

8 November 2019

Mr Simon Tan  
SK Aotearoa Trust  
45 Great North Road  
Kamo  
Whangarei 0112

Dear Simon

**RE: Wastewater Disposal Field Geotechnical Assessment - Corner SH1 and Port Marsden Highway, Ruakaka,**  
**(Our Reference: 16234.000.000\_03)**

## 1 Introduction

ENGEO Ltd was requested by SK Aotearoa Trust to undertake an assessment of the ground conditions underlying the proposed wastewater disposal field to service the proposed new service centre at the corner of State Highway 1 and Port Marsden Highway in Ruakaka. This work has been carried out in accordance with our signed agreement dated 18 October 2019 (ref. P2019.001.018\_03).

The purpose of the assessment was to confirm the nature of the near surface soils to support design of the wastewater disposal system by a third party. Our scope of work is limited to assessing the GD06 Soil Category (Table 16, Auckland Council Guideline document 2018/006) and measurement of groundwater levels at investigation borehole locations. Our scope of work does not include soil permeability testing.

## 2 Background Information

ENGEO has completed a Preliminary Geotechnical Investigation Report (ref. 16234.000.000\_02, dated 2 August 2019) for the proposed service centre, however the proposed wastewater disposal field area was not included in that investigation footprint.

The site is located on the northern corner of the intersection between State Highway 1 and the Port Marsden Highway. As detailed in the Preliminary Geotechnical Investigation Report, it is underlain by alluvium comprising mud, sand, gravel and peat of the Tauranga Group sedimentary lithology, with weathered clayey and sandy silt soils of the Ruarangi Formation at depth.

### 3 Wastewater Disposal Field Investigation

#### 3.1 Hand Auger Boreholes

ENGEO visited the site on 29 October 2019 to drill four new hand auger boreholes within the footprint of the proposed wastewater disposal field. The locations of the boreholes are shown on the appended Investigation Location Plan.

All boreholes were progressed to a target depth of 3 m below the existing ground surface, with associated *in situ* shear vane testing. Full borehole records are appended.

#### 3.2 Soil Profile

Topsoil was encountered at all borehole locations and was up to 0.3 m thick.

Tauranga Group alluvium comprising silty clay, clayey silt and organic silt layers with variable sand content was encountered underlying the topsoil at all borehole locations. Measured shear strengths ranged from 26 kPa to 101 kPa, indicating a variable strength soil described as firm to very stiff. Standing groundwater was measured within the Tauranga Group alluvium at all locations.

Ruarangi Formation soils comprising fine to coarse grained sandy silt were encountered underlying the alluvium at depths ranging from 1.9 m to 2.3 m below the ground surface. Measured shear strengths of 66 kPa and 157 kPa were recorded in borehole HA04 indicating a stiff to very stiff soil, however, at all other test locations the Ruarangi Formation soils were unable to be penetrated by the shear vane indicating a hard consistency.

#### 3.3 Groundwater

The depth to groundwater at each borehole location was measured upon completion of the drilling. Recorded groundwater levels are summarised in Table 1 below, and are measured from the ground surface.

**Table 1: Measured Groundwater**

Borehole ID	Groundwater Depth (m)
HA09	0.7
HA10	0.6
HA11	0.7
HA12	0.8

### 4 Summary of Findings

The near surface soils (<1 m depth) typically comprise topsoil overlying silty clays and clayey silts with variable sand content, with an organic silt layer containing plant remains recorded at all boreholes at approximately 1 m depth. We consider the inorganic soils to be broadly consistent with GD06 Soil Category 5 – “Sandy clay, light clay, silty clay”. The soil structure is inferred to be weakly structured or massive due to its shallow depositional environment and geologically young age. However, the wastewater system designer should make their own assessment based on a review of the factual data provided.

Groundwater was encountered at all of the borehole locations at depths between 0.6 m and 0.8 m below the ground surface.

## 5 Limitations

- i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, SK Aotearoa Trust, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.
- ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.
- iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.
- iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.
- v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

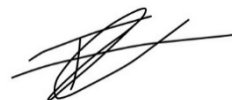
Report prepared by



**Heather Lyons, CMEngNZ (PEngGeol)**

Associate Engineering Geologist

Report reviewed by



**Dustin Tookey, CMEngNZ (CPEng)**


Senior Geotechnical Engineer

### Attachments:

Investigation Location Plans

Hand Auger Borehole Records HA09 – HA12



**Key:**  
 Hand Auger Borehole



<b>Date</b>	Nov-19	<b>Client</b>	SK Aotearoa Trust	
<b>Drawn by</b>	BF	<b>Project</b>	Corner SH1 and Port Marsden Highway, Whangarei	
<b>Approved by</b>	HL	<b>Description</b>	Investigation Location Plan	
<b>Scale</b>	NTS	<b>Appendix:</b>	1	<b>Project Number</b> 16234.000.000



# LOG OF HAND AUGER HA09

Geotechnical Investigation  
 Corner of SH1 and Port Marsden  
 Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust  
 Client Ref. : 16234.000.0000  
 Date : 29/10/2019  
 Hole Depth : 3 m  
 Hole Diameter : 50 mm

Shear Vane No : 2524  
 Logged By : BF  
 Reviewed By : RB  
 Latitude : -35.888336  
 Longitude : 174.433276

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remoulded	Notes/Remarks
	TS	OL	Topsoil.					N/A		
0.5		ML	Clayey SILT with minor fine to coarse sand and trace organics; light grey with orange streaks. Low plasticity.				M	St	58/26 91/29	
1.0		OL	Organic SILT with minor fine to coarse sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.					St	78/31 55/26	
1.5	ALLUVIUM	CH	Silty CLAY; light grey with orange streaks. High plasticity.					St	65/26	
2.0		OL	Organic SILT with minor fine to coarse sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.				W	St	60/17	
2.0		ML	Clayey SILT with minor fine to coarse sand; dark brown. Low plasticity.					St	75/34	
2.5	RF	ML	Fine to coarse sandy SILT; brown with grey streaks. Low plasticity.				S	H	UTP UTP UTP	
3.0	End of Hole Depth: 3 m Termination Condition: Target depth									

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

Hand auger met target depth at 3 m.  
 Dip test showed standing water at 0.7 m depth.  
 TS = Topsoil  
 UTP = Unable to Penetrate

N/A = Not Assessed  
 RF = Ruarangi Formation



# LOG OF HAND AUGER HA10

Geotechnical Investigation  
 Corner of SH1 and Port Marsden  
 Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust  
 Client Ref. : 16234.000.0000  
 Date : 29/10/2019  
 Hole Depth : 3 m  
 Hole Diameter : 50 mm

Shear Vane No : 2524  
 Logged By : BF  
 Reviewed By : RB  
 Latitude : -35.889067  
 Longitude : 174.433208

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remoulded	Notes/Remarks
	TS	ML	Topsoil.					N/A		
0.5		CH	Silty CLAY with trace organics; light grey with brown streaks. High plasticity.				M	St	75/31	
1.0		OL	Organic SILT with trace sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.					St	80/13	
1.5		CH	Silty CLAY; light grey. High plasticity.				W	F - St	83/26	
2.0		ML	Fine to medium sandy SILT with trace organics; brown with grey streaks. Low plasticity.					St	53/36	
2.5		ML	Fine to coarse sandy SILT; brown with grey streaks. Low plasticity.				S	H	26/21	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth						60/26	
									66/29	
									UTP	
									UTP	
									UTP	

Hand auger met target depth at 3 m.  
 Dip test showed standing water at 0.6 m depth.  
 TS = Topsoil  
 UTP = Unable to Penetrate

N/A = Not Assessed



# LOG OF HAND AUGER HA11

Geotechnical Investigation  
 Corner of SH1 and Port Marsden  
 Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust  
 Client Ref. : 16234.000.0000  
 Date : 29/10/2019  
 Hole Depth : 3 m  
 Hole Diameter : 50 mm

Shear Vane No : 2524  
 Logged By : BF  
 Reviewed By : RB  
 Latitude : -35.888988  
 Longitude : 174.434081

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remoulded	Notes/Remarks
	TS	ML	Topsoil.					N/A		
0.5	ALLUVIUM	ML	Clayey SILT with minor fine to coarse sand; light grey. Low plasticity.					VSt	101/31	
		ML	Silty CLAY with minor fibrous organics; brown with black streaks. Low plasticity.				M	St	93/39	
1.0		OL	Organic SILT; black with brown streaks. Low plasticity. Organics, fibrous.					St	99/39	
1.5		CH	Silty CLAY; light brown with orange streaks. High plasticity.				W	St	77/26	
2.0	RUARANGI FORMATION		Encountered 100 mm of organic material at 1.7 m depth.						70/31	
		ML	Fine to medium sandy SILT; brown. Low plasticity.					St - VSt	66/29	
2.5		ML					S		109/27	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth					H	UTP UTP	

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

Hand auger met target depth at 3 m.  
 Dip test showed standing water at 0.7 m depth.  
 TS = Topsoil  
 UTP = Unable to Penetrate

N/A = Not Assessed



# LOG OF HAND AUGER HA12

Geotechnical Investigation  
 Corner of SH1 and Port Marsden  
 Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust  
 Client Ref. : 16234.000.0000  
 Date : 29/10/2019  
 Hole Depth : 3 m  
 Hole Diameter : 50 mm

Shear Vane No : 2524  
 Logged By : BF  
 Reviewed By : RB  
 Latitude : -35.889838  
 Longitude : 174.433978

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remoulded	Notes/Remarks
	TS	ML	Topsoil.					N/A		
0.5	ALLUVIUM	ML	Clayey SILT with minor fine to coarse sand; light grey. Low plasticity.				M	St	83/13	
		ML	Clayey SILT with some fibrous organics; brown with black streaks. Low plasticity.					St	77/34	
1.0		OL	Organic SILT; black with brown streaks. Low plasticity.					St	79/34	
1.5		CH	Silty CLAY; light brown with orange streaks. High plasticity.				W	St	53/36	
2.0	RUARANGI FORMATION		Encountered 100 mm of organic material at 1.7 m depth.						79/23	
		ML	Fine to medium sandy SILT; brown. Low plasticity.					St	66/29	
2.5		ML						S	157/27	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth					H	UTP UTP	

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

Hand auger met target depth at 3 m.  
 Dip test showed standing water at 0.8 m depth.  
 TS = Topsoil  
 UTP = Unable to Penetrate

N/A = Not Assessed