

**A&Y CONTRACTOR LIMITED**  
c/- Baseplan Ltd  
By email: [jethro@baseplan.co.nz](mailto:jethro@baseplan.co.nz)  
Attention: Jethro Joffe

Our Reference: P -002665  
11 March 2025

Dear Jethro

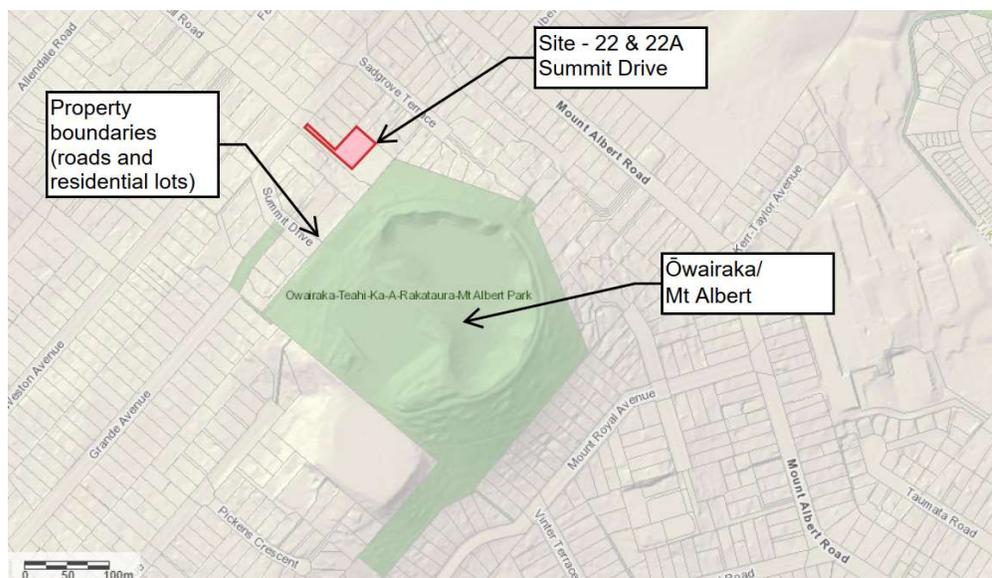
## 22 and 22A Summit Drive, Mount Albert Geological Assessment for Resource Consent

### 1. Introduction

Initia has been engaged to provide Geological and Geomorphological consulting services to inform a resource consent application process for a proposed construction of two dwellings at 22 and 22A Summit Drive, Mount Albert.

Our observations and interpretations are presented for discussion of geological and geomorphological conditions only. All geotechnical engineering, foundation design/parameters and geotechnical hazard inputs should be reviewed by Geostudio as the authors of the site Geotechnical Report.<sup>1</sup> Initia have reviewed the geotechnical investigation data presented in this report as part of our commentary and assessment.

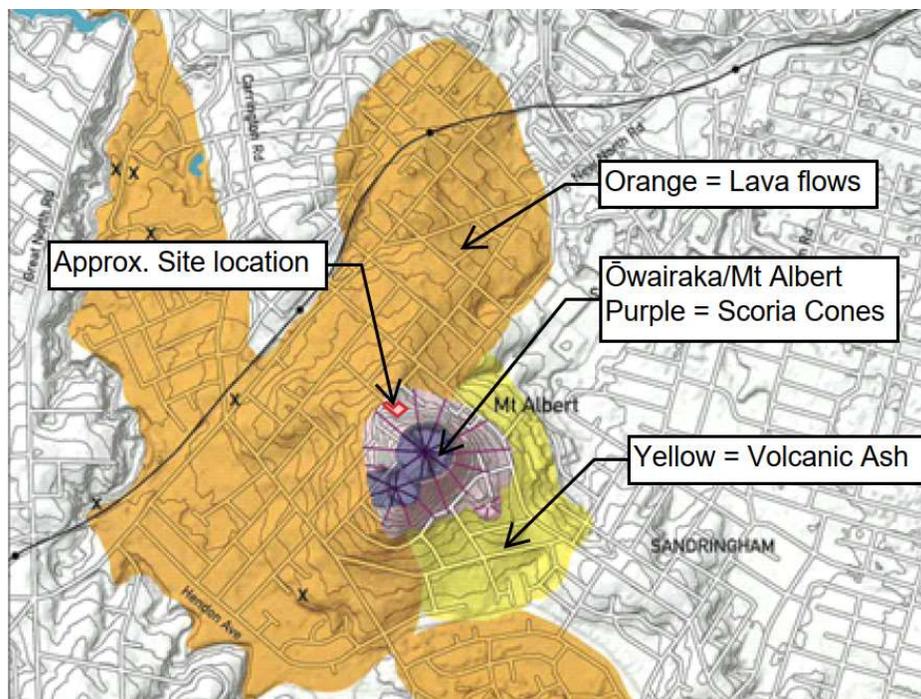
This letter has been prepared to inform any discussion of Outstanding Natural Features (ONF), and specifically geological or volcanic features of the site as referenced in the Auckland Unitary Plan: Operative in Part (AUP OP) maps, overlays and text relevant to the subject site and proposal. To discuss this we present interpretation of features in the wider area (Ōwairaka/Mount Albert volcanic cone) and the subject site (22 and 22A Summit Drive). See figure 1 below for the site location.



**Figure 1: Auckland Council GIS Terrain basemap labelled with site location and features**

<sup>1</sup> GeoStudio Ltd, 11 February 2025. 'Geotechnical Investigation Report, 22 & 22A Summit Drive, Mount Albert, For Alan An, Reference: 5057, Rev B





**Figure 3: Volcanoes of Auckland – Map of Ōwairaka/Mt Albert volcanic features**

### 2.3 Historic Modification



**Figure 4: North Side of Ōwairaka in the 1890's during early stages of scoria quarrying**

The Scoria cone of Ōwairaka/Mt Albert was modified by Māori occupation through the development of extensive terraces, pits, ditches and banks as part of a defensive pa formation.



The upper 15 m to 20 m of scoria and volcanic material was quarried from the top of the maunga, with 1.5 million cubic metres removed between 1860 and 1959 (See figure 4 above). The two upper cones of the maunga were further modified by installation of water reservoirs and sports fields with the quarried crests/cones. The quarrying, reservoir installation, roading and residential construction on the lower slopes have destroyed or damaged almost all pre-European, and Māori occupation features<sup>3</sup>.

Further to the above information, Initia have undertaken a review of aerial photography and a site walkover of the property. Historic aerial photography was sourced from Retorlens.co.nz, providing images from 1940, 1955, 1961, 1966 and 1975. These images identify that the site was formed into a fenced residential section from before 1940. The site has been cleared of vegetation and appears to have been treated as a garden lot (see figure 5 below).

Our site walkover identified a small mound feature in a central part of the lot. Removing some of the grass coverage revealed a stacked mound of basalt boulders (refer to Figure 6 for a site photo of this feature). We closely inspected the basalt exposed (to determine if it could be in-situ and reflect the underlying geology). We however identified that the basalt boulders do not interlock and have been stacked in a mound. This is therefore inferred as a manmade feature from clearing the ground surface of large boulders, and collecting in one area. In consultation with the project archaeologist (Clough & Associates), while we have no exact indication of the age of this mound, it is likely associated with the clearance of fields for farming in the late 19<sup>th</sup> century or subdivision works that occurred from 1911 or could also have been deposited more recently. It is noteworthy, that an archaeological investigation carried out by Clough & Associates at 24 Summit Drive also identified a similar feature which likely was linked to farming, or associated with the deconstruction of a former scoria wall<sup>4</sup>.



**Figure 5: 1940 Aerial photo showing the site as a fenced residential section**

<sup>3</sup> Bruce W. Hayward, Graeme Murdoch and Gordon Maitland (2011). "Volcanoes of Central Auckland- The Essential Guide". Page 150

<sup>4</sup> Clough & Associates, Nov 2017, 24 Summit Drive, Mt Albert: Archaeological Assessment



**Figure 6: Site photo of vegetation coverage and stacked mound of basalt boulders**

### 3. Desktop Review

As part of our assessment we have reviewed the geotechnical testing logs, and sections 6 and 7 of the supplied Geotechnical Investigation Report<sup>5</sup> for the site. The report presents six subsurface investigation logs, HA01 to HA04 (and including HA01B and HA02B). These logs prove ash and scoria mixtures present from surface levels. Hand auger drilling and scala penetrometer testing terminated at depths ranging from 0.8m to 3.0m depth below ground level.

Geostudio have interpreted that these investigations terminated on basalt rock. This may be accurate, but we note that the site is approximately 200m from the central cone vent of Ōwairaka/Mt Albert, and we therefore would expect the ash and scoria coverage to include large gravel and boulder sized bombs and inclusions of basalt. I.e shallow refusal of geotechnical testing is likely and can still be expected within ash and scoria deposits instead of a solid basalt lava flow sequence.

We have downloaded relevant borehole logs from the New Zealand Geotechnical Database. This included two machine drilled boreholes approximately 70m and 170m northeast of the site (downslope). The logs and site plan are attached as Appendix A to this letter. Each machine borehole log indicates basalt lava flow deposits from 1m depth to around 12 or 13m depth. Both boreholes extended through the basalt layer and into weathered Waitemata Group.

An additional eight shallow hand auger logs area available approximately 60m southwest of the site (upslope). These investigations show multiple auger and scala tests meeting shallow refusal from 'rock

<sup>5</sup> GeoStudio Ltd, 11 February 2025. 'Geotechnical Investigation Report, 22 & 22A Summit Drive, Mount Albert, For Alan An, Reference: 5057, Rev B



obstructions', however one scala penetrometer test was successful in extending 2.4m through silt and scoria.

Furthermore the client has forwarded photo evidence of excavations from 2023 at the time of construction for a retaining wall along the current driveway access to the site (see figure 7 below) which supported the consented establishment of the two legal allotments at the site. The exposure is predominantly a dark reddish brown ash and scoria deposit, and boulders of dark grey basalt (bombs/inclusions) can be seen in the cut face.



**Figure 7: Photograph of excavations and construction of the current driveway and retaining wall on site (2023)**

### **3.1 Geological Section**

Based on the desktop review information discussed above we have drafted a sketch geological section of the wider site. This is a sketch only, and should not be relied upon as a detailed geotechnical cross-section. It has been provided to give a visual guide of the likely geological layering and structure of the volcano, and also as basis for discussion of the geological value and potential or likelihood encountering outstanding natural features. This section is attached in Appendix B

## **4. Discussion of Lava Caves (Lava Tubes)**

Notable lava tubes and caves are formed when a low viscosity lava flows over a wide area. The flow needs to be sufficiently wide and thick over gentle slopes or flat areas.

These conditions are necessary for the upper and lower lava surfaces to cool, while a central portion is insulated maintaining its heat and low viscosity, and continues to flow and drain through a preferential conduit. The final stages of lava supply also need to continue to maintain a low viscosity and maintain flow for the tunnel/tube to empty (once the surrounding flow has cooled and is stable). See figure 8 below for an illustrative representation of lava tube in stages of formation and cooling.



Other features that can present as caves are gas blisters and fossil cavities (i.e cavity tree moulds). Gas blisters buldge within the lava flow as it depressurises and releases stored gas. If this buldge occurs at the same time as cooling then an arch and small cavity can be solidified into the surrounding basalt rock formation. Likewise lava flowing over or around trees will cool on contact and leave a cavity as the internal carbon material burns away. See Appendix C for a guide on lava flow features. Note that these cavities and blisters typically form closer to the outer edge of a lava flow.



**Figure 8: Two cross-sections showing lava cave formation (Sourced from 'Volcanoes of Auckland' <sup>6</sup>)**

#### **4.1 Lava Cave Summary**

The wider region of the site has been identified as having potential for lava cave features based on the presence of basalt lava flow layers . This is an appropriate initial assumption, as the geology maps of the area indicates there is basalt lava mapped nearby, and the Ōwairaka/Mt Albert lava flows are known to have produced lava cave features in the wider suburb of Mount Albert.

We however note that the site is specifically mapped as on the edge of the main scoria cone of Ōwairaka/Mt Albert Volcano. The contours of slopes from the maunga can also be interpreted to show the site is on a flank of ash and scoria that covers or drapes the wider basalt lava flows.

The depth and extent of proposed earthworks and cuts onsite (approximately 0.5m to 1.4m depth) is very shallow in relation to the inferred depth of covering ash and scoria deposits. This makes the presence of a lava cave in the vicinity of the proposed works a very low probability. Additionally if basalt rock is encountered at the base of excavations, the limited scale of this project (in respect to size of buildings and depth of excavation) has the benefit of being able to alter foundation designs to suit (i.e shallow foundations and concrete slab floors can be used instead of piles, to avoid disruption of any potential basalt lava)

Overall we assess that there is a low risk of encountering a lava cave within the earthworks area, (and also a low risk of encountering solid basalt lava). We however suggest that foundation design could prepare contingency plans in the unlikely case that a solid and continuous layer of basalt rock is encountered.

#### **4.2 Scoria, Ash and Tuff Deposits**

The upper ash and scoria deposits draping the surrounds of Ōwairaka/Mt Albert are interpreted as the result of late stages of eruption where fire fountaining occurs and strombolian or Hawaiian type eruptions. The area of the site (22 & 22A Summit Drive) is positioned on the lower flank of a scoria cone of the larger vent to Ōwairaka/Mt Albert Volcano. The site is approximately 200m from the central cone vent so is therefore well set back from the historic crater and upper cone of the volcano.

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<sup>6</sup> Bruce W.Hayward, Graeme Murdoch and Gordon Maitland (2011). "Volcanoes of Central Auckland- The Essential Guide". Page 14



The deposits have been emplaced in a massive layering (i.e there are no distinctive bedding features of a tuff ring) near the surface. The dark reddish brown ash and scoria deposits are very similar to deposits spread throughout Auckland and Pukekohe volcanic fields and surrounds.

### 4.3 Outstanding Natural Feature Discussion

The Auckland Unity Plan identifies the subject site as within the Outstanding Natural Feature(ONF) Overlay ID108, Mt Albert,(Owairaka). Schedule 6 defines the applicable ONF ID 108 as follows:

*Mt Albert is the western-most eruptive centre in the Auckland volcanic field. The volcano consists of a large scoria cone (now severely modified by quarrying), which overlies obscured tuff ring remnants. Lava flows spread in three directions from the volcano to cover some 3.3km.*

The schedule also notes that the following unitary plan criteria/factors that have been used to determine the broad applications of ONF ID108: *a, c, d, e, f, g, h and i*

Chapter D10 focuses the feature relevant to the subject site in Table D10.4.1 as follows:

*V2 – Large Volcanic landforms – The privately owned and partially modified portions of the scoria cones, explosion craters and tuff rings of the Auckland and South Auckland volcanic fields.*

Chapter B4 sets out the factors referenced in Schedule 6 as follows:

- (a) the extent to which the landform, feature or geological site contributes to the understanding of the geology or evolution of the biota in the region, New Zealand or the earth, including type localities of rock formations, minerals and fossils;*
- (c) the extent to which the feature is an outstanding representative example of the diversity of Auckland's natural landforms and geological features;*
- (d) the extent to which the landform, geological feature or site is part of a recognisable group of features;*
- (e) the extent to which the landform, geological feature or site contributes to the value of the wider landscape;*
- (f) the extent of community association with, or public appreciation of, the values of the feature or site;*
- (g) the potential value of the feature or site for public education;*
- (h) the potential value of the feature or site to provide additional understanding of the geological or biotic history;*
- (i) the state of preservation of the feature or site;*

In additions to the AUP OP, the Auckland Council has published a guidance document<sup>7</sup> regarding Outstanding Natural Features, which gives examples of volcanic features that may be defined as an ONF. These include explosion craters, tuff rings, scoria cones, scoria mounds, lava flows, lava caves etc.

Auckland has many of these features, however the value attributed to each is subjective depending on the presence of the geological feature, but also how well preserved it is, how accessible and identifiable it is. The lower flanks of a volcanic scoria cone may be highly modified and blend in with surrounding low lying land with no particular geological 'value'. Compared to a much smaller cone that is fully intact and displays structural features that are unique and therefore have greater geological 'value'.

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<sup>7</sup> Auckland Council (October 2019). "Auckland Unity Plan, Practice and Guidance Note, Outstanding Natural Features". Ref: RC 3.2.15(v.1)



Overall we assess this site as underlain by fairly generic ash and scoria deposits. These are on the flank of a scoria cone, however set back from more 'valuable' and identifiable features. The ash deposits show no structure or unique layering, and the upper surface is likely highly modified by a combination of Māori occupation, late 19<sup>th</sup> Century Quarrying, and then finally 20<sup>th</sup> century gardening, subdivision and roading construction etc.

Basalt lava is mapped as present in the area and has been proven in borehole investigations nearby. The approximate RL and thickness of these lava flows are however inferred to be at depth, and unlikely to be encountered or disturbed by the proposed development. The possibility of the lava flows having caves, tubes, or unique features below the site is unlikely and low risk. The development can also incorporate contingency planning to utilise shallow foundations should any basalt be uncovered (therefore avoiding the potential to penetrate or disturb lava flow features).

Specifically referencing back to the evaluative unitary plan criteria from Schedule 6 and Chapter B4, we note the following:

- a) The landform of the site does not display significant geological features, we assess that there is no contribution to understanding of geology, New Zealand or the earth, including no presence of rock formations, minerals or fossils. The biota appears modified as garden and grass
- c) We consider that the site does not display any features as an outstanding representative of Auckland's natural landforms and geology.
- d) The landform is a typical flank slope of one of Auckland's Volcanoes. It is very generic in the ash/gravel soil with no rock exposures, and is unremarkable in comparison to hundreds/thousands (including distal flank slopes) of similar residential sections in Auckland
- e) The landform offers no geological contribution to the value of the wider landscape. It shows no distinctive geological difference from surrounding and neighbouring residential lots.
- f) There is currently no public access to the site, and it is bordered by residential subdivided lots. We therefore assume low to no public appreciation or value.
- g) We assess there is no potential value of the site for public education (there are no distinctive geological features).h) We assess there is no potential value of the site for understanding of geological history beyond what is interpreted and presented in this memo letter (there are no distinctive geological features, we assume the biota is highly modified).
- i) The site appears highly modified and there are no features to preserve.

Our Geological and Geomorphological assessment is that the site does not display any geologically outstanding features of value. We support the resource consent application and can be available to inspect any construction excavations to verify the interpretations of this letter onsite.



## 5. Applicability

This letter has been prepared for A&Y CONTRACTOR LIMITED, with respect to the brief provided to us. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

Yours Sincerely,

Authorised for Initia by:



Ben Roy  
Senior Engineering Geologist



Matthew Wansbone  
Director

### Attached:

- Appendix A: New Zealand Geotechnical Database Logs
- Appendix B: Sketch Geological Cross Section
- Appendix C: Basaltic Lava Flow Features (NZ Geology: an illustrated guide. GSNZ Publication)



## Appendix A: New Zealand Geotechnical Database logs



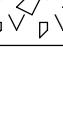
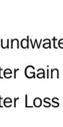
New Zealand Geotechnical Database Locations



 PATTLE DELAMORE PARTNERS LTD		<b>LOG OF CORED BOREHOLE</b> <b>Alberton Avenue Soakage Investigation</b>				HOLE NO. <b>SAD 01</b> JOB NO: A01581301							
CLIENT: Metrowater			LOCATION: 3a Sadgrove Tce										
START DATE: 6/08/2008 END DATE: 6/08/2008		COORDINATES: 1753291E 5916246N		TOTAL DEPTH: 16.5 m		LOGGED BY: DUL	SHEET 1 OF 3						
GROUND LEVEL: 70 m TOP OF CASING: --			STRENGTH VS S MS W	FRACTURE SPACING (cm) 50 10 5 1	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) 20 40 60 80	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION	
INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)												
FILL	Asphalt					0.0	70						
	Core loss												
	Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-6cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.						1.0	69					
	Slightly weathered, grey BASALT. Moderately strong, moderately vesicular, vesicles large, moderately strong. Fractures are 30°, rough, undulating, clay lined with minor fine sand, (brown), >1mm thick.  at 2.2m increase in size of vesicles						2.0	68				1	
	Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-6cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.												
	Unweathered, grey BASALT. Strong, highly vesicular, vesicles large, moderately strong. Fractures are 30° and vertical, rough, undulating, clay coated, (brown), <1mm thick.						3.0	67					
	VOID												
	Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-6cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.						4.0	66			→		
Unweathered, grey BASALT. Weakly vesicular, strong. Fractures are 30° and vertical, rough, undulating, clay coated, (brown), <1mm thick.						5.0	65					2	
Core loss						6.0	64						
Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-10cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.													

Notes: Hand cleared to 1m	<b>KEY</b>  Groundwater Level  Water Gain  Water Loss	<b>STRENGTH</b> ES = extremely strong VS = very strong S = strong MS = moderately strong W = weak VW = very weak	Drilled By: Boart Longyear
WL = No groundwater observed in borehole			Diameter: 100 mm
RL obtained from GIS			Method: 100m Cored bit Datum:
			Filename: A01581301B003

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

		<b>LOG OF CORED BOREHOLE</b> <b>Alberton Avenue Soakage Investigation</b>				HOLE NO. <b>SAD 01</b> JOB NO: A01581301							
CLIENT: Metrowater				LOCATION: 3a Sadgrove Tce									
START DATE: 6/08/2008 END DATE: 6/08/2008		COORDINATES: 1753291E 5916246N		TOTAL DEPTH: 16.5 m		LOGGED BY: DUL	SHEET 2 OF 3						
GROUND LEVEL: 70 m TOP OF CASING: --		STRENGTH VS S MS W	FRACTURE SPACING (cm) 50 10 5 1	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) 20 40 60 80	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION		
AUCKLAND VOLCANIC FIELD	Unweathered, grey BASALT. Few large vesicles, moderately strong. Fractures are 30° and vertical, rough, undulating, clay coated, (brown), <1mm thick.				7.0	63							
	Core loss												
	Unweathered, grey BASALT. Few large vesicles, strong. Fractures are 30° and vertical, rough, undulating, clay coated, (brown), <1mm thick.				8.0	62							
	Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-10cm. Clay is orangey brown; homogeneous. Soft; moist; moderately plastic. Iron stained.										3		
	Slightly weathered, grey BASALT. Highly vesicular, vesicles large, moderately strong. Fractures are 60° and vertical, rough, undulating, clay lined, (brown), <1mm thick, iron stained.				9.0	61							
	Welded TUFF. Brownish red, medium sand, moderately cohesive.												
	Core loss				10.0	60							
	Slightly weathered, grey BASALT. Highly vesicular, vesicles large, moderately strong. Fractures are 60° and vertical, rough, undulating, clay lined, (brown), <1mm thick, iron stained.												
	Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-10cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.				11.0	59							
	Unweathered, grey BASALT. Few large vesicles, moderately strong. Fractures are 30° and vertical, rough, undulating, clay coated, (brown), <1mm thick.												
Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-10cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.				12.0	58								
Core loss										4			
Slightly weathered, clay lined, grey, rubbly, scoriacious BASALT. Weak, moderately vesicular, basalt rubble is 1-10cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.				13.0	57								
Core loss													

Notes: Hand cleared to 1m

WL = No groundwater observed in borehole

RL obtained from GIS

**KEY**

 Groundwater Level

 Water Gain

 Water Loss

**STRENGTH**

ES = extremely strong

VS = very strong

S = strong

MS = moderately strong

W = weak

VW = very weak

Drilled By: Boart Longyear

Diameter: 100 mm

Method: 100m Cored bit

Datum:

Filename: A01581301B003

 PATTLE DELAMORE PARTNERS LTD		<b>LOG OF CORED BOREHOLE</b> <b>Alberton Avenue Soakage Investigation</b>					HOLE NO. <b>SAD 01</b> JOB NO: A01581301							
CLIENT: Metrowater				LOCATION: 3a Sadgrove Tce										
START DATE: 6/08/2008 END DATE: 6/08/2008		COORDINATES: 1753291E 5916246N		TOTAL DEPTH: 16.5 m		LOGGED BY: DUL	SHEET 3 OF 3							
GROUND LEVEL: 70 m TOP OF CASING: --		STRENGTH	FRACTURE SPACING (cm)	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%)	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION			
INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	VS	S	MS	W	50	10	5	1					
WAITEMATA GROUP	Sandy SILT with minor fine gravel; brown; homogeneous. Soft; moist; weakly plastic; sand is fine to medium; gravel is basalt.													
	no gravel at 14.6m													
	Core loss													
	SILT/CLAY, grey; homogeneous. Moist; stiff; moderately plastic.													
END OF BOREHOLE AT 16.5m														
Notes: Hand cleared to 1m  WL = No groundwater observed in borehole  RL obtained from GIS				<b>KEY</b>  Groundwater Level  Water Gain  Water Loss			<b>STRENGTH</b> ES = extremely strong VS = very strong S = strong MS = moderately strong W = weak VW = very weak			Drilled By: Boart Longyear Diameter: 100 mm Method: 100m Cored bit Datum: Filename: A01581301B003				

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

 PATTLE DELAMORE PARTNERS LTD		<b>LOG OF CORED BOREHOLE</b> <b>Alberton Avenue Soakage Investigation</b>				HOLE NO. <b>MTA 01</b> JOB NO: A01581301						
CLIENT: Metrowater			LOCATION: 43 Mount Albert Road									
START DATE: 7/08/2008 END DATE: 7/08/2008		COORDINATES: 1753291E 5916246N		TOTAL DEPTH: 13.5 m		LOGGED BY: DUL	SHEET 1 OF 2					
GROUND LEVEL: 62 m TOP OF CASING: --			STRENGTH VS S MS W	FRACTURE SPACING (cm) 50 10 5 1	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) 20 40 60 80	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION
INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)											
FILL	Asphalt					0.0	62					
	CLAY/SILT; brown; homogeneous. Soft; moist; moderately plastic.					1.0	61					
AUCKLAND VOLCANIC FIELD	Moderately weathered, grey BASALT. Highly vesicular, moderately strong. Fractures are 30° and vertical, rough, undulating, clay lined, (brown), <1mm thick. at 1.8m, fracture spacing increases, vesicles in horizontal alignment.					2.0	60					
	Slightly weathered, clay lined, grey, rubbly BASALT. Weak, moderately vesicular, basalt rubble is 3-7cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.					3.0	59			→		
	Slightly weathered, grey BASALT. Moderately vesicular, vesicles small, moderately strong. Fractures are 30°, rough, undulating, clay lined, (orange), <1mm thick.					4.0	58					
	Slightly weathered, clay lined, grey, rubbly BASALT. Weak, moderately vesicular, basalt rubble is 3-7cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.					5.0	57					
	Unweathered, grey BASALT, moderately vesicular, vesicles small, moderately strong. Fractures are 30°, rough, undulating, clay lined, (orange), <1mm thick. at 4.1 - some pumaceous clasts at 4.7 - vesicles increase in size, voids present					6.0	56					
	Slightly weathered, clay lined, grey, rubbly BASALT. Weak, highly vesicular, basalt rubble is angular, 7-12cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.					7.0	55				→	
	Core loss											
Unweathered, grey BASALT, highly vesicular, vesicles large, moderately strong. Fractures are 30° and vertical, rough, undulating, clay lined, (brown), <1mm thick.												

Notes: Hand cleared to 1m  
WL = DRY  
RL obtained from GIS

**KEY**  
 Groundwater Level  
 Water Gain  
 Water Loss

**STRENGTH**  
 ES = extremely strong  
 VS = very strong  
 S = strong  
 MS = moderately strong  
 W = weak  
 VW = very weak

Drilled By: Boart Longyear  
 Diameter: 100 mm  
 Method: 100m Cored bit  
 Datum:  
 Filename: A01581301B004

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

 PATTLE DELAMORE PARTNERS LTD		<b>LOG OF CORED BOREHOLE</b> <b>Alberton Avenue Soakage Investigation</b>				HOLE NO. <b>MTA 01</b> JOB NO: A01581301					
CLIENT: Metrowater			LOCATION: 43 Mount Albert Road								
START DATE: 7/08/2008 END DATE: 7/08/2008		COORDINATES: 1753291E 5916246N		TOTAL DEPTH: 13.5 m		LOGGED BY: DUL	SHEET 2 OF 2				
GROUND LEVEL: 62 m TOP OF CASING: --		STRENGTH VS S MS W	FRACTURE SPACING (cm) 50 10 5 1	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) 20 40 60 80	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION
INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)										
AUCKLAND VOLCANIC FIELD	Core loss										
	Slightly weathered clay lined, grey, rubbly BASALT. Weak, moderately vesicular, basalt rubble is 3-7cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.				8.0	54					
	Unweathered, grey BASALT. Moderately vesicular, vesicles large, strong. Fractures are 60°, rough, undulating, clay lined, (light yellow), >1mm thick.								→		
	Core loss				9.0	53					
	Slightly weathered clay lined, grey, rubbly BASALT. Weak, moderately vesicular, basalt rubble is 3-7cm. Clay is brown; homogeneous. Soft; moist; moderately plastic.										
	Unweathered, grey BASALT. Few large vesicles, up to 8cm, strong. Fractures are 30°, rough, undulating.					10.0	52				
WAITEMATA GROUP	Core loss										
	Unweathered, grey BASALT. Weakly vesicular, vesicles large, up to 8cm, moderately strong. Fractures are 30°, rough, undulating.				11.0	51					
	Core loss				12.0	50					
	CLAY with minor fine gravel; brown; homogeneous. Soft; moist; non-plastic; gravel is basalt.  SILT/CLAY with minor gravel, grey; homogeneous. Moist; soft; plastic.					13.0	49				
END OF BOREHOLE AT 13.5m											
Notes: Hand cleared to 1m  WL = DRY  RL obtained from GIS		<b>KEY</b>  Groundwater Level  Water Gain  Water Loss		<b>STRENGTH</b> ES = extremely strong VS = very strong S = strong MS = moderately strong W = weak VW = very weak		Drilled By: Boart Longyear Diameter: 100 mm Method: 100m Cored bit Datum: Filename: A01581301B004					

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

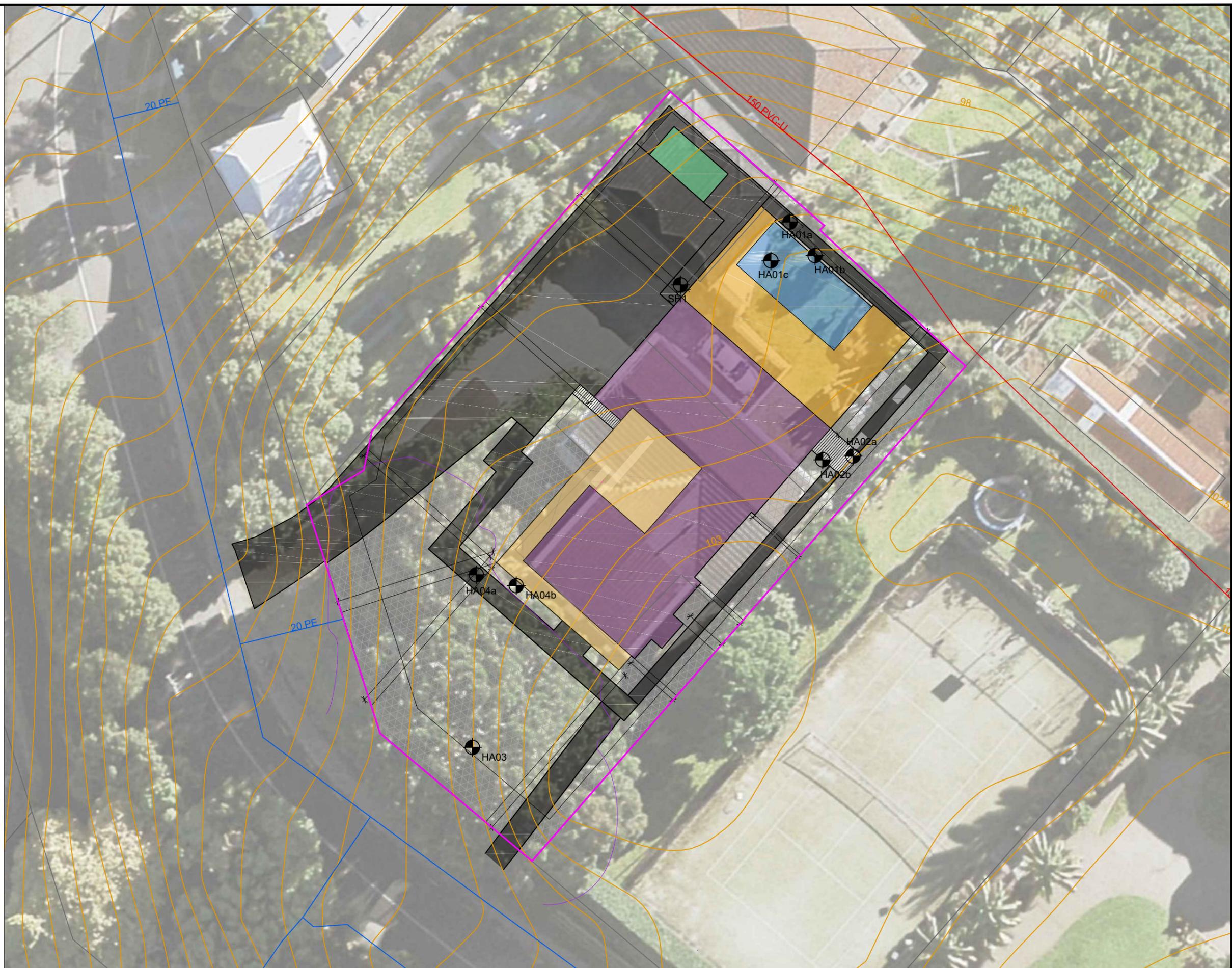


**KEY:**

- HA01 LandTech Consulting Ltd. augerhole locations, drilled 07 April 2021
- SH01 LandTech Consulting Ltd. soakhole locations, drilled 19 Mar 2021
- Existing boundary
- Contour lines
- Proposed Building Footprint
- Proposed concrete driveway and pathway
- Proposed Pool
- Proposed Shed
- Proposed Deck
- WWMH Wastewater line; manhole

**NOTES:**

Locations of features approximate only  
 Original sheet size A3  
 Boundary information on this *Test Location Plan* adapted from LINZ website: [www.data.linz.govt.nz](http://www.data.linz.govt.nz) (accessed 22/04/2021)  
 Elevations are in terms of NZVD2016  
 Location of proposed new dwelling adapted from Four Walls Architecture drawing titled: Site Plan, Sheet A-1000, dated 06/04/2021.



AMENDMENTS		
DATE	REV	DESCRIPTION
22/04/2021	A	Report Issue

Check all dimensions and levels on site before commencing construction.  
 This drawing and design remains the property of LandTech Consulting Ltd. and may not be reproduced without approval and permission from LandTech Consulting Ltd.

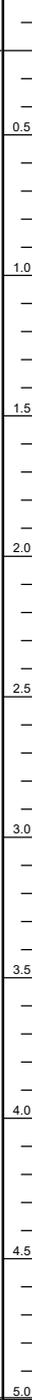
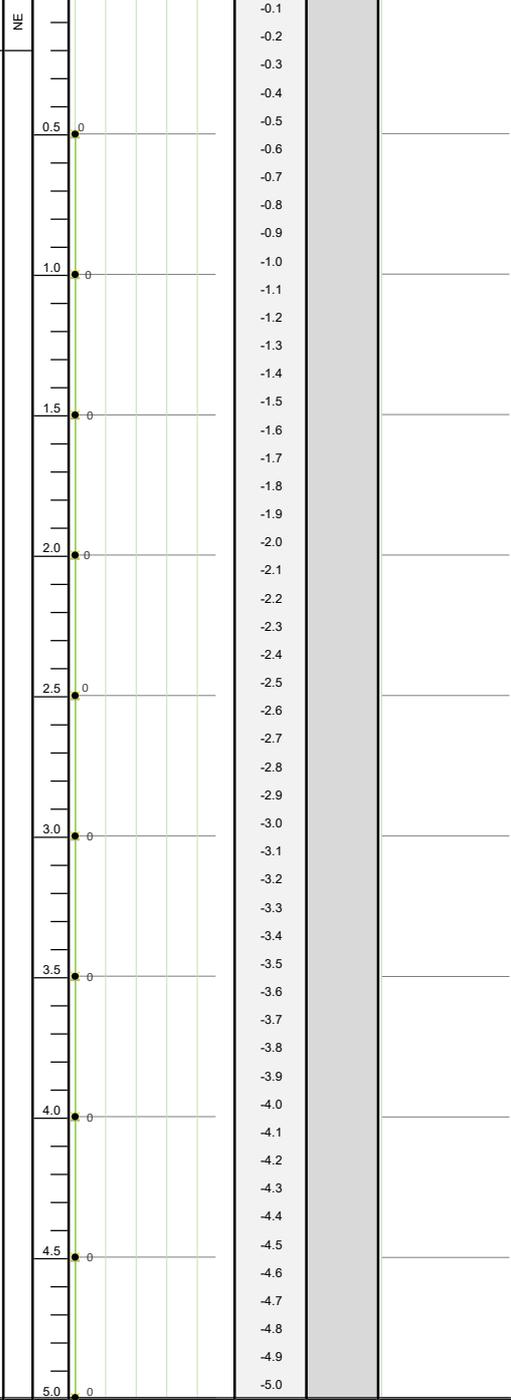
**Test Location Plan**  
 36 Summit Drive  
 MT ALBERT, AUCKLAND



Christchurch Office:  
 118 Carlyle Street, Sydenham, Christchurch 8023  
 Auckland Office:  
 17 Nils Andersen Road, Whenuapai, Auckland 0618  
 Postal Address:  
 PO Box 119, Christchurch 8013  
 Website: [www.landtech.nz](http://www.landtech.nz) Email: [info@landtech.nz](mailto:info@landtech.nz)

Drawing No: LTA21083/ 1	Drawn by: A. Alsharari	Date: 22 April 2021
Scale: 1: 250 (A3)	Checked by: MAH	Revision: A
Filename: LTA21083 - Test Location Plan.dwg		

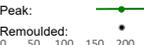
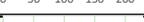
		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA01  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: NS Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:1753119.90; N:5916044.44 Ground Conditions: Gently Sloping, Grass Groundwater Level (m): Not Encountered	Logged By: NS Shear Vane No: 2715 Calibration Factor: 1.582 Calibration Date: 21-Aug-20 Calibration Constant: 0	
Stratigraphy Depth (m) Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	Groundwater Level (m) Depth (m)	In-situ Field Testing Shear Strength (kPa) Peak: ● Remoulded: ● 0 50 100 150 200
TOPSOIL/FILL 0.5 AVF 1.0	SILT, some fine to coarse sand, dark brown, stiff, moist, non-plastic  light grey  medium to coarse Sandy SILT, dark brown, very stiff, moist, non-plastic  End of Augerhole 1.0m [ROCK OBSTRUCTION]	Not Encountered 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	Dynamic Cone (Scala) Penetrometer Depth (m) Blow Count Scala Blow Count / 100mm 0 5 10 15 20 4 20 20
		In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001	
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA01A  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: NS Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:5916044.80; N:5916044.80 Ground Conditions: Gently Sloping, Grass Groundwater Level (m): Not Encountered	Logged By: NS Shear Vane No: 2715 Calibration Factor: 1.582 Calibration Date: 21-Aug-20 Calibration Constant: 0	
Stratigraphy Depth (m)	Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	In-situ Field Testing Shear Strength (kPa) Peak:  Remoulded: 0 50 100 150 200
TS/FILL Depth (m)		SILT, some fine to coarse sand, dark brown, moist, non-plastic light grey  End of Augerhole 0.2m [ROCK OBSTRUCTION]	Dynamic Cone (Scala) Penetrometer Depth (m)   Blow Count   Scala Blow Count / 100mm 0   0   0
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0			NE 
In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2. Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001			
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

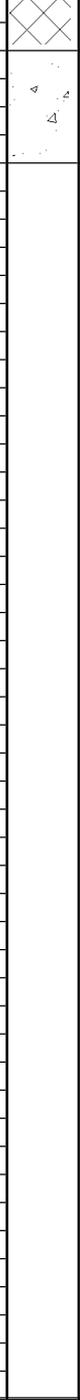
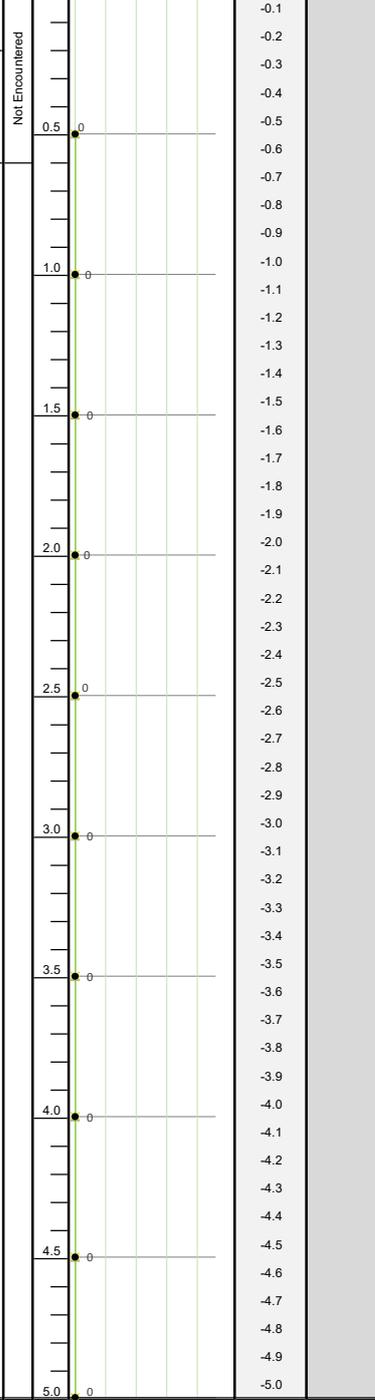
		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA01B  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: NS Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:1753121.23; N:5916047.12 Ground Conditions: Gently Sloping, Grass Groundwater Level (m): Not Encountered	Logged By: NS Shear Vane No: 2715 Calibration Factor: 1.582 Calibration Date: 21-Aug-20 Calibration Constant: 0	
Stratigraphy Depth (m)	Graphic Log Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	Groundwater Level (m) Depth (m)	In-situ Field Testing Shear Strength (kPa) Peak:  Remoulded:  0 50 100 150 200
TS/FILL 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	SILT, some fine to coarse sand, dark brown, stiff, moist, non-plastic  SILT, some fine to coarse sand, trace clay, grey, very stiff, moist, non to slightly plastic  End of Augerhole 0.7m [ROCK OBSTRUCTION]	Not Encountered 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	Dynamic Cone (Scala) Penetrometer Depth (m) Blow Count Scala Blow Count / 100mm 0
		In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2. Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001	
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA02  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: AA Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:1753125.61; N:5916030.88 Ground Conditions: Near Level, Grass Groundwater Level (m): Not Encountered	Logged By: AA Shear Vane No: 2995 Calibration Factor: 1.399 Calibration Date: 12-Oct-20 Calibration Constant: 0	
Stratigraphy Depth (m) Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	Groundwater Level (m) Depth (m)	In-situ Field Testing Shear Strength (kPa) Dynamic Cone (Scala) Penetrometer Scala Blow Count / 100mm
TS/FILL AVF 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	SILT, organic, dark brown, stiff, moist, non-plastic  SILT, some fine to medium scoria gravel, minor fine sand, brown with orangish brown mottles, stiff, moist, non-plastic  End of Augerhole 0.6m [GRAVEL OBSTRUCTION]	Not Encountered 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	Peak:  Remoulded:  0 50 100 150 200  Depth (m) 0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 Blow Count 0 5 10 15 20 40*
In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2. Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001			
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Nils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA02A  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: AA Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:1753123.50; N:5916030.62 Ground Conditions: Near Level, Grass Groundwater Level (m): Not Encountered	Logged By: AA Shear Vane No: 2995 Calibration Factor: 1.399 Calibration Date: 12-Oct-20 Calibration Constant: 0	
Stratigraphy Depth (m) Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	Groundwater Level (m) Depth (m)	In-situ Field Testing Shear Strength (kPa) Dynamic Cone (Scala) Penetrometer Scala Blow Count / 100mm Peak:  Remoulded:  Depth (m) Blow Count 0
TS/FILL AVF	SILT, organic, stiff, moist, non-plastic  SILT, minor fine sand and fine to medium scoria gravel, orangish brown, very stiff, moist, non-plastic  End of Augerhole 0.4m [GRAVEL OBSTRUCTION]	Not Encountered	-0.1 -0.2 -0.3 -0.4 -0.5 -0.6 -0.7 -0.8 -0.9 -1.0 -1.1 -1.2 -1.3 -1.4 -1.5 -1.6 -1.7 -1.8 -1.9 -2.0 -2.1 -2.2 -2.3 -2.4 -2.5 -2.6 -2.7 -2.8 -2.9 -3.0 -3.1 -3.2 -3.3 -3.4 -3.5 -3.6 -3.7 -3.8 -3.9 -4.0 -4.1 -4.2 -4.3 -4.4 -4.5 -4.6 -4.7 -4.8 -4.9 -5.0
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0		0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

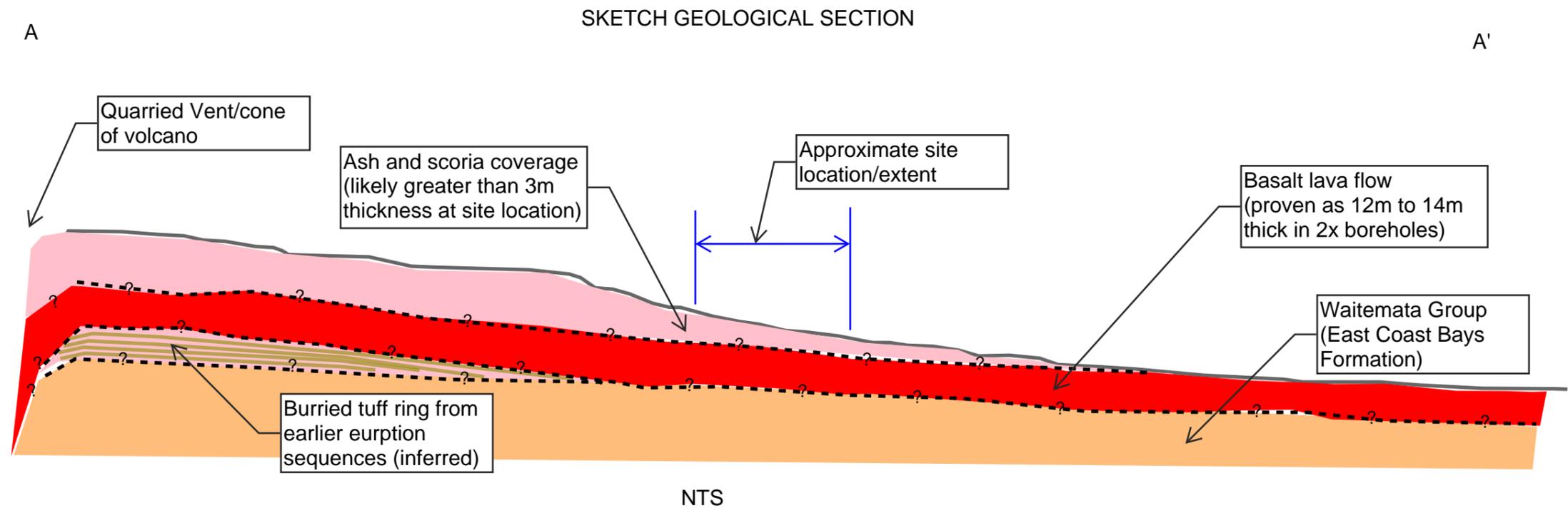
		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland		Augerhole No. HA03  Sheet No. 1 of 1		
Drill Type: 50ml Hand Auger Drilled By: AA Date Started: 7-Apr-21 Date Finished: 7-Apr-21		Project No: LTA21083 Coordinates: NZTM2000: E:1753099.16; N:5916010.66 Ground Conditions: Near Level, Grass Groundwater Level (m): Not Encountered		Logged By: AA Shear Vane No: 2995 Calibration Factor: 1.399 Calibration Date: 12-Oct-20 Calibration Constant: 0		
Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	In-situ Field Testing		
				Shear Strength (kPa)		Dynamic Cone (Scala) Penetrometer
				Peak: 	Depth (m)	Scala Blow Count / 100mm
				Remoulded: 	Blow Count	0 5 10 15 20
TS			SILT, organic, dark brown, stiff, moist, non-plastic			
AVF	0.5		SILT, minor fine sand, fine to medium scoria gravel and rootlets, orangish brown with white specks, hard, moist, non-plastic	Not Encountered		
	1.0		End of Augerhole 0.6m [ROCK OBSTRUCTION]	0.5		
	1.5					
	2.0					
	2.5					
	3.0					
	3.5					
	4.0					
	4.5					
	5.0					
				In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2. Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001		
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334		Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>		

		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA04  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: NS Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:1753099.43; N:5916022.64 Ground Conditions: Near Level, Grass Groundwater Level (m): Not Encountered	Logged By: NS Shear Vane No: 2715 Calibration Factor: 1.582 Calibration Date: 21-Aug-20 Calibration Constant: 0	
Stratigraphy Depth (m) Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005		In-situ Field Testing Shear Strength (kPa) Dynamic Cone (Scala) Penetrometer Peak:  Remoulded:  Depth (m)   Blow Count   Scala Blow Count / 100mm
TSFILL AVF 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	SILT, minor fine to coarse sand, dark brown, stiff, moist, non-plastic  SILT, trace fine scoria gravel, dark orangish brown, very stiff, moist, non-plastic  End of Augerhole 0.6m [ROCK OBSTRUCTION]	Not Encountered 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	-0.1 -0.2 -0.3 -0.4 -0.5 -0.6 -0.7 -0.8 -0.9 -1.0 -1.1 -1.2 -1.3 -1.4 -1.5 -1.6 -1.7 -1.8 -1.9 -2.0 -2.1 -2.2 -2.3 -2.4 -2.5 -2.6 -2.7 -2.8 -2.9 -3.0 -3.1 -3.2 -3.3 -3.4 -3.5 -3.6 -3.7 -3.8 -3.9 -4.0 -4.1 -4.2 -4.3 -4.4 -4.5 -4.6 -4.7 -4.8 -4.9 -5.0 40+
In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001			
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

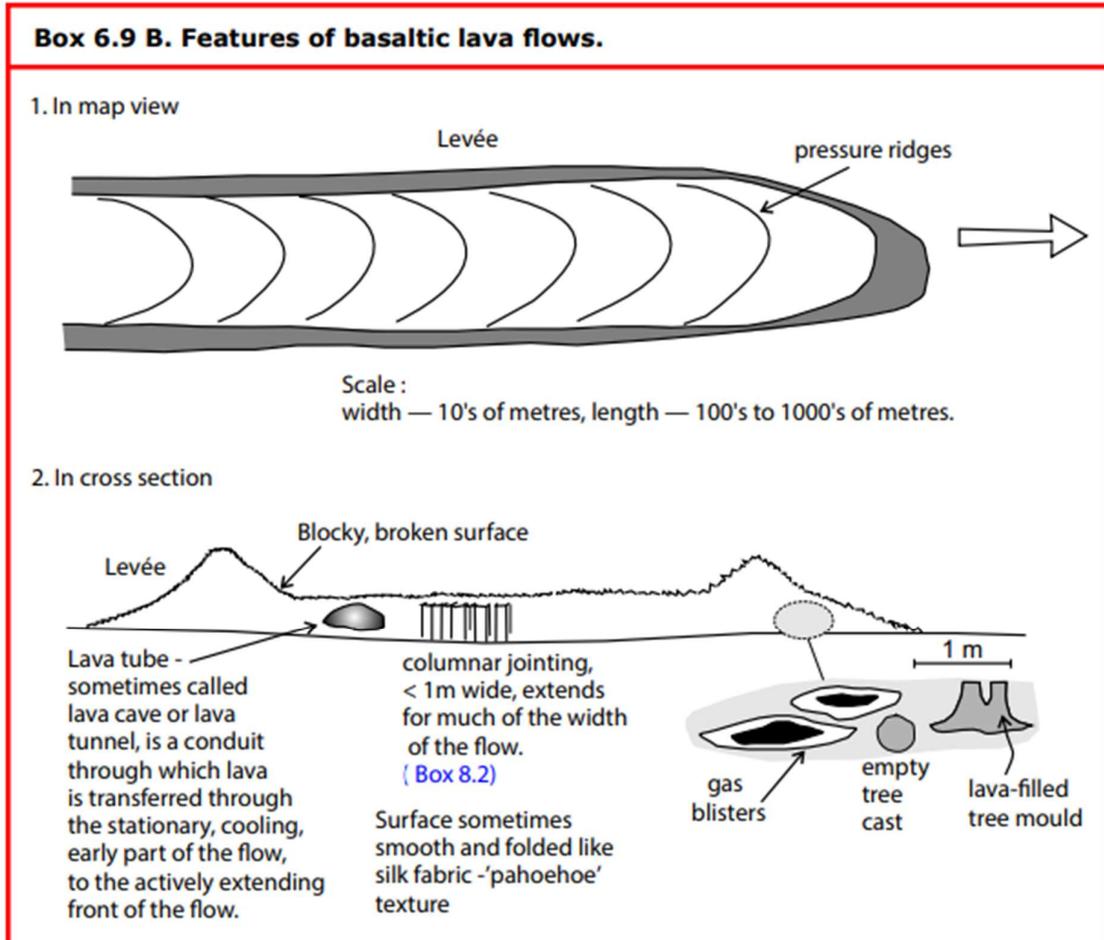
		Client: Antony & Jenni Stulich Project: Geotechnical Investigation for Proposed Residential Re-Development Address: 36 Summit Drive, Mount Albert, Auckland	Augerhole No. HA04A  Sheet No. 1 of 1
Drill Type: 50ml Hand Auger Drilled By: NS Date Started: 7-Apr-21 Date Finished: 7-Apr-21	Project No: LTA21083 Coordinates: NZTM2000: E:1753102.21; N:5916021.89 Ground Conditions: Near Level, Grass Groundwater Level (m): Not Encountered	Logged By: NS Shear Vane No: 2715 Calibration Factor: 1.582 Calibration Date: 21-Aug-20 Calibration Constant: 0	
Stratigraphy Depth (m)	Graphic Log	Soil description in accordance with <i>Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes</i> , NZ Geotechnical Society Inc., 2005	In-situ Field Testing Shear Strength (kPa) Peak:  Remoulded: 0 50 100 150 200
TS/FILL AVF 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0		SILT, minor fine to coarse sand, dark brown, moist, non-plastic  SILT, minor fine sand and fine to medium scoria gravel, dark orangish brown, hard, moist, non-plastic  End of Augerhole 0.6m [ROCK OBSTRUCTION]	Dynamic Cone (Scala) Penetrometer Scala Blow Count / 100mm Depth (m) Blow Count 0
		Groundwater Level (m) Depth (m) Not Encountered 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	
In-situ field testing in accordance with the following Standards: Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001			
LandTech Consulting Ltd. (Christchurch): 11B Carlyle Street, Sydenham LandTech Consulting Ltd. (Auckland): 17 Niils Andersen Road, Whenuapai		Phone: (03) 390 1371 Phone: (09) 930 9334	Email: <a href="mailto:info@landtech.nz">info@landtech.nz</a> Website: <a href="http://www.landtech.nz">www.landtech.nz</a>

## **Appendix B: Sketch Geological Cross section**





## Appendix C: Basaltic Lava Flow Features (NZ Geology: an illustrated guide. GSNZ Publication)



Reference: Peter Ballance, GSNZ Miscellaneous Publication 148. 397pp, version 2. *New Zealand Geology: an illustrated guide.*