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Mr Sherridan Cook
c/- Airey Consultants Ltd
IanG@Airey.co.nz

29 June 2020

Our Ref: 170457-C
Reissue of: 170457-B

Attention: Mr Ian Gibson

Dear Sir

GEOTECHNICAL ASSESSMENT
24 SUMMIT DRIVE, MT ALBERT

1.0 Introduction

The following report has been prepared by Riley Consultants Ltd (RILEY) at the request of Mr Sherridan Cook in support of a subdivision to form two new lots at the above address. This report presents the results of a geotechnical investigation together with comments and recommendations regarding the site development.

The specific aims of the investigation were to:

- Assess geotechnical suitability of the proposed building platforms on each new lot.
- Investigate subsoil/founding conditions in the proposed building platforms and western retaining wall, assess proposed ground stability, and provide preliminary retaining wall construction and general site development recommendations.

This report is intended to provide sufficient details to support a resource consent application to Auckland Council (Council) for the subdivision.

2.0 Site Description and Proposed Development

The vacant site is located on the northern flanks of Mount Albert with residential properties bounding the site to the east and west with another vacant lot to the north. The site is characterised by moderate to steep slopes (approximately 23°) falling to the north.

During our site walkover, it was noted that the site is relatively steep, covered in a thick layer of kikuyu grass, and remnants of basalt boulder stockpiles were observed.

Based on the provided earthworks plan by Airey Consultants Ltd (job no. 170097/1, dated May 2020), we understand the site is to be subdivided into two lots and a building platform is proposed in the central portion of each lot. To comply with accessway gradients and to reach the proposed Lot 2 boundary at ground level, it is proposed to create a 1V:2.5H (22°) permanent batter on the western portion of proposed Lot 1. A number of retaining walls are proposed along the western and eastern boundaries of the existing driveway to support the cut (2.5m) and fill (0.5m) faces. The proposed western retaining wall is below an existing boundary dry-stone wall (approximately 1m high) with the proposed 1V:2.5H batter below. The total retained height for the proposed western retaining wall including the existing rock wall is likely to be up to 3.5m high.

3.0 Geology

The 1:250,000 Geological Map 3 of Auckland, together with our experience of the surrounding area, indicates the site is underlain by Auckland basalt scoria of the Kerikeri Volcanic Group. This material is described as red-brown, poorly-sorted, vesicular, pebble to boulder sized ejecta of basaltic composition.

4.0 Review of Previous Reports

RILEY has carried out a review of the Preliminary Geotechnical Appraisal prepared by Coffey (Coffey Ref: AKLGE201280AA, dated 28 February 2017). Their geotechnical appraisal comprised a site walkover and desktop review, no subsurface investigations were carried out. Coffey noted that there were several basalt retaining walls around the site including within the designated driveway. No basalt scoria outcrops were observed other than remnants of a basalt boulder stockpile and basalt boulders scattered across the site. Coffey identified that some retaining walls would require reinstating to withstand traffic loading and leading edge piles may be required for the proposed foundations.

The vacant lot to the north, 22 Summit Drive, was investigated by KGA Geotechnical (KGA) and RILEY has reviewed their responses to a Council Request for Further Information (RFI) letter. KGA carried out six hand auger boreholes across the site of 22 Summit Drive, which encountered volcanic material from approximately 2m below ground level (bgl). KGA noted that the depth to rock will vary with elevation across the site, which is likely to be between 2.5m and 3m bgl.

RILEY has reviewed the New Zealand Geotechnical Database (NZGD) as well as previous nearby RILEY investigations. An NZGD investigation approximately 55m north of the site encountered slightly weathered basalt from 1m bgl while a RILEY investigation approximately 280m south-west of the site encountered basalt between 0.8m and 2.5m bgl. This confirms that the depth to basalt in the area is variable.

5.0 Site Investigation

Fieldwork was carried out on 26 July 2017 and 20 November 2017 and comprised six hand auger boreholes. All hand augers refused in scoria between 2m and 3.7m bgl. Scala penetrometer (Scala) testing was carried out in the base of the boreholes and reached refusal between 2.6m and 4.1m bgl.

5.1 Subsurface Conditions

The hand auger boreholes HA1 to HA6 encountered materials consistent with the expected site geology. Subsurface conditions are summarised as follows:

- Topsoil comprising silt with minor clay and organics was encountered from the surface to up to 0.2m bgl.
- Material from the Auckland Volcanic Field (AVF) comprising very stiff to hard silt with minor clay and trace scoria gravel (160kPa to in excess of 200kPa) was encountered to the hand auger borehole termination depth between 2m and 3m bgl.
- From Scala testing we have inferred that basalt rock is likely to be encountered from between 2.6m and 4.1m bgl.
- Groundwater was encountered in HA1 and HA2 only between 1.8m and 2.1m, respectively, on completion of the investigation.

6.0 Geotechnical Assessment

6.1 Soil Parameters

The geotechnical parameters shown in Table 1 has been based on our investigations as well as our experience and understanding of the behaviour of soils in the area.

Table 1: Soil Parameters

Material Description	Cohesion (c') (kPa)	Angle of Internal Friction (Φ') (degrees)	Unit Weight (γ) (kN/m^3)
Very stiff to hard AVF soils	7	32	18
AVF basalt rock	15	40	20

A seismic acceleration of 0.19g was adopted for the seismic scenario, based on the New Zealand Transport Agency (NZTA) Bridge Manual and New Zealand Geotechnical Society (NZGS) Module 6.

6.2 Slope Stability

To quantitatively assess the global stability of the proposed ground profile on proposed Lot 1, cross section A, shown on RILEY Dwg: 170457-1, has been modelled using a computer slope stability analysis package (Slide 2018). The Morgenstem-Price method of limit equilibrium analysis was adopted. The model considered long-term and short-term extreme groundwater conditions for circular and non-circular failure surfaces.

The degree of stability of a slope is expressed as the FoS, which is the ratio of the available restoring moment of the slope to resist failure (generated by stabilising forces), to the driving forces causing instability. Values of FoS less than 1.0 indicate greater stability. According to the Council Code of Practice, for land development and subdivision, sites should be shown to have a FoS of 1.5 under normal conditions, 1.3 under extreme (wet transient) conditions and 1.0 under seismic conditions. The slope stability results are presented in Table 2.

Table 2: Slope Stability Results

Failure Surface	Type of Analysis	Target FoS	FoS for Proposed Ground Profile
Circular	Normal groundwater conditions	1.5	2.6
	Extreme groundwater conditions	1.3	1.7
	Seismic	1.0	1.8
Non-circular	Normal groundwater conditions	1.5	2.5
	Extreme groundwater conditions	1.3	1.6
	Seismic	1.0	1.7

The slope stability analysis results demonstrate that the proposed ground profile can achieve the target FoS globally. However, due to the presence of moderately to steeply slopes, we suggest the installation of protection piles for the proposed future foundations. Further geotechnical inputs should be expected at the building consent stage when the detailed design drawings are available.

6.3 Foundation Recommendations

On the basis of our assessment of the ground conditions, we consider that the site is suitable for the proposed new development.

Due to the presence of moderate and steep sloping ground, we recommend that foundations within 4m of slopes exceeding 1V:4H should be piled. Rows of transition piles should be installed in between the pile foundations and the shallow foundations. Pile depths can reduce in areas of cut (i.e. where the platform is benched into the slope). Alternatively, the entire building platform could be fully supported on piles.

Any proposals for filling within or downslope of the building platform should be subject to geotechnical review.

It is recommended that RILEY be given the opportunity to review the earthworks and structural foundation drawings prior to lodgement for building consent to ensure recommendations detailed in this report are correctly applied to the design of the dwelling foundations.

6.4 Boundary Retaining Wall Parameters

Boundary retaining walls, up to a total retained height of 3.5m (2.5m proposed plus 1m existing), are proposed along the driveway. Due to the presence of shallow rock, we consider that shallow heel footing walls are likely to be the most appropriate wall type. The retaining wall foundations should either be founded on natural soils or basalt rock, and the design should take differential settlement into consideration between walls founded on different subsoils.

The following parameters are recommended for the structural foundation design, for retaining walls supported on stiff natural ground.

- 300kPa Ultimate Bearing Capacity (Geotechnical Ultimate).
- 150kPa Dependable Bearing Capacity (Ultimate Limit State).
- 100kPa Allowable Bearing Capacity (Serviceability Limit State).

The following parameters are recommended for the retaining foundations supported on competent basalt rock, assuming excavations are thoroughly cleaned of loose material.

- 1MPa Ultimate Bearing Capacity (Geotechnical Ultimate).
- 500kPa Dependable Bearing Capacity (Ultimate Limit State).
- 330kPa Allowable Bearing Capacity (Serviceability Limit State).

Apart from the bearing capacities provided above, the retaining walls should also assume the following parameters:

- $\phi' = 32^{\circ}$ and $\gamma = 18KN/m^3$ for the AVF soils.
- Ko (at rest) earth pressure modified for those with structures potentially applying surcharge loads.
- For wall shear key design, we recommend shear strength (cu) of 60kPa in the natural soils and 200kPa in the basalt rock.
- Allowance for surcharge loading as applicable (i.e. boundary, traffic, tier wall effects).

The retaining walls should be constructed with appropriate toe drainage and should be backfilled with granular material that complies with the NZTA F/2 specification, or approved proprietary strip drains. GAP graded drainage metals are not recommended. Toe drainage underline should be connected into an approved stormwater disposal system. Any necessary waterproofing details should be specified by the building designer.

It is recommended that RILEY be given the opportunity to review the retaining wall drawings to ensure our recommendations in this report are correctly applied.

6.5 Boundary Retaining Wall Construction Methodology

Maintaining support to the cut faces exceeding 1m and avoiding damage to the existing dry-stone wall would be challenging. The existing dry-stone wall is non-engineered and vulnerable to movement. We do not recommend a cantilevered pile wall to be drilled in basalt as rock drilling is slow and costly. Temporary walls should be installed prior to any excavations exceeding 1m in height to provide continuous support. Therefore, conventional cut and shoring techniques are not recommended. Based on the above, we suggest the following wall options and construction sequences below:

- Option 1: Rows of temporary soil nails to be installed prior to the excavation. During excavation, the nails will be progressively exposed, and faceplates will need to be progressively repositioned. Install a concrete facing wall (such as concrete poured wall at the bottom of the excavation and masonry blocks on top (or precast tilt slab) with shallow heel footing. The permanent cantilevered wall needs to be designed as a rigid structure and the heel footing of the wall is likely to be wide (part of the driveway). Nails are temporary but left in place. No easement would be required, however, neighbouring approval would be required.
- Option 2: Install temporary (sacrificial) timber cantilevered pole wall prior to the excavation and two rows of temporary rock anchor to be progressively installed during the excavation. A permanent concrete facing wall will be installed in front of the temporary timber wall and designed as a rigid structure as per the previous recommendations.
- Option 3: Install temporary (sacrificial) timber cantilevered pole wall prior to excavation. Progressively install props supported by Deadman supports within property (top and bottom). Note props and Deadman supports will restrict access and complicate permanent wall construction.

A condition assessment of the dry-stone wall should be carried out prior to and following the wall construction.

The construction methodology should be confirmed by the contractor, geotechnical and structural engineers.

7.0 Proposed Earthworks

We have reviewed the earthworks plan provided by Airey Consultants Ltd. Based on our investigation data, basalt rock is inferred to be encountered between 2.6m and 4.1m bgl, which is lower than the proposed excavation level, and therefore, it is unlikely that basalt rock will be encountered during earthworks. However, since the depth and extent of basalt rock can vary across the site, minor rock breaking may be required over some areas of the site.

All earthworks and drainage construction should be carried out in accordance with NZS 4404 and related documents and with Council Standards of Engineered Design and Construction.

It is recommended RILEY review, or be involved with the detailed earthworks design to ensure our design intentions have been followed.

There should be no temporary stockpiling of material above the cut or steep slopes to minimise surcharge loads. All excess excavated soil should be removed from site.

7.1 Clearing and Topsoil Stripping

All vegetation and topsoil should be stripped from areas of proposed earthworks (cuts and fills) prior to work commencing. The stripping should extend well beyond any area in which cutting or filling is to be undertaken to avoid peripheral fill contamination.

7.2 Excavatability

It is expected soils will be readily excavatable by conventional earthworks machinery, including hydraulic excavators of 20 tonne. Basalt rock is considered unlikely to be encountered but cannot be completely discounted. The basalt rock layer, likely to be encountered from between 2.6m and 4.1m bgl, may require some rock breaking if encountered.

7.3 Undercutting

Any deposit of unsuitable material encountered during stripping should be sub-excavated, and these materials should either be mixed with the topsoil stockpile if appropriate, or removed from the site.

The sub-excavated materials (organic rich soils) may be unsuitable for use as engineered fill within the development. It may, however, be possible to place some material as a thin layer of landscaping fill beneath the surface topsoil layer across the subdivision.

7.4 Filling

Only minor fill (up to 0.5m) associated with driveway formation are expected to be carried out. The suitability of materials to be used as engineered fill should be confirmed by a geotechnical engineer prior to commencement of work. Fill should be placed in layers of no more than 200mm thickness and compacted with specialised ‘protruding foot’ type rollers. It may be more practical to utilize compacted hardfill within the driveway.

8.0 Site Development

Stormwater runoff from roofs and paved areas should be collected and preferably piped to the public reticulation network. Alternatively, on site soakage (e.g. deep rock bores) may also be possible. Stormwater should not be disposed onto, or above steeper slopes and shallow soak pits/trenches are not recommended.

9.0 Conclusions and Recommendations

We consider the proposed residential development is feasible in geotechnical terms, subject to the following recommendations:

- The risk of ground instability affecting the proposed developments is considered low.
- We recommend the proposed dwellings within 4m of slopes exceeding 1V:4H be supported on piles. Transitional piles between the piles and the shallow foundations are required.

- Recommendations for the boundary retaining wall is provided in the report. As a minimum, temporary walls should be installed prior to any boundary excavations to provide continuous support to excavations exceeding 1m.
- Earthwork recommendations (including cutting and filling) are outlined in the report.
- Stormwater runoff from roofs and paved areas should be collected and piped to the provided reticulation. Stormwater should not be disposed onto, or above steeper slopes.
- It is recommended that RILEY reviews foundation details and development drawings prior to lodgement for building consent.

10.0 Limitation

This report has been prepared solely for the benefit of Mr Sherridan Cook as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Recommendations and opinions in this report are based on data from limited test positions. The nature and continuity of subsoil conditions away from the test positions are inferred, and it must be appreciated that actual conditions could vary considerably from the assumed model.

During excavation and construction the site should be examined by an engineer or engineering geologist competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. It is possible that the nature of the exposed subsoils may require further investigation and the modification of the design based upon this report.

It is essential Riley Consultants Ltd is contacted if there is any variation in subsoil conditions from those described in the report as it may affect the design parameters recommended in the report.

Yours faithfully
RILEY CONSULTANTS LTD

Prepared by:

Jessica Zhang
Geotechnical Engineer

Reviewed and approved for issue by:

Brett Black
Director, CPEng

Enc: Borehole Logs (HA1 to AH6)
Slide Outputs
RILEY Dwgs: 170457-1 and -2

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GEOTECHNICAL AND GEOLOGICAL INFORMATION

SOIL TYPES AND SYMBOLS


FILL


TOPSOIL


SILT


SAND


GRAVEL


CLAY


PEAT


GROUNDWATER LEVEL

10,11,10
SCALA PENETROMETER
LAST 3 NUMBER OF BLOWS PER 50mm INCREMENT

ROCK TYPES AND SYMBOLS


SANDSTONE


SILTSTONE


MUDSTONE


LIMESTONE


BASALT


TUFF


IGNIMBRITE


GREYWACKE

SOIL STRENGTH CLASSIFICATION

FINE GRAINED COHESIVE SOILS

TERM	FIELD IDENTIFICATION	UNDRAINED SHEAR STRENGTH (KPa)
Very Soft (Vs)	Exudes between fingers when squeezed.	<12
Soft (S)	Easily indented by fingers.	12 – 25
Firm (F)	Indented only by strong finger pressure.	25 – 50
Stiff (St)	Indented by thumb pressure.	50 – 100
Very Stiff (VSt)	Indented by thumbnail.	100 – 200
Hard (H)	Difficult to indent by thumbnail.	200+

SPT & SCALA PENETROMETER RESULTS

TERM	SPT VALUE No. of BLOWS/300mm	SCALA PENETROMETER No. of BLOWS/100mm
very dense	>50	17+
dense	30 – 50	7 – 17
medium dense	10 – 30	3 – 7
loose	4 – 10	1 – 3
very loose	0 – 4	0 – 2

ROCK STRENGTH CLASSIFICATION

TERM		FIELD IDENTIFICATION	UNCONFINED UNIAXIAL COMPRESSIVE STRENGTH (MPa)
Extremely weak	(EW)	Indented by thumbnail.	< 1
Very weak	(VW)	Crumbles under firm blows with point of geological hammer. Can be peeled with pocket knife.	1 – 5
Weak	(W)	Difficult to peel with pocket knife.	5 – 20
Moderately strong	(MS)	Cannot be scraped or peeled with pocket knife.	20 – 50
Strong	(S)	More than one blow of geological hammer to fracture.	50 – 100
Very strong	(VS)	Many blows of geological hammer to break.	100 – 250
Extremely strong	(ES)	Can only be chipped with geological hammer.	250+

MOISTURE CONDITION

Dry (D)	Looks and feels dry; powdery and friable.
Moist (M)	Feels cool; darkened in colour; no free water when remoulded.
Wet (W)	Feels cool; darkened in colour; free water forms on hands.
Saturated (S)	Free water is present on sample.

SAMPLE TYPES

UNDISTURBED


MACHINE AUGER DISTURBED

D
HAND AUGER DISTURBED


STANDARD PENETRATION TEST (solid cone)


STANDARD PENETRATION TEST (hollow cone)

DRILLING METHOD

OB	OPEN BARREL
TT	TRIPLE TUBE
WB	WASH BORE
SH	UNDISTURBED SHELBY TUBE
RC	ROCK CORE
SPT	STANDARD PENETRATION TEST

FIELD TESTS

V	SHEAR VANE (corrected to BS:1377)
R	REMOULDED STRENGTH
P	POCKET PENETROMETER
CH	CLEGG HAMMER

INFORMATION BASED ON THE NZ GEOTECHNICAL SOCIETY INC. GUIDELINES FOR THE CLASSIFICATION AND DESCRIPTION OF SOIL AND ROCK FOR ENGINEERING PURPOSES

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Engineers and Geologists
Riley Consultants Limited
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Takapuna, 0622
Tel: +649 48978782
Fax:

HAND AUGER LOG

Project:	Location:	Hole position:	No.:
24 Summit Drive	Mt Albert	Lot 1 Proposed Dwelling	HA1

Job No.:	Start Date: 26-07-17 Finish Date: 26-07-17	Ground Level (m):	Co-Ordinates ():
170457		97.00	E 1,753,201.00 N 5,916,048.00

Client:	Hole Depth:	Sheet:
Sherridan Cook	2.00 m	1 of 1

Elevation (m)	Depth (m)	Geological Unit	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)
+97.00			
+96.90	0.10	Auckland Volcanic Field	SILT, minor clay, minor organics; dark brown. Stiff, slightly plastic; rootlets [TOPSOIL]
			SILT, trace clay, trace gravel; dark brownish red. Very stiff, slightly plastic; gravels fine to medium grained scoria [AUCKLAND VOLCANIC FIELD]
	1		0.90 m Grades to hard, minor clay, slightly to moderately plastic
+95.80	1.20		SILT, some clay, trace gravel; dark brownish red. Hard, slightly plastic; gravels fine to medium grained scoria
+95.50	1.50		SILT, minor clay, trace gravel; dark brownish red. Hard, slightly plastic; gravels fine to medium grained scoria
+95.00	2.00		1.90 m Grades to minor gravels
	2		EOH @ 2.00 m
	3		

Legend; Unified Symbol

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15; 3.8m

Groundwater; Soil Moisture: M, MW, W, WS

Samples

Tests: V= 200 R= 72; V= 203+; V= 203+; UTP

No. 1
3, 3, 3,
3, 2, 3,
3, 3, 3,
3, 4, 3,
3, 3, 5,
5, 6, 7,
5, 5, 6,
10, 5,
5, 5, 5,
5, 6, 5,
5, 9, 8,
9, 10,
10, 10

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

GROUNDWATER

- [ ] None
- [x] Slow Seep (depth 1.8 m)
- [ ] Rapid Inflow (depth)

HOLE TERMINATED DUE TO: Refusal

Remarks

Refusal due to gravels

All dimensions in metres Scale 1:23		Shear Vane No. 1706	Logged by: AL	Checked by: SRO

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Tel: +649 48978782
Fax:

HAND AUGER LOG

Project:	Location:	Hole position:	No.:
24 Summit Drive	Mt Albert	Lot 2 Proposed Dwelling	HA2

Job No.:	Start Date: 26-07-17 Finish Date: 26-07-17	Ground Level (m):	Co-Ordinates ():
170457		92.00	E 1,753,207.00 N 5,916,076.00

Client:	Hole Depth:	Sheet:
Sherridan Cook	2.20 m	1 of 1

Elevation (m)	Depth (m)	Geological Unit	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Unified Symbol	Soil Shear Strength (kPa) 50 100 150 200	Scala Penetrometer (blows / 50 mm) 3 6 9 12 15	Groundwater	Soil Moisture	Samples	Tests
+92.00											
+91.90	0.10	Auckland Volcanic Field	SILT, minor clay, minor organics; dark brown. Stiff, slightly plastic; rootlets [TOPSOIL]						WS		
			SILT, minor clay, trace gravel; dark brownish red. Very stiff, slightly plastic; gravels fine to medium grained scoria [AUCKLAND VOLCANIC FIELD]						M		V= 203+
			0.30 m Grades to hard								
+91.30	0.70		SILT, some clay, trace gravel; dark brownish red. Hard, slightly plastic; gravels fine to medium grained scoria						MW		V= 203+
	1										V= 203+
+90.30	1.70		SILT, minor clay, trace gravel; dark brownish red. Hard, slightly plastic; gravels fine to coarse grained scoria						WS		UTP
	2		2.00 m Grades to saturated								No. 1 3, 3, 3, 2, 3, 3, 3, 3, 5, 5, 5, 5, 5, 5, 10, 6, 5, 5, 7, 7, 7, 7, 14, 14
+89.80	2.20		EOH @ 2.20 m				3.3m				
	3										

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- 1 Water Strike (1st, 2nd ...)
- 1 Water Rise (1st, 2nd ...) and Rise Time (minutes)

GROUNDWATER

- [ ] None
- [X] Slow Seep (depth 2.1 m)
- [ ] Rapid Inflow (depth)

HOLE TERMINATED DUE TO: Refusal

Remarks

Refusal due to gravels

All dimensions in metres Scale 1:23		Shear Vane No. 1706	Logged by: AL	Checked by: SKO

RILEY CONSULTANTS Engineers and Geologists
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Fax:

HAND AUGER LOG

Project:	Location:	Hole position:	No.:
24 Summit Drive	Mt Albert	Lot 1 Proposed Pool	HA3

Job No.:	Start Date: 26-07-17 Finish Date: 26-07-17	Ground Level (m):	Co-Ordinates ():
170457		96.00	E 1,753,188.00 N 5,916,060.00

Client:	Hole Depth:	Sheet:
Sherridan Cook	2.50 m	1 of 1

Elevation (m)	Depth (m)	Geological Unit	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Unified Symbol	Soil Shear Strength (kPa) 50 100 150 200	Scala Penetrometer (blows / 50 mm) 3 6 9 12 15	Groundwater	Soil Moisture	Samples	Tests
+96.00											
+95.80	0.20		SILT, trace clay, trace organics, trace gravel; dark brown. Stiff, slightly plastic; rootlets, gravels fine to medium grained scoria [TOPSOIL]						WS		
		Auckland Volcanic Field	SILT, minor clay, trace gravel; dark brownish red. Very stiff, slightly plastic; gravels fine to medium grained scoria [AUCKLAND VOLCANIC FIELD]						M		V= 203+
	1		0.50 m Grades to hard								V= 203+
+94.80	1.20		SILT, some clay, trace gravel; dark brownish red. Hard, moderately plastic								UTP
+94.40	1.60		SILT, minor clay, trace gravel; dark brownish red. Hard, slightly plastic						W		UTP
+93.90	2.10		SILT, some clay, minor gravel; dark brownish red. Hard, moderately plastic						WS		
+93.50	2.50		EOH @ 2.50 m				2.6m			No. 1 10, 10, 10	UTP
	3										

RILEYAKL GLB Log RILEY HA (AKL) NO MAP 170457 - 24 SUMMIT DR - BORELOGS.GPJ DWG35383.GDW 27/07/2017 12:19 Produced by gINT Professional

Explanations:
Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered
Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- 1 Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

GROUNDWATER
[X] None
[ ] Slow Seep (depth)
[ ] Rapid Inflow (depth)

HOLE TERMINATED DUE TO:
Refusal

Remarks
Refusal due to gravels

All dimensions in metres Scale 1:23		Shear Vane No. 1706	Logged by: AL	Checked by: SRD

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HAND AUGER LOG

Project:	Location:	Hole position:	No.:
24 Summit Drive	Mt Albert	Lot 2 Proposed Pool	HA4

Job No.:	Start Date: 26-07-17 Finish Date: 26-07-17	Ground Level (m):	Co-Ordinates ():
170457		90.00	E 1,753,201.00 N 5,916,080.00

Client:	Hole Depth:	Sheet:
Sherridan Cook	3.00 m	1 of 1

Elevation (m)	Depth (m)	Geological Unit	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Unified Symbol
+90.00					
+89.90	0.10	Auckland Volcanic Field	SILT, trace clay, trace organics, trace gravel; dark brown. Stiff, slightly plastic; rootlets, gravels fine to medium grained scoria [TOPSOIL]		
			SILT, minor clay, trace gravel; dark brownish red. Very stiff, slightly plastic; gravels fine to coarse grained scoria [AUCKLAND VOLCANIC FIELD]		
+89.10	0.90		SILT, some clay, trace gravel; dark brownish red. Hard, moderately plastic		
	1				
	2		2.50 m Grades to saturated		
			2.70 m Grades to minor gravels		
+87.00	3.00		EOH @ 3.00 m		

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

3.3m

Groundwater: MW, M, W

Soil Moisture

Samples: No. 1 3, 3, 4, 2, 2, 2, 2, 2, 10, 20

Tests: V= 174 R= 81; UTP; UTP; V= 203+; UTP; UTP

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- 1 Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

GROUNDWATER

- [X] None
- [ ] Slow Seep (depth)
- [ ] Rapid Inflow (depth)

HOLE TERMINATED DUE TO: Refusal

Remarks

Refusal due to gravels

All dimensions in metres Scale 1:23		Shear Vane No. 1706	Logged by: AL	Checked by: SRO

Riley Consultants Limited
4 Fred Thomas Drive
Takapuna 0622
Tel: +649 4897872
Fax:

HAND AUGER LOG

Project:	Location:	Hole position:	No.:
24 Summit Drive	Mt Albert	Near the retaining wall (Location A)	**HA5**

Job No.:	Start Date: 20-11-17 Finish Date: 20-11-17	Ground Level (m):	Co-Ordinates ():
170457			

Client:	Hole Depth:	Sheet:
Sherridan Cook	2.10 m	1 of 1

Elevation (m)	Depth (m)	Geological Unit	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Legend	Unified Symbol	Soil Shear Strength (kPa) 50 100 150 200	Scala Penetrometer (blows / 50 mm) 3 6 9 12 15	Groundwater	Soil Moisture	Samples	Tests
	0.10	Topsoil	SILT with trace sand and trace clay; reddish brown. Very stiff; non plastic; sand, fine; rootlets [TOPSOIL].						M		
		Auckland Volcanic Field	SILT with trace sand, trace clay and trace gravels; reddish brown. Very stiff; non to slightly plastic; sand, fine; gravel, scoria, fine; angular [AUCKLAND VOLCANIC FIELD].			×			MW		V= 190+
	1					×					V= 190+
						×					V= 190+
	2										UTP
	2.10		EOH @ 2.10 m				2.7m				No. 1 3, 3, 4, 6, 8, 8, 9, 10, 10, 10, 11, 12
	3										

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

GROUNDWATER

- [X] None
- [ ] Slow Seep (depth)
- [ ] Rapid Inflow (depth)

HOLE TERMINATED DUE TO: Refusal

Remarks

Refusal due to gravel

All dimensions in metres Scale 1:23		Shear Vane No. 1706	Logged by: AL	Checked by: SRO

RILEYAKL.GLB Log RILEY HA (AKL) NO MAP 170457 - 24 SUMMIT DR - BORELOGS.GPJ <<DrawingFile>> 18/12/2017 12:14 Produced by gINT Professional

RILEY CONSULTANTS Engineers and Geologists
Riley Consultants Limited
4 Fred Thomas Drive
Takapuna 0622
Tel: +649 4897872
Fax:

HAND AUGER LOG

Project:	Location:	Hole position:	No.:
24 Summit Drive	Mt Albert	Near the fence (Location B)	**HA6**

Job No.:	Start Date: 20-11-17 Finish Date: 20-11-17	Ground Level (m):	Co-Ordinates ():
170457			

Client:	Hole Depth:	Sheet:
Sherridan Cook	3.70 m	1 of 1

Depth (m)	Geological Unit	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)
0.10	Topsoil	SILT with minor clay and trace sand; reddish brown. Very stiff; non plastic; sand fine; rootlets [TOPSOIL].
	Auckland Volcanic Field	SILT with minor clay, trace sand and trace gravel; reddish brown. Very stiff; slightly plastic; sand, fine; gravel, fine to medium; scoria [AUCKLAND VOLOCANIC FIELD].
2.50		m Grades to clayey SILT, trace gravel; brownish red; scoria, fine to medium.
3.70		EOH @ 3.70 m

Soil Shear Strength (kPa): 50, 100, 150, 200

Scala Penetrometer (blows / 50 mm): 3, 6, 9, 12, 15

Soil Moisture: M, MW

Tests: UTP; V= 160 R= 44; V= 204 R= 68; V= 207 R= 59; V= 195 R= 50; V= 180 R= 30; UTP; No. 1 4, 4, 7, 5, 5, 5, 5, 5, 5, 25

4.1m

Explanations:

Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, completely weathered, residually weathered

Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense

- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

GROUNDWATER

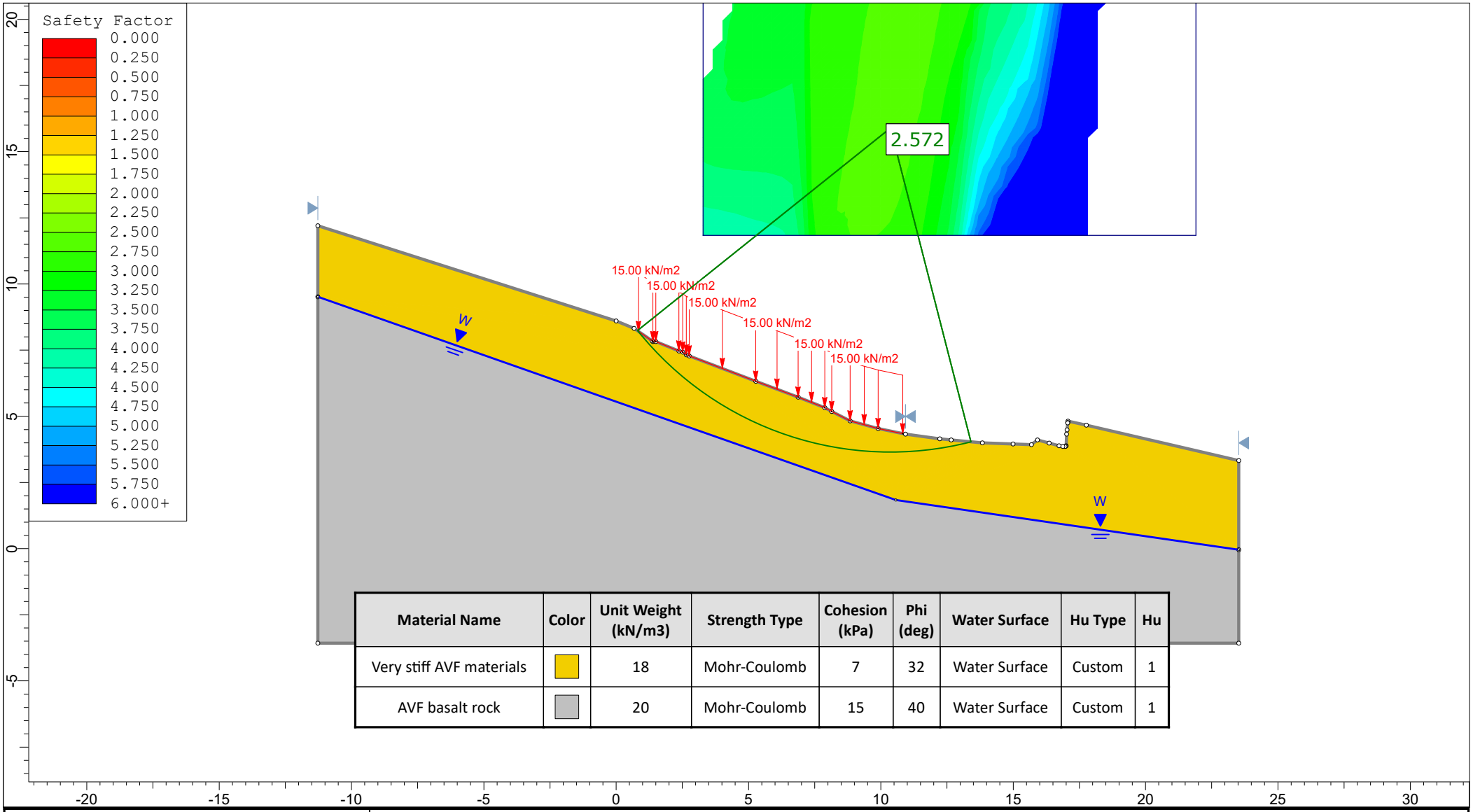
- [X] None
- [ ] Slow Seep (depth)
- [ ] Rapid Inflow (depth)

HOLE TERMINATED DUE TO: Refusal

Remarks

Refusal due to gravel

All dimensions in metres Scale 1:29		Shear Vane No. 608	Logged by: GB	Checked by: SRO

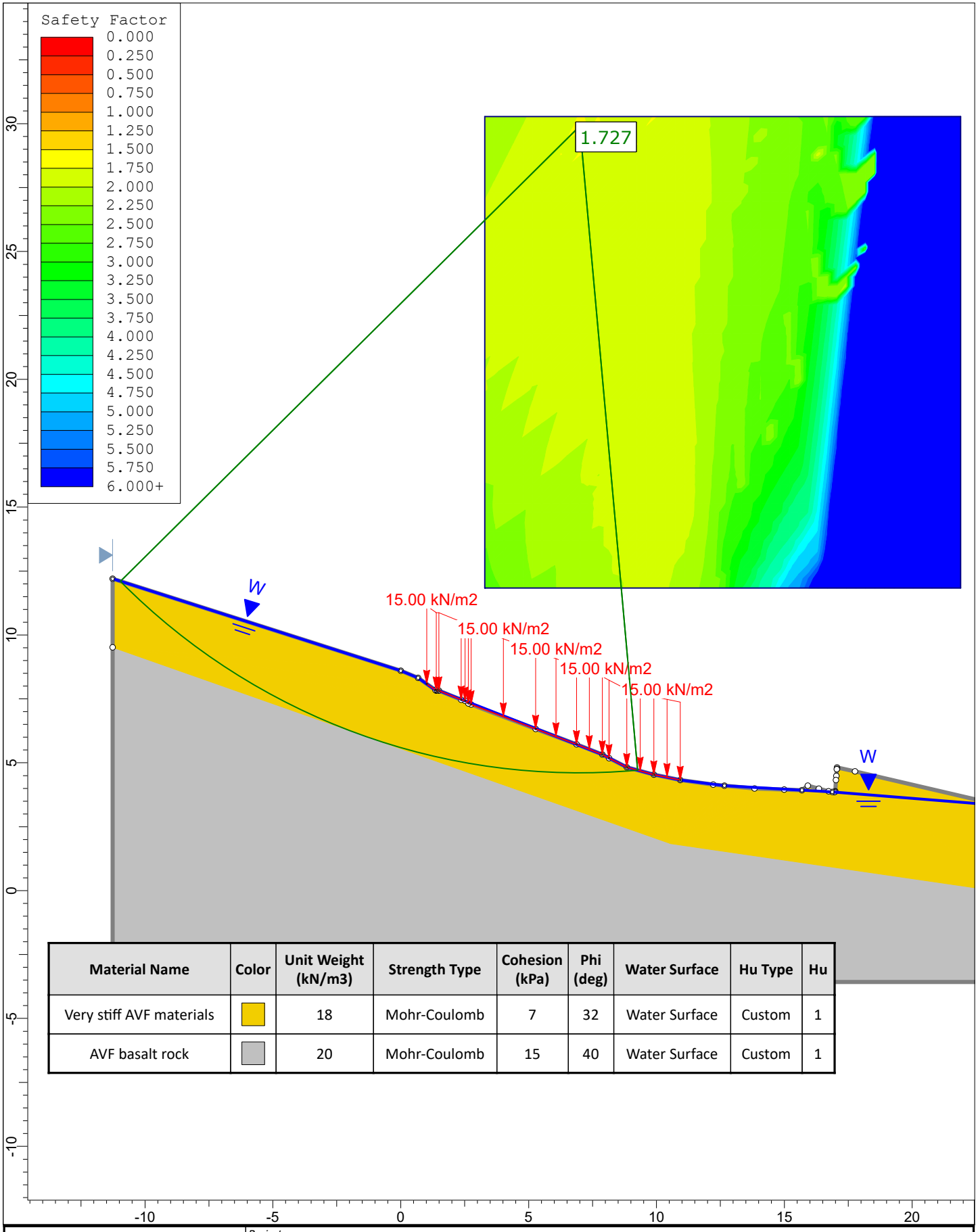


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Very stiff AVF materials		18	Mohr-Coulomb	7	32	Water Surface	Custom	1
AVF basalt rock		20	Mohr-Coulomb	15	40	Water Surface	Custom	1

RILEY CONSULTANTS

SLIDEINTERPRET 8.026

Project	170457 - 24 Summit Drive, Mt Albert				
Analysis Description	Section A, measured groundwater, static				
Drawn By	JZ	*Scale*	1:200	*Company*	Riley Consultants Ltd
Date	9/06/2020, 1:27:54 PM			*File Name*	Section A, MGW Static.slmd

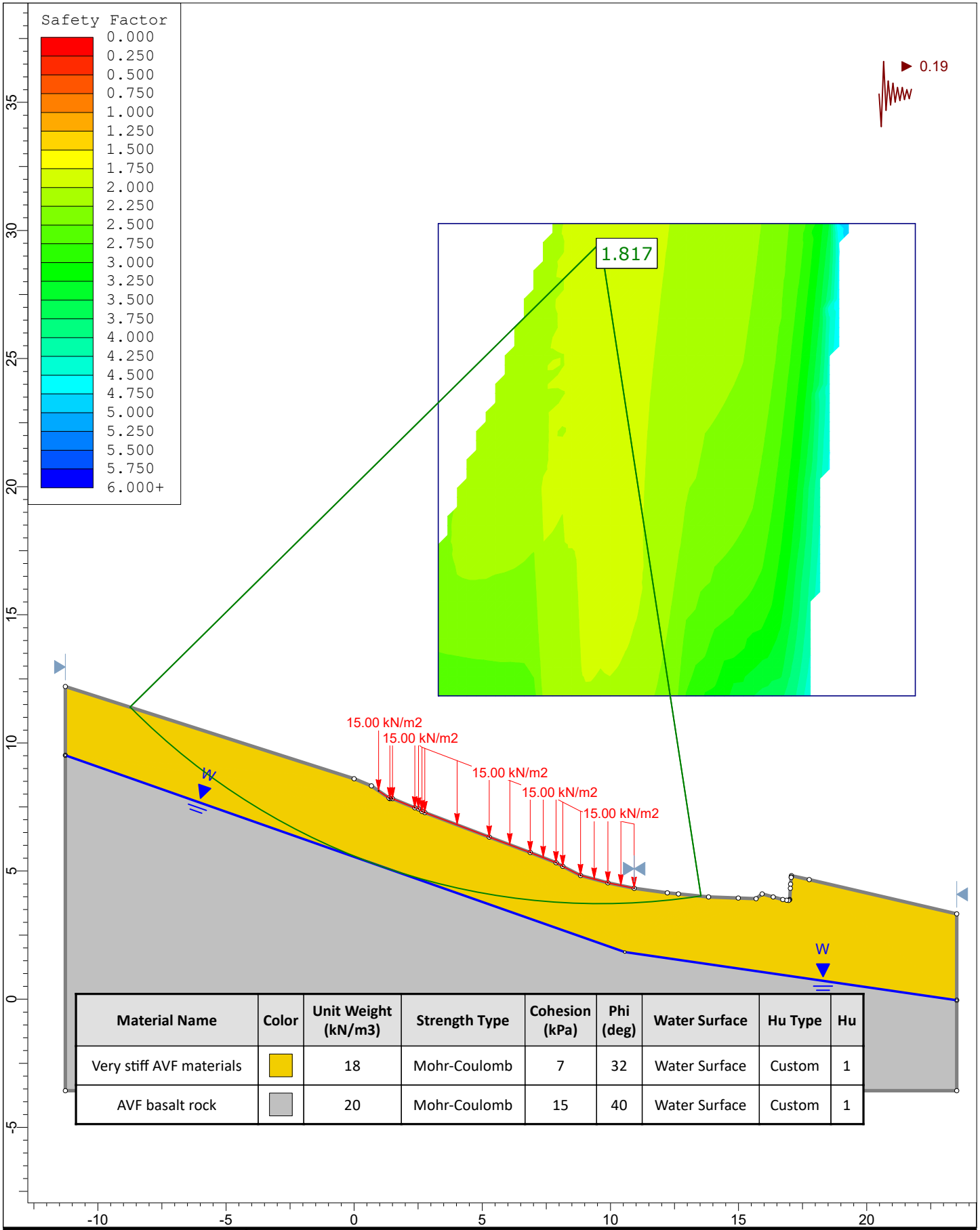


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Very stiff AVF materials		18	Mohr-Coulomb	7	32	Water Surface	Custom	1
AVF basalt rock		20	Mohr-Coulomb	15	40	Water Surface	Custom	1

RILEY CONSULTANTS

SLIDEINTERPRET 8.026

Project	170457 - 24 Summit Drive, Mt Albert		
Analysis Description	Section A, elevated groundwater, static		
Drawn By	JZ	Scale 1:200	Company Riley Consultants Ltd
Date	9/06/2020, 1:27:54 PM		File Name Section A, RGW Static.slmd

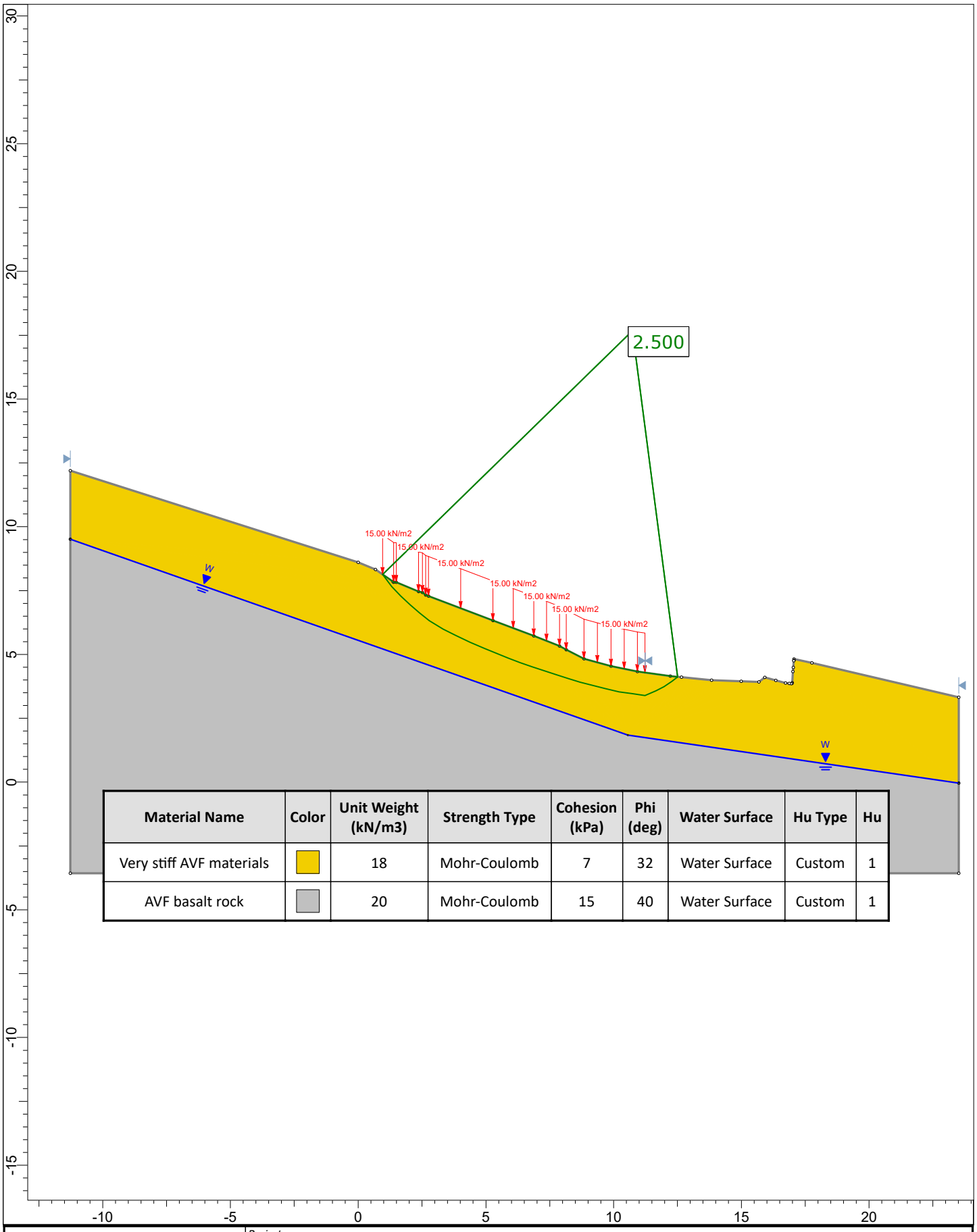


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Very stiff AVF materials		18	Mohr-Coulomb	7	32	Water Surface	Custom	1
AVF basalt rock		20	Mohr-Coulomb	15	40	Water Surface	Custom	1

RILEY CONSULTANTS

SLIDEINTERPRET 8.026

Project	170457 - 24 Summit Drive, Mt Albert		
Analysis Description	Section A, measured groundwater, seismic		
Drawn By	JZ	Scale 1:200	Company Riley Consultants Ltd
Date	9/06/2020, 1:27:54 PM		File Name Section A, MGW Seismic.slmd

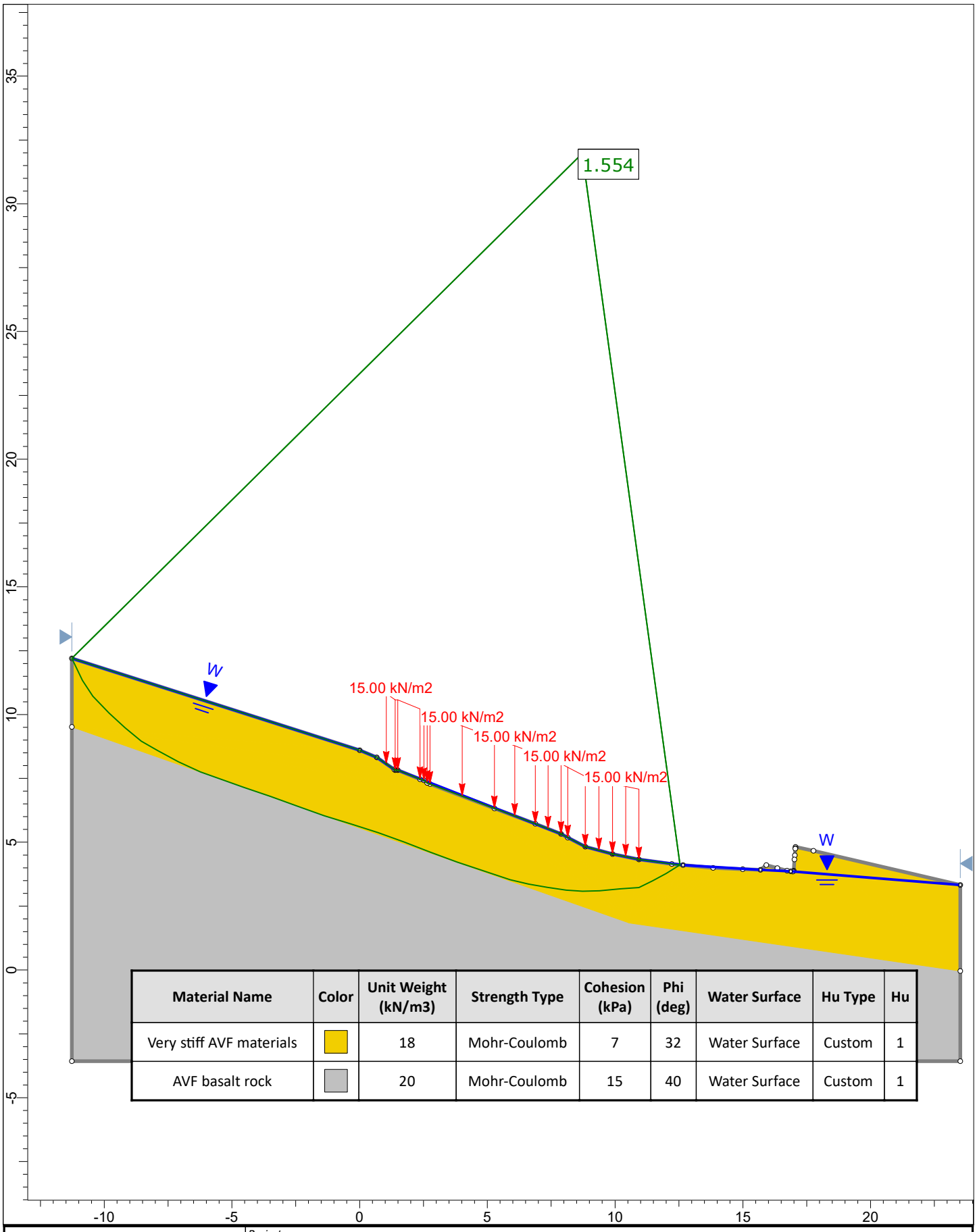


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Very stiff AVF materials		18	Mohr-Coulomb	7	32	Water Surface	Custom	1
AVF basalt rock		20	Mohr-Coulomb	15	40	Water Surface	Custom	1

RILEY CONSULTANTS

SLIDEINTERPRET 8.026

Project	170457 - 24 Summit Drive, Mt Albert		
Analysis Description	Section A, measured groundwater, static (non-circular)		
Drawn By	JZ	*Scale* 1:200	*Company* Riley Consultants Ltd
Date	9/06/2020, 1:27:54 PM		*File Name* Section A, MGW Static (non-circular).slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Very stiff AVF materials		18	Mohr-Coulomb	7	32	Water Surface	Custom	1
AVF basalt rock		20	Mohr-Coulomb	15	40	Water Surface	Custom	1

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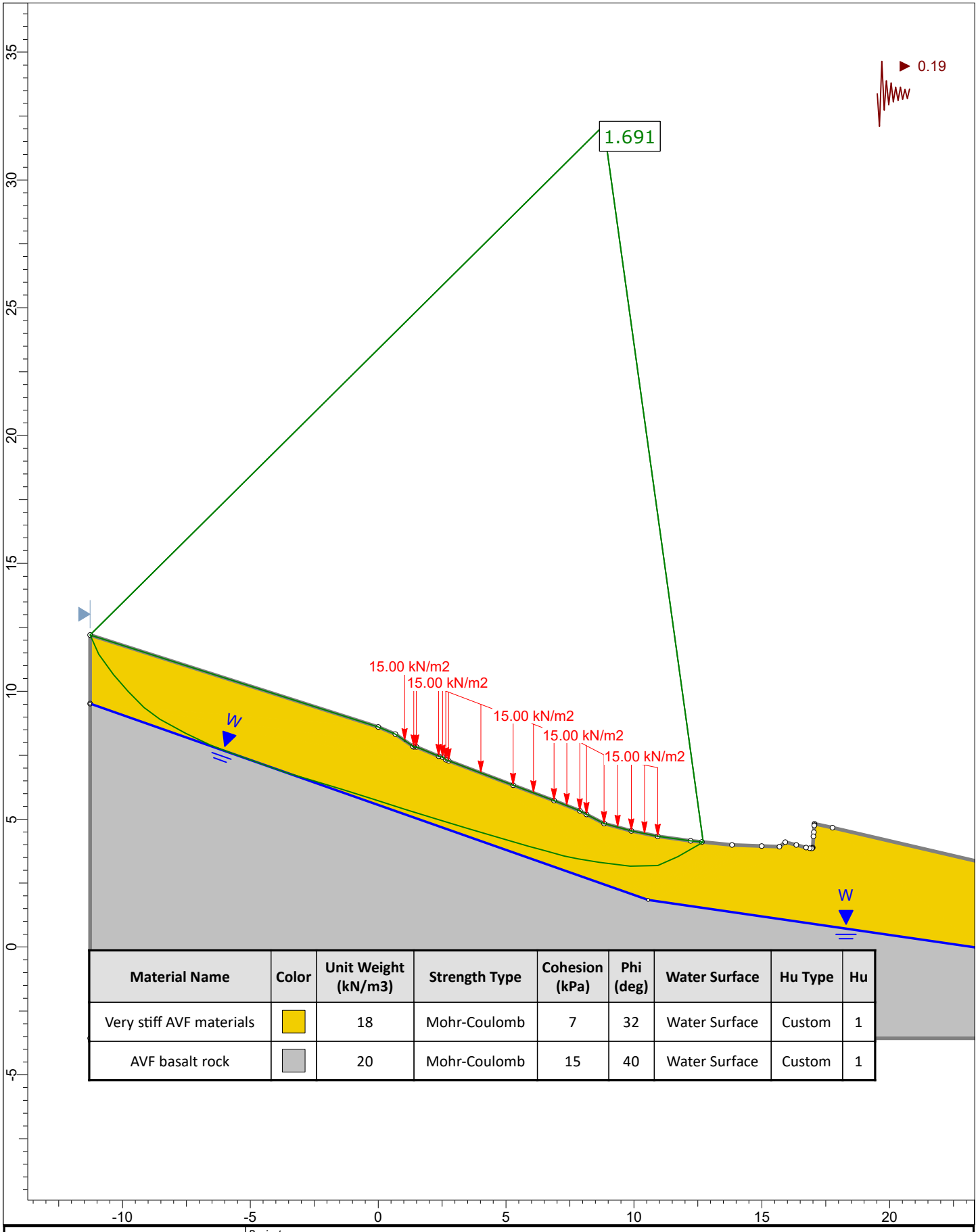
SLIDEINTERPRET 8.026

Project	170457 - 24 Summit Drive, Mt Albert		
Analysis Description	Section A, elevated groundwater, static (non-circular)		
Drawn By	JZ	*Scale* 1:200	*Company* Riley Consultants Ltd
Date	9/06/2020, 1:27:54 PM	*File Name*	Section A, RGW Static (non-circular).slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Very stiff AVF materials		18	Mohr-Coulomb	7	32	Water Surface	Custom	1
AVF basalt rock		20	Mohr-Coulomb	15	40	Water Surface	Custom	1

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SLIDEINTERPRET 8.026

Project	170457 - 24 Summit Drive, Mt Albert		
Analysis Description	Section A, measured groundwater, seismic (non-circular)		
Drawn By	JZ	Scale 1:200	Company Riley Consultants Ltd
Date	9/06/2020, 1:27:54 PM		File Name Section A, MGW Seismic (non-circular).slmd

LEGEND

- BOUNDARIES
- PROPOSED BOUNDARY
- EXISTING CONTOURS (AUCKLAND COUNCIL)
- PROPOSED CONTOURS
- PROPOSED RETAINING WALLS
- SS — EXISTING WASTEWATER LINE
- W — W — EXISTING WATERSUPPLY LINE
- HA1 — HAND AUGER LOCATION
- PROPOSED BUILDING PLATFORM

NOTE:

PLAN BASED ON ELECTRONIC DATA FROM AUCKLAND COUNCIL GIS. PROPOSED SUBDIVISION DETAILS DIGITISED FROM PLAN BY ALIGNWORKS, JULY 2017.

SCALE 1: 250

0 5 10 15 (m)

NO.22
NO.7
NO.24
NO.26
PROPOSED 1V:2.5H BATTER
PROPOSED ACCESS TO LOT 2
PROPOSED BUILDING PLATFORMS
(PROPOSED)
22°
14°
17°
LOT 1
LOT 2
HA1
HA2
HA3
HA4
HA5
HA6
A/2

FOR INFORMATION

REV	DESCRIPTION	BY	DATE
2	PROPOSED BLDG. PLATFORM ADDED	MD	19.06.2020
1	FIRST ISSUE		

DESIGN LS | CHECKED JZ
DRAWN AL | CHECKED JM
DATE DRAWN JULY 2017

APPROVED FOR ISSUE: B BLACK
DATE: 23/06/20

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NORTH SHORE
AUCKLAND 0745
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TITLE

SHERRIDAN COOK

24 SUMMIT DRIVE, MT ALBERT

GEOTECHNICAL INVESTIGATION - SITE PLAN

CADFILE 170457-1
SCALES (A3) 1:250
ACENZ
DRAWING No. 170457-1
REV. 2

LEGEND

HA1 — HAND AUGER LOCATION

FILL | CLAY | ORGANICS

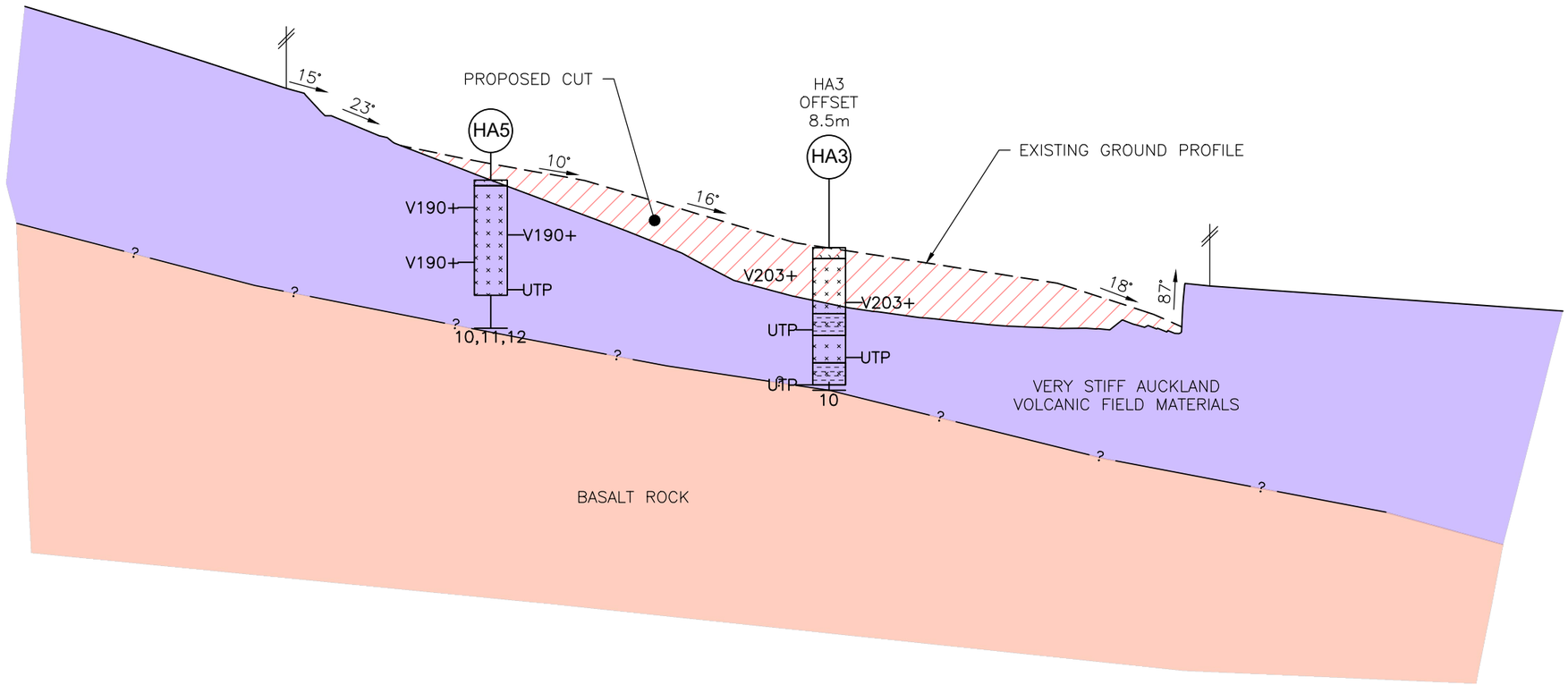
SILT | SAND

— v188+ INSITU UNDRAINED SHEAR STRENGTHS (kPa)

(6,7,7) SCALA PENETROMETER FROM BASE OF BOREHOLE (blows/50mm for last 150mm)

WL GROUNDWATER LEVEL

10° EXISTING GROUND SLOPE



SECTION A/1

SCALE 1:100

SCALE 1: 100

0 1 2 3 4 6 (m)

FOR INFORMATION

1	FIRST ISSUE	MD	19.06.2020		
REV	DESCRIPTION	BY	DATE		

DESIGN JZ | CHECKED JZ

DRAWN MD | CHECKED JM

DATE DRAWN JUN 2020

APPROVED FOR ISSUE: B BLACK

DATE: 23/06/20

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TITLE

SHERRIDAN COOK

24 SUMMIT DRIVE, MT ALBERT

GEOTECHNICAL INVESTIGATION - CROSS SECTION A

CADFILE 170457-2

SCALES (A3) 1:100

ACENZ

DRAWING No. 170457-2

REV. 1