

Appendix 9: Geotechnical factual report



Document control

Title: Geotechnical Factual Report					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
30/07/25	1	Geotechnical Factual Report issue	P. Lee	D. Henderson	K. Murahidy

Distribution:

Environment Canterbury

1 PDF copy

Tonkin & Taylor Ltd (FILE)

1 PDF copy

Table of contents

1	Introduction	1
2	Site description	2
3	Published geology	3
4	Site investigations	3
	4.1.1 Machine boreholes	3
	4.1.2 Test pits	4
	4.1.3 Hand augered boreholes	4
	4.1.4 Scala Penetrometer tests	5
	4.2 Groundwater monitoring	6
	4.3 Laboratory testing	7
	4.3.1 Geotechnical testing	7
5	Applicability	8
Appendix A	Figures	
Appendix B	Machine borehole logs	
Appendix C	Test pit logs	
Appendix D	Hand augered borehole logs	
Appendix E	Laboratory Test Results	

1 Introduction

Tonkin & Taylor Ltd (T+T) was engaged by Environment Canterbury to conduct a geotechnical investigation for the Waitarakao Channel and Stopbank Realignment Project (Stage 1).

This investigation was undertaken to provide factual geotechnical data to support the concept design for Stage 1 of the realignment of the Seadown Drain, associated stopbank and the installation of conveyance/channel crossing. The Stage 1 scope covers an area from Washdyke Lagoon to just north of the Aorangi Rifle Range.

Geotechnical services were provided in accordance with our contract dated 11 June 2025¹ and included the following scope of work:

- Intrusive investigations, comprising:
 - Service location using a CAT and GPR scanner along the investigation alignment.
 - 3 No. Machine drilled (Sonic) boreholes to depths of 6, 15 and 20 metres below ground level (mgb).l).
 - 6 No. test pits to 3 m bgl or when refusal conditions were met.
 - 6 No. hand auger boreholes to 3 m bgl or when refusal conditions were met.
 - 13 no. Scala penetrometer tests to 3 m bgl or when refusal conditions were met.
- Laboratory testing.

Preparation of this geotechnical factual report describing the results of the geotechnical investigations and laboratory testing conducted.

¹ Short Form Agreement for Consultant Engagement. Between Environment Canterbury (ECan) and Tonkin + Taylor (T+T). Dated 11 June 2025.

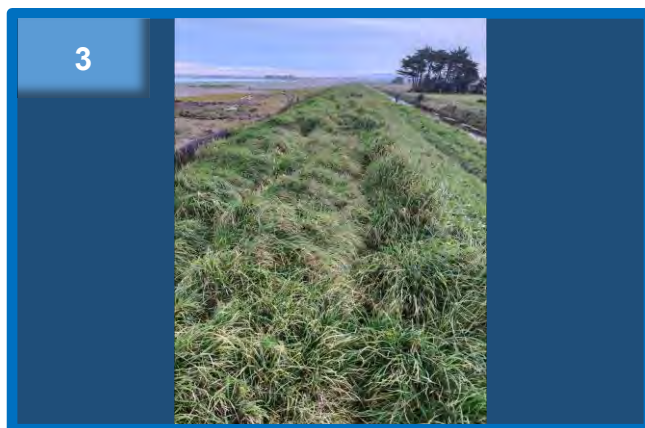
2 Site description



1. General site view of dumped fill present across the area.



2. General site view with the rifle range embankment visible in the background.



3. View of the existing stopbank.



Figure 2.1. Aerial photograph showing the site boundary and locations of site photographs referenced in this report.



4. View of the existing drain.



5. View of the area adjacent to Test Pit 4.

Site Description

The proposed coastal retreat initiative involving the realignment of the Seadown Drain and associated stopbank is immediately north east of Washdyke, Timaru. The site lies within a low-lying coastal zone approximately 150 m inland from the active shoreline (as bounded by the yellow box in Figure 2.1).

The site is generally grassed and relatively flat with a gentle slope toward the east and the Seadown Drain. An existing stopbank, around 2 m in height, is present immediately east of the drain. Both the existing stopbank and drain run parallel to the coastline.

Within the site are wetlands, open ditches, and constructed drains that connect into the Seadown Drain.

To the north of Aorangi Road, fill mounds (some up to approximately 5 m high) are evident. These are likely the result of uncontrolled deposition of fill material from neighbouring sites. Aerial imagery from 2010 to 2014² indicates that substantial earthworks occurred in the area, likely related to the construction of the adjacent wastewater treatment ponds. In addition, localised areas of dumped fill were observed south of Aorangi Road.

T+T completed a site walkover from 30 June to 2 July 2025. During the walkover, the entire site was observed to be wet, with areas of standing water and soft, boggy ground conditions present.

² <https://mapviewer.canterburymaps.govt.nz/>

3 Published geology

The published geological map of the area³ indicates that the site is underlain by late Pleistocene river deposits (Q2a) consisting of *light brownish grey river gravel, sand and silt within abandoned outwash plains or low to mid level terraces*.

The location of the site in the context of the regional geology is presented on Figure 3.1 below.



Figure 3.1: Geological setting with the approximate investigation area (red box) taken from QMAP³.

4 Site investigations

Geotechnical investigations were carried out at the project site from 30 June to 2 July 2025. The investigations comprised:

- 3 machine boreholes (using the sonic drilling method).
- 6 test pits with adjacent Scala penetrometer tests.
- 6 hand augured boreholes with adjacent Scala penetrometer tests.

Investigation positions were selected by T+T on the basis of access, presence of overhead and buried services and traffic management considerations.

The locations of the investigations were surveyed by hand held GPS and are presented on Figure 1 attached in Appendix A.

4.1.1 Machine boreholes

The machine boring of three vertical boreholes was undertaken over the period between 30 June and 2 July 2025. The works were carried out using a sonic coring drilling rig, supplied and operated by Pro-Drill Limited. The boreholes were advanced from ground level.

In situ Standard Penetration Testing (SPT) was carried out at regular (1.5 m) intervals through the soil horizon. The recovered drill core was photographed and logged to NZGS 'Field Description of Soil and Rock' guidelines.

³ Coxm S.C.; Barrell, D.J.A. (compilers) 2007: *Geology of the Aoraki area*. Institute of Geological & Nuclear Sciences 1:250,000 geological map 15. 1 sheet + 71 p. Lower Hutt, New Zealand. GNS Science.

The boreholes were drilled at key locations along the project site; the investigation locations are presented on Figure 1, Appendix A. Summary borehole logs and core photographs are presented in Appendix C. Summary borehole details are presented in Table 4.1 below.

Table 4.1: Machine Borehole Summary

BH ID	Location (NZTM)		Ground Surface Elevation RL (m)	Depth (m)
	Easting (m)	Northing (m)		
BH01	1462069	5088312	1.65	6.49
BH02	1461688	5087911	2.90	15.65
BH03	1461052	5086969	2.69	20.10

4.1.2 Test pits

The excavation of 6 test pits was undertaken by Paul Smith Earthworks on 1 and 2 July 2025, under the supervision of an engineering technician from T+T. The test pits had a target depth of 3 mbgl, however, most test pits were terminated early due to sidewall collapse. The test pits were logged to NZGS 'Field Description of Soil and Rock' guidelines.

The test pit locations are presented on Figure 1, Appendix A. Test pit logs are appended in Appendix C. Summary test pit details are presented in Table 4.2 below.

Table 4.2: Test Pit Summary

Test Pit ID	Location (NZTM)		Ground Surface Elevation RL (m)	Depth (m)	Reason for termination
	Easting (m)	Northing (m)			
TP1	1461957	5088137	2.35	3.00	Target depth reached
TP2	1461769	5087959	5.06	3.00	Target depth reached
TP3	1461613	5087627	1.84	2.50	Refusal - Collapse
TP4	1461412	5087493	0.52	2.00	Refusal - Collapse
TP5	1461334	5087236	2.63	2.10	Refusal - Collapse
TP6	1461210	5087091	2.76	2.00	Refusal - Collapse

4.1.3 Hand augered boreholes

The drilling of 6 hand augered boreholes was undertaken on 1 and 2 July 2025. The works were carried out by an engineering technician from T+T.

Investigation locations are presented on Figure 1, Appendix A. The hand augered borehole logs are presented in Appendix D and a summary of the hand augered boreholes are presented in Table 4.3 below.

Table 4.3: Hand Augered Borehole Summary

HA ID	Location (NZTM)		Ground Surface Elevation RL (m)	Depth (m)
	Easting (m)	Northing (m)		
HA1	1462089	5088390	2.55	0.20
HA2	1462000	5088232	3.30	1.40
HA3	1461878	5088063	2.89	1.20
HA4	1461649	5087735	4.52	1.00
HA5	1461269	5087167	1.76	0.50
HA6	1461133	5087038	3.07	0.50

4.1.4 Scala Penetrometer tests

12 Scala penetrometer tests were undertaken by an engineering technician from T+T on 1 July and 2 July 2025.

The tests were distributed as follows:

- 6 tests: at the location of the proposed test pits (TP1-6) and prior to excavation of each test pit.
- 6 tests: immediately adjacent to each hand augered borehole (HA1-6).

The Scala penetrometer tests had a target depth of 3 mbgl, however, reached 'refusal' at depths of 0.5 to 2.1 mbgl due to dense or impenetrable subsurface materials.

The Scala penetrometer test locations are shown where the other site investigation locations are, as presented on Figure 1, Appendix A. Scala penetrometer test logs are presented in the Appendices alongside their corresponding respective site investigation, and a summary of the tests is presented in Table 4.4 below.

Table 4.4: Scala Penetrometer Test Summary

Scala Penetrometer test ID	Location (NZTM)		Ground Surface Elevation RL (m)	Depth (m)	Reason for termination
	Easting (m)	Northing (m)			
TP01 (SP)	1461957	5088137	2.35	1.05	Refusal - Unable to penetrate
TP02 (SP)	1461769	5087959	5.06	2.10	
TP03 (SP)	1461613	5087627	1.84	0.60	
TP04 (SP)	1461412	5087493	0.52	0.65	
TP05 (SP)	1461334	5087236	2.63	0.8	
TP06 (SP)	1461210	5087091	2.76	0.85	
HA01 (SP)	1462089	5088390	2.55	0.50	
HA02 (SP)	1462000	5088232	3.30	1.65	
HA03 (SP)	1461878	5088063	2.89	1.20	
HA04 (SP)	1461649	5087735	4.52	1.40	
HA05 (SP)	1461269	5087167	1.76	1.00	
HA06 (SP)	1461133	5087038	3.07	1.90	

4.2 Groundwater monitoring

Groundwater levels were recorded within several of the machine boreholes and test pits. The recorded groundwater levels are presented below in Table 4.5.

Groundwater was not encountered in any of the hand augered boreholes (HA01–HA06).

Table 4.5: Groundwater levels

Investigation ID	Ground surface elevation RL (m)	Depth to groundwater level (m bgl)	Groundwater elevation RL (m)	Date of measurement
BH01	1.65	1.40	0.25	01/07/2025
BH02	2.90	7.10*	-4.20	01/07/2025
BH03	2.69	4.80*	-2.11	30/06/2025
TP01	2.35	Not encountered	Not encountered	02/07/2025
TP02	5.06	3.00	2.06	02/07/2025
TP03	1.84	1.00	0.84	01/07/2025
TP04	0.52	1.00	-0.48	01/07/2025
TP05	2.63	0.80	1.83	01/07/2025
TP06	2.76	1.50	1.26	02/07/2025

*Note: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.

4.3 Laboratory testing

4.3.1 Geotechnical testing

Geotechnical laboratory samples were collected from the stopbank site test pits and hand augered boreholes. The samples were tested at the Geotechnics laboratory for determination of the particle size distributions (wet sieve and hydrometer tests) and determination of the dry density and water content.

The laboratory testing schedule adopted the following standards:

- Particle size distribution via wet sieve grading (NZS 4402:1986 Test 2.8.1).
- Particle size distribution via hydrometer test (NZS 4402:1986 Test 2.8.4).
- Determination of the Dry Density/Water Content Relationship (NZS 4402:1986 Test 4.1.2 (Heavy Compaction)).

Summary results of the particle size distribution tests are provided in **Error! Reference source not found.**, while the heavy compaction test results are presented in **Error! Reference source not found.** Results of all the laboratory testing are presented in Appendix E.

Table 4.6: Particle size distribution testing summary results

Investigation ID	Sample Depth (m bgl)	Geological Field Description	Test type	PSD fractions			
				%Clay	%Silt	%Sand	%Gravel
TP02	0.1 – 1.0	Sandy Silt	Wet sieve + Hydrometer	12	41	31	16
TP02	2.5 – 3.0	Sandy Gravels	Wet sieve	8		20	72
TP05	1.0	Sandy Gravels	Wet sieve	2		23	75
TP06	1.5 – 1.75	Gravel some sand	Wet sieve	5		18	77

Table 4.7: Heavy Compaction Test Results

Investigation ID	Sample Depth (m bgl)	Geological Field Description	MDD (t/m ³)	OMC (%)	NWC (%)
TP02	2.5 – 3.0	Sandy Gravels	2.27	7.0	11.2
TP05	1.0	Sandy Gravels	2.34	4.8	6.7
TP06	1.5 – 1.75	Gravel some sand	2.33	6.5	6.5

5 Applicability

This report has been prepared for the exclusive use of our client Environment Canterbury, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Information presented in this report primarily comprises data from discrete investigation locations. The nature and continuity of subsoil away from these locations may be inferred but it must be appreciated that actual conditions could vary from assumed models.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:



Peter Lee
Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:



Kirsti Murahidy
Project Director

PELE

\\ttgroup.local\corporate\christchurch\tt projects\1099029\issueddocuments\2025.07.30.factual_report_v3.docx

Appendix A Figures

- **Figure 1: Geotechnical investigation site plan**





Tonkin+Taylor
Exceptional thinking together www.tonkintaylor.co.nz

NOTES:

ALL TEST PIT AND HAND AUGER LOCATIONS ALONG THE PROPOSED STOPBANK HAVE A PAIRED SCALA TEST.

PROPOSED STOPBANK AND DRAIN REALIGNMENT SHOWN IS BASED ON THE KASTORWORKS LTD DRAWING TITLED "PROPOSED DESIGN ALIGNMENTS – GENERAL OVERVIEW PLAN", DATED 28 MAY 2025 (PROJECT NO. 24006-01, REVISION 1.0).

CRS: NZGD 2000 New Zealand Transverse Mercator Credits: Environment Canterbury, Maxar, Earthstar Geographics, Stats NZ, Esri, TomTom, Garmin, FAO, MET/NASA, USGS, LINZ, Stats NZ, Esri, TomTom, Garmin, MET/NASA, USGS



LOCATION PLAN

PROJECT No. 1099029.0000		
DESIGNED	DEMC	JUL.25
DRAWN	-WEB-	JUL.25
CHECKED		

APPROVED DATE

CLIENT **ENVIRONMENT CANTERBURY**

PROJECT **WAITARAKAO CHANNEL & STOPBANK REALIGNMENT**

TITLE **GEOTECHNICAL INVESTIGATION SITE PLAN**

SCALE (A3) 1:7,500 FIG No. FIGURE 1. REV 1

Appendix B Machine borehole logs

BOREHOLE LOG

BOREHOLE No.: **BH01**

SHEET: 1 OF 1

PROJECT: Waitartkao Seadown SW Drain Realignment										LOCATION: Washdyke, Timaru										JOB No.: 1099029.0000														
CO-ORDINATES: 5088312 mN (NZTM2000) 1462069 mE					DRILL TYPE: Fraste XL 170 Duo										HOLE STARTED: 01/07/2025																			
R.L.: 1.65m					METHOD: Sonic core drilling										HOLE FINISHED: 01/07/2025																			
DATUM: NZVD2016					DRILL FLUID: WATER										LOGGED BY: SHTH										CHECKED: PELE									
GEOLOGICAL		METHOD OBSERVATIONS										ENGINEERING DESCRIPTION																						
GEOLOGICAL UNIT/ ADDITIONAL OBSERVATIONS		FLUID LOSS (%)	WATER	CASING	CORE RECOVERY (%)	METHOD	TESTS	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (So, kPa)					ESTIMATED ROCK COMPRESSIVE STRENGTH (So, MPa)					DEFECT SPACING (mm)					DESCRIPTION					
Topsoil		01/07/2025	▼		100	SNC			1	TS		M	S																0.00m: Organic SILT, trace gravel; dark brown with brownish grey specks. Soft, moist, non-plastic, dilatant. Gravel, fine to coarse, rounded. (PLACED TOPSOIL).					
																							0.55 - 2.85m: No gravel.											
Quaternary outwash plains (Q2a)					100	SPT		0.0// 0.1/1/2 N=4	0	TS				S-F																2.85m: SILT, minor sand, trace clay; bluish grey mottled brown. Soft to firm, moist, non-plastic, dilatant. Sand, fine.				
																							3.00m: Sandy fine to coarse GRAVEL; brown. Dense, moist to wet, well graded. Gravel, rounded to sub-angular; sand, fine to coarse.											
																								3.75 - 4.00m: Some sand. Sand, fine to coarse.										
																									4.00 - 6.48m: Minor silt. Very dense.									
					99	SPT		7.9// 6.7/7/6 N=26	3	TS		M-W	D																					
					100	SNC			4	TS				VD																				
					99	SPT		7.1/9// 17/15/10/8 for 60mm N>50	-3	TS																								
					101	SNC			5	TS																								
					99	SPT		9.1/8// 18/15/14/4 for 10mm N>50	-6	TS																								
									-5																				6.49m: END OF BOREHOLE					

COMMENTS:

Hole Depth
6.49m

Scale 1:40

CORE PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5088312.00 mN 1462069.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 01/07/2025
R.L.:	1.65m	METHOD: Sonic core drilling	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: SHTH CHECKED: PELE

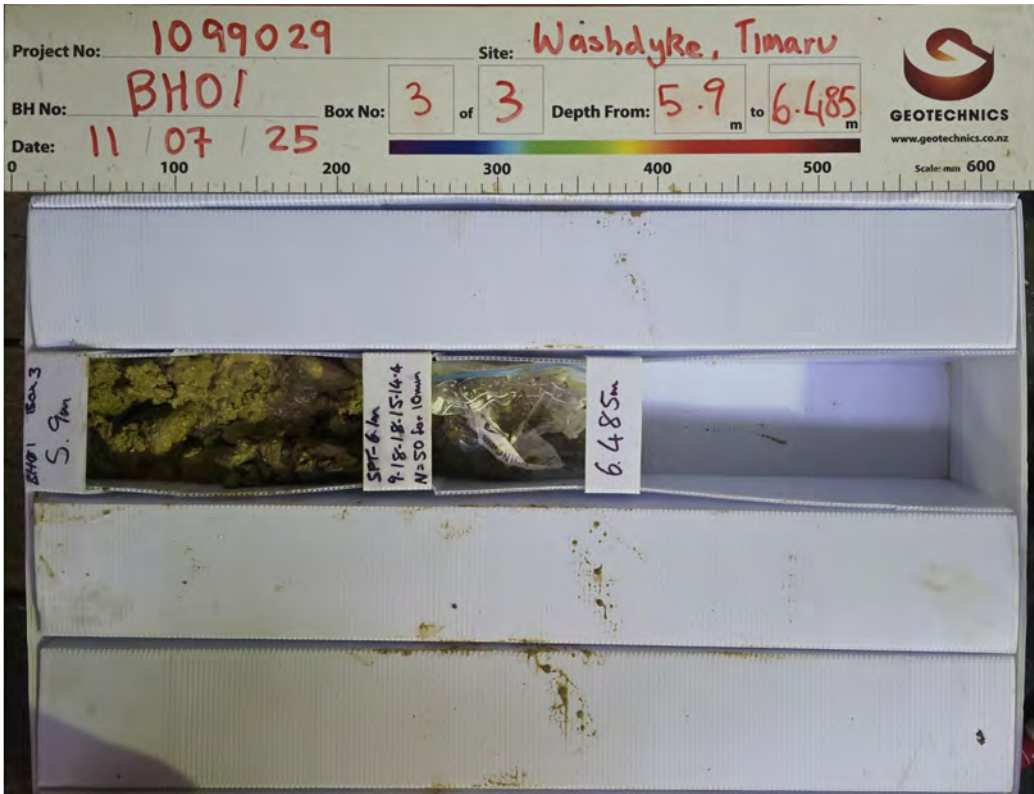


0.00-2.80m



2.80-5.90m

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5088312.00 mN 1462069.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 01/07/2025
R.L.:	1.65m	METHOD: Sonic core drilling	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: SHTH CHECKED: PELE



5.90-6.49m

BOREHOLE LOG

BOREHOLE No.: **BH02**

SHEET: 1 OF 2

PROJECT: Waitartkao Seadown SW Drain Realignment										LOCATION: Washdyke, Timaru										JOB No.: 1099029.0000																																				
CO-ORDINATES: 5087911 mN (NZTM2000) 1461688 mE					DRILL TYPE: Fraste XL 170 Duo										HOLE STARTED: 01/07/2025																																									
R.L.: 2.90m					METHOD: Sonic core drilling										HOLE FINISHED: 01/07/2025																																									
DATUM: NZVD2016					DRILL FLUID: WATER										LOGGED BY: SHTH										CHECKED: PELE																															
GEOLOGICAL					METHOD OBSERVATIONS										ENGINEERING DESCRIPTION																																									
GEOLOGICAL UNIT/ ADDITIONAL OBSERVATIONS					FLUID LOSS (%)	WATER	CASING	CORE RECOVERY (%)	METHOD	TESTS					RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (So, kPa)					ESTIMATED ROCK COMPRESSIVE STRENGTH (So, MPa)					DEFECT SPACING (mm)					DESCRIPTION																				
Topsoil								100	SNC									W	S																	0.00m: Organic SILT, minor gravel, trace sand; brown. Soft, wet, non-plastic, dilatant. Gravel, fine to medium, rounded; sand, fine. (TOPSOIL). 0.20 - 0.70m: Dark brown with greyish brown specks. No gravels.																				
Quaternary outwash plains (Q2a)								100	SPT	12/11// 11/10/13/13 N=47						2	1		M	D																	0.70m: Sandy fine to coarse GRAVEL, trace silt; grey. Dense, moist, uniformly graded. Gravel, rounded to sub-angular; sand, fine to coarse. 1.10 - 3.00m: Brownish grey mottled orange.																			
								100	SNC							0	2																				3.00 - 11.85m: Brown.																			
								100	SPT	11/11// 10/10/10/9 N=39						3	3																																							
								100	SNC							-1	4																																							
								99	SPT	12/19// 17/17/16 for 75mm N>=50						-2	5					VD																				4.50 - 12.55m: Very dense.														
								100	SNC							-3	6																																							
								100	SPT	13/9// 11/26/13 for 50mm N>=50						-4	7					W M																									6.00 - 6.10m: Wet.									
								100	SNC							-5	8																																							
								100	SPT	16/14// 23/20/7 for 50mm N>=50							9																																							

COMMENTS: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.

Hole Depth
15.65m

Scale 1:40

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH02**

SHEET: 2 OF 2

PROJECT: Waitartkao Seadown SW Drain Realignment										LOCATION: Washdyke, Timaru										JOB No.: 1099029.0000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
CO-ORDINATES: 5087911 mN (NZTM2000) 1461688 mE					DRILL TYPE: Fraste XL 170 Duo										HOLE STARTED: 01/07/2025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
R.L.: 2.90m					METHOD: Sonic core drilling										HOLE FINISHED: 01/07/2025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
DATUM: NZVD2016					DRILL FLUID: WATER										LOGGED BY: SHTH										CHECKED: PELE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
GEOLOGICAL					METHOD OBSERVATIONS										ENGINEERING DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
GEOLOGICAL UNIT/ ADDITIONAL OBSERVATIONS					TESTS										FLUID LOSS (%)										WATER										CASING										CORE RECOVERY (%)										METHOD										RL (m)										DEPTH (m)										GRAPHIC LOG										WEATHERING CLASSIFICATION										MOISTURE CLASSIFICATION										CONSISTENCY / DENSITY CLASSIFICATION										ESTIMATED SOIL SHEAR STRENGTH (kPa)										ESTIMATED ROCK COMPRESSIVE STRENGTH (kPa)										DEFECT SPACING (mm)										DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
Quaternary outwash plains (Q2a)					14/24// 20/22/8 for 20mm N>50										100										SNC										SPT										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC										100										SNC									

COMMENTS: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.

Hole Depth
15.65m

Scale 1:40

Rev.: A

PROJECT: Waitatkaio Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES:	5087911.00 mN (NZTM2000) 1461688.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 01/07/2025
R.L.:	2.90m	METHOD: Sonic core drilling	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
			LOGGED BY: SHTH
			CHECKED: PELE



0.00-2.80m



2.80-6.10m

CORE PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5087911.00 mN 1461688.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 01/07/2025
R.L.:	2.90m	METHOD: Sonic core drilling	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
		LOGGED BY: SHTH	CHECKED: PELE



6.10-8.85m

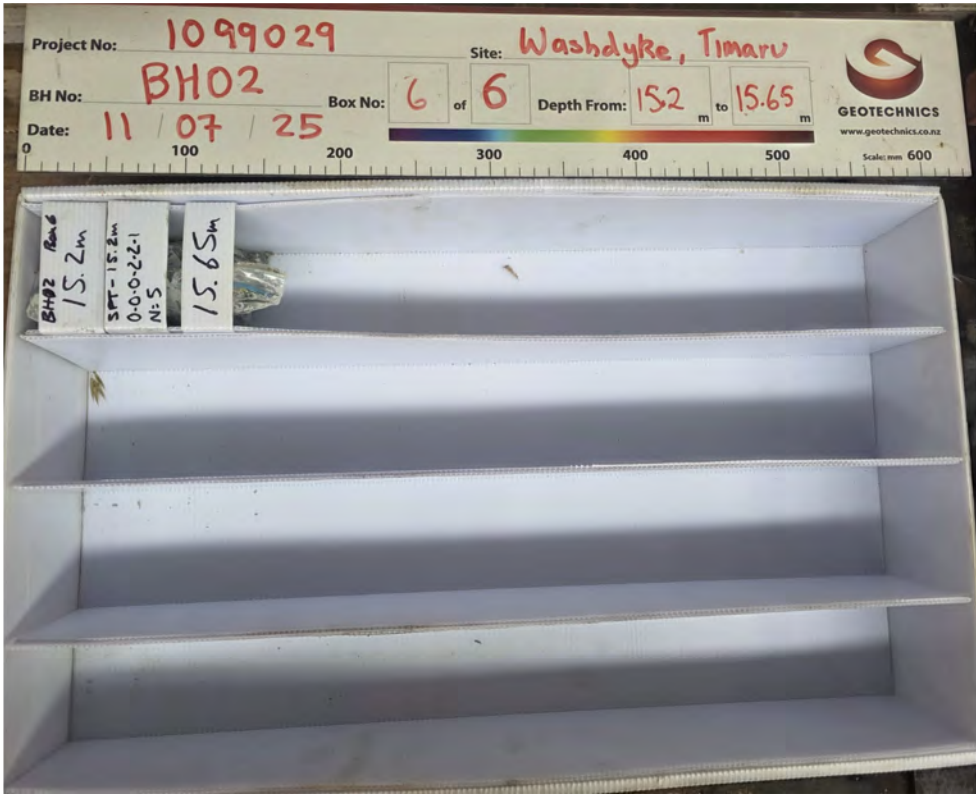


8.85-11.85m

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5087911.00 mN 1461688.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 01/07/2025
R.L.:	2.90m	METHOD: Sonic core drilling	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
			LOGGED BY: STHH
			CHECKED: PELE



11.85-15.20m



15.20-15.65m

BOREHOLE LOG

BOREHOLE No.: **BH03**

SHEET: 1 OF 3

PROJECT: Waitartkao Seadown SW Drain Realignment										LOCATION: Washdyke, Timaru										JOB No.: 1099029.0000																			
CO-ORDINATES: 5086969 mN (NZTM2000) 1461052 mE										DRILL TYPE: Fraste XL 170 Duo										HOLE STARTED: 30/06/2025																			
R.L.: 2.69m										METHOD: Sonic core drilling										HOLE FINISHED: 30/06/2025																			
DATUM: NZVD2016										DRILL FLUID: WATER										DRILLED BY: Pro Drill																			
																				LOGGED BY: SHTH										CHECKED: PELE									
GEOLOGICAL		METHOD OBSERVATIONS										ENGINEERING DESCRIPTION																											
GEOLOGICAL UNIT/ ADDITIONAL OBSERVATIONS		TESTS										DESCRIPTION																											
Topsoil																																							
Fill																																							

COMMENTS: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.

Hole Depth
20.1m

Scale 1:40

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH03**

SHEET: 2 OF 3

PROJECT: Waitartkao Seadown SW Drain Realignment	LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: 5086969 mN (NZTM2000) 1461052 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 30/06/2025
R.L.: 2.69m	METHOD: Sonic core drilling	HOLE FINISHED: 30/06/2025
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
		LOGGED BY: SHTH
		CHECKED: PELE

GEOLOGICAL		METHOD OBSERVATIONS										ENGINEERING DESCRIPTION												
GEOLOGICAL UNIT/ ADDITIONAL OBSERVATIONS		FLUID LOSS (%)		WATER	CASING	CORE RECOVERY (%)	METHOD	TESTS		RL (ft)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION		ESTIMATED SOIL SHEAR STRENGTH (ksi, kPa)		ESTIMATED ROCK COMPRESSIVE STRENGTH (ksi, MPa)		DEFECT SPACING (mm)		DESCRIPTION	
		25	50												MR	MR	MR	MR	MR	MR	MR	MR		
Quaternary outwash plains (Q2a)						100	SNC			-6				M	VD									[CONT] 1.50m: Sandy fine to coarse GRAVEL, trace silt; brownish grey. Medium dense, moist, well graded. Gravel, rounded to sub-angular; sand, fine to coarse.
					100	SPT		6/11// 14/11/214 for 10mm N>50	-9															
					101	SNC			-7															
					100	SPT		9/17// 17/20/13 for 65mm N>50	-8															
Quaternary estuarine deposits						100	SPT		7/8// 22/34 N=11	-10				F-St										12.20m: SILT, minor clay; bluish grey. Firm to stiff, moist, low plasticity.
					100	SNC			-13					S-F										13.30 - 14.15m: Some clay. Soft to firm, low to medium plasticity.
					100	SPT		0/0// 02/32 N=7	-11															14.15 - 14.60m: Some sand. Sand, fine.
					100	SNC			-12					F-St										
Pleistocene Alluvium / Colluvium and Fan Deposits						100	SNC			-15				D										14.60m: Silty fine to medium SAND; greenish grey. Dense, moist, uniformly graded.
					100	SPT		2/8// 10/11/10/7 N=38	-13															

COMMENTS: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.

Hole Depth
20.1m

Scale 1:40

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH03**

SHEET: 3 OF 3

PROJECT: Waitartkao Seadown SW Drain Realignment						LOCATION: Washdyke, Timaru						JOB No.: 1099029.0000												
CO-ORDINATES:		5086969 mN (NZTM2000) 1461052 mE				DRILL TYPE: Fraste XL 170 Duo						HOLE STARTED: 30/06/2025												
R.L.:		2.69m				METHOD: Sonic core drilling						HOLE FINISHED: 30/06/2025												
DATUM:		NZVD2016				DRILL FLUID: WATER						DRILLED BY: Pro Drill												
												LOGGED BY: SHTH												
												CHECKED: PELE												
GEOLOGICAL		METHOD OBSERVATIONS						ENGINEERING DESCRIPTION																
GEOLOGICAL UNIT/ ADDITIONAL OBSERVATIONS		FLUID LOSS (%)	WATER	CASING	CORE RECOVERY (%)	METHOD	TESTS	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (kPa)			ESTIMATED ROCK COMPRESSIVE STRENGTH (kPa)			DEFECT SPACING (mm)			DESCRIPTION	
Pleistocene Alluvium / Colluvium and Fan Deposits					100	SNC						M	D										[CONT] 14.60m: Silty fine to medium SAND; greenish grey. Dense, moist, uniformly graded.	
					100	SPT	56// 6/9/9'10 N=34	-14	17															
					100	SNC		-15	18														18.00m: Fine to coarse SAND; brown mottled orange. Dense, moist, uniformly graded.	
					100	SPT	47// 9/12/9'10 N=40	-16	19														18.20 - 19.00m: Mottled grey.	
					100	SNC		-17	20				VD										19.45m: Gravelly fine to coarse SAND, trace silt; brown mottled orange. Very dense, moist, well graded. Gravel, fine to medium, sub-rounded to sub-angular.	
					100	SPT	14/16// 16/34 for 70mm N=50	-20																20.1m: END OF BOREHOLE
								-18	21															
								-19	22															
								-20	23															
								-21																
COMMENTS: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.																								
Hole Depth 20.1m																								

COMMENTS: The deeper groundwater level recorded may have been influenced by drilling disturbance or residual water in the borehole at the time of measurement. This reading may not reflect stabilised groundwater conditions.

Hole Depth
20.1m

Scale 1:40

Rev.: A

CORE PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES:	5086969.00 mN (NZTM2000) 1461052.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 30/06/2025
R.L.:	2.69m	METHOD: Sonic core drilling	HOLE FINISHED: 30/06/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
			LOGGED BY: SHTH
			CHECKED: PELE



0.00-3.94m



3.94-6.95m

CORE PHOTOS

BOREHOLE No.: **BH03**

SHEET: 2 OF 4

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5086969.00 mN 1461052.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 30/06/2025
R.L.:	2.69m	METHOD: Sonic core drilling	HOLE FINISHED: 30/06/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
			LOGGED BY: SHTH
			CHECKED: PELE



6.95-10.00m



10.00-13.10m

CORE PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES:	5086969.00 mN (NZTM2000) 1461052.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 30/06/2025
R.L.:	2.69m	METHOD: Sonic core drilling	HOLE FINISHED: 30/06/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
			LOGGED BY: SHTH
			CHECKED: PELE



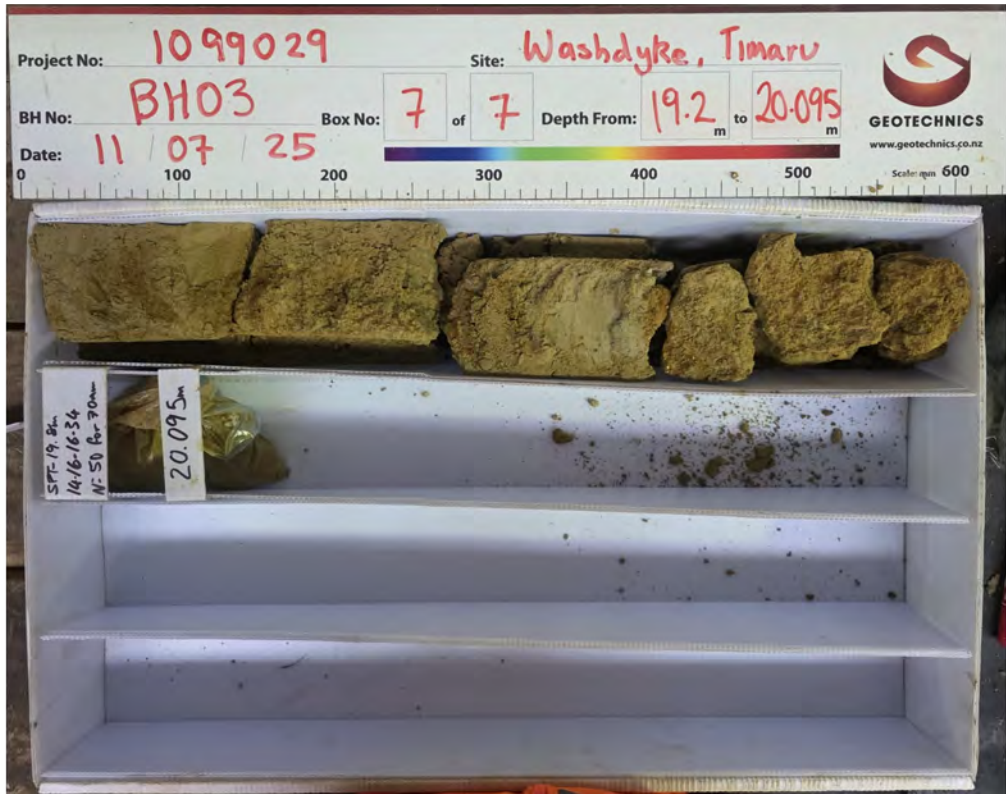
13.10-16.10m



16.10-19.20m

CORE PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5086969.00 mN 1461052.00 mE	DRILL TYPE: Fraste XL 170 Duo	HOLE STARTED: 30/06/2025
R.L.:	2.69m	METHOD: Sonic core drilling	HOLE FINISHED: 30/06/2025
DATUM:	NZVD2016	DRILL FLUID: WATER	DRILLED BY: Pro Drill
			LOGGED BY: SHTH CHECKED: PELE



19.20-20.10m

Appendix C Test pit logs

EXCAVATION LOG

Excavation Id.: **TP-01**

SHEET: 1 OF 1

PROJECT: Waitatkaio Seadown SW Drain Realignment LOCATION: Washdyke, Timaru JOB No.: 1099029.0000

CO-ORDINATES: 5088137 mN METHOD: Trial pit/trench EXCAV. STARTED: 02/07/2025
 (NZTM2000) 1461957 mE EQUIPMENT: 14T EXCAV. FINISHED: 02/07/2025

R.L.: 2.35m OPERATOR: Paul Smith LOGGED BY: SAMP
 DATUM: NZVD2016 DIMENSIONS: 3m by 0.4m CHECKED BY: PELE

EXCAVATION TESTS				ENGINEERING DESCRIPTION										GEOLOGICAL	
PENETRATION	SUPPORT	WATER	SCALA PENETROMETER (Blows/50mm)	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (kPa, kN/m ²)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3			0 1 2 3 4 5 6 7 8 9										12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87 90 93 96 99 102 105 108 111 114 117 120 123 126 129 132 135 138 141 144 147 150 153 156 159 162 165 168 171 174 177 180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228 231 234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282 285 288 291 294 297 300 303 306 309 312 315 318 321 324 327 330 333 336 339 342 345 348 351 354 357 360 363 366 369 372 375 378 381 384 387 390 393 396 399 402 405 408 411 414 417 420 423 426 429 432 435 438 441 444 447 450 453 456 459 462 465 468 471 474 477 480 483 486 489 492 495 498 501 504 507 510 513 516 519 522 525 528 531 534 537 540 543 546 549 552 555 558 561 564 567 570 573 576 579 582 585 588 591 594 597 600 603 606 609 612 615 618 621 624 627 630 633 636 639 642 645 648 651 654 657 660 663 666 669 672 675 678 681 684 687 690 693 696 699 702 705 708 711 714 717 720 723 726 729 732 735 738 741 744 747 750 753 756 759 762 765 768 771 774 777 780 783 786 789 792 795 798 801 804 807 810 813 816 819 822 825 828 831 834 837 840 843 846 849 852 855 858 861 864 867 870 873 876 879 882 885 888 891 894 897 900 903 906 909 912 915 918 921 924 927 930 933 936 939 942 945 948 951 954 957 960 963 966 969 972 975 978 981 984 987 990 993 996 999 1002 1005 1008 1011 1014 1017 1020 1023 1026 1029 1032 1035 1038 1041 1044 1047 1050 1053 1056 1059 1062 1065 1068 1071 1074 1077 1080 1083 1086 1089 1092 1095 1098 1101 1104 1107 1110 1113 1116 1119 1122 1125 1128 1131 1134 1137 1140 1143 1146 1149 1152 1155 1158 1161 1164 1167 1170 1173 1176 1179 1182 1185 1188 1191 1194 1197 1200 1203 1206 1209 1212 1215 1218 1221 1224 1227 1230 1233 1236 1239 1242 1245 1248 1251 1254 1257 1260 1263 1266 1269 1272 1275 1278 1281 1284 1287 1290 1293 1296 1299 1302 1305 1308 1311 1314 1317 1320 1323 1326 1329 1332 1335 1338 1341 1344 1347 1350 1353 1356 1359 1362 1365 1368 1371 1374 1377 1380 1383 1386 1389 1392 1395 1398 1401 1404 1407 1410 1413 1416 1419 1422 1425 1428 1431 1434 1437 1440 1443 1446 1449 1452 1455 1458 1461 1464 1467 1470 1473 1476 1479 1482 1485 1488 1491 1494 1497 1500 1503 1506 1509 1512 1515 1518 1521 1524 1527 1530 1533 1536 1539 1542 1545 1548 1551 1554 1557 1560 1563 1566 1569 1572 1575 1578 1581 1584 1587 1590 1593 1596 1599 1602 1605 1608 1611 1614 1617 1620 1623 1626 1629 1632 1635 1638 1641 1644 1647 1650 1653 1656 1659 1662 1665 1668 1671 1674 1677 1680 1683 1686 1689 1692 1695 1698 1701 1704 1707 1710 1713 1716 1719 1722 1725 1728 1731 1734 1737 1740 1743 1746 1749 1752 1755 1758 1761 1764 1767 1770 1773 1776 1779 1782 1785 1788 1791 1794 1797 1800 1803 1806 1809 1812 1815 1818 1821 1824 1827 1830 1833 1836 1839 1842 1845 1848 1851 1854 1857 1860 1863 1866 1869 1872 1875 1878 1881 1884 1887 1890 1893 1896 1899 1902 1905 1908 1911 1914 1917 1920 1923 1926 1929 1932 1935 1938 1941 1944 1947 1950 1953 1956 1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992 1995 1998 2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055 2058 2061 2064 2067 2070 2073 2076 2079 2082 2085 2088 2091 2094 2097 2100 2103 2106 2109 2112 2115 2118 2121 2124 2127 2130 2133 2136 2139 2142 2145 2148 2151 2154 2157 2160 2163 2166 2169 2172 2175 2178 2181 2184 2187 2190 2193 2196 2199 2202 2205 2208 2211 2214 2217 2220 2223 2226 2229 2232 2235 2238 2241 2244 2247 2250 2253 2256 2259 2262 2265 2268 2271 2274 2277 2280 2283 2286 2289 2292 2295 2298 2301 2304 2307 2310 2313 2316 2319 2322 2325 2328 2331 2334 2337 2340 2343 2346 2349 2352 2355 2358 2361 2364 2367 2370 2373 2376 2379 2382 2385 2388 2391 2394 2397 2400 2403 2406 2409 2412 2415 2418 2421 2424 2427 2430 2433 2436 2439 2442 2445 2448 2451 2454 2457 2460 2463 2466 2469 2472 2475 2478 2481 2484 2487 2490 2493 2496 2499 2502 2505 2508 2511 2514 2517 2520 2523 2526 2529 2532 2535 2538 2541 2544 2547 2550 2553 2556 2559 2562 2565 2568 2571 2574 2577 2580 2583 2586 2589 2592 2595 2598 2601 2604 2607 2610 2613 2616 2619 2622 2625 2628 2631 2634 2637 2640 2643 2646 2649 2652 2655 2658 2661 2664 2667 2670 2673 2676 2679 2682 2685 2688 2691 2694 2697 2700 2703 2706 2709 2712 2715 2718 2721 2724 2727 2730 2733 2736 2739 2742 2745 2748 2751 2754 2757 2760 2763 2766 2769 2772 2775 2778 2781 2784 2787 2790 2793 2796 2799 2802 2805 2808 2811 2814 2817 2820 2823 2826 2829 2832 2835 2838 2841 2844 2847 2850 2853 2856 2859 2862 2865 2868 2871 2874 2877 2880 2883 2886 2889 2892 2895 2898 2901 2904 2907 2910 2913 2916 2919 2922 2925 2928 2931 2934 2937 2940 2943 2946 2949 2952 2955 2958 2961 2964 2967 2970 2973 2976 2979 2982 2985 2988 2991 2994 2997 3000		
							2	TS	0.00m: SILT, some sand, trace rootlets; dark brown. Moist. Sand, fine. (TOPSOIL).		M				Topsoil
							0.5	TS							
							1.0	TS	0.80m: Silty sandy fine to coarse GRAVEL; light grey. Moist. Gravel, rounded to sub- rounded; sand, fine to coarse. 1.00m: Some silt; brown.						
							1.5		1.50m: Greyish brown. Wet.						
							2.0								
							2.5								
							3.0		3m: END OF TEST PIT. Target depth reached.						
							-1								

SKETCH / PHOTO:



0.0 - 3.0m:

COMMENTS:

Hole Depth
3m

Scale 1:29

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP-02**

SHEET: 1 OF 1

PROJECT: Waitatkaio Seadown SW Drain Realignment LOCATION: Washdyke, Timaru JOB No.: 1099029.0000

CO-ORDINATES: 5087959 mN METHOD: Trial pit/trench EXCAV. STARTED: 02/07/2025
 (NZTM2000) 1461769 mE EQUIPMENT: 14T EXCAV. FINISHED: 02/07/2025

R.L.: 5.06m OPERATOR: Paul Smith LOGGED BY: SAMP
 DATUM: NZVD2016 DIMENSIONS: 4m by 0.4m CHECKED BY: PELE

EXCAVATION TESTS				ENGINEERING DESCRIPTION										GEOLOGICAL	
PENETRATION	SUPPORT	WATER	SCALA PENETROMETER (Blows/50mm)	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (kPa, $c_{u,15}$)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3			0 1 2 3 4 5 6 7 8 9										12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87 90 93 96 99 102 105 108 111 114 117 120 123 126 129 132 135 138 141 144 147 150 153 156 159 162 165 168 171 174 177 180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228 231 234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282 285 288 291 294 297 300		
				TP2 @ 0.10m Particle size distribution test		5		TS	0.00m: Organic sandy SILT, some gravel, minor clay; dark brown. Moist. Sand, fine; gravel, fine, rounded to sub-rounded. (PLACED TOPSOIL).		M				
							0.5	TS							
							1.0	TS							
							1.5	TS							
							2.0	TS	1.80m: Soft plastic fragments noted						
							2.5	TS	2.20m: Silty sandy fine to coarse GRAVEL; light grey. Moist. Gravel, rounded to sub- rounded; sand, fine to coarse. 2.40m: Trace cobbles; brown. Moist to wet. Cobbles, rounded to sub-rounded.						
				TP2_2 @ 2.50m Particle size distribution test and Heavy Compaction Test			3.0	TS	3m: END OF TEST PIT. Target depth reached.						

SKETCH / PHOTO:



0.0 - 3.0m:

COMMENTS:

Hole Depth
3m

Scale 1:29

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP-03**

SHEET: 1 OF 1

PROJECT: Waitatkaio Seadown SW Drain Realignment LOCATION: Washdyke, Timaru JOB No.: 1099029.0000

CO-ORDINATES: 5087627 mN METHOD: Trial pit/trench EXCAV. STARTED: 01/07/2025
(NZTM2000) 1461613 mE EQUIPMENT: 14T EXCAV. FINISHED: 01/07/2025

R.L.: 1.84m OPERATOR: Paul Smith LOGGED BY: SAMP
DATUM: NZVD2016 DIMENSIONS: 3m by 0.4m CHECKED BY: PELE

EXCAVATION TESTS				ENGINEERING DESCRIPTION										GEOLOGICAL	
PENETRATION	SUPPORT	WATER	SCALA PENETROMETER (Blows/50mm)	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (kPa, %s)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3			0 1 2 3 4 5 6 7 8 9										12 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		
		01/07/2025 Seepage ▼							0.00m: Organic SILT, minor sand; dark brown. Moist. (TOPSOIL). 0.15m: SILT, some sand and some gravel, trace rootlets and trace clay; light grey. Moist. Sand, fine to medium; gravel, fine to medium, rounded to sub-rounded. 0.30m: Sandy fine to coarse GRAVEL, some silt; light grey. Wet. Gravel, rounded to sub-rounded; sand, fine to coarse. 1.00m: Trace cobbles; greyish brown. Cobbles, rounded to sub-rounded.		M				Top
							0.5				W				Quaternary outwash plains (Q2a)
							1								
							2.0								
							2.5		2.5m: END OF TEST PIT. (Walls caving)						
							3.0								

SKETCH / PHOTO:



0.0 - 2.5m:

COMMENTS:

Hole Depth
2.5m

Scale 1:29

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP-05**

SHEET: 1 OF 1

PROJECT: Waitaitkaro Seadown SW Drain Realignment LOCATION: Washdyke, Timaru JOB No.: 1099029.0000

CO-ORDINATES: 5087236 mN METHOD: Trial pit/trench EXCAV. STARTED: 01/07/2025
 (NZTM2000) 1461334 mE EQUIPMENT: 14T EXCAV. FINISHED: 01/07/2025

R.L.: 2.63m OPERATOR: Paul Smith LOGGED BY: SAMP
 DATUM: NZVD2016 DIMENSIONS: 3m by 0.4m CHECKED BY: PELE

EXCAVATION TESTS								ENGINEERING DESCRIPTION					GEOLOGICAL		
PENETRATION	SUPPORT	WATER	SCALA PENETROMETER (Blows/50mm)	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (kPa, kN/m ²)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3		01/07/2025 Seepage ▼	0 1 2 3 4 5 6 7 8 9	TP5 @ 1.00m Particle size distribution test and Heavy Compaction Test					0.00m: Organic SILT, minor sand; dark brown to black. Moist. Sand, fine. (TOPSOIL). 0.20m: Gravelly SILT, some sand, trace clay; light grey. Moist. Gravel, fine to medium; sand, fine to coarse. 0.40m: Sandy fine to coarse GRAVEL, trace silt; light grey grading to blueish grey. Saturated. Gravel, rounded to sub-rounded; sand, fine to coarse. 1.00m: Minor cobbles; light grey to brown. Cobbles, rounded to sub-rounded. 2.1m: END OF TEST PIT. (Walls caving)		M 				

SKETCH / PHOTO:



0.0 - 2.1m:

COMMENTS:

Hole Depth

2.1m

Scale 1:29

Rev.: A

Appendix D Hand augered borehole logs

HAND AUGER LOG

HOLE Id: **HA-01**

SHEET: 1 OF 1

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru		JOB No.: 1099029.0000										
CO-ORDINATES: 5088390 mN (NZTM2000) 1462092 mE		DRILL TYPE: HA		HOLE STARTED: 02/07/2025										
R.L.: 2.55m		METHOD: Hand auger		HOLE FINISHED: 02/07/2025										
DATUM: NZVD2016				DRILLED BY: Tonkin + Taylor Ltd										
				LOGGED BY: SAMP CHECKED: PELE										
GEOLOGICAL		METHOD OBSERVATIONS				ENGINEERING DESCRIPTION								
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SILT CONTENT (%) SHEAR STRENGTH (kPa)	DESCRIPTION
Fill		100	HA	0.5							D-M			0.00m: Organic SILT, some sand; dark brown. Dry to moist, topsoil. Sand, fine; organics, rootlets (fresh).
Quaternary outwash plains (Q2a)				2										0.10m: Gravelly SILT, some sand, trace clay; light grey. Dry to moist. Gravel, fine, rounded to sub-rounded; sand, fine to coarse.
				3										
				4										
				5										
				6										
				2										
				9										
				20 >										
								0.5						
								2						
								1						
								1.0						
								1.5						
0.2m: END OF HAND AUGER. Unable to penetrate.														

COMMENTS:

Hole Depth
0.2m

Scale 1:10

Rev.: A

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5088390 mN 1462092 mE	DRILL TYPE: HA	HOLE STARTED: 02/07/2025
R.L.:	2.55m	METHOD: Hand auger	HOLE FINISHED: 02/07/2025
DATUM:	NZVD2016		DRILLED BY: Tonkin + Taylor Ltd
			LOGGED BY: SAMP CHECKED: PELE



0.00-0.20m

HAND AUGER PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES:	5088232 mN (NZTM2000) 1461983 mE	DRILL TYPE: HA	HOLE STARTED: 02/07/2025
R.L.:	3.30m	METHOD: Hand auger	HOLE FINISHED: 02/07/2025
DATUM:	NZVD2016		DRILLED BY: Tonkin + Taylor Ltd
			LOGGED BY: SAMP CHECKED: PELE



0.00-1.40m

HAND AUGER LOG

HOLE Id: **HA-03**

SHEET: 1 OF 1

PROJECT: Waitartkao Seadown SW Drain Realignment				LOCATION: Washdyke, Timaru				JOB No.: 1099029.0000							
CO-ORDINATES: 5088063 mN (NZTM2000) 1461865 mE				DRILL TYPE: HA				HOLE STARTED: 02/07/2025							
R.L.: 2.89m				METHOD: Hand auger				HOLE FINISHED: 02/07/2025							
DATUM: NZVD2016								DRILLED BY: Tonkin + Taylor Ltd							
								LOGGED BY: SAMP CHECKED: PELE							
GEOLOGICAL		METHOD OBSERVATIONS						ENGINEERING DESCRIPTION							
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS		WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm)	TESTS	SAMPLES	R _L (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL STRENGTH SHEAR (S _u , kPa)	DESCRIPTION
					0 1 2 3 4 5 6 7 8 9										
Topsoil					0					TS		M			0.00m: Organic SILT, minor sand; dark brown. Moist. Sand, fine. (PLACED TOPSOIL).
					0					TS					
					1					TS					
					2					TS					
					4					TS					
					4					TS					
					2					TS					
					2					TS					
					2					TS					
					3					TS					
Quaternary outwash plains (Q2a)					2				0.5	TS		D-M			0.60m: SILT, trace clay and trace sand; light grey with orange mottling. Dry to moist. Sand, fine.
					3					TS					
					3					TS					
					4					TS					
					5					TS					
					7					TS					
					6					TS					
					6					TS					
					5					TS					
					4					TS					
					3				1.0	TS					1.20m: Trace gravel. Gravel, fine, rounded to sub-rounded.
					5					TS					
					10					TS					
					20 >>					TS					
										TS					
										TS					
										TS					
										TS					
										TS					
										TS					
									1.5						1.2m: END OF HAND AUGER. Unable to penetrate.

COMMENTS:

Hole Depth
1.2m

Scale 1:10

Rev.: A

HAND AUGER PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES:	5088063 mN (NZTM2000) 1461865 mE	DRILL TYPE: HA	HOLE STARTED: 02/07/2025
R.L.:	2.89m	METHOD: Hand auger	HOLE FINISHED: 02/07/2025
DATUM:	NZVD2016		DRILLED BY: Tonkin + Taylor Ltd
			LOGGED BY: SAMP CHECKED: PELE



0.00-1.20m

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5087735 mN 1461652 mE	DRILL TYPE: HA	HOLE STARTED: 01/07/2025
R.L.:	4.52m	METHOD: Hand auger	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016		DRILLED BY: Tonkin + Taylor Ltd
			LOGGED BY: SAMP CHECKED: PELE



0.00-1.00m

HAND AUGER LOG

HOLE Id: **HA-05**

SHEET: 1 OF 1

PROJECT: Waitatkaio Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru		JOB No.: 1099029.0000										
CO-ORDINATES: 5087167 mN (NZTM2000) 1461271 mE		DRILL TYPE: HA		HOLE STARTED: 02/07/2025										
R.L.: 1.76m		METHOD: Hand auger		HOLE FINISHED: 02/07/2025										
DATUM: NZVD2016				DRILLED BY: Tonkin + Taylor Ltd										
				LOGGED BY: SAMP CHECKED: PELE										
GEOLOGICAL		METHOD OBSERVATIONS				ENGINEERING DESCRIPTION								
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SLOPE SHEAR STRENGTH (kPa)	DESCRIPTION
Topsoil			HA	1						M			0.00m: Organic SILT, some sand; dark brown. Moist. Sand, fine. (TOPSOIL).	
				4										0.10m: SILT, minor sand, trace rootlets; light grey with orange mottling. Moist, low plasticity. Sand, fine.
Quaternary outwash plains (Q2a)		100	HA	4									0.50m: Minor gravel. Gravel, fine, rounded to sub-rounded.	
				6										
				4										
				3										
				3										
				3										
				3										
				9										
			HA	9									0.5m: END OF HAND AUGER. Unable to penetrate.	
				10										
				10										
				10										
				9										
				9										
				7										
				12 >>										
				10										
				12 >>										

COMMENTS:

Hole Depth
0.5m

Scale 1:10

Rev.: A

HAND AUGER PHOTOS

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES:	5087167 mN (NZTM2000) 1461271 mE	DRILL TYPE: HA	HOLE STARTED: 02/07/2025
R.L.:	1.76m	METHOD: Hand auger	HOLE FINISHED: 02/07/2025
DATUM:	NZVD2016		DRILLED BY: Tonkin + Taylor Ltd
			LOGGED BY: SAMP CHECKED: PELE



0.00-0.50m

HAND AUGER LOG

HOLE Id: **HA-06**

SHEET: 1 OF 1

PROJECT: Waitartkao Seadown SW Drain Realignment				LOCATION: Washdyke, Timaru				JOB No.: 1099029.0000							
CO-ORDINATES: 5087038 mN (NZTM2000) 1461134 mE				DRILL TYPE: HA				HOLE STARTED: 01/07/2025							
R.L.: 3.07m				METHOD: Hand auger				HOLE FINISHED: 01/07/2025							
DATUM: NZVD2016								DRILLED BY: Tonkin + Taylor Ltd							
								LOGGED BY: SAMP CHECKED: PELE							
GEOLOGICAL		METHOD OBSERVATIONS						ENGINEERING DESCRIPTION							
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS		WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL STRENGTH (kPa)	DESCRIPTION
					0 1 2 3 4 5 6 7 8 9										
Topsoil			100	HA	2 1 2 2 2 2 1.5 1.5			3				M			0.00m: Organic SILT, minor sand and minor gravel; dark brown. Moist. Sand, fine; gravel, fine to medium, rounded to sub-rounded. (TOPSOIL).
Quaternary outwash plains (Q2a)					1 1			0.5							0.40m: Gravelly fine to coarse SAND, trace silt; light brown. Moist. Gravel, fine to coarse.
					1 2 5 6 5 3 5 5 6 9 5 3 3 3 3 3 3 3 3 4 4 5 5 5 14 >> 12 >> 17 >>			2							0.5m: END OF HAND AUGER. Unable to penetrate.

COMMENTS:

Hole Depth
0.5m

Scale 1:10

Rev.: A

PROJECT: Waitartkao Seadown SW Drain Realignment		LOCATION: Washdyke, Timaru	JOB No.: 1099029.0000
CO-ORDINATES: (NZTM2000)	5087038 mN 1461134 mE	DRILL TYPE: HA	HOLE STARTED: 01/07/2025
R.L.:	3.07m	METHOD: Hand auger	HOLE FINISHED: 01/07/2025
DATUM:	NZVD2016		DRILLED BY: Tonkin + Taylor Ltd
			LOGGED BY: SAMP CHECKED: PELE



0.00-0.50m

Appendix E Laboratory Test Results

- Particle size distributions via wet sieve grading and hydrometer test
- Dry density / water content relationship



24 July 2025

Our Ref: 1100987.0071.0.0/Rep1

Customer Ref: 1099029

Tonkin & Taylor Limited
PO BOX 5271
Auckland 1141

Attention: Peter Lee

Dear Peter

101-150 Aorangi Road, Washdyke, Timaru
Laboratory Test Report

Samples from the above-mentioned site have been tested as received according to your instructions and the results are included in this report. Results apply only to the sample(s) tested.

Descriptions are enclosed for your information but are not covered under the IANZ endorsement of this report.

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

This report may be reproduced only in full.

Samples not destroyed during testing will be retained for one month from the date of this report before being discarded. If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report approved by:



.....
Jack Singh
Senior Laboratory Technician
Key Technical Person

Authorised for Geotechnics by:



.....
Vic O'Connor
Project Director



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

24-Jul-25

\\\\ttgroup.local\\corporate\\geotechnicsgroup\\projects\\1100987\\1100987.0071\\workingmaterial\\20250724.jasi.1100987.0071.0.0.rep1.doc
x



GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p. +64 3 361 0300

Geotechnics Project ID
Customer Project ID

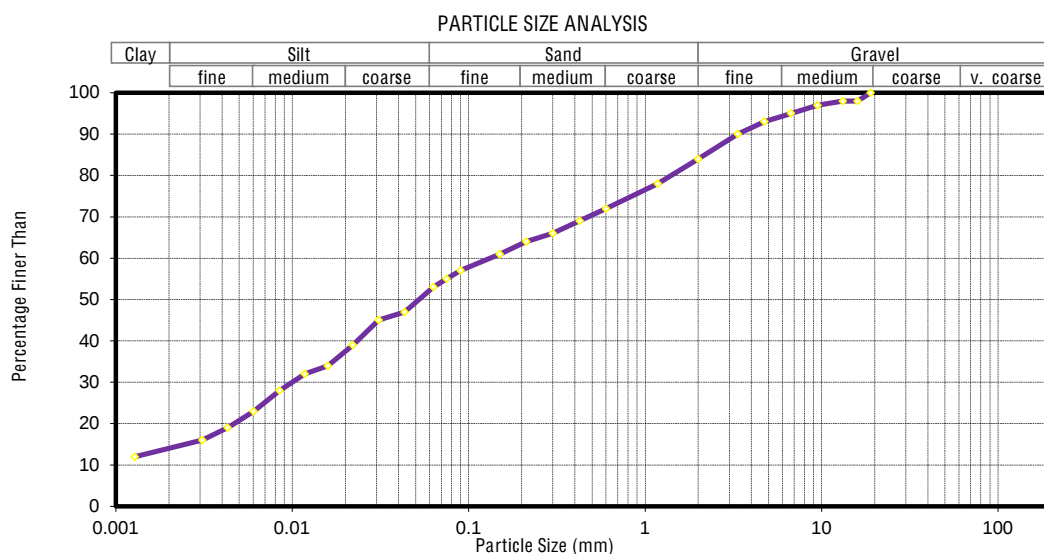
1100987.0071.0.0
1099029

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve Method)
Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.4 (Hydrometer Method)

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Description	Waitarakao Seadown Lab		
	Data	N/A		
SAMPLE	Geotechnics ID	CHCH202528-4		
	Reference	TP2	Depth	0.1m - 1.0m
	Description	Sandy SILT with minor clay and some gravel and trace rootlets dark brown. Moist.		
SPECIMEN	Reference	N/A	Depth	N/A
	Description	N/A		

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150.0	-	16.0	98	0.600	72
100.0	-	13.2	98	0.425	69
75.0	-	9.50	97	0.300	66
63.0	-	6.70	95	0.212	64
53.0	-	4.75	93	0.150	61
37.5	-	3.35	90	0.090	57
26.5	-	2.00	84	0.075	55
19.0	100	1.18	78	0.063	53

Equivalent Particle Diameter D (mm)	Percentage of Particles Finer than D (%)	Equivalent Particle Diameter D (mm)	Percentage of Particles Finer than D (%)
0.0453	47	0.0036	16
0.0326	45	0.0015	12
0.0243	39		
0.0177	34		
0.0131	32		
0.0096	28		
0.0070	23		
0.0050	19		

TEST REMARKS

• The material used for testing was natural, whole soil. • An assumed solid density value of 2.65 t/m³ was used. We do not take responsibility for misrepresentation or misinterpretation arising from the use of this assumed value.

Two representative sub samples were split from the original sample for wet sieve and hydrometer analysis. The wet sieve sample was washed over 0.063 mm test sieve, until the individual particles were clean. The material retained on 0.063 mm test sieve was oven dried and dry sieved. The hydrometer sample was oven dried at the end of the test to determine the mass passing 0.063 mm for hydrometer calculations. The sieve data was combined with the hydrometer analysis to give a continuous curve.

Suspension pH 8.0

The classification of sand-silt-clay components are described on the basis of particle size analysis.

Date tested: 16/07/2025

This test result is IANZ accredited.

Approved by KTP

JASI

Date

17/07/2025



45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p. +64 3 361 0300

Geotechnics Project ID

1100987.0071.0.0

Customer Project ID

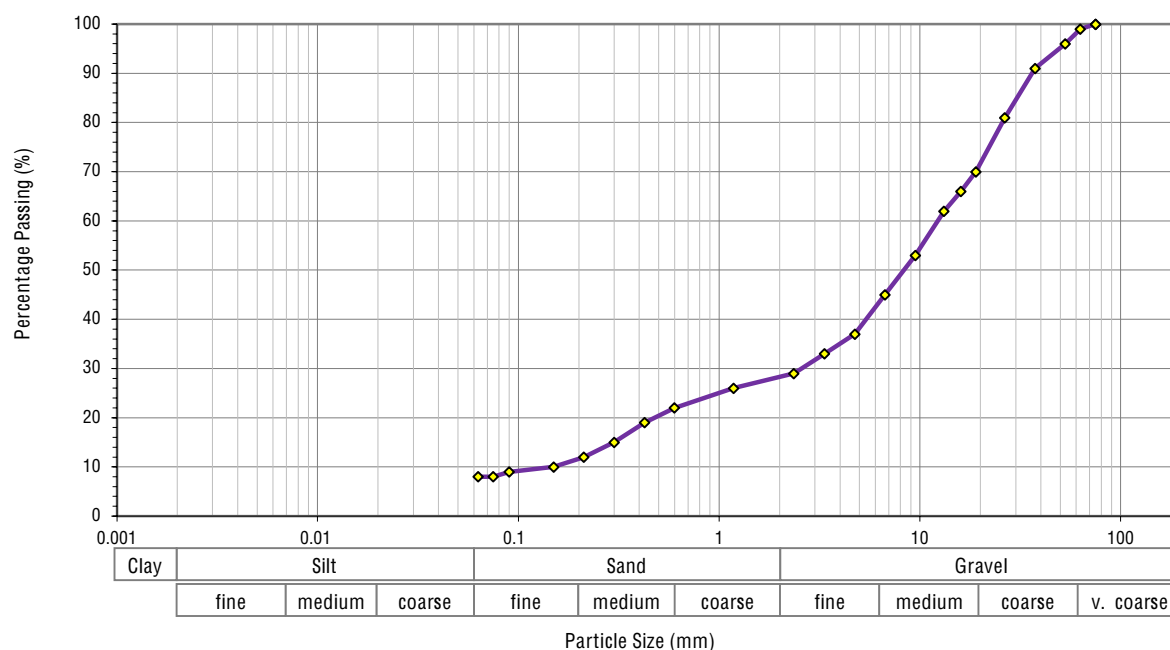
1099029

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Description	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Data	N/A		
SAMPLE	Geotechnics ID	CHCH2025285-1		
	Reference	TP2	Depth	2.5m - 3.0m
	Description	Sandy fine to coarse GRAVEL, with minor silt, grey. Wet. Sand fine to coarse.		
SPECIMEN	Reference	N/A	Depth	N/A
	Description	N/A		

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	81	4.75	37	0.300	15
100	-	19.0	70	3.35	33	0.212	12
75.0	100	16.0	66	2.36	29	0.150	10
63.0	99	13.2	62	1.18	26	0.090	9
53.0	96	9.50	53	0.600	22	0.075	8
37.5	91	6.70	45	0.425	19	0.063	8

TEST REMARKS

- The material used for testing was natural, Whole soil
- The percentage passing the <0.063mm was obtained by difference.

This test result is IANZ accredited.

Approved by KTP

JASI

Date

9/07/2025



45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p. +64 3 361 0300

Geotechnics Project ID

1100987.0071.0.0

Customer Project ID

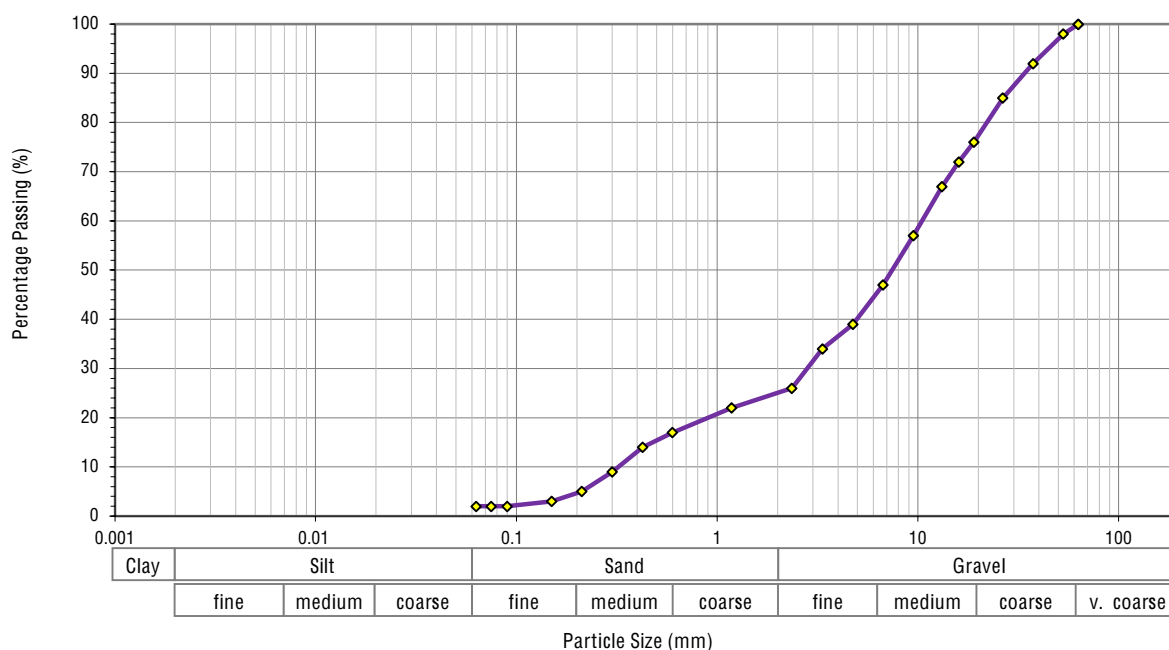
1099029

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973	
	Description	101-150 Aorangi Road, Washdyke, Timaru 7973	
	Data	N/A	
SAMPLE	Geotechnics ID	CHCH202528-2	
	Reference	TP5	Depth 1.0m
	Description	Sandy fine to coarse GRAVEL with trace silt, grey. Moist to wet. Sand fine to coarse.	
SPECIMEN	Reference	N/A	Depth N/A
	Description	N/A	

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	85	4.75	39	0.300	9
100	-	19.0	76	3.35	34	0.212	5
75.0	-	16.0	72	2.36	26	0.150	3
63.0	100	13.2	67	1.18	22	0.090	2
53.0	98	9.50	57	0.600	17	0.075	2
37.5	92	6.70	47	0.425	14	0.063	2

TEST REMARKS

- The material used for testing was natural, Whole soil.
- The percentage passing the <0.063mm was obtained by difference.

This test result is IANZ accredited.

Approved by KTP

JASI

Date

9/07/2025



45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p. +64 3 361 0300

Geotechnics Project ID

1100987.0071.0.0

Customer Project ID

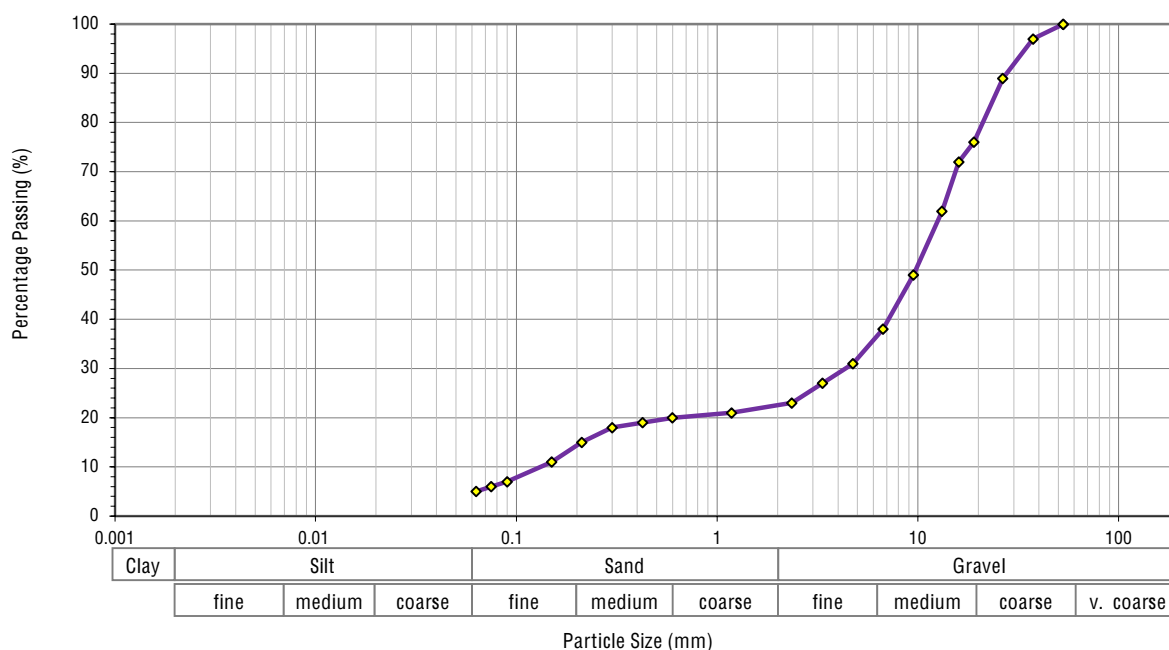
1099029

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Description	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Data	N/A		
SAMPLE	Geotechnics ID	CHCH202528-3		
	Reference	TP6	Depth	1.5m - 2.0m
	Description	Fine to coarse GRAVEL with some sand and trace silt, grey. Wet. Sand fine to coarse.		
SPECIMEN	Reference	N/A	Depth	N/A
	Description	N/A		

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	89	4.75	31	0.300	18
100	-	19.0	76	3.35	27	0.212	15
75.0	-	16.0	72	2.36	23	0.150	11
63.0	-	13.2	62	1.18	21	0.090	7
53.0	100	9.50	49	0.600	20	0.075	6
37.5	97	6.70	38	0.425	19	0.063	5

TEST REMARKS

• The material used for testing was natural, Whole soil • The percentage passing the <0.063mm was obtained by difference.

This test result is IANZ accredited.

Approved by KTP

JASI

Date

9/07/2025



45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p. +64 3 361 0300

Geotechnics Project ID
Customer Project ID

1100987.0071.0.0
1099029

Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.2 (Heavy Compaction)

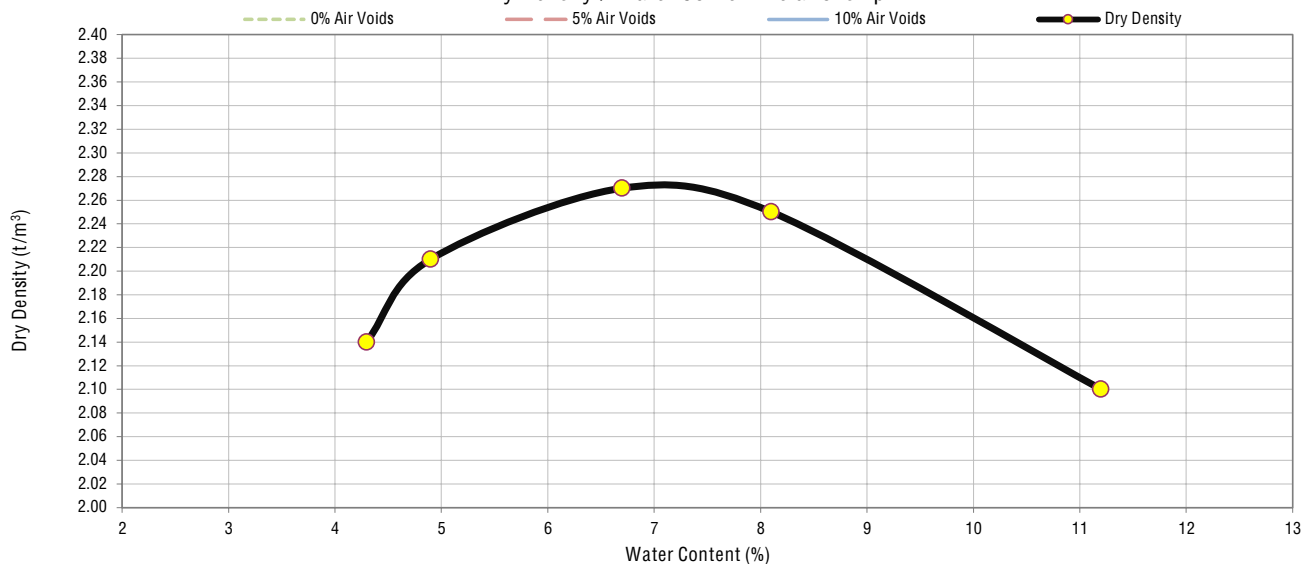
Determination of Shear Strength by the Laboratory Vane Method - BS 1377 Part 7:1990 - Clause 3

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Description	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Data	N/A		
SAMPLE	Geotechnics ID	CHCH202528-1		
	Reference	TP2	Depth	2.5m - 3.0m
	Description	Sandy fine to coarse GRAVEL, with minor silt, grey. Wet. Sand fine to coarse.		
SPECIMEN	Reference	N/A	Depth	N/A
	Description	N/A		

TEST RESULTS

Dry Density / Water Content Relationship



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
2.27 t/m³	7.0%	N/A	N/A

Natural Water Content	(NWC)						
Water Content	(%)	4.3	4.9	6.7	8.1	11.2	
Dry Density	(t/m³)	2.144	2.211	2.270	2.254	2.101	
Undrained Shear Strength	(kPa)	N/A	N/A	N/A	N/A	N/A	

TEST REMARKS

- The material used for testing was natural, fraction <19mm sieve. • The amount of material retained on a 19mm sieve was 29% by wet mass.

This test result is IANZ accredited.

Approved by KTP JASI Date 18/07/2025



45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p. +64 3 361 0300

Geotechnics Project ID
Customer Project ID

1100987.0071.0.0
1099029

Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.2 (Heavy Compaction)

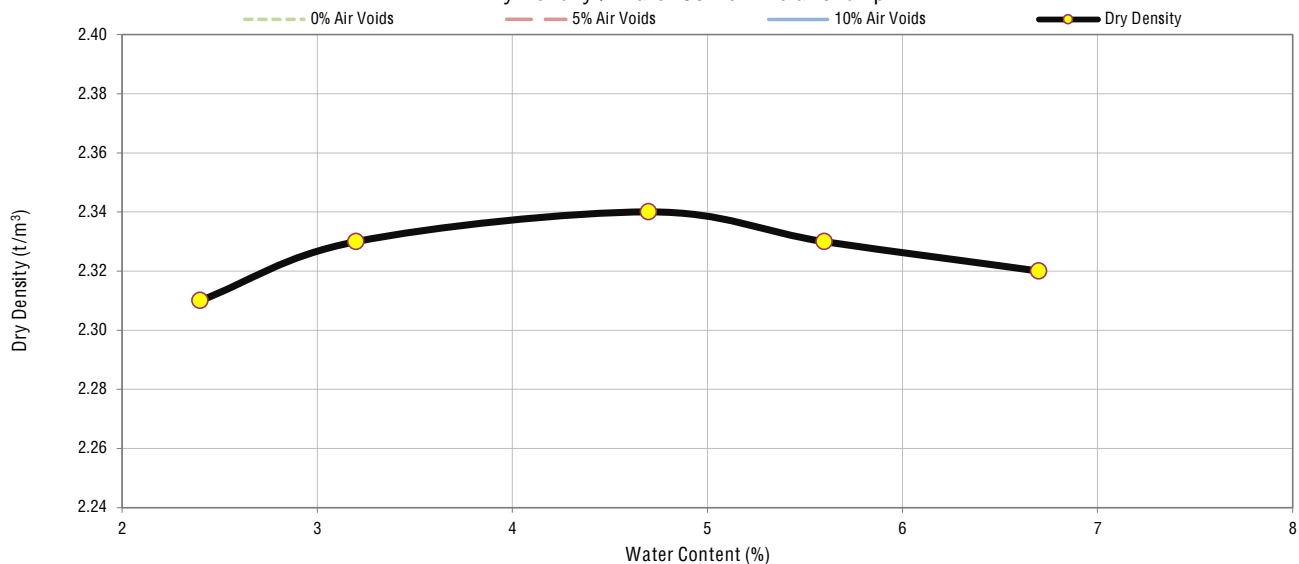
Determination of Shear Strength by the Laboratory Vane Method - BS 1377 Part 7:1990 - Clause 3

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Description	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Data	N/A		
SAMPLE	Geotechnics ID	CHCH202528-2		
	Reference	TP5	Depth	1.0m
	Description	Sandy fine to coarse GRAVEL with trace silt, grey. Moist to wet. Sand fine to coarse.		
SPECIMEN	Reference	N/A	Depth	N/A
	Description	N/A		

TEST RESULTS

Dry Density / Water Content Relationship



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
2.34 t/m³	4.8%	N/A	N/A

Natural Water Content (NWC)					✓		
Water Content (%)	2.4	3.2	4.7	5.6	6.7		
Dry Density (t/m³)	2.312	2.327	2.341	2.334	2.321		
Undrained Shear Strength (kPa)	N/A	N/A	N/A	N/A	N/A		

TEST REMARKS

- The material used for testing was natural, fraction <19mm sieve.
- The amount of material retained on a 19mm sieve was 23% by wet mass.

This test result is IANZ accredited.

Approved by KTP JASI Date 18/07/2025



45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p. +64 3 361 0300

Geotechnics Project ID
Customer Project ID

1100987.0071.0.0
1099029

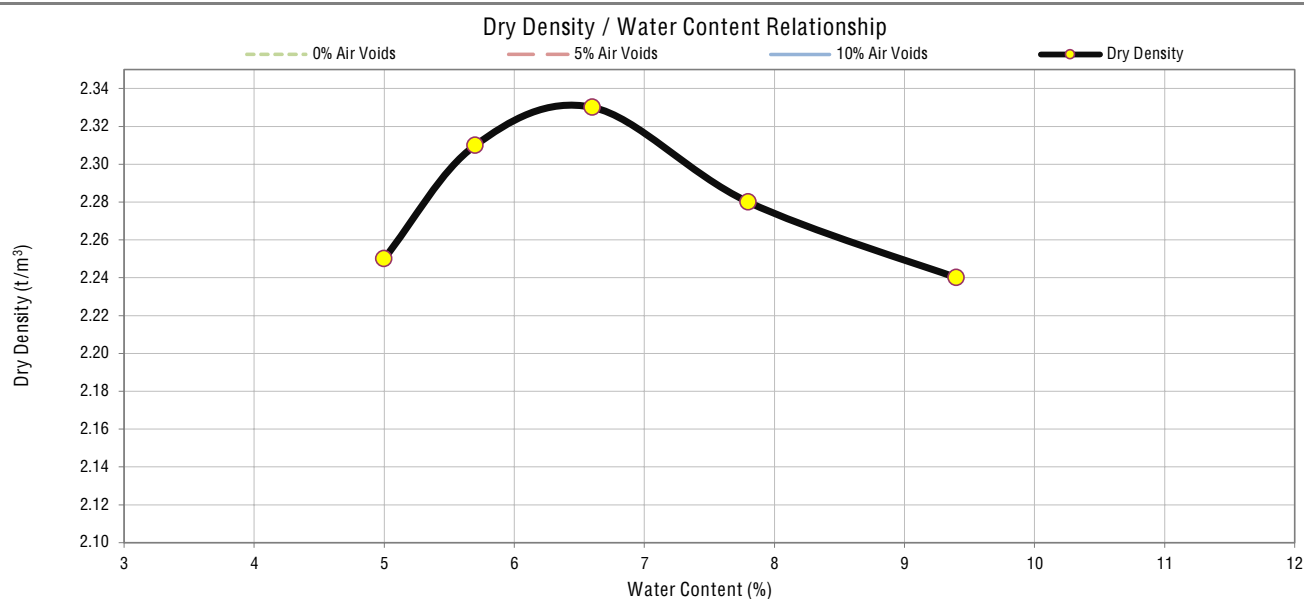
Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.2 (Heavy Compaction)

Determination of Shear Strength by the Laboratory Vane Method - BS 1377 Part 7:1990 - Clause 3

TEST DETAILS

LOCATION	ID	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Description	101-150 Aorangi Road, Washdyke, Timaru 7973		
	Data	N/A		
SAMPLE	Geotechnics ID	CHCH202528-3		
	Reference	TP6	Depth	1.5m - 2.0
	Description	Fine to coarse GRAVEL with some sand and trace silt, grey. Wet. Sand fine to coarse.		
SPECIMEN	Reference	N/A	Depth	N/A
	Description	N/A		

TEST RESULTS



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
2.33 t/m³	6.5%	N/A	N/A

Natural Water Content	(NWC)						
Water Content	(%)	5.0	5.7	6.6	7.8	9.4	
Dry Density	(t/m³)	2.245	2.309	2.325	2.277	2.243	
Undrained Shear Strength	(kPa)	N/A	N/A	N/A	N/A	N/A	

TEST REMARKS

- The material used for testing was natural, fraction <19mm sieve.
- The amount of material retained on a 19mm sieve was 24% by wet mass.

This test result is IANZ accredited.

Approved by KTP JASI Date 18/07/2025

www.tonkintaylor.co.nz