



Tauranga City Council
21 Devonport Road
Tauranga 3143
New Zealand

13 April 2023

Attention: [REDACTED]

Dear [REDACTED]

BC330131 Request for Further Information #3 - Category 1 Geo-Professional Review

Further to the above, this letter provides a review by a Category 1 Geo-Professional of the Beca geotechnical report dated 30/09/2022 (included in Appendix A for reference). The two documents should be read in conjunction.

This letter is structured as Questions and Answers to address the questions received from the TCC Development Engineer in the Request for Further Information listed above.

Question 1: Provide a review of the Beca geotechnical report dated 30/9/2022 from a Category 1 Geo-Professional and include a S72 assessment in respect to land stability.

Answer: Our assessment of land stability is discussed in Section 6 of the Beca letter report dated 30/09/2022 (refer Appendix A). More specifically, for the purpose of a S72 assessment, we split the land stability assessment in two parts:

- **Slope above the base track:** all the building work proposed is located below the base track, so land stability is not affected by the building work.
- **Slope below the base track:** to assess the effects of the proposed structure on the stability of the slope below the track we carried out slope stability analyses for the following cases, in accordance with the performance criteria set out in section DS10.3 of the *TCC Infrastructure Development Code Design Standard DS-10 Natural Hazards and Earthworks* (TCC IDC DS-10):
 - Static, normal seepage condition (target Factor of Safety: minimum of 1.5)
 - Extreme groundwater level (target Factor of Safety: minimum of 1.2)
 - Seismic loading (target Factor of Safety: minimum of 1.0)

We carried out analyses for the existing conditions and with the proposed structure. The results of the analyses are summarised in Table 1 below. In all cases the slope stability meets the minimum requirements of TCC IDC DS-10.

Table 1 – Results of slope stability analyses

Case	Minimum Factor of Safety required	Existing	Proposed	Requirements met?
Static	1.5	1.87	1.54	Y
Extreme groundwater level	1.2	1.47	1.22	Y
Seismic	1.0	1.27	1.26	Y

The outputs of the slope stability analyses are presented in Appendix B.

Question 2: Provide an updated Beca geotechnical report detailing the importance level of the proposed building structure.

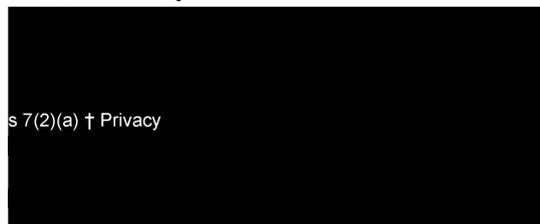
Answer: The proposed structure is Importance Level 2 with a design life of 50 years.

Question 3: Provide a geotechnical review of the foundation design.

Answer: We confirm that we have provided geotechnical input into the foundation design and have reviewed the final design, as recorded in revision 0A of the structural drawing set issued for Building Consent.

Please contact the undersigned should you have any queries.

Yours sincerely



Tauranga City Council Category 1 Accredited Geo-Professional

on behalf of

Beca Limited

Phone Number: s 7(2)(a) † Privacy

Email: s 7(2)(a) † Privacy

Appendices

Appendix A – Geotechnical Investigation and Desktop Summary Report

Appendix B – Slope Stability Analyses

A

Appendix A – Geotechnical Investigation and Desktop Summary Report

Tauranga City Council
21 Devonport Road
Tauranga 3143
New Zealand

30 September 2022

Attention: [REDACTED]

Dear [REDACTED]

Awaiti Project Geotechnical Investigation and Desktop Summary Report

1 Introduction

Beca Ltd (Beca) has been commissioned by Tauranga City Council (TCC) under the TCC Reserves Walking and Cycling Panel to provide geotechnical engineering services for the Awaiti project along the base track of Mauao. As per the draft developed design by the landscape architect (Law Creative, 2021) the Awaiti includes a raised timber platform, seating, an interpretation panel and a ramp for wheelchair access (refer Figure 1 below).



Figure 1 – Artist's impression of proposed Awaiti (Creative Law, 2021)

We understand that the proposed location for the Awaiti is preferred for cultural, historical, and aesthetic reasons. We also understand from the draft developed design that for both the platform and interpretation panel there is preference for Screw foundations.

The purpose of this preliminary geotechnical assessment report is to:

- Present the results of:
 - a high-level review of geohazards for the site
 - a geotechnical site investigation
- Summarise the findings of the geohazards review and geotechnical investigation
- Provide recommendations for the next stage (detailed design)

2 Information Available

The following sources of information were used in this report:

- Published geological maps:
 - Geology of the Rotorua area QMAP (Leonard et al, 2010).
- Tauranga City Council Mapi (TCC, 2022)
 - Natural hazards maps, including flooding, tsunamis, slopes and relic slips and liquefaction vulnerability
 - Historic aerial photos
- Retrolens – historic aerial photos (Retrolens, 2022)

3 Site Description

The site is located on the northern most point of the Mauao base track. The Mauao base track navigates the circumference of Mauao a few meters above the high tide mark. The track has been cut into the surrounding slopes. Some areas have vertical cuts.

The Awaiti site is a relatively flat area about 12m x 4m in plan, extending from the track towards the sea. In front (downslope) of the site is a near vertical, 5m drop off to a shelly beach with rock pools. Directly behind (upslope of) the site the base track has been cut into the slope.

The slope behind the base track is moderately inclined (approximately 25°) and vegetated in grasses and native trees. Two historic slope failures are present across this slope.

4 Geotechnical Site Investigation

A geotechnical site investigation consisting of geomorphic mapping and ground investigation was carried out between 8 and 9 September 2022.

4.1 Geomorphic mapping

A high-level geomorphic mapping of the site was completed by a Beca Engineering Geologist. Results of the mapping are presented in sketches 4280807-GE-K002 to GE-K004 Rev A, included in Appendix A.

4.2 Ground investigation

The locations of the ground investigations were visually estimated from TCC Mapi and are reported in terms of Bay of Plenty 2000 coordinates and New Zealand Vertical Datum 2016 reduced levels. Investigation locations are presented in sketch 4280807-GE-K001 Rev A, included in Appendix A.

4.2.1 Standards and Calibration

The investigation was undertaken in general accordance with the New Zealand Ground Investigation Specification (NZGS, 2017), and a list of standards used during the site investigation is shown in Table 1.

Table 1 - Summary of standards used in this investigation

Field Procedure	Standard Used
Soil and Rock Logging	In general accordance with New Zealand Geotechnical Society Guidelines (NZGS, 2005).
Hand Held Shear Vane Test	In general accordance with New Zealand Geotechnical Society Guidelines (NZGS, 2001).
Scala (Dynamic Cone) Penetrometer Testing	NZS 4402.6.5.2 (1988)

Up to date calibration certificates for the hand held shear vane used in the investigation are attached in Appendix B .

4.2.2 Hand Auger Holes

Four hand auger holes were completed to refusal across the proposed site. Hand auger holes were drilled and logged on site by a Beca Engineering Geologist. Logs and photographs are presented in Appendix B .

In-situ testing in the hand auger holes comprised:

- Down-hole, hand held shear vane tests were undertaken at about 250mm centres in cohesive materials
- Scala penetrometer testing was undertaken between the ground surface and to a maximum of 500mm below the base of the hole where possible, undertaken at 50mm centres. The hole was augered between tests, with a maximum of one rod length per test

4.2.3 Scala (Dynamic Cone) Penetrometer Testing

Additional Scala penetrometer tests were carried out at the ground surface to 1m depth at two locations on the slope above the site. Logs are presented in Appendix B .

5 Ground Model

5.1 Geology

The published geological map indicates the site is underlain by Minden Rhyolite Subgroup, consisting of flow-banded rhyolite to rhyodacite lava.

Beca is not aware of previous geotechnical investigations undertaken within the site. However, like most areas of Tauranga, it is anticipated that a mantle of weathered volcanic ashes overly the local geology.

5.2 Ground Profile

The results from the ground investigation show weathered volcanic ashes and colluvium overlying in situ residual rock, overlying slightly weathered rock. Typical soils encountered at the site are presented in Table 2 below.

Table 2 - Typical soils encountered

Unit	Description	Strength / Relative Density	Depth (m)
Undifferentiated Volcanic Ashes	SILT, some fine to coarse sand, minor clay; brown; moist, high plasticity	Stiff to very stiff	0 – 1.4
Colluvium	SILT, some fine to coarse sand, minor clay; brown; moist, high plasticity	Stiff to very stiff	0 – 0.8
Residual Rock	Fine to coarse SAND, minor silt, trac	Loose to medium dense	0.8 – 2.5
Rhyolite Rock	Slightly weathered; dark grey; interbedded RHYOLITE	Strong to very strong	1.5 – 2.5

Groundwater was observed in the hand auger holes at the interface of the residual rock and overlying units. Groundwater was also observed immediately behind the site on the cut face. Here groundwater appears to be seeping through the interface of residual rock mass and overlying unit (colluvium). At the base of the slope in front of the site groundwater was observed coming out of the rock mass.

6 Geohazards

6.1 Slope instability

Mauao has a relatively long history of landslides, including rotational/translational slides, debris flow, debris avalanche and rock falls, as documented by Martin and Brideau (2014). TCC Mapi shows no relic slips in the slopes surrounding the proposed Awaiti location.

6.1.1 Rotational and shallow translational slides

Our aerial photo review identified that two shallow landslides started to develop from 2007. Our subsequent site inspection confirmed that two failures have occurred upslope of the proposed Awaiti location, to the west and east. The location and details of these failures are illustrated in sketches 4280807-GE-K002 to GE-K004 Rev A, included in Appendix A

The western failure is approximately 10m in diameter. The failure appears to have occurred on the interface of the residual rock and overlying soils. Groundwater appears to be permeating along the contact of the residual rock and overlying soils. The slope has been replanted with young vegetation, however there is continued surface erosion of the sandy residual rock material by rainfall. No evidence of recent instability was observed.

The eastern failure is approximately 9m in diameter. The failure appears to have occurred within a larger historic failure, now apparently largely stable. The failure seems to have developed on the interface of the residual rock and overlying soils. Groundwater appears to be permeating along the contact of the residual rock and overlying soils. No evidence of recent instability has been observed.

Our inspection at the top of the slope above both failures identified no signs of any instability higher on the slope. A fence runs approximately perpendicular to the expected direction of movement of the landslides and shows no sign of displacement/bends.

Both slope failures occurred either side of a ridge which persists to the beach below as bedrock. The proposed location of the Awaiti viewing platform is positioned on this ridge where rock outcrops are near the surface. Based on this and the fact that no evidence of recent instability has been observed, our assessment is that the risk of a slope instability above the track affecting the Awaiti site during its design life is relatively low.

Below the site no evidence of instability was observed and the rock mass is found at shallow depth (approximately 2-2.5m). Therefore our assessment is that the risk of an underslip impacting the Awaiti during its design life is relatively low.

6.1.2 Rockfalls

A number of isolated boulders can be observed in the grassed area upslope from the base track, above the proposed Awaiti location. These boulders are indicative of past rockfall events occurring on the slope, with boulders being released from the higher, steeper upper parts of Mauao and coming to rest at the shallower slopes towards the base. The boulders that appeared to have travelled farthest are located about 75m away from the base track. This matches the observations from Martin and Brideau (2014) that past rockfalls on the northeast slopes of Mauao don't seem to have reached as far as the base track.

As such, our assessment is that the risk of rockfalls impacting the Awaiti and its users is relatively low and very similar to the current risk for users of the base track.

6.1.3 Slope instability summary

Our assessment is that the risk of a slope instability process affecting the Awaiti site or its users during the design life of the structure is relatively low.

6.2 Tsunami

The proposed viewing platform is on top of the rocks, at approximately 7m RL. TCC Mapi shows the site is clear of any Tsunami evacuation zone which deems it safe during a tsunami. TCC Mapi also shows the site to be above any flood depth associated with a tsunami.

6.3 Liquefaction

The site is underlain by weathered volcanic ashes and colluvium described as stiff silts with some sand underlain by residual rock described as a sand. Groundwater is identified at the interface of the residual rock and overlying soils. These soils are considered unlikely to liquefy in seismic events with an annual probability of exceedance of 1/500 or less.

According to the TCC Mapi, the liquefaction vulnerability is low.

7 Site Suitability, Preliminary Considerations for Design and Recommendations for the Next Stage

7.1 Site Suitability

Based on the geohazard assessment presented in section 6, we consider the site suitable for the proposed structures.

7.2 Considerations for Design

Liquefaction is unlikely to affect the site in seismic events with an annual probability of exceedance of 1/500 or less.

Rock was encountered at a maximum depth of 2.5m. The site subsoil class recommended for structural design is Class B – Rock, as per NZS1170.5:2004.

Due to the shallow rock there may be constructability challenges with Screw foundations to achieve the required structural capacity. We recommend that other foundation solutions be considered for detailed design, e.g. conventional socketed piles.

For the platform abutment, subject to further detailing in conjunction with the structural engineer, shallow foundations are anticipated to achieve a geotechnical ultimate bearing capacity in excess of 300kPa.

7.3 Recommendations for the next stage

Below are our recommendations for the next stage (detailed design for building consent):

- Meeting with TCC to present the findings of this report and agree scope for next stage
- Working in conjunction with the structural engineer to establish design requirements, confirm structural loads and provide inputs to detailed design.
- Confirming with TCC any specific geotechnical requirements for building consent.

8 References

Creative Law (2021). Mauao – Interpretation & Placemaking Design – Developed Design – Draft. May, 2021.

Leonard, G.S.; Begg, J.G.; Wilson, C.J.N. (2010). Geology of the Rotorua area. *Institute of Geological & Nuclear Sciences 1:250,000 geological map. 1 sheet + 102p*. Lower Hutt, New Zealand. GNS Science.

New Zealand Geotechnical Society – NZGS (2001). Guidelines for the Hand Held Shear Vane Test.

New Zealand Geotechnical Society – NZGS (2005). Field Description for Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes.

Martin, Z; Brideau, M.A. (2014). Spatio-temporal distribution of mass movements on Mount Maunganui, New Zealand. 6th Canadian Geohazards Conference, Kingston, Ontario.

January 2014 Conference: 6th Canadian Geohazards Conference At: Kingston, Ontario

New Zealand Geotechnical Society – NZGS (2017). *New Zealand Ground Investigation Specification, Volume 1*, ISBN: 978-1-98-851731-5.

Retrolens (2022). Historic aerial photos. Retrieved 21 September 2022 from <https://retrolens.co.nz/>

Standards New Zealand (1988). Methods of testing soils for civil engineering purposes - Soil strength tests - Determination of the penetration resistance of a soil - Test 6.5.2 Hand method using a dynamic cone penetrometer (NZS 4402.6.5.2:1988).

Standards New Zealand (2004). Structural design actions. Par 5: Earthquake actions – New Zealand (NZS 1170.5:2004).

Tauranga City Council – TCC (2022). Mapi GIS web map viewer. Retrieved 21 September 2022 from <https://mapi.tauranga.govt.nz/Html5/index.html?viewer=Mapi>

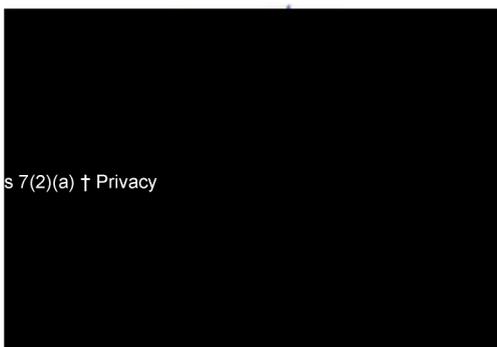
9 Applicability

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

This report contains site investigation data. The site investigation has been undertaken at discrete locations and no inferences about the nature and continuity of ground conditions away from the investigation locations are made. Furthermore, logs are provided presenting description of the soils and geology based on our observation of the samples recovered in the fieldwork and may not be truly representative of the actual underlying conditions.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

Yours sincerely

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Beca Limited

Phone Number:

Email: s 7(2)(a) † Privacy

Appendices:

Appendix A – Site Plan and Geo Hazard Map

Appendix B – Hand Auger Logs and Photographs

A

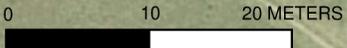
Appendix A – Site Plan and GeoHazard Map



LEGEND

-  HAND AUGER
-  DYNAMIC CONE PENETROMETER (DCP)
-  INDICATIVE LOCATION OF PLATFORM

2022 AERIAL PHOTO SOURCED FROM TAURANGA CITY COUNCIL MAPS



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NO DWG FILE

FOR INFORMATION
NOT FOR CONSTRUCTION

A FOR INFORMATION		s 7(2)(a)		21/09/22	
No.	Revision	By	Chk	Appd	Date

Drawing Originator: **Beca**

Original Scale (A1)	Design	Drawn	21/09/22
Reduced Scale (A3)	Design Checker	Checked	
AS SHOWN	* Refer to Revision 1 for Original Signature		

Client: TAURANGA CITY COUNCIL

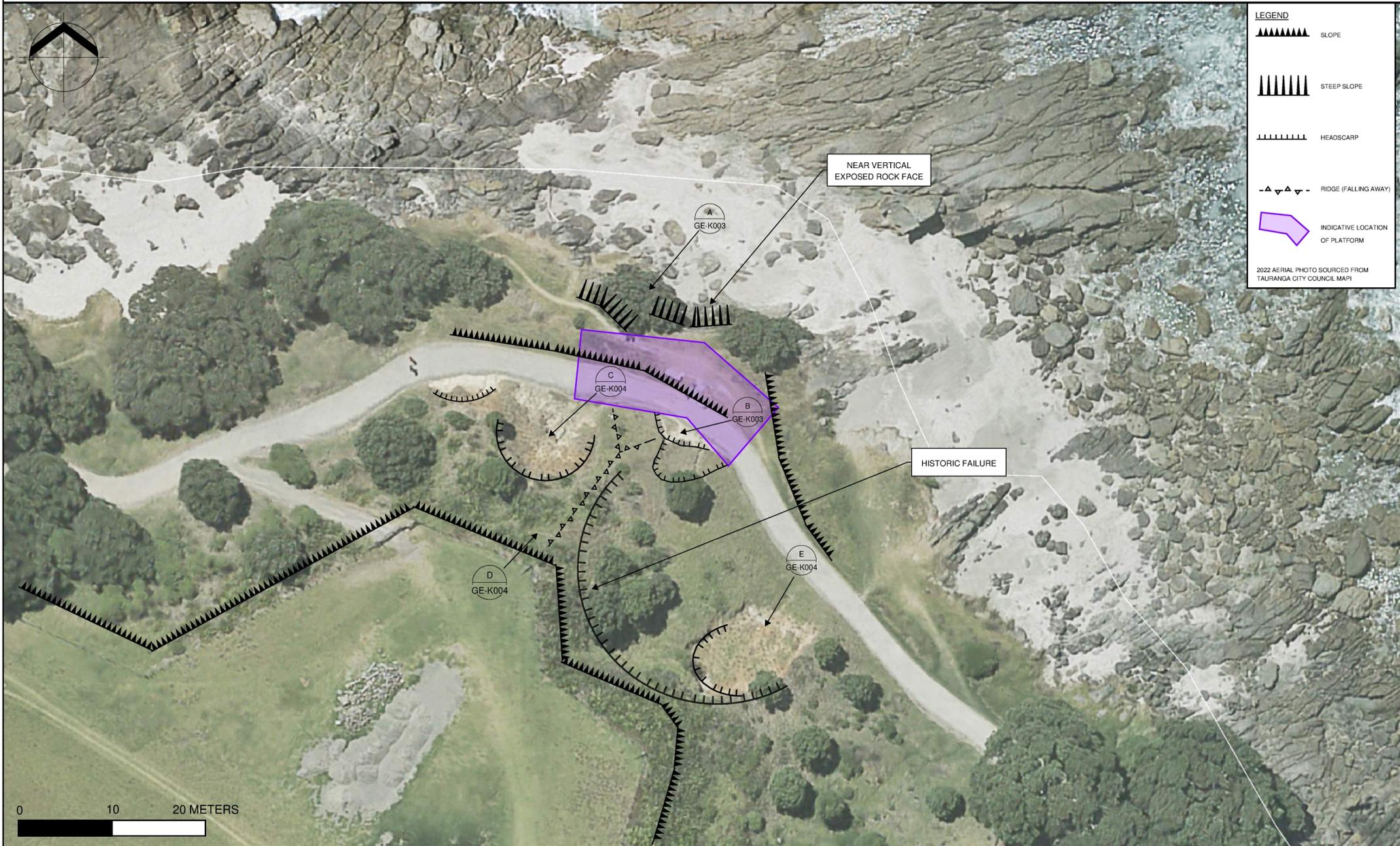
Project: MAUAO PLACEMENT PROJECT

Title: GEOTECHNICAL INVESTIGATION PLAN

Discipline: GEOTECHNICAL

Drawing No: 4280807-GE-K001

Rev: A



LEGEND

- SLOPE
- STEEP SLOPE
- HEADSCARP
- RIDGE (FALLING AWAY)
- INDICATIVE LOCATION OF PLATFORM

2022 AERIAL PHOTO SOURCED FROM TAURANGA CITY COUNCIL MAPI

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No.	Revision	By	Chk	Appd	Date
A	FOR INFORMATION				21/09/22



Original Scale (A1)	Design	21/09/22
Reduced Scale (A3)	Drawn	s 7(2)(a)
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	Design Check	
	Refer to Revision 1 for Original Signature	

Client: TAURANGA CITY COUNCIL

Project: MAUAO PLACEMENT PROJECT

Title: AWAITI GEOMORPHIC MAP

Discipline: GEOTECHNICAL
Drawing No: 4280807-GE-K002
Rev: A



NEAR VERTICAL ROCK FACE

GROUNDWATER SEEPING THROUGH ROCKMASS

A DETAIL
GE-K002 N.T.S

NOTES

1. IMAGE A: VIEW FROM BEACH TOWARDS PROPOSED VIEWING PLATFORM. ROCK FACE IS APPROXIMATELY 5m HIGH. ROCK OUTCROP IS VERY STEEPLY INCLINED. VERTICAL. ROCK APPEARS TO BE IN-SITU. NO SIGNS OF INSTABILITY OF THE ROCK FACE. GROUNDWATER SEEPING THROUGH THE BOTTOM OF THE SLOPE.
2. IMAGE B: VIEW TOWARDS SLOPE FROM PATH. ABOVE PROPOSED VIEWING PLATFORM. EXPOSED CUT APPROXIMATELY 3m HIGH. SOILS APPEAR TO BE COLLUVIUM AND ASHES OVERLYING RESIDUAL ROCK MASS. HEAD SCARP WITH MINOR DOWNTHROWN FEATURES TRACK SOUTH TOWARDS TREE. WATER SEEPING THROUGH RESIDUAL ROCK. NO IMMEDIATE RISK OF SLOPE FAILURE AFFECTING VIEWING PLATFORM.

B DETAIL
GE-K002 N.T.S



ASHES

COLLUVIUM

GROUNDWATER SEEPING THROUGH RESIDUAL ROCK

RESIDUAL ROCKMASS

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No.	Revision	By	Chk	Appd	Date
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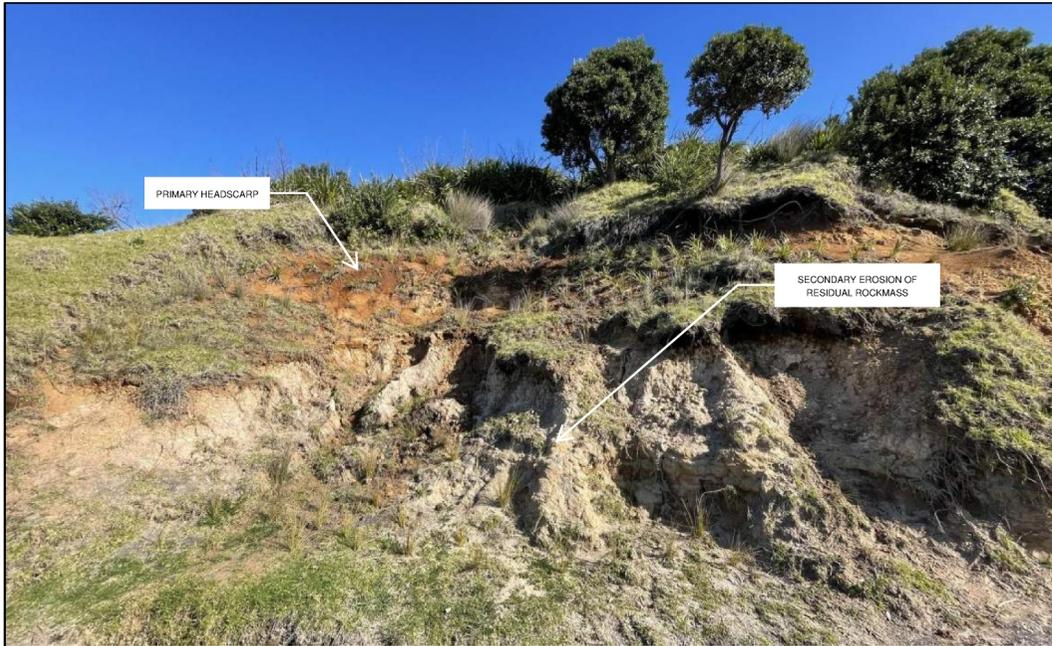
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 Original Scale (A1): N.T.S
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 Checked: [Signature]
 Date: 21/08/22
 * Refer to Revision 1 for Original Signature

Client: TAURANGA CITY COUNCIL

Project: MAUAO PLACEMENT PROJECT

Title: SITE PHOTOS SHEET 1

Discipline: GEOTECHNICAL
Drawing No: 4280807-GE-K003
Rev: A



C DETAIL
GE-K002 N.T.S



D DETAIL
GE-K002 N.T.S



E DETAIL
GE-K002 N.T.S

NOTES:

1. IMAGE C: VIEW LOOKING SOUTH FROM PROPOSED VIEWING PLATFORM. SLOPE APPROXIMATELY 10m HIGH. PREVIOUS SLOPE FAILURE APPROXIMATELY 7m HIGH AND 10m WIDE. FAILURE APPEARS TO HAVE OCCURRED ALONG CONTACT OF ASHES AND RESIDUAL ROCK MASS. SECONDARY EROSION PRESENT ON SANDY RESIDUAL ROCK CREATING STEEP FACES. PLANTING ALONG. NO SIGNS OF CONTINUED FAILURE.
2. IMAGE D: VIEW FROM TOP OF SLOPE LOOKING NORTH, TOWARDS VIEWING PLATFORM. SLOPE FALLS TO THE WEST AND EAST WHERE SLOPE FAILURES HAVE OCCURRED. NO SIGNS OF FURTHER INSTABILITY AT THE TOP OF SLOPE.
3. IMAGE E: VIEW FROM BEACH LOOKING SOUTH, TOWARDS MAUAO. SLOPE APPROXIMATELY 10m HIGH ABOVE BASE TRACK. PREVIOUS SLOPE FAILURE APPROXIMATELY 10m HIGH AND 9m WIDE. FAILURE APPEARS TO HAVE OCCURRED ALONG CONTACT OF ASHES AND RESIDUAL ROCK MASS. PLANTING ALONG FACE. OVERSTEEPENED HEADSCARP WITH SOME DEBRIS PRESENT

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A FOR INFORMATION		7(2)(a) Privacy		21/09/22	
No.	Revision	By	Chk	Appd	Date

Drawing Originator: [Redacted]
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 Design: [Redacted] 7(2)(a) 21/09/22
 Drawn: [Redacted]
 Dtg Verifier: [Redacted]
 Scale (A3): N.T.S
 Dtg Check: [Redacted]
 * Refer to Revision 1 for Original Signature

Client: TAURANGA CITY COUNCIL	Project: MAUAO PLACEMENT PROJECT
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Title: SITE PHOTOS SHEET 2	Discipline: GEOTECHNICAL
Drawing No: 4280807-GE-K004	Rev: A

B

Appendix B – Hand Auger Logs and Photographs

SOIL AND ROCK DESCRIPTIONS

Soil and Rock Descriptions are in general accordance with the NZ Geotechnical Society (NZGS), 2005.
Hand-held Vane Shear Strength measurements are in general accordance with the NZGS, 2001.

METHODS

BH	Machine Borehole
CPT	Cone Penetration Test
DCP	Dynamic Cone Penetration
HA	Hand Auger
SPT	Standard Penetration Test
IVAN	In-situ Vane Test
MA	Machine Auger
OB	Open Barrel
SNC	Sonic Core Drilling
TP	Test Pit/Trench
TT	Triple Tube
PT	Thin-walled Open Drive Tube
VE	Vacuum Excavation
W	Wash Boring

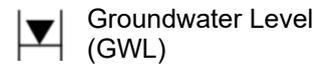
WEATHERING

CW	Completely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
UW	Unweathered

SAMPLES

B	Bulk Disturbed Sample
C	Core Sample
D	Small Disturbed Sample
PT	Thin-wall Open Drive (Push) Tube Sample

WATER



IN-SITU TESTS

<i>Shear Vane</i>	
Su	In-situ peak undrained shear strength and remoulded undrained shear strength
UTP	Unable to Penetrate
CB	Pilcon-type vane tested in Core Barrel
DH	Pilcon-type vane tested in-situ (downhole)
GV	Geonor vane, tested in-situ
IcV	Iccone vane, tested in-situ
<i>Standard Penetration Test (SPT)</i>	
N	SPTn Sampler (Split-spoon)
Nc	SPTn Solid Cone
HB	SPT Hammer Bouncing

TERMINOLOGY

RL	Relative Ground Level
RQD	Rock Quality Designation

GRAPHIC LOG (1 or a combination of the following)

	Clay		Silt		Sandstone (SST)		Conglomerate		Fine Igneous
	Gravel		Sand		Siltstone (ZST)		Limestone		Coarse Igneous
	Shells		Organic Material		Mudstone		Foliated Metamorphic		Ignimbrite
	Cobbles / Boulders		Wood		Interbedded SST & ZST		Asphalt		No Core

MONITORING INSTALLATION

Backfill Material

	Sand		Grout		Bentonite
	Gravel		Cement Mixes		

Standpipe

	Plain		Slotted		Vibrated Wire
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ORGANIC SOILS

Von Post Degree of Humidification

H1	Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.
H2	Partially unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.
H3	Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible.
H4	Slightly decomposed or slightly muddy peat, when pressed gives muddy water and plant structure is less visible.
H5	Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.
H6	Moderately decomposed or very muddy peat with indistinct growth structure.
H7	Fairly well decomposed or very muddy peat but the growth structure can just be seen.
H8	Well decomposed or very muddy peat with very indistinct growth structure.
H9	Practically decomposed or mud-like peat in which almost no growth structure is evident.
H10	Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.

Hand Auger Log

Hand Auger ID:

HA01

Sheet 1 of 1

Project: Mauao Awaiti	Project Number: 4280807
Site Location: Northern point of Mauao Base Track	Client: TCC
Location: Western end of proposed platform.	Coordinate System: BOP2000
	Vertical Datum: NZVD 2016
	Northing: 815038.6
	Ground level (mRL): 7.00
	Easting: 374177.5
	Location Method: Map

Groundwater (m)	In Situ Tests		Samples	Depth (m)	RL (m)	Graphic Log	Soil/ Rock Description	Geological Unit
	Su (kPa)	Scala blows/50mm						
	214/57	2 1 2 1 2 1 2 1 2 2 3 1 1 0 1 0 1 0 0 0		0.5	7.5		Very stiff, clayey SILT, some fine to coarse sand; brown; moist, high plasticity. 0.50m: Dark brown; trace fine gravel. Gravel: shell fragments and angular rhyolite.	Colluvium
	147/70	1 1 0 1 0 1 0 0 0		1.0	8.0		Stiff, SILT, some fine to coarse sand, minor organics, trace clay; dark brownish black; moist, low plasticity. Organics: fibrous rootlets and amorphous. 0.90m: Wet.	Buried Topsoil
	184/50	1 3 3 3 8		1.5	8.5		Dense, silty fine to coarse SAND, minor clay; brown mottled orange; wet, non plastic.	Residual rock
				2.0	9.0	2.00m - End of hand auger, Hole terminated at refusal		
				2.5	9.5			
				3.0	10.0			
				3.5	10.5			
				4.0	11.0			
				4.5	11.5			

Date Started: 09/09/2022	Vane ID: GEO1825	Comments: Terminated at refusal into rock.
Logged By: [Redacted]	Vane Width: 19mm	
Diameter: 50mm	Vane Type: Down hole	

For Explanation of Symbols and Abbreviations See Key Sheet

Project: Mauao Awaiti	Project number: 4280807	
Site location: Northern point of Mauao Base Track	Client Name: TCC	
Location: Western end of proposed platform.	Coordinate system: BOP2000	Vertical datum: NZVD 2016
	Northing: 815038.6	Ground level (mRL): 7.00
	Easting: 374177.5	Location method: Map



Box 1 - 0.00m to 2.00m

Project: Mauao Awaiti	Project number: 4280807	
Site location: Northern point of Mauao Base Track	Client Name: TCC	
Location: Centre of proposed platform	Coordinate system: BOP2000	Vertical datum: NZVD 2016
	Northing: 815036.2	Ground level (mRL): 7.00
	Easting: 374188.0	Location method: Map



Box 1 - 0.00m to 2.00m

Project: Mauao Awaiti	Project number: 4280807	
Site location: Northern point of Mauao Base Track	Client Name: TCC	
Location: Eastern end of proposed platform	Coordinate system: BOP2000	Vertical datum: NZVD 2016
	Northing: 815029.4	Ground level (mRL): 7.00
	Easting: 374193.1	Location method: Map



Box 1 - 0.00m to 2.50m

Hand Auger Log

Hand Auger ID:

HA04

Sheet 1 of 1

Project: Mauao Awaiti	Project Number: 4280807
Site Location: Northern point of Mauao Base Track	Client: TCC
Location: Between existing stair rail and seat	Coordinate System: BOP2000
	Vertical Datum: NZVD 2016
	Northing: 815032.7
	Ground level (mRL): 8.00
	Easting: 374185.3
	Location Method: Map

Groundwater (m)	In Situ Tests		Samples	Depth (m)	RL (m)	Graphic Log	Soil/ Rock Description	Geological Unit
	Su (kPa)	Scala blows/50mm						
	234						Stiff, SILT, minor fine to coarse sand, minor clay, trace organics; dark brown; moist, high plasticity. [Topsoil]	Undifferentiated Volcanic Ashes
				0.5	7.5		Medium dense, fine to coarse SAND, trace silt; brown mottled orange and grey; moist, non plastic,	Residual rock
				1.0	7.0			
				1.5	6.5		1.30m: wet	
				1.5	6.5		1.50m - End of hand auger, Hole terminated at refusal	
				2.0	6.0			
				2.5	5.5			
				3.0	5.0			
				3.5	4.5			
				4.0	4.0			
				4.5	3.5			

Date Started: 09/09/2022	Vane ID: GEO1825	Comments: Terminated at refusal into rock.
Logged By: s 7(2)(a)	Vane Width: 19mm	
Diameter: 50mm	Vane Type: Down hole	

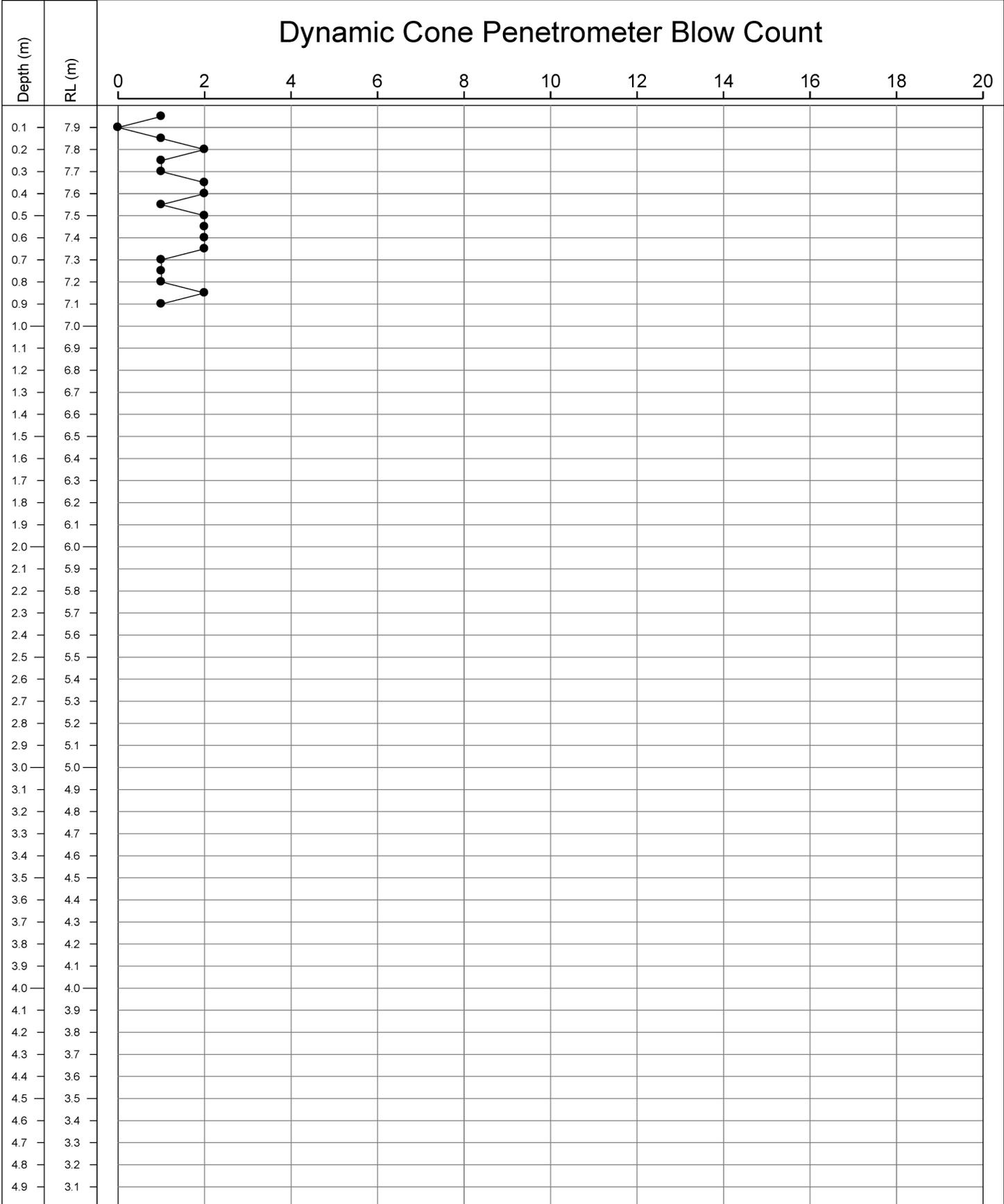
For Explanation of Symbols and Abbreviations See Key Sheet

Project: Mauao Awaiti	Project number: 4280807	
Site location: Northern point of Mauao Base Track	Client Name: TCC	
Location: Between existing stair rail and seat	Coordinate system: BOP2000	Vertical datum: NZVD 2016
	Northing: 815032.7	Ground level (mRL): 8.00
	Easting: 374185.3	Location method: Map



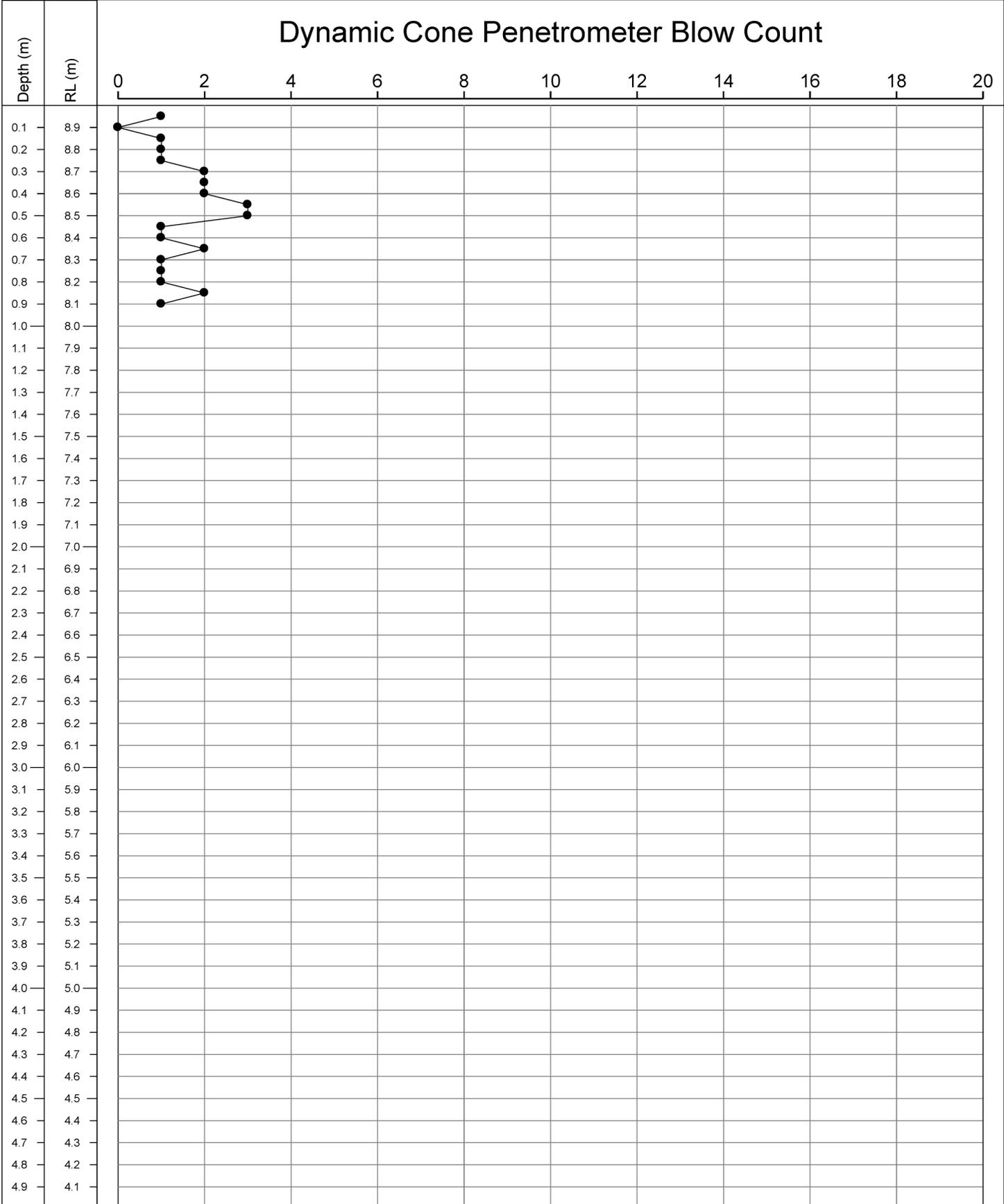
Box 1 - 0.00m to 1.50m

Project: Mauao Awaiti	Project number: 4280807
Site location: Northern point of Mauao Base Track	Client name: TCC
Location: Upslope of proposed platform above basetrack, towards the east.	Coordinate system: BOP2000
	Vertical datum: NZVD 2016
	Northing: 815026.4
	Ground level (mRL): 8.00
	Easting: 374185.7
	Location method: Map



Date started: 09/09/2022	Date end: 09/09/2022	Comments: Terminated at target depth
Logged by: s 7(2)(a) ... Privat	Tested by:	
Equipment: 9Kg DCP	Method: NZS 4402.6.5.2:1988	

Project: Mauao Awaiti	Project number: 4280807
Site location: Northern point of Mauao Base Track	Client name: TCC
Location: Directly behind slope of proposed platform above basetrack on top of ridge.	Coordinate system: BOP2000
	Vertical datum: NZVD 2016
	Northing: 815028.3
	Ground level (mRL): 9.00
	Easting: 374180.8
	Location method: Map



Date started: 09/09/2022	Date end: 09/09/2022	Comments: Terminated at target depth
Logged by: s7(2)(a) ... Priva	Tested by:	
Equipment: 9Kg DCP	Method: NZS 4402.6.5.2:1988	



Calibration Certificate

Certificate No: 718333

Certificate Issued To	Beca Ltd		Address	32 Harington St Tauranga	
Purchase Order No					
Manufacturer	Geotechnics	Model	Geovane	S/No	1825
				Unique ID	
Description	Handheld shear vane with matching blade(s)				
Calibration Date	14/03/2022	Temp During Test	19.9 to 20.3 °C		
Method	MCC 5.51c.01 – Handheld Soil Shear Vane Testers (2021), Guideline for Hand Held Shear Vane Test (NZGS, 2001) was used as a guide.				
Statement of Performance	The equipment meets the requirements of the method for which it was tested.				

Results

19 mm Ø Vane Blade

Shear Strength = A × Reading	A (kPa/div)	1.671	Area Ratio	23.8%
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Reading (div)	Shear Strength (kPa)								
0	0	30	50	60	100	90	150	120	201
2	3	32	53	62	104	92	154	122	204
4	7	34	57	64	107	94	157	124	207
6	10	36	60	66	110	96	160	126	211
8	13	38	64	68	114	98	164	128	214
10	17	40	67	70	117	100	167	130	217
12	20	42	70	72	120	102	170	132	221
14	23	44	74	74	124	104	174	134	224
16	27	46	77	76	127	106	177	136	227
18	30	48	80	78	130	108	180	138	231
20	33	50	84	80	134	110	184	140	234
22	37	52	87	82	137	112	187		
24	40	54	90	84	140	114	191		
26	43	56	94	86	144	116	194		
28	47	58	97	88	147	118	197		

The expanded uncertainty of measurement, expressed at the 95% confidence level, is ±8.7 kPa. The coverage factor (k) is 2.

Remarks

When received, this equipment was in not working condition. The equipment was adjusted and/or repaired prior to calibration and the recording of measurements.

Measurement results are traceable to the International System of Units (SI), or other recognised references via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

This certificate has been prepared for the benefit of Beca Ltd, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This calibration was performed at 1 Hill Street, Onehunga, Auckland, NZ.

Prepared by
Checked by
Key Technical Person

s 7(2)(a) † Privacy



All measurements reported herein have been performed in accordance with the laboratory's scope of accreditation



Calibration Certificate

Certificate No: 718333

Certificate Issued To	Beca Ltd		Address	32 Harington St Tauranga	
Purchase Order No					
Manufacturer	Geotechnics	Model	Geovane	S/No	1825
				Unique ID	
Description	Handheld shear vane with matching blade(s)				
Calibration Date	14/03/2022		Temp During Test	19.9 to 20.3 °C	
Method	MCC 5.51c.01 – Handheld Soil Shear Vane Testers (2021), Guideline for Hand Held Shear Vane Test (NZGS, 2001) was used as a guide.				
Statement of Performance	The equipment meets the requirements of the method for which it was tested.				

Results

33 mm Ø Vane Blade

Shear Strength = A × Reading	A (kPa/div)	0.308	Area Ratio	12.6%
-------------------------------------	--------------------	--------------	-------------------	-------

Reading (div)	Shear Strength (kPa)								
0	0	30	9	60	18	90	28	120	37
2	1	32	10	62	19	92	28	122	38
4	1	34	10	64	20	94	29	124	38
6	2	36	11	66	20	96	30	126	39
8	2	38	12	68	21	98	30	128	39
10	3	40	12	70	22	100	31	130	40
12	4	42	13	72	22	102	31	132	41
14	4	44	14	74	23	104	32	134	41
16	5	46	14	76	23	106	33	136	42
18	6	48	15	78	24	108	33	138	42
20	6	50	15	80	25	110	34	140	43
22	7	52	16	82	25	112	34		
24	7	54	17	84	26	114	35		
26	8	56	17	86	26	116	36		
28	9	58	18	88	27	118	36		

The expanded uncertainty of measurement, expressed at the 95% confidence level, is ±1.5 kPa. The coverage factor (k) is 2.

Remarks

When received, this equipment was in not working condition. The equipment was adjusted and/or repaired prior to calibration and the recording of measurements.

Measurement results are traceable to the International System of Units (SI), or other recognised references via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

This certificate has been prepared for the benefit of Beca Ltd, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This calibration was performed at 1 Hill Street, Onehunga, Auckland, NZ.

Prepared by

Checked by

Key Technical Person

s 7(2)(a) Privacy



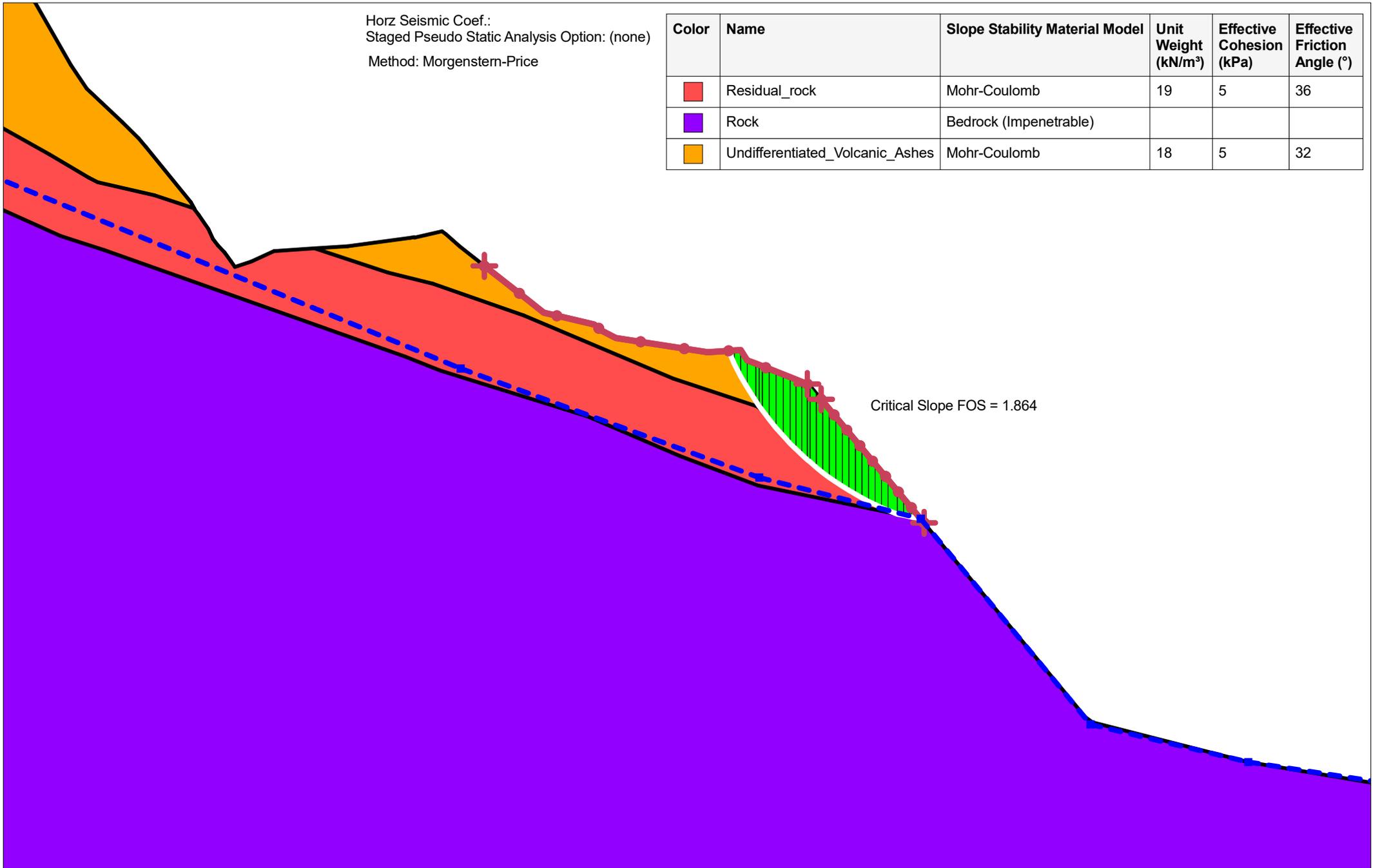
All measurements reported herein have been performed in accordance with the laboratory's scope of accreditation

B

Appendix B – Slope Stability Analyses

Horz Seismic Coef.:
 Staged Pseudo Static Analysis Option: (none)
 Method: Morgenstern-Price

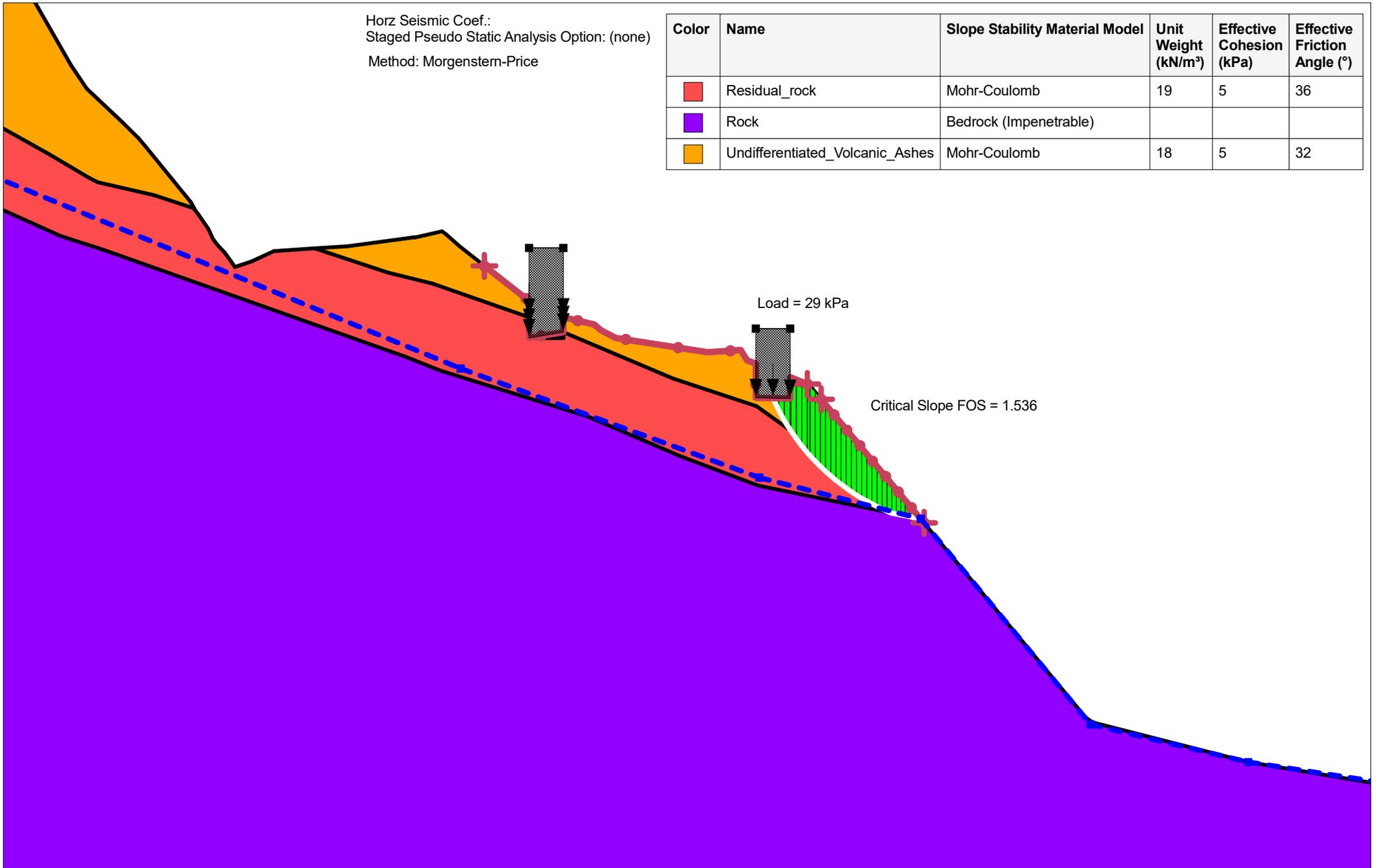
Color	Name	Slope Stability Material Model	Unit Weight (kN/m ³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Red	Residual_rock	Mohr-Coulomb	19	5	36
Purple	Rock	Bedrock (Impenetrable)			
Orange	Undifferentiated_Volcanic_Ashes	Mohr-Coulomb	18	5	32



	Mauao Viewing Platform	Mauao viewing platform.gsz Existing static	Job Number: 4280807	Date: 13/04/2023
			Scale: 1:50	4280807-GA-K001

Horz Seismic Coef.:
 Staged Pseudo Static Analysis Option: (none)
 Method: Morgenstern-Price

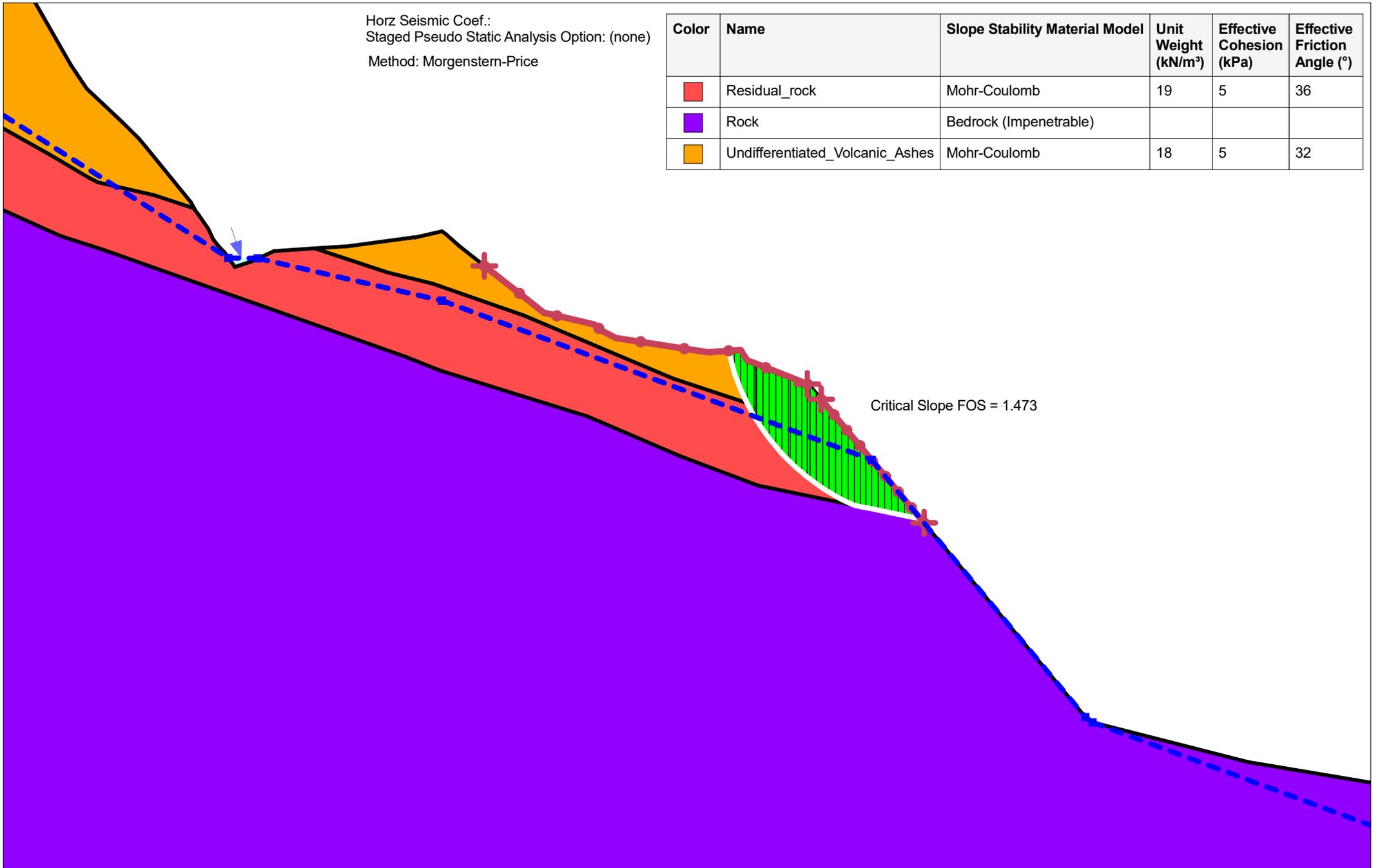
Color	Name	Slope Stability Material Model	Unit Weight (kN/m ³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Red	Residual_rock	Mohr-Coulomb	19	5	36
Purple	Rock	Bedrock (Impenetrable)			
Orange	Undifferentiated_Volcanic_Ashes	Mohr-Coulomb	18	5	32



	Mauao Viewing Platform	Mauao viewing platform.gsz Proposed static	Job Number: 4280807	Date: 13/04/2023
			Scale: 1:50	4280807-GA-K002

Horz Seismic Coef.:
 Staged Pseudo Static Analysis Option: (none)
 Method: Morgenstern-Price

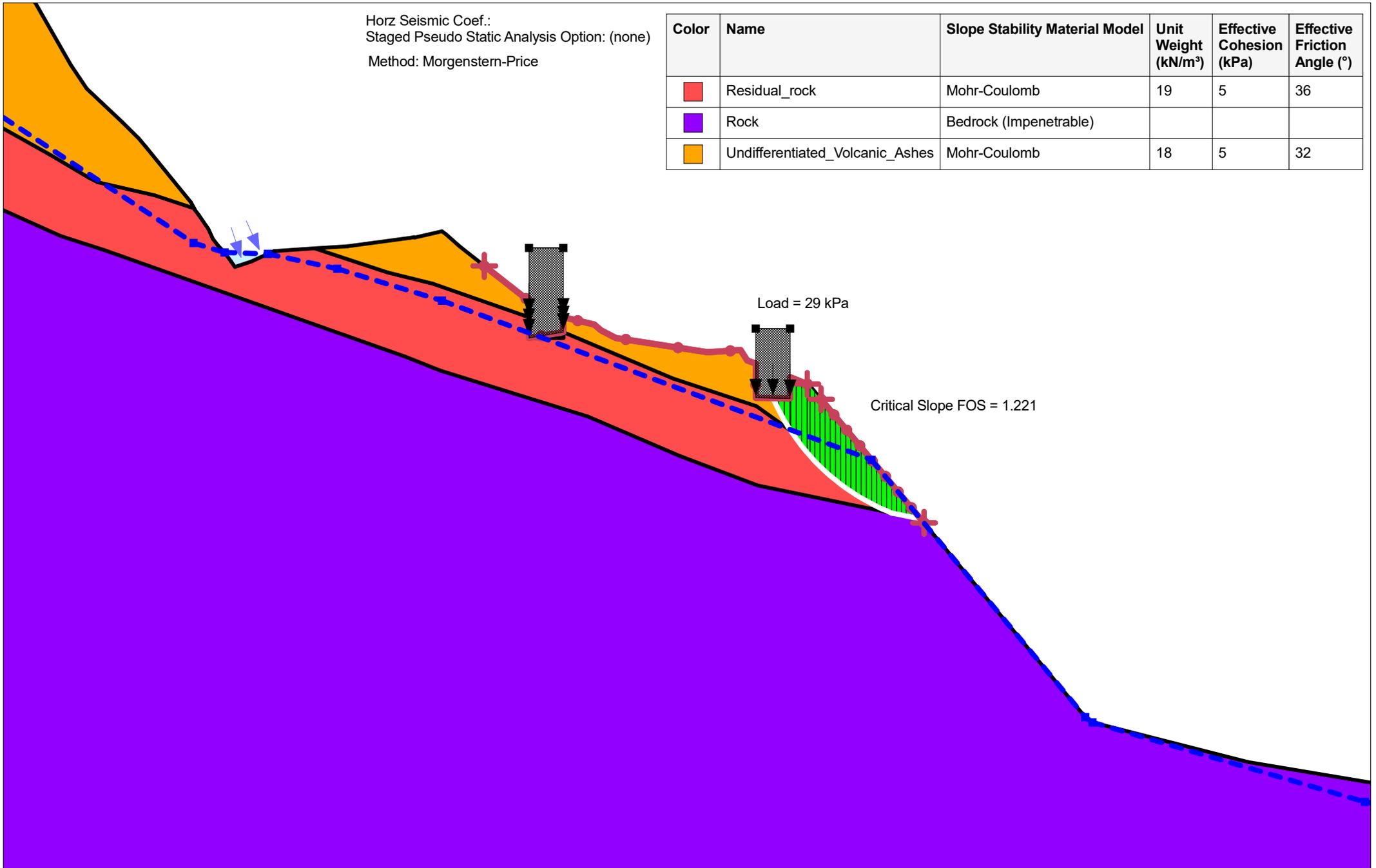
Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Red	Residual_rock	Mohr-Coulomb	19	5	36
Purple	Rock	Bedrock (Impenetrable)			
Orange	Undifferentiated_Volcanic_Ashes	Mohr-Coulomb	18	5	32



	Mauao Viewing Platform	Mauao viewing platform.gsz Existing extreme GWL	Job Number: 4280807	Date: 13/04/2023
			Scale: 1:50	4280807-GA-K003

Horz Seismic Coef.:
 Staged Pseudo Static Analysis Option: (none)
 Method: Morgenstern-Price

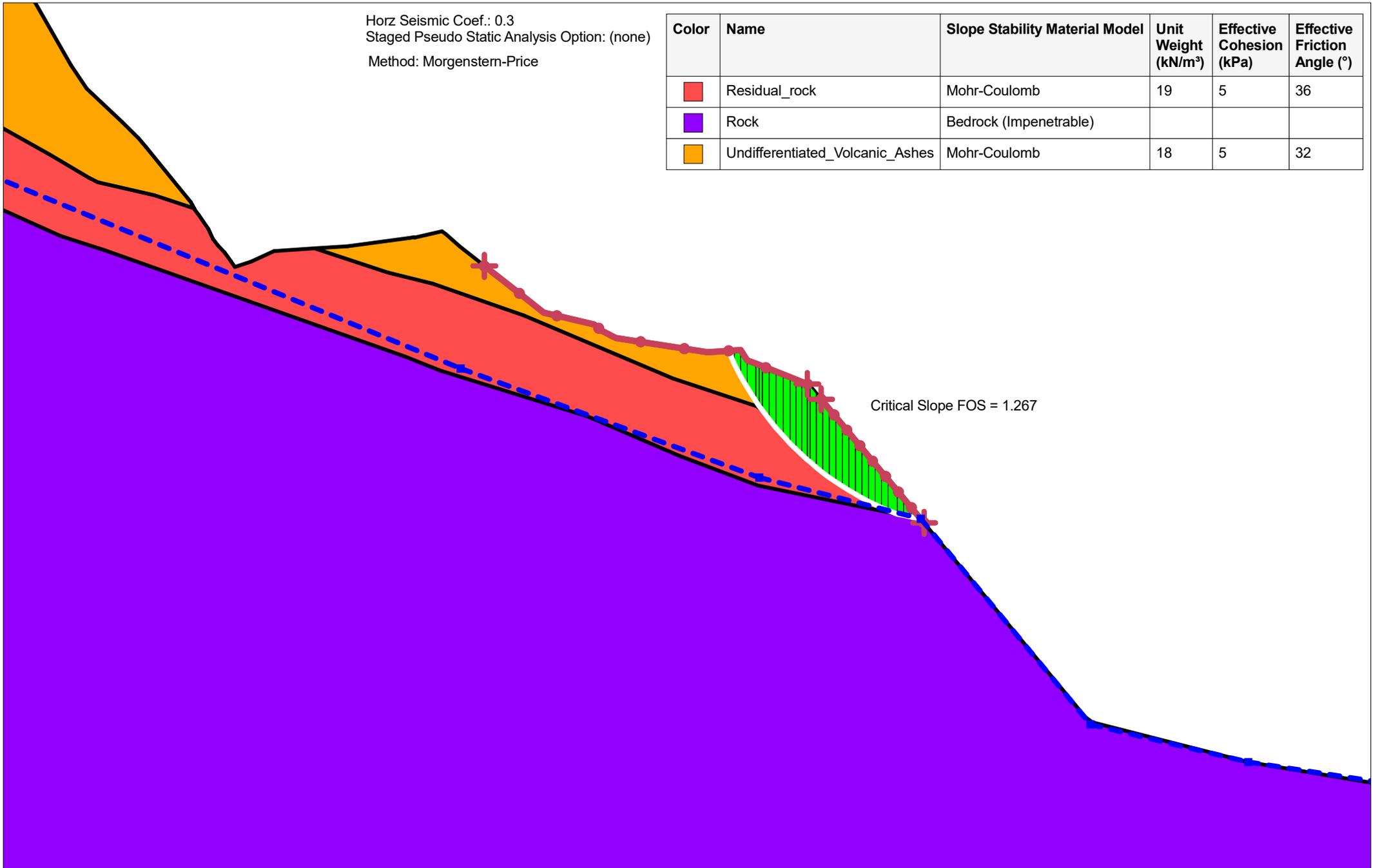
Color	Name	Slope Stability Material Model	Unit Weight (kN/m ³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Red	Residual_rock	Mohr-Coulomb	19	5	36
Purple	Rock	Bedrock (Impenetrable)			
Orange	Undifferentiated_Volcanic_Ashes	Mohr-Coulomb	18	5	32



	Mauao Viewing Platform	Mauao viewing platform.gsz Proposed extreme GWL	Job Number: 4280807	Date: 13/04/2023
			Scale: 1:50	4280807-GA-K004

Horz Seismic Coef.: 0.3
 Staged Pseudo Static Analysis Option: (none)
 Method: Morgenstern-Price

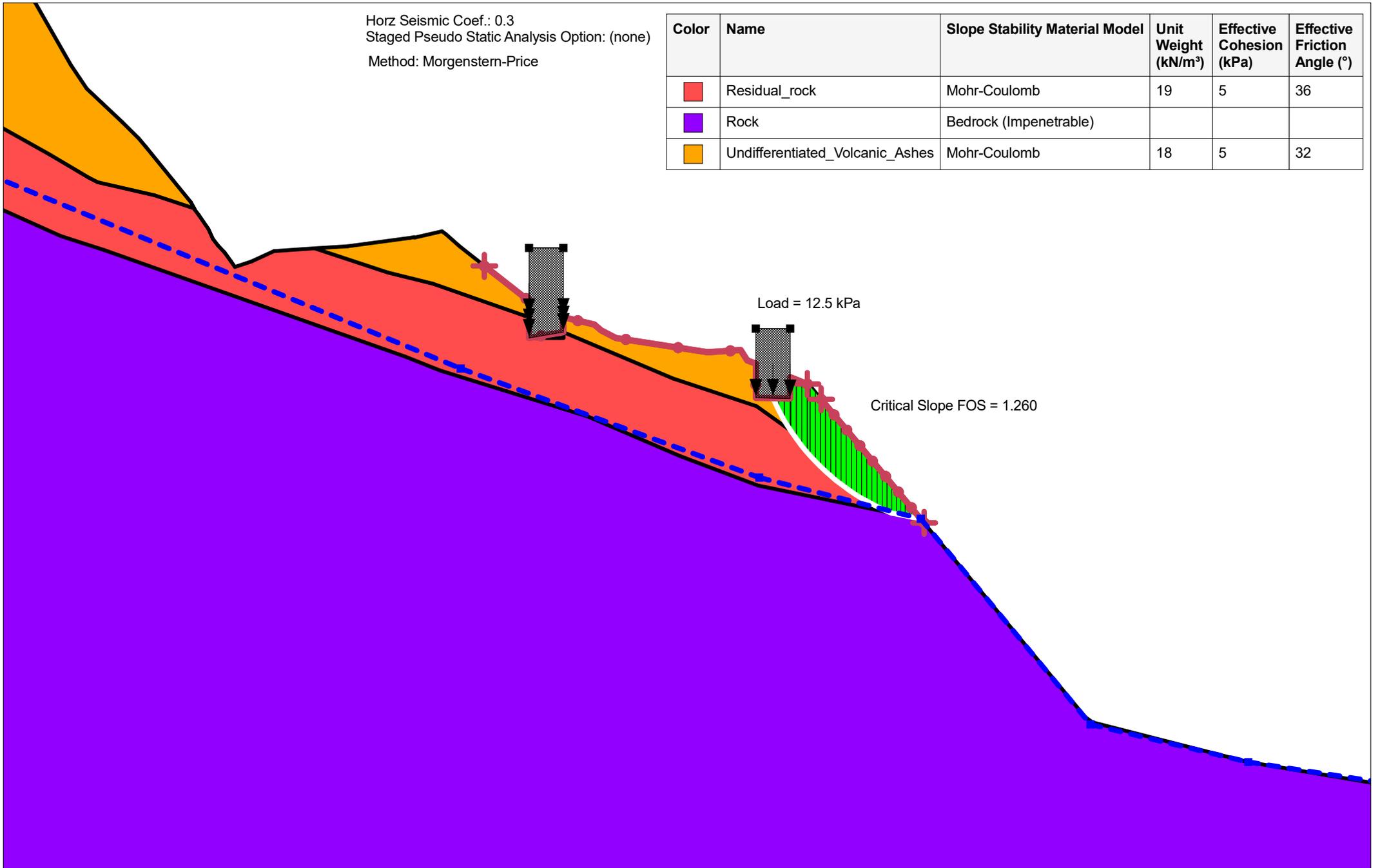
Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Red	Residual_rock	Mohr-Coulomb	19	5	36
Purple	Rock	Bedrock (Impenetrable)			
Orange	Undifferentiated_Volcanic_Ashes	Mohr-Coulomb	18	5	32



	Mauao Viewing Platform	Mauao viewing platform.gsz Existing seismic	Job Number: 4280807	Date: 13/04/2023
			Scale: 1:50	4280807-GA-K005

Horz Seismic Coef.: 0.3
 Staged Pseudo Static Analysis Option: (none)
 Method: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (kN/m ³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Red	Residual_rock	Mohr-Coulomb	19	5	36
Purple	Rock	Bedrock (Impenetrable)			
Orange	Undifferentiated_Volcanic_Ashes	Mohr-Coulomb	18	5	32



	Mauao Viewing Platform	Mauao viewing platform.gsz Proposed seismic	Job Number: 4280807	Date: 13/04/2023
			Scale: 1:50	4280807-GA-K006