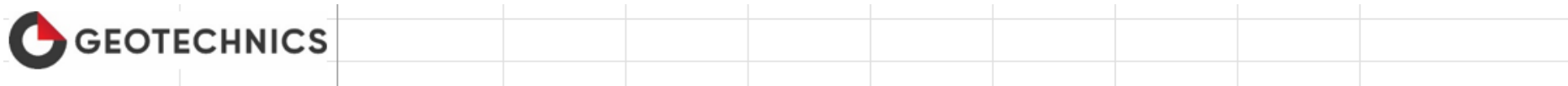


Appendix C Geotechnics piezometer data sheets

[illegible]

[illegible]

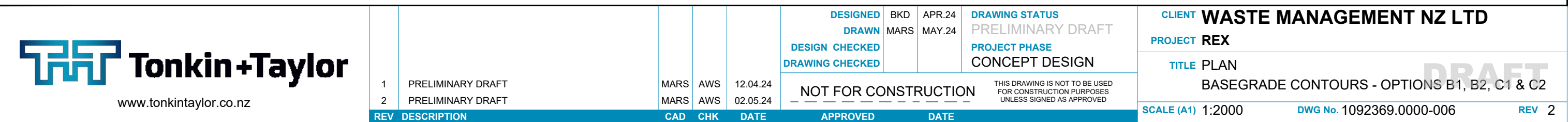
Instrument ID.	PZ42 (Deep)								
Site	Redvale Landfill, Dairy Flat, Auckland								
Borehole Number	BH W136								
Installed Depth (m)	15.0								
Reference Level RL(m)	78.45								
Installed RL (m)	63.45								
Serial No.	2320523?S14059								
Cable (m)	30								
Tag	PZ42 S14059								
Range (kPa)	350								
A (MPa)	-8.558E-08								
B (MPa)	-0.0998								
Site Zero C (MPa)	869.8246								
K (MPa)	-0.1302								
Site Initial TemperatureTo	15.3								
Factory C (MPa)	869.6733								
Factory Zero TemperatureT°	24.3								
Convert Factor kPa to mH2O	0.10197								
General Comments	Date / Time	Tech	Hz	Hz2/1000	T	mH2O	kPa	Water Level RL(m)	Comments
Manual Readings	0/2024 10:31	OLAR/PACO	2767.8	7660.7	16.3	10.211	100.13	73.66	
Manual Readings	1/2024 9:58	PACO	2773.8	7694.0	16.2	9.869	96.78	73.32	
Manual Readings	1/2024 9:34	PACO	2777.0	7711.7	16.2	9.686	94.99	73.14	
Manual Readings	2/2024 9:48	PACO	2778.8	7721.7	16.2	9.583	93.98	73.04	
Manual Readings	2/2024 10:50	OLAR	2781.8	7738.4	16.2	9.411	92.29	72.86	
Manual Readings	1/2025 9:59	PACO	2783.9	7750.1	16.2	9.290	91.11	72.74	
Manual Readings	1/2025 10:44	OLAR	2786.9	7766.8	16.2	9.118	89.42	72.57	

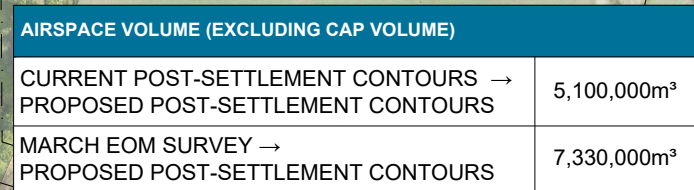
[illegible]

Instrument ID.	PZ44 (Shallow)								
Site	Redvale Landfill, Dairy Flat, Auckland								
Borehole Number	BH W138								
Installed Depth (m)	7.1								
Reference Level RL(m)	78.38								
Installed RL (m)	71.33								
Serial No.	2266995/S12292								
Cable (m)	15								
Tag	PZ44 S12292								
Range (kPa)	350								
A (MPa)	2.454E-07								
B (MPa)	-0.1100								
Site Zero C (MPa)	953.0174								
K (MPa)	-0.2323								
Site Initial TemperatureTo	16.5								
Factory C (MPa)	954.3853								
Factory Zero TemperatureT°	21.9								
Convert Factor kPa to mH2O	0.10197								
General Comments	Date / Time	Tech	Hz	Hz2/1000	T	mH2O	kPa	Water Level RL(m)	Comments
Manual Readings									
Manual Readings	5/11/2024 9:30	PACO	2937.6	8629.5	16.9	2.239	21.95	73.57	
Manual Readings	19/11/2024 9:15	PACO	2939.0	8637.7	16.8	2.152	21.11	73.48	
Manual Readings	03/12/24 09:30	PACO	2935.8	8618.9	16.7	2.357	23.12	73.69	
Manual Readings	17/12/24 10:38	OLAR	2937.6	8629.5	16.7	2.243	22.00	73.57	
Manual Readings	07/01/25 09:35	PACO	2943.1	8661.8	16.6	1.897	18.60	73.23	
Manual Readings	21/01/25 10:36	OLAR	2943.1	8661.8	16.6	1.897	18.60	73.23	

[illegible]

Appendix D Option C1, Option B1 and Basegrade Plans







Appendix K Perimeter Bunds' Geotechnical Factual Report

EGL Ref: 10096

**WM NEW ZEALAND LIMITED
REDVALE LANDFILL
GEOTECHNICAL FACTUAL REPORT**

WM New Zealand Limited

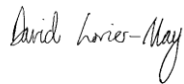
21 November 2025

DOCUMENT CONTROL

Document information

Title	WM New Zealand Limited (WMNZ) Redvale Geotechnical Factual Report
Revision	2
Date	21 November 2025
EGL Reference	10096
Client Reference	---
File Name	Redvale Geotechnical Factual Report Rev 1.docx

Document roles and approvals

Role	Name	Title	Signature	Doc. Rev.	Date
Author:	P. Carter	Senior Geotech Engineer		2	21/11/2025
Reviewer:	D. Lorier-May	Senior Engineering Geologist		2	21/11/2025
Approver:	P. Carter	Senior Geotechnical Engineer		2	21/11/2025

Final version report issues require signatures.

Document revision and issue record

Revision.	Date	Revision Description	Issued by
2	21/11/2025	Final	P. Carter

Draft report versions are assigned alphabetic revision numbers.

Final report versions and subsequent revision are assigned numeric revision numbers.

Final version report issues require signatures.

Document applicability and disclaimers

This report has been prepared by EGL (Engineering Geology Limited) for the sole benefit of WM New Zealand Limited (WMNZ) as our client with respect to the particular brief given to us.

The content of this report and any advice given in undertaking this work cannot to be relied on by any person or parties other than the above-named client, or for any purpose other than the client's particular brief, without EGL's prior written agreement.

This report shall only be read in its entirety.

Where this report is issued as a draft version its contents shall not be relied upon and used for initial information and review purposes only as they are subject to change.

CONTENTS

	Page No.
1.0 INTRODUCTION	1
2.0 GEOLOGY	1
2.1. Geological Units	1
3.0 GROUND INVESTIGATION OBJECTIVES	2
4.0 GROUND INVESTIGATIONS	2
4.1.1. Machine Boreholes	2
4.1.2. Logging Standards	2
5.0 RELEVANT HISTORICAL BOREHOLES	3
6.0 REFERENCES	3

TABLES

TABLE 1 – LIST OF BOREHOLES

APPENDICES

APPENDIX A - GROUND INVESTIGATION LOCATION PLANS

APPENDIX B – BOREHOLE LOGS AND CORE PHOTOGRAPHS

APPENDIX C – RELEVANT HISTORICAL BOREHOLE LOGS

WM NEW ZEALAND LIMITED REDVALE LANDFILL GEOTECHNICAL FACTUAL REPORT

1.0 INTRODUCTION

Engineering Geology Limited (EGL) has been engaged by WM New Zealand Limited (WMNZ) to provide geotechnical services for a proposed further development of the Redvale Landfill located at Dairy Flat, Auckland.

2.0 GEOLOGY

2.1. Geological Units

The following geological description of the strata that is inferred to underlie landfill is based on a review of the currently available site-specific investigation results and information published on the Geological and Nuclear Science (GNS) 1:250,00 scale geological map. excerpt from the GNS geological map is presented as Figure 1 below.

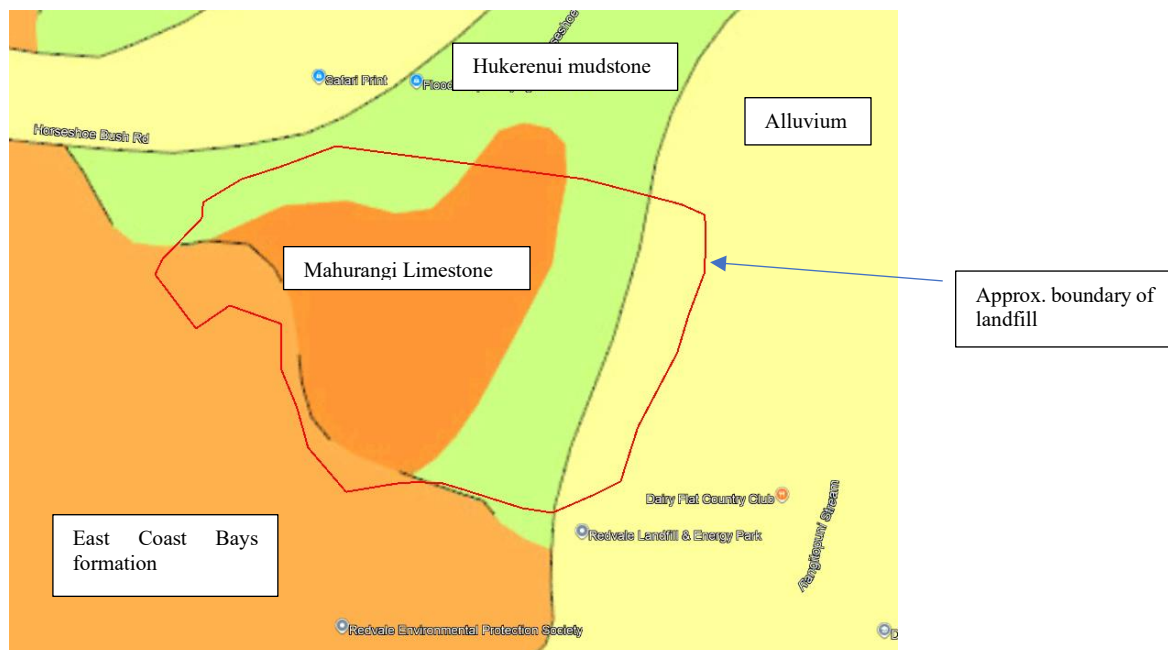


Figure 1: Excerpt from the 1:250,000 Scale map (source Institute of geological and nuclear science)

The summary of the main geological units on site is as follows:

Alluvial Deposits(IQa): Undifferentiated, typically unconsolidated, variable weathered gravels with interbeds of sands, silts and clays. This unit is generally encountered in the valley floors. These materials comprise clays, silts, sands and gravels derived from parent materials upslope of the deposition location.

Hukerenui Mudstone (Mangakahia Complex) (Kkh): Red, brown, green and grey, typically noncalcareous, commonly highly sheared mudstone with small serpentinite bodies.

Mahurangi Limestone (Motatau Complex) (Omm): Blue-grey to white, micritic, coccolith foraminiferal, muddy limestone, commonly with thin glauconitic sandstone beds:

East Coast Bays Formation (Mwe): Alternating sandstone and mudstone with variable volcanic content and interbedded volcanoclastic grits.

Both the mudstone and limestones are part of the Northland Allochthon.

3.0 GROUND INVESTIGATION OBJECTIVES

The ground investigation purpose to determine the depth of the underlying natural ground.

4.0 GROUND INVESTIGATIONS

4.1.1. Machine Boreholes

A series of fifteen rotary cored boreholes (RC) were drilled by pro- Drill Limited to investigate the depth top mudstone along the eastern boundary access road. These boreholes were drilled using an “open barrel” that was then changed to triple tube rotary coring when the ground was too stiff for the open barrel technique.

A table summarising the geotechnical borehole drilling is appended (Table 1). Summary logs and borehole core photographs are presented in Appendix B.

4.1.2. Logging Standards

Full time supervision of the machine boreholes was undertaken by an EGL geologist, with the recovered core being logged adjacent to the drill rig.

All machine boreholes were logged in general accordance with the relevant guidelines which are set out in the New Zealand Geotechnical Society publication “Field Description of Soil and Rock: Guidelines for the Field Description of Soil and Rock for Engineering Purposes.” (2005).

5.0 RELEVANT HISTORICAL BOREHOLES

A selection of historical boreholes sourced from the New Zealand Geotechnical database is shown on the attached plan. The boreholes are presented in Appendix C and are for information only.

6.0 REFERENCES

1. New Zealand Geotechnical Society (2005). Guidelines description of soil and rock for engineering purposes
2. GNS. (2018). GNS Geological Map of New Zealand 1:250,000

TABLE 1. SUMMARY OF BOREHOLE INVESTIGATIONS.

Borehole No.	Borehole Depth (m)	Northing	Easting	Ground Level RL (m)	Depth to top of Siltstone from ground surface(m)	Top of Siltstone RL (m)
MBH1	4.5	724316.162	288359.207	63.9	3.2	60.7
MBH2	6	724234.223	288342.184	56	4	52.0
MBH3	3.5	724188.772	288284.951	56.7	2.4	54.3
MBH4	3.5	724128.907	288252.527	56.5	2	54.5
MBH5	3.5	724062.214	288284.36	59.0	2.9	56.1
MBH6	3.5	723975.663	288276.295	58.5	3	55.5
MBH7	1.3	723906.557	288248.122	55.7	0.8	54.9
MBH8	3.5	723843.222	288193.281	51.7	2	49.7
MBH9	2	723771.755	288154.594	51.9	1.3	50.6
MBH10	3.5	723706.341	288124.881	53.9	3.2	50.7
MBH11	7.4	723709.801	288053.689	56.1	6.7	49.4
MBH12	12	723730.21	287977.879	58.4	11.6	46.8
MBH13	3	723738.224	287888.102	60.1	2.7	57.4
MBH14	3.5	723778.542	287807.083	62.3	3.2	59.1
MBH15	7.5	723811.037	287716.874	64.2	3	61.2

APPENDIX A
Ground Investigation Location Plans



PRINTED: 2025-11-21 15:17:23

LEGEND

100

EXISTING 5m INTERVAL CONTOURS

PERIMETER BUND

AB LINE

MBH1

MUDSTONE RL 60.7m

PROPOSED MACHINE BOREHOLE

71097

HISTORICAL BOREHOLES (SOURCED BY NZ GEOTECHNICAL DATABASE)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD1949.
3. LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946.
4. AERIAL IMAGE & CONTOURS ARE DOWNLOADED FROM AUCKLAND COUNCIL GEOMAPS [#https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html](https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html) ON 20/10/2025.

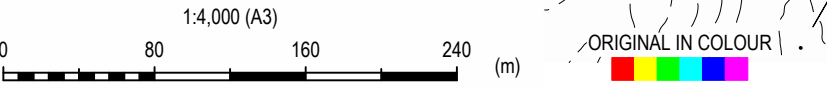


FIGURE 01



WASTE MANAGEMENT LIMITED
REDALE LANDFILL

GEOTECHNICAL INVESTIGATION
MACHINE BOREHOLE LOCATION PLANE

DRAWN	S.K.	DATE	JOB No	SCALE (A3)	REV.
CHECKED	P.C.	19/11/2025	10096	1:4,000	A

Z:\10001-10250\10096\05 CAD\FIG10096-FIG-01.dwg

APPENDIX B
Borehole Logs and Core Photographs

EGL - Rock Log v8.1 (test) - 21/11/2025 1:16:34 pm - Produced with Core-GS by Geoc

 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz			ROCK LOG		DRILLHOLE No.: MBH1 SHEET 1 OF 1 Job No.: 10096											
PROJECT: Redvale Landfill & Energy Park LOCATION: Landfill Access Road, Dairy Flat COORDINATES: East 288359.2 North 724316.2 GRID: NZGD 1949			RL GROUND: 64.2 DATUM: NZ		HOLE STARTED: 28/10/2025 HOLE FINISHED: 28/10/2025 HOLE DEPTH: 4.5m INCLINATION: Vertical ORIENTATION:											
Core Description			Rock Defects		Drilling & Testing											
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Fill	Concrete. (Road pavement)		64													
	Silty CLAY; greyish brown. Hard; moist; high plasticity.										1.50	50				
	Dark grey.		63													SV: 1.5m, Test 1 UTP
Mangakahia Complex	Topsoil inclusion.															
			2								1.50	50				SV: 3.0m, Test 1 UTP
	Completely weathered, SILTSTONE; grey; very weak. Gravel sized clast with siltstone matrix.		61								1.50	100				SV: 4.5m, Test 1 UTP
		EOH: 4.50 m														
NOTES:					LOGGED: SK		DRILLER: PRO-DRILL									
E.O.B. @ 4.5m (target depth). Coordinates obtained from Auckland Council GIS.					CHECKED: PC		DRILL TYPE:									



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH2

SHEET 1 OF 2

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 288342.2 North 724234.2
GRID: NZGD 1949
RL GROUND: 60.3
DATUM: NZ
HOLE STARTED: 28/10/2025
HOLE FINISHED: 28/10/2025
HOLE DEPTH: 6.0m
INCLINATION: Vertical
ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Mangakahia Complex	Concrete. (Road pavement)		60													
	Fill Silty CLAY; brownish grey. Hard; high plasticity.	1	59							1.50	100					SV: 1.5m, Test 1 UTP
	Silty CLAY; light grey. Very stiff; moist; high plasticity.	2	58							1.50	100					SV: 3.0m, Test 1 UTP
		3	57							1.50	80					SV: 4.5m, Test 1 UTP
	Completely weathered, SILTSTONE; light grey; very weak. Gravel sized clasts in siltstone matrix.	4	56							1.50	65					
Groundwater Not Encountered																

NOTES:
E.O.B. @ 6m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:

 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz				ROCK LOG		DRILLHOLE No.: MBH2 SHEET 2 OF 2 Job No.: 10096										
PROJECT: Redvale Landfill & Energy Park LOCATION: Landfill Access Road, Dairy Flat COORDINATES: East 288342.2 North 724234.2 GRID: NZGD 1949				RL GROUND: 60.3 DATUM: NZ		HOLE STARTED: 28/10/2025 HOLE FINISHED: 28/10/2025 HOLE DEPTH: 6.0m INCLINATION: Vertical ORIENTATION:										
Core Description				Rock Defects		Drilling & Testing										
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
	Completely weathered, SILTSTONE; light grey; very weak. Gravel sized clasts in siltstone matrix.	55									1.50	65		Groundwater Not Encountered		
EOH: 6.00 m																SV: 6.0m, Test 1
																UTP
NOTES: E.O.B. @ 6m (target depth). Coordinates obtained from Auckland Council GIS. LOGGED: SD CHECKED: PC DRILLER: PRO-DRILL DRILL TYPE:																



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK
LOG

DRILLHOLE No.: MBH3

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park

LOCATION: Landfill Access Road, Dairy Flat

COORDINATES: East 288285.0 North 724188.8

GRID: NZGD 1949

RL GROUND: 57.1

DATUM: NZ

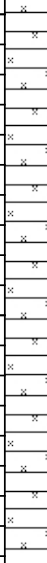
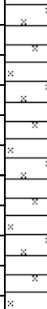
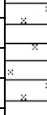
HOLE STARTED: 29/10/2025

HOLE FINISHED: 29/10/2025

HOLE DEPTH: 3.5m

INCLINATION: Vertical

ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
						2 5 10 15 20 25 30 35 40 45 50										
Fill	ASPHALT. (Road pavement)		57													
	GRAVEL; grey . Dense; moist; gravel, medium to coarse.															
	Silty CLAY; grey . Hard; moist; high plasticity; clay, Mustone clasts.															
Mangakahia Complex		1	56								1.00 OB	0		Groundwater Not Encountered		
		2	55								1.00 HQ	0				
	Completely weathered, SILTSTONE; light grey; very weak.										1.50 HQ	0				
		3	54													

EOH: 3.50 m

Groundwater Not Encountered

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SK

CHECKED: PC

DRILLER: PRO-DRILL

DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK
LOG

DRILLHOLE No.: MBH4

SHEET 1 OF 1

Job No.: 10096

PROJECT:	Redvale Landfill & Energy Park	RL GROUND:	56.8	HOLE STARTED:	29/10/2025
LOCATION:	Landfill Access Road, Dairy Flat	DATUM:	NZ	HOLE FINISHED:	29/10/2025
COORDINATES:	East 288252.5 North 724128.9			HOLE DEPTH:	3.5m
GRID:	NZGD 1949			INCLINATION:	Vertical
				ORIENTATION:	

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Fill	ASPHALT. (Road pavement)					2										
	GRAVEL; grey . Dense; moist; gravel, coarse.					5										
	Brown silty matrix.					10										
Mangakahia Complex						15										
						20										
						25										
						30										
						35										
						40										
						45										
						50										
						55										
						60										
	Silty CLAY; light grey. Hard; moist; high plasticity.	1									2.00 OB	0				SV: 1.5m, Test 1 UTP

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH5

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park

LOCATION: Landfill Access Road, Dairy Flat

COORDINATES: East 288284.4 North 724062.2

GRID: NZGD 1949

RL GROUND: 59.3

DATUM: NZ

HOLE STARTED: 29/10/2025

HOLE FINISHED: 29/10/2025

HOLE DEPTH: 3.5m

INCLINATION: Vertical

ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
						2 5 10 15 20 25 30 35 40 45 50										
Fill	Concrete. (Road pavement)															
	Silty CLAY; orangish brown. Hard; moist; low plasticity.		59								1.50	100				
	Silty CLAY; light grey. Hard; wet; low plasticity.		58													SV: 1.5m, Test 1 UTP
Mangakahia Complex																
			57								2.00	100				
	Completely weathered, SILTSTONE; light grey; very weak.		56													SV: 3.0m, Test 1 UTP

EOH: 3.50 m

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD

CHECKED: PC

DRILLER: PRO-DRILL

DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH6

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park

LOCATION: Landfill Access Road, Dairy Flat

COORDINATES: East 288276.3 North 723975.7

GRID: NZGD 1949

RL GROUND: 58.8

DATUM: NZ

HOLE STARTED: 29/10/2025

HOLE FINISHED: 29/10/2025

HOLE DEPTH: 3.5m

INCLINATION: Vertical

ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
						2 5 10 20 40 50										
Fill	Concrete. (Road pavement)															
	Poor recovery suspect Silty CLAY with gravel from pavement.															
Mangakahia Complex																
	Silty CLAY; light grey. Hard; moist; low plasticity.															
	Completely weathered, SILTSTONE; orangish brown; extremely weak.															

EOH: 3.50 m

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SK

CHECKED: PC

DRILLER: PRO-DRILL

DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH7
SHEET 1 OF 1
Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 288248.1 North 723906.6
GRID: NZGD 1949
RL GROUND: 56.0
DATUM: NZ
HOLE STARTED: 29/10/2025
HOLE FINISHED: 29/10/2025
HOLE DEPTH: 1.3m
INCLINATION: Vertical
ORIENTATION:

		Core Description			Rock Defects			Drilling & Testing									
GEOLOGICAL UNIT		ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
							2 5 10 20 50				25 50 75					25 50 75	
Fill		Concrete gravel.		56													
		Clayey SILT; light grey. Hard; moist; low plasticity.										1.30 0			Groundwater Not Encountered		
iwangakaha Complex		Completely weathered, SILTSTONE; light grey; extremely weak. Occasional clast of angular mudstone gravel..	1	55													
SV: 1.0m, Test 1 UTP																	

EOH: 1.30 m

NOTES:
E.O.B. @ 1.3m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

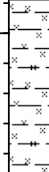
ROCK LOG

DRILLHOLE No.: MBH8

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 288193.3 North 723843.2
GRID: NZGD 1949
RL GROUND: 52.0
DATUM: NZ
HOLE STARTED: 29/10/2025
HOLE FINISHED: 29/10/2025
HOLE DEPTH: 3.5m
INCLINATION: Vertical
ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Fill	ASPHALT (Road pavement).		52													
	SILT & GRAVEL; brown marix with grey clasts. Dense; moist; non-plastic.										0.50	0				
	No silt, poor sample recovery.	1	51								1.50 OR	0				
Mangakahia Complex	Clayey SILT; dark grey. Hard; moist; low plasticity; Angular sheared siltstone gravels.															SV: 1.5m, Test 1 UTP
	Completely weathered, SILTSTONE; light grey with mottled black; extremely weak.	2	50													
	2.0m: Recovered as sheared angular siltstone gravels in angular silty clay matrix.											1.50	0			
	Matrix matured, orangish brown.	3	49													
Groundwater Not Encountered																

EOH: 3.50 m

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH9
SHEET 1 OF 1
Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 288154.6 North 723771.8
GRID: NZGD 1949
RL GROUND: 52.1
DATUM: NZ
HOLE STARTED: 30/10/2025
HOLE FINISHED: 30/10/2025
HOLE DEPTH: 2.0m
INCLINATION: Vertical
ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
						2 5 10 20 40 50				25 50 75					25 50 75	
Fill	Concrete. (Road pavement).		52													
	Clayey SILT; light grey. Hard; moist; low plasticity.										1.50 60			Groundwater Not Encountered		
Mangakahia Complex	Completely weathered, SILTSTONE; light grey with orangish brown stains; extremely weak.		51							0.50 100						

EOH: 2.00 m

NOTES:
E.O.B. @ 2m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH10

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 288124.9 North 723706.3
GRID: NZGD 1949

RL GROUND: 54.2
DATUM:

HOLE STARTED: 30/10/2025
HOLE FINISHED: 30/10/2025
HOLE DEPTH: 3.5m
INCLINATION: Vertical
ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Fill	Concrete. (Road pavement)		54			2										
	0.0m: Poor recovery 1.5m.															
Alluvium	Clayey SILT; greyish orange. Hard; moist; non-plastic.		53			5					1.50	20				
	Silty CLAY; brown. Hard; moist; high plasticity.															
Mangakahi a Complex	Organic material (wood).		52			10					2.00	100				
	3.2m: Recovered as sheared grey matrix.															
	Completely weathered, SILTSTONE; greenish grey; extremely weak.		51			20										

EOH: 3.50 m

SV: 1.5m, Test 1
200 / - kPa (N/A)

SV: 3.0m, Test 1
200 / - kPa (N/A)

Groundwater Not Encountered

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SK
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Job No.: 10096

HOLE STARTED: 30/10/2025
HOLE FINISHED: 30/10/2025
HOLE DEPTH: 7.4m
INCLINATION: Vertical
ORIENTATION:

LOGGED:	SD	DRILLER:	PRO-DRILL
CHECKED:	PC	DRILL TYPE:	



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH11

SHEET 2 OF 2

Job No.: 10096

PROJECT:	Redvale Landfill & Energy Park	RL GROUND:	56.4	HOLE STARTED:	30/10/2025
LOCATION:	Landfill Access Road, Dairy Flat	DATUM:		HOLE FINISHED:	30/10/2025
COORDINATES:	East 288053.7 North 723709.8			HOLE DEPTH:	7.4m
GRID:	NZGD 1949			INCLINATION:	Vertical
				ORIENTATION:	

Core Description					Rock Defects					Drilling & Testing						
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Mangakahia Complex	Clayey SILT; blueish grey. Hard; moist; low plasticity.															

EOH: 7.40 m

NOTES:
E.O.B. @ 7.4m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK
LOG

DRILLHOLE No.: MBH12

SHEET 1 OF 3

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 287977.9 North 723730.2
GRID: NZGD 1949

RL GROUND: 58.7
DATUM:

HOLE STARTED: 30/10/2025
HOLE FINISHED: 30/10/2025
HOLE DEPTH: 12.0m
INCLINATION: Vertical
ORIENTATION:

GEOLOGICAL UNIT	Core Description			Rock Defects			Drilling & Testing									
	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Fill	ASPHALT.															
	GRAVEL, with some silt; grey clasts with brown mottles. Dense; moist; gravel, medium to coarse.		58								2.00 CB	0				
Alluvium	Silty CLAY; brown. Very stiff; moist; high plasticity.		57													
	CORE LOSS.	2		C/L												
				C/L												
				C/L												
			56	C/L							1.50 HQ	0				
		3		C/L												
				C/L												
	Silty CLAY; grey. Hard; moist; high plasticity.															
	SAND; grey . Hard; wet; sand, fine to medium.		55								1.50 HQ	0				
	Silty CLAY, with trace peat (amorphous); grey . Very stiff; moist; high plasticity.	4														
	Some sand.		54													

NOTES:
E.O.B. @ 12m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



DRILLHOLE No.: MBH12
SHEET 2 OF 3
Job No.: 10096

RL GROUND: 58.7

DATUM:

HOLE STARTED: 30/10/2025
HOLE FINISHED: 30/10/2025
HOLE DEPTH: 12.0m
INCLINATION: Vertical
ORIENTATION:

[illegible]

LOGGED:	SD	DRILLER:	PRO-DRILL
CHECKED:	PC	DRILL TYPE:	



DRILLHOLE No.: MBH12
SHEET 3 OF 3
Job No.: 10096

HOLE STARTED: 30/10/2025
HOLE FINISHED: 30/10/2025
HOLE DEPTH: 12.0m
INCLINATION: Vertical
ORIENTATION:

EOH: 12.00 m

LOGGED: SD DRILLER: PRO-DRILL
CHECKED: PC DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH13

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park

LOCATION: Landfill Access Road, Dairy Flat

COORDINATES: East 287888.1 North 723738.2

GRID: NZGD 1949

RL GROUND: 60.3

DATUM:

HOLE STARTED: 31/10/2025

HOLE FINISHED: 31/10/2025

HOLE DEPTH: 3.0m

INCLINATION: Vertical

ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
TS	TOPSOIL; brown. Hard; moist; low plasticity. 0.0m: HydroVac to 1.5m.															
Alluvium	Silty CLAY; brown. Hard; moist; high plasticity.		60								1.50	0				
	Trace to some organic wood fragments.		1													
Mangakani a Complex	Completely weathered, SILTSTONE; light greyish black mottles.; extremely weak.		59								1.50	100				
	2.7m: Angular sheared siltstone gravel in clast.		58													

EOH: 3.00 m

NOTES:
E.O.B. @ 3m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SK

CHECKED: PC

DRILLER: PRO-DRILL

DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK LOG

DRILLHOLE No.: MBH14

SHEET 1 OF 1

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 287807.1 North 723778.5
GRID: NZGD 1949
RL GROUND: 62.6
DATUM: NZ
HOLE STARTED: 31/10/2025
HOLE FINISHED: 31/10/2025
HOLE DEPTH: 3.5m
INCLINATION: Vertical
ORIENTATION:

Core Description				Rock Defects				Drilling & Testing								
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY	WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)	CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)	FIELD TESTS
Fill	Fill.															
	0.0m: HydroVac to 1.5m.															
Mangakahia Complex	Completely weathered, SILTSTONE; light blueish grey.; extremely weak.															
	1.5m: Recovered as sheared angular gravel matrix and silty clay matrix.															

EOH: 3.50 m

NOTES:
E.O.B. @ 3.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SK
CHECKED: PC
DRILLER: PRO-DRILL
DRILL TYPE:



Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

ROCK
LOG

DRILLHOLE No.: MBH15

SHEET 1 OF 2

Job No.: 10096

PROJECT: Redvale Landfill & Energy Park
LOCATION: Landfill Access Road, Dairy Flat
COORDINATES: East 287716.9 North 723811.0
GRID: NZGD 1949

RL GROUND: 64.5
DATUM: NZ

HOLE STARTED: 31/10/2025
HOLE FINISHED: 31/10/2025
HOLE DEPTH: 7.5m
INCLINATION: Vertical
ORIENTATION:

Core Description				Rock Defects				Drilling & Testing											
GEOLOGICAL UNIT	ROCK / SOIL MATERIAL DESCRIPTION	DRILLED LENGTH (m)	ELEVATION RL (m)	GRAPHIC LOG	DEFECT DESCRIPTION & ADDITIONAL NOTES	FRACTURE FREQUENCY		WEATHERING	ROCK STRENGTH	PT LOAD / UCS (MPa)	CORE LOSS (%)		CORE LENGTH / TYPE	RQD (%)	SAMPLES	WATER LEVEL	WATER LOSS (%)		FIELD TESTS
						2	5				25	50					75	25	
Fill	Concrete. (Road pavement)																		
	0.0m: HydroVac to 1.5m.																		
	Clayey SILT; light yellowish brown. Hard; moist; high plasticity.		64										1.50	0					
Mangakahia Complex	Silty CLAY; brownish orange. Hard; moist; high plasticity.		63																
	Organic woods.		2										1.50	100					
	Completely weathered, SILTSTONE; dark brownish grey.; extremely weak.		3																SV: 3.0m, Test 1 UTP
			61										1.50	100					
			4																
			60										1.50	100					SV: 4.5m, Test 1 UTP

Groundwater Not Encountered

SV: 3.0m, Test 1
UTP

SV: 4.5m, Test 1
UTP

NOTES:
E.O.B. @ 7.5m (target depth). Coordinates obtained from Auckland Council GIS.

LOGGED: SD

DRILLER: PRO-DRILL

CHECKED: PC

DRILL TYPE:



DRILLHOLE No.: MBH15
SHEET 2 OF 2
Job No.: 10096

HOLE STARTED: 31/10/2025
HOLE FINISHED: 31/10/2025
HOLE DEPTH: 7.5m
INCLINATION: Vertical
ORIENTATION:

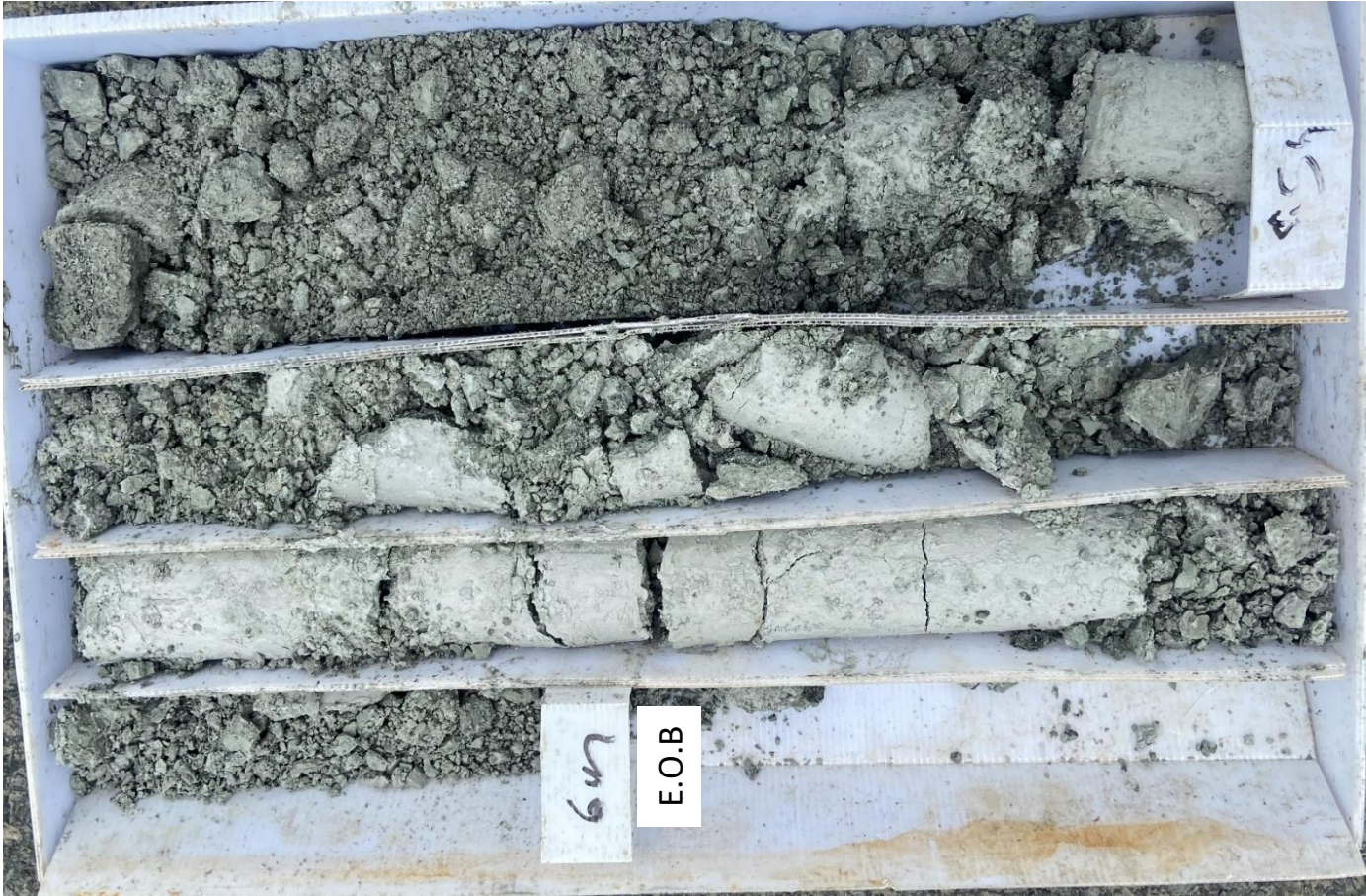
EGL - Rock Log v8.1 (test) - 21/11/2025 1:16:41 pm - Produced with Core-GS by Geroc

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd 📞 +64 9 486 2546 ✉ info@egl.co.nz 📍 Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 🌐 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH1 CORE BOX PHOTOGRAPHS				



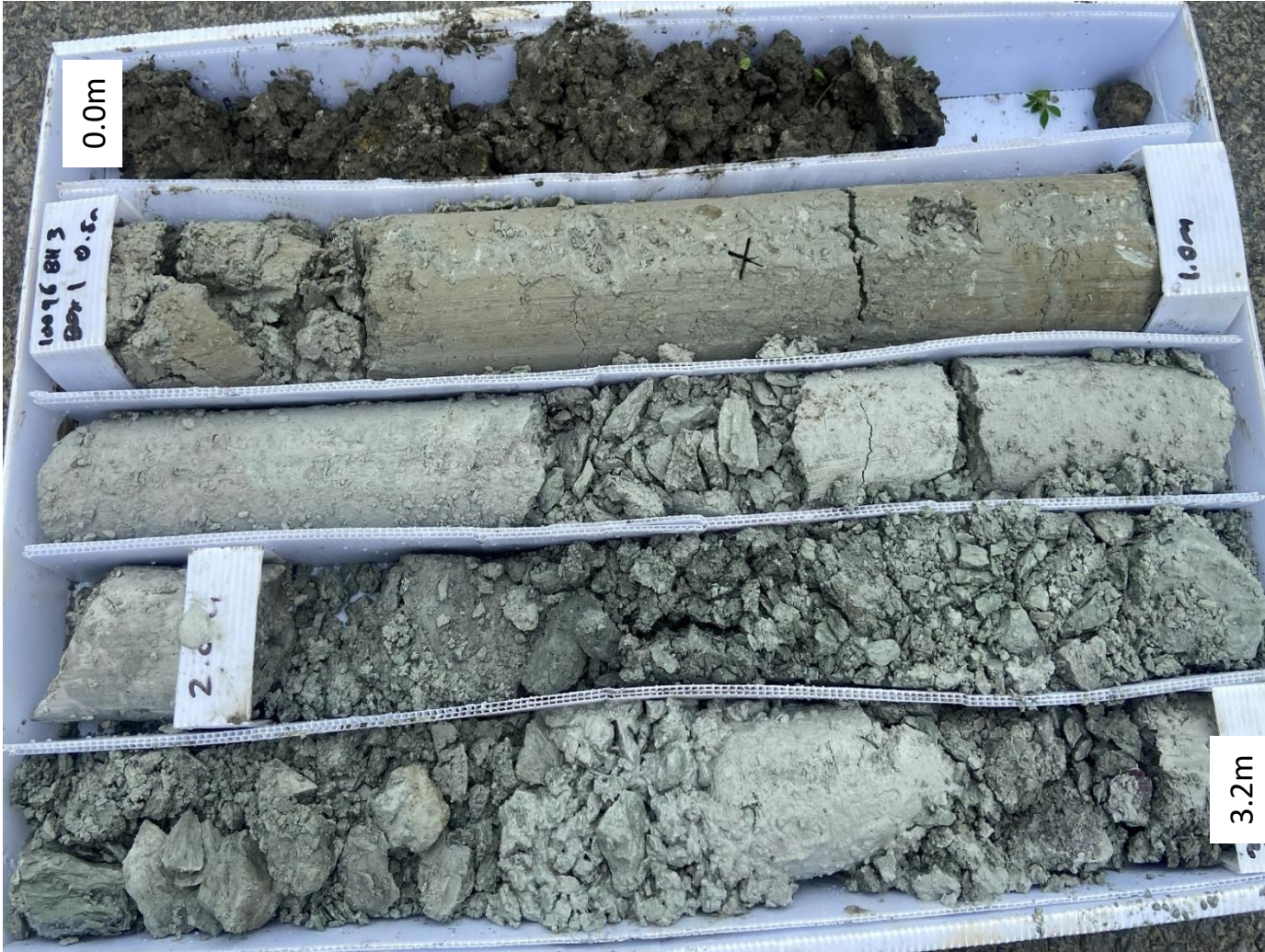
Depth: 0m to 4.5m (E.O.B)

Client Name.	Waste Management NZ	Job No.	10096		
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH2 CORE BOX PHOTOGRAPHS				
					
Depth: 0m to 4m					

Client Name.	Waste Management NZ	Job No.	10096			
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road				
	Photographer	SK	Date:	31/10/2025		
Title:	MBH2 CORE BOX PHOTOGRAPHS					
						
Depth: 4m to 6m (E.O.B)						

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz		Address	Landfill Access Road		
		Photographer	SK	Date:	31/10/2025

Title:	MBH3 CORE BOX PHOTOGRAPHS
--------	---------------------------

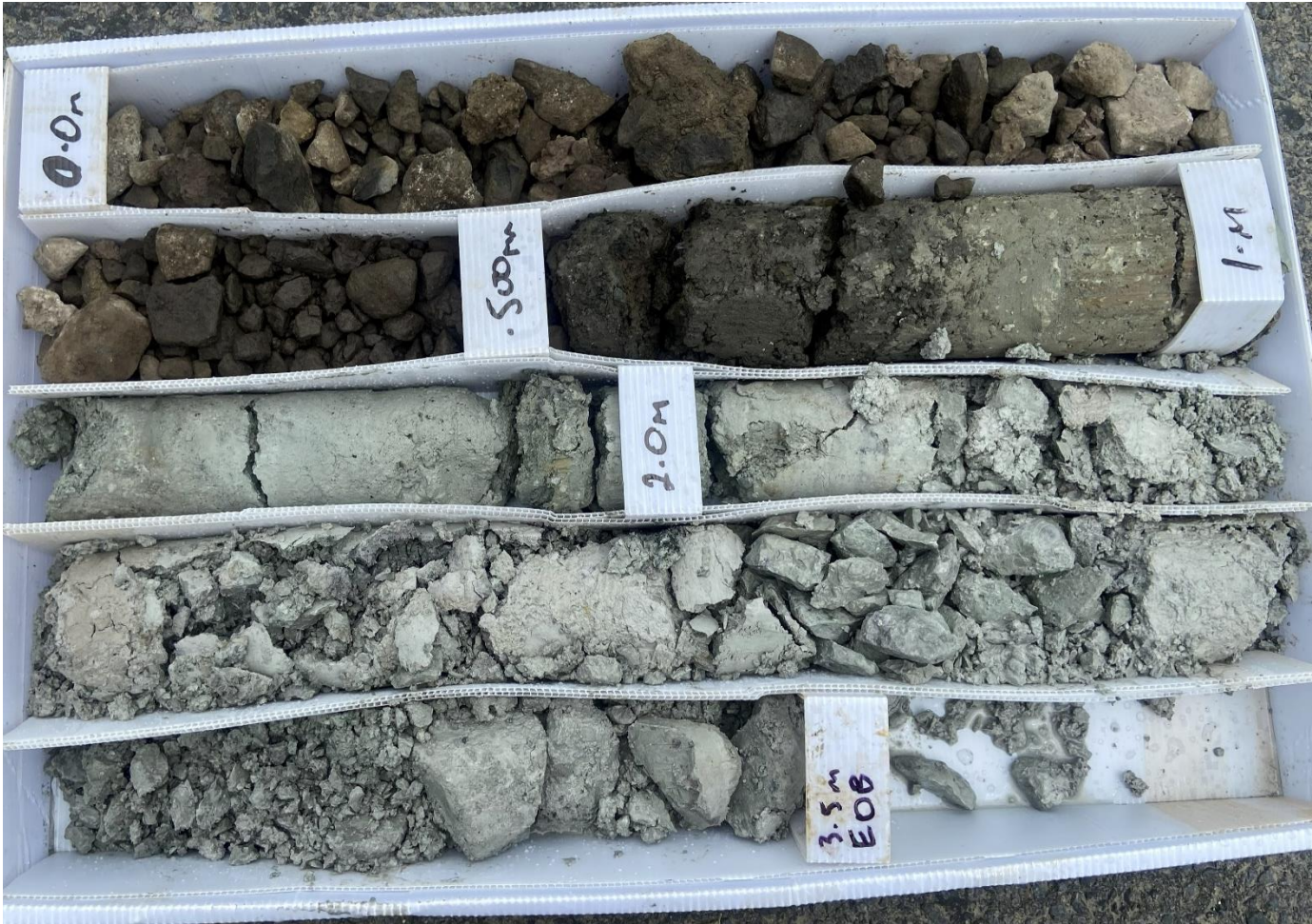


Depth: 0m to 3.2m

Client Name.	Waste Management NZ	Job No.	10096		
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz		Address	Landfill Access Road		
		Photographer	SK	Date:	31/10/2025
Title:	MB3 CORE BOX PHOTOGRAPHS				
					
Depth: 3.2m to 3.5m (E.O.B)					

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz		Address	Landfill Access Road		
		Photographer	SK	Date:	31/10/2025

Title:	MBH4 CORE BOX PHOTOGRAPHS
--------	---------------------------



Depth: 0m to 3.5m (E.O.B)

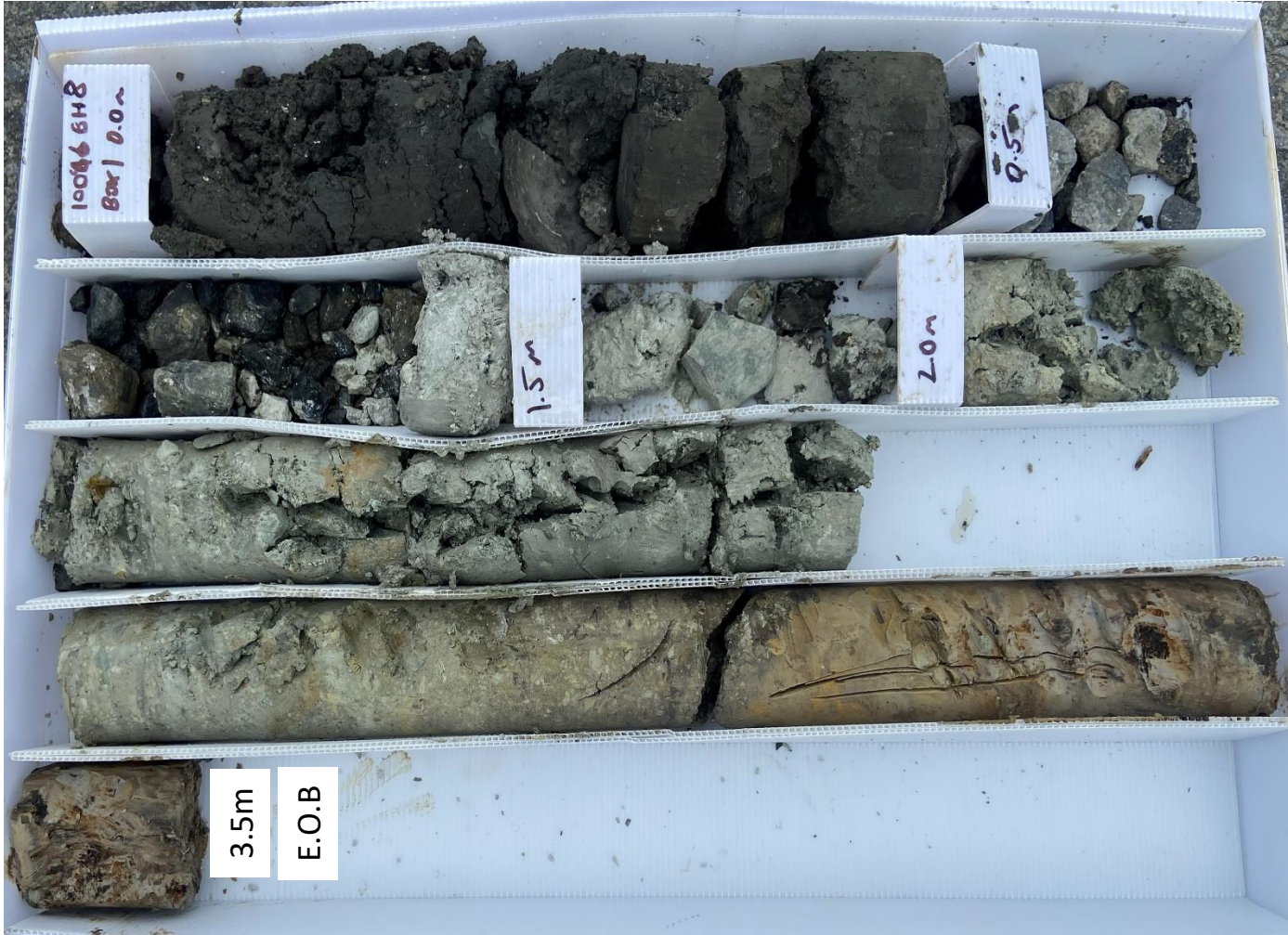
Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz <td>Address</td> <td colspan="3">Landfill Access Road</td>	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH5 CORE BOX PHOTOGRAPHS				
					
Depth: 0m to 3.5m (E.O.B)					

Client Name.	Waste Management NZ	Job No.	10096		
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH6 CORE BOX PHOTOGRAPHS				
					
Depth: 0m to 3.5m (E.O.B)					

Client Name.	Waste Management NZ	Job No.	10096			
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road				
	Photographer	SK	Date:	31/10/2025		
Title:	MBH7 CORE BOX PHOTOGRAPHS					
						
Depth: 0m to 1.3m (E.O.B)						

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz		Address	Landfill Access Road		
		Photographer	SK	Date:	31/10/2025

Title:	MBH8 CORE BOX PHOTOGRAPHS
--------	---------------------------



Depth: 0m to 3.5m (E.O.B)

Client Name.	Waste Management NZ	Job No.	10096		
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH9 CORE BOX PHOTOGRAPHS				
					
Depth: 0m to 2m (E.O.B)					

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address		Landfill Access Road		
	Photographer	SK	Date:	31/10/2025	

Title:	MBH10 CORE BOX PHOTOGRAPHS
--------	----------------------------



Depth: 0m to 3.5m (E.O.B)

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz		Address	Landfill Access Road		
		Photographer	SK	Date:	31/10/2025

Title:	MBH11 CORE BOX PHOTOGRAPHS
--------	----------------------------



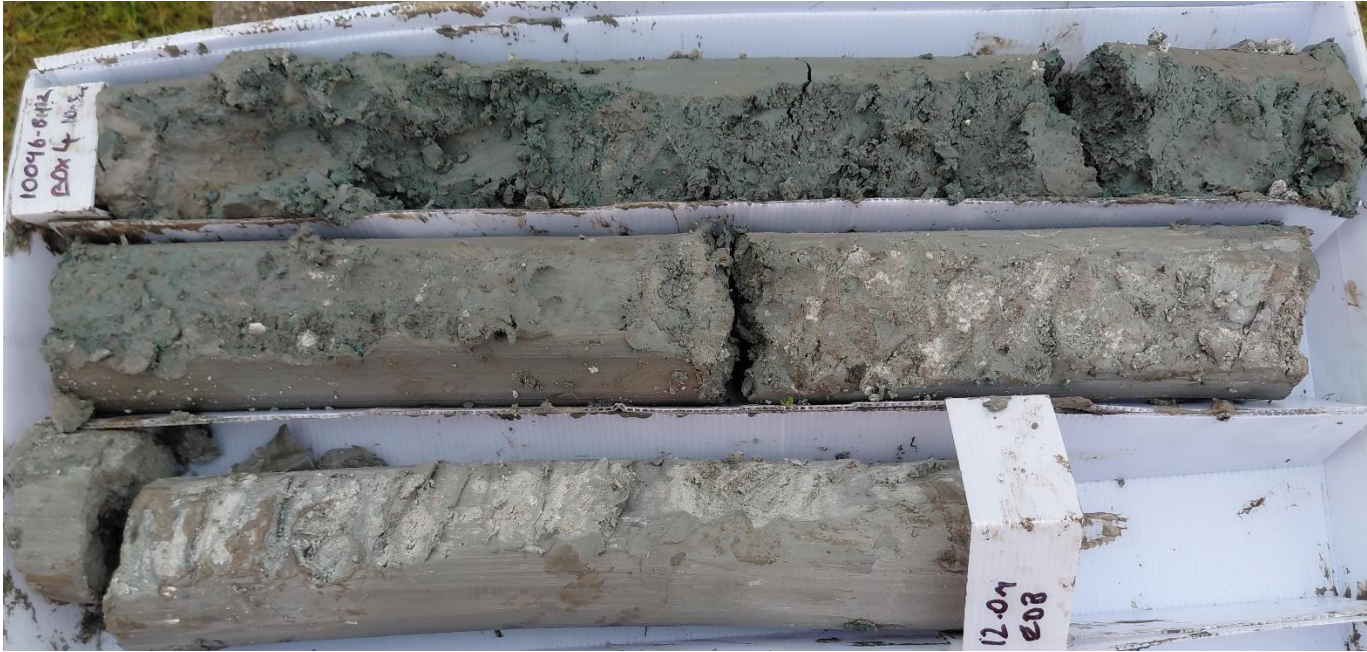
Depth: 0m to 5.4m

Client Name.	Ron Dykman	Job No.	8889		
		Address	116 Lucerne Road, REMUERA		
		Photographer	MC	Date:	16/08/2019
Title:	MBH11 CORE BOX PHOTOGRAPHS				
					
Depth: 5.4m to 7.4m (E.O.B)					

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH12 CORE BOX PHOTOGRAPHS				
					
Depth: 0m to 4.5m					

Client Name.	Ron Dykman		Job No.	8889		
			Address	116 Lucerne Road, REMUERA		
			Photographer	MC	Date:	16/08/2019
Title:	MBH12 CORE BOX PHOTOGRAPHS					
						
Depth: 4.5m to 8m						

Client Name.	Waste Management NZ	Job No.	10096		
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH12 CORE BOX PHOTOGRAPHS				
					
Depth: 8m to 10.5m (E.O.B)					

Client Name.	Ron Dykman		Job No.	8889		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address		116 Lucerne Road, REMUERA			
	Photographer	MC	Date:	16/08/2019		
Title:	MBH12 CORE BOX PHOTOGRAPHS					
						
Depth: 10.5m to 12m						

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address		Landfill Access Road		
	Photographer	SK	Date:	31/10/2025	

Title:	MBH13 CORE BOX PHOTOGRAPHS
--------	----------------------------



Depth: 1.5m to 3m (E.O.B)

Client Name.	Waste Management NZ	Job No.	10096		
 EGL Geotechnical, Earthquake and Dam Engineers Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address	Landfill Access Road			
	Photographer	SK	Date:	31/10/2025	
Title:	MBH14 CORE BOX PHOTOGRAPHS				
					
Depth: 0m to 3.5m (E.O.B)					

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address		Landfill Access Road		
	Photographer	SK	Date:	31/10/2025	

Title:	MBH15 CORE BOX PHOTOGRAPHS
--------	----------------------------



Depth: 0m to 4.5m

Client Name.	Waste Management NZ	Job No.	10096		
 Engineering Geology Ltd +64 9 486 2546 info@egl.co.nz Unit 7C, 331 Rosedale Road, Albany, Auckland PO Box 301054, Albany, Auckland 0752 www.egl.co.nz	Address		Landfill Access Road		
	Photographer	SK	Date:	31/10/2025	

Title:	MBH15 CORE BOX PHOTOGRAPHS
--------	----------------------------



Depth: 4m to 7.5m (E.O.B)

APPENDIX C

Relevant Historical Boreholes

[illegible]

FILE NO.

WL 5

STARTED 14:00 4/6/91

PROJECT PIEZOMETER INSTALLATION - REDVALE

FINISHED 9:00 5/6/91

FEATURE	LOCATION
---------	----------

COORDINATES 724 280
288 522 MN

DRILL NO. 3

ANGLE FROM HORIZONTAL 90° BEARING

' RI COLLAR 59-92

E.O.H. 64m

COPE BOXES 1, - 2

CLIENT

NOTES

WASTE MANAGEMENT (NZ) LTD

- Drilled with Hollow-stemmed auger & cored with Lasky sampler.
- Core swelling in barrel.

71097 Woodward-Clyde



DATE . JUNE 1991

PROJECT NO.
2450-06

BORE NO. W1

SHEET 2 OF 2

DRILLER: GEOFF LEWER		LOG OF DRILL HOLE		HOLE NO. 647 WL 3	
STARTED: 10:45 30-5-91		PROJECT: GEOTECHNICAL ZOMETER INSTALLATION - REDVALE		COORDINATES: 723 753 mN 288 168 mE	
FINISHED: 16:00 30-5-91		FEATURE: LOCATION:		R.L. COLLAR: 50m	
DRILL NO. 3		ANGLE FROM HORIZONTAL: 90° BEARING:			
DESCRIPTION OF CORE		DEFECTS		DATE DEPTH	
WEATHERING, HARDNESS, STRENGTH, COLOUR, NAME, DEFECT TYPE, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc.) STRATIGRAPHIC NAME.		JOINTS, BEDDING, SEAMS, SHATTER, SHEAR AND CRUSH ZONES, FOLIATION, SCHISTOSITY (altitude, spacing, continuity, roughness, infilling.) (OR SOIL DESCRIPTION) (consistency, relative density, water content, plasticity, grading classification, symbol, etc.)		DATE DEPTH	
Brown silty TOPSOIL, moist, firm. greyish orange/pink silty CLAY, with dark orange bands, moist, plastic. Occasional red streaks. grey sandy SILT, with yellowish orange bands, occasional reddish streaks, moist, mod. plastic. dark greenish brown sandy SILT, with dark brown/black wood fragments, plastic. greyish orange/pink silty CLAY, light orange/red mottling, moist, plastic, large wood fragments. dark green peaty CLAY, black mottling, highly plastic, non-calcareous. light grey sandy SILT, with darker grey/brown bands, layered, silty fragments, firm, moist, plastic, slightly calcareous. grey LIMESTONE with brown & orange mottling; mod. hard, dry, black streaks, highly fractured, extremely calcareous.		SW WEATHERING ROCK HARDNESS SOIL CONSISTENCY SAMPLE NO TEST DATA CORE LOSS LIFT CORE SIZE CASING GRAPHIC LOG SPACING OF NATURAL DEFECTS DATE DEPTH WATER LEVEL DRILL WATER LOSS WATER PRESSURE TEST		10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000	

GROUNDWATER A.R.W.B.

W.R. No.

NAME

TECHNICAL FILES

14/17/64

ACTIONS

BORE LOG

PUMP TEST

COMPUTER

WATER QUAL

ROCK WEATHERING

Unweathered UW

Slightly weathered SW

Moderately weathered MW

Highly weathered HW

Completely weathered CW

ROCK HARDNESS

Very hard R5

Hard R4

Moderately hard R3

Soft R2

Very soft R1

SOIL CONSISTENCY

Hard S8

Very stiff S6

Stiff S4

Firm S3

Soft S2

Very soft S1

LOGGED CMLT

TRACED DJK

CHECKED WJR

ORIGINAL VERTICAL SCALE

1:20

LENGTH 7.5m

CORE BOXES 1-5

CLIENT:

WASTE MANAGEMENT (NZ) LTD

NOTES

Both piezometers placed in geotextile bag filled with coarse sand to aid centralising and weighting

Terram 1000 sleeve 1m long and 75 φ, tied top & bottom



HOLE NO. WL 3		LOG OF DRILL HOLE	
STARTED 10:45 30/5/91		PROJECT PIEZOMETER INSTALLATION - REDVALE	
FINISHED 16:00 30/5/91		FEATURE	LOCATION
DRILL NO. 3		COORDINATES 723.753 mN 280.168 mE	
ANGLE FROM HORIZONTAL 90°		BEARING R.L. COLLAR 50 m	

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, NAME, DEFECT TYPE, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc.) STRATIGRAPHIC NAME	WEATHERING SW MW HW CW	ROCK HARDNESS or SOIL CONSISTENCY	SAMPLE NO. TEST DATA	CORE LOSS LIFT	DEPTH H.A.D. CORE SIZE CLOSING	GRAPHIC LOG	SPACING OF NATURAL DEFECTS	DEFECTS JOINTS, BEDDING, SEAMS, SHATTER, SHEAR AND CRUSH ZONES, FOLIATION, SCHISTOSITY (altitude, spacing, continuity, roughness, infilling) (OR SOIL DESCRIPTION) (consistency, relative density, water content, plasticity, grading classification, symbol, etc.)		DATE	DEPTH R.Q.D.	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE TEST
								DATE	0-100					
grey LIMESTONE, becoming powdered due to increased hardness. E.O.H. 7.5 m					5.0 6.0 7.0 8.0									

ROCK WEATHERING Unweathered UW Slightly weathered SW Moderately weathered MW Highly weathered HW Completely weathered CW	ROCK HARDNESS Very hard R5 Hard R4 Moderately hard R3 Soft R2 Very soft R1	SOIL CONSISTENCY Hard S8 Very stiff S5 Stiff S4 Firm S3 Soft S2 Very soft S1	LOGGED CMLT TRACED DJK CHECKED WJR ORIGINAL VERTICAL SCALE 1:20	LENGTH 7.5 m CORE BOXES 1-3
--	--	---	--	--------------------------------

CLIENT: WASTE MANAGEMENT (NZ) LTD	NOTES: - Drilled with Hollow-Stem Auger & Cored with Laskay sampler. - Core swelling in sampler. - Borehole dry at start of construction.
--	--

Woodward-Clyde



LOG OF DRILL HOLE PROJECT: PIEZOMETER INSTALLATION - REDVALE FEATURE: LOCATION: COORDINATES: 723.716 mN 287.204 mE ANGLE FROM HORIZONTAL: 90° BEARING: ° R.L. COLLAR: 61.0 m		HOLE NO WL 2 647
STARTED: 19:00 27-5-91 FINISHED: 17:00 28-5-91 DRILL NO. 3		

DESCRIPTION OF CORE	WEATHERING	ROCK HARDNESS	SOIL CONSISTENCY	SAMPLE NO	TEST DATA	CORE LOSS	LIFT	DEPTH H.A.D.	CORE SIZE	CASING	GRAPHIC LOG	SPACING OF NATURAL DEFECTS	DEFECTS	DATE	DEPTH R.O.D.	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE TEST
grey, coarse, gravelly ROAD METAL.																		
dark yellowish orange silty CLAY, moist, highly plastic.																		
light grey silty CLAY, with yellowish orange mottling, moist, plastic. Tree roots. Occasional red bands, non-calcareous.																		
yellowish orange bands becoming less.																		
light grey sandy SILT, flecks of red/orange, moist, plastic.																		
dark greyish green SAND, occasional flecks of red/orange, moist, plastic, non-calcareous.																		
dark green/grey SAND, slightly plastic, moist, med. to large fragments of wood & black material.																		

ROCK WEATHERING Unweathered UW Slightly weathered SW Moderately weathered MW Highly weathered HW Completely weathered CW	ROCK HARDNESS Very hard R5 Hard R4 Moderately hard R3 Soft R2 Very soft R1	SOIL CONSISTENCY Hard S6 Very stiff S5 Stiff S4 Firm S3 Soft S2 Very soft S1	LOGGED CMLT TRACED DJK CHECKED WJR ORIGINAL VERTICAL SCALE 1:20	LENGTH 18.5 CORE BOXES 1-8
--	--	---	--	-------------------------------

CLIENT: WASTE MANAGEMENT (NZ) LTD	NOTES: - Swelling of cores in core barrel. - 1 bag cement: 30 l water + 22 rapid hardener - 'Sika Rod' - Box No. 1 ~ photo upside down. - Box No. 3 ~ no photo (too dark).
-----------------------------------	--



STARTED

PROJECT PIEZOMETER INSTALLATION - REDVALE

FINISHED

FEATURE

LOCATION

COORDINATES 723 716 MN 287 904 ME

DRILL NO. 3

ANGLE FROM HORIZONTAL 90°

BEARING

R.L. COLLAR 61.0 m

DESCRIPTION OF CORE

WEATHERING, HARDNESS, STRENGTH, COLOUR
NAME, DEFECT TYPE, LITHOLOGICAL
FEATURES (bedding, foliation, mineralogy,
texture, cement, etc.)
STRATIGRAPHIC NAME

WEATHERING
SW
MW
HW
CW

ROCK HARDNESS
or
SOIL CONSISTENCY

SAMPLE NO TEST DATA

CORE LOSS
LIFT

DEPTH
H.A.D.

CORE SIZE
CASING

GRAPHIC LOG

SPACING OF
NATURAL
DEFECTS

500
100
50

DEFECTS

JOINTS, BEDDING, SEAMS, SHATTER, SHEAR
AND CRUSH ZONES, FOLIATION,
SCHISTOSITY (attitude, spacing, continuity,
roughness, infilling.)

(OR SOIL DESCRIPTION)

(consistency, relative density, water content,
plasticity, grading classification, symbol, etc.)

DATE DEPTH
R.G.D.

WATER LEVEL

DRILL WATER
LOSS

DATE 0-100

WATER PRESSURE
TEST

dark green/grey SAND, moist,
slightly plastic, with wood fragments.

greenish grey SAND, light grey
mottling, moist, slightly plastic.

greyish green silty CLAY, with
black & light grey fragments.

dark green MUDSTONE, with
black & dark brown flecks &
light grey mottling, moist,
slightly calcareous, highly
weathered.

Soft

Very Soft

WL
2/6

WL
2/8

Grout

-6.45

Bentonite

-6.9

Pneumatic
Piezometer
-7.5

Coarse
Sand

-7.9

Bentonite

-8.5

Rapid
hardened
grout.

ROCK WEATHERING

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

ROCK HARDNESS

Very hard R5
Hard R4
Moderately hard R3
Soft R2
Very soft R1

SOIL CONSISTENCY

Hard S6
Very stiff S5
Stiff S4
Firm S3
Soft S2
Very soft S1

LOGGED CMLT

TRACED DJK

CHECKED WJR

ORIGINAL VERTICAL SCALE

1:20

LENGTH 18.5 m

CORE BOXES 1-8

CLIENT

WASTE MANAGEMENT (NZ) LTD

NO

Woodward-Clyde


DATE
JUNE 1991

PROJECT NO.
2450-06

BORE NO.
WL 2

SHEET 2 OF 4

STARTED

PROJECT PIEZOMETER INSTALLATION - REDVALE

FINISHED

FEATURE

LOCATION

COORDINATES 723 710 mm

DRILL NO. 3

ANGLE FROM HORIZONTAL 90° BEARING

R.L. COLLAR 61.0 m

723 710 mm
687 994 m

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, NAME, DEFECT TYPE, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc.) STRATIGRAPHIC NAME	WEATHERING SW MW HW	ROCK HARDNESS R4 R3 R2 R1	SOIL CONSISTENCY S8 S5 S4 S3 S2 S1	SAMPLE NO. TEST DATA	CORE LOSS LIFT	DEPTH H.A.D. CORE SIZE CASING	GRAPHIC LOG	SPACING OF NATURAL DEFECTS	DEFECTS JOINTS, BEDDING, SEAMS, SHATTER, SHEAR AND CRUSH ZONES, FOLIATION, SCHISTOSITY (attitude, spacing, continuity, roughness, infilling) (OR SOIL DESCRIPTION) (consistency, relative density, water content, plasticity, grading classification, symbol, etc.)	DATE	DEPTH R.O.D.	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE TEST
dark green MUDSTONE, with black & dark brown flecks & occasional light grey mottling, moist, slightly calcareous, highly weathered.						10.0								
						11.0								
						12.0								
dark greyish green MUDSTONE, with dark brown veins running horizontally, dry, hard, flaky, crumbly, slightly calcareous, slightly weathered.						13.0								
						14.0								
core lost to crumbling.						15.0								

ROCK WEATHERING

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

ROCK HARDNESS

Very hard R5
Hard R4
Moderately hard R3
Soft R2
Very soft R1

SOIL CONSISTENCY

Hard S8
Very stiff S5
Stiff S4
Firm S3
Soft S2
Very soft S1

LOGGED CMLT

TRACED DJK
CHECKED WJR
ORIGINAL VERTICAL SCALE
1:20

LENGTH 18.5 m

CORE BOXES 1-8

CLIENT

WASTE MANAGEMENT (NZ) LTD

NOTES:

- Water level @ 15.74 m on 28-5-91, 9:00 (start of construction)



LOG OF DRILL HOLE

HOLE
NO

WL 2

STARTED

PROJECT PIEZOMETER INSTALLATION - REDVALE

FINISHED

FEATURE LOCATION

COORDINATES 723 716 mm
287 964 mm

DRILL NO. 3

ANGLE FROM HORIZONTAL 90° BEARING R.L. COLLAR 610 m

DESCRIPTION OF CORE

WEATHERING, HARDNESS, STRENGTH, COLOUR,
NAME, DEFECT TYPE, LITHOLOGICAL
FEATURES (bedding, foliation, mineralogy,
texture, cement, etc.)
STRATIGRAPHIC NAME

WEATHERING

ROCK HARDNESS
OR
SOIL CONSISTENCY

SAMPLE NO. TEST DATA

CORE LOSS
LIFTDEPTH
H.A.D.
CORE SIZE
CASING

GRAPHIC LOG

SPACING OF
NATURAL
DEFECTS

DEFECTS

JOINTS, BEDDING, SEAMS, SHATTER, SHEAR
AND CRUSH ZONES, FOLIATION,
SCHISTOSITY (attitude, spacing, continuity,
roughness, infilling.)

(OR SOIL DESCRIPTION)

(consistency, relative density, water content,
plasticity, grading classification, symbol, etc.)

DATE

DEPTH
R.O.D.

WATER LEVEL

DRILL WATER
LOSSWATER PRESSURE
TEST

DATE

0-100

Core lost to crumbling.

dark greyish green MUDSTONE
with dark brown veins, running
horizontally, dry, hard, flaky,
crumbly, slightly calcareous,
slightly weathered.

Last 50 mm very hard.

E.O.H. 18.5 m

Very
hardWL
2/13

15.0

16.0

17.0

18.0

19.0

Cement
grout-16.6
Bentonite
-17.0Coarse
SandPneumatic
piezometer.
-18.0

200 mm

ROCK WEATHERING

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

ROCK HARDNESS

Very hard R5
Hard R4
Moderately hard R3
Soft R2
Very soft R1

SOIL CONSISTENCY

Hard S6
Very stiff S5
Stiff S4
Firm S3
Soft S2
Very soft S1

LOGGED CMLT
TRACED DJK
CHECKED WJR
ORIGINAL VERTICAL SCALE
1:20

LENGTH 18.5 m
CORE BOXES 1-2

CLIENT

WASTE MANAGEMENT (NZ) LTD

NOTES

Woodward-Clyde

DATE
JUNE 1991PROJECT NO.
2450-06BORE NO.
WL 2

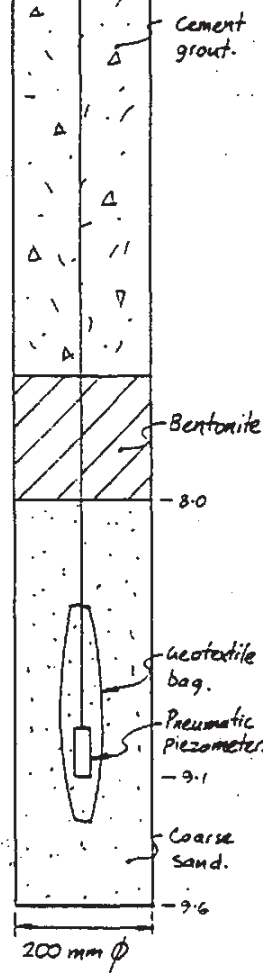
SHEET 4 OF 4

DRILLER: GEOFF LEWIS		LOG OF DRILL HOLE				HOLE NO.	WL 4	
STARTED: 10:30 31/5/91		PROJECT: PIEZOMETER INSTALLATION - REDVALE				COORDINATES: 723 277.288 399.411		
FINISHED: 11:00 4/6/91		FEATURE: LOCATION: R.L. COLLAR: 56.1 m				ANGLE FROM HORIZONTAL: 90° BEARING: °		
DRILL NO. 3								
DESCRIPTION OF CORE		DEFECTS						
WEATHERING, HARDNESS, STRENGTH, COLOUR, NAME, DEFECT TYPE, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc.) STRATIGRAPHIC NAME		JOINTS, BEDDING, SEAMS, SHATTER, SHEAR AND CRUSH ZONES, FOLIATION, SCHISTOSITY (altitude, spacing, continuity, roughness, infilling.) (OR SOIL DESCRIPTION) (consistency, relative density, water content, plasticity, grading classification, symbol, etc.)				DATE DEPTH R.O.D. WATER LEVEL DRILL WATER LOSS WATER PRESSURE TEST		
dark brown TOPSOIL, moist, soft, becoming greyish brown.		Soft				0.0		
yellowish grey silty CLAY, with dark yellowish orange bands & occasional red flecks, moist, plastic.		Firm				1.0		
yellowish grey silty CLAY, with orange & dark brown mottling, light grey sand @ 1.0-1.1, moist, plastic.		Soft/Firm				1.5		
greyish orange silty CLAY, with orange blotches, firm.		Firm				2.0		
becoming more tan/orange.		Firm				2.5		
grey LIMESTONE, with orange bands, highly weathered, highly fractured, moist/dry, calcareous.		Firm				3.0		
light grey LIMESTONE, dry hard, powdered.		Hard				4.0		
						4.5		
						5.0		
						5.5		
						6.0		
						6.5		
						7.0		
						7.5		
						8.0		
						8.5		
						9.0		
						9.5		
						10.0		
						10.5		
						11.0		
						11.5		
						12.0		
						12.5		
						13.0		
						13.5		
						14.0		
						14.5		
						15.0		
						15.5		
						16.0		
						16.5		
						17.0		
						17.5		
						18.0		
						18.5		
						19.0		
						19.5		
						20.0		
						20.5		
						21.0		
						21.5		
						22.0		
						22.5		
						23.0		
						23.5		
						24.0		
						24.5		
						25.0		
						25.5		
						26.0		
						26.5		
						27.0		
						27.5		
						28.0		
						28.5		
						29.0		
						29.5		
						30.0		
						30.5		
						31.0		
						31.5		
						32.0		
						32.5		
						33.0		
						33.5		
						34.0		
						34.5		
						35.0		
						35.5		
						36.0		
						36.5		
						37.0		
						37.5		
						38.0		
						38.5		
						39.0		
						39.5		
						40.0		
						40.5		
						41.0		
						41.5		
						42.0		
						42.5		
						43.0		
						43.5		
						44.0		
						44.5		
						45.0		
						45.5		
						46.0		
						46.5		
						47.0		
						47.5		
						48.0		
						48.5		
						49.0		
						49.5		
						50.0		
						50.5		
						51.0		
						51.5		
						52.0		
						52.5		
						53.0		
						53.5		
						54.0		
						54.5		
						55.0		
						55.5		
						56.0		
						56.5		
						57.0		
						57.5		
						58.0		
						58.5		
						59.0		
						59.5		
						60.0		
						60.5		
						61.0		
						61.5		
						62.0		
						62.5		
						63.0		
						63.5		
						64.0		
						64.5		
						65.0		
						65.5		
						66.0		
						66.5		
						67.0		
						67.5		
						68.0		
						68.5		
						69.0		
						69.5		
						70.0		
						70.5		
						71.0		
						71.5		
						72.0		
						72.5		
						73.0		
						73.5		
						74.0		
						74.5		
						75.0		
						75.5		
						76.0		
						76.5		
						77.0		
						77.5		
						78.0		
						78.5		
						79.0		
						79.5		
						80.0		
						80.5		
						81.0		
						81.5		
						82.0		
						82.5		
						83.0		
						83.5		
						84.0		
						84.5		
						85.0		
						85.5		
						86.0		
						86.5		
						87.0		
						87.5		
						88.0		
						88.5		
						89.0		
						89.5		
						90.0		
						90.5		
						91.0		
						91.5		
						92.0		
						92.5		
						93.0		
						93.5		
						94.0		
						94.5		
						95.0		
						95.5		
						96.0		
						96.5		
						97.0		
						97.5		
						98.0		
						98.5		
						99.0		
						99.5		
						100.0		
						100.5		
						101.0		
						101.5		
						102.0		
						102.5		
						103.0		
						103.5		
						104.0		
						104.5		
						105.0		
						105.5		
						106.0		
						106.5		
						107.0		
						107.5		
						108.0		
						108.5		
						109.0		
						109.5		
						110.0		
						110.5		
						111.0		
						111.5		
						112.0		
						112.5		
						113.0		
						113.5		
						114.0		
						114.5		
						115.0		
						115.5		
						116.0		
						116.5		
						117.0		
						117.5		
						118.0		
						118.5		
						119.0		
						119.5		
						120.0		
						120.5		
						121.0		
						121.5		
						122.0		
						122.5		
						123.0		
						123.5		
						124.0		
						124.5		
						125.0		
						125.5		
						126.0		
						126.5		
						127.0		
						127.5		
						128.0		
						128.5		
						129.0		
						129.5		
						130.0		
						130.5		
						131.0		
						131.5		
						132.0		
						132.5		
						133.0		
						133.5		
						134.0		
						134.5		
						135.0		
						135.5		
						136.0		
						136.5		
						137.0		
						137.5		
						138.0		
						138.5		
						139.0		
						139.5		
						140.0		
						140.5		
						141.0		
						141.5		
						142.0		
						142.5		
						143.0		
						143.5		
						144.0		
						144.5		
						145.0		
						145.5		
						146.0		
						146.5		
						147.0		
						147.5		
						148.0		
						148.5		
						149.0		
						149.5		
						150.0		
						150.5		
						151.0		
						151.5		
						152.0		
						152.5		
						153.0		
						153.5		
						154.0		
						154.5		
						155.0		
						155.5		
						156.0		
						156.5		
						157.0		
						157.5		
						158.0		
						158.5		
						159.0		
						159.5		
						160.0		
						160.5		
						161.0		

DRILLER: GEOFF LEWER		LOG OF DRILL HOLE		HOLE NO.	WL 4
STARTED: 10:30 31/5/91		PROJECT: PIEZOMETER INSTALLATION - REDVALE		COORDINATES: 723 277.00N 288 304.00E	
FINISHED: 11:00 4/6/91		FEATURE: LOCATION:		R.L. COLLAR: 56.1m	
DRILL NO. 3		ANGLE FROM HORIZONTAL: 90°		BEARING:	

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, NAME, DEFECT TYPE, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc.) STRATIGRAPHIC NAME.	WEATHERING SW MW HW CW	ROCK HARDNESS or SOIL CONSISTENCY	SAMPLE NO. TEST DATA	CORE LOSS LIFT	DEPTH H.A.D.	GRAPHIC LOG	SPACING OF NATURAL DEFECTS	DEFECTS JOINTS, BEDDING, SEAMS, SHATTER, SHEAR AND CRUSH ZONES, FOLIATION, SCHISTOSITY (attitude, spacing, continuity, roughness, infilling.) (OR SOIL DESCRIPTION) (consistency, relative density, water content, plasticity, grading classification, symbol, etc.)	DATE	DEPTH	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE TEST			
									R.O.D.	DATE	0-100					
light grey LIMESTONE, dry, hard, powdered.	Hard	Hard	WL 4/4	5.0	5.0											
					6.0											
					7.0											
					8.0											
					9.0											
					10.0											

E.O.H. 9.6 m



ROCK WEATHERING Unweathered UW Slightly weathered SW Moderately weathered MW Highly weathered HW Completely weathered CW	ROCK HARDNESS Very hard R5 Hard R4 Moderately hard R3 Soft R2 Very soft R1	SOIL CONSISTENCY Hard S8 Very stiff S5 Stiff S4 Firm S3 Soft S2 Very soft S1	LOGGED CMLT TRACED DJK CHECKED WJR ORIGINAL VERTICAL SCALE 1:20	LENGTH 9.6 CORE BOXES 1-4
--	--	---	--	------------------------------

CLIENT WASTE MANAGEMENT (NZ) LTD	NOTES: - WL 4/4 taken from cuttings at auger flights. - Borehole dry at start of construction. - Drilled with Hollow-stemmed auger & cored with Loskey sampler.
Woodward-Clyde	DATE: 11/06/2001 PROJECT NO.: 2450.05 BORE NO.: WL 4 SHEET 2 OF 2

DRILLER GEOFF. LEWER		LOG OF DRILL HOLE										HOLE NO. G 1							
STARTED 2:00 22/5/91		PROJECT PIEZOMETER INSTALLATION - REDVALE										COORDINATES 723 724 mN 288 100 mE							
FINISHED 2:45 22/5/91		FEATURE LOCATION										R.L. COLLAR 55.0 m							
DRILL NO. 3		ANGLE FROM HORIZONTAL 90° BEARING																	
DESCRIPTION OF CORE		WEATHERING	ROCK HARDNESS or SOIL CONSISTENCY	SAMPLE NO	TEST DATA	CORE LOSS	LIFT	DEPTH M.A.D.	CORE SIZE	CASING	GRAPHIC LOG	SPACING OF NATURAL DEFECTS	DEFECTS		DATE	DEPTH R.O.D.	WATER LEVEL	DRILL WATER LOSS	WATER PRESSURE TEST
WEATHERING, HARDNESS, STRENGTH, COLOUR NAME, DEFECT TYPE, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc.) STRATIGRAPHIC NAME.													(OR SOIL DESCRIPTION) (consistency, relative density, water content, plasticity, grading classification, symbol, etc.)						
grey sandy SILT, with brown flecks & black streaks, moist, plastic.								5.0											
becoming greener.								6.0						Squeezed material					
Very dark green PEAT, with occasional black blotches, very soft, very moist, highly plastic.								7.0						- 60 Bentonite pellets					
ABANDONED SEALED - BP 862 -								8.0						- 25 mm φ PVC dotted screen.					
R/S 568 028 GROUNDWATER A.R.W.B. W.R. No. NA NAME WASTE MANAGEMENT TECHNICAL FILES 23/12/92 ACTIONED								9.0						- Coarse sand.					
BORE LOG ✓ PUMP TEST COMPUTER WATER QUAL								10.0						- 25 mm φ P.V.C.					
grey LIMESTONE, weathered, slightly plastic, becoming harder & more brittle, highly calcareous.								11.0						- Cement grout.					
grey LIMESTONE, with occasional light gray fragments, highly fractured.								12.0						- 25 mm φ P.V.C.					
ROCK WEATHERING		ROCK HARDNESS		SOIL CONSISTENCY		LOGGED C.M.L.T.		LENGTH 12.8 m											
Unweathered UW		Very hard R5		Hard S6		TRACED D.J.K.		CORE BOXES 1-5											
Slightly weathered SW		Hard R4		Very stiff S5		CHECKED W.N.R.													
Moderately weathered MW		Moderately hard R3		Stiff S4		ORIGINAL VERTICAL SCALE 1:20													
Highly weathered HW		Soft R2		Firm S3															
Completely weathered CW		Very soft R1		Soft S2															
				Very soft S1															
CLIENT WASTE MANAGEMENT (NZ) LTD										NOTES:									
Woodward-Clyde										DATE JUNE 1991 PROJECT NO. 2450-06 BORE NO. G 1 SHEET 2 OF 3									

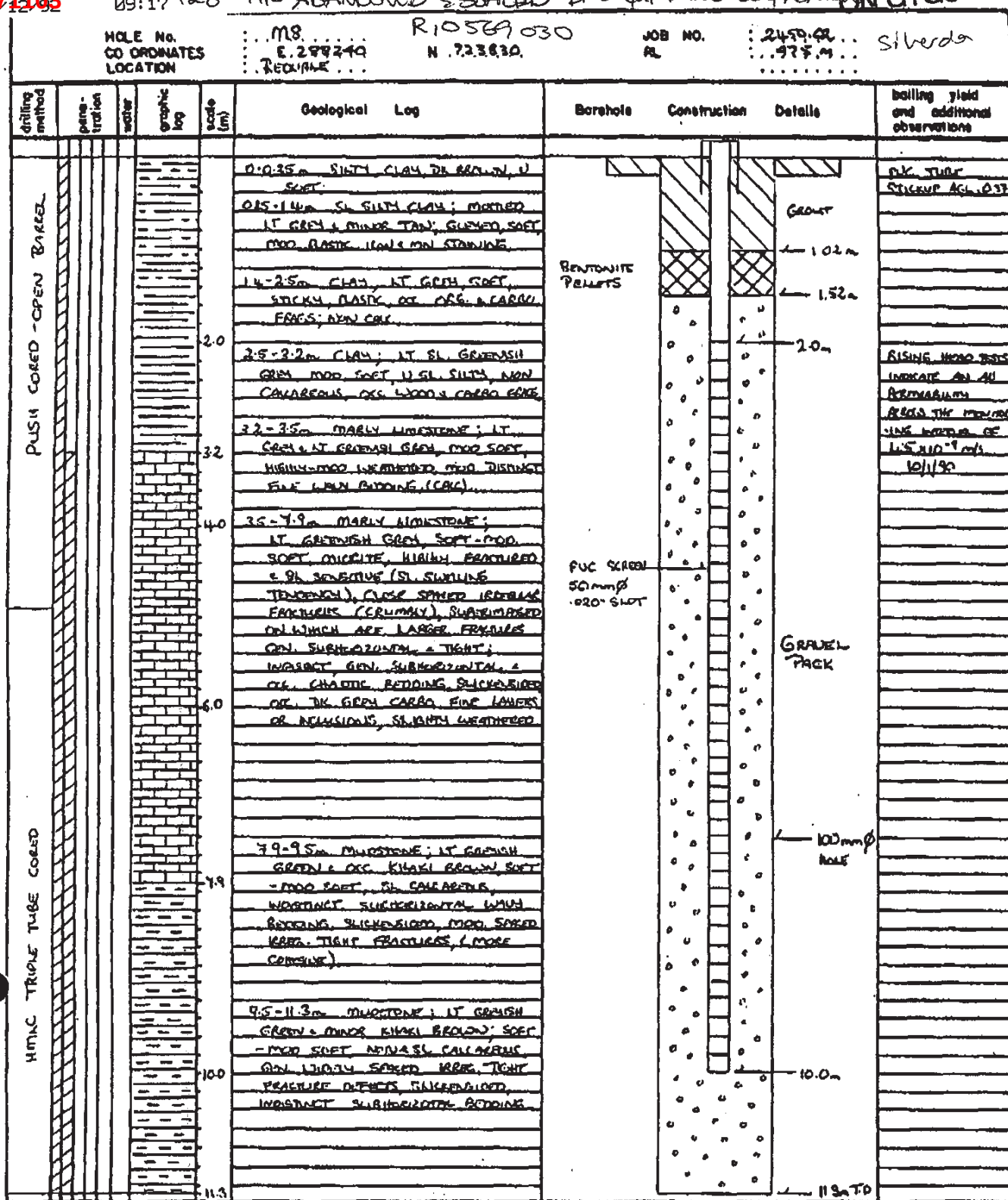
[illegible]

ON GTGS

HOLE No CO ORDINATES LOCATION					M7 E 258100 N 273655	JOB NO. FL	2450-01 54.5 m	
drilling method	penetration rate	water	geologic log	scale (m)	Geological Log	Borehole Construction Details		
ROTARY WASH				0	Light Creamy Yellow Mottled Red Clay	Cuttings and Bentonite Pellets		
				2	Moist Firm Plastic Becoming Darker with depth			
				4	Grey Silty Clay Moist Firm to Stiff			
				6	Highly Plastic Greenish Grey Silty Clay Moist Hard Highly Plastic		5.0	50 mm Ø PVC
				8	Variable Lithologies Grey, Green, Minor Brown Clays and Siltstones, Grey mudstones calcic	Bentonite Pellets		
				10				
				12	Creamy Brown Slightly Calcic Siltstone		11.0	
				14				
				16		Filter Gravel (1.2 - 2.0 mm Ø)		50 mm Ø PVC screen 1 mm
				18				50 mm Ø PVC
				20			19.0	
				22				
				24		Bentonite Pellets		
				26	Variable Assemblage of Grey and Green Clays Creamy Siltstones and Grey Limestone Fragments in very Puggy Clay		25.0	
				28				
				30				
				32		Filter Gravel and Collapse Material		
				34	Limestone - Grey to Light Khaki Marly			
				36			50 mm Ø PVC p	
				38				
				40				
				42				
				44				
				46				
				48				
				50			50.0	
				52				50 mm Ø PVC screen 1mm sl
				54				
				56			56.0	hole diameter 150 mm

DRILL TYPE ... Wash FEED ... Chain DRILLER ... G Lower COMMENCED ... 6/9/88 COMPLETED ... 7/9/88 LOGGED BY ... DEW CHECKED BY ... WJR VERTICAL SCALE 1:100	KEY penetration no resistance ranging to refusal	water 10.01.80 water level and date water inflow water outflow
---	---	---

CLIENT WASTE MANAGEMENT (NZ) LTD	PROJECT PRELIMINARY SITE INVESTIGATION - REDVALE
GCNZ Consultants Water and Environmental Engineers and Geoscientists	GROUNDWATER INVESTIGATION CONSTRUCTION LOG OF MONITORING WELLS
DATE NOVEMBER 1988	DRAWING NO 2450-01
FIGURE 141 A19	



DRILL TYPE GEMCO HP10
FEED HYDRAULIC
DRILLER P. ROBERTSON
COMMENCED 13/12/87
COMPLETED 14/12/87
LOGGED BY GCH
CHECKED BY
VERTICAL SCALE 1:40

KEY

penetration
no resistance
ranging to
refusal

water

10.01.80
water level and date
water inflow
water outflow

CLIENT :

WASTE MANAGEMENT (NZ) LTD 2

PROJECT :

SITE INVESTIGATION - REDUABLE

GROUNDWATER INVESTIGATION
LOG OF BORE

GCNZ consultants



Water and Environmental Engineers and Geoscientists.

DATE :

DECEMBER 1990

DRAWING NO.

FIGURE NO.

A1

Appendix L Geological Units

L1 General setting and stratigraphy

The published geological maps for the area,³⁵ show the Redvale Landfill site to be underlain by Northland Allochthon deposits. The Northland Allochthon, (formerly known as the Onerahi Chaos Breccia), was initially deposited as marine sediments in a deep sedimentary basin. When subduction began beneath Northland in the early Miocene, those marine sediments along with parts of the ocean crust were emplaced as thrust sheets on top of existing rocks to form the Northland Allochthon. Waitemata Group sediments were deposited during the period of Allochthon emplacement and have been picked up and included within the Allochthon mass. The lateral displacement and thrusting endured by the materials during the Allochthon emplacement process has resulted in the generally extensive degree of shearing and deformation, particularly of the weaker units, and the overall structural complexity of the unit.

Published data³⁶ indicates Northland Allochthon units below the Redvale Landfill site to comprise Mahurangi Limestone, (forming the resource for the earlier quarrying works), and Hukerenui Mudstone. East Coast Bays Formation Siltstones and Sandstones, part of the Waitemata Group, are identified to the south-west of the landfill site. Overlying the site is a variable thickness of Pleistocene Sediments with localised Recent Alluvium also probably originally present in stream channels and pond areas.

L2 Geological Units

L2.1 Fill

Various types of engineered fill, as defined by the Technical Specification,³⁷ have been placed as part of the Landfill development. Such engineered fill comprises site-won materials derived principally from Northland Allochthon mudstones/siltstones and to a lesser extent limestone. High strength structural fill, generally corresponding to Type 1C high strength structural fill as defined by the Specification,³⁸ is the principal engineered fill type placed to date as part of the landfill construction.

L2.2 Pleistocene sediments

The Pleistocene Sediments that originally mantled the site are typically represented by firm to stiff, locally very stiff, light grey and light orange-grey and orange mottled, silty Clay with scattered rootlets and organic debris, locally including shattered tree branches, trunks and stumps. Thicknesses encountered are generally of the order of between about 1 m and 4 m, but locally greater depths have been encountered associated with infilled gulleys and stream channels within the underlying Northland Allochthon paleo-topography, particularly to the south of Phases 1, 14 and 15 along the southern boundary of the Eastern Property. The recent EGL investigations for the proposed perimeter bund, (see Appendix K in the draft Geotechnical Assessment Report), encountered up to 8.7 m of Pleistocene Sediments overlying Northland Allochthon at 10.2 m depth in boreholes on the eastern half of that southern boundary. The materials within those boreholes

³⁵ Institute of Geological and Nuclear Sciences Ltd: 2001: Geology of Auckland, 1:250,000. Sheet 3; Kermode L : 1992 : Geology of the Auckland Urban Area. 1: 50,000. Sheet R11. Institute of Geological and Nuclear Sciences Ltd

³⁶ Institute of Geological and Nuclear Sciences Ltd: 2001: Geology of Auckland, 1:250,000. Sheet 3; Kermode L : 1992 : Geology of the Auckland Urban Area. 1: 50,000. Sheet R11. Institute of Geological and Nuclear Sciences Ltd

³⁷ Waste Management (NZ) Ltd : 1994 : Phase 10 Bund Toe Key As-Built Drawings

³⁸ Waste Management (NZ) Ltd : 1994 : Phase 10 Bund Toe Key As-Built Drawings

were assessed by EGL as stiff to very stiff, occasionally hard, which matches T+T's observations during construction of the cells along the landfill's south-eastern boundary.

Geotechnical investigations and site inspections have identified that the base of the Pleistocene Sediments, at their junction with the underlying weathered Northland Allochthon mudstone and siltstone, is typically softened relative to the overlying materials, with assessed strengths of firm to stiff. In a number of instances low angle shear planes have also been identified at that junction, with the shear planes generally observed to be dipping approximately parallel to the Pleistocene Sediments/Northland Allochthon contact and/or the original pre-construction topography. The shear planes are typically noted as being tight, semi-continuous (stepped), pre-sheared, and apparently with low persistence. The surface of the observed shear planes varies from smooth, with no evidence of polishing per se, to slickensided and undulating, with relief on undulations of less than 50 mm.

L2.3 Northland Allochthon

L2.3.1 Limestone

The Mahurangi Limestone, designated Unit N1 on the Engineering Geological Plans Figures D1 and D2, is typically white to greyish-white, thinly to thickly bedded and weak to moderately strong, with sandy and muddy (marly) horizons and inter-beds in part. Within the Western Property the limestone appears to be generally more sheared and with a higher silt/sand content than the relatively more massive, "purer" Limestone encountered in the Eastern Property. The rock mass is typically very closely fractured and is generally extensively crushed and sheared with a pervasive fabric, particularly near contacts with other lithologies and zones of previous ground movements.

L2.3.2 Mudstone and siltstone

The Northland Allochthon materials designated Units N2 to N8 on the Engineering Geological Plans, Figures D1 and D2, generally comprise muddy Siltstone, silty Mudstone and occasional Greensands. The materials are characterised by being pervasively and tightly sheared with fracture surfaces commonly polished. Considering each Unit briefly in turn:

Unit N2: Light grey to light grey-green Silty Mudstone and muddy Siltstone, very weak to weak, and locally moderately strong, with a generally pervasively sheared, but locally more blocky, fabric.

Unit N3: Grey brown to dark chocolate brown, often carbonaceous, Mudstone, typically very weak to weak, but locally moderately strong generally with a relatively more blocky fabric with wider spaced fractures. Fractures within this unit are generally tight, planar and impersistent.

Unit N4: White crushed Mudstone.

Unit N5: Cemented muddy Siltstone, with a characteristic blocky fabric and clay infilled fractures.

Unit N6: Grey to grey-brown, typically weak to locally moderately strong, muddy Siltstone and silty Mudstone. This material is generally less fractured and pervasively sheared than the other units and generally exhibits a relatively blocky fabric with tight, planar and impersistent jointing.

Unit N7: Distinctive unit typically comprising grey-green to dark grey-green, fractured and pervasively sheared, very weak to locally weak Mudstone. Fractures are often curvilinear, smooth and polished. The unit generally becomes more intensely

sheared and locally softened towards contacts with other lithologies, in particular with the relatively less deformable limestone.

Unit N8: Calcareous grey to dark grey-green Mudstone often with sandy horizons and a generally blocky texture.

The assessed distribution of the geological Units N2 to N8 is shown on the Engineering Geological Plans, Figures D1 and D2. It should be recognised that the separation of the Northland Allochthon mudstone and siltstone into seven Units is for convenience. In practice the materials show considerable, and frequent interbanding and local variation in the proportions of mudstone and siltstone, structure and overall description.

Where the Pleistocene Sediments have not been removed a well-developed weathering profile is generally apparent at the top of the Northland Allochthon Mudstone and Siltstones, typically represented by a stiff to hard greenish-brown silty Clay and clayey Silt. The weathered material grades into the underlying unweathered rock mass from which it is distinguishable on the basis of colour and increased strength. The assessed thickness of such weathered material varies considerably but is probably typically less than about 1.5 m to 2 m.

As noted in Section L2.2 above, low angle-shear planes are often present at the base of the Pleistocene Sediments and within the underlying weathered Northland Allochthon mudstones and siltstones.

L2.4 Waitemata Group

Waitemata Group sediments were encountered in investigations and mapping to the west of the assessed Northland Allochthon/Waitemata Group thrust fault boundary and are generally similar to such materials encountered elsewhere in the Auckland region. Their distribution below the current Landfill area is limited to the top portion of the Western Property's Southern Highwall, i.e. generally above the RL 100 m basegrade contour, see Engineering Geological Plans, Figures D1 and D2. They are primarily present south of (outside) the designated Landfill boundary where they form the principal stratigraphic unit. As such they are likely to form the basegrade below the western part of the proposed landfill Class 2 waste extension to the south-west of the current landfill boundary.

The Waitemata Group sediments can be separated into two units on the basis of whether they had been deposited pre or post the Northland Allochthon emplacement. The two units are very similar lithologically, and typically distinguished primarily on the basis of their assessed degree of weathering and hence strength:

- 1 The pre-Northland Allochthon emplacement unit is typically described as very weak to weak green, grey to dark grey interbedded Sandstone and Siltstone.
- 2 The post-Northland Allochthon emplacement unit typically shows a more developed weathering profile and overall lower strengths, with very stiff to hard Silt and medium dense Sand grading with depth to extremely weak grey interbedded Siltstone and Sandstone respectively.

Where encountered in construction of the Western Property's Southern Highwall, the unit was typically identified as yellow brown, grey and orange-brown, often steeply thinly banded, very weak to weak but locally up to moderately strong, clayey, silty fine Sandstone. The rock mass was generally relatively massive with irregular rough tight joints parallel to the colour banding /bedding. Sandy Siltstone horizons were also identified together with localised zones of sandstone/siltstone breccia in a clayey/silty matrix.

L2.5 Geological structure and defects

Emplacement of the Northland Allochthon has resulted in extensive structural disturbance of the rock mass, reflected in the observed shearing and distortion, particularly of the weaker Mudstone units, and the overall structural complexity of the lithologies underlying the site. The following summarises the principal structural features typically encountered within the Northland Allochthon materials below the Landfill:

- 1 The Mudstone and Siltstone mass is usually intensely sheared adjacent to Limestone contacts but elsewhere the fabric varies from intensely sheared, to pervasively sheared to relatively blocky, particularly in the Unit N3 and Unit N6 materials. The general structural fabric in the Mudstones and Siltstones to the east of the main Limestone mass in the Eastern Property is generally NNE to SSW, i.e. approximately parallel to the Limestone trend. To the west of the Limestone, and across the eastern two-thirds of the Western Property, the general structural trend gradually becomes more NW to SE, approximating to the strike of the main Thrust Fault separating the Northland Allochthon and Waitemata Group materials along the south-western boundary of the landfill. Foliation and lamination/bedding orientations within the Mudstone and Siltstones are generally steep typically varying between about 60° dip and vertical.
- 2 The Limestone (Unit N1) materials, although typically weak to moderately strong, usually exhibit a pervasively sheared fabric generally elongated and aligned parallel the principal Limestone/Mudstone contacts.
- 3 The Mudstones and Siltstones are commonly cross-cut by narrow shear zones, typically near vertical and characterised by up to about 100 mm of dark grey, very stiff clay representing gouge material formed by the shearing process.
- 4 Fractures within the Northland Allochthon materials are generally tight and impersistent, normally planar or gently undulating, and usually with no evidence of polishing or relative movement along the fracture planes. The prominent exception is the Northland Allochthon Mudstone Unit N7 which is characterised by extremely closely spaced, curvilinear, polished joints.
- 5 A Thrust Fault, forming the assessed Northland Allochthon/Waitemata Group contact boundary, generally runs NW to SE obliquely across the upper portion of the proposed Western Property Southern Highwall, see Engineering Geology Plans, Figures D1 and D2. South of the Landfill boundary the Thrust Fault alignment is assessed as becoming more NNW to SSE and likely intersecting the western part of the proposed landfill Class 2 waste extension to the south-west of the current landfill boundary. Mapping of the Southern Highwall basegrade suggests that the Thrust fault is not a single defined fault plane but more a series of steeply south-westerly dipping irregularly interbanded sub-parallel sheared zones consisting of sheared Northland Allochthon Limestone, Waitemata Group Sandstones and an Autoclastic Breccia, all formed as part of the Northland Allochthon emplacement process. This has resulted in the sub-parallel bands of Limestone, Autoclastic Breccia and Waitemata Group shown on the Engineering Geology Plans, Figures D1 and D2.

L2.6 Geological model

The extensive geological and geotechnical data gathered at the Redvale Landfill site since the original resource consent process commenced in 1988 have enabled a comprehensive and robust geological model to be developed for the site, see Engineering Geological Plans, Figures D1 and D2.

The model has identified the Eastern Property and the eastern two-thirds of the Western Property to be underlain by sheared, generally NNE to SSW trending Northland Allochthon deposits. These are dominated by a prominent central (Mahurangi) Limestone mass aligned approximately along the Properties' common boundary, flanked to the west and east by sheared, often contorted, interbanded Mudstones and Siltstones.

Waitemata Group Sandstones and Siltstones form the bedrock geology to the south and west of the Redvale Landfill boundary. The inferred contact between those units and the Northland Allochthon materials is delineated by a steeply WSW dipping thrust fault which runs approximately NW to SE across the south-western edge of the Western Property and then NNE to SSE to the south of the Landfill. Along the thrust fault is a zone of Autoclastic Breccia, formed during the Allochthon emplacement process, with further, irregularly interbedded, sub-parallel bands of Limestone, Autoclastic Breccia and Waitemata Group extending south-westwards towards and beyond (south of) the Landfill boundary and the Waitemata Group country rock.

Pleistocene Sediments and/or residual soils derived from weathering of the Northland Allochthon mudstone/siltstone formed the immediate surface materials over much of the study area, which have mostly been stripped away as part of site development. Low-angle shear planes have been observed at the base of those Pleistocene Sediments and within the underlying weathered Northland Allochthon mudstones and siltstones.

Appendix M Historic (pre-2024) Geotechnical Investigations

M1 General

Extensive geotechnical investigations have been carried out at the Redvale Landfill site, and immediate environs, since pre-consenting assessment of the site began in 1988. Those historic (pre-2024) investigations can be split into three principal stages, namely:

1 Pre-1992 Investigations by T+T and others:

Prior to granting of the original landfill consents in 1992 investigations were carried out comprising machine excavated trenches and machine boreholes at locations within, and outside, the proposed landfill perimeter. In addition, T+T carried out a geotechnical study in 1991, which included the excavation of several large diameter drilled shafts.

2 Post-1992 Investigations by T+T:

As the Redvale Landfill cells have been progressively constructed, between 1992 and 2014 T+T carried out a large number, and wide range, of geotechnical investigations both within the landfill perimeter and externally for works such as stockpiles and sedimentation ponds. Those investigations principally comprised:

- Machine drilled boreholes
- Machine excavated test pits and a more limited number of trenches

Other investigations carried out to a limited extent included:

- Cone Penetrometer Tests (CPT)
- Hand-Auger Boreholes

Other sources of geotechnical information obtained as part of the ongoing landfill development has included data from construction observations, engineering geology mapping and the Basegrade Inspection process required under the current consents.

Laboratory testing, principally triaxial strength testing, has also been carried out on selected samples to confirm geotechnical design parameters.

3 2010 Investigations by S&R:

As part of their design assessment for the proposed Managed Fill S&R carried out limited investigations for the stockpile works comprising:

- 3 No. machine boreholes to between 12.50 m and 20.45 m deep.
- 15 No. hand-auger boreholes to up to 5 m depth.
- 7 No. test pits to up to 3.5 m depth.

The following sections briefly review and discuss the historic (pre-2024) geotechnical investigations.

M2 Investigations

M2.1 General

The locations of historic geotechnical investigations known to have been carried out at the Redvale Landfill site, to date, are shown on the Engineering Geology Plans, Figures D1 and D2.

In reviewing the historic investigation data, it should be noted that, in view of the changing ground levels as a result of construction works within the study area, the coordinates of many of the investigations are now correct in plan only.

The post-1992 investigations were generally supervised, and boreholes and test pits logged, by T+T Engineering Geologists or Geotechnical Engineers.

M2.2 Boreholes and shafts

A review of records shows that over 150 No. machine drilled boreholes, 6 No. Hand-Auger boreholes and 6 No. Machine drilled large diameter shafts have been carried out at the Redvale Landfill site, specifically:

- 1 Machine drilled boreholes: These have been the primary investigation method to allow visual inspection (logging) of materials, together with installation of piezometers or inclinometers within selected boreholes.
- 2 Hand-Auger Boreholes: A limited number of hand-auger boreholes were carried out to assess the thickness of Pleistocene Sediments as part of the geotechnical assessment of the Co-Generation Plant.
- 3 Machine drilled Shafts: As part of the earlier phases of investigation in 1991, 6 No. large diameter shafts were drilled within the landfill area using a piling rig, so as to allow direct inspection of ground conditions in the shaft walls.
- 4 Horizontal Drains: These were installed in a number of locations as part of individual cell development, notably within the Eastern Property's Western Highwall and the Western Property's Southern Highwall. In addition to groundwater information the drill cuttings and drilling rates were used to supplement other geotechnical investigation data.

M2.3 Test pits and trenches

Records shows that 262 No. machine excavated test pits and 19 No. machine excavated trenches have been carried out at the Redvale Landfill site, specifically:

- 1 Test Pits: A variety of test pits have been excavated across the site with their dimension and depth varying depending on the excavator used and the objectives of the particular pits. Generally the test pits were about 1.5 m by 2 m in plan, with test pits typically at least 1.5 m deep but many up to the reach limit of the 20 tonne excavators typically used, i.e. about 5 m.
- 2 Trenches: These may be viewed as linear test pits, and were carried out primarily to assist in identifying unit contacts or shear zones.

M2.4 Engineering geology mapping and basegrade inspections

Engineering geology mapping was carried out progressively throughout the construction of the Redvale Landfill. The mapping was primarily focused on inspection of areas prior to, during and following construction works, but has also included more opportunist mapping of temporary access road cuts, borrow areas, drain/pipe excavations and the like.

To comply with Water Right No. 907315/21067, Special Condition 1.3 for the Redvale Landfill, an independent Quality Assurance Report on the lining system basegrade preparation works is required to be submitted to Council prior to placement of refuse within a completed Landfill cell. As part of that QA compliance a designated Liner Review Team, (LRT), comprising a representative from T+T and from the Peer Review Panel, carried out an inspection and engineering geology mapping of the, trimmed basegrade to confirm its suitability for lining system placement. The results of that inspection and mapping are documented for subsequent incorporation into that cell's lining system QA Report.

The results of the engineering geology mapping and Basegrade Inspections, together with information from the geotechnical investigations, e.g. boreholes and test pits, was used to develop an Engineering Geology Plan for the Redvale Landfill site. That Plan was progressively revised and upgrade as the landfill development proceeded, and the latest revision is included as Figure D1 (Eastern Property) and Figure D2 (Western Property).



Together we create + sustain a better world