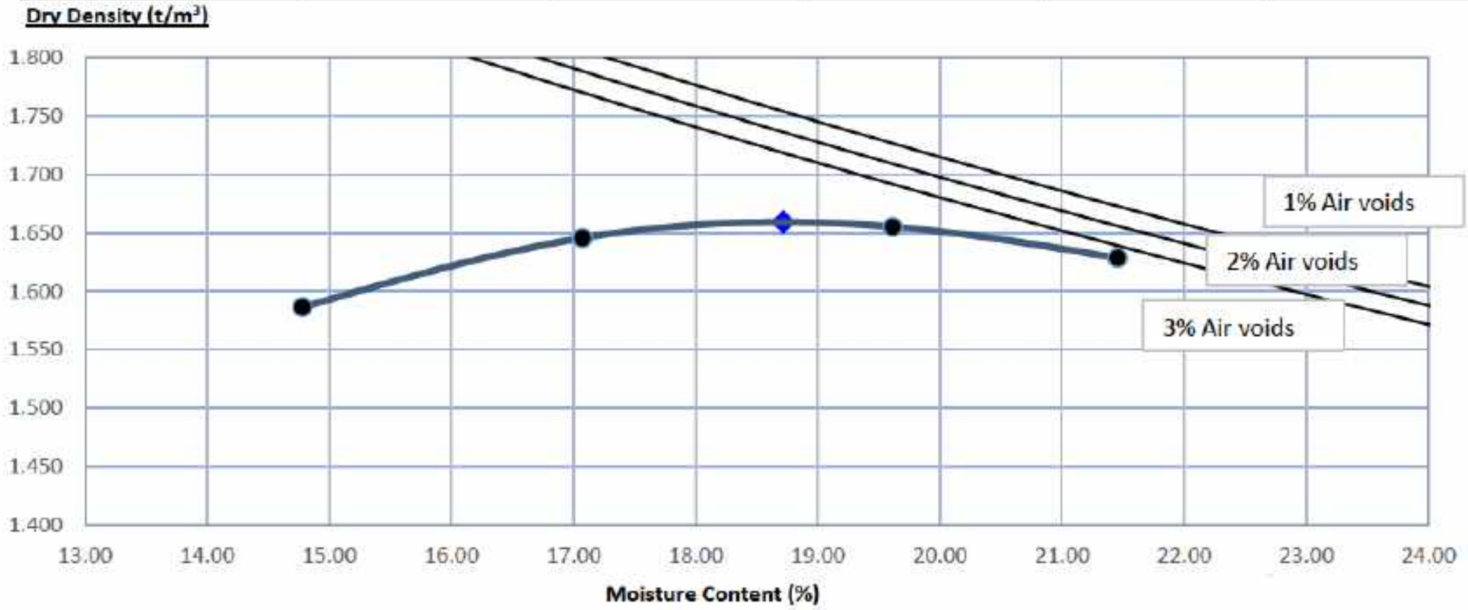
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **25 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**14.8**	**17.1**	**19.6**	**21.5**	
Dry Density (t/m³)	**1.586**	**1.646**	**1.655**	**1.628**	



Standard Maximum Dry Density (t/m³) **1.66**

Optimum Moisture Content (%) **18.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.651 t/m³*

[redacted]

Date: 18-February-2022

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WA 6155
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E-PRECISION LABORATORY

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

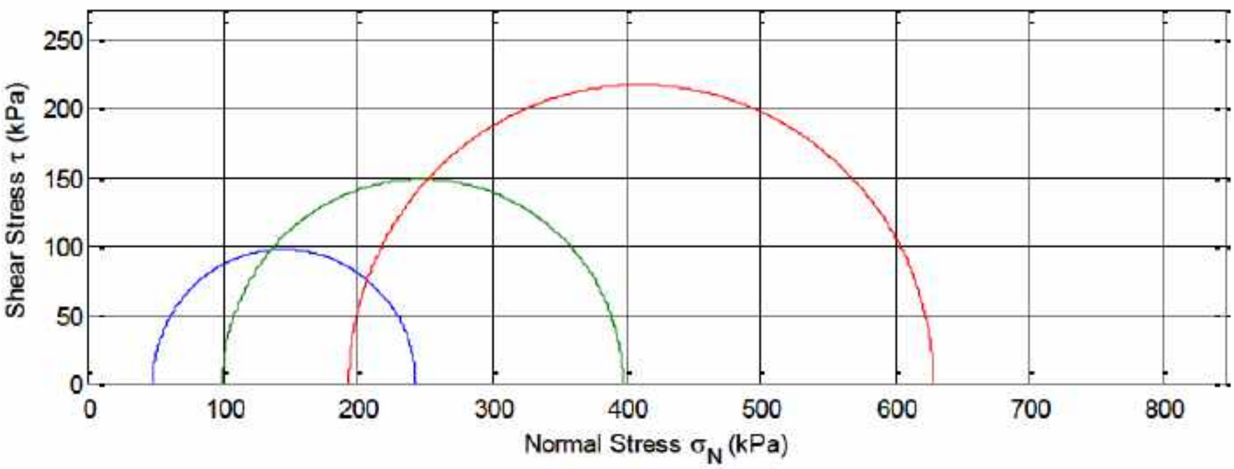
Method: AS1289.6.4.2 / In-house Method

Client:	Western Geotechnical Lab Services	Date Tested:	28/02/2022
Project:	Fingals TSG	EP Lab Job Number:	WGEO
Sample No:	TP02	Lab:	EPLab
Sample ID:	WG22_2634_CU3		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Tested by:	Phil Li	Initial Moisture (%):	26.72	Strain Rate (mm/min):	0.006
Height (mm):	125.87	Final Moisture (%):	30.65	Skempton's (B):	0.98
Diameter (mm):	61.80	Bulk Density (t/m³):	1.91	Geology:	-
L/D Ratio:	2.04	Dry Density (t/m³):	1.50	Particle Density (t/m³):	-

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	30.16	36.66	49.03
Angle of Shear Resistance Φ' (Degrees) :	29.68	26.57	24.70

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NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

Integrity Precision Innovation

Perth
16 Gympie Way, Willetton
WA 6155

[redacted]

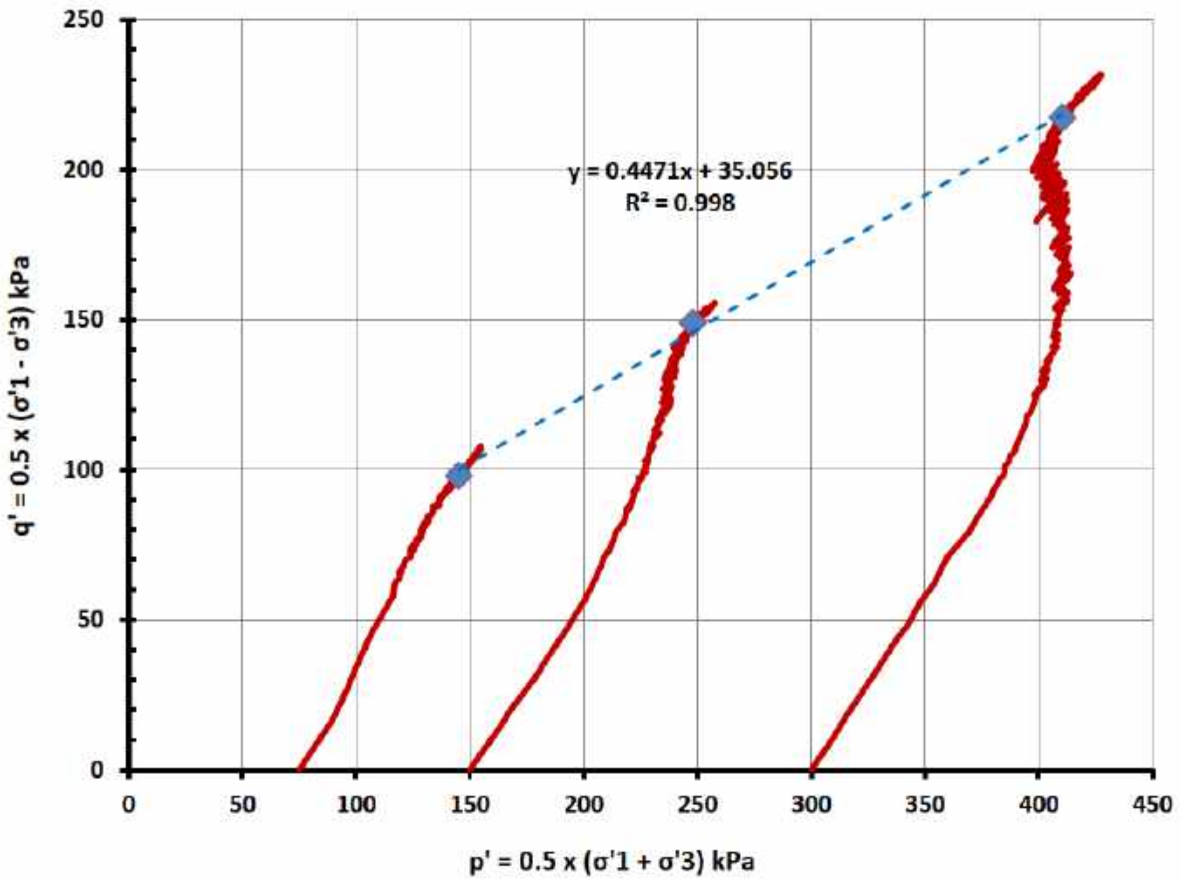
E-PRECISION LABORATORY

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Western Geotechnical Lab Services	Date Tested:	28/02/2022
Project:	Fingals TSG	EP Lab Job Number:	WGEO
Sample No:	TP02	Lab:	EPLab
Sample ID:	WG22_2634_CU3		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	39.26
Angle of Shear Resistance Φ' (Deg) :	26.74

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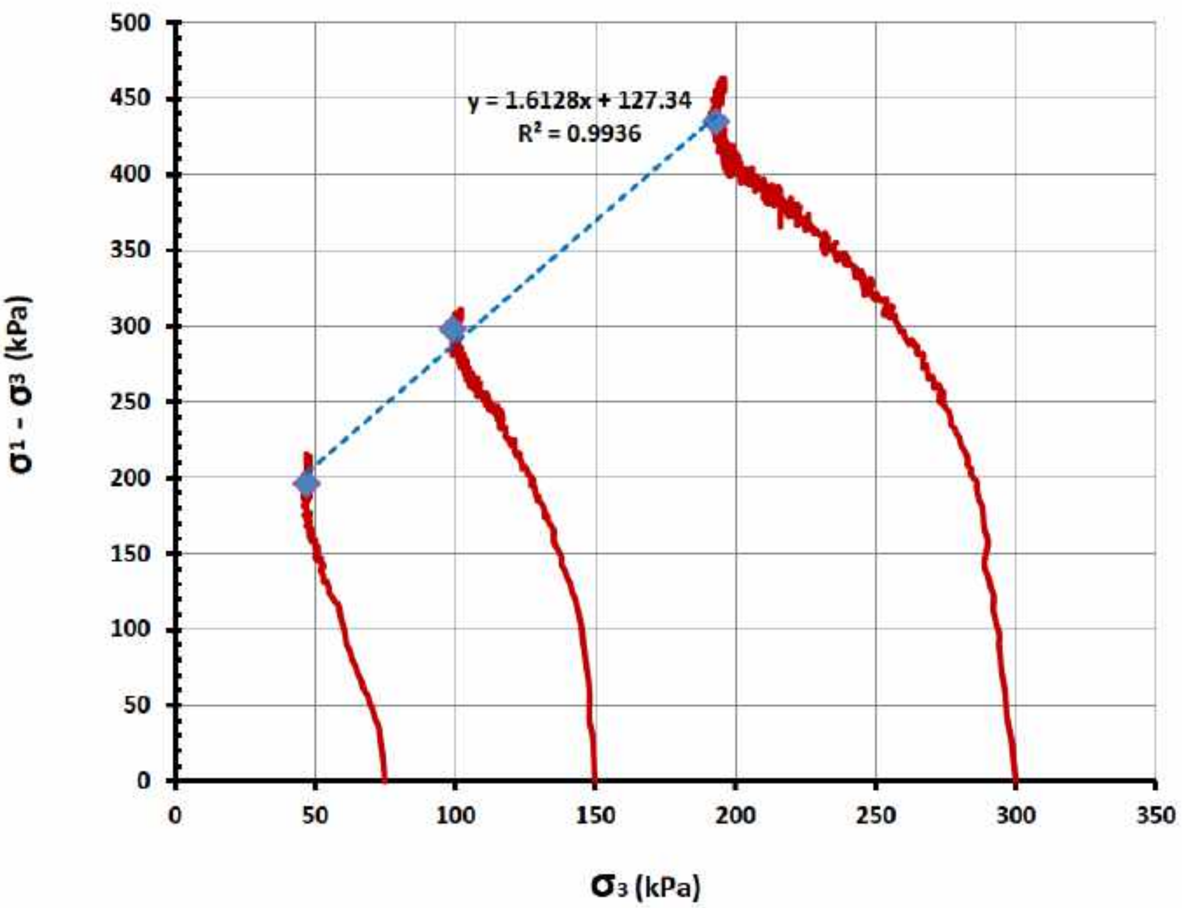
E-PRECISION LABORATORY

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Western Geotechnical Lab Services	Date Tested:	28/02/2022
Project:	Fingals TSG	EP Lab Job Number:	WGEO
Sample No:	TP02	Lab:	EPLab
Sample ID:	WG22_2634_CU3		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 39.41

Angle of Shear Resistance Φ' (Deg) : 26.49

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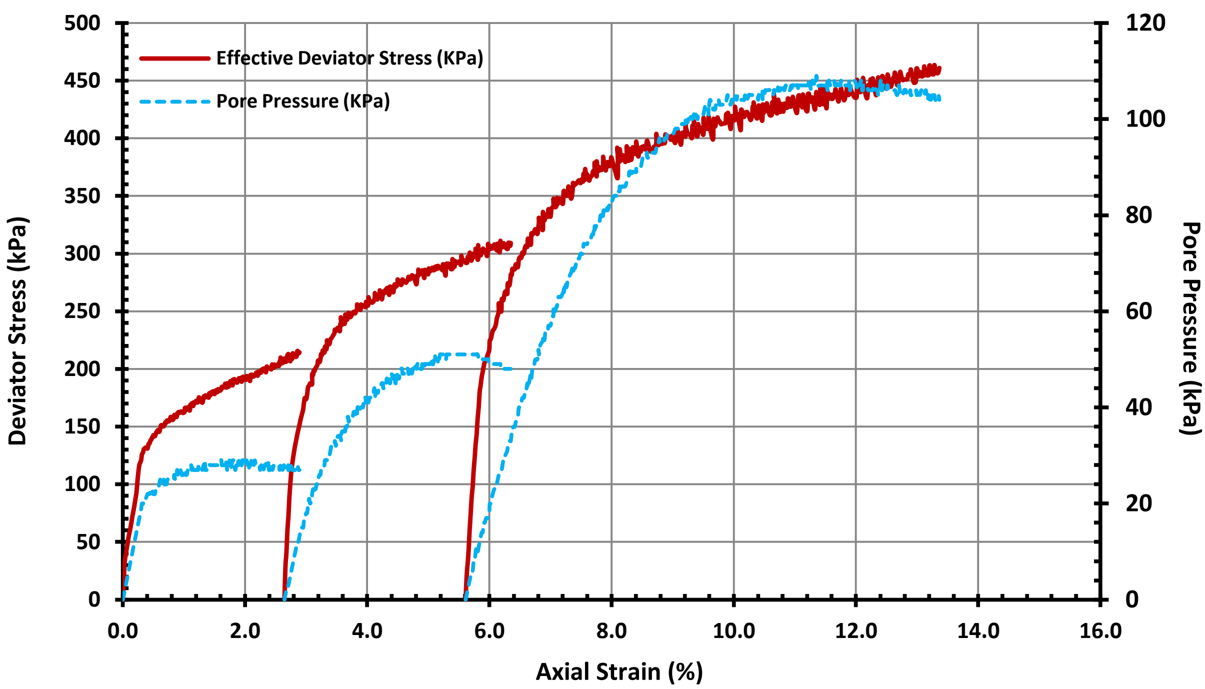
E-PRECISION LABORATORY

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Western Geotechnical Lab Services	Date Tested:	28/02/2022
Project:	Fingals TSG	EP Lab Job Number:	WGEO
Sample No:	TP02	Lab:	EPLab
Sample ID:	WG22_2634_CU3		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'_0	U'_f	Principal Effective Stresses			$\sigma'_1 - \sigma'_3$	Strain (%)
				σ'_1	σ'_3	σ'_1 / σ'_3		
1	75	0	28	243	47	5.17	196	2.23
2	150	0	51	397	99	4.01	298	5.76
3	300	0	107	628	193	3.25	435	12.18

Integrity Precision Innovation

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-PRECISION LABORATORY

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Western Geotechnical Lab Services	Date Tested:	28/02/2022
Project:	Fingals TSG	EP Lab Job Number:	WGEO
Sample No:	TP02	Lab:	EPLab
Sample ID:	WG22_2634_CU3		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP02	**Depth (m):**	0.50 - 1.00
Lab ID:	WG22_2634_CU3	**Date Tested:**	28/02/2022

Failure Mode: Bulging Failure

Notes: **Sample remolded to 95% MDD @ OMC**

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical** [redacted]

NATA
ACCREDITATION NO: 19078

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Integrity Precision Innovation

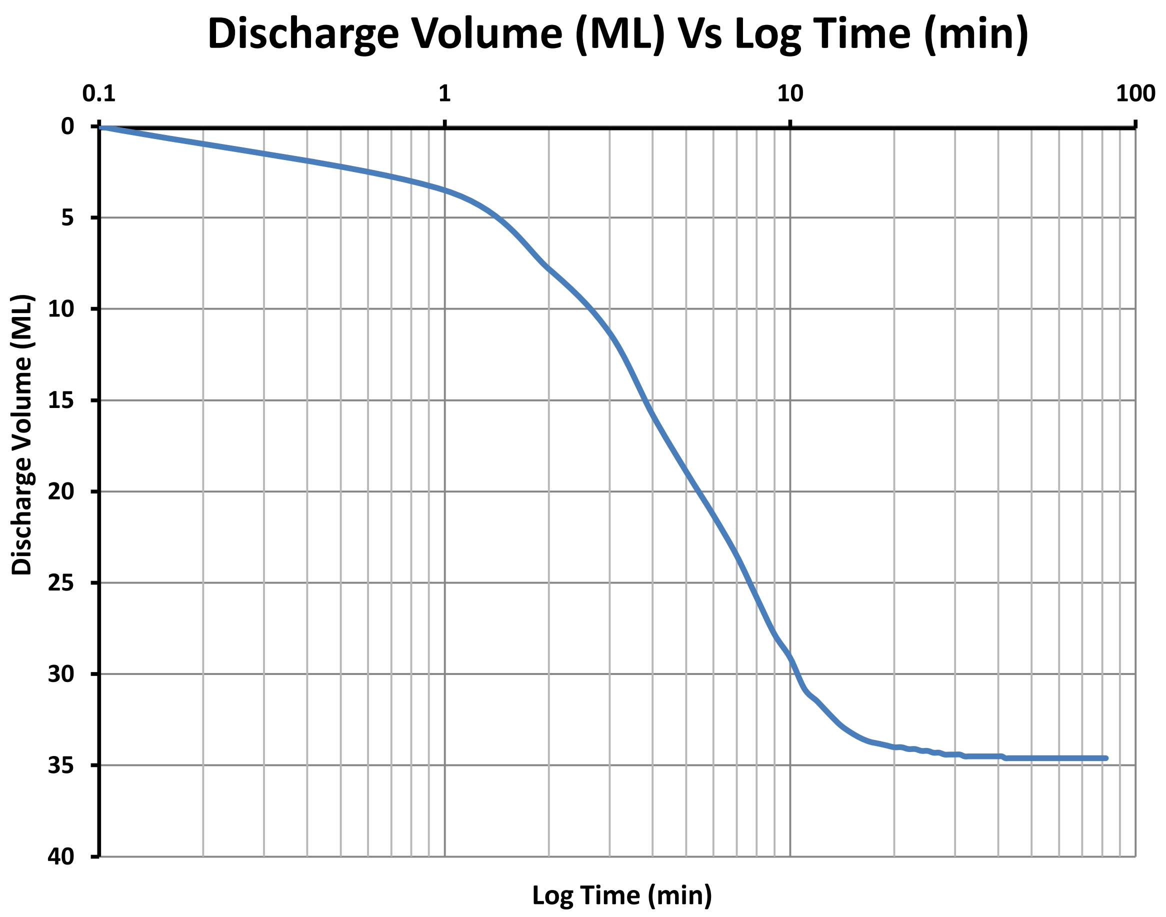
Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

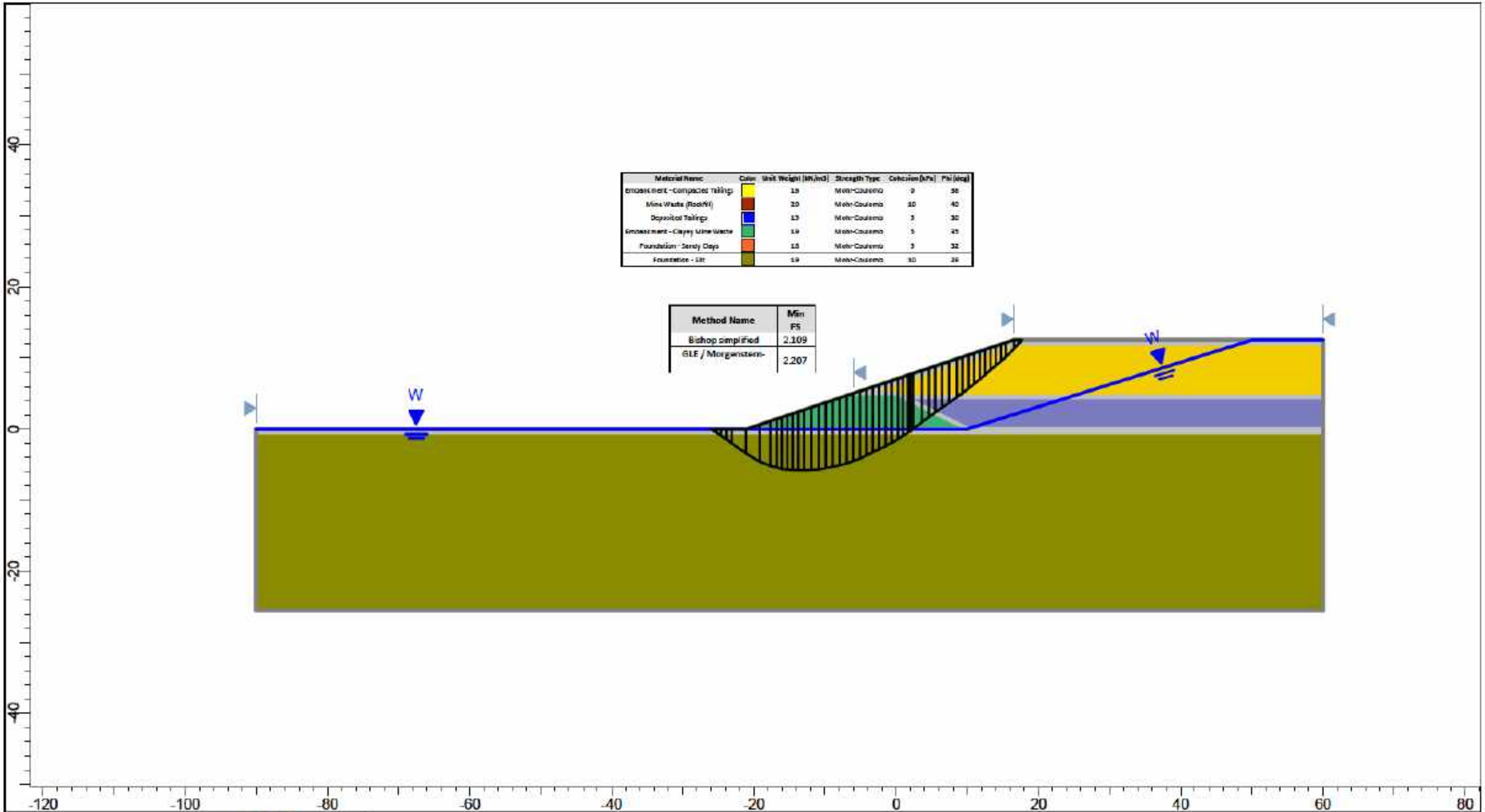
Client:	Western Geotechnical Lab Services	Date Tested:	28/02/2022
Project:	Fingals TSG	EP Lab Job Number:	WGEO
Sample No:	TP02	Lab:	EPLab
Sample ID:	WG22_2634_CU3		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C



Cv (cm²/s): 0.062 based on t_{90}

Integrity Precision Innovation

Appendix D
Slope Stability Analyses



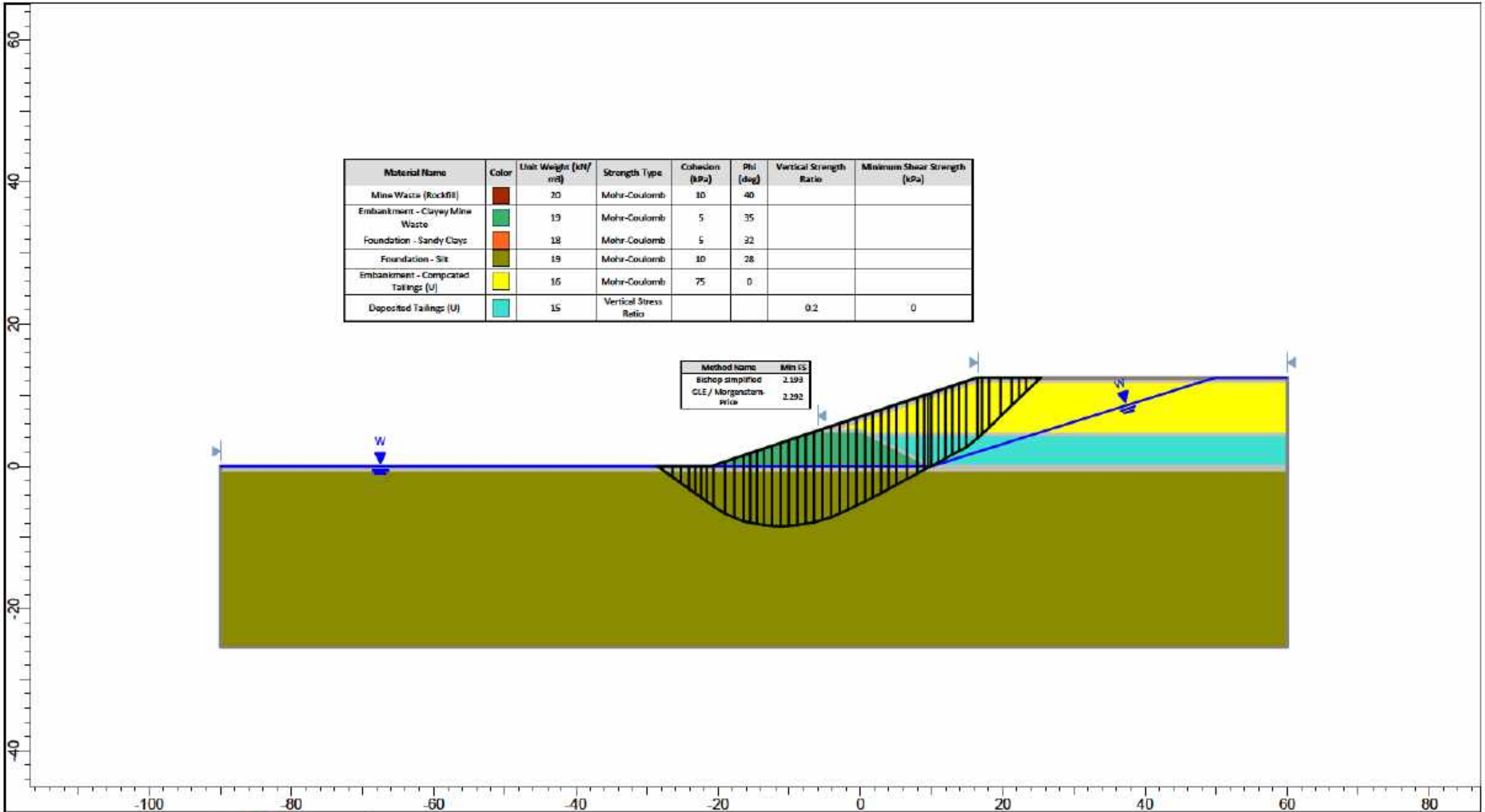
Project	Fingals TSF		
Scenario	Case 1: Drained		
Drawn By	SW	Company	CMW
Date	28/03/2022	File Name	Drained.slmd

CMW Geosciences

SLIDEINTERPRET 9.009

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (kPa)
Mine Waste (Rockfill)		20	Mohr-Coulomb	10	40		
Embankment - Clayey Mine Waste		19	Mohr-Coulomb	5	35		
Foundation - Sandy Clays		18	Mohr-Coulomb	5	32		
Foundation - Silt		19	Mohr-Coulomb	10	28		
Embankment - Compcated Tailings (U)		16	Mohr-Coulomb	75	0		
Deposited Tailings (U)		15	Vertical Stress Ratio			0.2	0

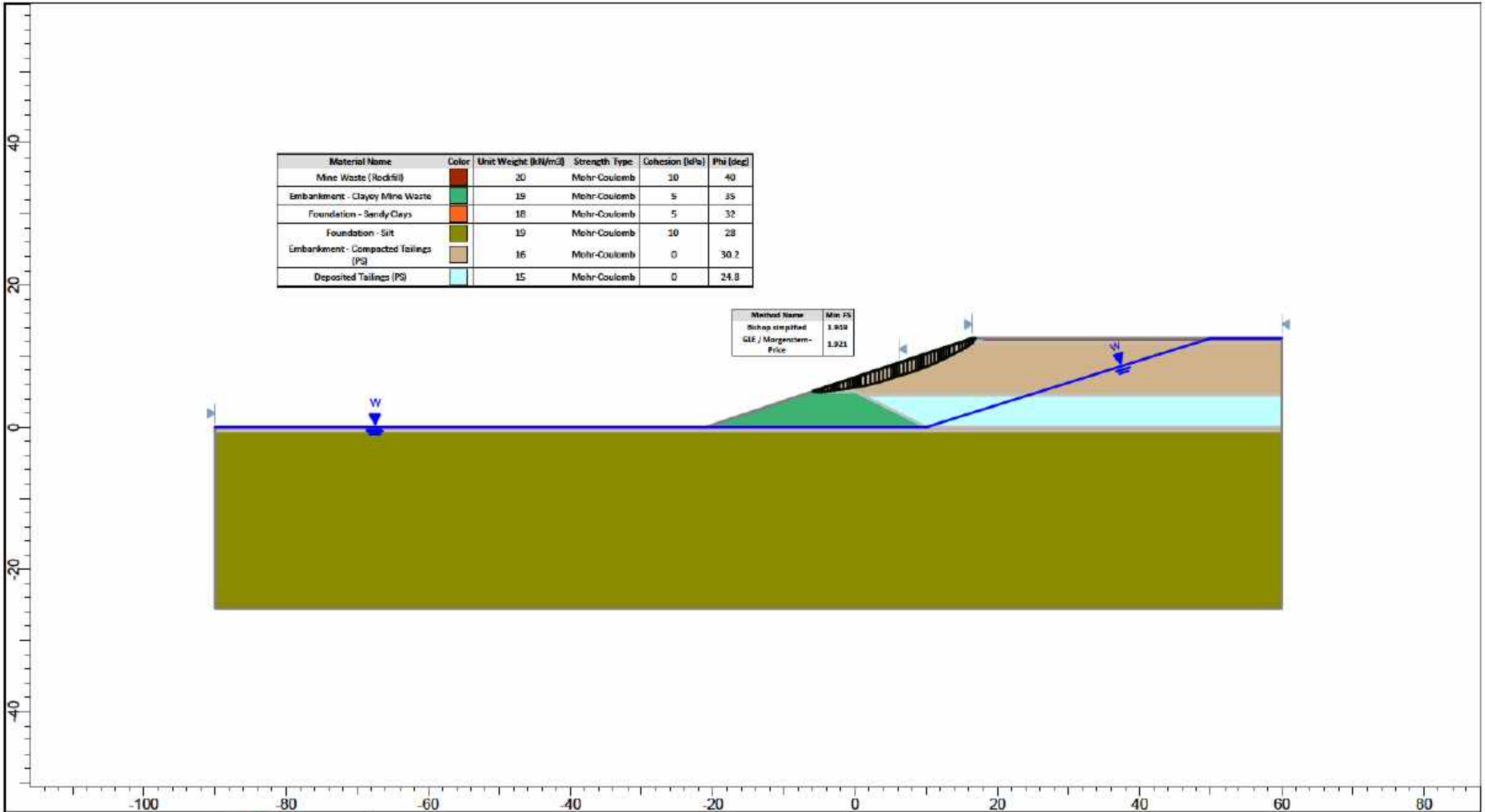
Method Name	Min FS
Bishop simplified	2.193
GLE / Morgenstern-Price	2.292



CMW Geosciences

Project	Fingals TSF
Scenario	Case 2: Undrained
Drawn By	SW
Company	CMW
Date	28/03/2022
File Name	Undrained.slmd

SLIDEINTERPRET 9.009



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Mine Waste (Rockfill)		20	Mohr-Coulomb	10	40
Embankment - Clayey Mine Waste		19	Mohr-Coulomb	5	35
Foundation - Sandy Clays		18	Mohr-Coulomb	5	32
Foundation - Silt		19	Mohr-Coulomb	10	28
Embankment - Compacted Tailings (PS)		16	Mohr-Coulomb	0	30.2
Deposited Tailings (PS)		15	Mohr-Coulomb	0	24.8

Method Name	Min FS
Bishop simplified	1.919
GLE / Morgenstern-Price	1.921

CMW Geosciences

SLIDEINTERPRET 9.009

Project	Fingals TSF
Scenario	Case 3: Post-seismic
Drawn By	SW
Company	CMW
Date	28/03/2022
File Name	Post-seismic.slmd

APPENDIX B Referenced Geoanalytica Document

GEOAnalytica

Futi Bagus In-pit Tailings Storage Facility

Black Cat Syndicate Limited

Geotechnical Cutback Design Assessment

LMGAU0012-REP-001

21 September 2021

Disclaimer

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[redacted]

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Figures List

Tables List

1. INTRODUCTION

Black Cat Syndicate (herein referred to as BC8) is currently developing the Kal East Gold Project comprising four Mining Centres: Myhree, Fingals, Majestic, and Trojan.

At the Fingals Mining Centre lies the Futi Bagus Pit (FBP), which was developed in the 1990s and subsequently converted into an in-pit tailings storage facility (IPTSF). BC8 has subsequently discovered additional gold resources immediately southeast of the FBP and is proposing to develop a new open pit, which will intersect the existing tailings deposited within the FBP and requires a cutback into the deposited tailings forming the north-eastern face of the new pit shell and the adjacent natural ground. BC8 has indicated that the new open pit mine will have a short operating lifespan not exceeding 6 months.

BC8 has commissioned Land & Marine Geological Services Pty. Ltd. (L&MGSPL) and Geoanalytica Pty. Ltd. (Geoanalytica) to undertake geotechnical assessment of the proposed cutback into the in-situ tailings material within the FBP and the findings of this assessment is presented in this report.

1.1 Geotechnical Scope of Work

The geotechnical Scope of Work undertaken as part of the IPTSF cutback design assessment is as follows:

- Undertake geotechnical site investigation works (comprising both fieldwork and laboratory soil testing) of the deposited tailings within the FBP;
- Undertake geotechnical characterisation of the tailings to evaluate its composition, shear strength properties and moisture content;
- Identification of potential geohazards relating to the proposed cutback into tailings material;
- Undertake geotechnical slope stability assessment and provide recommendations for achieving a geotechnically-stable cut batter into the in-situ tailings material.

1.2 Provided Information

BC8 has provided Geoanalytica with (a) a plan layout drawing illustrating the proposed new pit footprint superimposed over a satellite image showing the existing FBP, and (b) a drawing illustrating the as-built cross-section of the FBP shell surface cut in the north-west to south-east direction. Both drawings are provided in Appendix A of this report.

2. GEOTECHNICAL SITE INVESTIGATION

The geotechnical site investigation works comprised fieldwork and laboratory soil testing as detailed below.

2.1 Fieldwork

Fieldwork comprised Piezocone Penetration Test (CPTu) probing at four (4) locations within the FBP footprint including (a) the undertaking of six (6) excess pore pressure dissipation (EPPD) tests along the probed depth, and (b) the extraction of eight (8) nos. undisturbed 63 mm diameter thin wall tube (U63) soil samples. The above works were undertaken utilising a 22 t truck-mounted rig operated by CPTWest Pty. Ltd.

The CPTu probes were aligned along a north-west to south-east axis of the proposed cutback through the tailings within the as-built pit cross-section of the pit, as per Figure 2 1 and the drawing in Appendix A.

Table 2-1 summarises GPS grid coordinates (GDA94 datum) and ground surface elevation (AHD) recorded at each CPTu location by the CPTu rig in-built GPS.FBP.

Table 2-1 CPTu location details

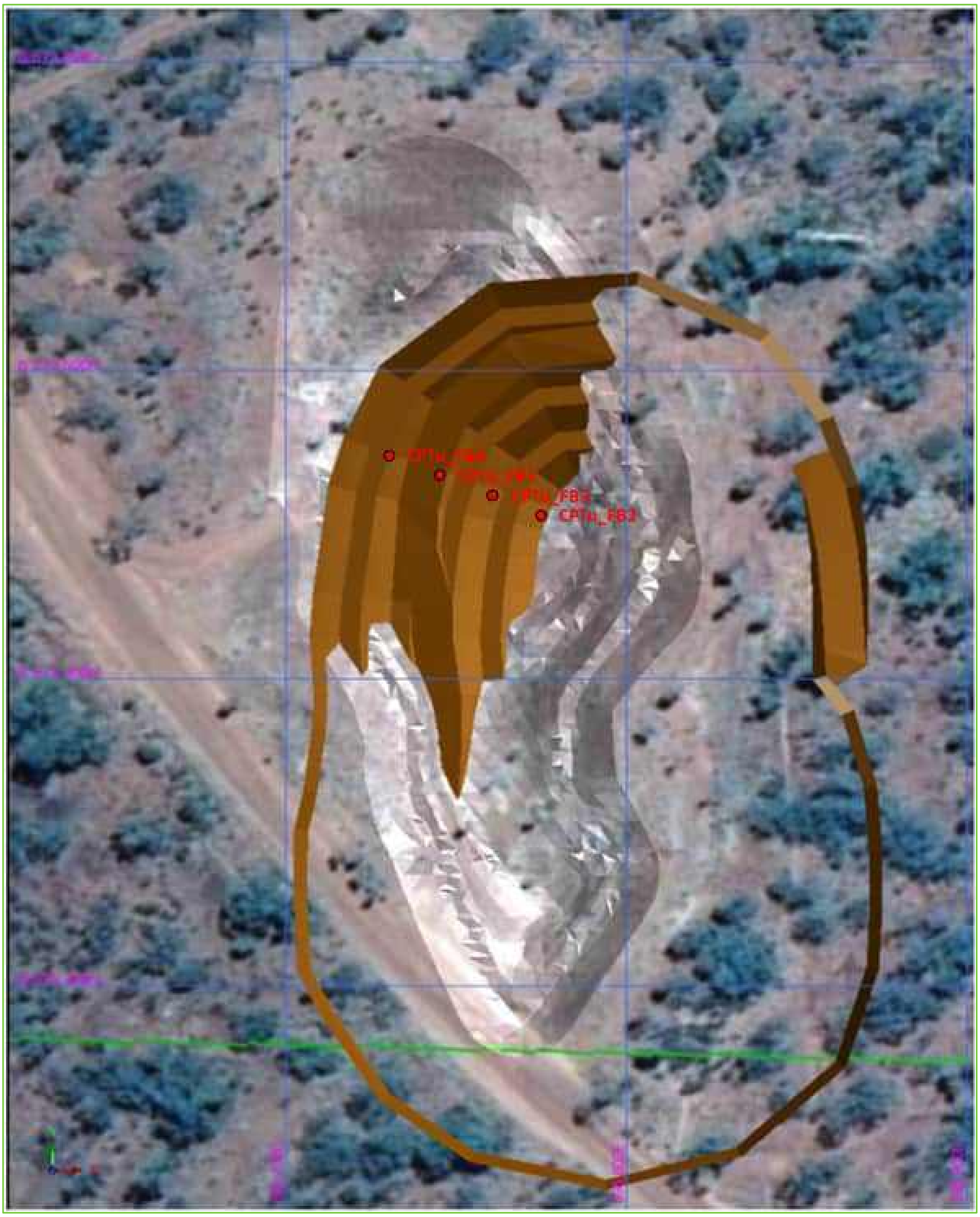
CPTu location	Location coordinates (m)		Probed surface elevation (RL m AHD)	CPTu probed depth (m)
	Easting	Northing		
CPTu_FB1	395745.20	6573466.26	391.02	35.95
CPTu_FB2	395774.84	6573453.11	391.53	43.65
CPTu_FB3	395760.66	6573459.69	391.21	44.08
CPTu_FB4	395730.29	6573472.71	391.05	31.49

Details of where the EPPD tests were undertaken, including time taken to achieve 50% and 90% pore pressure dissipation estimated based on a square root time approach, initial maximum pore pressure, and final pore pressure at end of test are summarised in Table 2-2 below. EPPD reading curves are provided in Appendix A.

Table 2-2 EPPD test details

CPTu location	Test depth (m)	Initial maximum pore pressure reading (kPa)	Final pore pressure reading at end of test (kPa)	Time to achieve 50% pore pressure dissipation (s)	Time to achieve 90% pore pressure dissipation (s)
CPTu_FB1	8.79	357.96	-21.83	46	286
CPTu_FB1	14.00	555.8	-1.59	53	345
CPTu_FB1	32.01	668.27	3.08	37	282
CPTu_FB2	14.01	266.87	20.26	54	525
CPTu_FB2	32.01	220.23	13.32	114	570
CPTu_FB2	43.01	320.77	6.87	4	58

Figure 2-1 CPTu probe location



Details of the CPTu location and probed depth from which the U63 tube soil samples were collected are summarised in Table 2-3.

Table 2-3 Undisturbed thin wall push tube soil sample collection details

CPTu location	Sampled depth (m)	CPTu location	Sampled depth (m)	CPTu location	Sampled depth (m)
CPTu_FB1	9	CPTu_FB1	13	CPTu_FB1	19
CPTu_FB3	14	CPTu_FB3	19	CPTu_FB2	9
CPTu_FB2	15.5	CPTu_FB2	21	-	-

2.2 Laboratory Testing

The U63 tube soil samples were sent to a NATA-accredited geotechnical soil testing laboratory for the following tests to be undertaken:

- One (1) nos. Particle Size Distribution (PSD) grading with hydrometer measurement;
- Two (2) nos. PSD grading only;
- Two (2) nos. particle density / specific gravity (S_g) measurement;
- Four (4) nos. phase diagram measurements comprising bulk density, moisture content, and void ratio measurement;
- Two (2) nos. Atterberg Limits measurements;
- Two (2) nos. minimum / maximum dry density measurements;
- Two (2) nos. consolidated undrained triaxial compression shear (CUTX) tests;
- Two (2) nos. consolidated drained triaxial compression shear (CDTX) tests; and
- Two (2) nos. direct shear box tests (DST).

Results from the above tests, including details of which U63 tube samples were used for each test, are summarised in Table 2-4 and Table 2-5.

Table 2-4 Geotechnical laboratory soil test results summary – Soil particle size distribution and density properties

CPTu location	Sampled depth (m)	Particle size distribution - % soil content smaller than the following particle size (mm):					Density and moisture properties						
		0.002	0.075	0.21	0.6	2.36	Particle specific gravity, S_g	In-situ moisture content (%)	In-situ bulk density (t/m³)	In-situ dry density (t/m³)	In-situ void ratio, e	Minimum dry density (t/m³)	Maximum dry density (t/m³)
CPTu_FB1	9	28.4	98.6	99.7	100	100	2.919	43.22	1.871	1.306	1.23	-	-
CPTu_FB1	13	-	-	-	-	-	-	-	-	-	-	-	-
CPTu_FB1	19	-	24.7	70	100	100	3.011	6.79	1.724	1.614	0.87	1.292	1.509
CPTu_FB3	14	-	-	-	-	-	-	-	-	-	-	-	-
CPTu_FB3	19	-	20.8	70	100	100	2.966	6.32	1.739	1.636	0.81	1.342	1.547
CPTu_FB2	9	-	-	-	-	-	-	-	-	-	-	-	-
CPTu_FB2	15.5	-	-	-	-	-	-	-	-	-	-	-	-
CPTu_FB2	21	-	-	-	-	-	3.041	8.09	1.878	1.737	0.75	-	-

Table 2-5 Geotechnical laboratory soil test results summary – Index properties and shear test data

CPTu location	Sampled depth (m)	Soil index properties			Triaxial shear test data - failure stress at different stage (1 - 3) (kPa)		Direct shear test data - failure stress at different stage (1 - 3) (kPa)	
		Plastic Limit (%)	Liquid Limit (%)	Plasticity index (%)	Effective lateral stress, σ_3'	Effective axial stress, σ_1'	Effective normal stress, σ_n'	Effective shear stress, τ'
CPTu_FB1	9	34.98	52.8	17.82	-	-	-	-
CPTu_FB1	13	-	-	-	5 (1), 11 (2), 26 (3)	87 (1), 111 (2), 154 (3)	-	-
CPTu_FB1	19	21.41	28.7	7.29	10 (1), 50 (2), 100 (3)	149 (1), 384 (2), 584 (3)	10 (1), 50 (2), 250 (3)	21 (1), 65 (2), 226 (3)
CPTu_FB3	14	-	-	-	-	-	-	-
CPTu_FB3	19	-	-	-	-	-	25 (1), 150 (2), 500 (3)	38 (1), 174 (2), 452 (3)
CPTu_FB2	9	-	-	-	-	-	-	-
CPTu_FB2	15.5	-	-	-	8 (1), 15 (2), 38 (3)	87 (1), 109 (2), 164 (3)	-	-
CPTu_FB2	21	-	-	-	25 (1), 75 (2), 400 (3)	190 (1), 470 (2), 1705 (3)	-	-

3. GEOTECHNICAL SITE CHARACTERISATION

3.1 Groundwater Condition

Based on both CPTu U2 pore pressure measurements and final pore pressure readings from the EPPD test, tending towards zero pressure reading, groundwater/phreatic surface is indicative that the tailings are not fully saturated, thus there is effectively no groundwater present throughout the entire in-situ tailings profile within the FBP.

3.2 In-situ Tailings Properties

3.2.1 Material Composition

In-situ tailings material intersected by the CPTu probing and undisturbed thin wall tube sampling can be delineated into two (2) categories: Coarse Tailings and Fine Tailings. The tailings type classification for all the collected undisturbed U63 tube samples is summarised in Table 3-1 below.

Table 3-1 Undisturbed thin wall push tube soil sample – tailings type classification

CPTu location	Sampled depth (m)	Tailings type
CPTu_FB1	9	Fine Tailings
CPTu_FB1	13	Fine Tailings
CPTu_FB1	19	Coarse Tailings
CPTu_FB3	14	Fine Tailings
CPTu_FB3	19	Coarse Tailings
CPTu_FB2	9	Fine Tailings
CPTu_FB2	15.5	Fine Tailings
CPTu_FB2	21	Coarse Tailings

Detail discussions of the material composition for both tailings types are provided below in general accordance with Australian Standard AS1726:2017 *Geotechnical Site Investigations.*

<u>Coarse Tailings</u>

The encountered Coarse Tailings material is composed predominantly of silty SAND material, with the silt being of low plasticity, whereas the sands are fine-grained and its particle angularity is sub-rounded to sub-angular.

The Coarse Tailings material can generally be distinguished from the CPTu data where (a) the cone tip resistance $q_t \geq 5$ MPa, and (b) the q_t trace profile with depth is jagged and zigzags.

<u>Fine Tailings</u>

The encountered Fine Tailings material is composed predominantly of SILT material of high plasticity.

The Fine Tailings material can generally be distinguished from the CPTu data where (a) the cone tip resistance $q_t \leq 5$ MPa, and (b) the q_t trace profile with depth is generally smooth and linearly increasing with depth.

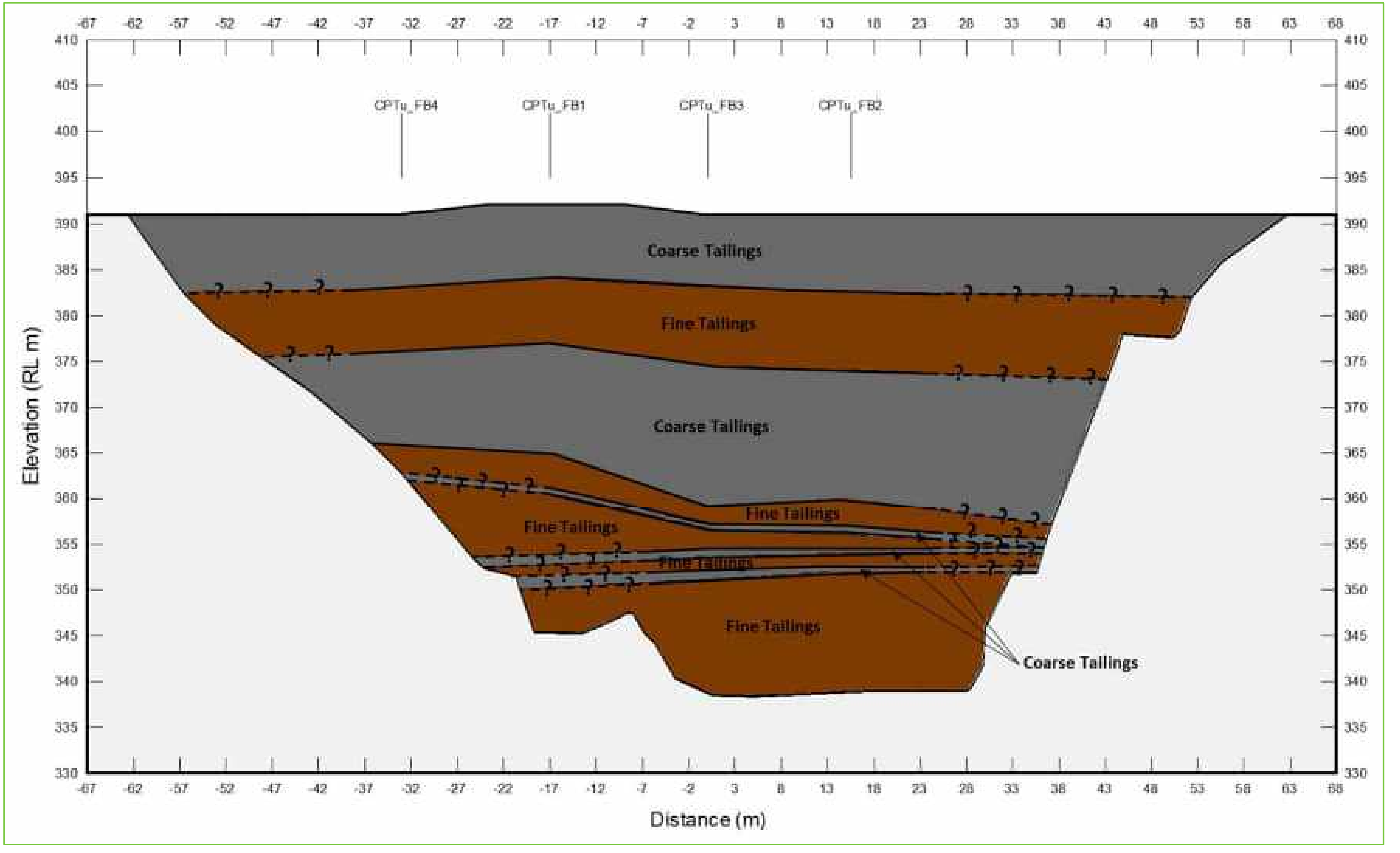
3.2.2 Distribution of in-situ Coarse and Fine Tailings

The lateral and vertical distribution of both Coarse and Fine Tailings within FBP has been interpreted from the CPTu q_t data, as per above discussions, and is illustrated on the provided as-built FBP shell cross-section as per Figure 3-1.

The interpretation of the layering within the FBP, indicates the following:

- The tailings materials and layering may reflect the timing of deposition and the treatment of difference ore types as indicated be the alternate sand and clay layers. As far as we are aware there are no reports of the process and deposition covering the period of operation;
- Segregation of the tailings during deposition near the pit rim as the sand fraction falls out of suspension, with the finer fraction (silt and clay) carried further out into the deposition area; and
- Tailings deposition points may have been moved around the pit rim resulting in alternating sand and clay layers, although typically, in-pit tailings deposition is typically focused on maintaining the supernatant pond and water recovery pump at the haul ramp, which means limited movement of deposition locations.

Figure 3-1 In-situ Coarse and Fine Tailings distribution within FBP



3.2.3 Density and moisture condition

Coarse Tailings

The Coarse Tailings material possesses in-situ bulk density ranging between 1.7 t/m^3 and 1.9 t/m^3, with the in-situ moisture content ranging between 6% and 8%, and the corresponding in-situ dry density ranging between 1.6 and 1.7 t/m^3.

The measured soil particle density (specific gravity) for the Coarse Tailings particles range between 2.9 and 3.0 t/m^3, which is somewhat higher than typical gold tailings where the values are closer to 2.70 t/m^3.

Fine Tailings

The Fine Tailings material is anticipated to possess similar bulk density as per the above range, and is skewed to the higher end, however it possesses an in-situ moisture content of ~40%. The measured in-situ dry density is approximately 1.3 t/m^3.

The measured soil particle density (specific gravity) for the Fine Tailings particles is similar to that of the Coarse Tailings particles.

3.2.4 Shear Strength

Coarse Tailings

This material observed to possess some degree of cementation, for which the successful extraction of undisturbed samples via the thin wall push tube sampling method is most likely attributed to (see Figure 3-2 for illustration), and is possibly associated with the conditioning effect of lime introduced into the milled ore, prior to leaching, to maintain a sufficiently high pH as part of the gold cyanidation process.

Due to its dry condition, above observed cemented nature, and free-drained nature associated with its coarse-grained soil composition, the Coarse Tailings material is anticipated to shear in a drained effective manner under all soil stress conditions (static and transient), and its geotechnical shear strength can be defined under the Mohr-Coulomb failure criterion. The governing shear strength parameters defined under this failure criterion is the effective friction angle φ' and apparent cohesion c'. Both these parameters have been interpreted from laboratory CDTX and DST effective failure stress measurements as presented on a graph in Figure 3-3. The adopted design Mohr-Coulomb failure plane is defined as a red line in Figure 3-3 and is represented by φ' = 40° and c' = 20 kPa.

Fine Tailings

As groundwater/phreatic surface has not been encountered within the FBP, the in-situ Fine Tailings material is anticipated to geotechnically shear in a drained effective manner under static soil stress conditions, and its effective geotechnical shear strength has been interpreted based on the Mohr-Coulomb failure criterion as per above discussion. The design effective geotechnical shear strength parameters has been interpreted from laboratory CUTX effective failure stress measurements, as per graph in Figure 3-4, and is estimated to be represented by φ' = 26° and c' = 22.5 kPa.

It is however to be noted that due to its high in-situ moisture content relative to its liquid limit, and the observed excess pore pressure development during CPTu probe penetration through the in-situ Fine Tailings layers, the in-situ Fine Tailings material can also potentially shear in an undrained manner under static transient soil stress conditions typically arising from mine blasting activities.

The geotechnical shear strength under such shear behaviour can be defined under the Tresca failure criterion, with the governing parameter being the undrained shear strength parameter S_u.

S_u has been interpreted from the CPTu q_t data as per empirical relationship by Robertson (2015) and is based on a typical cone factor N_{kt} of 14. The interpreted S_u profile with depth is presented as a graph in Figure 3-5. Based on this graph, S_u is indicated to be approximately 50 kPa for Fine Tailings present above RL 375 m, and at least 70 kPa or more at depths lower than RL 365 m.

3.2.5 Design geotechnical parameters

Design geotechnical parameters adopted for assessments covered by this report is summarised in Table 3-2 below.

Table 3-2 Design geotechnical parameters for in-situ tailings material within FBP

Soil material	Bulk unit weight (kN/m³)	Drained effective geotechnical shear strength		Undrained geotechnical shear strength, S_u (kPa)
		Effective friction angle, φ' (°)	Apparent cohesion, c' (kPa)	
Coarse Tailings	18.5	40	20	N/A
Fine Tailings	18.5	26	22.5	50 above RL 375 m 70 below RL 365 m

Figure 3-2 Push tube sampler end with extracted undisturbed in-situ Coarse Tailings material

Figure 3-3 Geotechnical effective failure shear stress response of Coarse Tailings

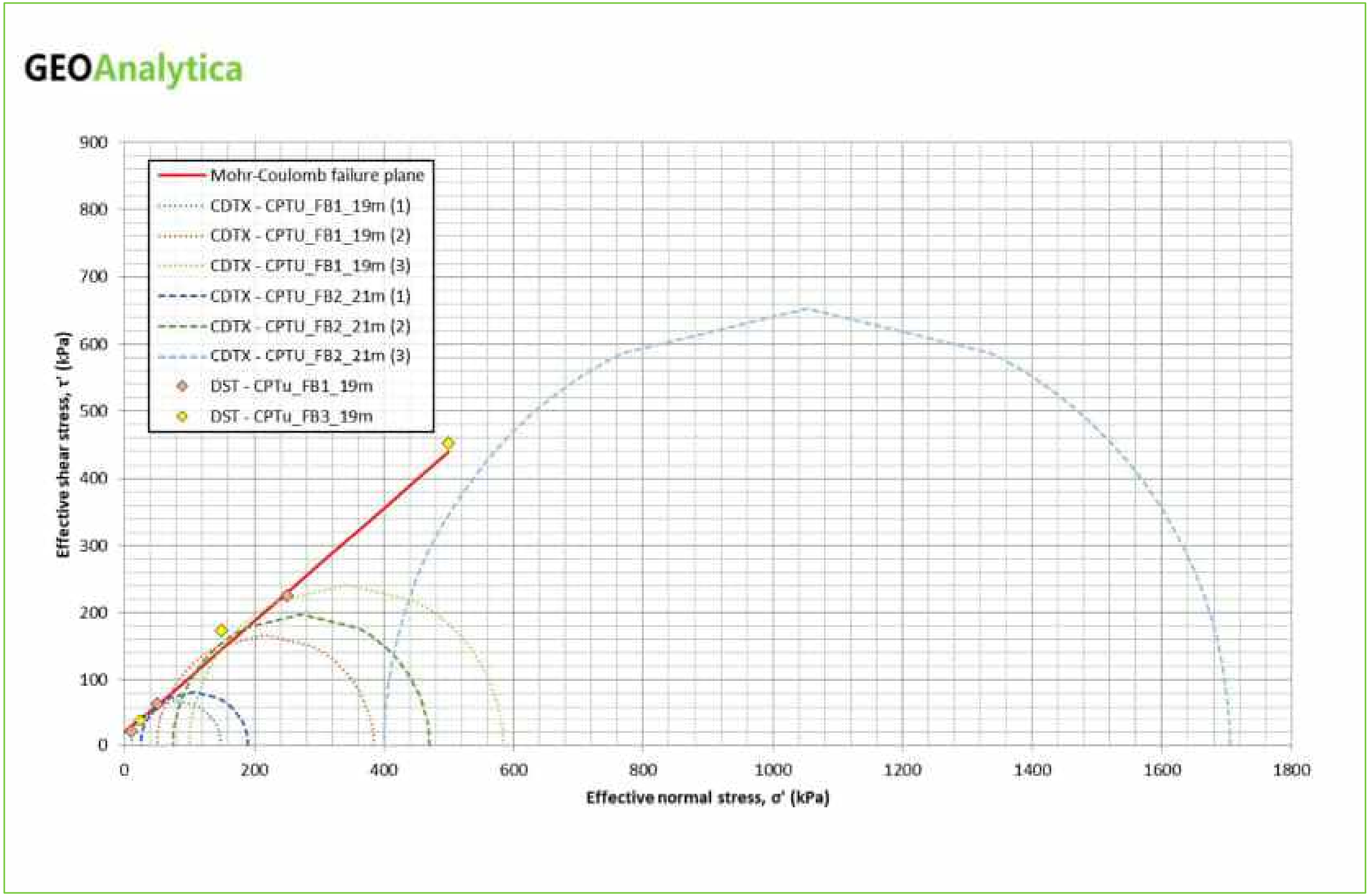


Figure 3-4 Geotechnical effective failure shear stress response of Fine Tailings

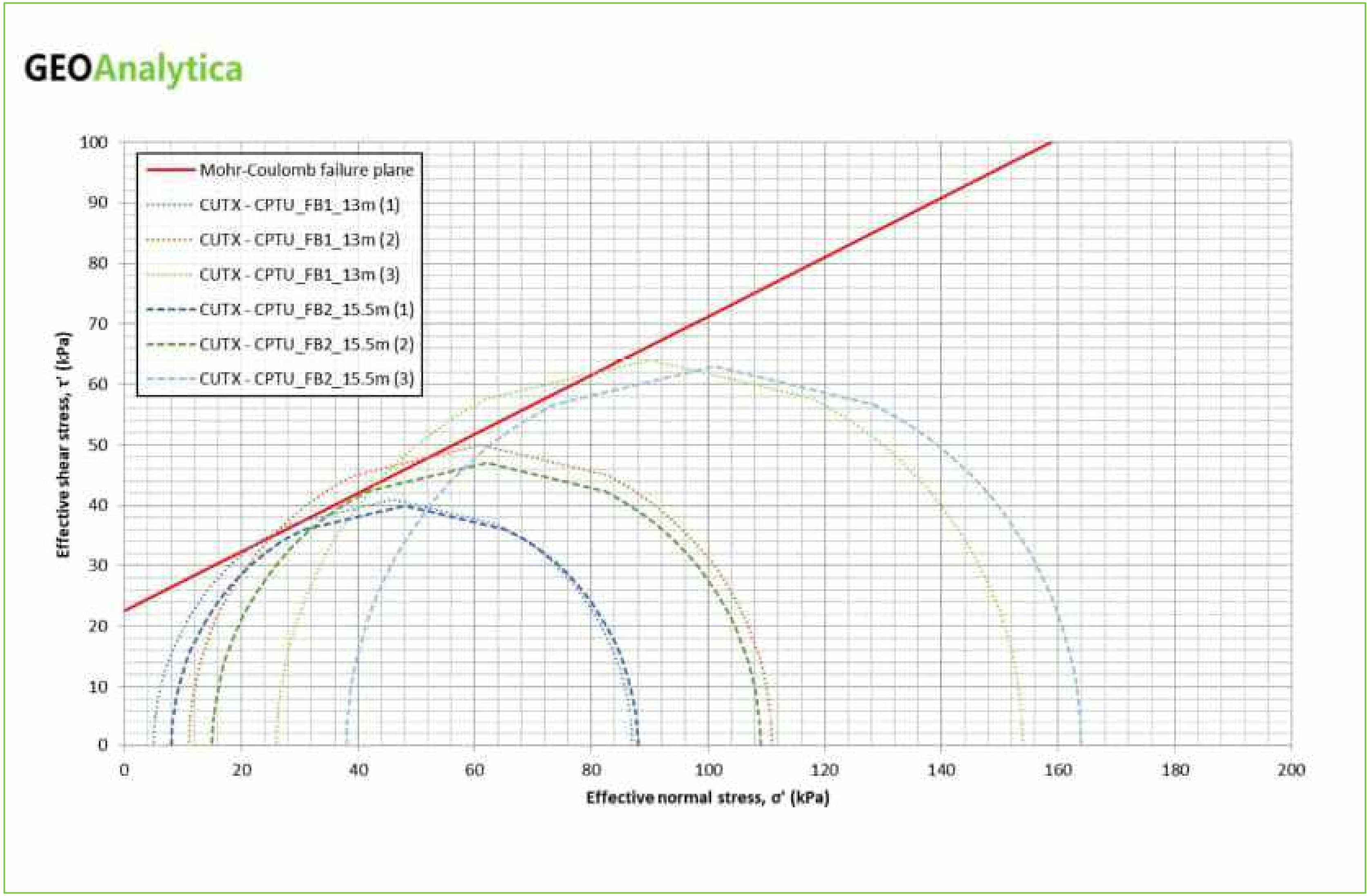
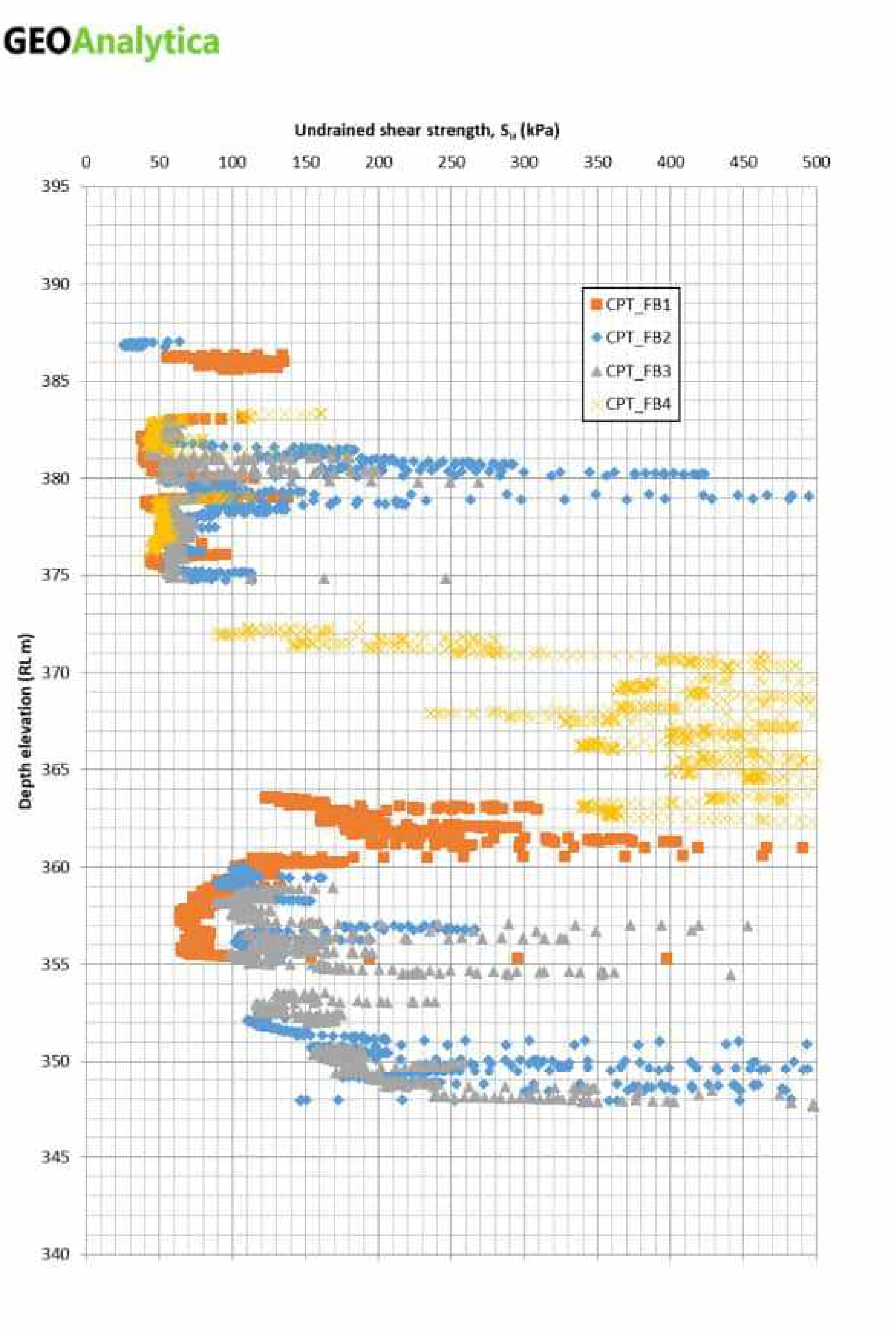


Figure 3-5 Geotechnical undrained shear strength of Fine Tailings



4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Potential Geohazards

Based on the interpreted geotechnical characteristics of the in-situ tailings material within FBP, BC8 should be aware of the potential geohazards associated with the proposed cutback into the tailings material as part of the open pit mine development:

1) Slumping failure of the tailings cutback embankment as the tailings geotechnical shear strength transition from drained to undrained state due to mine blasting activities; and/or
2) Trafficking difficulty and bogging risk for tracked earthworks machinery traversing across the tailings surface during the cutback exercise. The in-situ tailings is anticipated to be too soft to support the traversing of haul trucks.

4.2 Assessment Objectives

In relation to the potential geohazards identified in Section 4.1, The following assessments have been undertaken:

1) Slope stability assessment to evaluate what is the maximum allowable slope gradient that can be formed when cutting into the in-situ tailings while ensuring the cut slope has sufficient geotechnical stability;
2) Ground bearing pressure assessment to evaluate the maximum allowable track ground bearing pressure of earthwork machineries that can be safely supported by the in-situ Coarse and Fine Tailings material; and
3) Detail discussion on the cutback earthworks sequence considering only tracked earthwork machineries, and not haul trucks, are likely able to traverse across the in-situ tailings.

4.3 Slope Stability Assessment

4.3.1 General methodology

The assessment involves the estimation of geotechnical slope stability Factors of Safety (FoS_{slope}) based on a two-dimensional Limit Equilibrium (2D LE) analysis approach. The commercial analysis software Geostudio SLOPE/W 2012, employing the Morgenstern-Price method of slices, has been utilised for this assessment.

As detailed above, the assessment has been carried out to estimate the maximum allowable slope gradient at which the tailings can be cut to and considers the following soil stress conditions:

- Static conditions whereby all in-situ tailings material geotechnically shear in a drained manner;
- Transient condition to simulate mine blasting activities, whereby the in-situ Fine Tailings material is treated to geotechnically shear in an undrained manner, whereas the in-situ Coarse Tailings still geotechnically shear in a drained manner; and
- Drained and undrained design geotechnical shear strength parameters in Table 3-2 have been adopted.

Geotechnical slope stability assessment considering seismic soil stress conditions has not been undertaken as it is not deemed to be necessary due to the short operating lifespan of the proposed new open pit mine (≤ 6 months).

4.3.2 FoS criteria

Considering the dry condition of the in-situ tailings and FBP, the proposed cutback into such tailings is anticipated to be no different to cutback into naturally-occurring soils, as such the recommended FoS_{slope} criteria provided in the CSIRO (2009) *Guidelines for Open Pit Slope Design* is deemed to be applicable for this assessment. The adopted FoS_{slope} criteria is as per Table 4-1 below.

Table 4-1 Geotechnical slope stability FoS_{slope} criteria

Soil stress condition	Minimum FoS_{slope} requirement
Static	≥ 1.3
Transient	≥ 1.1

4.3.3 Analysis results and recommendation

Based on a few SLOPE/W analysis permutations, a global, overall, cutback slope gradient from crest to toe must not be steeper than 1V:1.7H (≤ 30.45° taken from the horizontal plane) is required to ensure the slope possesses sufficient FoS_{slope} ≥ 1.3; SLOPE/W output illustrating the predicted critical geotechnical failure mechanism and corresponding FoS_{slope} is provided in Figure 4-1.

Under transient conditions, the proposed cutback slope is anticipated to be geotechnically unstable with a high potential for large slumping failure onto the pit base regardless of how mild the cutback slope gradient where blasting works are required for the new open mine pit development. If blasting is anticipated all in-situ tailings material will have to be removed from the FBP prior to any blasting works.

4.4 Track Ground Bearing Pressure Assessment

An assessment to estimate the maximum allowable track ground bearing pressure (q_{all}) has been undertaken based on recommendations by Lyamin et al (2007), utilising the design geotechnical parameters provided in Table 3-2, and considers the following assumptions:

- The earthwork machineries comprise dozers and / or excavators than run on tracks; and
- The track width is at least 600 mm or more;
- Fine Tailings material geotechnically behave in an undrained manner due to vibrations induced by the earthworks machinery; and
- A minimum geotechnical bearing capacity FoS of 3.0 has been applied.

The estimated q_{all} for the different in-situ tailings material, including recommendations of suitable earthwork machineries, are summarised in Table 4-2 below.

Table 4-2 Maximum allowable ground-bearing pressure and earthwork machinery recommendation

In-situ tailings material	Maximum allowable ground-bearing pressure, q_{all} (kPa)	Earthwork machinery recommendation
Coarse Tailings	150	Cat D11T dozer or equivalent

In-situ tailings material	Maximum allowable ground-bearing pressure, q_{all} (kPa)	Earthwork machinery recommendation
Fine Tailings present above RL 375 m	100	Cat D8T dozer or equivalent
Fine Tailings present below RL 365 m	140	Cat D11T dozer or equivalent

4.5 Cutback earthworks sequence considerations

It is anticipated that the tailings cutback earthworks will have to be undertaken in conjunction with the advancement of the new open mine pit, and the following earthworks sequence should be considered:

1) Excavation into natural ground within the new open mine pit footprint is advanced down by increments of not more than 3 m depth (referred to below as newly-excavated basin);
2) Dozers (as per recommendation in Table 4-2) are used to push the in-situ tailings onto the newly-excavated floor where truck and excavators are located on natural ground to facilitate load and haul operations for the mine waste, tailings and ore, as appropriate;
3) The newly-excavated basin is advanced another 3 m depth, and the above earthwork sequence is repeated.

Figure 4-1 Geotechnical slope stability analysis output – Static soil stress condition

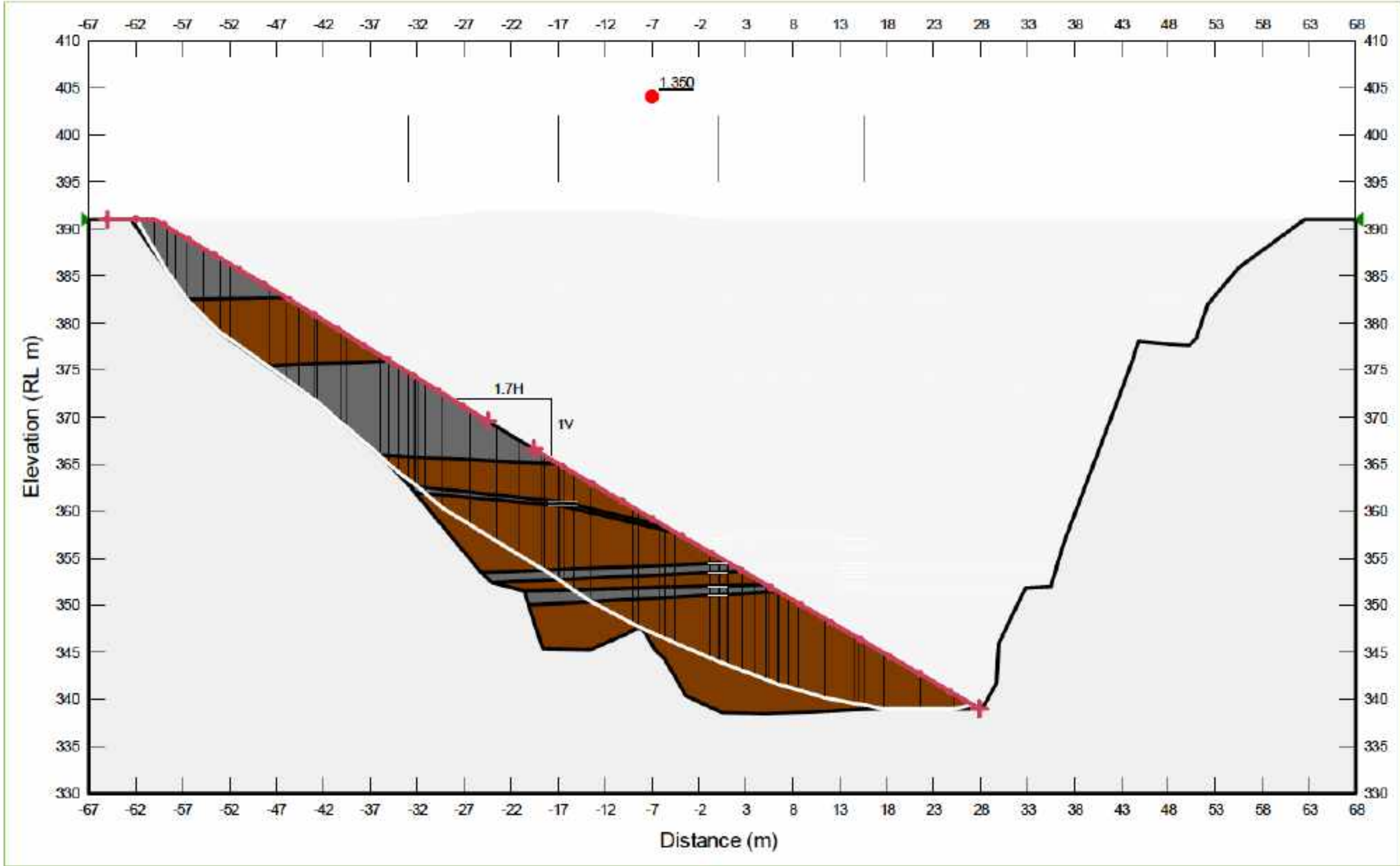
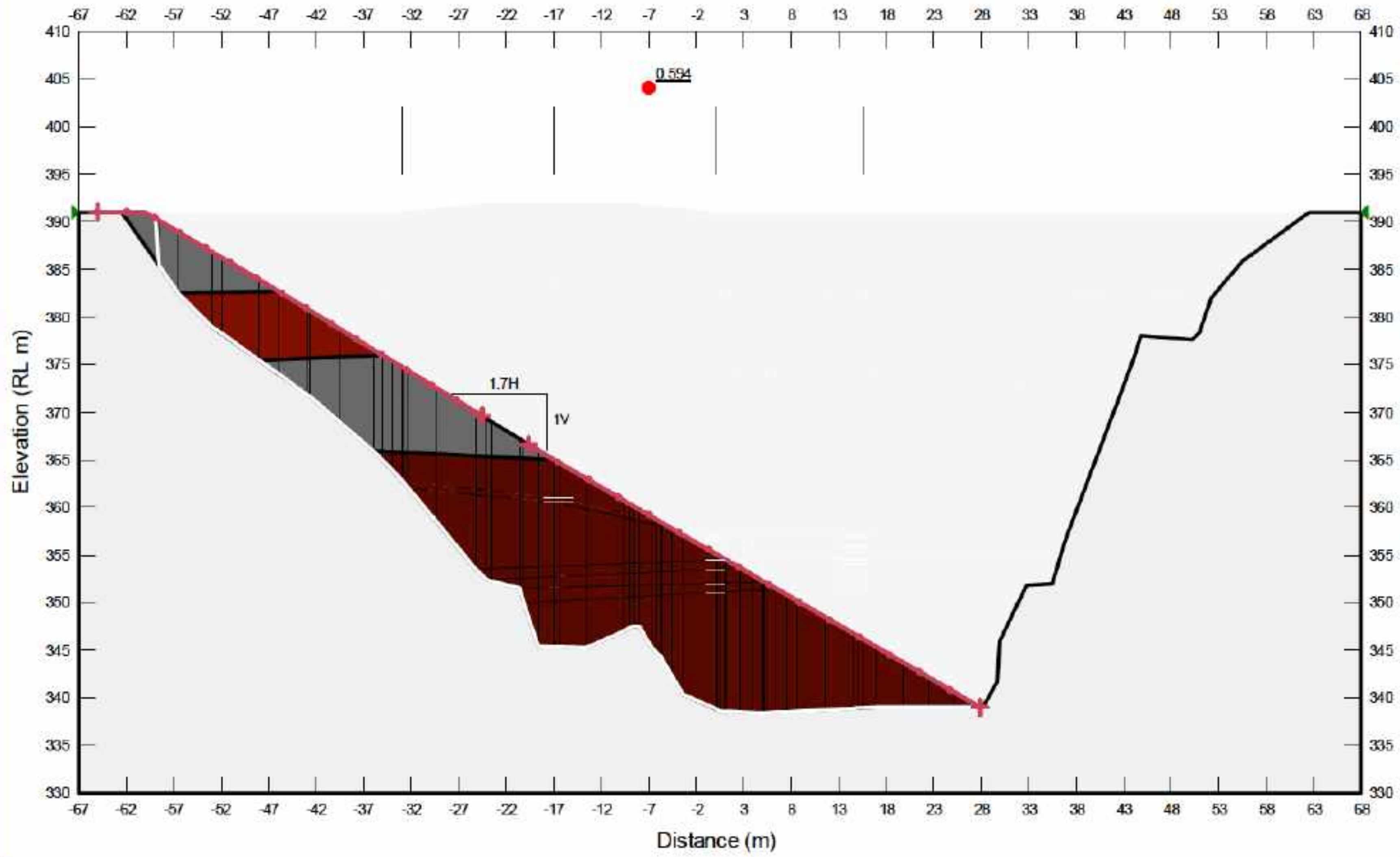


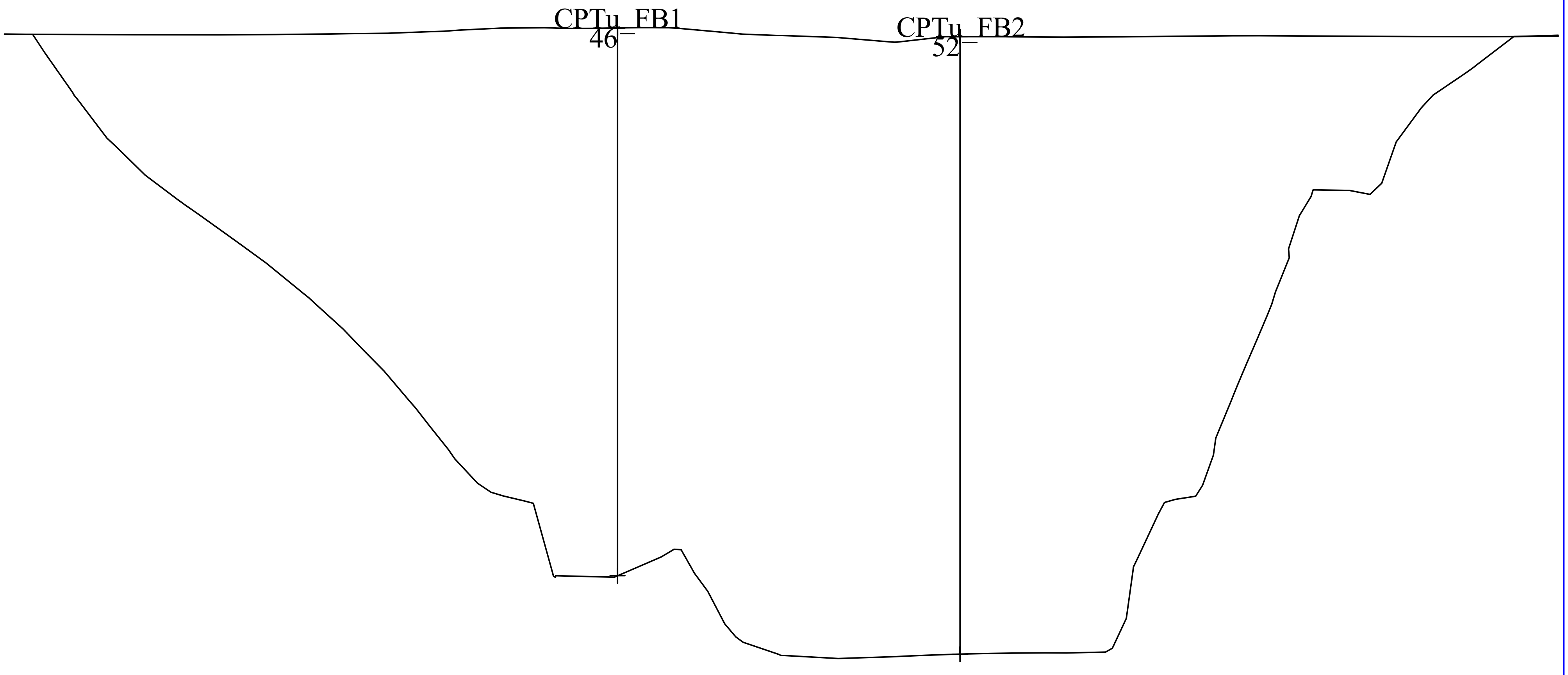
Figure 4-2 Geotechnical slope stability analysis output – Transient soil stress condition



5. REFERENCE

1. Lyamin, A.V., Salgado, R., Sloan, S.W., and Prezzi, M. (2007) “Two- and three-dimensional bearing capacity of footings in sand”, *Geotechnique*, Vol. 57, no. 8, pp. 647 - 662
2. Robertson, P.K. (2015), *Guide to Cone Penetration Testing*, 6th Edition

Appendix A Client-supplied information



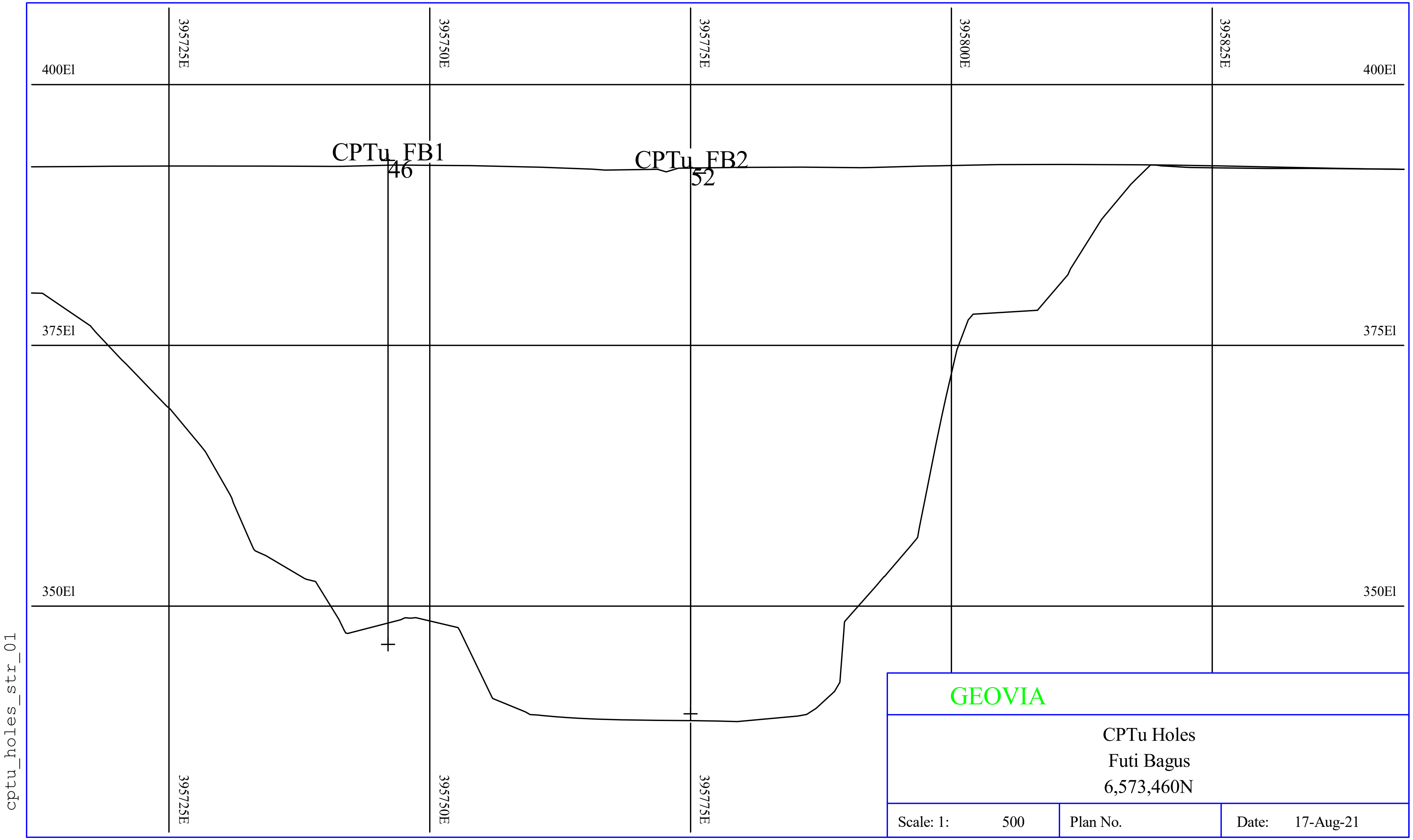
GEOVIA

CPTu Holes
Futi Bagus

Scale: 1: 500	Plan No.	Date: 17-Aug-21

cptu_holes_str

SURPAC - GEOVIA



GEOVIA

CPTu Holes
Futi Bagus
6,573,460N

Scale: 1: 500	Plan No.	Date: 17-Aug-21

SURPAC - GEOVIA

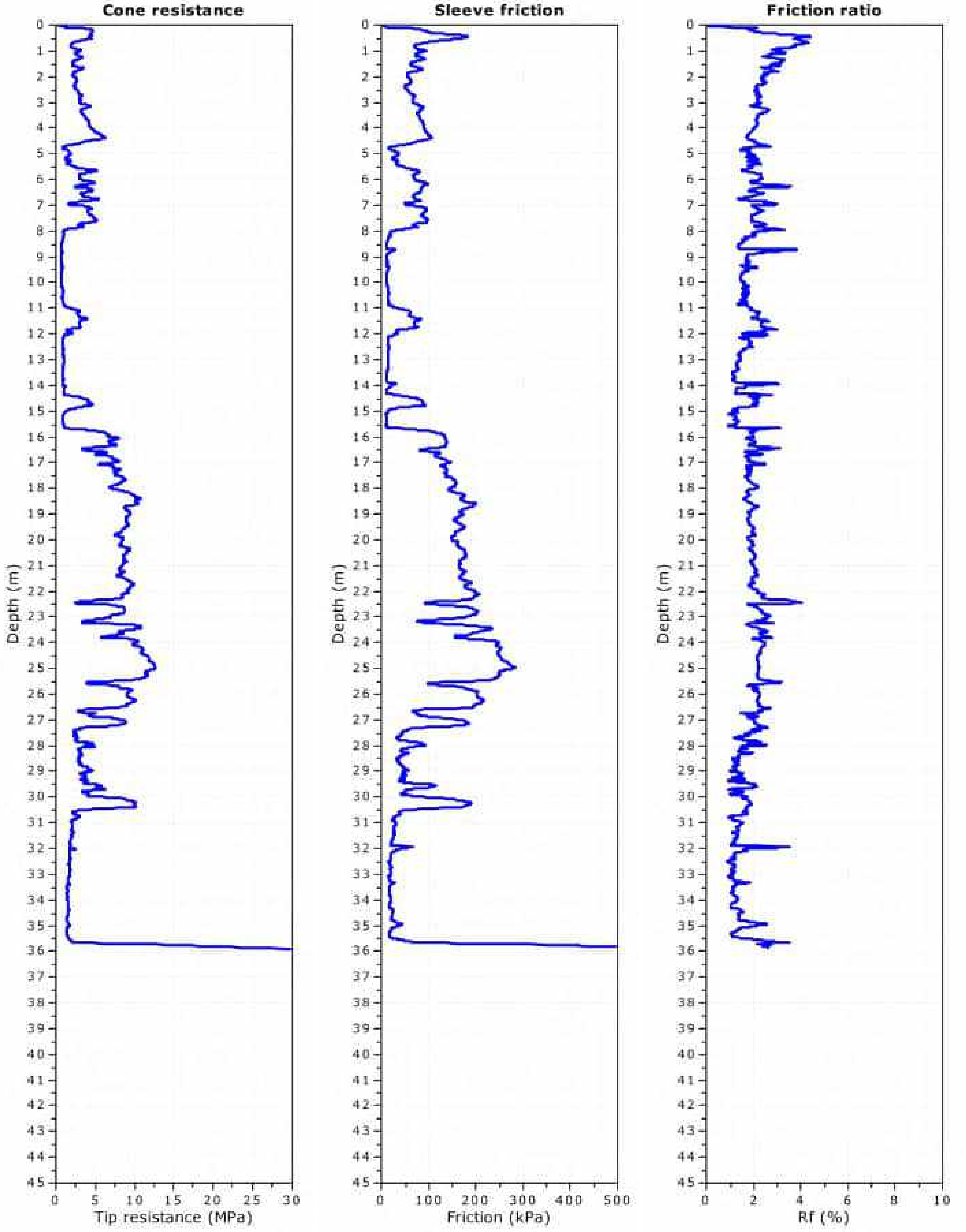
Appendix B Geotechnical site investigation data – CPTu plots

info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB1

Total depth: 35.95 m, Date: 24/08/2021
Surface Elevation: 391.02 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395745.20, Y:6573466.26
Cone Operator: Andrew

Futi Bagus **Futi Bagus Tailings**
Kalgoorli **Kalgoorlie**

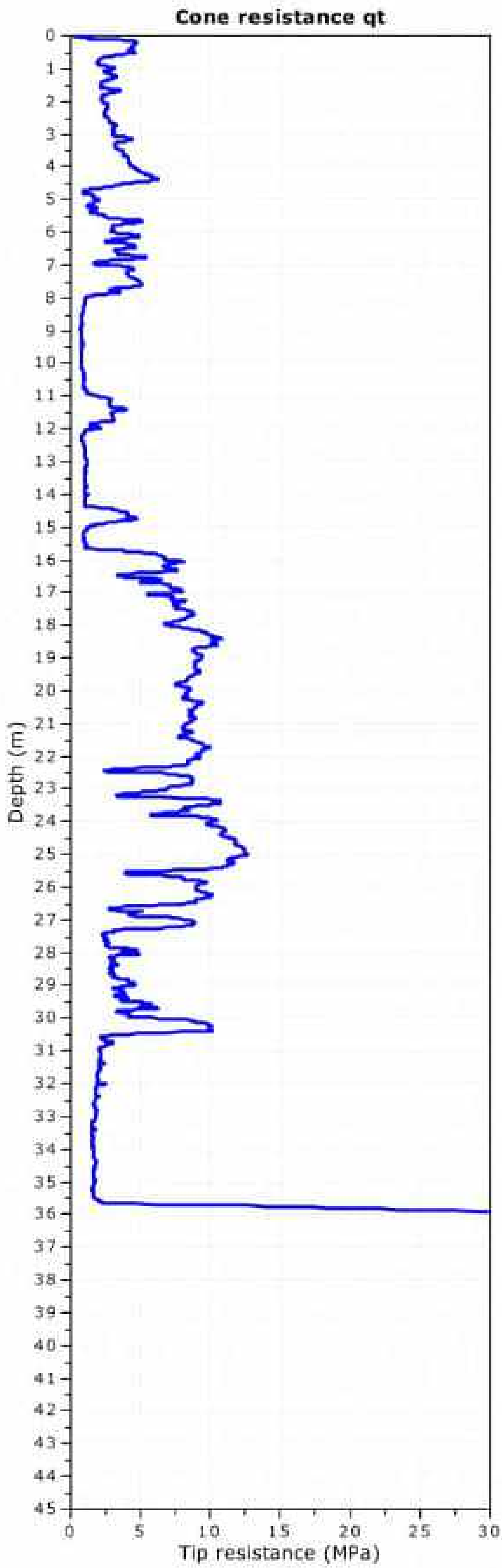


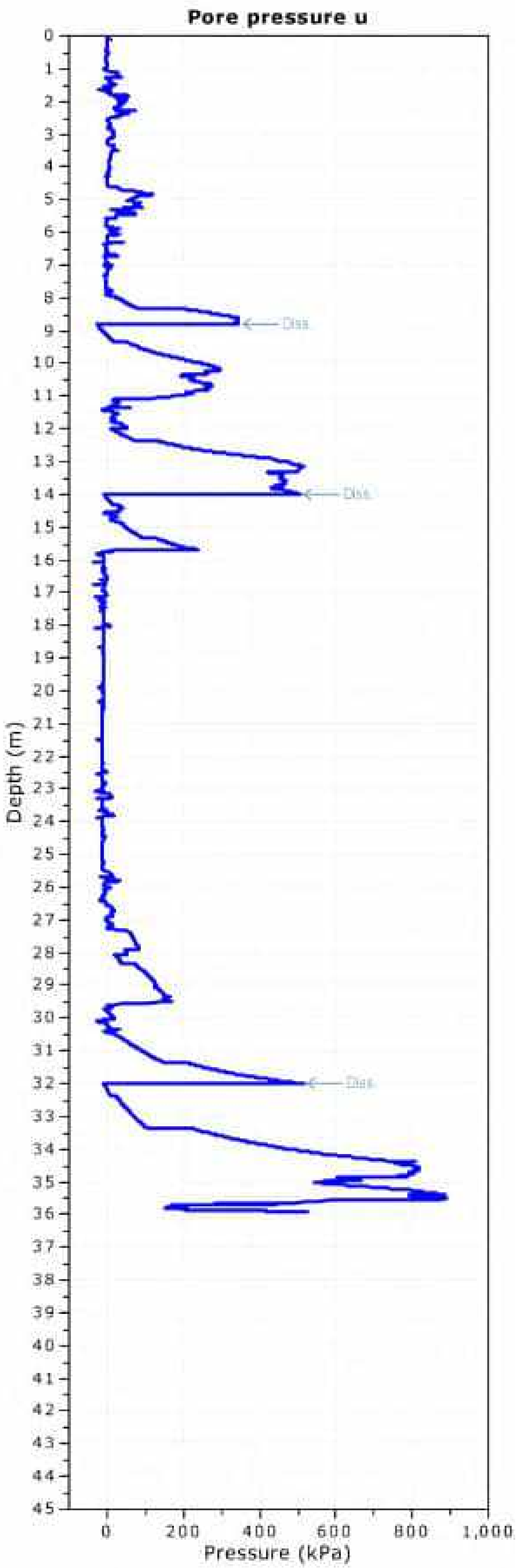
info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB1

Total depth: 35.95 m, Date: 24/08/2021
Surface Elevation: 391.02 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395745.20, Y:6573466.26
Cone Operator: Andrew

Futi Bagus **Futi Bagus Tailings**
Kalgoorli **Kalgoorlie**



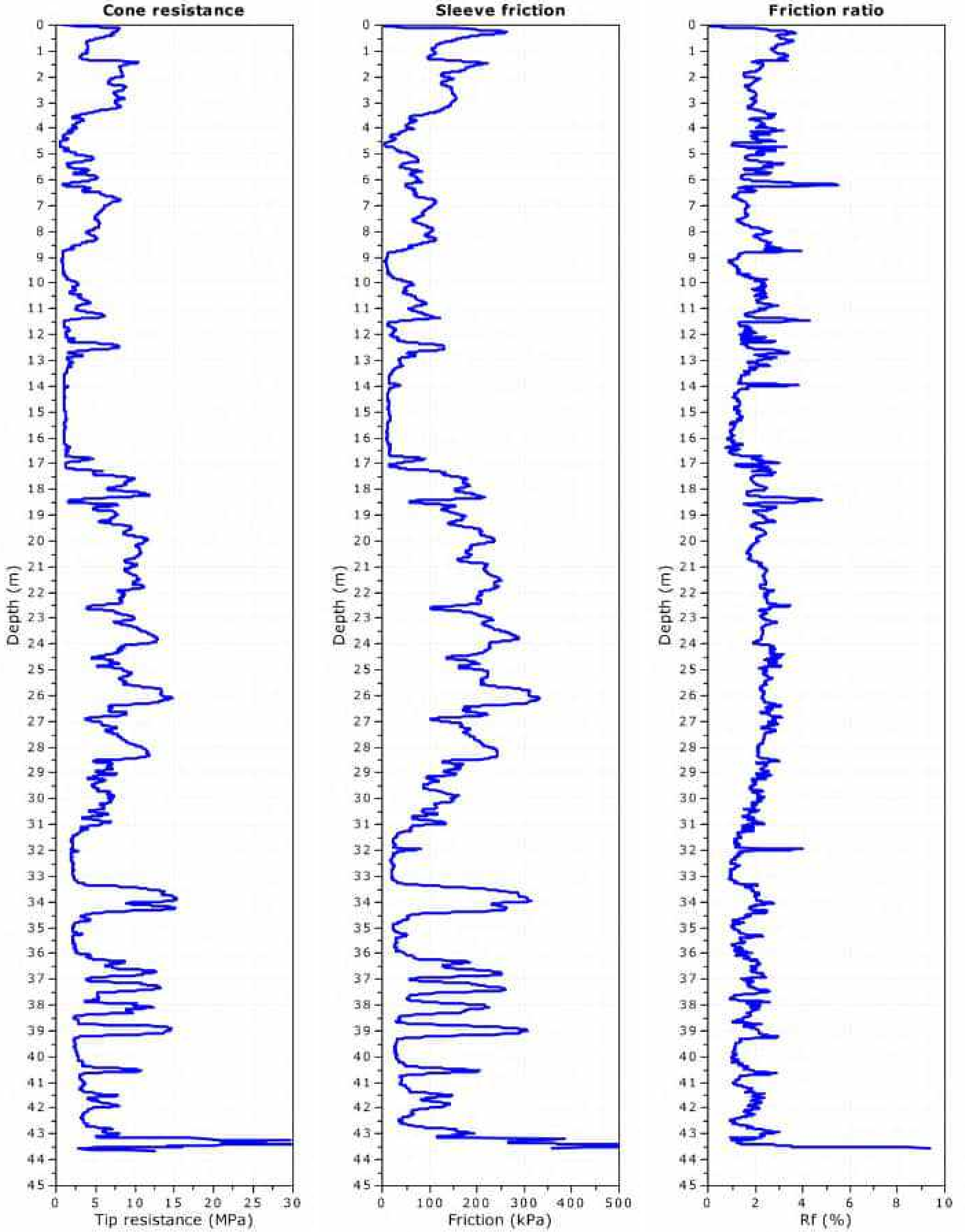


info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB2

Total depth: 43.65 m, Date: 24/08/2021
Surface Elevation: 391.53 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395774.84, Y:6573453.11
Cone Operator: Andrew

Futi Bagus Futi Bagus Tailings
Kalgoorli Kalgoorlie

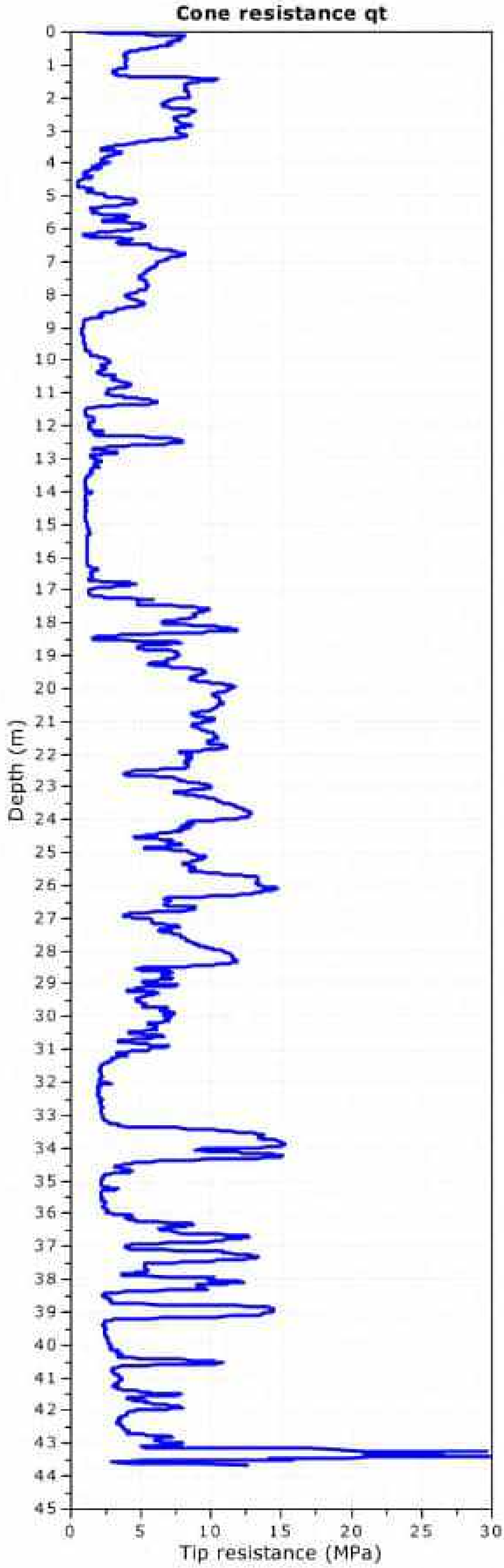


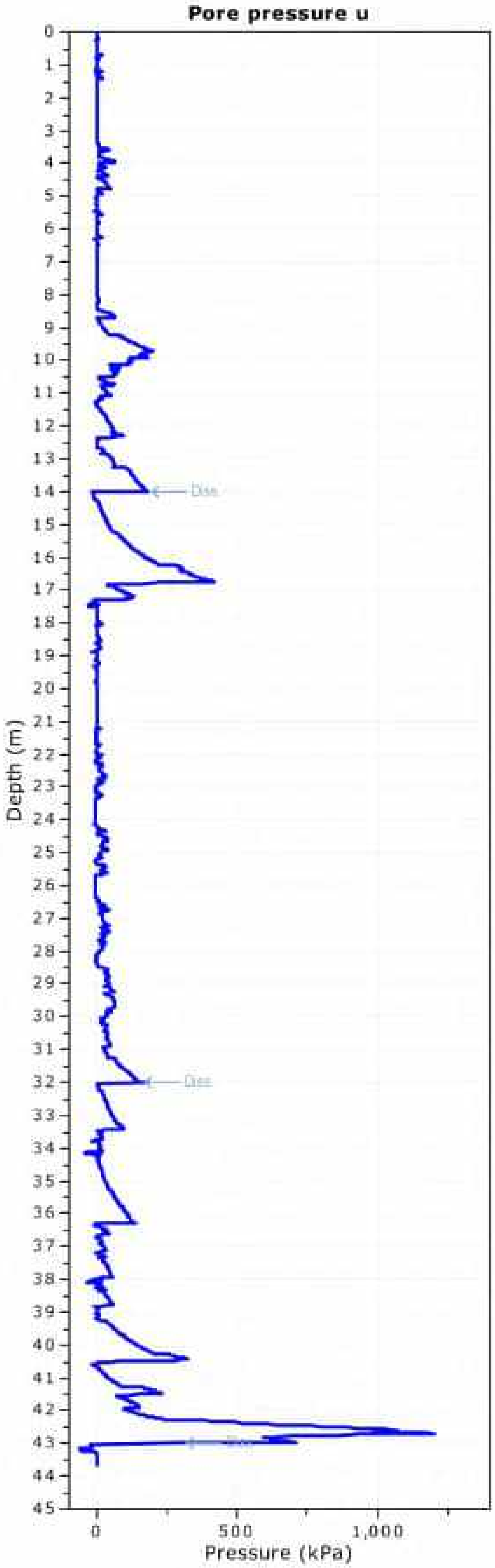
info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB2

Total depth: 43.65 m, Date: 24/08/2021
Surface Elevation: 391.53 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395774.84, Y:6573453.11
Cone Operator: Andrew

Futi Bagus Kalgoorli **Futi Bagus Tailings**
Kalgoorli **Kalgoorlie**



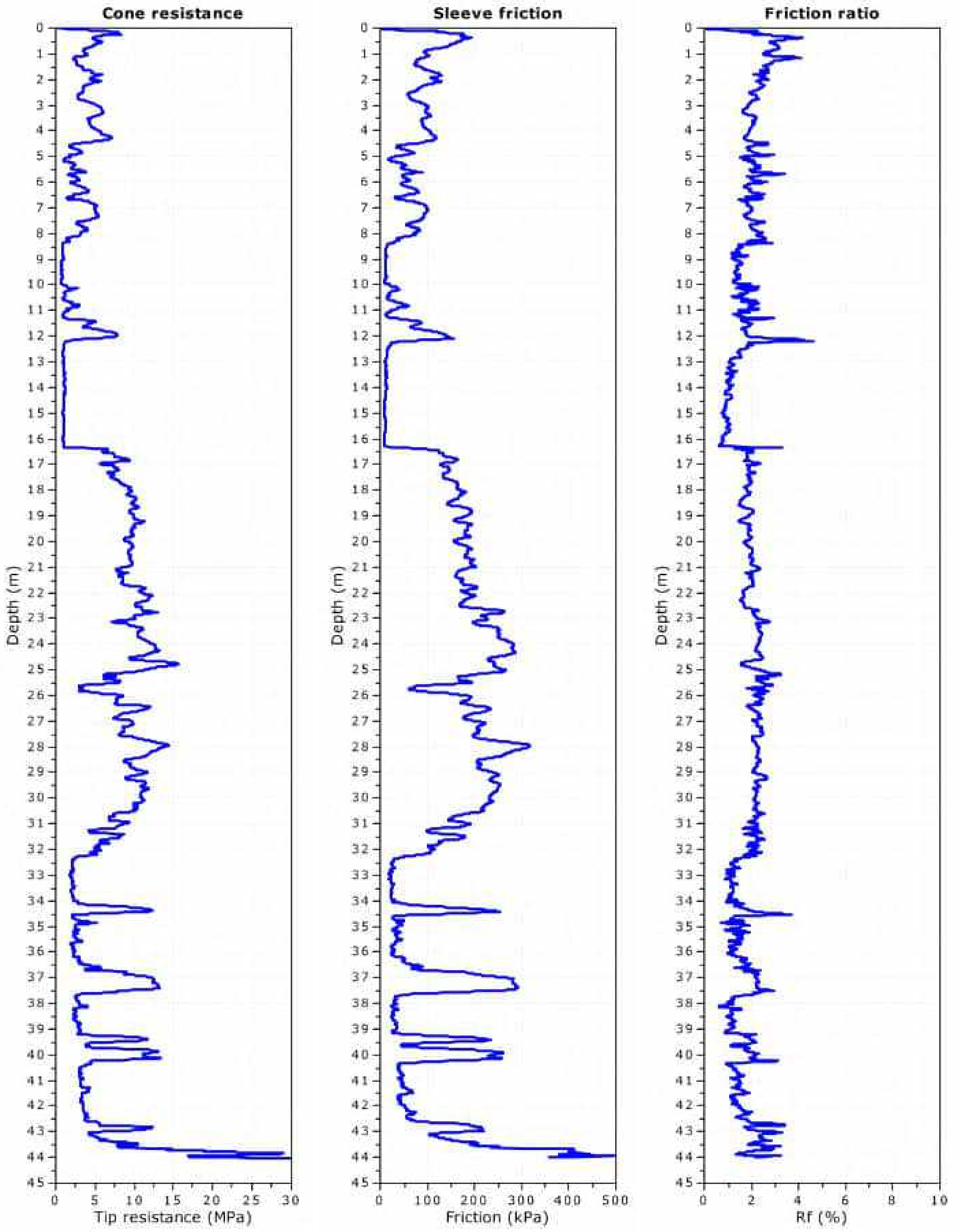


info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB3

Total depth: 44.08 m, Date: 24/08/2021
Surface Elevation: 391.21 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395760.66, Y:6573459.69
Cone Operator: Andrew

Futi Bagus **Futi Bagus Tailings**
Kalgoorli **Kalgoorlie**

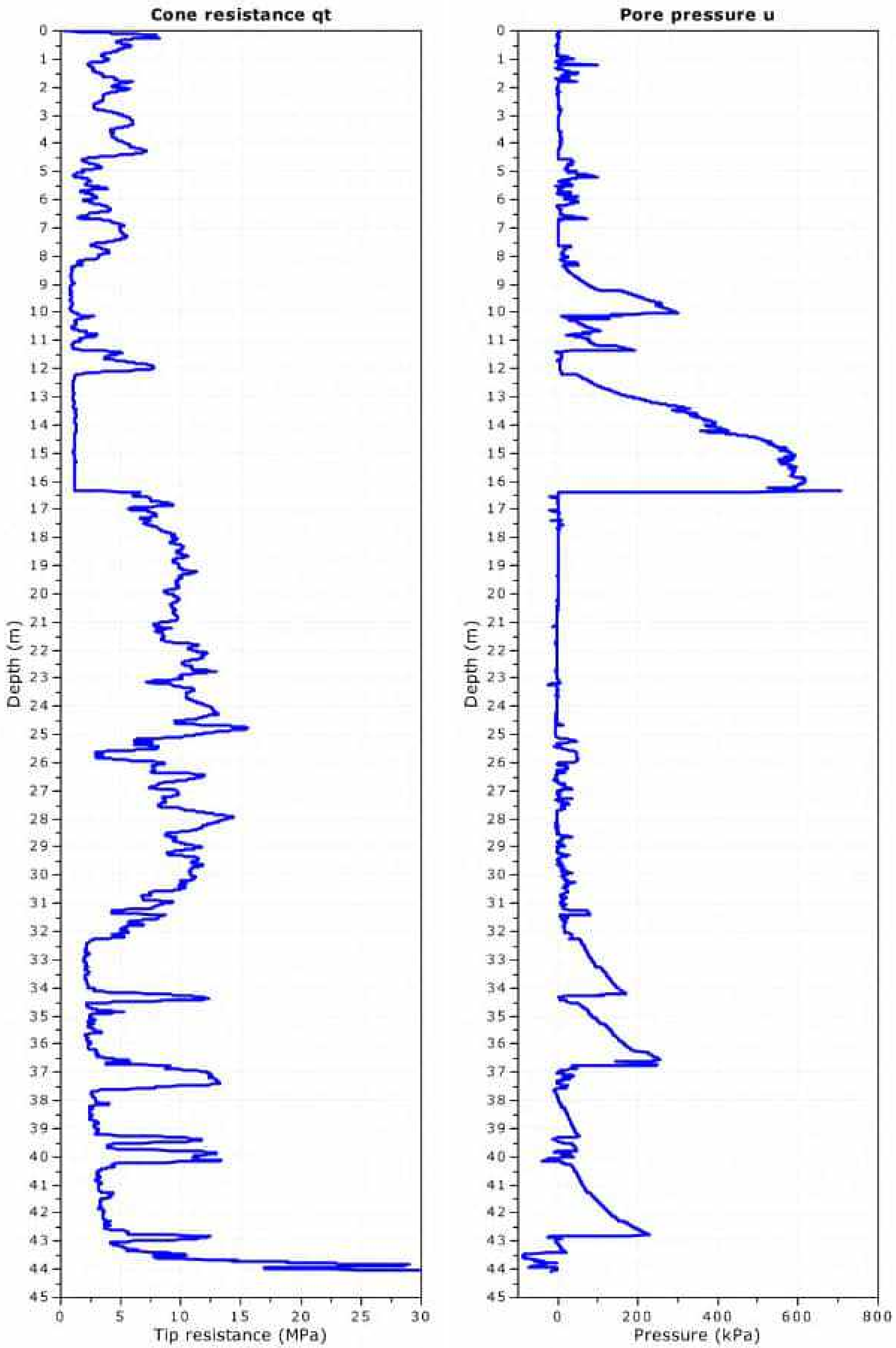


info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB3

Total depth: 44.08 m, Date: 24/08/2021
Surface Elevation: 391.21 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395760.66, Y:6573459.69
Cone Operator: Andrew

Futi Bagus **Futi Bagus Tailings**
Kalgoorli **Kalgoorlie**

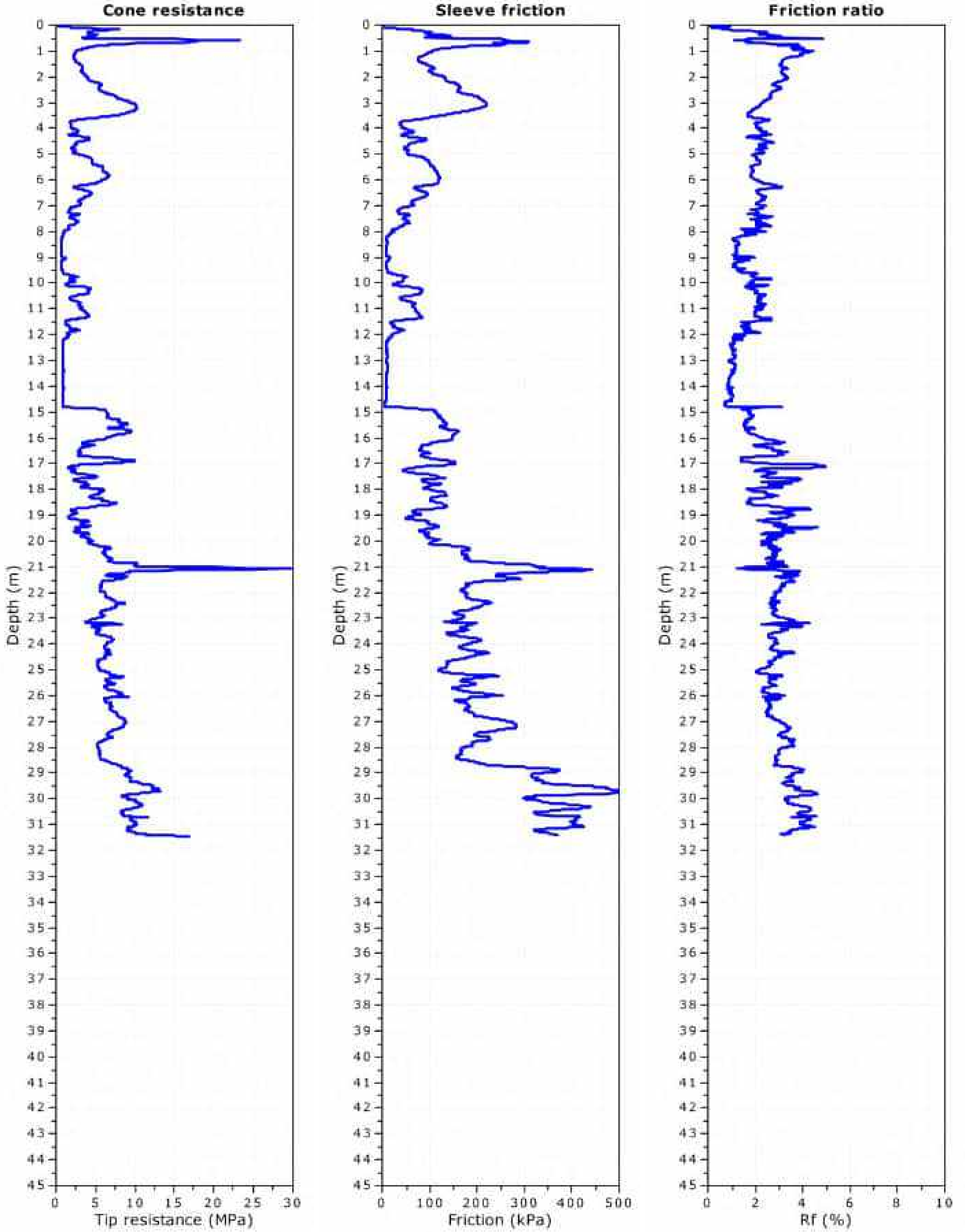


info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

CPTu_FB4

Total depth: 31.49 m, Date: 24/08/2021
Surface Elevation: 391.05 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395730.29, Y:6573472.71
Cone Operator: Andrew

Futi Bagus Tailings
Kalgoorlie Kalgoorlie

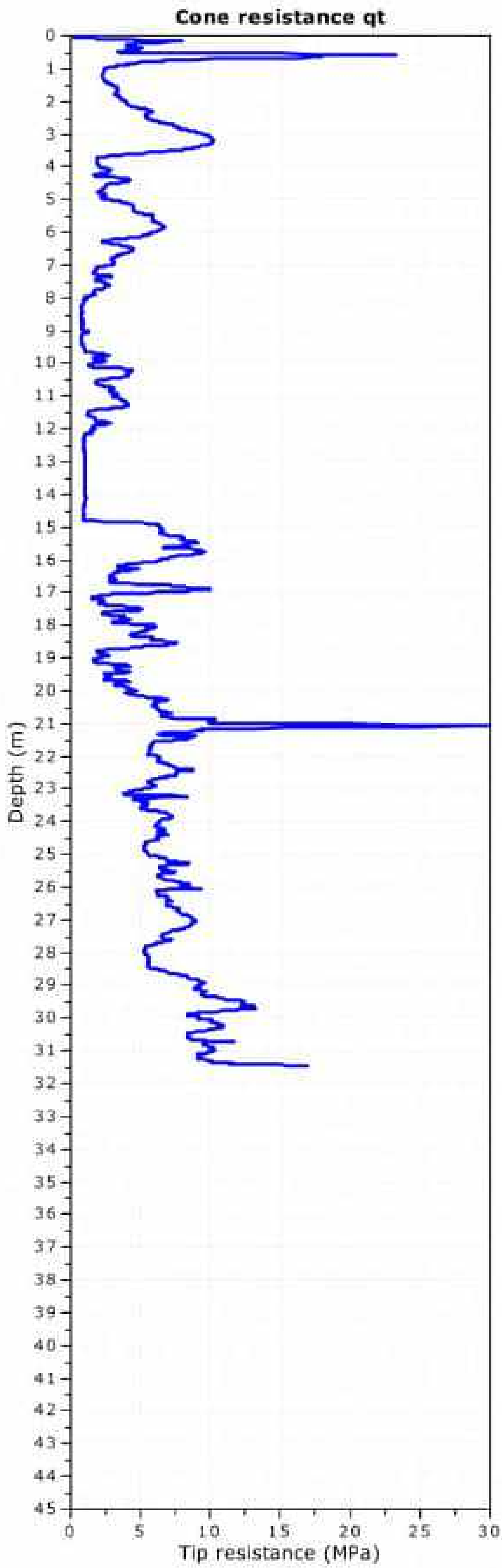


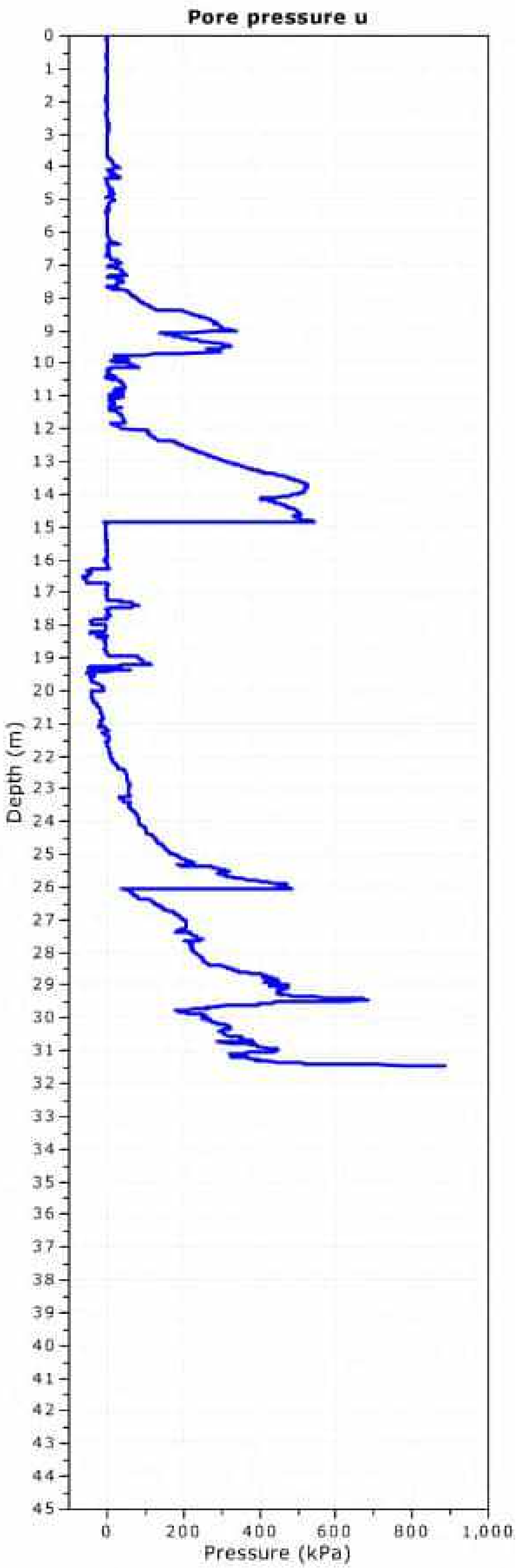
info@cptwest.com.au
www.cptwest.com.au
T: 0403 370 045

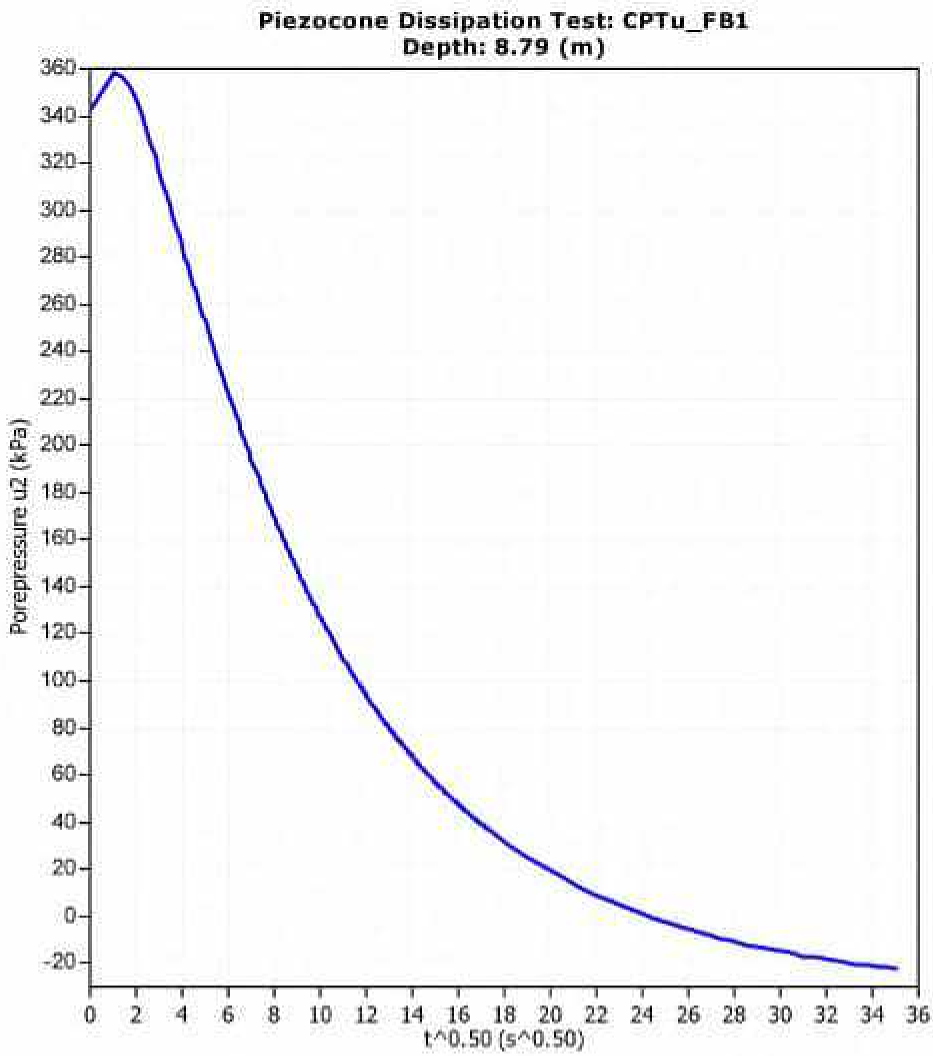
CPTu_FB4

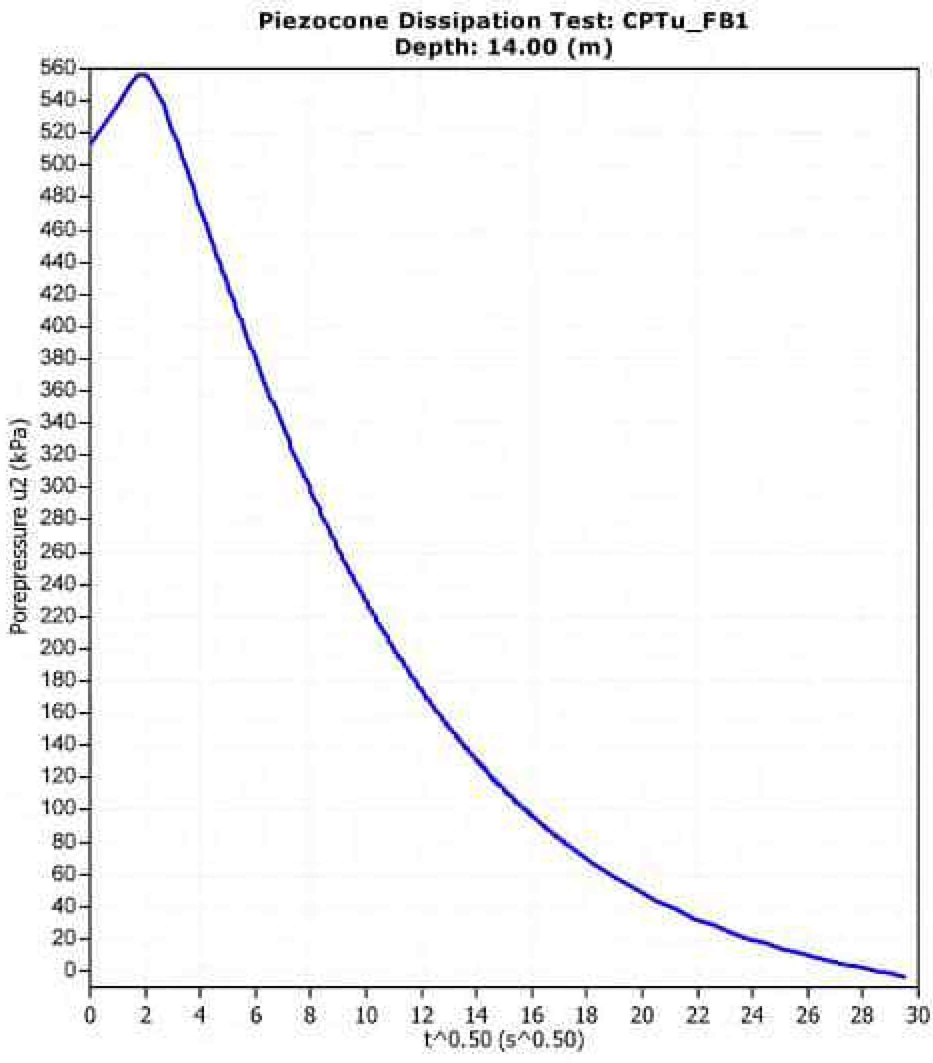
Total depth: 31.49 m, Date: 24/08/2021
Surface Elevation: 391.05 [(IIF(<unit_system>=0,'m','ft'))]
Coords: X:395730.29, Y:6573472.71
Cone Operator: Andrew

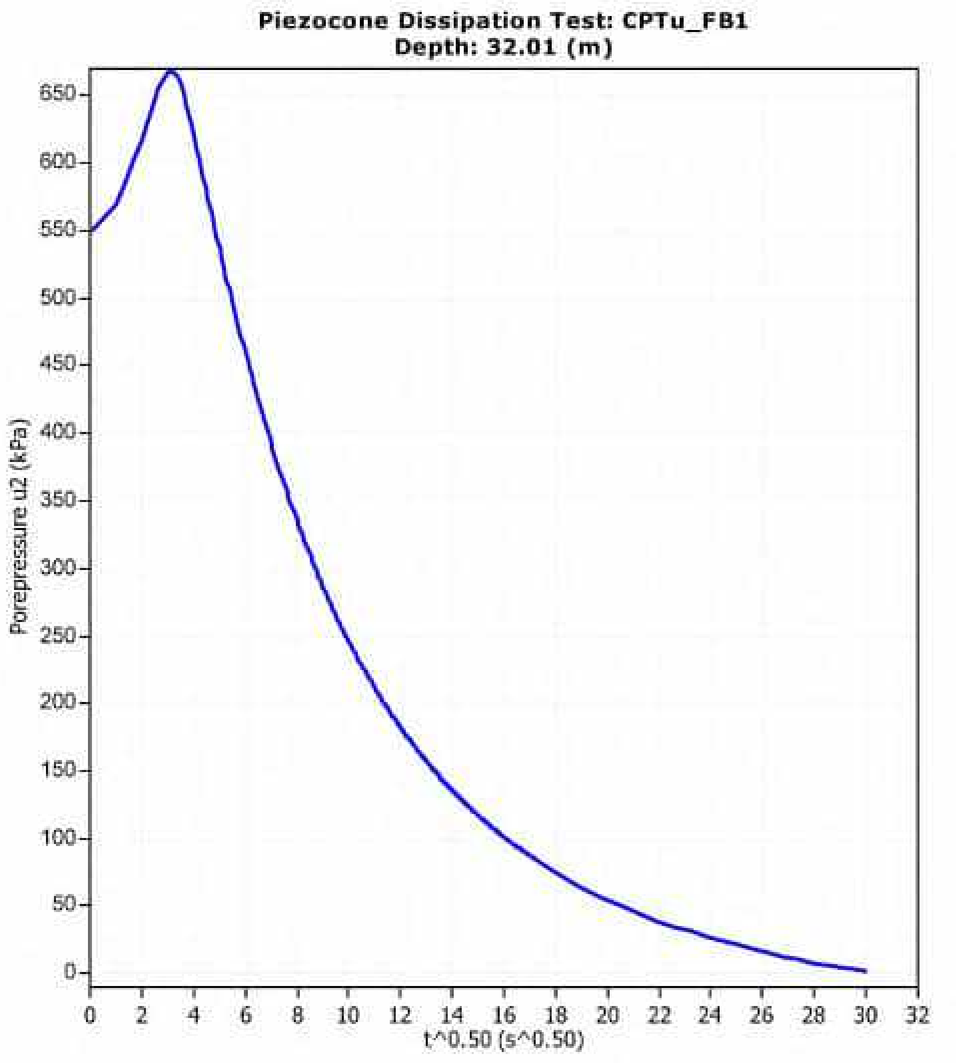
Futi Bagus **Futi Bagus Tailings**
Kalgoorli **Kalgoorlie**

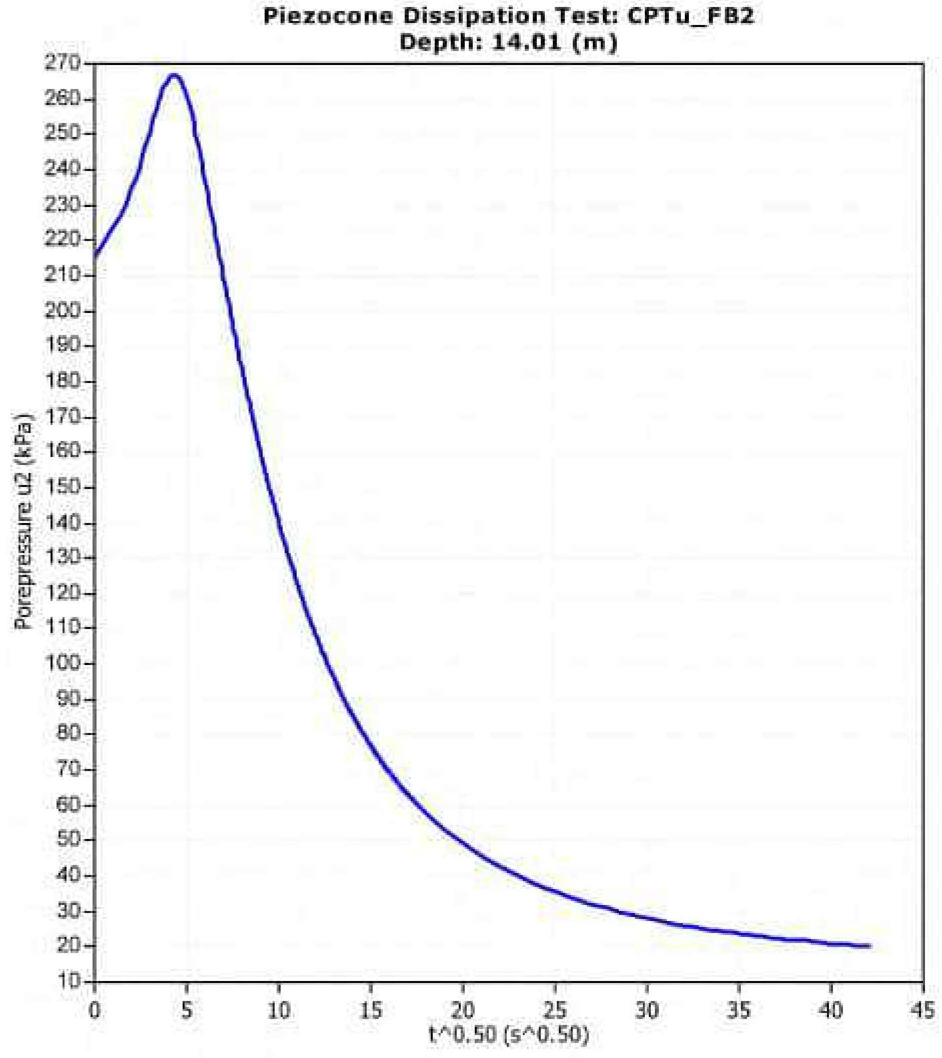


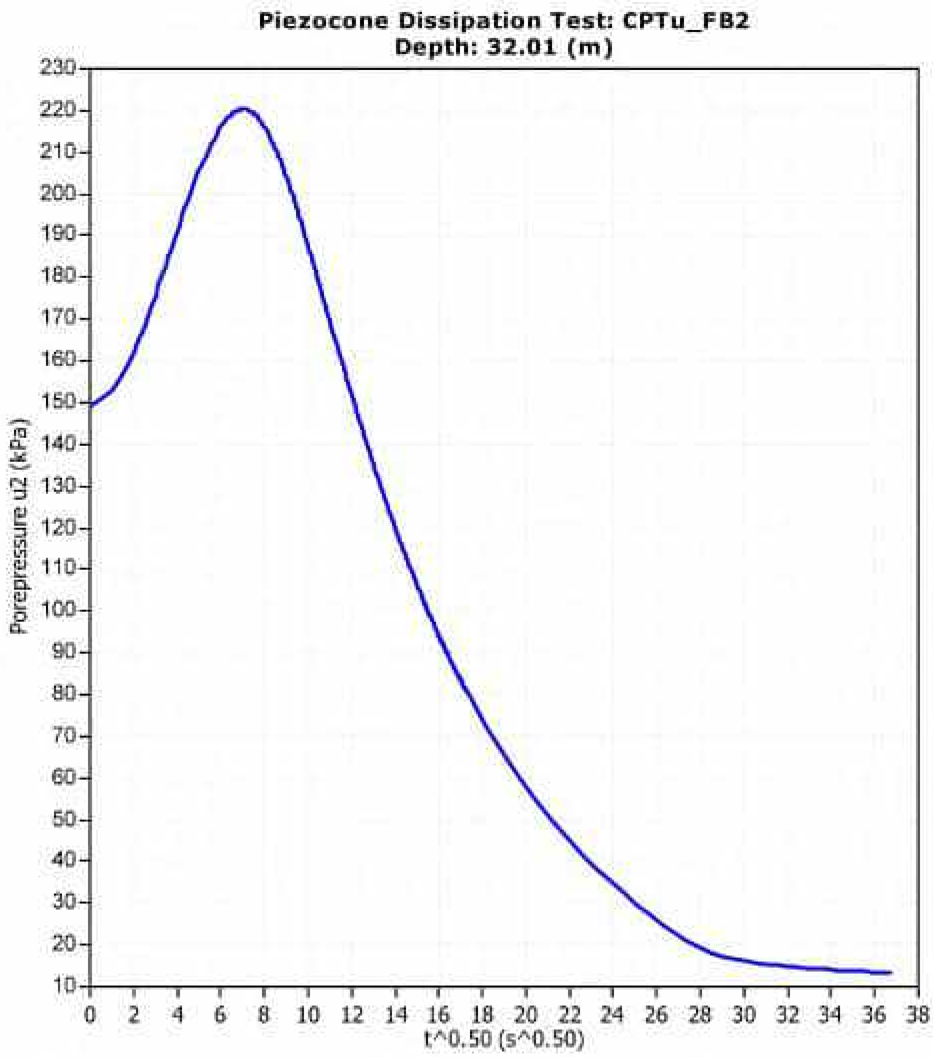


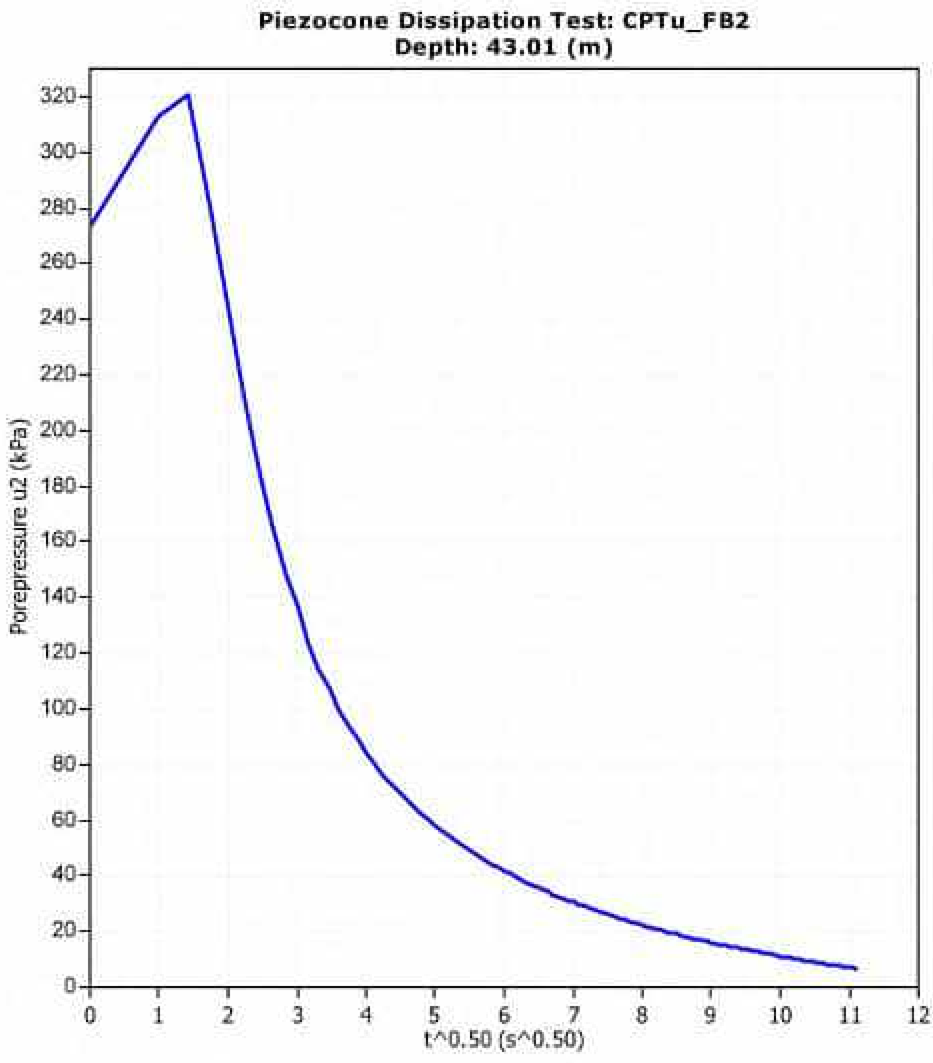

Piezocone Dissipation Test: CPTu_FB1
Depth: 8.79 (m)
Porepressure u2 (kPa)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
t^0.50 (s^0.50)


Piezocone Dissipation Test: CPTu_FB1
Depth: 14.00 (m)
Porepressure u2 (kPa)
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
t^0.50 (s^0.50)


Piezocone Dissipation Test: CPTu_FB1
Depth: 32.01 (m)
Porepressure u2 (kPa)
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
t^0.50 (s^0.50)


Piezocone Dissipation Test: CPTu_FB2
Depth: 14.01 (m)
Porepressure u2 (kPa)
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
5
10
15
20
25
30
35
40
45
t^0.50 (s^0.50)


Piezocone Dissipation Test: CPTu_FB2
Depth: 32.01 (m)
Porepressure u2 (kPa)
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
t^0.50 (s^0.50)


Piezocone Dissipation Test: CPTu_FB2
Depth: 43.01 (m)
Porepressure u2 (kPa)
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
11
12
t^0.50 (s^0.50)

Appendix C Geotechnical site investigation data – laboratory test certificates

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-PRECISION LABORATORY

RELATIVE DENSITY TEST REPORT

Test Method: AS1289 5.5.1

Client:	Geo Analytica	Date Tested:	08/09/2021
Project:	BC8 Futi Bagus Testing 2021	Date Reported:	14/09/2021
		EP Lab Job Number:	GEO
Lab:	EPLAB		
Tested by:	Phil		

Lab ID:	CPTU_FB1_MM	CPTU_FB3_MM			
Test Type:	MAX / MIN DENSITY	MAX / MIN DENSITY			
Depth (m):	19	19			
Lithology/Description:	-	-			
Moisture Content (%):	-	-			
Max Dry Density (t/m^3)	**1.509**	**1.547**			
Min Dry Density (t/m^3)	**1.292**	**1.342**			

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer): [redacted]

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-PRECISION LABORATORY

DENSITY REPORT

Test Method: In House

Client:	Geo Analytica	Date Tested:	2/09/2021
Project:	BC8 Futi Bagus Testing 2021	Lab:	EPLAB

Test Results

Sample ID	Depth (m)	Particle Density (t/m³)	Bulk Density (t/m³)	Moisture Content (%)	Void Ratio (ei)
CPTU FB1	9	2.919	1.871	43.22	1.23
CPTU FB1	19	3.011	1.724	6.79	0.87
CPTU FB3	19	2.966	1.739	6.32	0.81
CPTU FB2	21	3.041	1.878	8.09	0.75

Notes: tested using distilled water @ 19deg

Samples tested as supplied by client
Samples supplied by the Client

[redacted]

Perth
16 Gympie Way, Willetton
WA 6155

[redacted]

E-Precision Laboratory

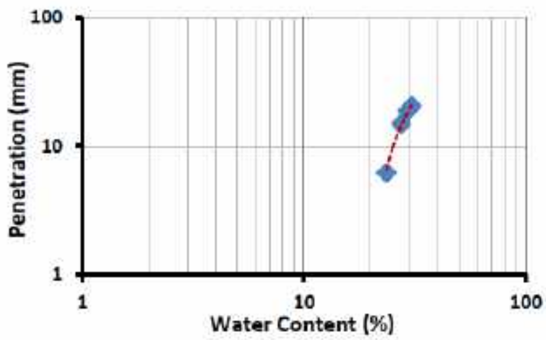
ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

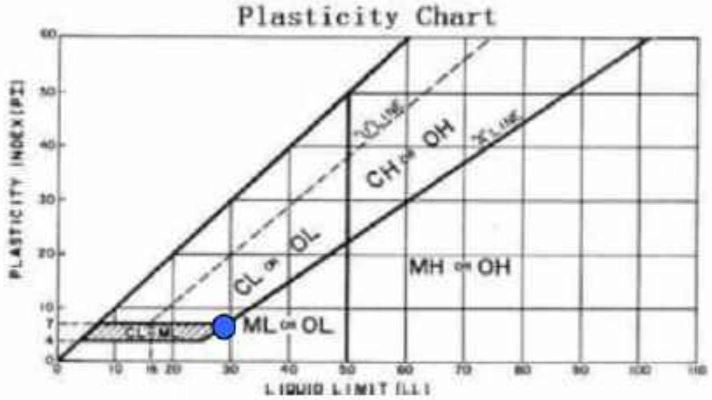
Client:	Geo Analytica	Date Tested:	12/09/2021
Project:	BC8 Futi Bagus Testing 2021	Lab:	EPLAB
Sample No:	CPTU_FB1	Job Number:	GEO
Lab ID:	CPTU_FB1_19.00_ATT		
Depth(m):	19	Room Temperature at Test:	20°C
Tested by:	Raymond	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	28.70
Plastic Limit (%):	21.41
Plasticity Index (%):	7.29
Liquidity Index (%):	-
Shrinkage Limit (%):	18.92
Linear Shrinkage(%):	2.19

Results Chart



Plasticity Chart



Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signature: [redacted]

Integrity Precision Innovation

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-Precision Laboratory

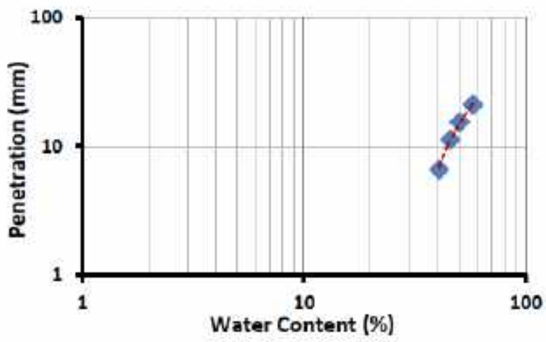
ATTERBERG LIMITS TEST REPORT

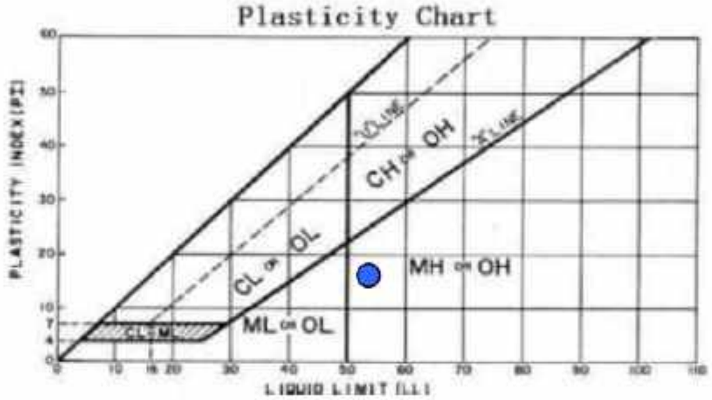
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Geo Analytica	Date Tested:	12/09/2021
Project:	BC8 Futi Bagus Testing 2021	Lab:	EPLAB
Sample No:	CPTU_FB1	Job Number:	GEO
Lab ID:	CPTU_FB1_9.00_ATT		
Depth(m):	9	Room Temperature at Test:	20°C
Tested by:	Raymond	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	52.80
Plastic Limit (%):	34.98
Plasticity Index (%):	17.82
Liquidity Index (%):	-
Shrinkage Limit (%):	26.12
Linear Shrinkage(%):	6.64

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received
Samples supplied by the Client

Authorised Signature: [redacted]

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Integrity Precision Innovation

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-Precision Laboratory

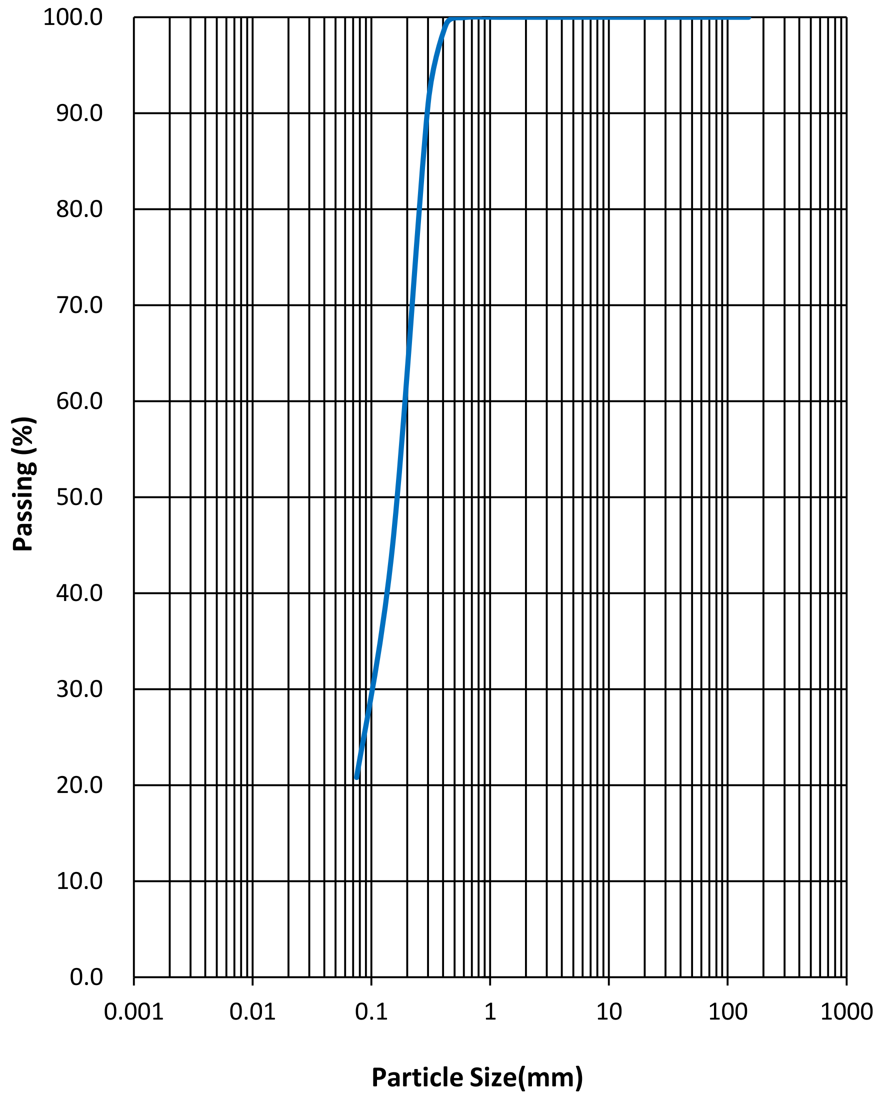
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1

Client:	Geo Analytica	Date Tested:	10/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Depth(m):	19
Lab ID:	CPTU_FB1_19.00_PSD	Room Temperature at Test:	19°C
Tested by:	Kohei	2.36mm Particle Density (t/m³):	-
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.425	99.3
0.3	91.0
0.15	44.8
0.075	20.8

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signatur[redacted]

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly sta[redacted]
Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Integrity Precision Innovation

Perth
16 Gympie Way, Willetton
WA 6155

[redacted]

E-Precision Laboratory

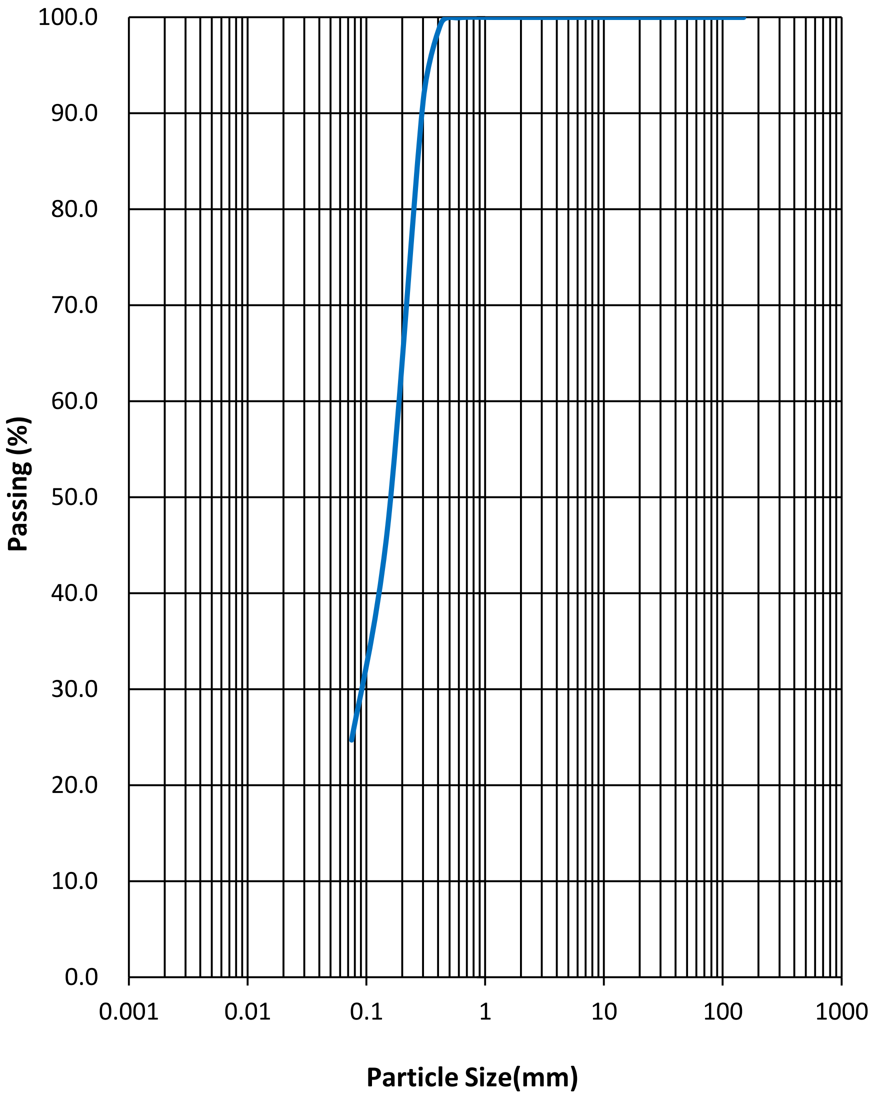
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1

Client:	Geo Analytica	Date Tested:	10/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Depth(m):	19
Lab ID:	CPTU_FB1_19.00_PSD	Room Temperature at Test:	19°C
Tested by:	Kohei	2.36mm Particle Density (t/m³):	-
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.425	99.4
0.3	91.3
0.15	46.6
0.075	24.7

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signature [redacted]

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-Precision Laboratory

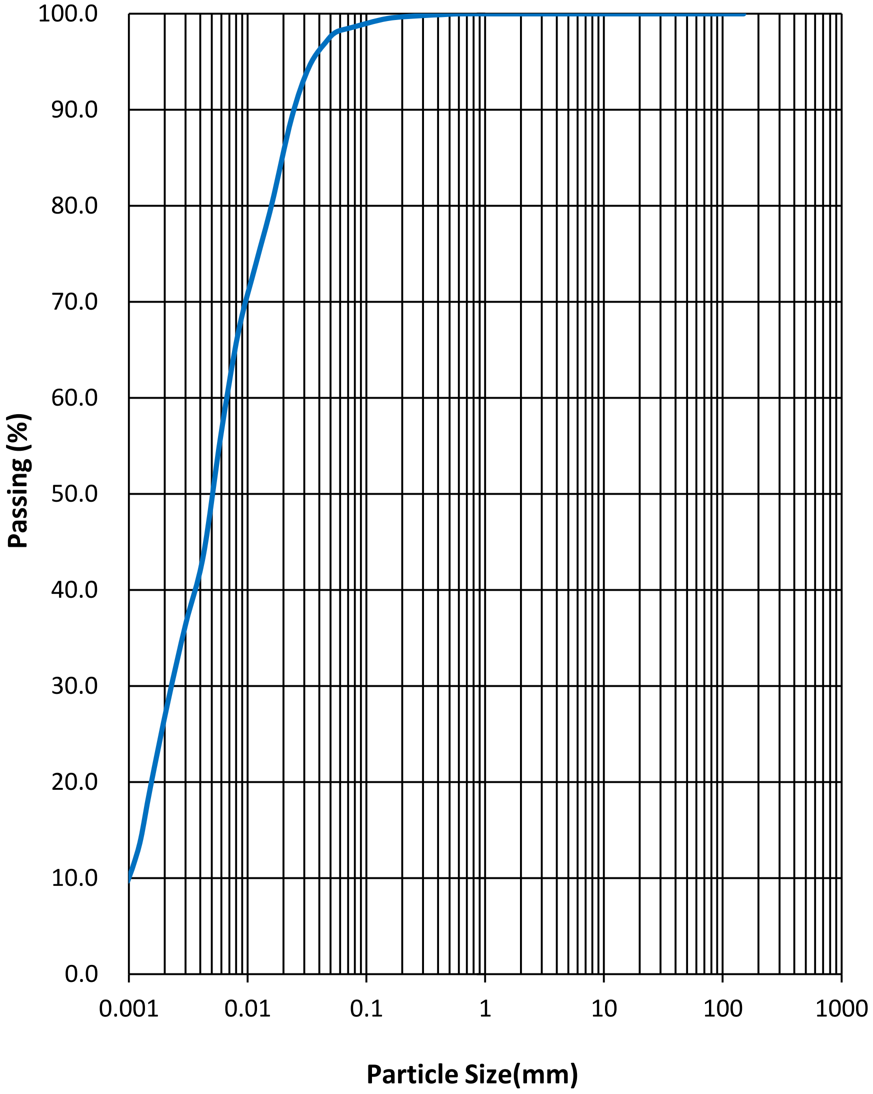
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Geo Analytica	Date Tested:	10/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Depth(m):	19
Lab ID:	CPTU_FB1_9.00_PSDH	Room Temperature at Test:	19°C
Tested by:	Kohei	2.36mm Particle Density (t/m³):	2.919
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.425	99.9
0.3	99.8
0.15	99.5
0.075	98.6
0.05579	98.1
0.04668	97.2
0.03306	94.5
0.02347	89.2
0.01601	80.2
0.01174	74.0
0.00835	66.8
0.00595	56.1
0.00424	43.6
0.00301	36.5
0.00214	28.4
0.00152	19.5
0.00126	14.1
0.00110	11.4
0.00098	9.7

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signature: [redacted]

Perth
16 Gympie Way, Willetton
WA 6155
[redacted]

E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

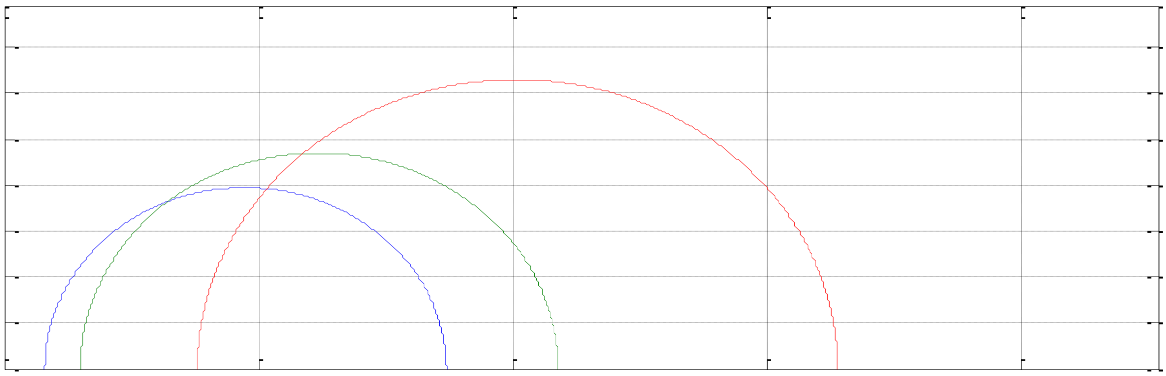
Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_15.50_CU3		
Depth (m):	15.5	Room Temperature at Test:	~ 18°c

Tested by:	Phil Li	Initial Moisture (%):	38.78	Strain Rate (mm/min):	0.006
Height (mm):	141.95	Final Moisture (%):	29.69	Skempton's (B):	1
Diameter (mm):	59.13	Bulk Density (t/m³):	2.15	Geology:	-
L/D Ratio:	2.40	Dry Density (t/m³):	1.55		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	17.45	20.53	23.22
Angle of Shear Resistance Φ' (Degrees) :	30.96	26.57	24.70

Accredited for compliance with ISO/IEC 17025-TESTING
NATA: 19078
Authorised Signatory (Geotechnical Engin [redacted]

NATA

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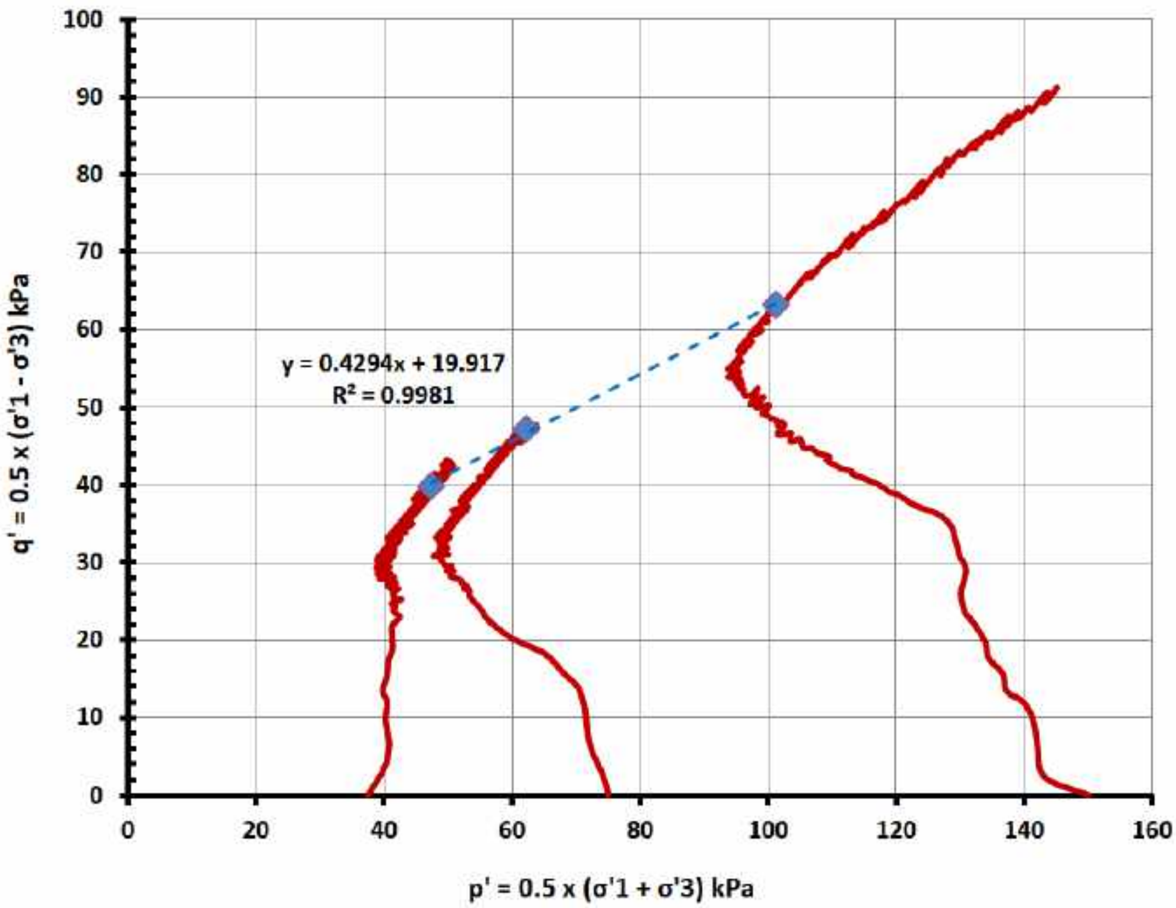
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_15.50_CU3		
Depth (m):	15.5	Room Temperature at Test:	~18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	22.06
Angle of Shear Resistance Φ' (Deg) :	25.47

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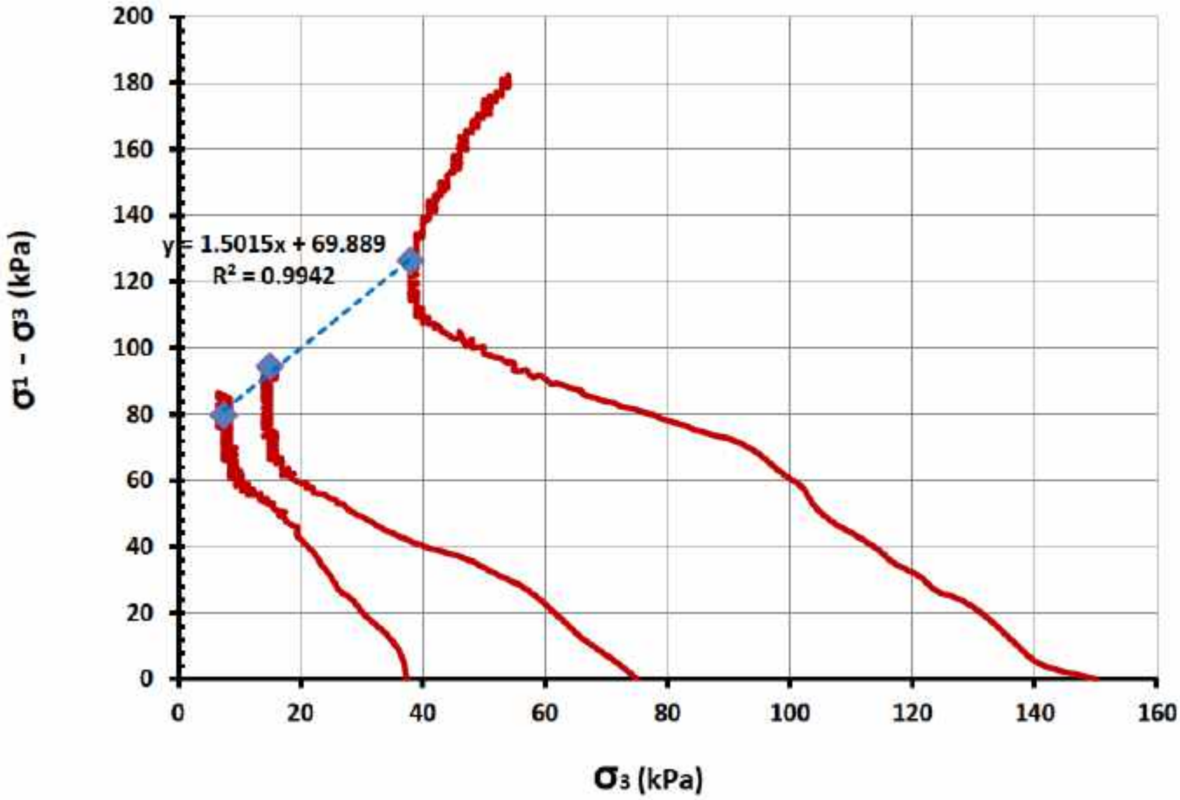
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_15.50_CU3		
Depth (m):	15.5	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	22.10
Angle of Shear Resistance Φ' (Deg) :	25.38

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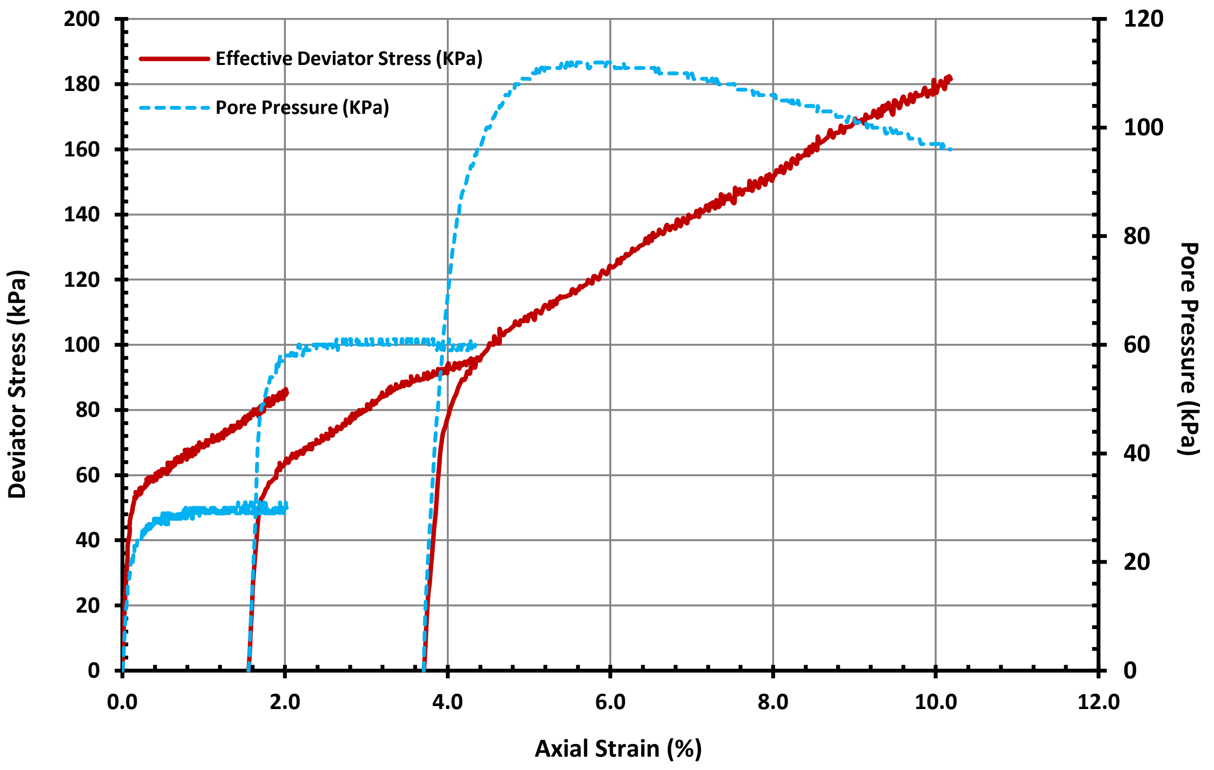
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_15.50_CU3		
Depth (m):	15.5	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	37.5	0	30	87	8	11.62	80	1.65
2	75	0	60	109	15	7.30	94	4.19
3	150	0	112	164	38	4.33	126	6.16

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_15.50_CU3		
Depth (m):	15.5	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	CPTU_FB2	**Depth (m):**	15/01/1900
Lab ID:	CPTU_FB2_15.50_CU3	**Date Tested:**	01/09/2021

Failure Mode: Bulging Failure

Notes: **Sample extruded from tubes**

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Eng**[redacted]

NATA ACCREDITATION NO: 19078

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

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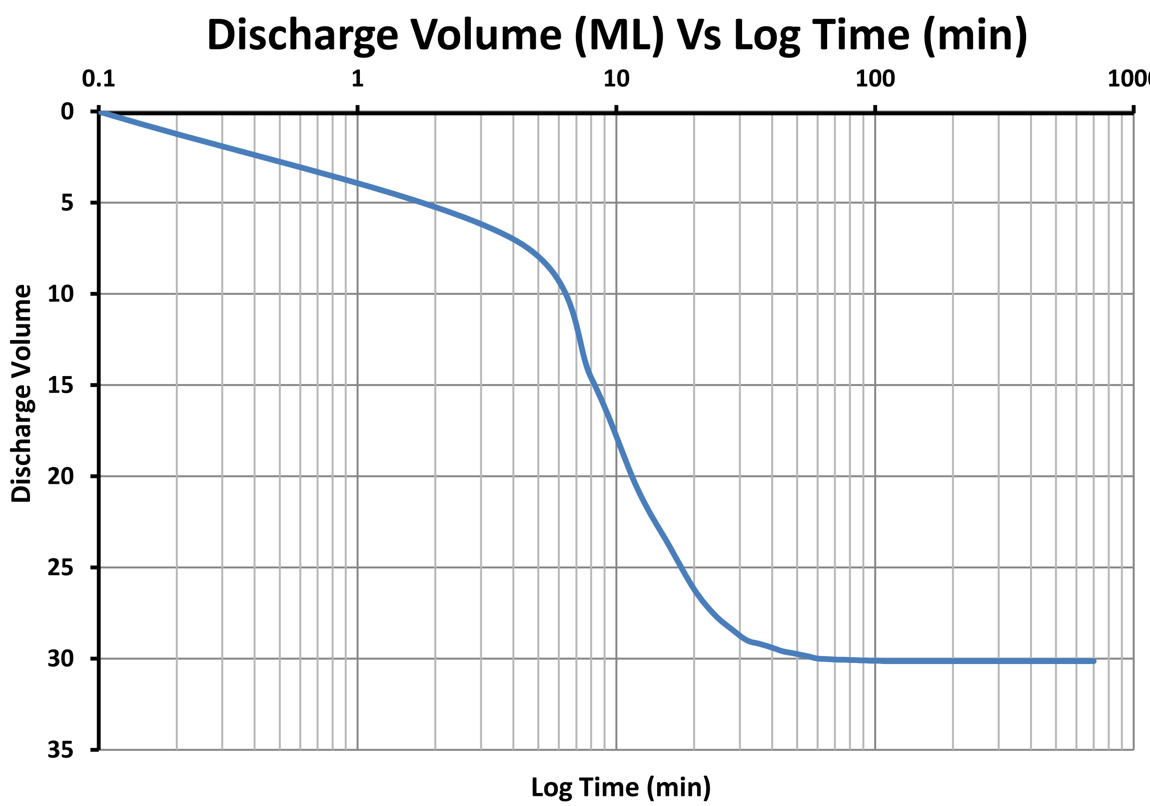
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_15.50_CU3		
Depth (m):	15.5	Room Temperature at Test:	~ 18°C



Cv (cm²/s): 0.050 based on t_{90}

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

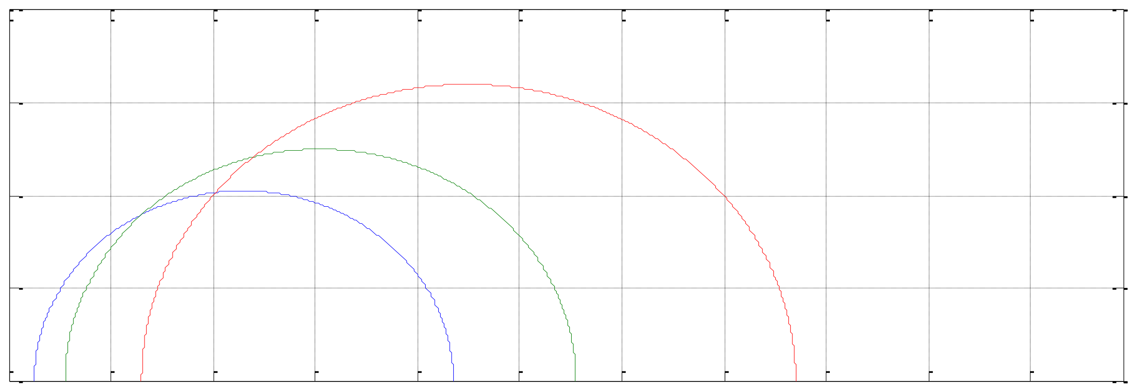
Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_13.00_CU3		
Depth (m):	13	Room Temperature at Test:	~ 18°c

Tested by:	Phil Li	Initial Moisture (%):	36.38	Strain Rate (mm/min):	0.006
Height (mm):	135.71	Final Moisture (%):	29.66	Skempton's (B):	0.98
Diameter (mm):	59.08	Bulk Density (t/m³):	2.14	Geology:	-
L/D Ratio:	2.30	Dry Density (t/m³):	1.57		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	16.75	19.89	23.47
Angle of Shear Resistance Φ' (Degrees) :	36.87	31.38	28.81

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NATA: 19078
Authorised Signatory (Geotechnical Engineer): [redacted]

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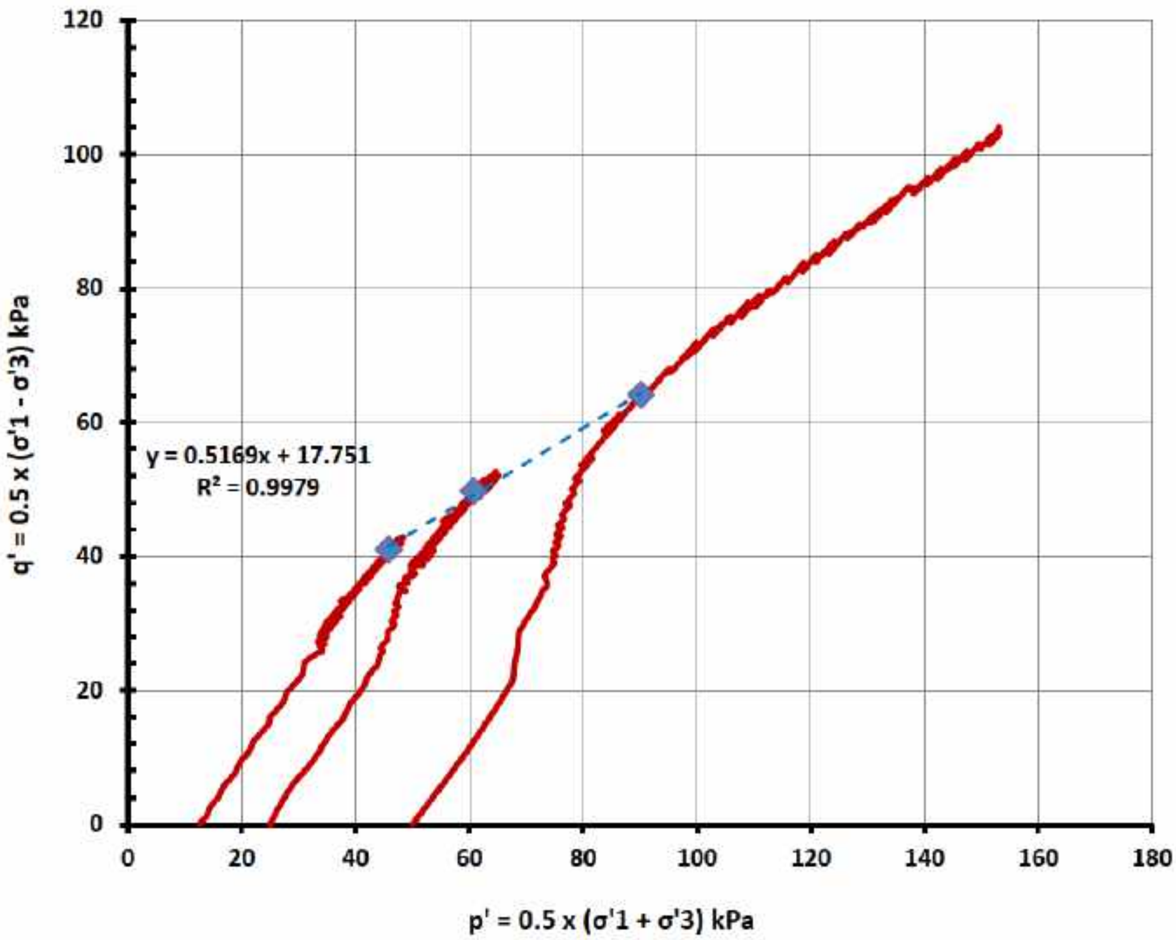
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_13.00_CU3		
Depth (m):	13	Room Temperature at Test:	~18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	20.78
Angle of Shear Resistance Φ' (Deg) :	31.33

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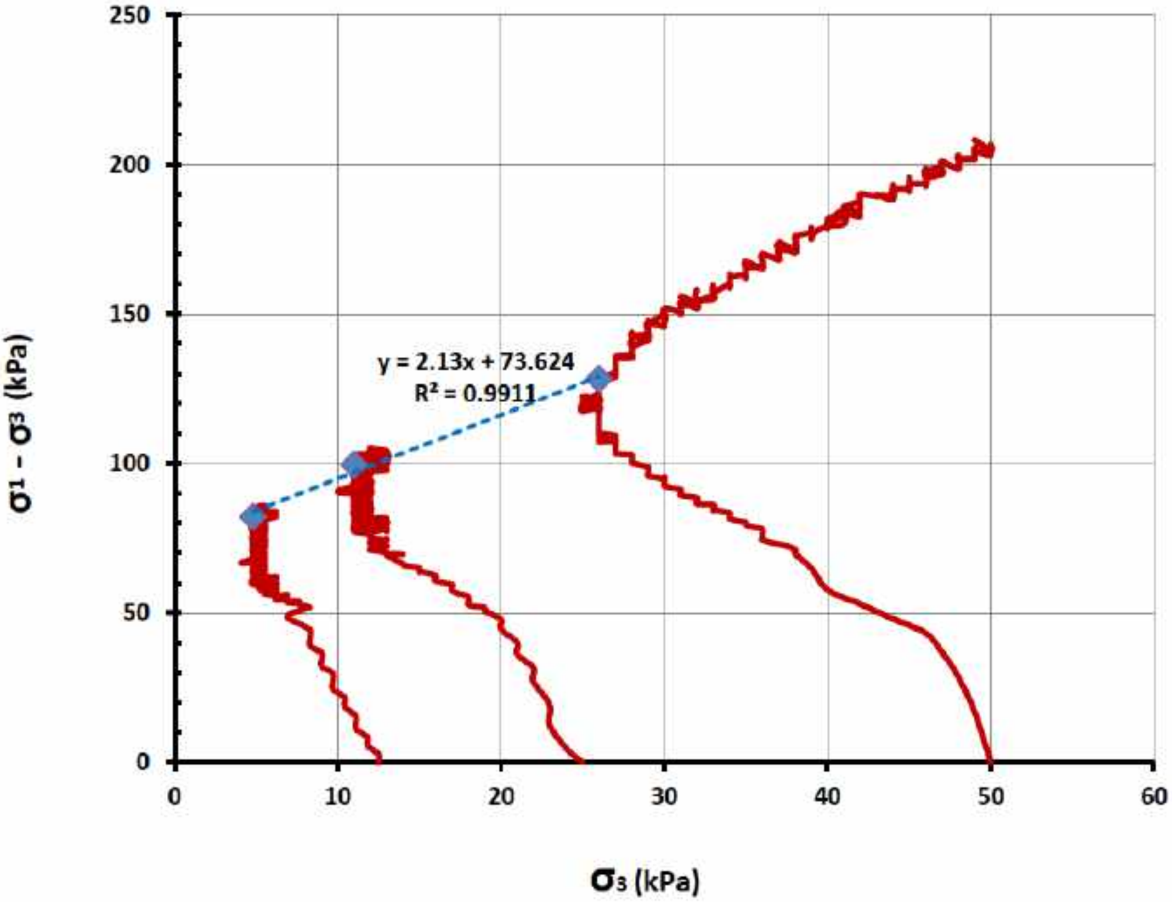
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_13.00_CU3		
Depth (m):	13	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	20.81
Angle of Shear Resistance Φ' (Deg) :	31.05

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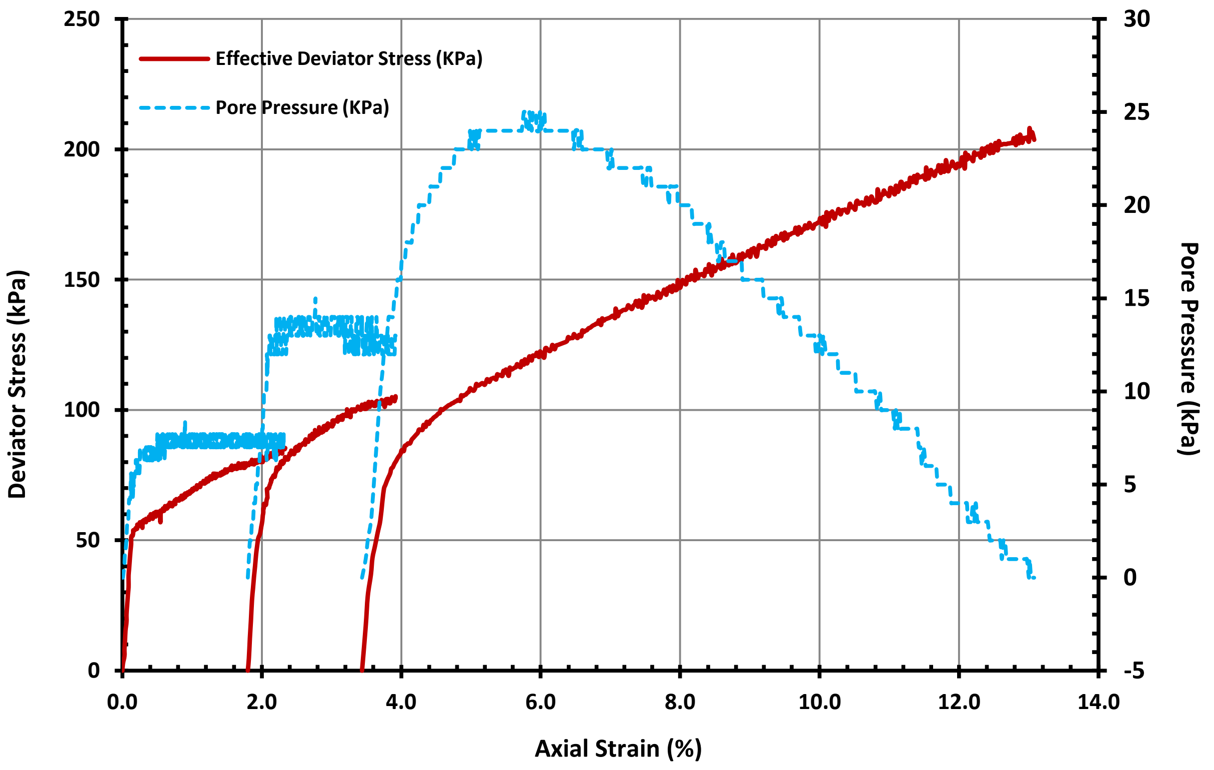
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_13.00_CU3		
Depth (m):	13	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	12.5	0	8	87	5	18.10	82	2.06
2	25	0	14	111	11	10.05	100	3.29
3	50	0	24	154	26	5.93	128	6.58

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_13.00_CU3		
Depth (m):	13	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	CPTU_FB1	**Depth (m):**	13/01/1900
Lab ID:	CPTU_FB1_13.00_CU3	**Date Tested:**	01/09/2021

Failure Mode: Bulging Failure

Notes: **Sample extruded from tubes**
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Eng**[redacted]

NATA ACCREDITATION NO: 19078

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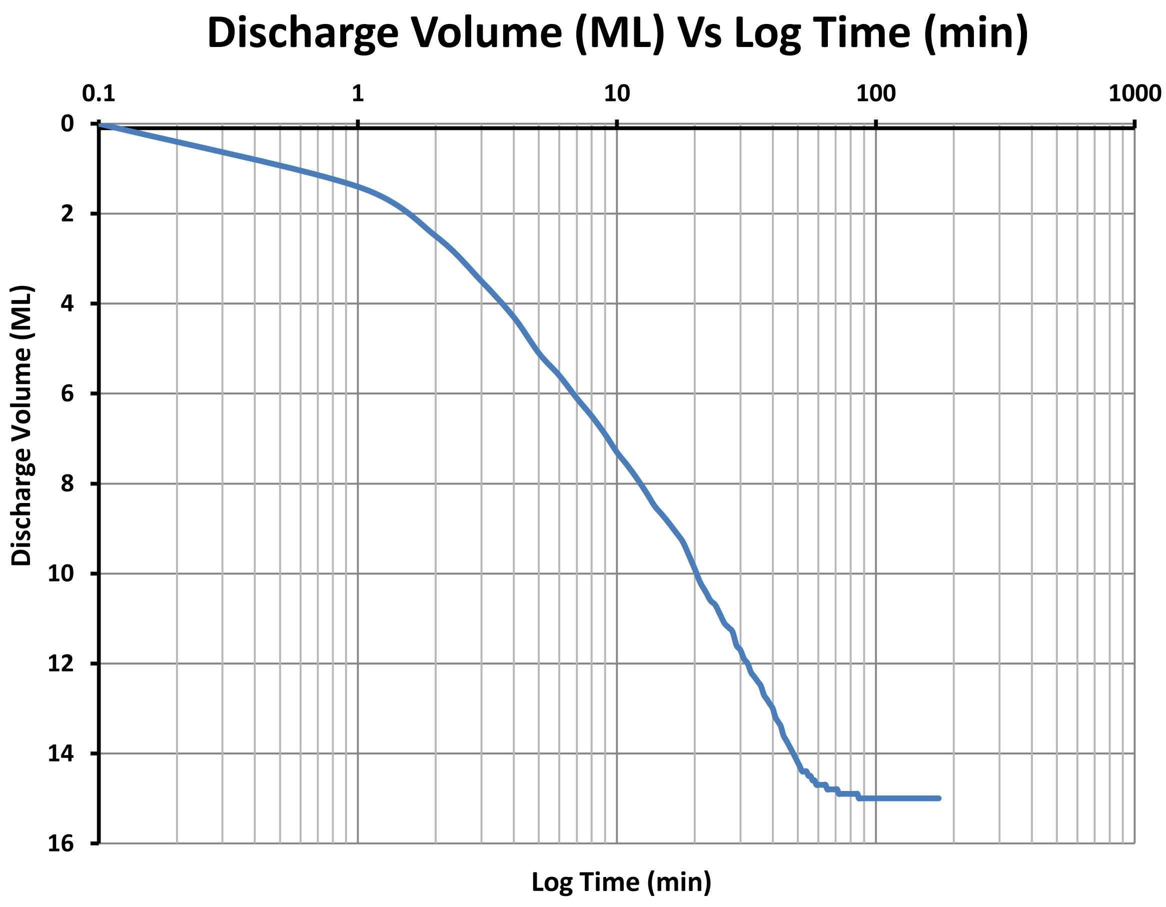
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Geo Analytica	Date Tested:	01/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_13.00_CU3		
Depth (m):	13	Room Temperature at Test:	~ 18°C



Cv (cm²/s): 0.080 based on t_{90}

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MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

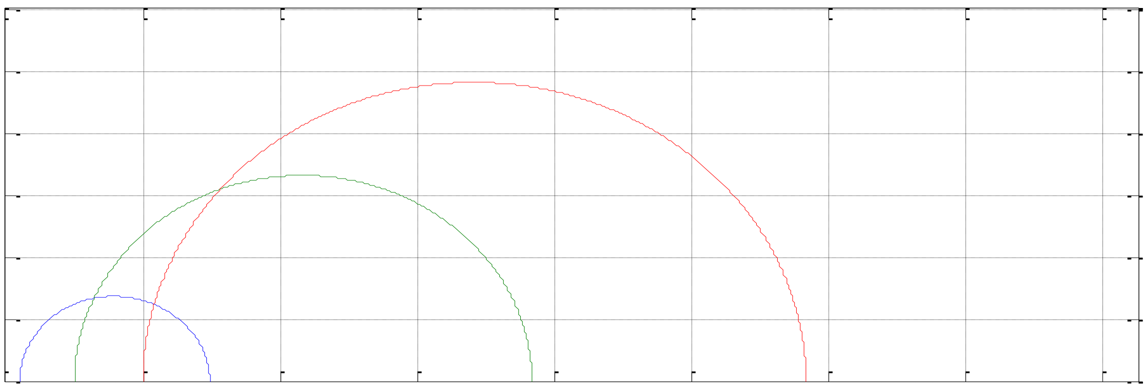
Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°c

Tested by:	Phil Li	Initial Moisture (%):	9.53	Strain Rate (mm/min):	0.01
Height (mm):	125.43	Final Moisture (%):	18.95	Skempton's (B):	1
Diameter (mm):	63.72	Bulk Density (t/m³):	1.85	Geology:	-
L/D Ratio:	1.97	Dry Density (t/m³):	1.69		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	18.62	22.89	46.00
Angle of Shear Resistance Φ' (Degrees) :	45.29	41.02	36.87

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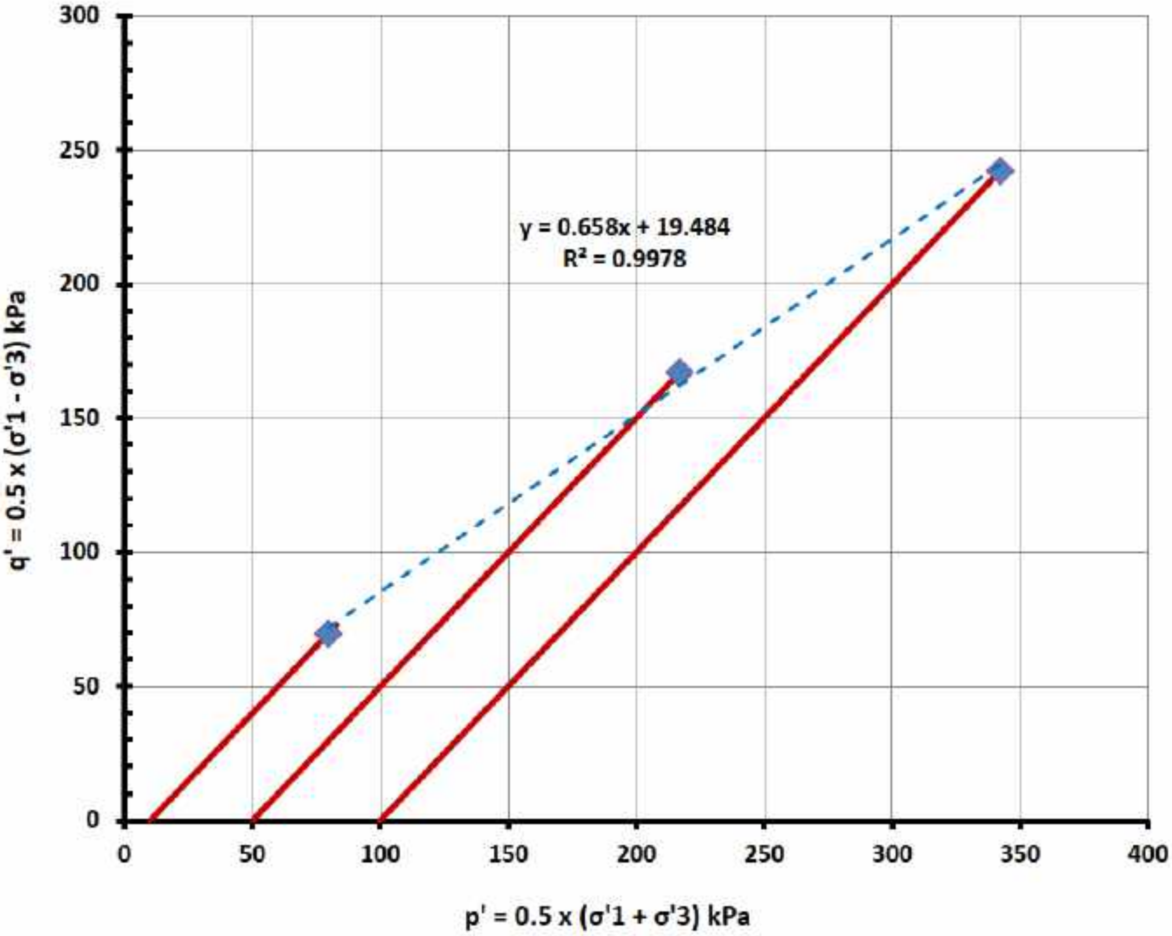
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	25.94
Angle of Shear Resistance Φ' (Deg) :	41.30

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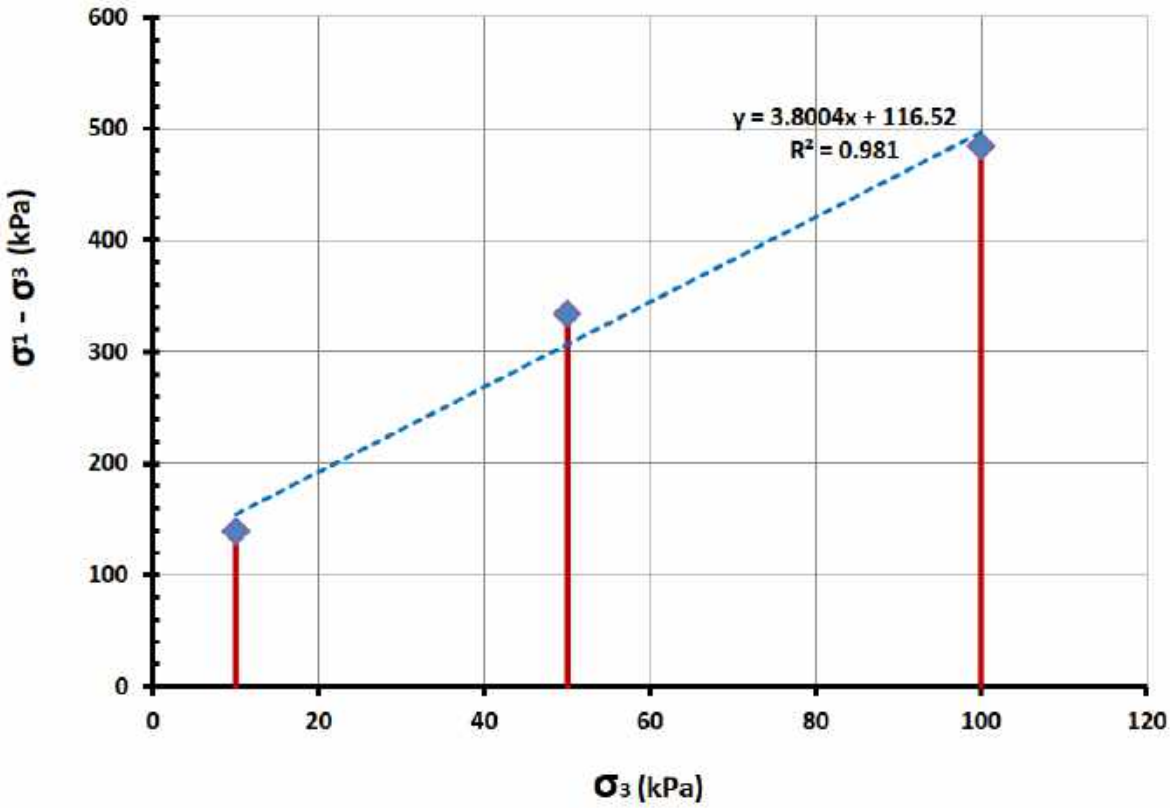
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	26.59
Angle of Shear Resistance Φ' (Deg) :	40.93

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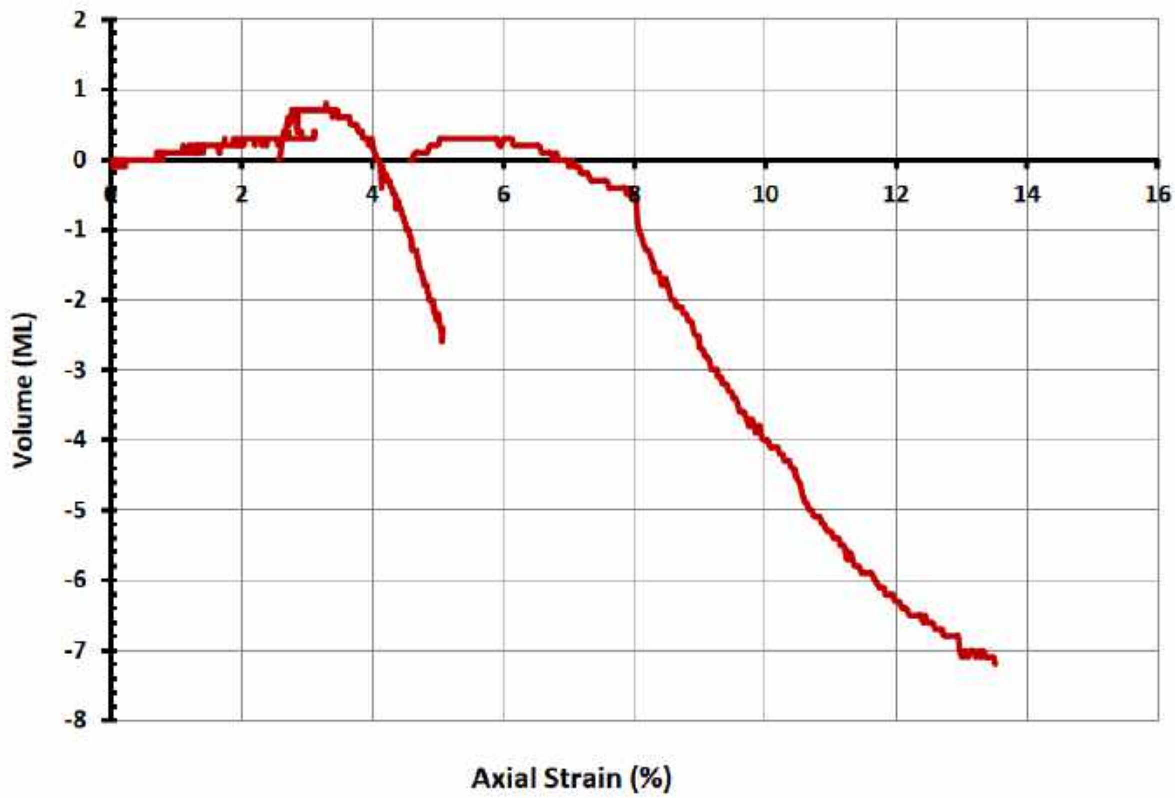
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°C

Volume (ML) Vs Axial Strain (%)



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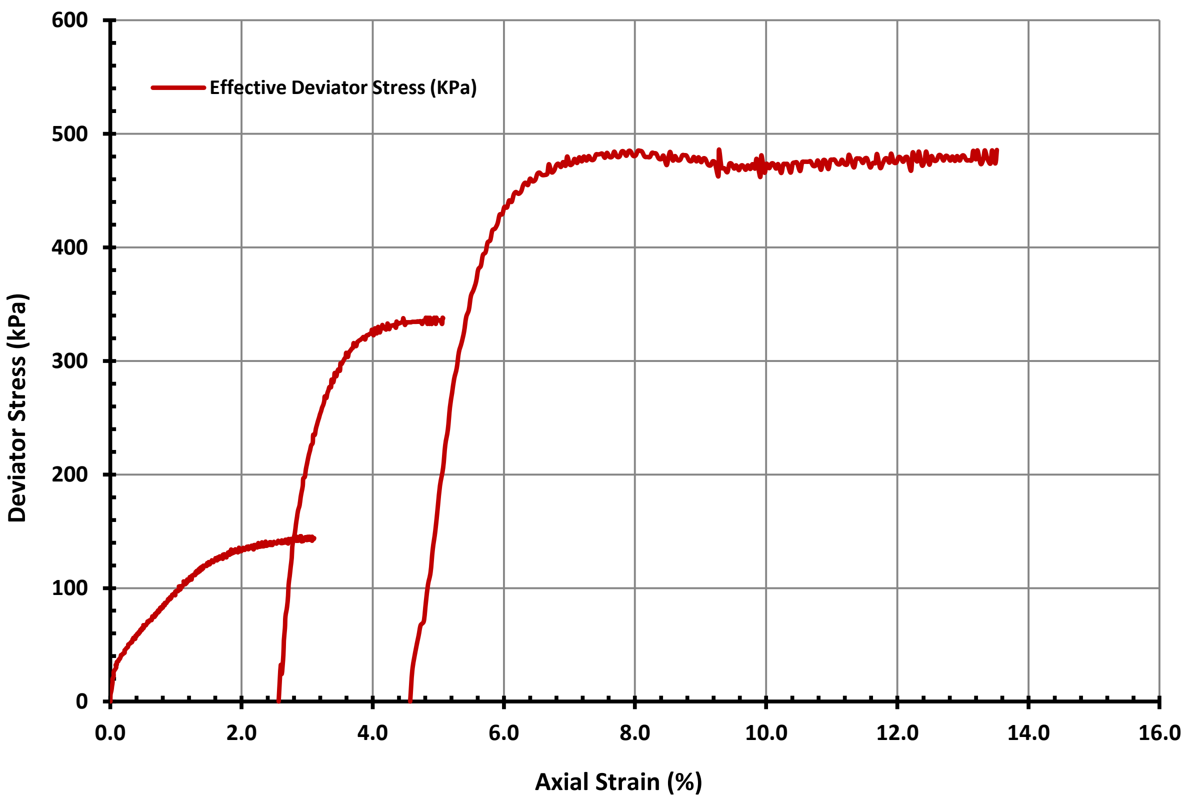
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°C

Deviator Stress (kPa) Vs Strain Diagram (%)



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'$_0$	U'$_f$	Principal Effective Stresses			σ'$_1$ - σ'$_3$	Strain (%)
				σ'$_1$	σ'$_3$	σ'$_1$ / σ'$_3$		
1	10	0	0	149	10	14.93	139	2.71
1	50	0	0	384	50	7.68	334	4.51
1	100	0	0	584	100	5.84	484	7.80

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MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°C

Photo After Test

Failure Mode: Bulging Failure

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Enginee [redacted]

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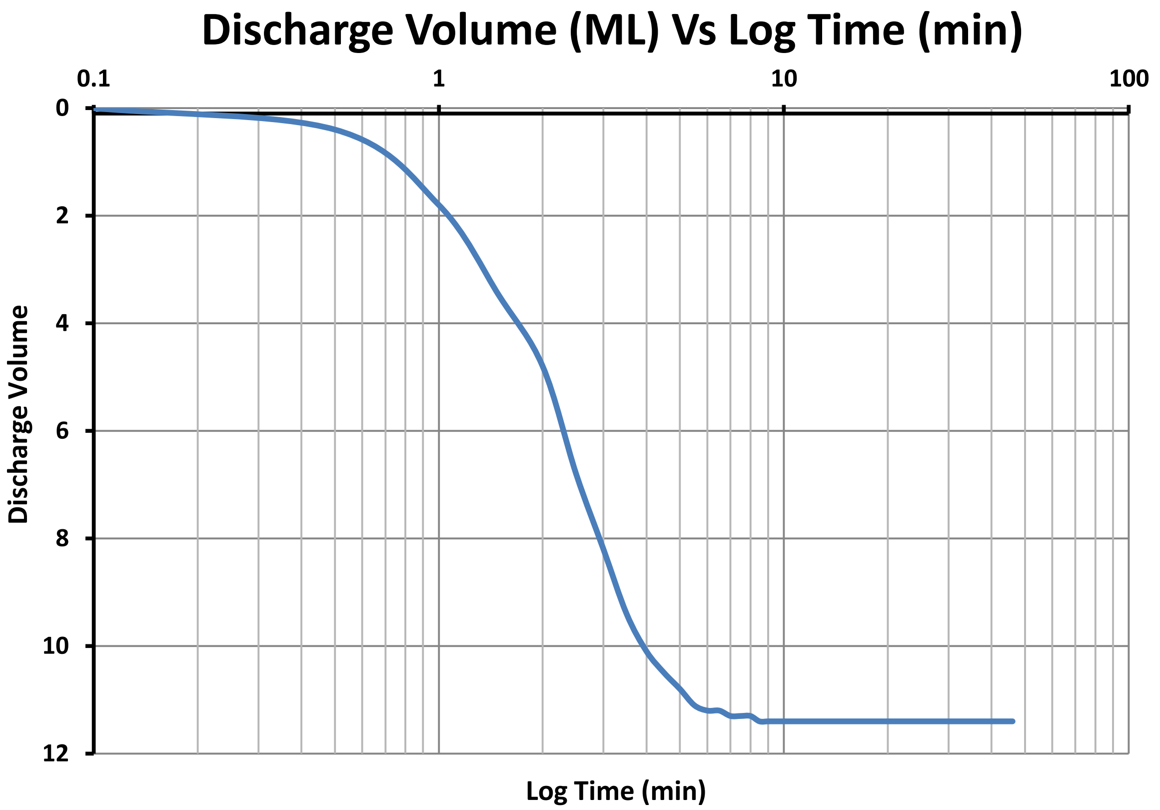
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_CD3		
Depth (m):	19	Room Temperature at Test:	~ 18°C



Cv (cm²/s): 0.765 based on t_{90}

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E-Precision Laboratory

MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

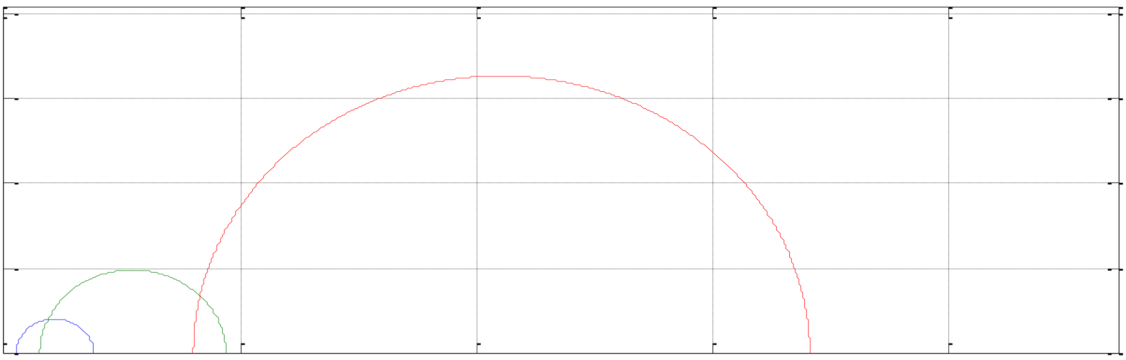
Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C

Tested by:	Phil Li	Initial Moisture (%):	7.85	Strain Rate (mm/min):	0.01
Height (mm):	127.93	Final Moisture (%):	13.77	Skempton's (B):	1
Diameter (mm):	64.39	Bulk Density (t/m³):	1.90	Geology:	-
L/D Ratio:	1.99	Dry Density (t/m³):	1.76		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	10.56	22.14	47.45
Angle of Shear Resistance Φ' (Degrees) :	44.13	37.23	35.75

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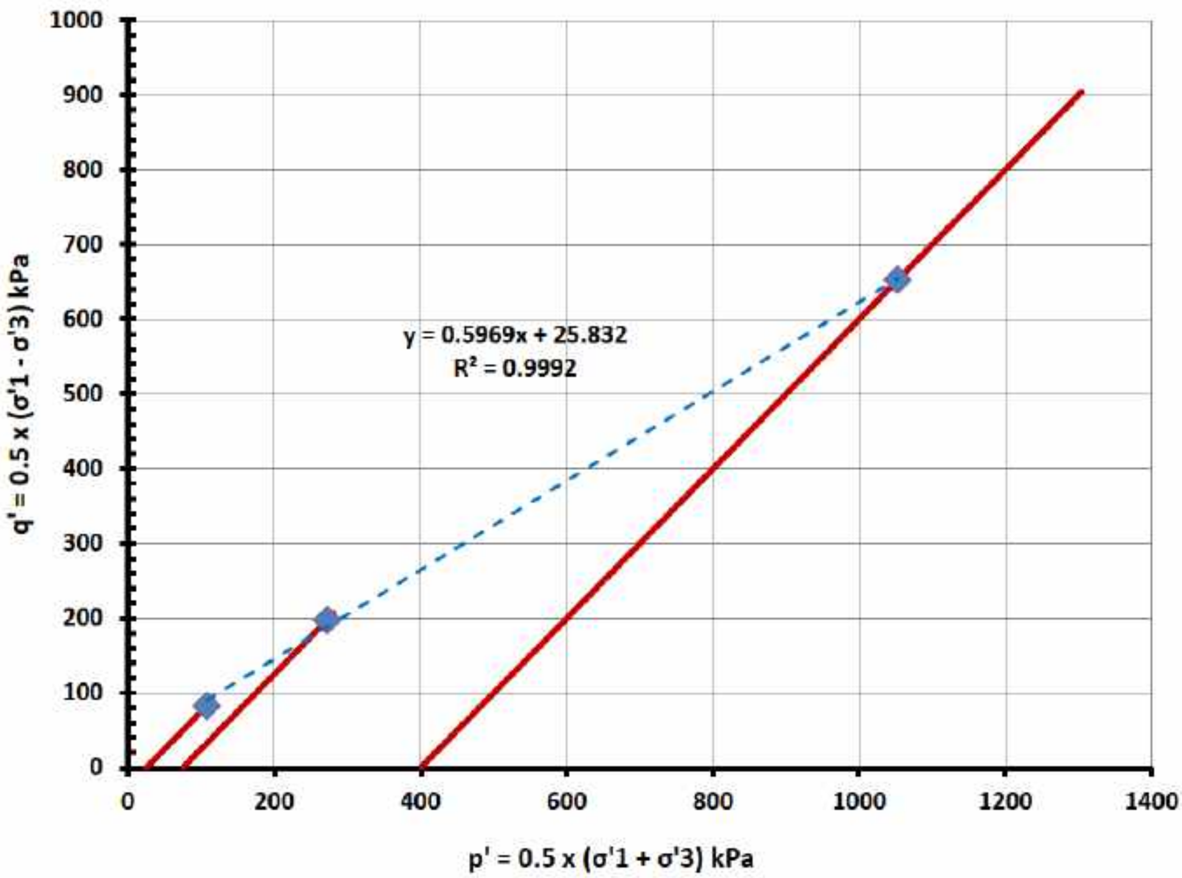
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	32.93
Angle of Shear Resistance Φ' (Deg) :	36.58

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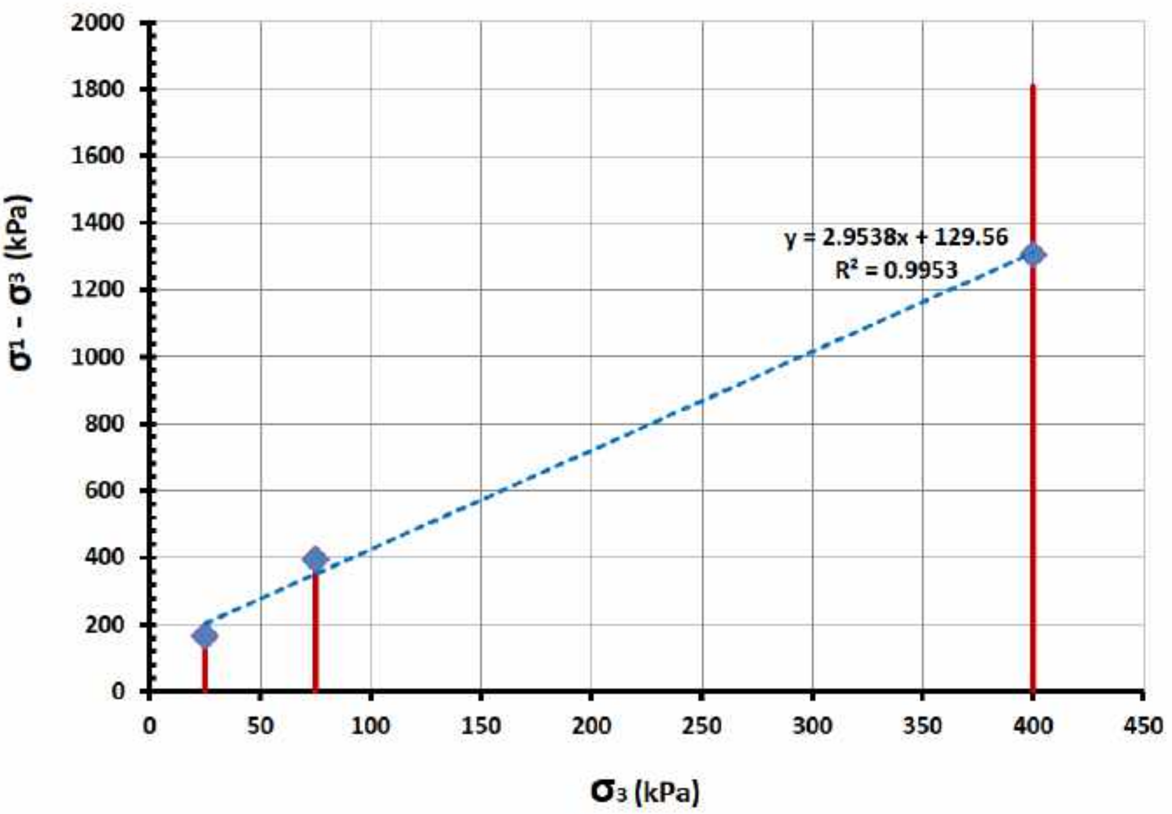
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	33.36
Angle of Shear Resistance Φ' (Deg) :	36.58

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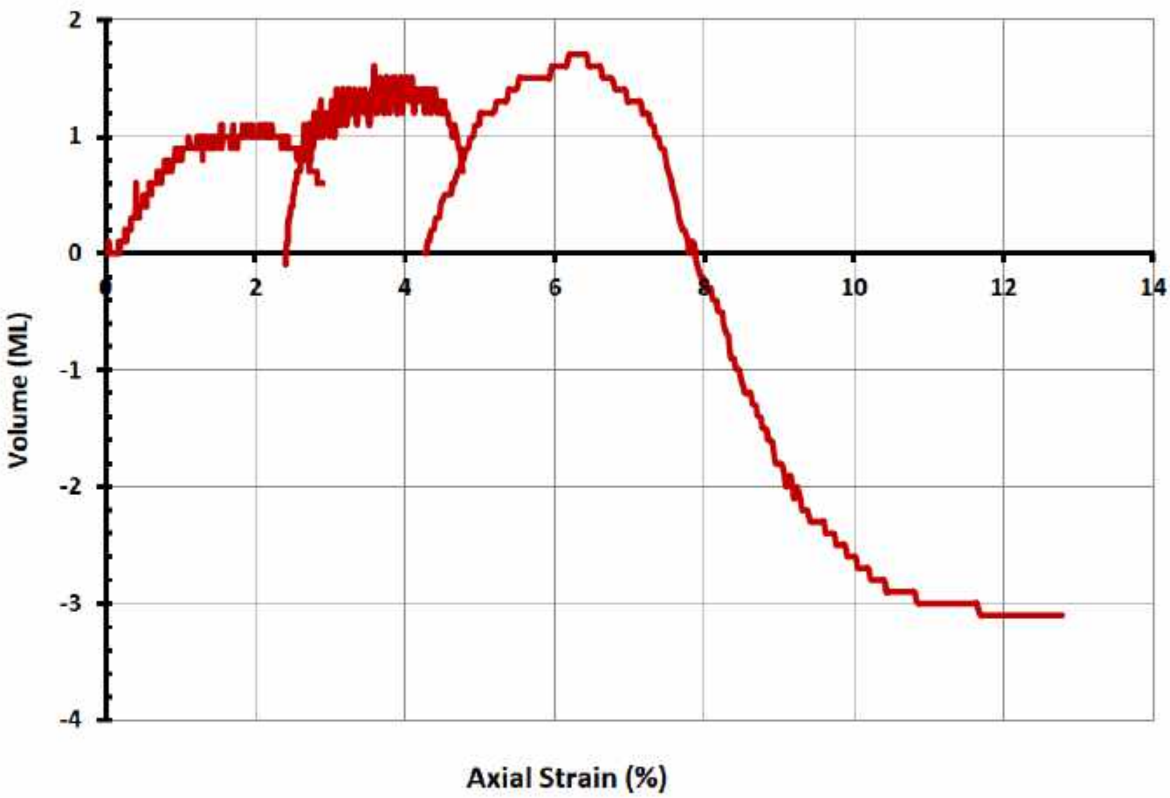
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C

Volume (ML) Vs Axial Strain (%)



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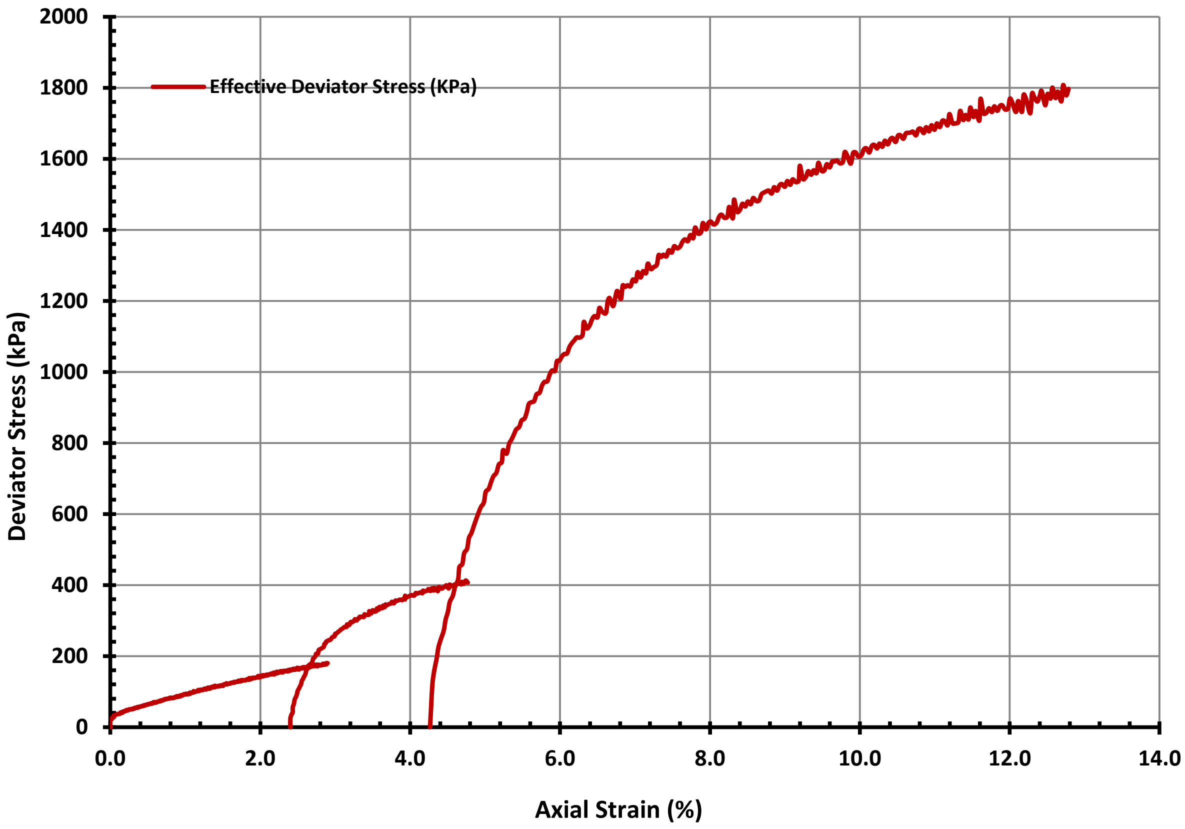
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C

Deviator Stress (kPa) Vs Strain Diagram (%)



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	25	0	0	190	25	7.62	165	2.56
1	75	0	0	470	75	6.27	395	4.46
1	400	0	0	1705	400	4.26	1305	7.21

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MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C

Photo After Test

Failure Mode: Bulging Failure

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer) [redacted]

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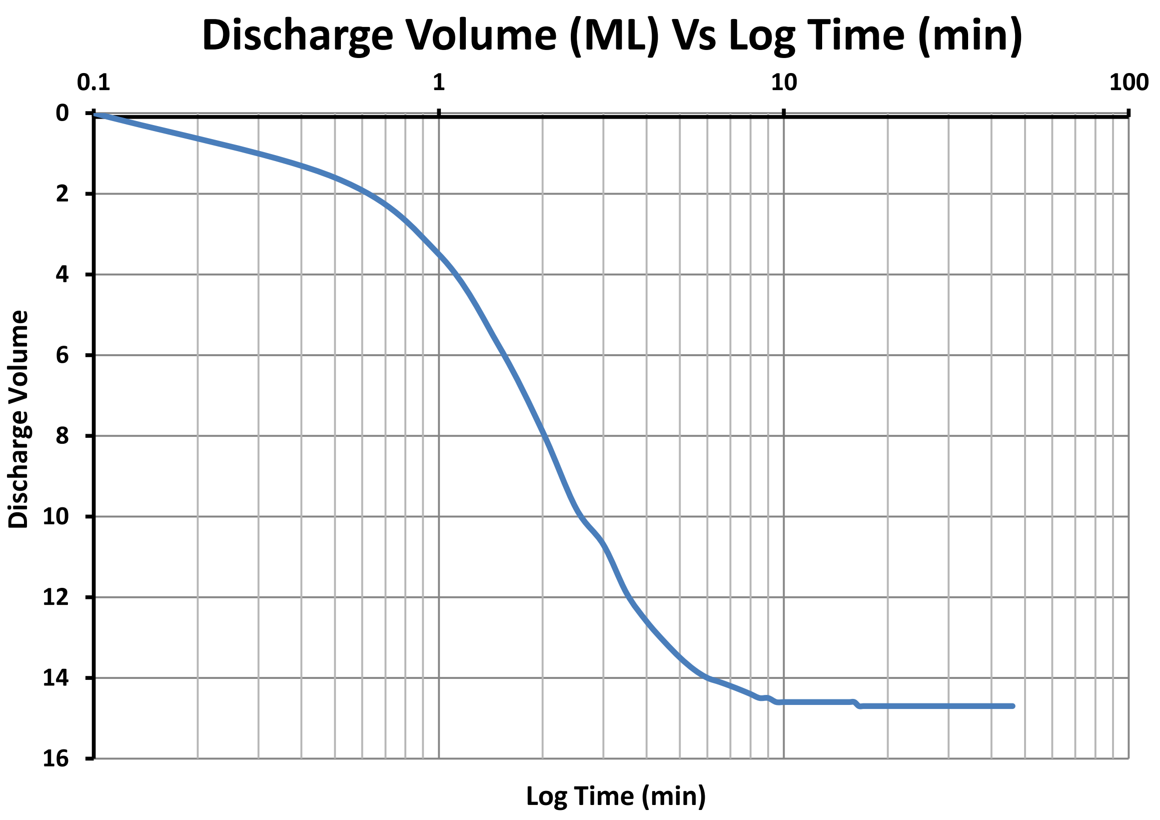
MULTISTAGE CONSOLIDATED DRAINED TRIAXIAL TEST

Method: In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB2	Lab:	EPLab
Sample ID:	CPTU_FB2_21.00_CU3		
Depth (m):	21	Room Temperature at Test:	~ 18°C



Cv (cm²/s): 0.636 based on $\mathbf{t_{90}}$

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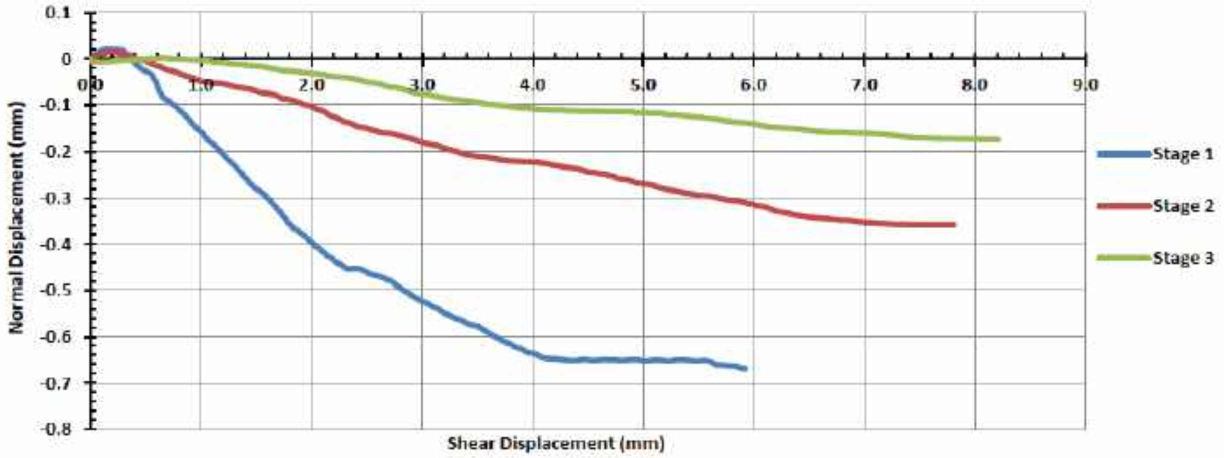
MULTISTAGE DIRECT SHEAR TEST REPORT

Method: AS1289.6.2.2 / In-house Method

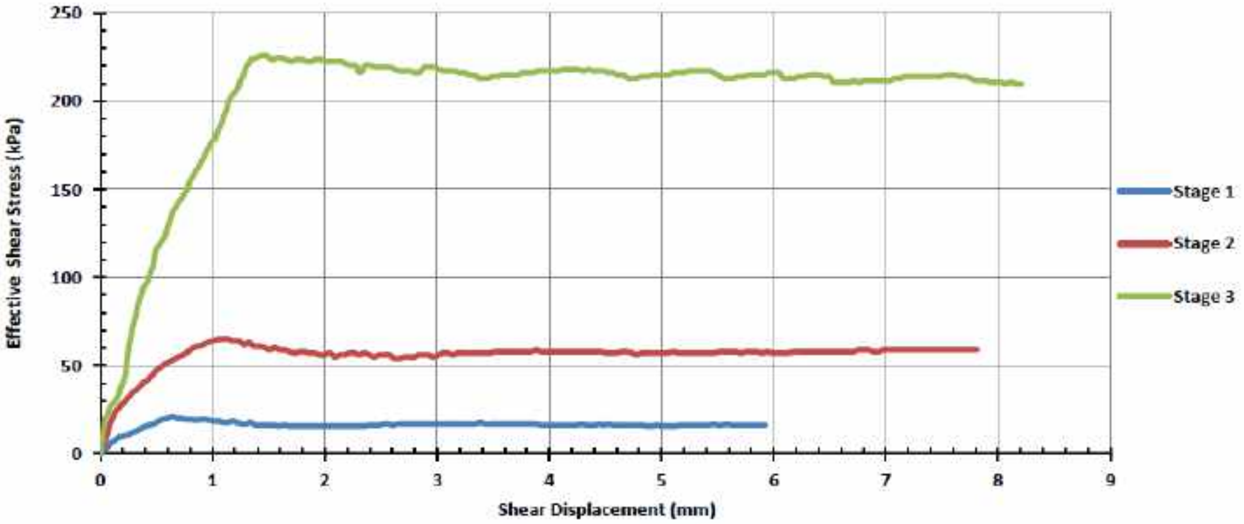
Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_IDST3		
Depth (m):	19	Room Temperature at Test:	20°

Type of Test:	Multistage Drained Shearing	**Sample Description:**	-
Dimensions (mm):	61.80 x 61.80	**Shear Plane Dip Angle (°):**	N/A
Rate of Strain (mm/min):	0.015	**Initial Bulk Density (t/m³):**	1.76
Failure Criteria:	Horizontal Shear	**Moisture Content (%):**	7.22

Normal Displacement Vs Shear Displacement Plot



Effective Shear Stress Vs Shear Displacement Plot



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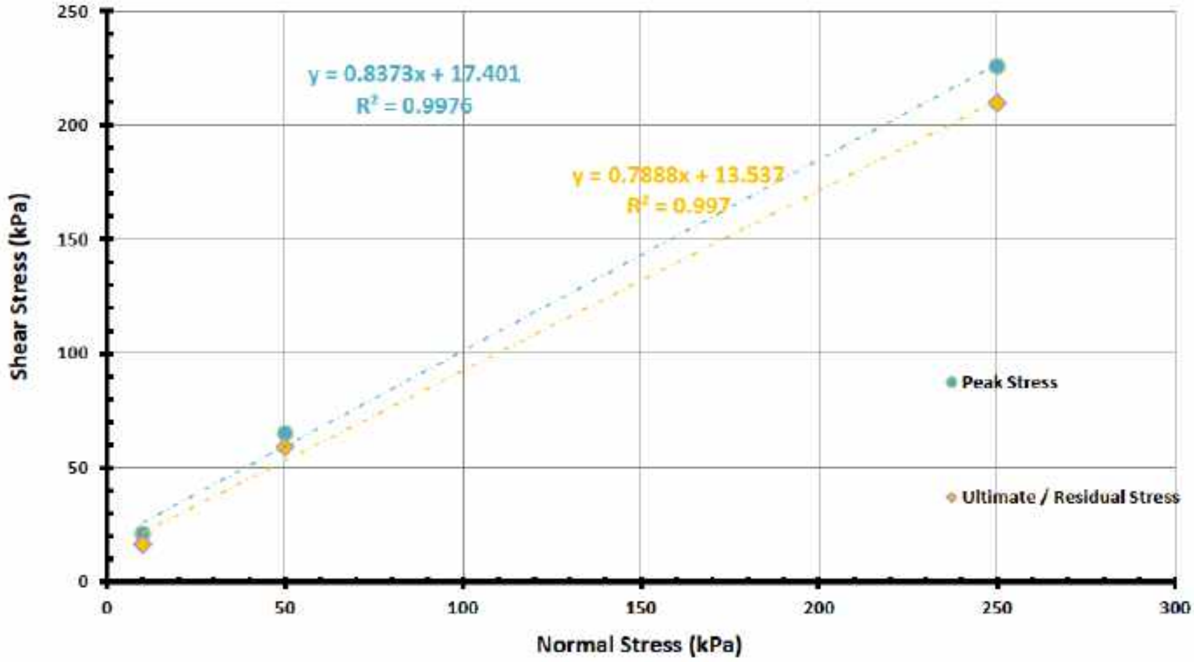
MULTISTAGE DIRECT SHEAR TEST REPORT

Method: AS1289.6.2.2 / In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_IDST3		
Depth (m):	19	Room Temperature at Test:	20°

(Peak / Ultimate) Normal Stress Vs Shear Stress (Effective Stresses)



Defect Surface: N/A

Dip Angle (°): N/A

Peak	**Shear Angle (°)**	40.03	**Normal Stress (kPa)**		**Shear Stress (kPa)**	
	Cohesion (kPa)	17.40	Stage 1	10	Stage 1	21
	R^2	0.9976	Stage 2	50	Stage 2	65
			Stage 3	250	Stage 3	226
Ultimate / Residual	**Shear Angle (°)**	38.31	**Normal Stress (kPa)**		**Shear Stress (kPa)**	
	Cohesion (kPa)	13.54	Stage 1	10	Stage 1	16
	R^2	0.9970	Stage 2	50	Stage 2	59
			Stage 3	250	Stage 3	210

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MULTISTAGE DIRECT SHEAR TEST REPORT

Method: AS1289.6.2.2 / In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB1	Lab:	EPLab
Sample ID:	CPTU_FB1_19.00_IDST3		
Depth (m):	19	Room Temperature at Test:	20°

Photo of Sample Post Testing

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signature (Geotechnical Engineer): [redacted]

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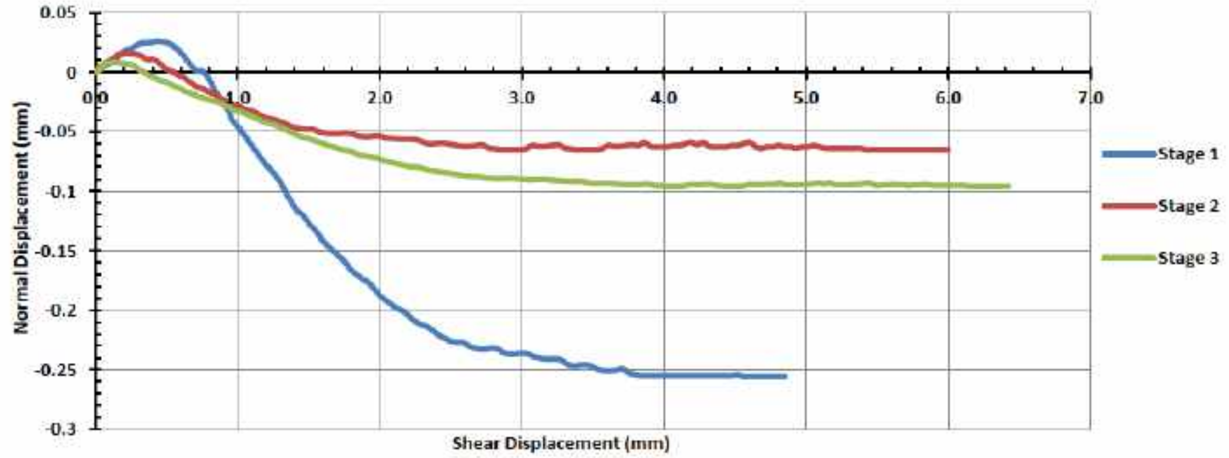
MULTISTAGE DIRECT SHEAR TEST REPORT

Method: AS1289.6.2.2 / In-house Method

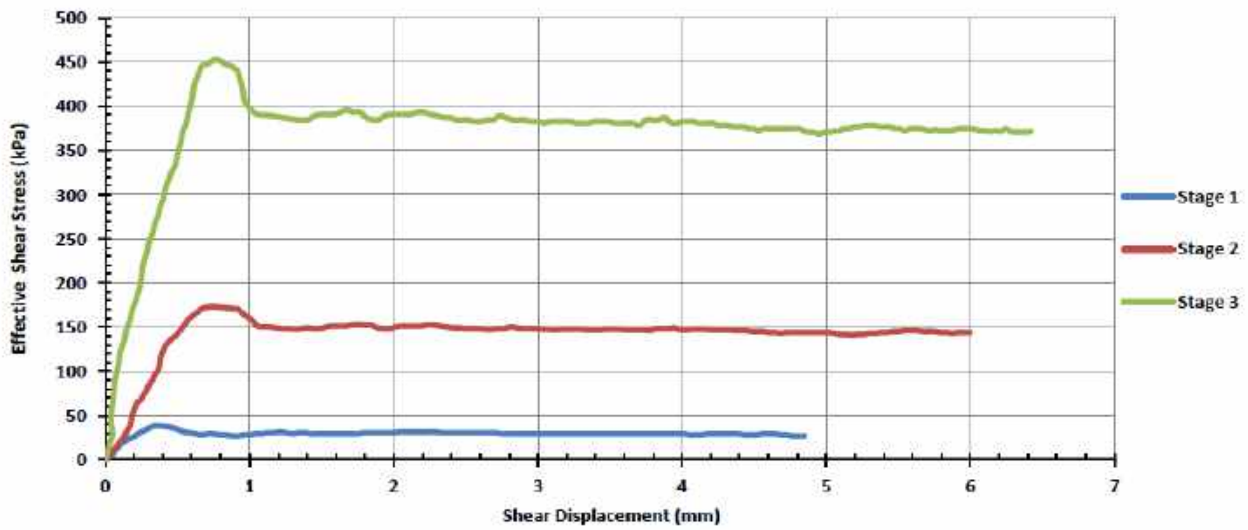
Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB3	Lab:	EPLab
Sample ID:	CPTU_FB3_19.00_IDST3		
Depth (m):	19	Room Temperature at Test:	20°

Type of Test:	Multistage Drained Shearing	**Sample Description:**	-
Dimensions (mm):	61.80 x 61.80	**Shear Plane Dip Angle (°):**	N/A
Rate of Strain (mm/min):	0.015	**Initial Bulk Density (t/m³):**	1.76
Failure Criteria:	Horizontal Shear	**Moisture Content (%):**	6.23

Normal Displacement Vs Shear Displacement Plot



Effective Shear Stress Vs Shear Displacement Plot



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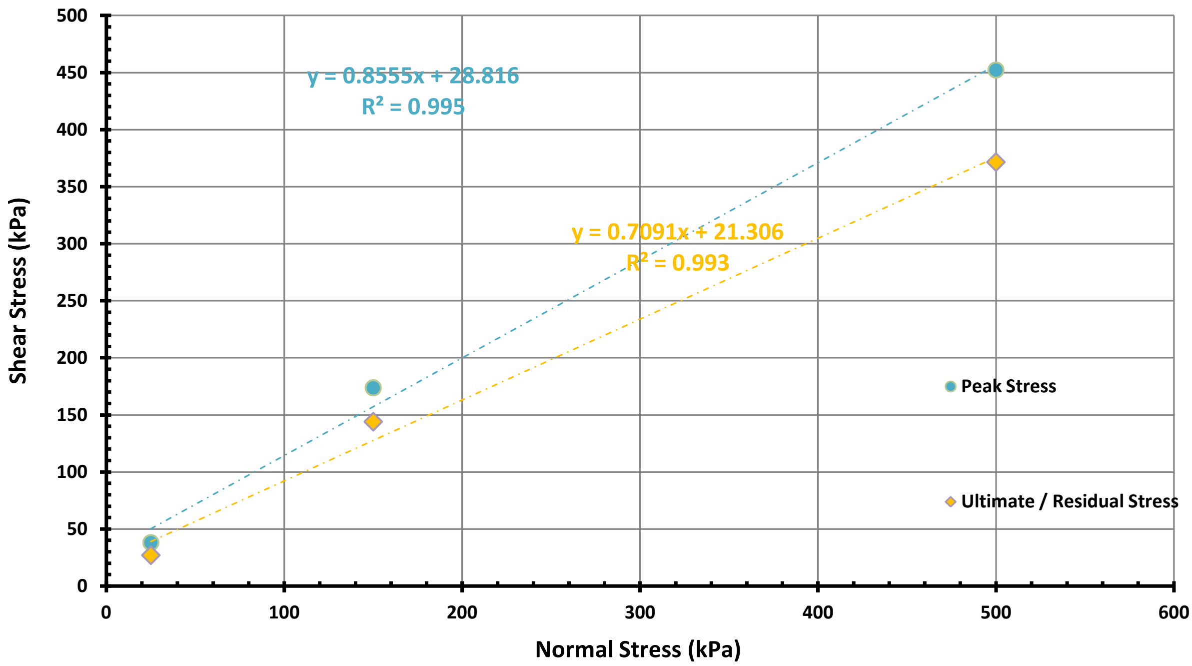
MULTISTAGE DIRECT SHEAR TEST REPORT

Method: AS1289.6.2.2 / In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB3	Lab:	EPLab
Sample ID:	CPTU_FB3_19.00_IDST3		
Depth (m):	19	Room Temperature at Test:	20°

(Peak / Ultimate) Normal Stress Vs Shear Stress (Effective Stresses)



Defect Surface: N/A

Dip Angle (°): N/A

Peak			**Normal Stress (kPa)**		**Shear Stress (kPa)**	
	Shear Angle (°)	40.70				
	Cohesion (kPa)	28.82	Stage 1	25	Stage 1	38
	R^2	0.9950	Stage 2	150	Stage 2	174
			Stage 3	500	Stage 3	452

Ultimate / Residual			**Normal Stress (kPa)**		**Shear Stress (kPa)**	
	Shear Angle (°)	35.37				
	Cohesion (kPa)	21.31	Stage 1	25	Stage 1	27
	R^2	0.9930	Stage 2	150	Stage 2	144
			Stage 3	500	Stage 3	372

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MULTISTAGE DIRECT SHEAR TEST REPORT

Method: AS1289.6.2.2 / In-house Method

Client:	Geo Analytica	Date Tested:	02/09/2021
Project:	BC8 Futi Bagus Testing 2021	EP Lab Job Number:	GEO
Sample No:	CPTU_FB3	Lab:	EPLab
Sample ID:	CPTU_FB3_19.00_IDST3		
Depth (m):	19	Room Temperature at Test:	20°

Photo of Sample Post Testing

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signature (Geotechnical Engineer): [redacted]

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87