

MANGERE WEST STAGE 1

Superlot MW-A17

Geotechnical Completion Report

Document Control

MANGERE WEST STAGE 1– SUPERLOT MW-A17 – GEOTECHNICAL COMPLETION REPORT

DATE	VERSION	DESCRIPTION	PREPARED BY	REVIEWED BY	AUTHORISED BY
January 2023	1.0	Geotechnical Completion Report	Scott Zhang	Elby Tang	Elby Tang

Distribution

Kāinga Ora - Homes and Communities

1 PDF copy

Piritahi

1 PDF copy

Contents

1.0	Introduction	1
2.0	Geotechnical Investigation Report.....	1
3.0	Site visits.....	1
4.0	Earthworks	1
4.1	Earthworks subgrade	1
4.1.1	Natural Soils.....	2
5.0	Infrastructure	2
5.1	Infrastructure removal	2
5.2	Infrastructure Installation.....	3
6.0	Statement of professional opinion on suitability of land for building construction	4
7.0	Applicability.....	6

Appendix A – Site Observation Reports

Appendix B – As Built Plans

Appendix C – Piritahi Test Results

Appendix D – Geotechnics Test Results

Appendix E – Piritahi ITPs

Appendix F – Foundation maintenance and footing performance: a homeowner's guide

1.0 Introduction

Piritahi was engaged by Kāinga Ora - Homes and Communities to provide geotechnical observations during the construction stage of the Mangere West Project, Stage 1.

Construction works to date on Superlot MW-A17 comprised:

- Removal of the existing buildings;
- Surficial soil strip to remove potentially contaminated soils (see Site Validation Report¹);
- Decommissioning, removal and backfill of a stormwater line and two wastewater lines.
- Removal and backfill of three stormwater and nine wastewater lot connections.
- Installation of a wastewater manhole

2.0 Geotechnical Investigation Report

The Geotechnical Investigation Report for this site was provided by CMW Geosciences, "Geotechnical Investigation Report for Stage 1E of Proposed Residential Development in Mangere Bridge South", dated October 2018, Revision.0.

3.0 Site visits

Site visits to observe construction were carried out as summarised in Table 1 below and discussed in this report. Site visit reports are provided in Appendix A.

Table 1: Summary of geotechnical observations on Superlot MW-A17

DATE	INSPECTION BY	DESCRIPTION
15/10/2022	Cameron Taylor	Subgrade testing for WW manhole installation
16/12/2022	Cameron Taylor and Scott Zhang	Site walkover inspection and soil testing on finished subgrade level (shear vane and Scala penetrometer testing).

4.0 Earthworks

4.1 Earthworks subgrade

The existing houses within Superlot MW-A17 have been removed. An approximately 300mm thick surficial soil strip (including topsoil) was undertaken across the site extent to remove potentially contaminated soils. The exposed subgrade beneath the surface strip comprised natural soils. Our observations of the material conditions in these areas are presented in the following sections.

¹ Piritahi Alliance. 19 January 2023. Site Validation Report – Mangere West A Stage 1 Superlot MW-A17.

4.1.1 Natural Soils

Natural soils comprising Takanini Formation clay and silt were observed across the site. Shear vane and Scala penetrometer testing was undertaken on the finished subgrade level in natural soils by Piritahi Geotechnical Engineers. The shear vane test results generally ranged between 95 and 221+ kPa (unable to penetrate). The Scala penetrometer testing recorded blow counts ranged between 0.5 to 5 blows per 50mm penetration, on average in excess of 1 blow per 50 mm across the entire superlot.

The test location plans and results for the earthworks testing carried out by Piritahi Geotechnical Engineers can be found in Appendix A.

5.0 Infrastructure

5.1 Infrastructure removal

A stormwater (SW) line was decommissioned and removed from within the superlot. Backfill of the removed 1.1m deep SW trench was carried out using GAP65. Clegg impact hammer testing carried out by the Piritahi Construction team, recording CIV ranging 30 to 59. Nuclear densometer testing recorded an average maximum dry density of 93%. The backfill for this removed stormwater line complies with the Piritahi Earthwork Fill ITP requirements.

A stormwater manhole at the west end of the SW line was removed. Backfill of the removed 0.6m deep (measured from the base of the SW trench) SW manhole trench was carried out using GAP65. Clegg impact hammer testing carried out by the Piritahi Construction team between 1.3 m bgl and 1.9 m bgl, recording CIV ranging 32 to 53. Nuclear densometer testing recorded an average maximum dry density of 93%. The backfill for this removed stormwater line complies with the Piritahi Earthwork Fill ITP requirements.

Two wastewater (WW) lines, along with a WW manhole connecting them, were also decommissioned and removed from within the superlot. The depth of the two WW trenches are 1.3m and 1.6m, respectively. Backfill of the removed WW trenches was carried out using GAP65. Clegg impact hammer testing carried out by the Piritahi Construction team, recording CIV ranging 30 to 61. Nuclear densometer testing recorded an average maximum dry density of 93%. The backfill for the two removed wastewater line complies with the Piritahi Earthwork Fill ITP requirements.

Approximately 0.3m to 1.0m deep trenches (depth measured following the strip for soil contaminants) were excavated to remove 12 decommissioned lot connections comprising three stormwater and nine wastewater connections. Backfill for the trenches was carried out using GAP65 and Clegg impact hammer testing carried out by the Piritahi Construction team. Clegg Impact Values (CIV) generally ranging 30 to 53 were measured. Nuclear densometer testing were carried out on nine lot connections trenches with depth greater than 600mm, recorded an average maximum dry density of 93%. The CIV and NDM readings meet the Earthworks ITP requirements.

The test frequency and methodology are shown on the Piritahi Inspection and Test Plan (ITP). The test location plans and results for the earthworks testing carried out by Piritahi Geotechnical Engineers and the Piritahi construction team can be found in Appendix C. The test location plans and results for the earthworks testing carried out by Geotechnics can be found in Appendix D. The as built plan is attached in Appendix B and the Piritahi ITP is attached in Appendix E.

5.2 Infrastructure Installation

New infrastructure was installed within Superlot MW-A17, this comprised the following utilities:

- A new stormwater manhole (WWMH A-1) installed near the southern portion of the western boundary
- Shear vane testing, conducted at the base of excavation of the new manhole (MH 5-2), measured undrained shear strengths between 120 and 145 kPa. No undercut was required at the base of this manhole.

Backfill around the manhole was carried out using GAP65 hardfill. Testing of the backfill recorded CIV readings from 30 to 48. Nuclear densometer testing recorded an average maximum dry density of 94%. The backfill for this installed WW manhole complies with the Piritahi Earthwork Fill ITP requirements.

The manhole installation and test records are provided in Appendix C and Appendix D. The new manhole is shown on the as built plan in Appendix B.

6.0 Statement of professional opinion on suitability of land for building construction

I, Elby Tang, of Piritahi, 139 Quay St, Auckland 1010, hereby confirm that:

1. I am a geo-professional as defined in clause 1.2.2 of NZ 4404:2010 and was retained by the Developer as the geo-professional on Stage 1 of the Mangere West Development.
2. The extent of the preliminary investigations are described in the Piritahi Geotechnical Investigation Report provided by CMW Geosciences (dated October 2018, Rev. 0). As noted in the report, the scope of this investigation report is limited, as it was carried out prior to design of the development. Depending on the proposed development, supplementary geotechnical investigations may be required to inform detailed design and building consent.
3. Construction works carried out by Piritahi at this site comprise:
 - a. Removal of existing buildings;
 - b. Stripping of surficial soils to remove potential contaminants;
 - c. Removal and backfill of decommissioned lot service connections;
 - d. Removal and backfill of two WW lines, along with a manhole connecting them;
 - e. Removal and backfill of a SW line and a manhole attached to its western end; and
 - f. Installation of a WW manhole.
4. The extent of my inspections during construction, and the results of all the tests and/or evaluations carried out are described in this Piritahi Geotechnical Completion Report dated December 2022, version 1.0.
5. In my professional opinion, not to be construed as a guarantee, I consider that:
 - a. Observations of the underlying soils by Piritahi to date are generally in line with the findings of the CMW Geosciences Geotechnical Investigation Report.
 - b. Based on the site observations and subgrade testing undertaken, the natural soils on the site does not meet the definition of "good ground" as outlined in NZS 3604-2011 with regards to bearing capacity, expansivity and liquefaction. Foundations on soils will need to be designed for Class H1 conditions under AS2870 (highly expansive).
 - c. The existing lot service connections indicated on the as built plans have been decommissioned and backfilled with compacted hardfill backfill, up to 1.0m deep. Clegg Impact Values generally ranges between 30 to 53 were measured.
 - d. A decommissioned stormwater line was removed and backfilled. The compacted hardfill backfill for the approximately 1.1m deep SW line trench achieved average Clegg Impact Values ranging 30 to 59 and the average maximum dry density of 93%. This is in accordance with the Piritahi ITP for Earthworks Fill.
 - e. A SW manhole attached to the SW line was removed and backfilled. The compacted hardfill backfill for the approximately 0.6m deep (measured from the based of SW trench) manhole trench achieved average Clegg Impact Values ranging 32 to 53 and the average maximum dry density of 93%. This is in accordance with the Piritahi ITP for Earthworks Fill.

- f. Two decommissioned wastewater lines, along with a manhole connecting them were removed and backfilled. The compacted hardfill backfill for the approximately 1.3 m to 1.6m deep WW line trenches achieved average Clegg Impact Values ranging 30 to 61 and the average maximum dry density of 93%. This is in accordance with the Piritahi ITP for Earthworks Fill.
 - g. A new WW manhole was installed and excavation around it was backfilled. The compacted hardfill backfill for the approximately 0.9m deep WW manhole trench achieved Clegg Impact Values ranging 30 to 48 and the average maximum dry density of 94%. This is in accordance with the Piritahi ITP for Earthworks Fill.
 - h. The design of future works should take into account the existing service lines running across the western portion of the superlot, as shown on the as built plan (Appendix B). This may require avoidance, bridging or piling around the pipes.
 - i. The subgrade may deteriorate if left exposed to the weather for an extended period or to construction traffic. For this reason, the soils should be reinspected by a Chartered Geotechnical Engineer at the time of construction of any building foundations or pavements. It may be necessary to remove or recompact soils which have lost strength due to exposure to weather or traffic.
- 6. This professional opinion is furnished to the TA and the developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.
 - 7. This certificate shall be read in conjunction with my geotechnical report referred to in clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report and the geotechnical investigation report.
 - 8. General guidance for homeowners regarding expansive soils has been enclosed in Appendix F of this report.

Signed:



Date: 20 January 2023

Elby Tang

BE Civil (Hons), ME Civil (Hons) ,CMEngNZ

CPEng 1020514

AC Author PSA125042

7.0 Applicability

This report has been prepared for the exclusive use of our client Kāinga Ora - Homes and Communities Ltd 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.

Appendix A – Site Observation Reports

SITE VISIT RECORD SHEET

Project Name: Mangere West A Stage 1	Project No.: TOC57
Ref #:	Date/Time: 15/10/2022
Site Location: Harvard Place, Mangere (Superlot MW-A17)	Inspection by: Cameron Taylor
Weather: Fine	Inspection with: Sean Donnelly
Site Condition: Good	Purpose of Visit: WWMH A-1 Subgrade testing
Site Induction Completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	JSEA completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Health and safety observation notes:</p> <ul style="list-style-type: none"> • Working around moving plant • Working at heights • Slips trips and fall • Confined space • Open deep excavation 	
<p>Machinery onsite:</p> <ul style="list-style-type: none"> - 1x 24T excavator (Hitachi ZAXIS 225) 	
<p>Dust/erosion & sediment control:</p> <ul style="list-style-type: none"> - NA 	
<p>Current active works:</p> <ul style="list-style-type: none"> - Excavation and installation of new wastewater line within Mayflower Close 	
<p>Observations:</p> <p>A Piritahi Geotechnical Engineer visited site to observe the ground conditions for wastewater manhole A1 (WWMH A1). The ground conditions observed from the sides of the trench from ground level to approximately 1.3m depth comprise orange-brown volcanic ash silt/clay. From approximately 1.3 m depth to the base of the excavation, grey to dark grey Tauranga Group silt/clay was observed.</p> <p>Shear vanes were undertaken at the base of the excavation, resulting in undrained shear strength readings of 120 kPa to 145 kPa.</p> <p>As the per the Wastewater ITP for manhole subgrade with shear strengths greater than 80 kPa, no undercut is required.</p> <p>Groundwater was seen ponding at the base of the excavation. It was discussed with the construction team that this water and any loose material be removed from the excavation prior to the laying of hardfill. The construction team shall ensure that the backfill of the undercut and material surrounding the new pipe and manholes shall be maximum 200mm thick compacted thickness per layer and tested using Clegg hammer (or shear vanes for cohesive upper fill).</p>	
<p>Agreements/recommendations onsite:</p> <ul style="list-style-type: none"> - Base of excavation to be cleaned of any loose material and debris prior to manhole installation. - Construction team to ensure backfilled layers are 200mm thick maximum and tested with Clegg hammer (or shear vane for cohesive upper backfill layers), in accordance with the wastewater ITP. - Backfill test record sheets to be reviewed by CPS for completeness and compliance with the ITP. 	
<p>Follow-ups and further actions required:</p> <ul style="list-style-type: none"> - CPS to follow up on compaction testing QA for the manhole and the wastewater line once constructed 	

SITE VISIT RECORD SHEET

Photographs below. Drawing TOC057-A17-4001 attached.

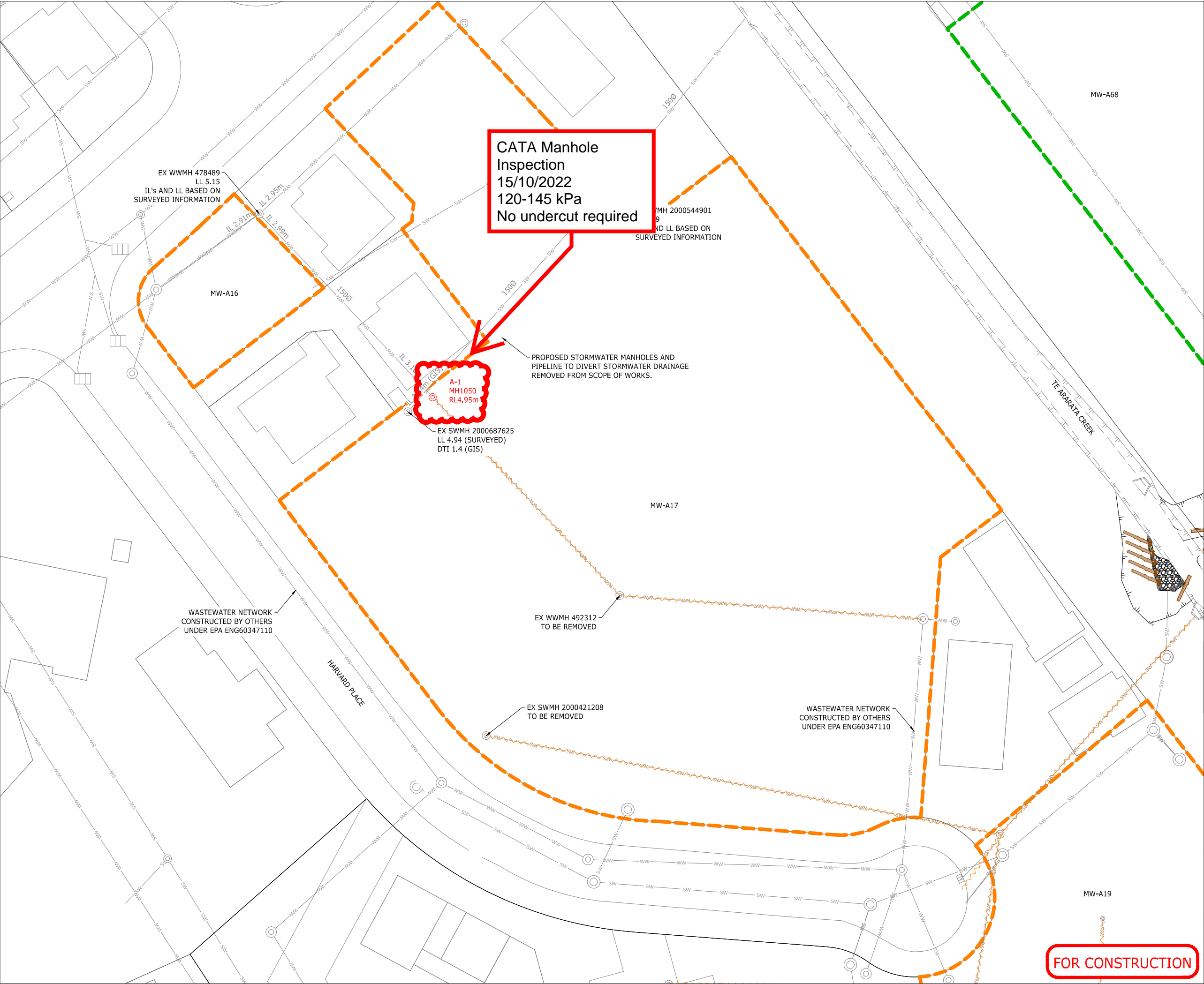


Photograph 1: Location of WWMH A-1.

SITE VISIT RECORD SHEET



Photograph 2: Ground conditions at location of WWMH-A1.



- NOTES:**
- WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERED TO THE ENGINEER FOR CLARIFICATION.
 - EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
 - CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
 - REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
 - CONSTRUCTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATCHPIT
- EXISTING OUTLET

A	ISSUED FOR CONSTRUCTION	CA	27.07.2022
2	EPA AMENDMENT	CA	19.07.2022
1	FOR ENGINEERING APPROVAL	CA	20.05.2022
REVISION DETAILS		BY	DATE

PROJECT: **STAGE 4 MANGERE WEST DEVELOPMENT**

DESCRIPTION: **STORMWATER & WASTEWATER LAYOUT PLAN SUPERLOT MW-A17**

	SURVEYED	-	-
	DESIGNED	AE	20.05.2022
	DRAWN	AE	20.05.2022
	CHECKED	CA	20.05.2022
	APPROVED	HVV	20.05.2022

SCALE	1:500 @A1	1:1000 @A3	REVISION
STATUS	CONSTRUCTION ISSUE		A
PRECINCT	MANGERE WEST		
DWG NO	TOC057-A17-4001		

SITE VISIT RECORD SHEET

Project Name: Mangere West A Stage 1	Project ID: 1007708.2102
Ref #: DI104	Date/Time: 16/12/2022
Site Location: Superlot AO-018a (Winthrop Way, Mangere East)	Inspection by: Scott Zhang and Cameron Taylor
Weather: Fine	Inspection with:
Site Condition: Dry	Purpose of Visit: Site walkover and subgrade testing
Site Induction Completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	JSEA completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Health and safety observation notes: Be aware of slips/trips/falls hazards	
Machinery onsite: N/A	
Dust/erosion & sediment control: N/A	
Current active works: Nil within Superlot	
Observations: Two representatives of the Piritahi geotechnical team undertook a site walkover and subgrade testing for the Superlot MW-A17 within TOC57. Fine grained soils (clayey SILT/silty CLAY) were observed at the subgrade cut level. Shear vane and Scala penetrometer testing were conducted across the subgrade. Shear vane testing was undertaken in fine grained soils at 42 locations along with Scala penetrometer tests to 900 mm depth at the same 42 locations. Test locations are shown in the attached site testing plan. Corrected peak undrained shear strengths of between 95 and 221+ kPa were recorded, for an average of 172 kPa. This indicates the surficial soils at subgrade level is typically very stiff to hard. Scala penetrometer blow counts generally ranged from 0.5 to 5 blows per 50 mm penetration on the subgrade. The results for the subgrade tests and a site testing location plan are attached. These results indicate the subgrade soils are within the ITP requirements for earthworks cut.	
Agreements/recommendations onsite: Nil.	

SITE VISIT RECORD SHEET

Follow-ups and further actions required:

Piritahi geotechnical team to prepare Ground Completion Report for Superlot MW-A17.

Testing results and Site plan attached. Photos below.



Photograph 1: Superlot overview – looking south west



Photograph 2: Superlot overview – looking north

SITE VISIT RECORD SHEET



Photograph 3: Water pond near the centre of the superlot



- LEGEND:
- CPT
 - Cored machine drilled borehole
 - Hand auger borehole
 - Percussion drilled borehole
 - Test Pit
 - Planned CPT
 - Planned Cored Machine Drilled Borehole
 - Planned Hand Auger
 - Planned Percussion Drilled Borehole
 - Planned Test Pit
 - Ready to Drill CPT
 - Ready to Drill Cored Machine Borehole
 - Ready to Drill Hand Auger
 - Ready to Drill Percussion Drilled Borehole
 - Ready to Drill Test Pit
 - Alternate CPT
 - Alternate Cored Machine Drilled Borehole
 - Alternate Hand Auger
 - Alternate Percussion Drilled Borehole
 - Alternate Test Pit

Piritahi
LAYING THE GROUNDWORK

Level 8, 139 Quay Street, Auckland, 1010
www.piritahi.nz



ArcGIS Web Map

DATE:	15 Dec 2022
SCALE:	1:1,128



Shear Vane Results

Job No: 1007708.2102
 Project: *Piritahi Mangere West A*
 Location: *MW-A17*
 RL: 5

Date: 16/12/2022
 Operated by: *SCZH and CATA*
 Logged by: *SCZH and CATA*
 Checked by:

Test No.

Sheet **1**
of

Test	Corrected Undrained Shear Strength
1	98
2	190
3	161
4	221
5	101
6	155
7	190
8	149
9	177
10	221
11	202
12	205
13	126
14	95
15	UTP
16	193
17	221
18	221
19	221
20	221
21	221
22	221



Shear Vane Results

Job No: 1007708.2102	Date: 16/12/2022	Test No.
Project: Piritahi Mangere West A	Operated by: SCZH and CATA	Sheet of 2
Location: MW-A17	Logged by: SCZH and CATA	
RL: 5	Checked by:	

Test	Corrected Undrained Shear Strength
23	142
24	209
25	221
26	161
27	220
28	145
29	136
30	158
31	145
32	190
33	UTP
34	UTP
35	95
36	155
37	95
38	145
39	155
40	158
41	130
42	107

[1]



Piritahi

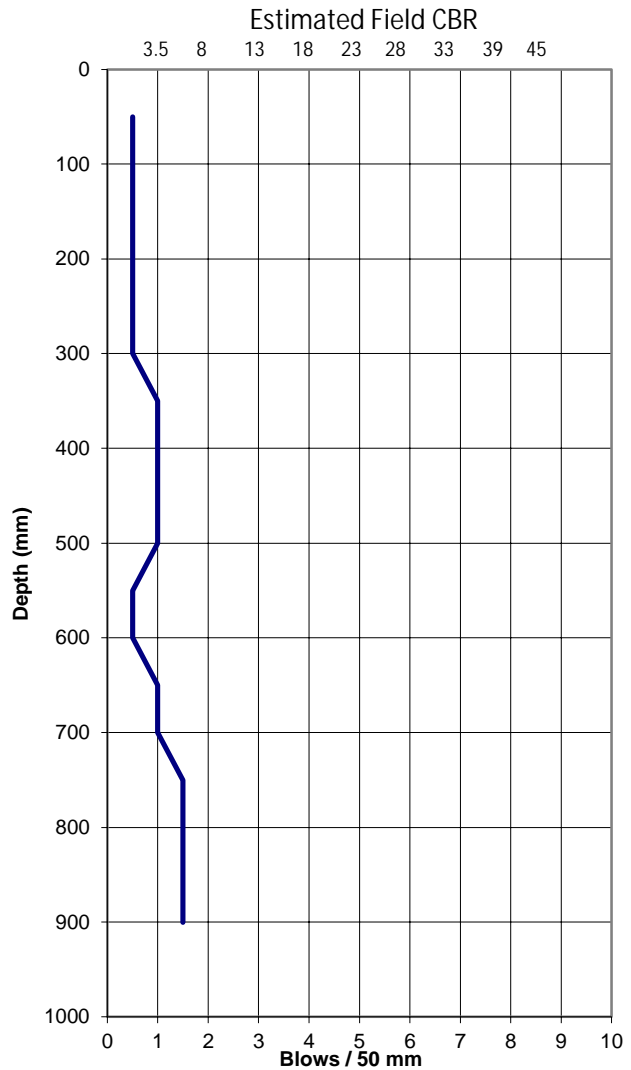
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP01

Sheet 3
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	0.5
300	0.5
350	1
400	1
450	1
500	1
550	0.5
600	0.5
650	1
700	1
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

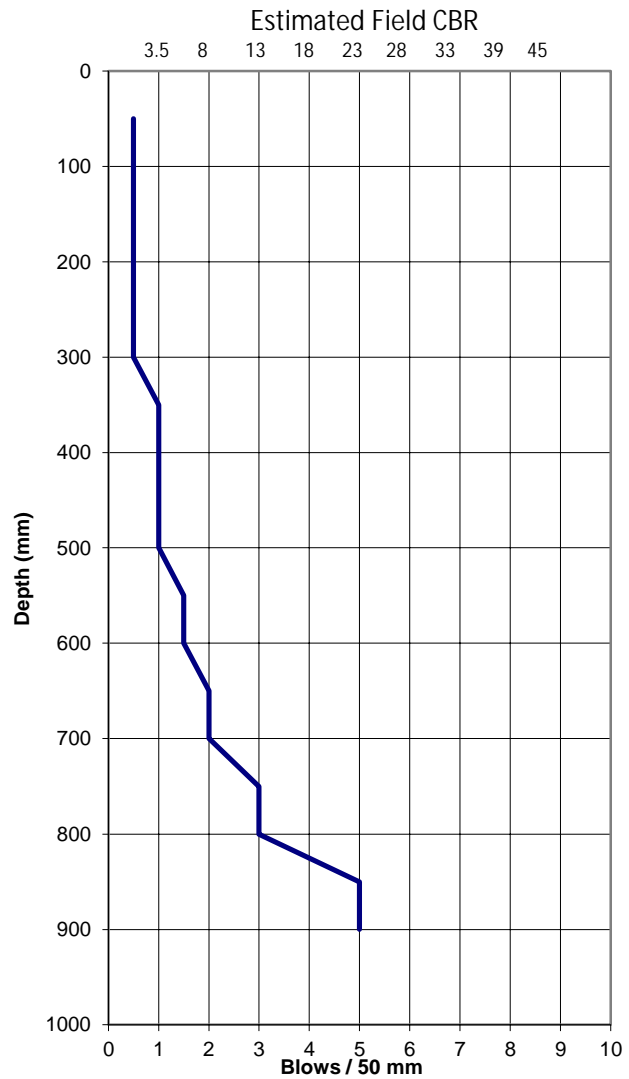
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP02

Sheet 4
 of

mm	No. of
Driven	Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	0.5
300	0.5
350	1
400	1
450	1
500	1
550	1.5
600	1.5
650	2
700	2
750	3
800	3
850	5
900	5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

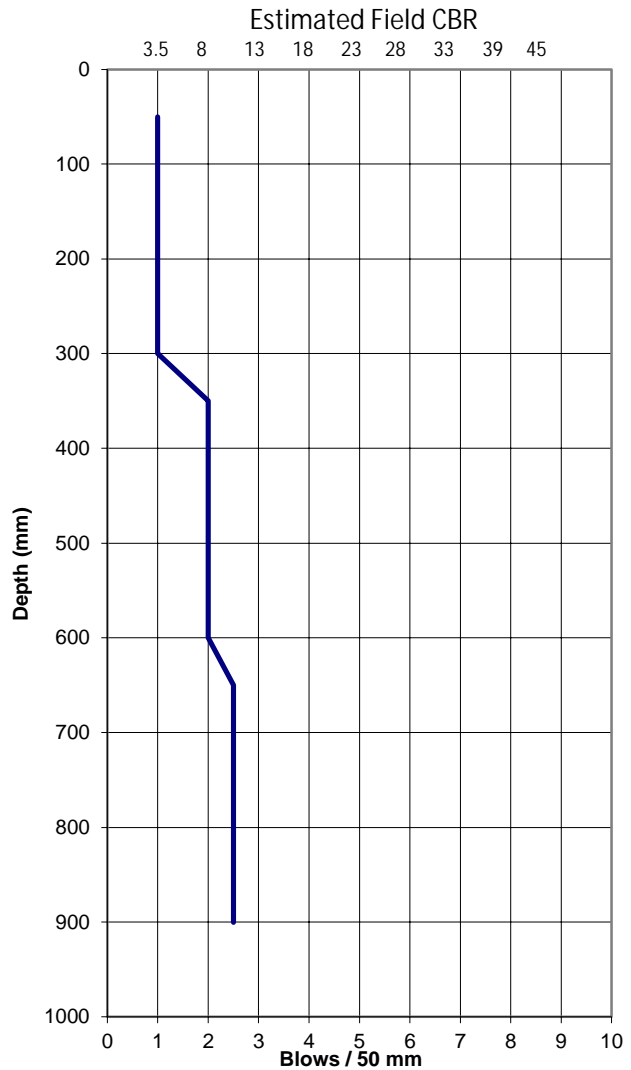
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP03

Sheet 5
 of

mm Driven	No. of Blows
50	1
100	1
150	1
200	1
250	1
300	1
350	2
400	2
450	2
500	2
550	2
600	2
650	2.5
700	2.5
750	2.5
800	2.5
850	2.5
900	2.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

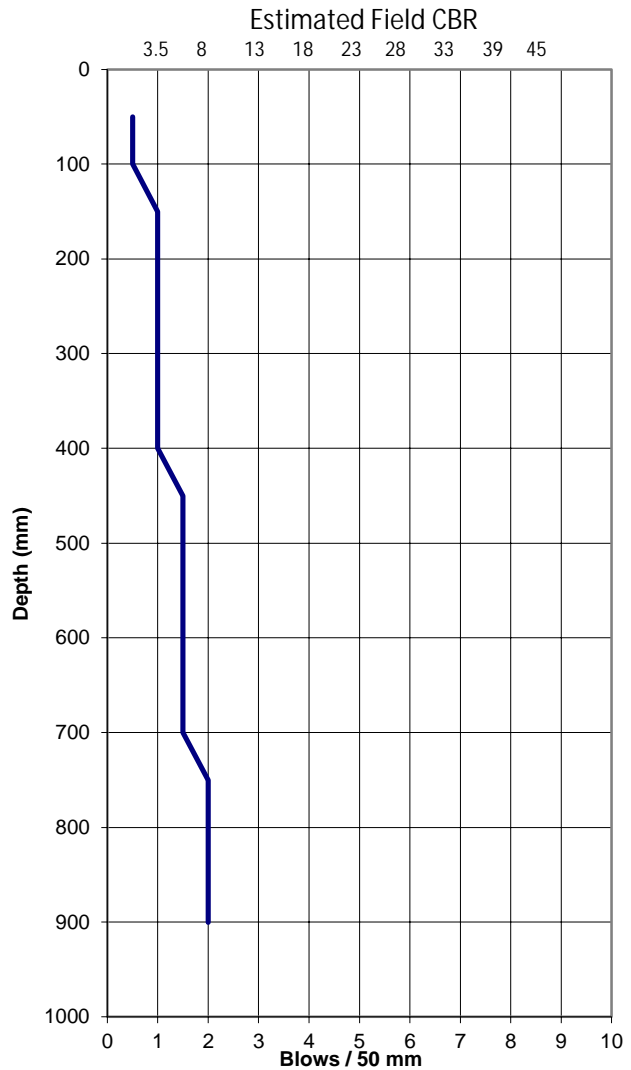
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP04

Sheet 6
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	1
350	1
400	1
450	1.5
500	1.5
550	1.5
600	1.5
650	1.5
700	1.5
750	2
800	2
850	2
900	2



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

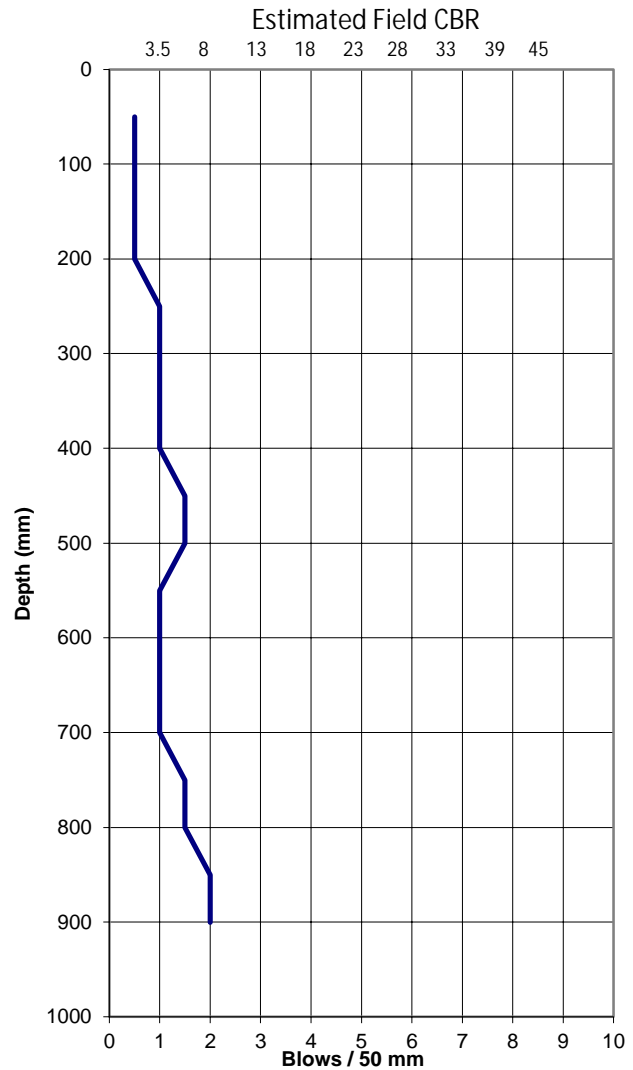
Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Piritahi**Piritahi****SCALA PENETROMETER LOG**

Job No: 1007708.2102 Date: 16/12/2022
 Project: *Piritahi Mangere West A* Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP05**Sheet 7
of**

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	1
400	1
450	1.5
500	1.5
550	1
600	1
650	1
700	1
750	1.5
800	1.5
850	2
900	2



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

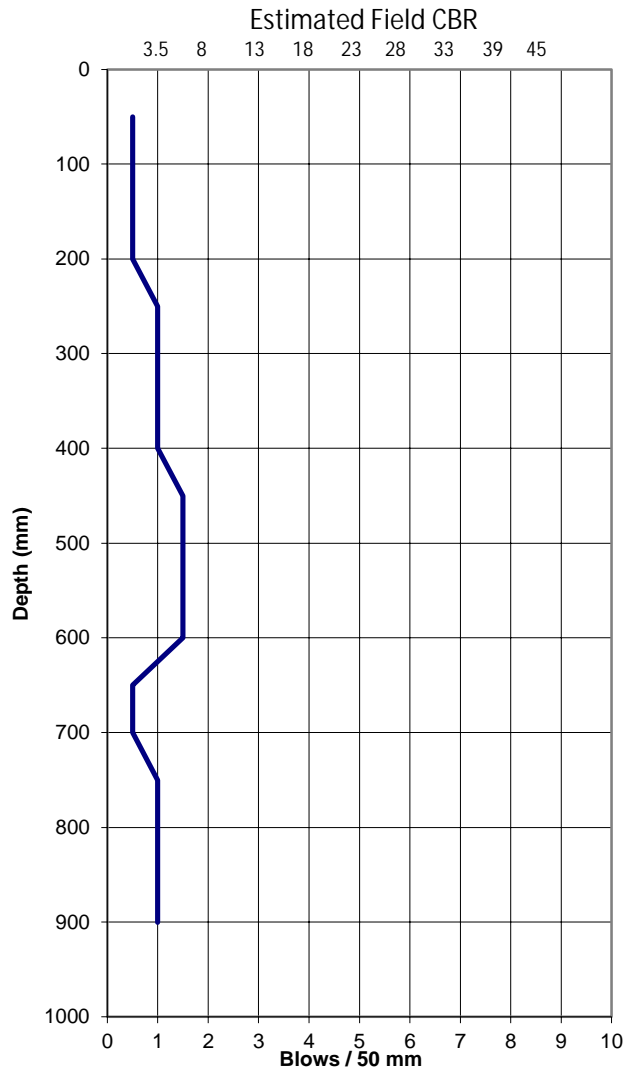
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP06

Sheet 8
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	1
400	1
450	1.5
500	1.5
550	1.5
600	1.5
650	0.5
700	0.5
750	1
800	1
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

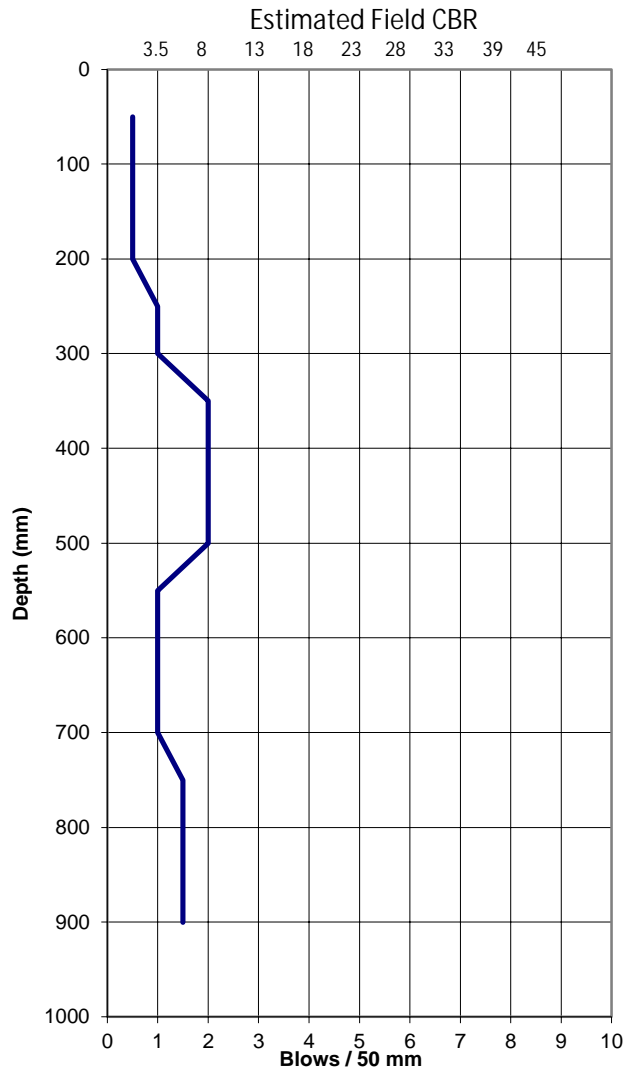
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP07

Sheet 9
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	2
400	2
450	2
500	2
550	1
600	1
650	1
700	1
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

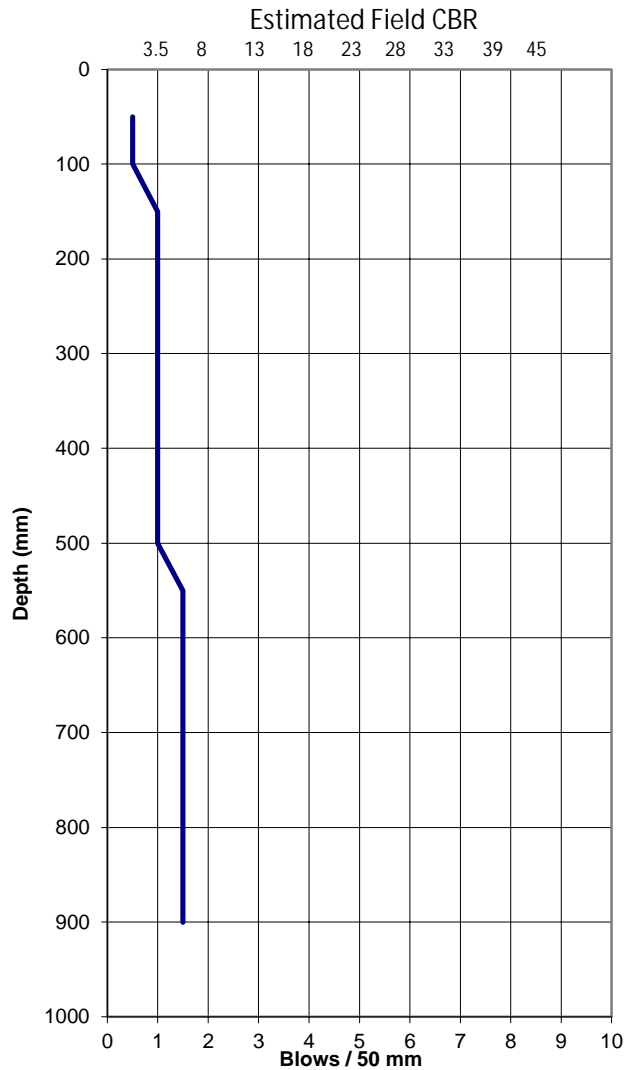
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP08

Sheet 10
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	1
350	1
400	1
450	1
500	1
550	1.5
600	1.5
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Piritahi**Piritahi****SCALA PENETROMETER LOG**

Job No: 1007708.2102

Date: 16/12/2022

Project: *Piritahi Mangere West A* Operated by: SCZH and CATA

Location: MW-A17

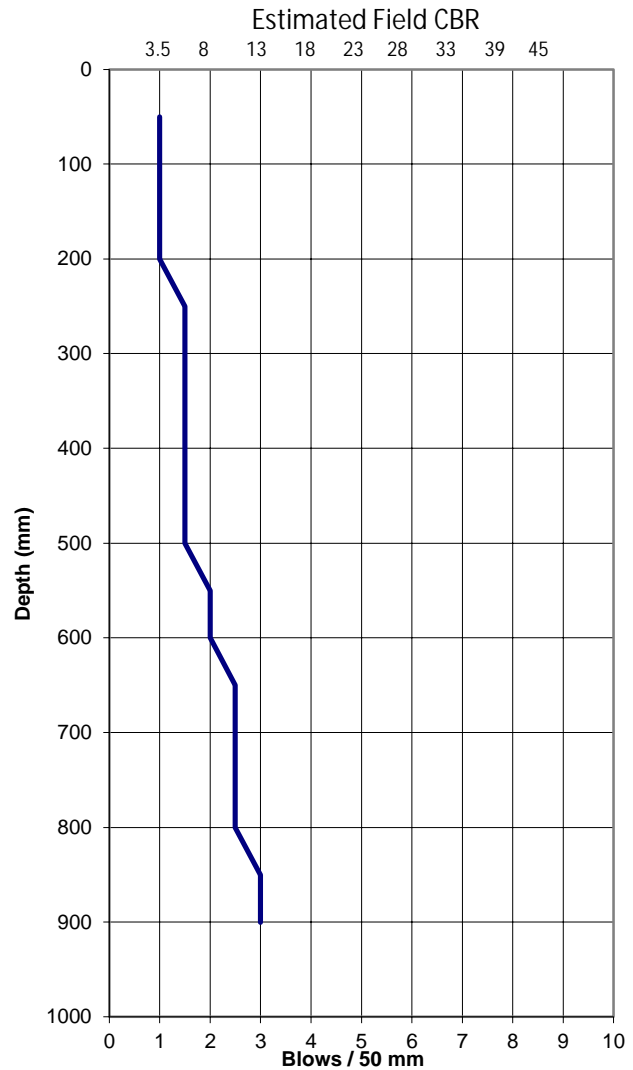
Logged by: SCZH and CATA

RL: 5

Checked by:

Test No. DCP09**Sheet 11
of**

mm Driven	No. of Blows
50	1
100	1
150	1
200	1
250	1.5
300	1.5
350	1.5
400	1.5
450	1.5
500	1.5
550	2
600	2
650	2.5
700	2.5
750	2.5
800	2.5
850	3
900	3



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

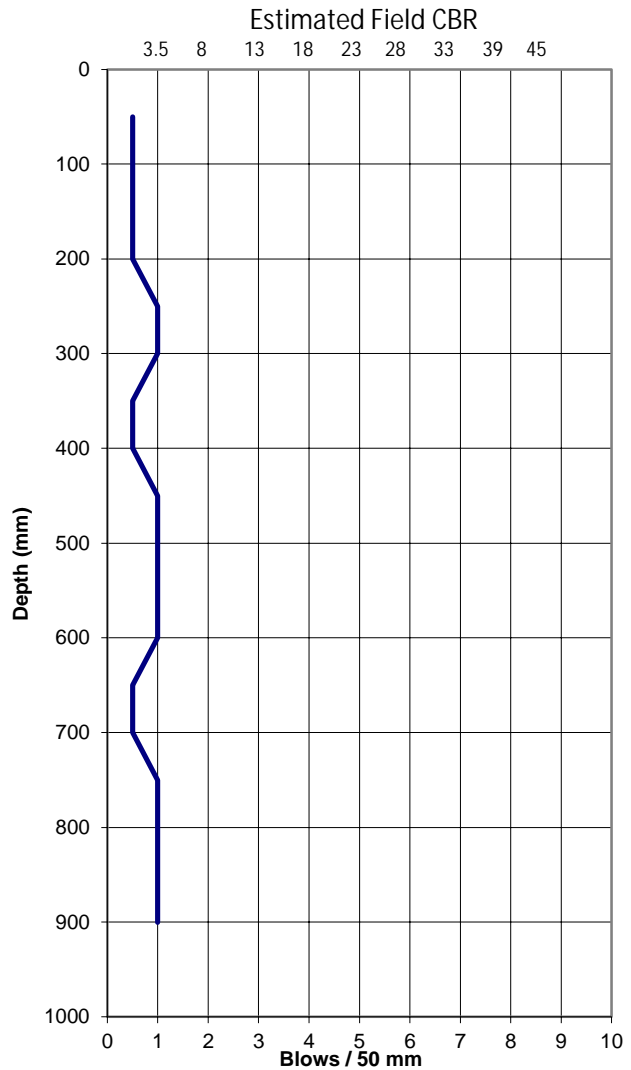
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP10

Sheet 12
 of

mm	No. of
Driven	Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	0.5
400	0.5
450	1
500	1
550	1
600	1
650	0.5
700	0.5
750	1
800	1
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

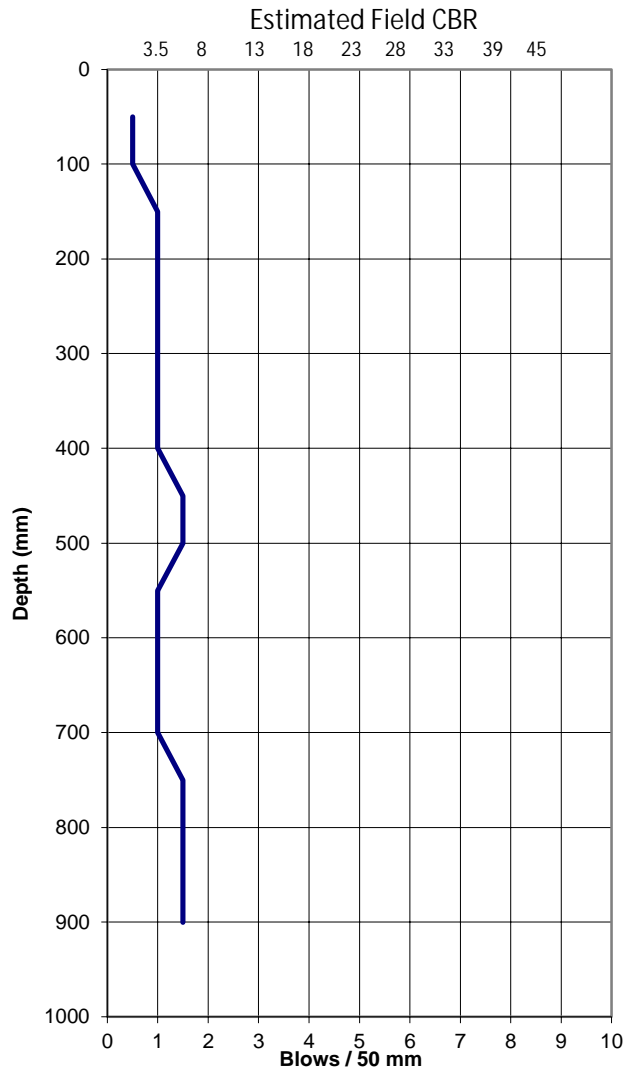
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP11

Sheet 13
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	1
350	1
400	1
450	1.5
500	1.5
550	1
600	1
650	1
700	1
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

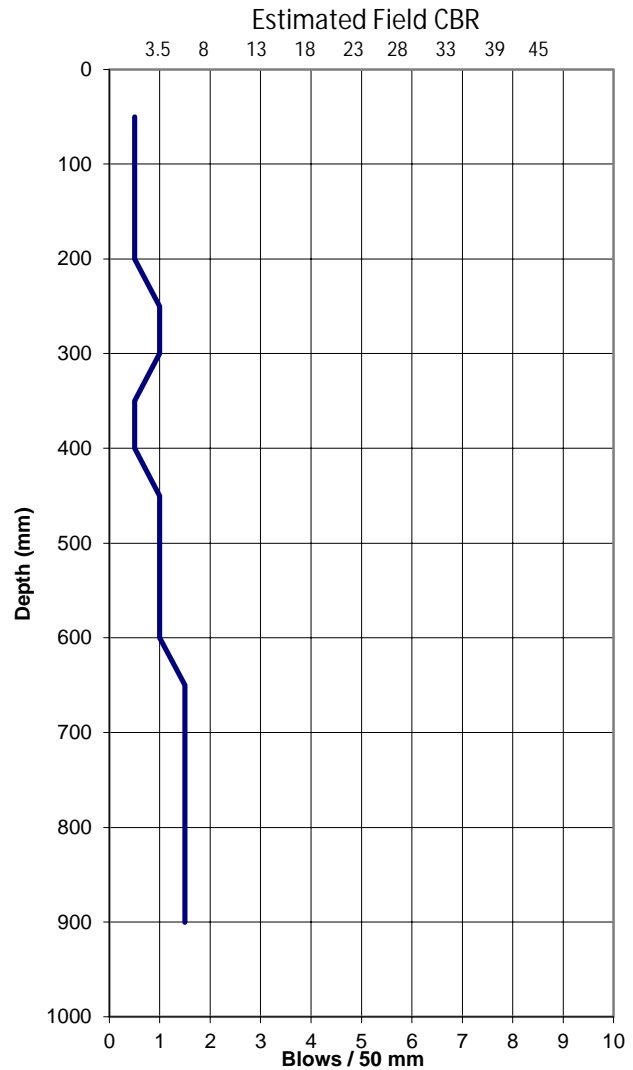
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP12

Sheet 14
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	0.5
400	0.5
450	1
500	1
550	1
600	1
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

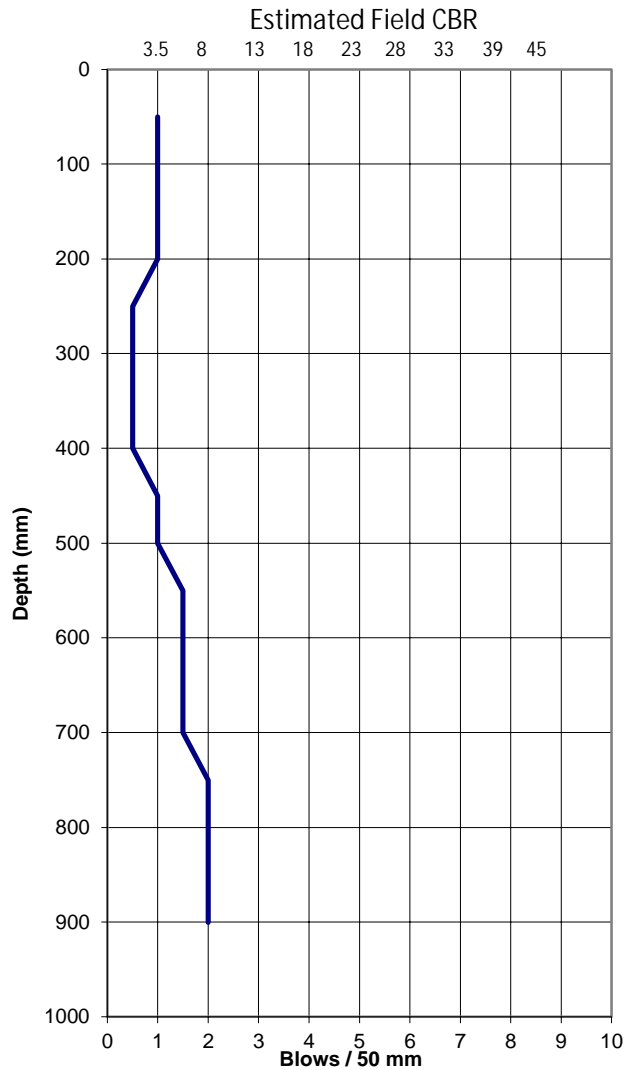
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP13

Sheet 15
 of

mm Driven	No. of Blows
50	1
100	1
150	1
200	1
250	0.5
300	0.5
350	0.5
400	0.5
450	1
500	1
550	1.5
600	1.5
650	1.5
700	1.5
750	2
800	2
850	2
900	2



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

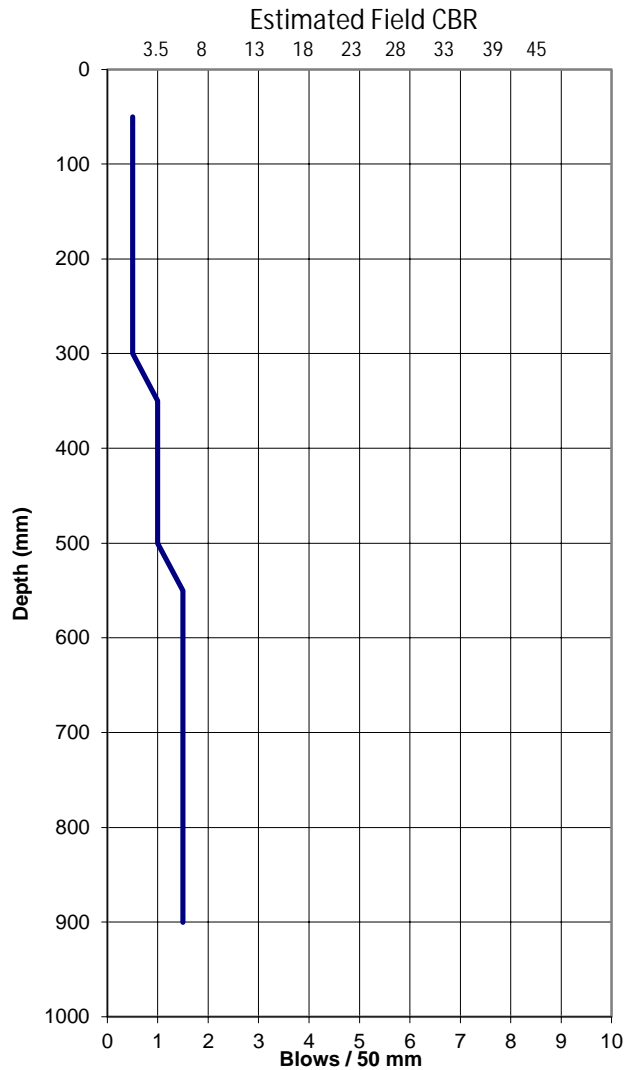
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP14

Sheet 16
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	0.5
300	0.5
350	1
400	1
450	1
500	1
550	1.5
600	1.5
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



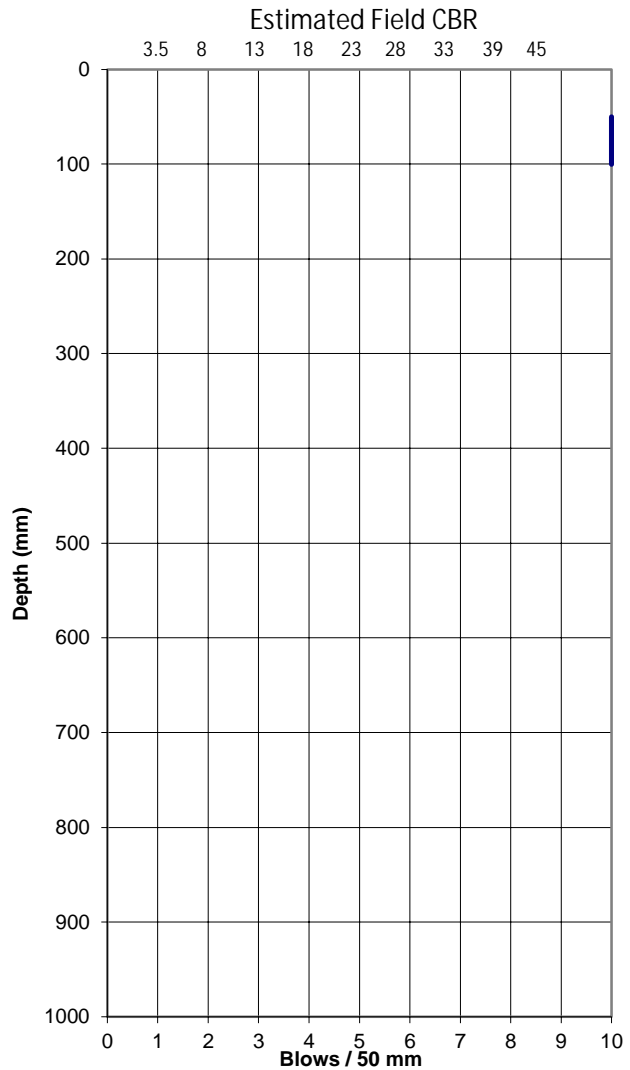
Piritahi

SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: *Piritahi Mangere West A* Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. **DCP15**Sheet **17**
of

mm Driven	No. of Blows
50	10
100	10
150	
200	
250	
300	
350	
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

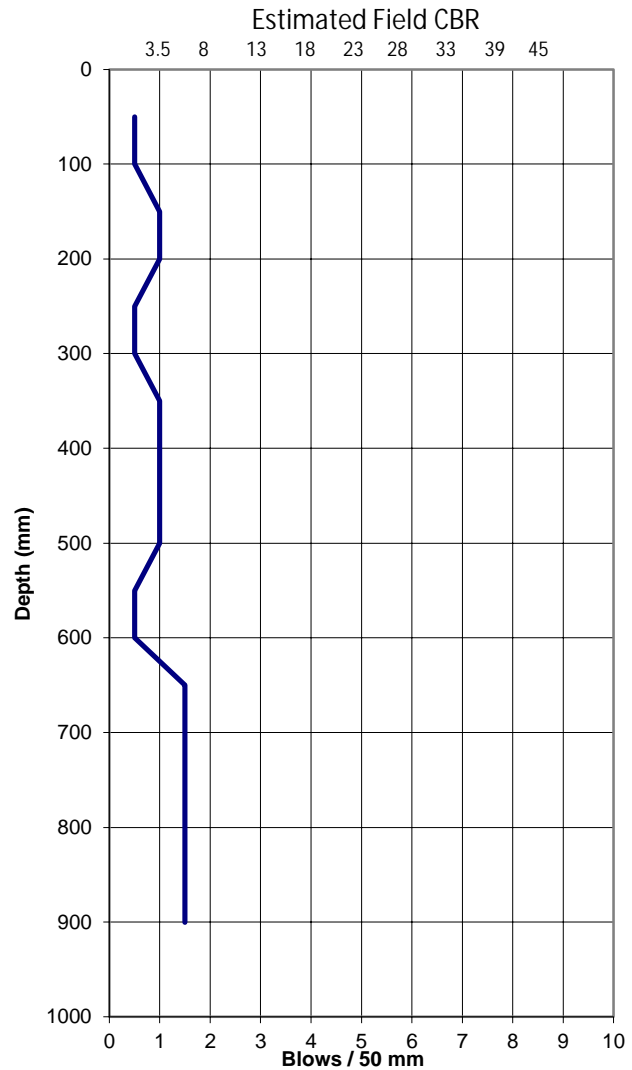
Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Piritahi**Piritahi****SCALA PENETROMETER LOG**

Job No: 1007708.2102 Date: 16/12/2022
 Project: *Piritahi Mangere West A* Operated by: *SCZH and CATA*
 Location: *MW-A17* Logged by: *SCZH and CATA*
 RL: 5 Checked by:

Test No. DCP16**Sheet 18
of**

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	0.5
300	0.5
350	1
400	1
450	1
500	1
550	0.5
600	0.5
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

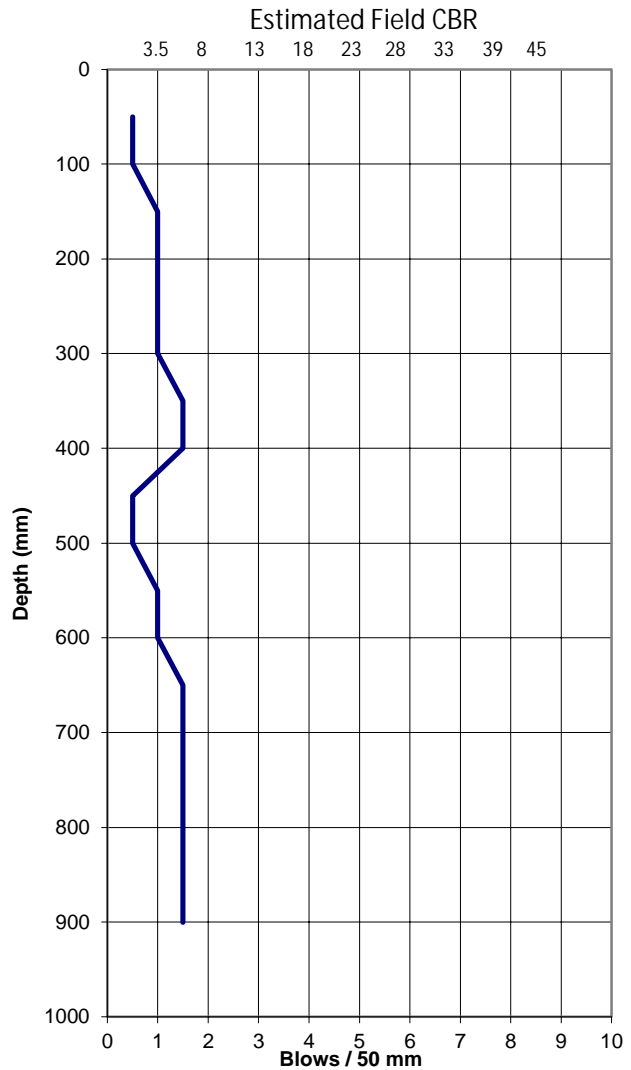
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP17

Sheet 19
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	1
350	1.5
400	1.5
450	0.5
500	0.5
550	1
600	1
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

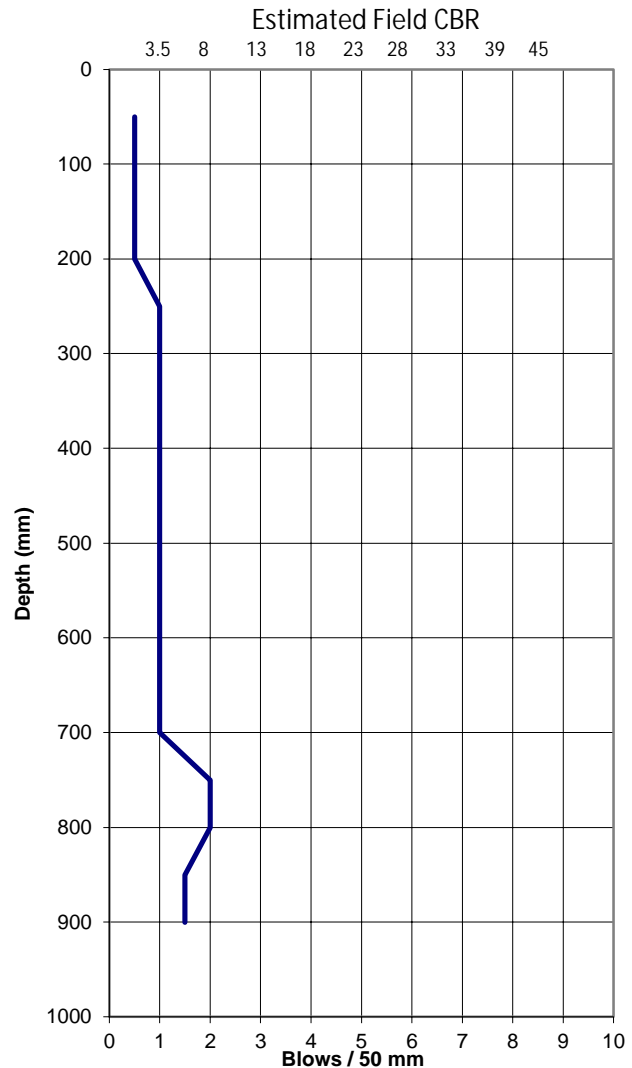
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP18

Sheet 20
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	1
400	1
450	1
500	1
550	1
600	1
650	1
700	1
750	2
800	2
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

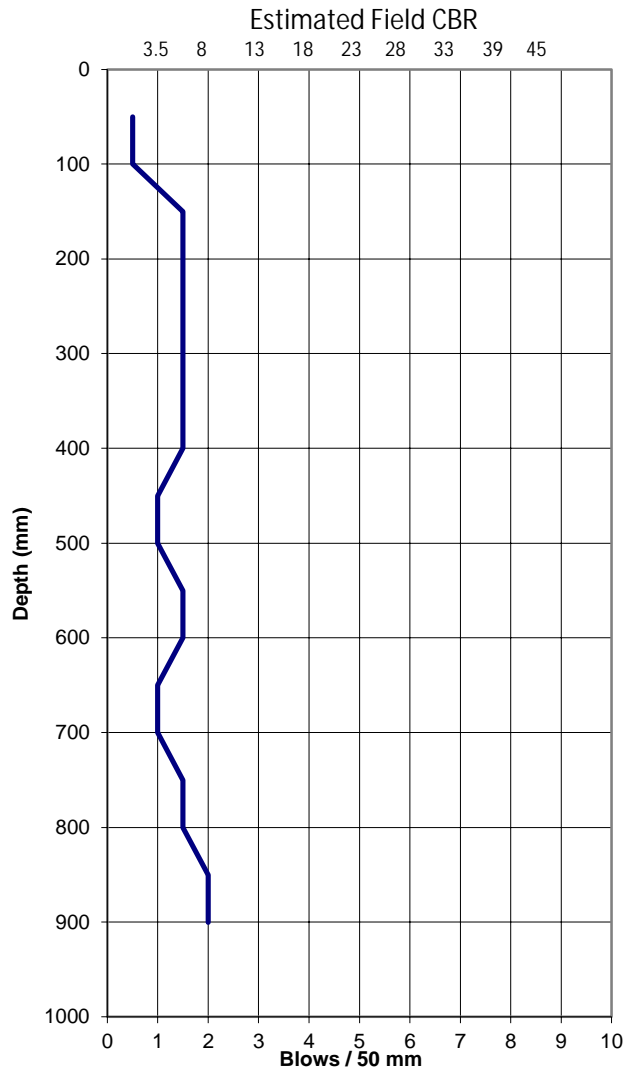
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP19

Sheet 21
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1.5
200	1.5
250	1.5
300	1.5
350	1.5
400	1.5
450	1
500	1
550	1.5
600	1.5
650	1
700	1
750	1.5
800	1.5
850	2
900	2



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

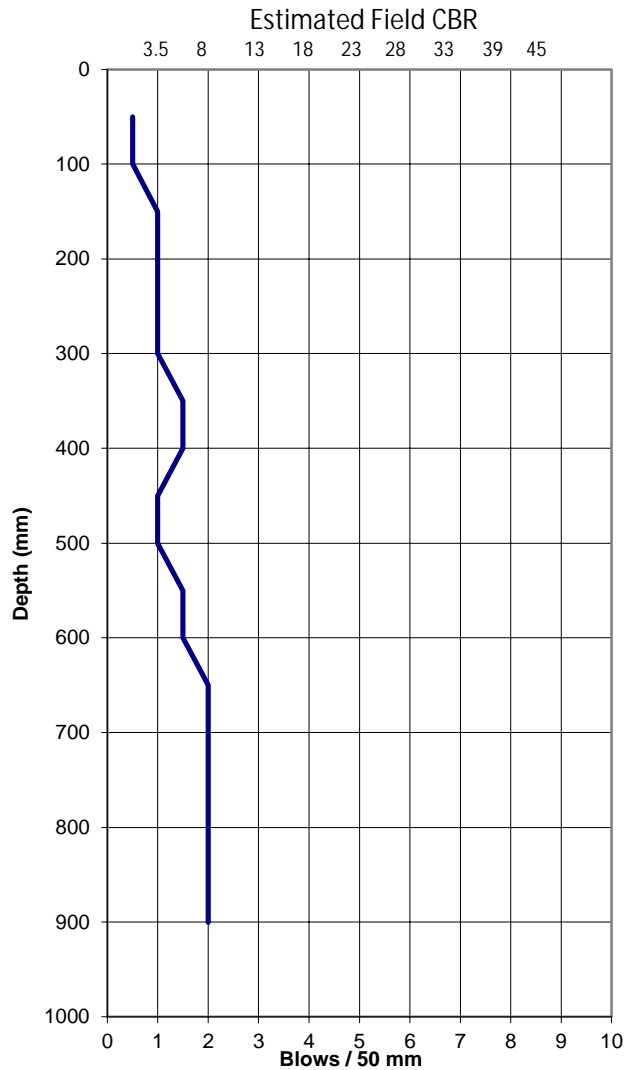
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP20

Sheet 22
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	1
350	1.5
400	1.5
450	1
500	1
550	1.5
600	1.5
650	2
700	2
750	2
800	2
850	2
900	2



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

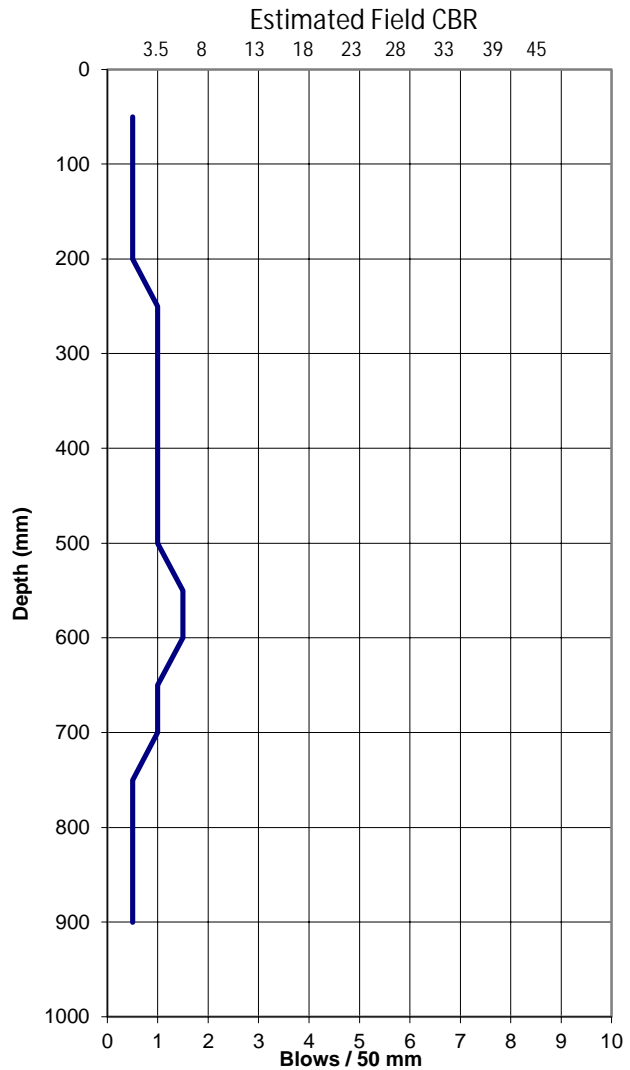
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP21

Sheet 23
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	1
400	1
450	1
500	1
550	1.5
600	1.5
650	1
700	1
750	0.5
800	0.5
850	0.5
900	0.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

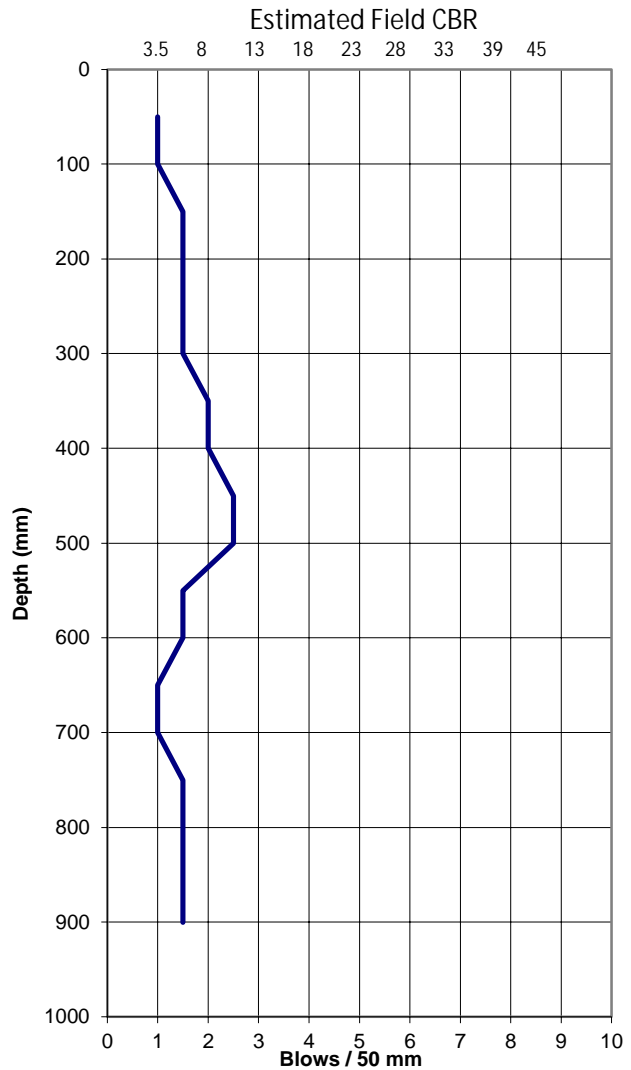
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP22

Sheet 24
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1.5
300	1.5
350	2
400	2
450	2.5
500	2.5
550	1.5
600	1.5
650	1
700	1
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

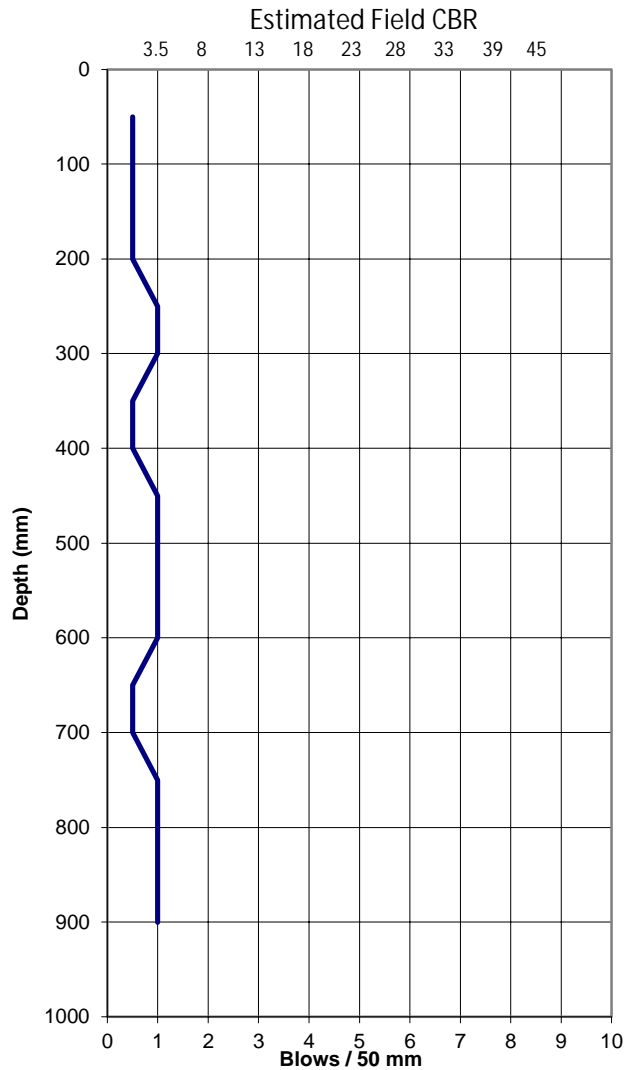
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP23

Sheet 25
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	0.5
400	0.5
450	1
500	1
550	1
600	1
650	0.5
700	0.5
750	1
800	1
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

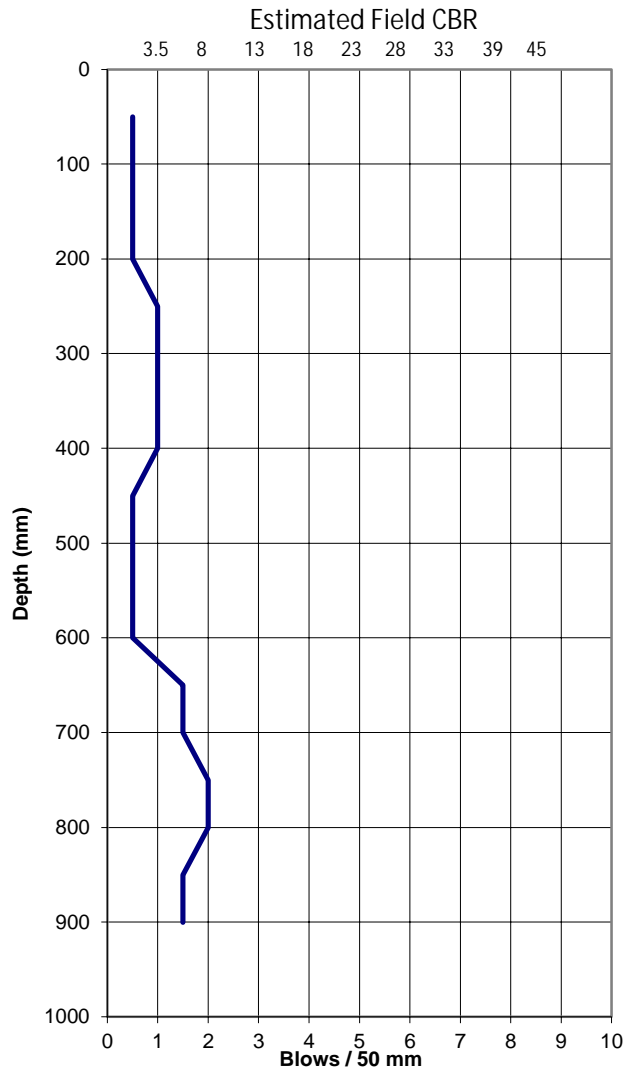
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP24

Sheet 26
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	1
400	1
450	0.5
500	0.5
550	0.5
600	0.5
650	1.5
700	1.5
750	2
800	2
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

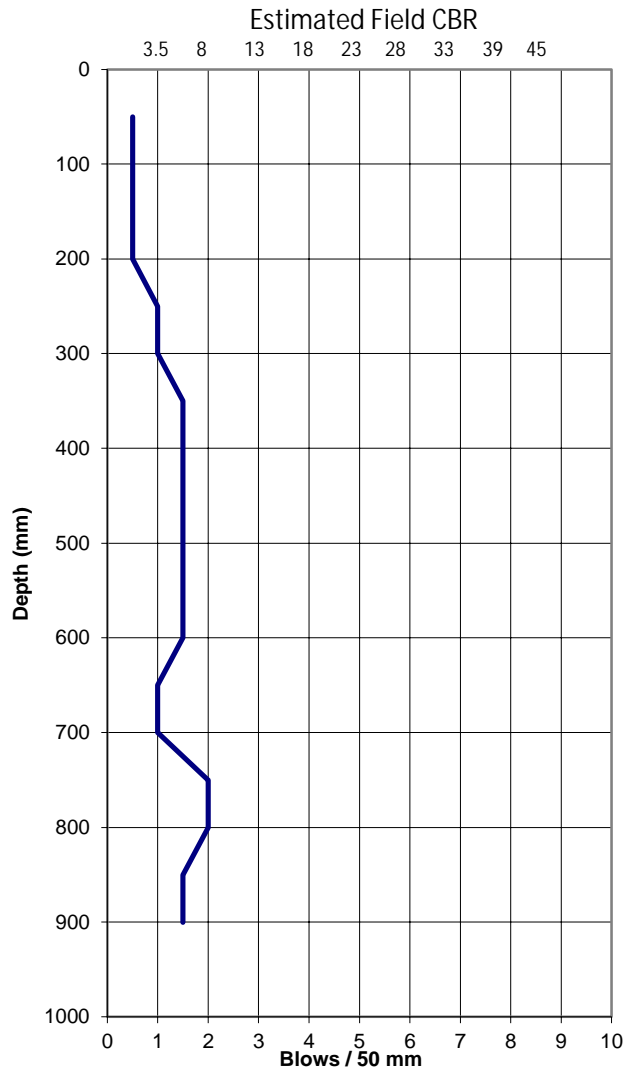
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP25

Sheet 27
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1
300	1
350	1.5
400	1.5
450	1.5
500	1.5
550	1.5
600	1.5
650	1
700	1
750	2
800	2
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

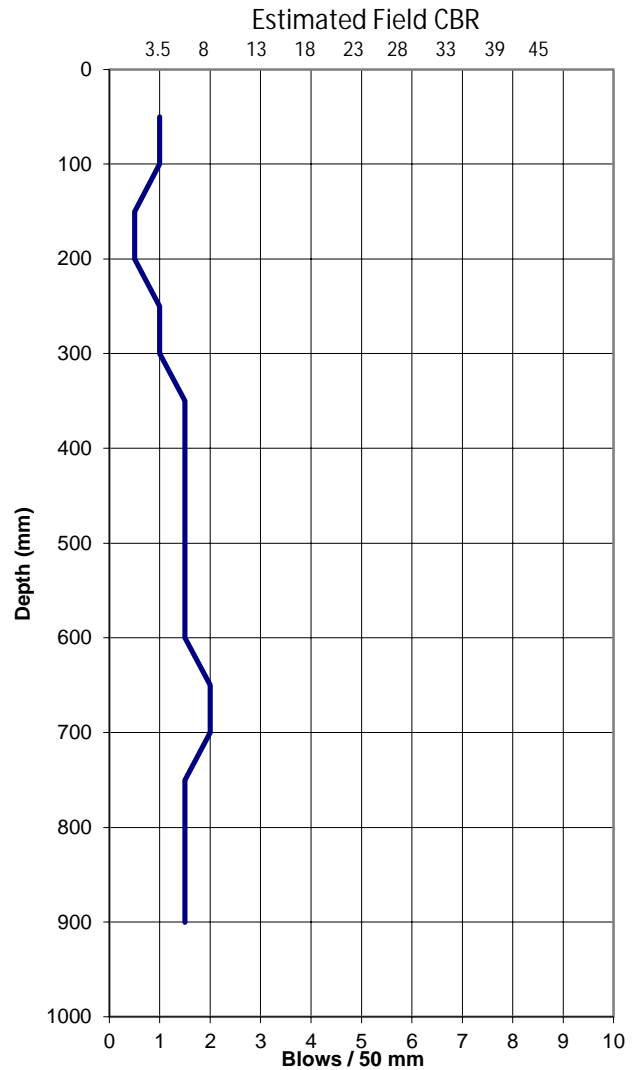
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP26

Sheet 28
 of

mm Driven	No. of Blows
50	1
100	1
150	0.5
200	0.5
250	1
300	1
350	1.5
400	1.5
450	1.5
500	1.5
550	1.5
600	1.5
650	2
700	2
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

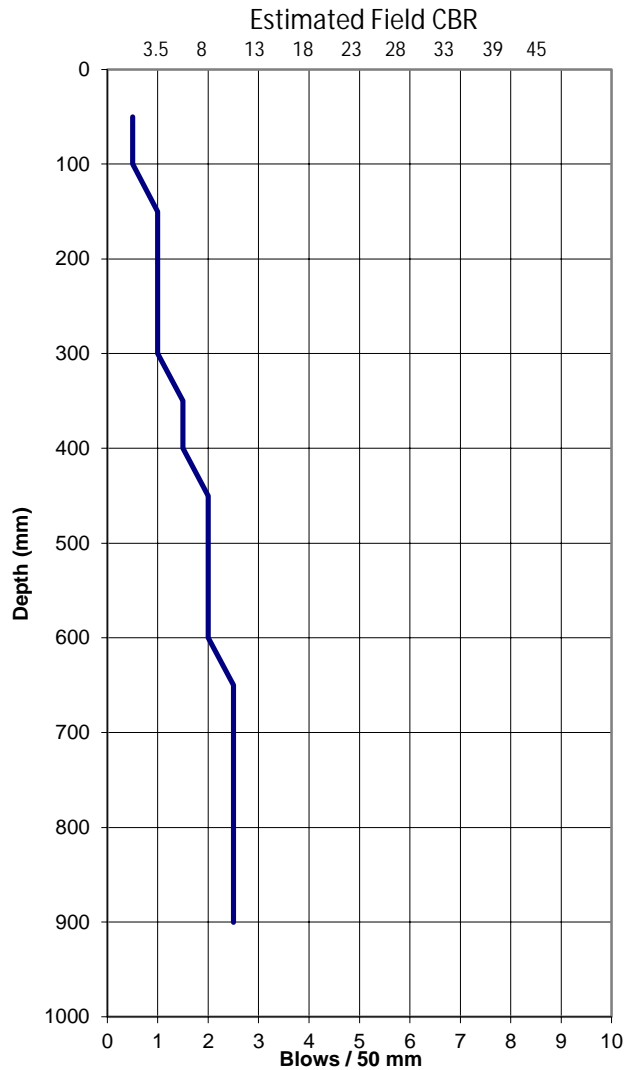
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP27

Sheet 29
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	1
350	1.5
400	1.5
450	2
500	2
550	2
600	2
650	2.5
700	2.5
750	2.5
800	2.5
850	2.5
900	2.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

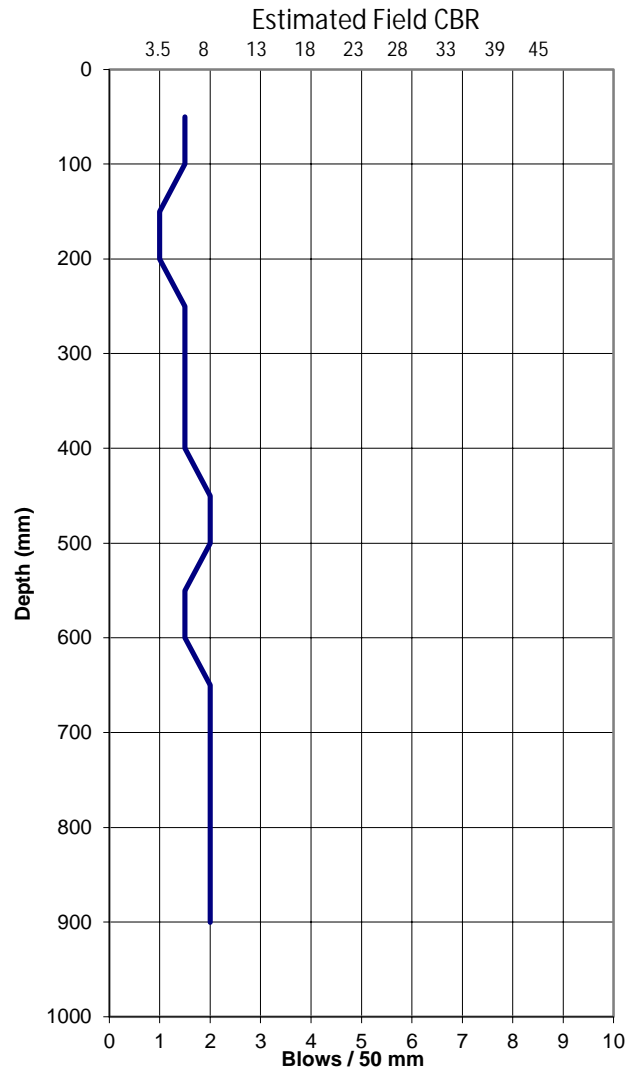
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP28

Sheet 30
 of

mm Driven	No. of Blows
50	1.5
100	1.5
150	1
200	1
250	1.5
300	1.5
350	1.5
400	1.5
450	2
500	2
550	1.5
600	1.5
650	2
700	2
750	2
800	2
850	2
900	2



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

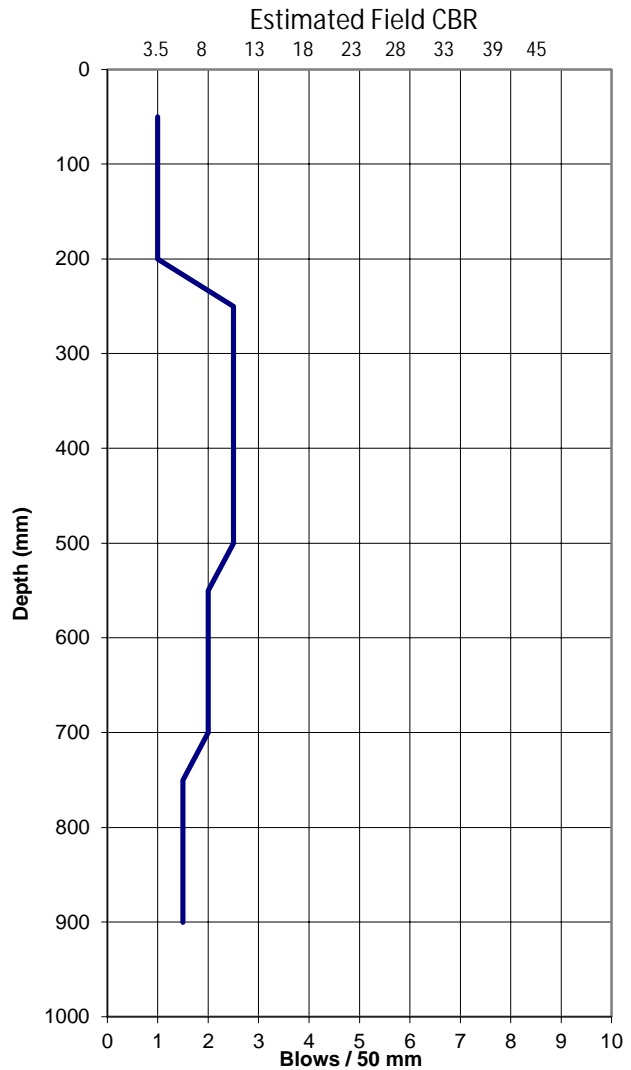
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP29

Sheet 31
 of

mm Driven	No. of Blows
50	1
100	1
150	1
200	1
250	2.5
300	2.5
350	2.5
400	2.5
450	2.5
500	2.5
550	2
600	2
650	2
700	2
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

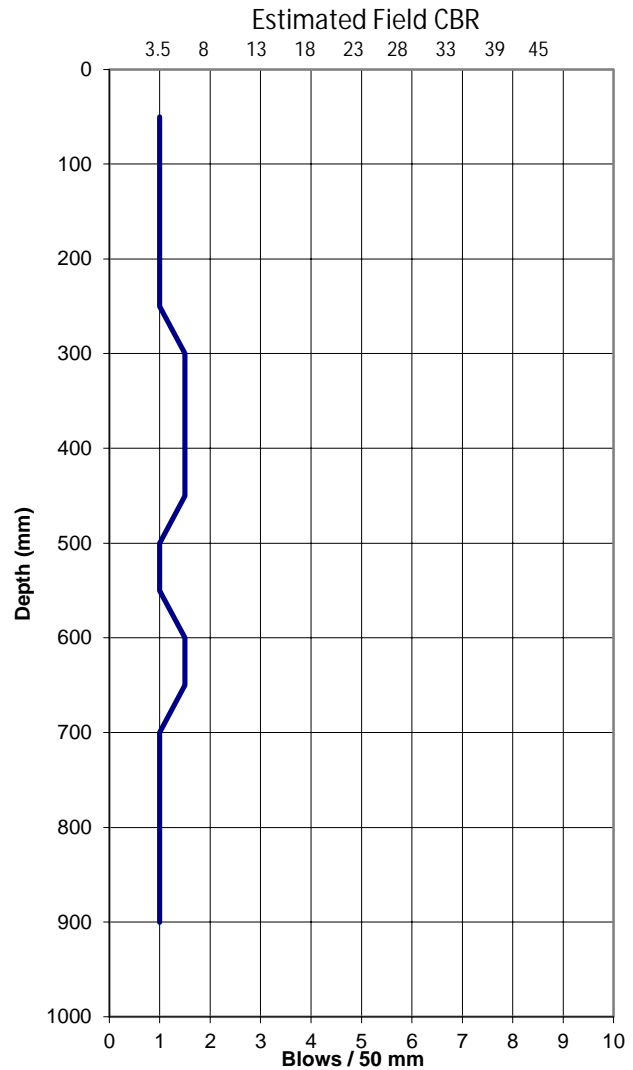
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP30

Sheet 32
 of

mm Driven	No. of Blows
50	1
100	1
150	1
200	1
250	1
300	1.5
350	1.5
400	1.5
450	1.5
500	1
550	1
600	1.5
650	1.5
700	1
750	1
800	1
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

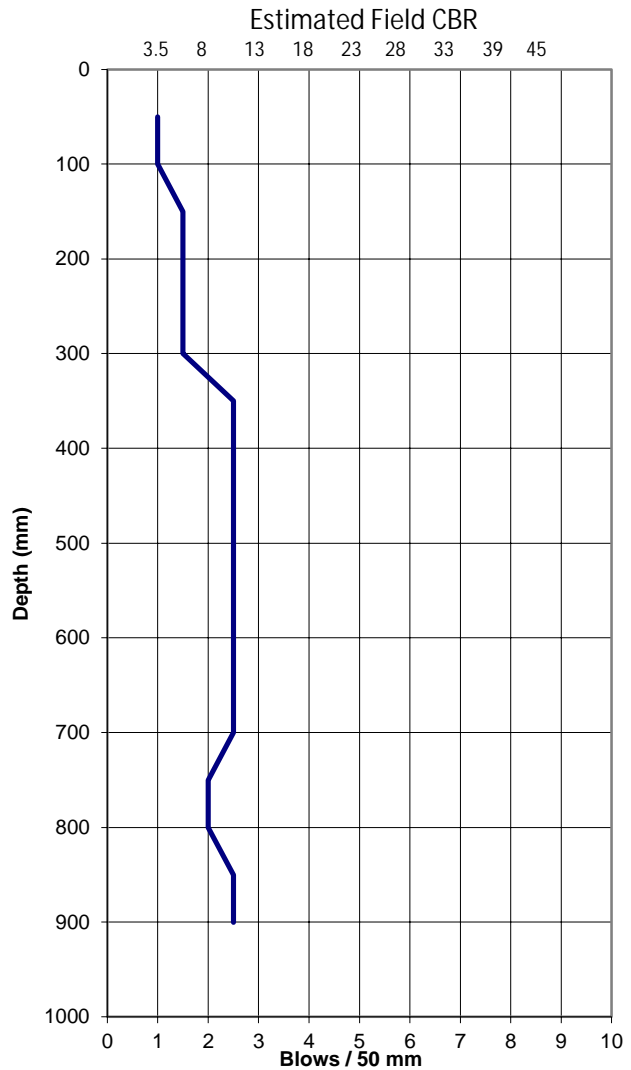
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP31

Sheet 33
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1.5
300	1.5
350	2.5
400	2.5
450	2.5
500	2.5
550	2.5
600	2.5
650	2.5
700	2.5
750	2
800	2
850	2.5
900	2.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

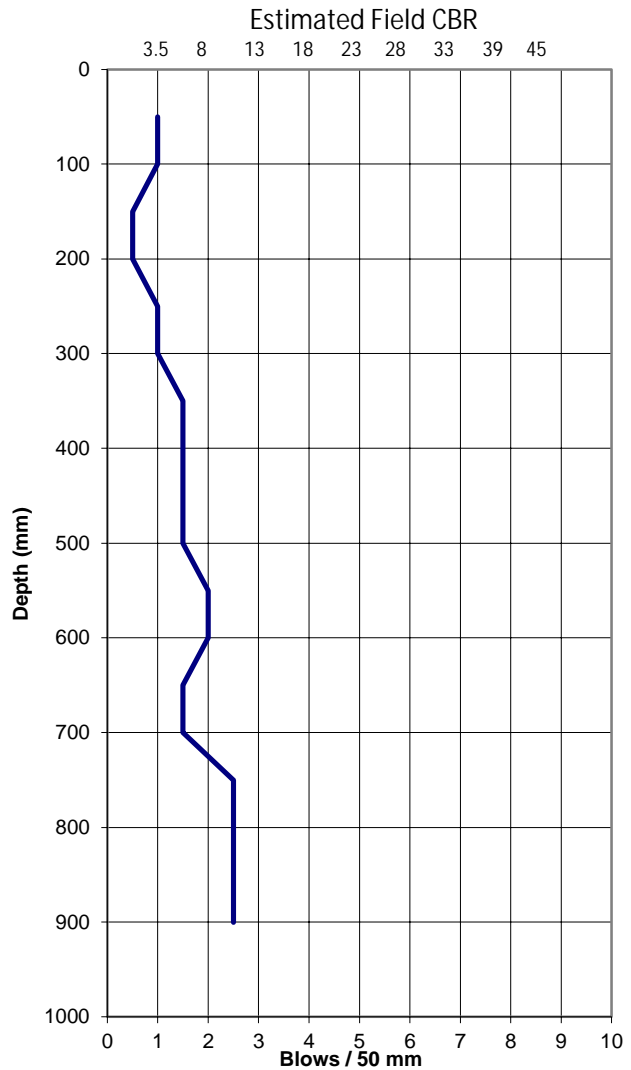
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP32

Sheet 34
 of

mm Driven	No. of Blows
50	1
100	1
150	0.5
200	0.5
250	1
300	1
350	1.5
400	1.5
450	1.5
500	1.5
550	2
600	2
650	1.5
700	1.5
750	2.5
800	2.5
850	2.5
900	2.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

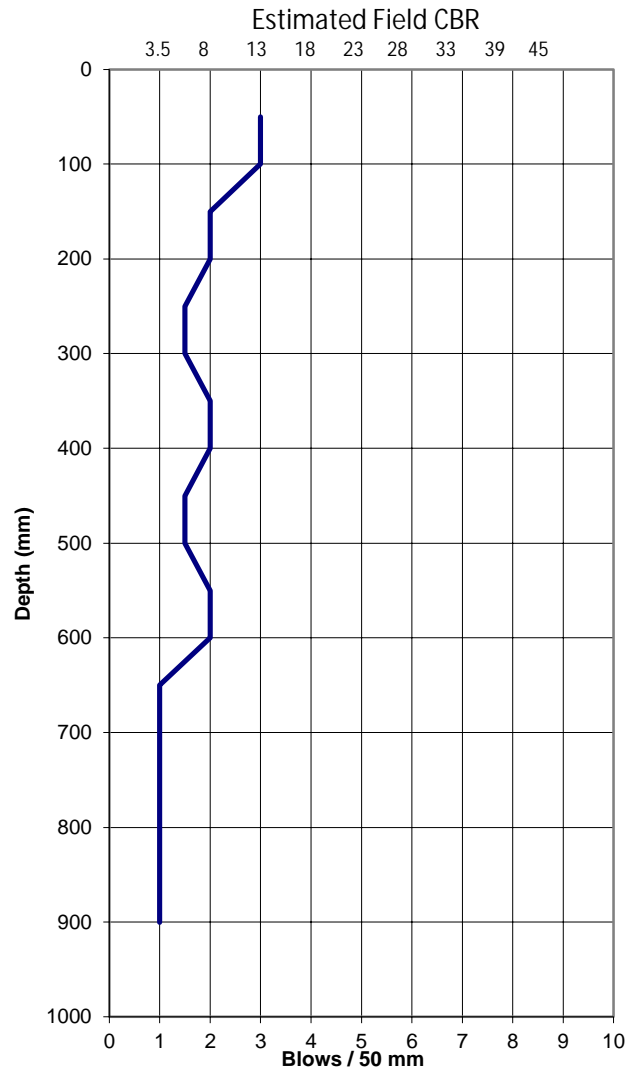
Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Piritahi**Piritahi****SCALA PENETROMETER LOG**

Job No: 1007708.2102 Date: 16/12/2022
 Project: *Piritahi Mangere West A* Operated by: *SCZH and CATA*
 Location: *MW-A17* Logged by: *SCZH and CATA*
 RL: 5 Checked by:

Test No. DCP33**Sheet 35
of**

mm Driven	No. of Blows
50	3
100	3
150	2
200	2
250	1.5
300	1.5
350	2
400	2
450	1.5
500	1.5
550	2
600	2
650	1
700	1
750	1
800	1
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

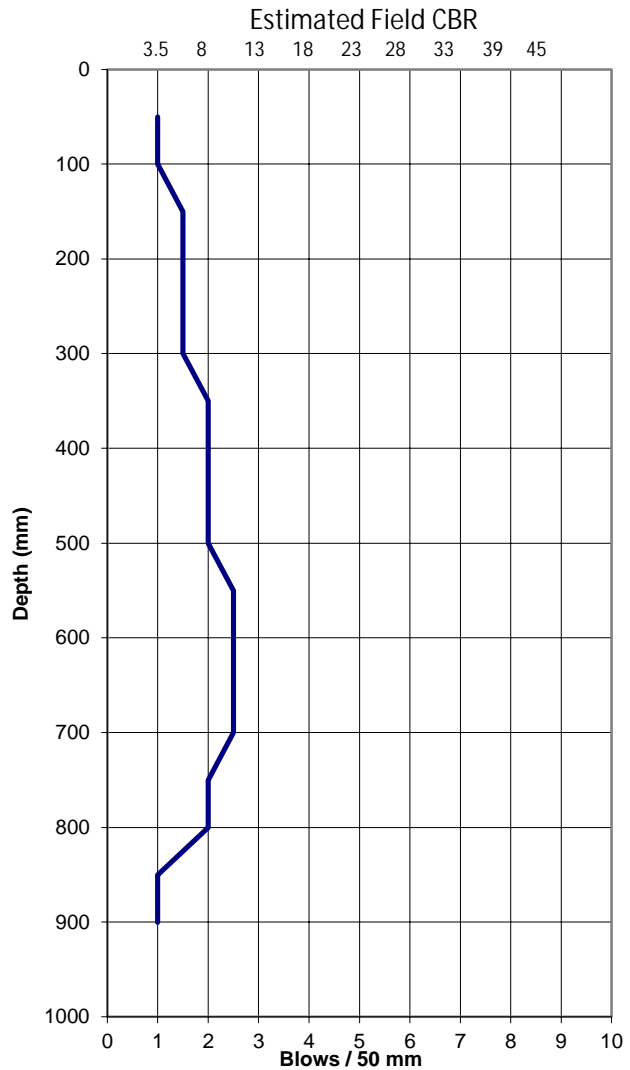
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP34

Sheet 36
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1.5
300	1.5
350	2
400	2
450	2
500	2
550	2.5
600	2.5
650	2.5
700	2.5
750	2
800	2
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

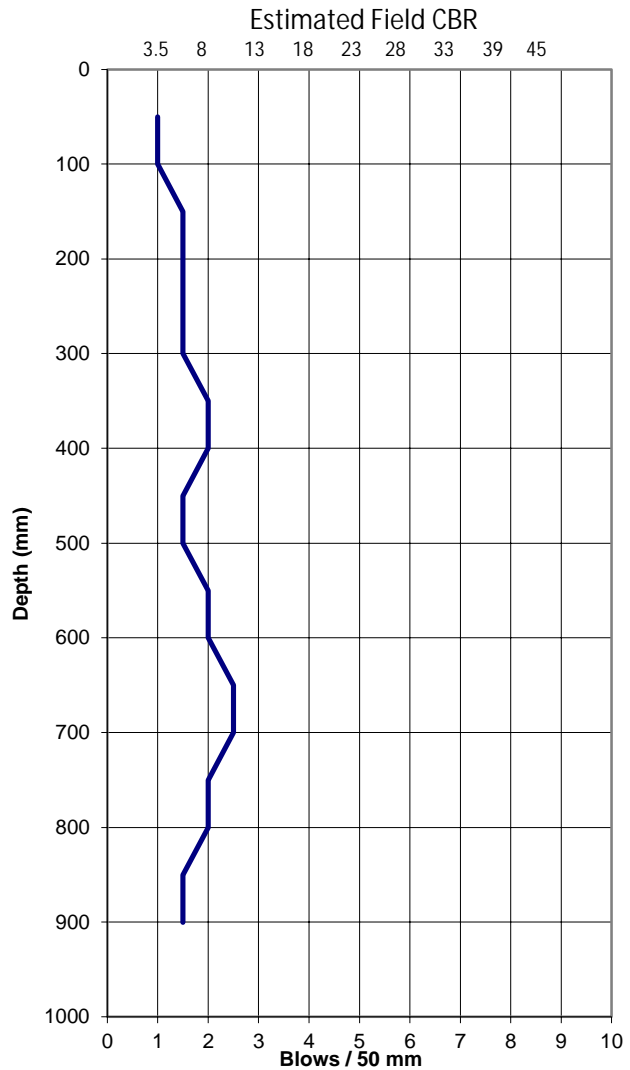
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP35

Sheet 37
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1.5
300	1.5
350	2
400	2
450	1.5
500	1.5
550	2
600	2
650	2.5
700	2.5
750	2
800	2
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

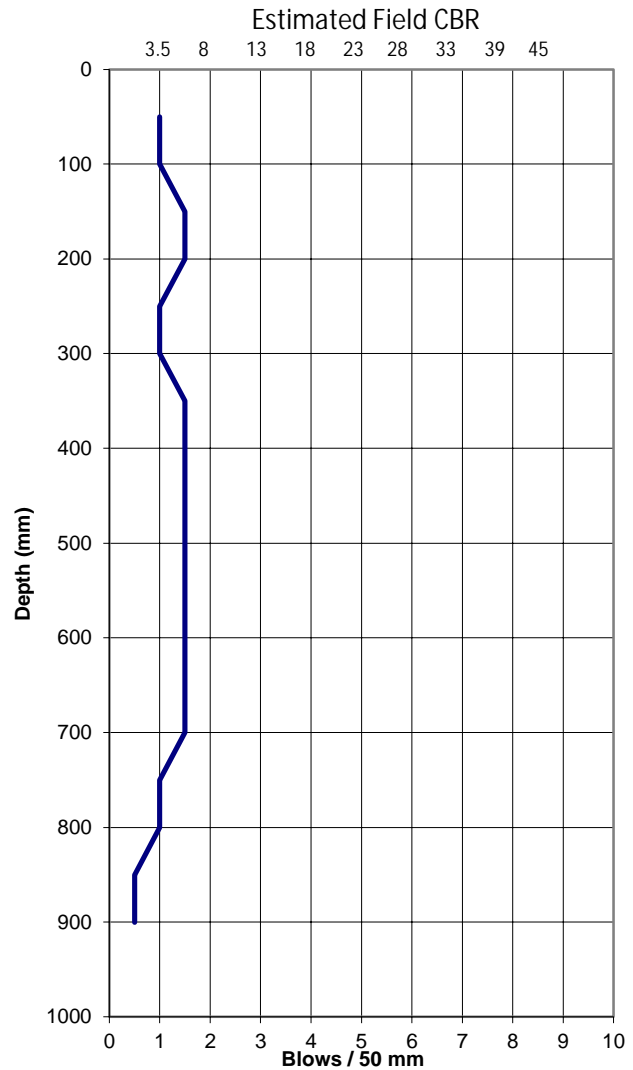
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP36

Sheet 38
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1
300	1
350	1.5
400	1.5
450	1.5
500	1.5
550	1.5
600	1.5
650	1.5
700	1.5
750	1
800	1
850	0.5
900	0.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

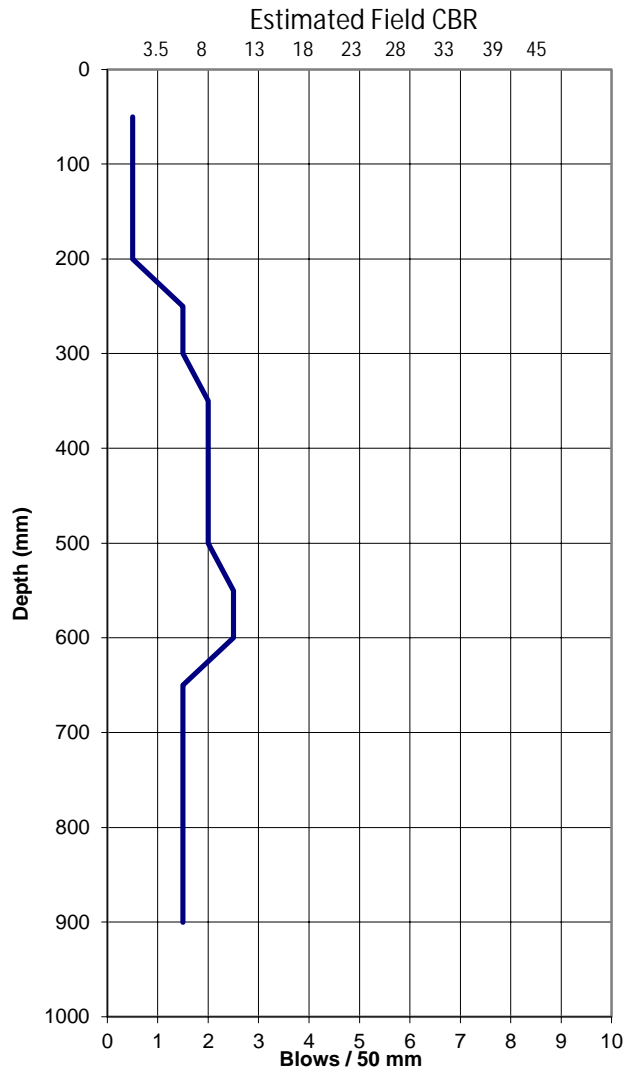
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP37

Sheet 39
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	1.5
300	1.5
350	2
400	2
450	2
500	2
550	2.5
600	2.5
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

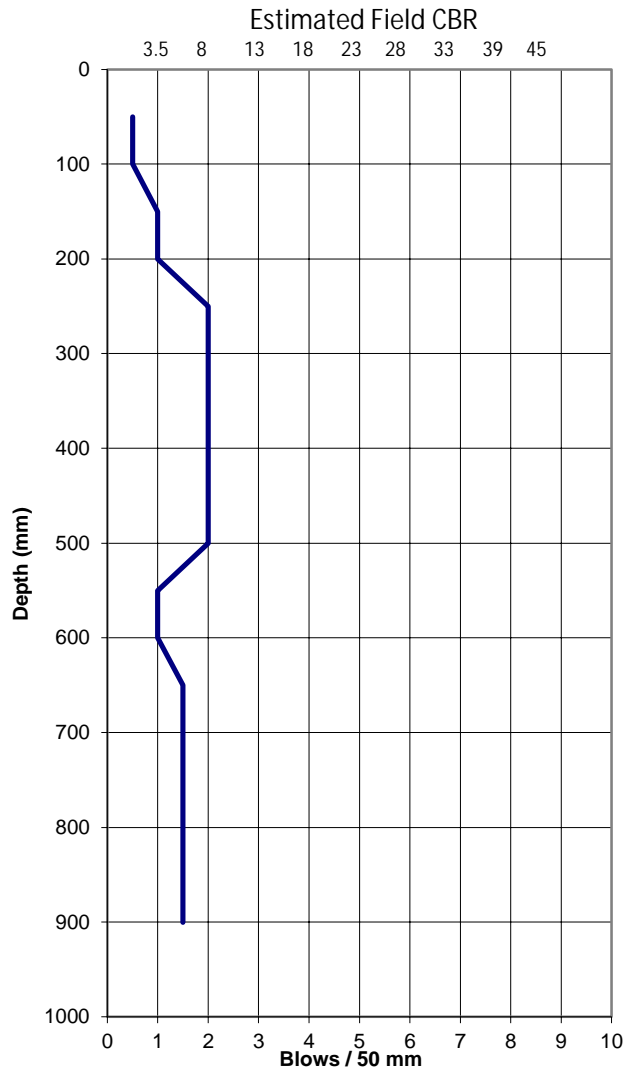
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP38

Sheet 40
 of

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	2
300	2
350	2
400	2
450	2
500	2
550	1
600	1
650	1.5
700	1.5
750	1.5
800	1.5
850	1.5
900	1.5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

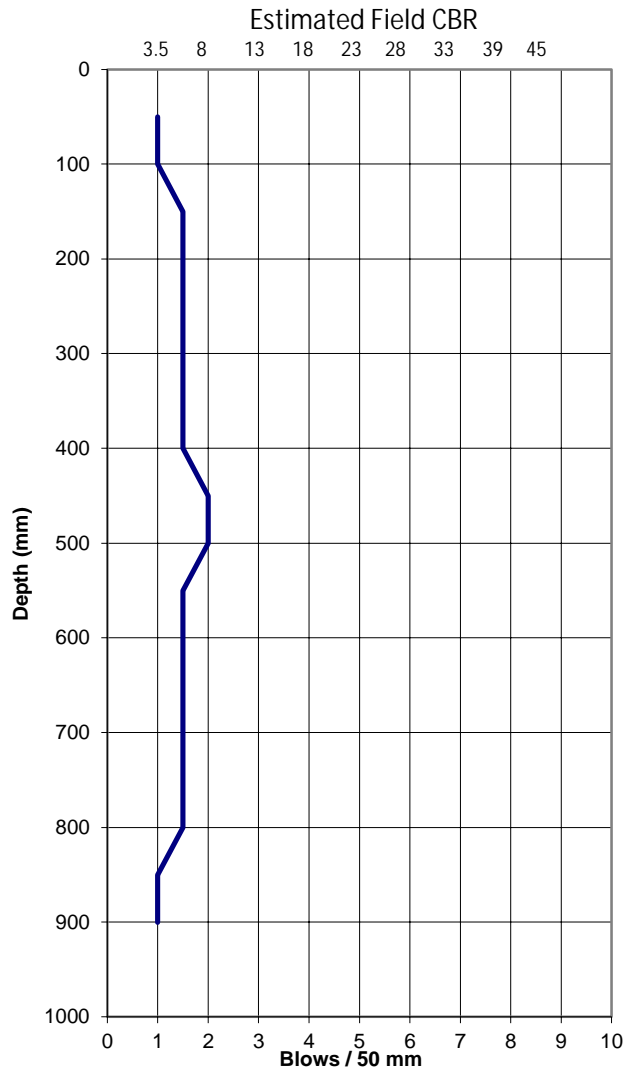
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP39

Sheet 41
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1.5
300	1.5
350	1.5
400	1.5
450	2
500	2
550	1.5
600	1.5
650	1.5
700	1.5
750	1.5
800	1.5
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

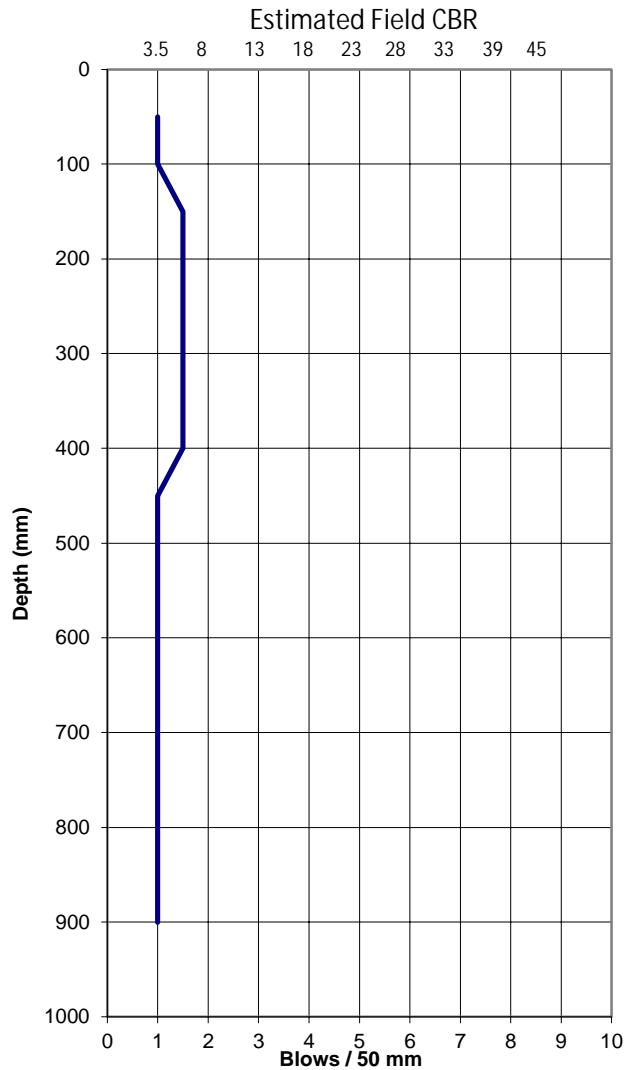
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP40

Sheet 42
 of

mm Driven	No. of Blows
50	1
100	1
150	1.5
200	1.5
250	1.5
300	1.5
350	1.5
400	1.5
450	1
500	1
550	1
600	1
650	1
700	1
750	1
800	1
850	1
900	1



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

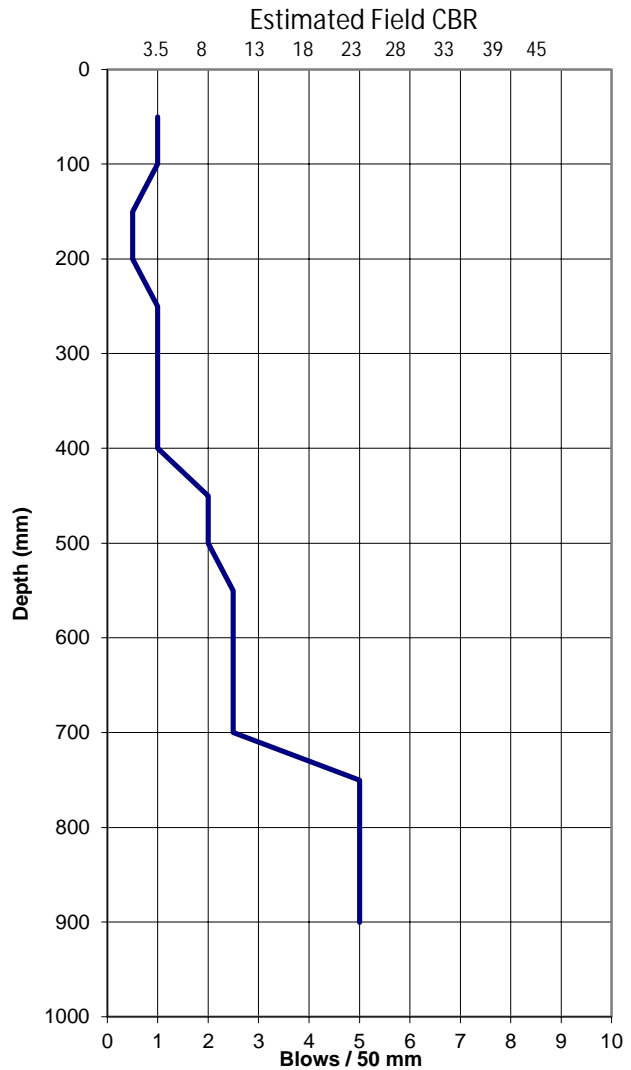
Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Piritahi**Piritahi****SCALA PENETROMETER LOG**

Job No: 1007708.2102 Date: 16/12/2022
 Project: *Piritahi Mangere West A* Operated by: *SCZH and CATA*
 Location: *MW-A17* Logged by: *SCZH and CATA*
 RL: 5 Checked by:

Test No. DCP41**Sheet 43
of**

mm Driven	No. of Blows
50	1
100	1
150	0.5
200	0.5
250	1
300	1
350	1
400	1
450	2
500	2
550	2.5
600	2.5
650	2.5
700	2.5
750	5
800	5
850	5
900	5



Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer



Piritahi

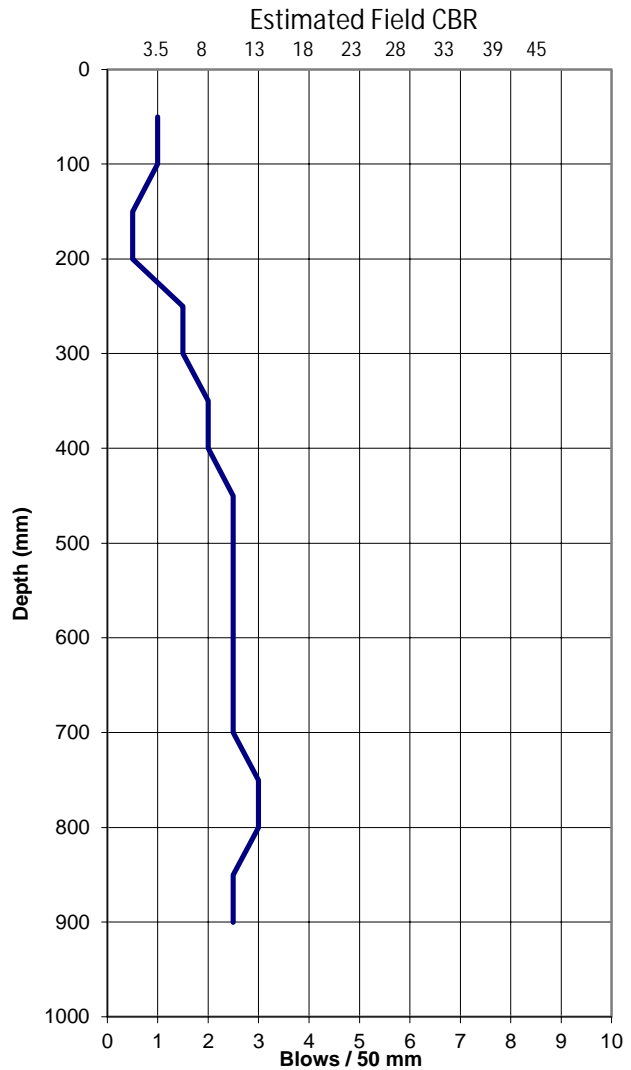
SCALA PENETROMETER LOG

Job No: 1007708.2102 Date: 16/12/2022
 Project: Piritahi Mangere West A Operated by: SCZH and CATA
 Location: MW-A17 Logged by: SCZH and CATA
 RL: 5 Checked by:

Test No. DCP42

Sheet 44
 of

mm Driven	No. of Blows
50	1
100	1
150	0.5
200	0.5
250	1.5
300	1.5
350	2
400	2
450	2.5
500	2.5
550	2.5
600	2.5
650	2.5
700	2.5
750	3
800	3
850	2.5
900	2.5

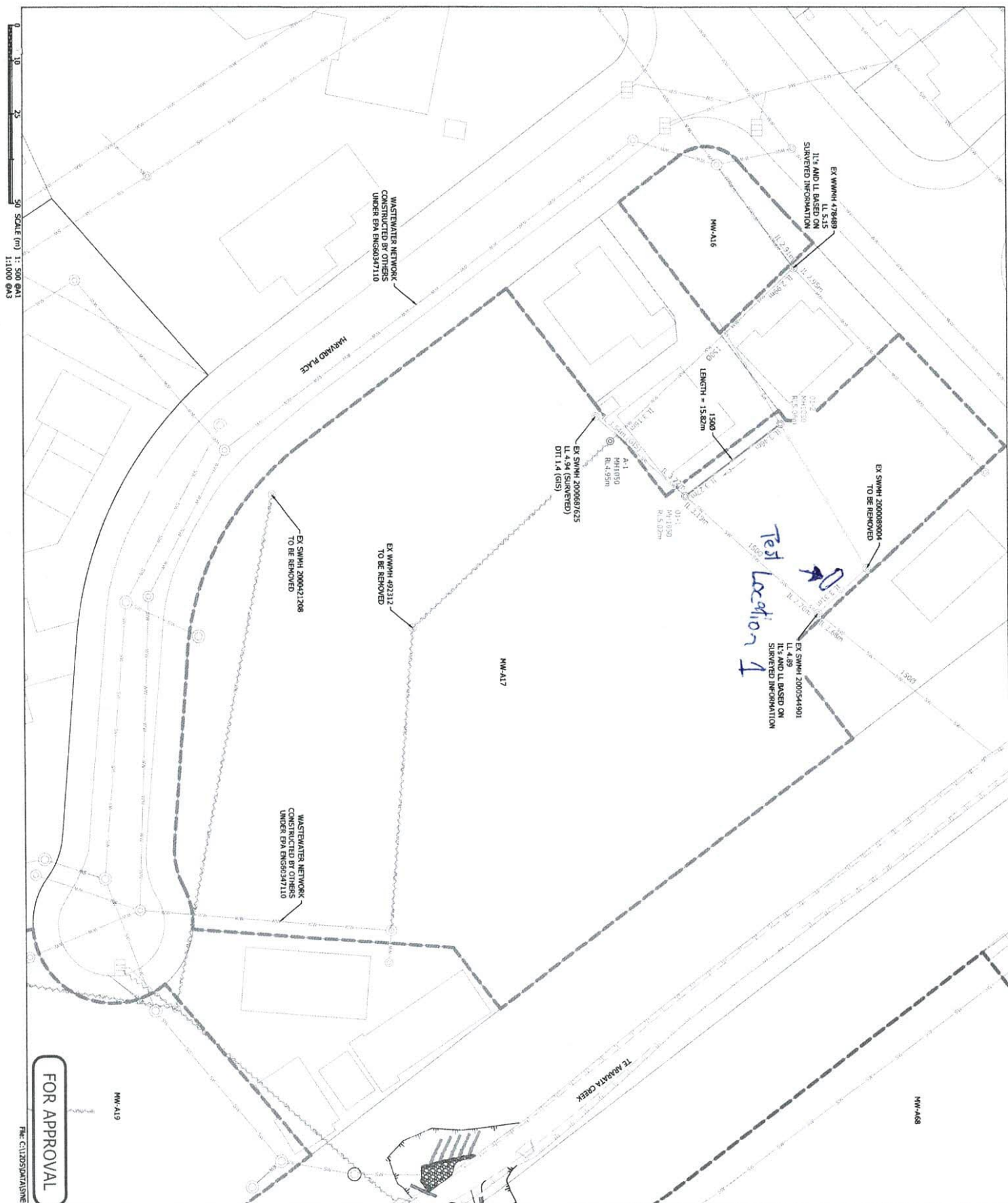


Note: The estimated CBR values are based upon Fig. 5, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (1992) 'Pavement Design - A Guide to the Structural Design of Road Pavements'

Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Appendix B – As Built Plans

Appendix C – Piritahi Test Results



- NOTES:

1. WORKMAN MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AJO/COUNCIL COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWINGS AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AJO/COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTORS TO CONFER LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TPODS/PLAN/1-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONSTRUCTION SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO PIPE INSTALLATION SHALL BE REPORTED TO THE ENGINEER FOR APPROVAL.

LEGEND:

-
- EXISTING BOUNDARIES
- STREETLIGHT POLE COMPONENT STAGE 3 BOUNDARY
- SUPERLIFT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- PROPOSED WASTEWATER MAINLINE
- PROPOSED WASTEWATER MANHOLE
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER TREATMENT PLANT



LAYING THE GROUNDWORK

REVISION DETAILS


MANGERE WEST DEVELOPMENT

DESCRIPTION:

STORMWATER & WASTEWATER LAYOUT PLAN

SUPERLOT MW-A1/

SURVEYED	-	-
DESIGNED	AE	20.05.20
DRAWN	AE	20.05.20
CHECKED	CA	20.05.20

 N

File: C:\1205\DATA\SYNERGY\SERVER\1D_1283\02 DESIGN\CAD\CURRENT\TDC057-A17-4001.DWG

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	21/10/22
Location/Description	7a Elmdon St (Trench Lateral)	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		910	36	5			
			30				
			32				
			36				
2				6			
3				7			
4				8			

Tested By: *Yashvinder Singh* Date: 21/10/22

Reviewed By: _____ Date: _____

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	21/10/22
Location/Description	Trench Lateral (Ta Elmden St)	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		600	39	5			
			38				
			39				
			32				
2				6			
3				7			
4				8			

Tested By: Yaduinder Singh Date: 21/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOL 57 Mangere West	Date:	21/10/22
Location/Description	7A Elmdon St (Trench Lateral)	Layer:	

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/22
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		300	36	5			
			30				
			31				
			42				
2				6			
3				7			
4				8			

Tested By:	Yaduvinder Singh	Date:	21/10/22
Reviewed By:		Date:	

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOL 57 Manger West	Date:	21/10/22
Location/Description	7A Elmdon St (Trench Lateral)	Layer:	3

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Grp 65	Calibration Expiry Date:	23/11/22
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	33	5			
			30				
			30				
			39				
2				6			
3				7			
4				8			

Tested By:	Yadwinder Singh	Date:	21/10/22
Reviewed By:		Date:	

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	21/10/22
Location/Description:	7a Elmdon St (Lateral)	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	32	5			
		0	30				
			33				
			36				
2				6			
3				7			
4				8			

Tested By: Yodunder Singh Date: 21/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	7/10/22
Location/Description	7a Elmdon St (Lateral)	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		300	34	5			
			30				
			35				
			32				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 7/10/22

Reviewed By: Date:

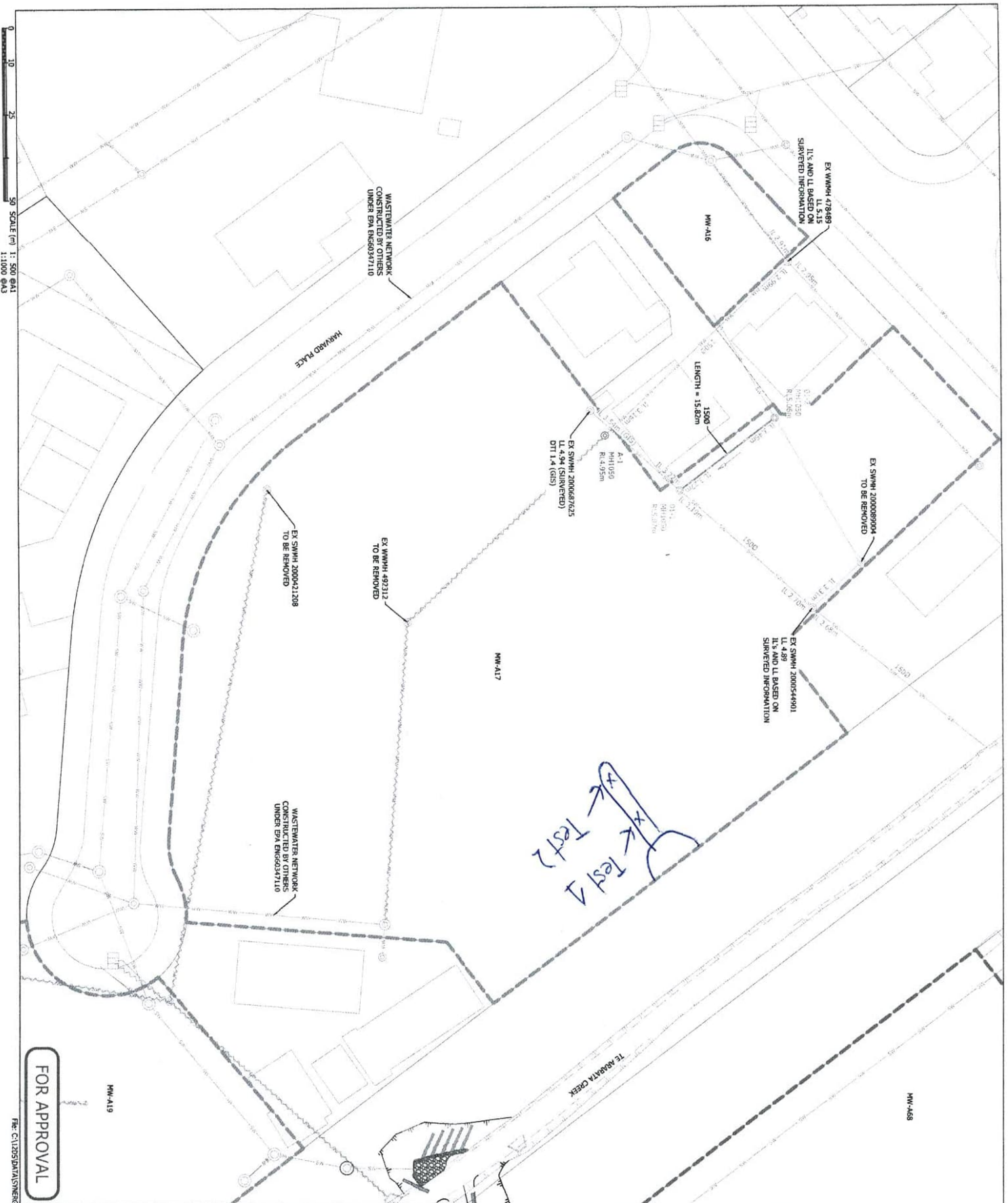
Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021



Handwritten notes: 'Test 1' and 'Test 2' with arrows pointing to specific locations on the plan.

- NOTES:**
- WORKS, MATERIALS AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR ROADWORKS, 2015, ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
 - EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
 - CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
 - REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
 - CONTRACTOR SHALL EXCAVATE AND CORRECT INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATCHPIT
- EXISTING OUTLET

Kāinga Ora
Piritahi
Housing and Communities
LAYING THE GROUNDWORK

PROJECT: STAGE 4 MANGERE WEST DEVELOPMENT

1	FOR ENGINEERING APPROVAL	CA	20.05.2022
REVISION DETAILS	BY	DATE	

DESCRIPTION: STORMWATER & WASTEWATER LAYOUT PLAN
SUPERLOT MW-A17

SURVEYED	AE	20.05.2022
DRAWN	AE	20.05.2022
CHECKED	CA	20.05.2022
APPROVED	HW	20.05.2022

FOR APPROVAL

SCALE: 1:500 @A1 1:1000 @A3

PRECINCT: MANGERE WEST

STATUS: FOR ENGINEERING APPROVAL

DWG NO: TOC057-MWA17-4001

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	8 Howard Place Lateral	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		320	31	5			
			30				
			32				
			33				
2		300	39	6			
			33				
			36				
			30				
3				7			
4				8			

Tested By: Yachinder Singh Date: 27/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

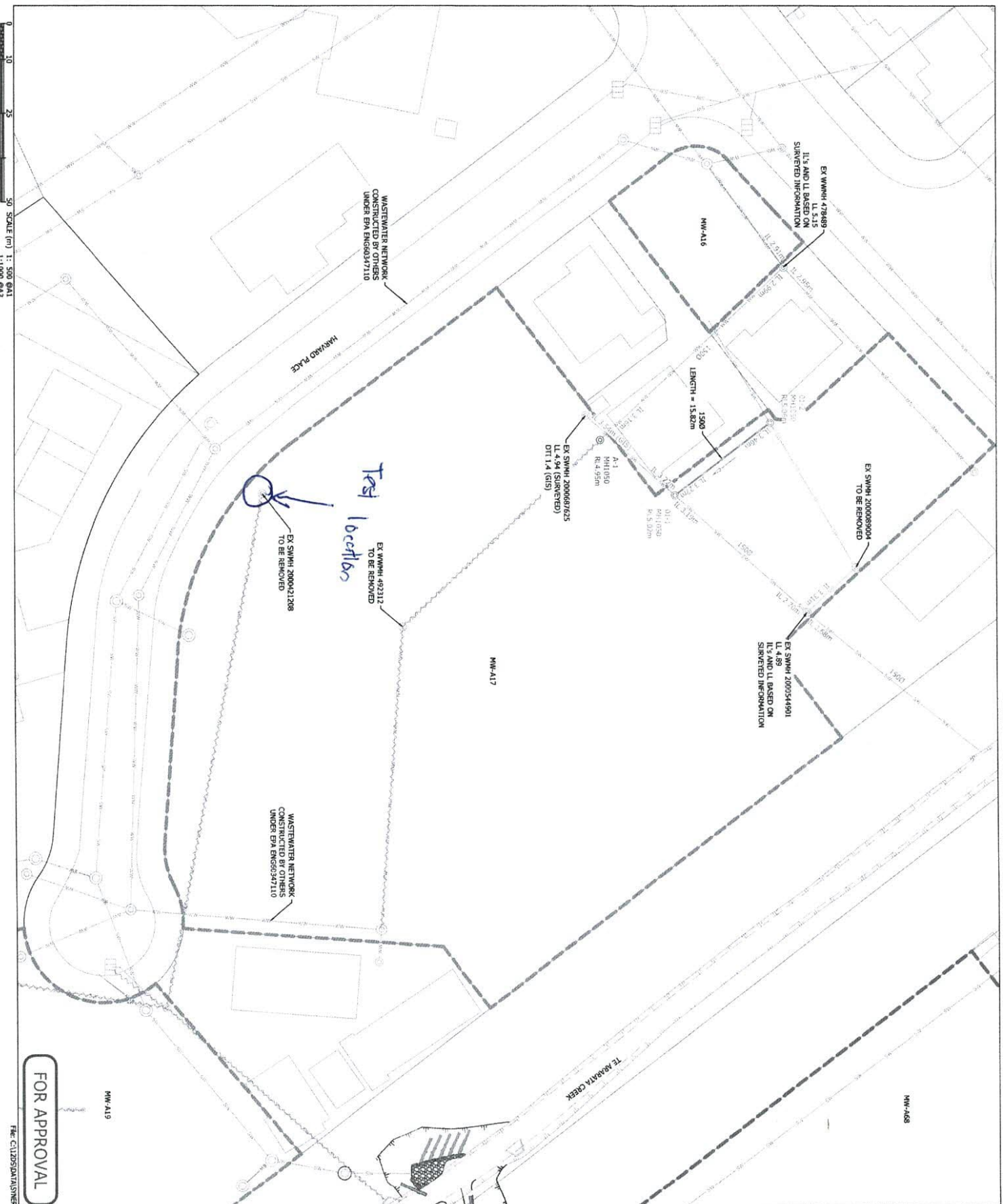
TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	8 Horwood Place Lateral	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	33	5			
			32				
			36				
			30				
2		0	30	6			
			31				
			38				
			30				
3				7			
4				8			

Tested By:	Yadvinder Singh	Date:	27/10/22
Reviewed By:		Date:	



- NOTES:**
1. WORKS MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
 2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
 3. CONTRACTOR TO CONFER LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
 4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
 5. CONTRACTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT
- STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT
- STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATCIPRT
- EXISTING OUTLET



REVISION	DATE	BY	QA
1 FOR ENGINEERING APPROVAL	20.05.2022		

STAGE 4
MANGERE WEST DEVELOPMENT

DESCRIPTION:
STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

SURVEYED	AE	20.05.2022
DESIGNED	AE	20.05.2022
DRAWN	AE	20.05.2022
CHECKED	CA	20.05.2022
APPROVED	MW	20.05.2022

SCALE 1:500 @A1 1:1000 @A3
STATUS FOR ENGINEERING APPROVAL
PRECINCT MANGERE WEST
1

FOR APPROVAL

DWG NO TOC057-MWA17-4001

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	19/10/22
Location/Description	Ex SWMH 2000/21208 (12 Harvard)	Layer:	Base / First / 2nd

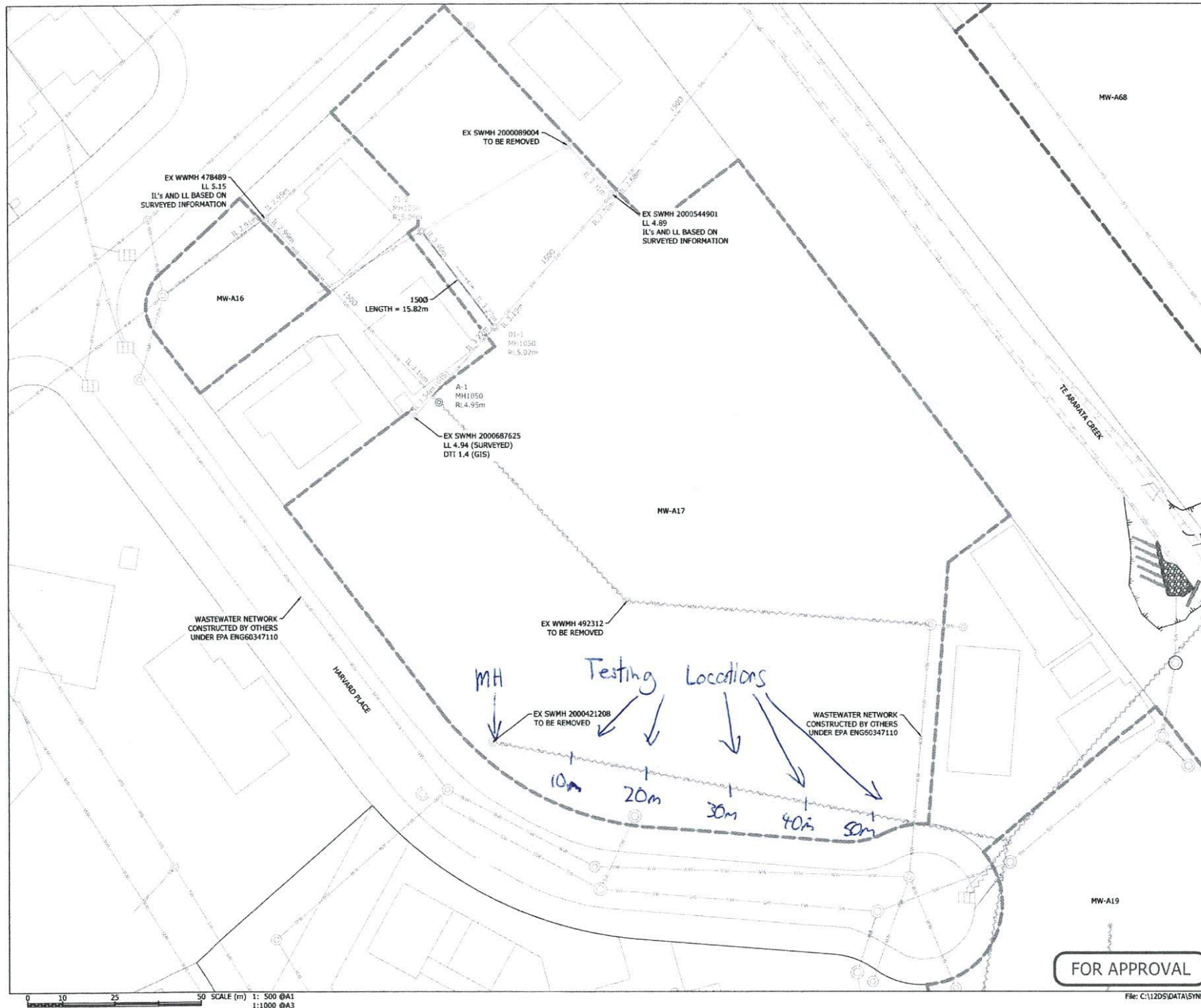
Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	0	1900	41	5			
			34				
			36				
			53				
2	0	1600	51	6			
			35				
			38				
			48				
3	0	1300	34	7			
			32				
			39				
			53				
4				8			

Tested By: Yachindes Singh Date: 19/10/22

Reviewed By: Date:



NOTES:

- WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
- EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
- CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
- REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
- CONTRACTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

	EXISTING BOUNDARIES
	SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
	SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
	PROPOSED STORMWATER NETWORK UPGRADES
	EXISTING STORMWATER NETWORK
	EXISTING STORMWATER NETWORK TO BE REMOVED
	EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
	PROPOSED WASTEWATER MANHOLE
	EXISTING WASTEWATER NETWORK
	EXISTING WASTEWATER NETWORK TO BE REMOVED
	EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
	EXISTING CATCHPIT
	EXISTING OUTLET

Kāinga Ora
Homes and Communities
Piritahi
LAYING THE GROUNDWORK

REVISION	DETAILS	BY	DATE
1	FOR ENGINEERING APPROVAL	CA	20.05.2022

PROJECT: **STAGE 4 MANGERE WEST DEVELOPMENT**

DESCRIPTION: **STORMWATER & WASTEWATER LAYOUT PLAN SUPERLOT MW-A17**

	SURVEYED	+	+
	DESIGNED	AE	20.05.2022
	DRAWN	AE	20.05.2022
	CHECKED	CA	20.05.2022
	APPROVED	HW	20.05.2022
SCALE	1:500 @A1	1:1000 @A3	REVISION
STATUS	FOR ENGINEERING APPROVAL		1
PRECINCT	MANGERE WEST		
DWG NO	TOC057-MWA17-4001		

FOR APPROVAL

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	16/9/22
Location/Description	Stormwater Main 12 Howard Place	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	1100	31	5			
			31				
			30				
			30				
2	20	1100	34	6			
			30				
			30				
			30				
3	30	1100	33	7			
			31				
			30				
			30				
4				8			

Tested By:	Yachinder Singh	Date:	16/9/22
Reviewed By:		Date:	

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	16/9/22
Location/Description	SW Main 12 Harvard Place	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	740	36	5			
			30				
			42				
			33				
2	20	780	30	6			
			32				
			38				
			30				
3	30	800	32	7			
			47				
			34				
			41				
4				8			

Tested By: Yashvinder Singh	Date: 16/9/22
Reviewed By:	Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	16/9/22
Location/Description	SW Main 12 Harvard Place	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	500	30	5			
			43				
			30				
			40				
2	20	500	30	6			
			41				
			61				
			33				
3	30	500	43	7			
			56				
			59				
			34				
4				8			

Tested By: Yashwinder Singh Date: 16/9/22
Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57	Mangere West	Date:	16/9/22
Location/Description	SW Main	12 Howard place	Layer:	3

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	300	42	5			
			52				
			35				
			42				
2	20	300	32	6			
			43				
			53				
			63				
3	30	300	30	7			
			40				
			43				
			31				
4				8			

Tested By: <i>Yadvinder Singh</i>	Date: 16/9/22
Reviewed By:	Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	19/9/22
Location/Description	SW Main 12 Howard Place	Layer:	4

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	0	31	5			
			34				
			42				
			37				
2	20	0	30	6			
			32				
			42				
			33				
3	30	0	41	7			
			42				
			35				
			46				
4				8			

Tested By: Yadvinder Singh Date: 19/9/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57	Mangere West	Date:	20/9/22
Location/Description	SW Main	14 Harvard Place	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	40	1250	30	5			
			35				
			35				
			37				
2	50	1225	33	6			
			33				
			32				
			31				
3				7			
4				8			

Tested By: Yashvinder Singh Date: 20/9/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57	Mangere West	Date:	20/9/22
Location/Description	SW Main	14 Harvard Place	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	40	1500	33	5			
			31				
			60				
			30				
2	50	1700	50	6			
			33				
			40				
			55				
3				7			
4				8			

Tested By: Yadvinder Singh Date: 20/9/22

Reviewed By: _____ Date: _____

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	21/9/22
Location/Description	SW Main 14 Harvard Place	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	40	1050	32	5			
			58				
			42				
			38				
2	50	1000	37	6			
			32				
			69				
			34				
3				7			
4				8			

Tested By: Yachinder Singh Date: 21/9/22
Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	21/9/22
Location/Description	SW Main 14 Howard Place	Layer:	3

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	40	600	48	5			
			55				
			36				
			36				
2	50	650	55	6			
			45				
			46				
			52				
3				7			
4				8			

Tested By: Yachinda Singh Date: 21/9/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57	Mangere West	Date:	21/9/22
Location/Description	SW	Main	Layer:	4

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	40	300	33	5			
			64				
			43				
			31				
2	50	300	30	6			
			38				
			69				
			34				
3				7			
4				8			

Tested By: Yashvir Singh Date: 21/9/22
Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

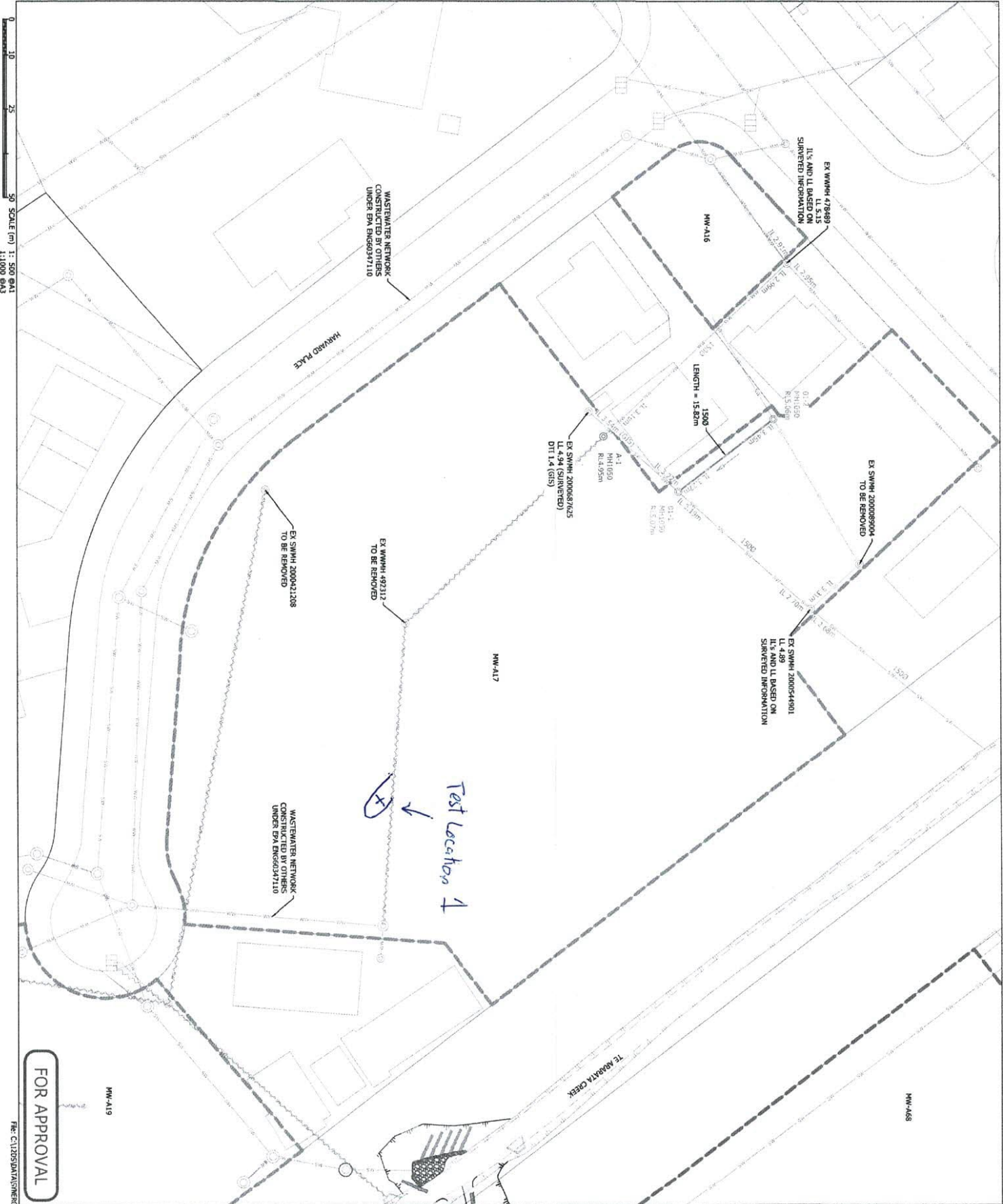
Revision: 1

Page 1 of 1

August 2021







- NOTES:**
1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWINGS AND THE SPECIFICATIONS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
 2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
 3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
 4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON LOCOS: MWA17-1101 FOR PIPE AND MANHOLE SPECIFICATIONS.
 5. CONSTRUCTION SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MAINLINE
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATGROFT
- EXISTING OUTLET

Kainga Ora
Piritahi
 LAYING THE GROUNDWORK

STAGE 4

REVISION DETAILS	BY	DATE
1 FOR ENGINEERING APPROVAL	CA	20.05.2022

PROJECT:
 MANGERE WEST DEVELOPMENT

DESCRIPTION:
 STORMWATER & WASTEWATER LAYOUT PLAN
 SUPERLOT MW-A17

STATUS	DATE	REVISION
DESIGNED	20.05.2022	1
CHECKED	20.05.2022	1
APPROVED	20.05.2022	1

FOR APPROVAL

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	15/10/22
Location/Description	NW Main MW-A17	Layer:	Base

Test Methods: Lateral

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		600	32	5			
			30				
			33				
			39				
2				6			
3				7			
4				8			

Tested By: Yachinder Singh Date: 15/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	15/10/22
Location/Description	WW Main MW-A17	Layer:	1

Test Methods: Lateral

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		300	32	5			
			32				
			33				
			35				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 15/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	15/10/22
Location/Description	WW Main MW-A17	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	41	5			
			34				
			41				
			33				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 15/10/22

Reviewed By: Date:

NOTES:

1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONSTRUCTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

	EXISTING BOUNDARIES
	SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
	SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
	PROPOSED STORMWATER NETWORK UPGRADES
	EXISTING STORMWATER NETWORK
	EXISTING STORMWATER NETWORK TO BE REMOVED
	EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
	PROPOSED WASTEWATER MANHOLE
	EXISTING WASTEWATER NETWORK
	EXISTING WASTEWATER NETWORK TO BE REMOVED
	EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
	EXISTING CATCHPIT
	EXISTING OUTLET

Kainga Ora
Piritahi
LAYING THE GROUNDWORK

REVISION DETAILS	BY	DATE
1 FOR ENGINEERING APPROVAL	CA	20.05.2022

PROJECT:
STAGE 4
MANGERE WEST DEVELOPMENT

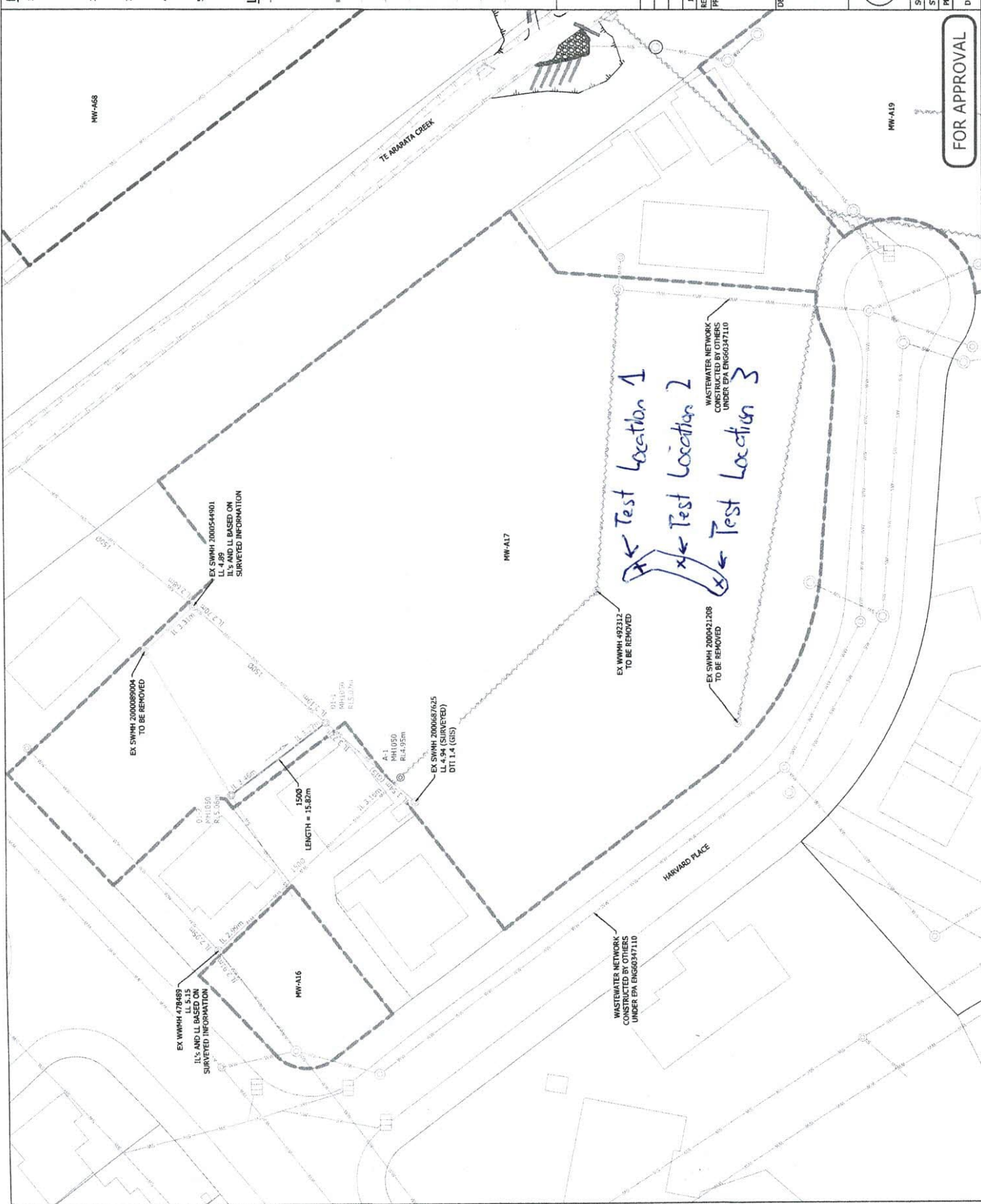
DESCRIPTION:

STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

	SURVEYED	20.05.2022
DESIGNED	AE	20.05.2022
DRAWN	AE	20.05.2022
CHECKED	CA	20.05.2022
APPROVED	HW	20.05.2022
SCALE	1:500 @A1	1:1000 @A3
STATUS	FOR ENGINEERING APPROVAL	REVISION
PRECINCT	MANGERE WEST	1

DWG NO
TOC057-MWA17-4001

FILE: C:\13505\DATA\ENGINEERING\REV\13505_03 DESIGN\CAD\CURRENT\TOC057-A17-4001.DWG



0 10 25 50 SCALE (m) 1: 500 @A1 1:1000 @A3

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	29/9/22
Location/Description	14 Horvord Place (Lateral)	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		500	32	5			
			33				
			37				
			38				
2		500	41	6			
			31				
			46				
			34				
3		500	32	7			
			34				
			35				
			35				
4				8			

Tested By: Yadvinder Singh Date: 29/9/22

Reviewed By: Date:

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	29/9/22
Location/Description	14 Howard Place (Lateral)	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		200	37	5			
			35				
			38				
			45				
2		200	39	6			
			38				
			38				
			42				
3		180	43	7			
			33				
			31				
			34				
4				8			

Tested By: Yadvinder Singh Date: 29/9/22
Reviewed By: _____ Date: _____

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	29/9/22
Location/Description	14 Howard Place (Lateral)	Layer:	1 2

Test Methods:

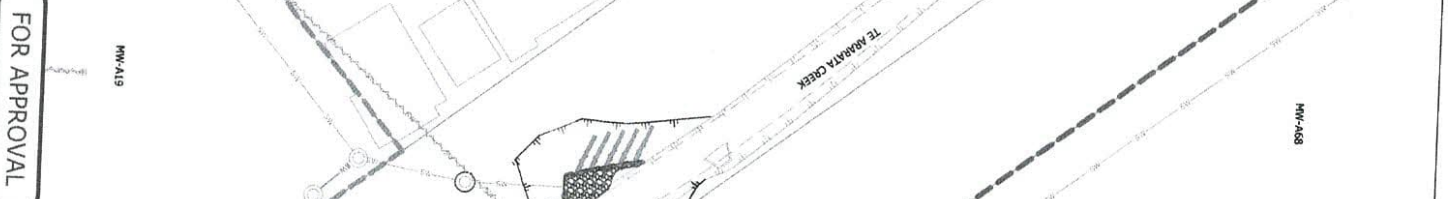
Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	35	5			35
			30				
			34				
			36				
2		0	30	6			
			31				
			37				
			37				
3		0	34	7			
			32				
			34				
			35				
4				8			

Tested By: Yachander Singh Date: 29/9/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.



1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE ALBUQUERQUE CITY ENGINEERING DEPARTMENT'S STANDARD SPECIFICATIONS FOR WATER ABILITY BETWEEN THESE DRAINING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THE PLAN IS A COMBINATION OF ALBUQUERQUE CITY DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REEFS TO DRAINAGE LONGITUDINAL SECTIONS ON TIE RODS 1/2" DIA. @ 4'-10" FOR PIPE AND MAINHOLE SPECIFICATIONS.
5. CONSTRUCTION SHALL EXCAVATE AND CONFIRM EXISTING LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

-LEGEND:

-
- The diagram illustrates the evolution of network boundaries through six stages, labeled 1 through 6, arranged vertically. Each stage is represented by a small icon and a corresponding text label below it.
- 1** A single node icon. Below it: EXISTING BOUNDARIES
 - 2** A node icon connected to a single line. Below it: SUPERLOT DEVELOPMENT STAGE 1 BOUNDARY
 - 3** A node icon connected to a line that branches into two. Below it: SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
 - 4** A node icon connected to a line that branches into three. Below it: PROPOSED STORMWATER NETWORK UPGRADES
 - 5** A node icon connected to a line that branches into four. Below it: EXISTING STORMWATER NETWORK TO BE REMOVED
 - 6** A node icon connected to a line that branches into five. Below it: EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- Below these six stages, there are three additional text labels, each preceded by a small circle icon:
- PROPOSED WASTEWATER MAINLINE
 - EXISTING WASTEWATER NETWORK TO BE REMOVED
 - EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- At the bottom of the diagram, there are three more text labels, each preceded by a small triangle icon:
- EXISTING CATCHMENT
 - EXISTING CATCHMENT
 - EXISTING CATCHMENT




LAYING THE GROUNDWORK

STAGE 4
MANGERE WEST DEVELOPMENT

DESCRIPTION:
STORMWATER & WASTEWATER

SURVEYED	-	-
----------	---	---

	DESIGNED	AE	20.05..
	DRAWN	AE	20.05.5
	CHECKED	CA	20.05.2
	APPROVED	HW	20.05.2
SCALE	1:500 @A1	1:1000 @A3	REVISION
STATUS	FOR ENGINEERING APPROVAL		
PROJECT	MANAGER WORK		

FOR APPROVAL

File: C:\12DS\DATA\SYNFR\SYSTEMED\1.D 1500

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 51 Mangere West	Date:	21/10/22
Location/Description	4 Horizontal Pipe	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gcp 65	Calibration Expiry Date:	23/11/22
Criteria:	≥ 5	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		1000	32	5			
			36				
			39				
			34				
2				6			
3				7			
4				8			

Tested By: Yashinder Singh Date: 21/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	4 Harvard Place	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		600	32	5			
			33				
			31				
			36				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 27/10/22
Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	4 Howard Place	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		300	32	5			
			30				
			38				
			32				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 27/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	28/10/22
Location/Description	4 Howard Place	Layer:	3

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	36	5			
			41				
			40				
			34				
2				6			
3				7			
4				8			

Tested By: *Yadvinder Singh* Date: 28/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	8 Harvard Place	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		300	32	5			
			36				
			30				
			38				
2		290	31	6			
			32				
			34				
			30				
3		400	32	7			
			30				
			36				
			30				
4		500	31	8			
			38				
			42				
			42				

Tested By:	Yaduvinder Singh	Date:	27/10/22
Reviewed By:		Date:	

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	8 Aconard Place	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	33	5			
			31				
			30				
			32				
2		0	41	6			
			32				
			33				
			30				
3		100	31	7			
			30				
			35				
			30				
4		250	31	8			
			33				
			30				
			36				

Tested By: *Yashinder Singh* Date: 27/10/22

Reviewed By: _____ Date: _____

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	27/10/22
Location/Description	8 Harvard Place, MW-A17	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1				5			
2				6			
3		0	32	7			
			33				
			30				
			41				
4		0	36	8			
			32				
			31				
			33				

Tested By: Yadvinder Singh Date: 28/10/22
Reviewed By: Date:

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mungee West	Date:	26/10/22
Location/Description	Trench along driveway	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Grp 6S	Calibration Expiry Date:	23/11/22
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	33	5		900	38
			41				32
			30				30
			32				31
2		100	42	6			
			38				
			30				
			33				
3		300	33	7			
			30				
			39				
			32				
4		600	34	8			
			34				
			30				
			36				

Tested By: Yochander Singh Date: 26/10/22
Reviewed By: Date:

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	26/10/22
Location/Description	Trench along driveway	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1				5		600	32
							35
							36
							39
2		0	32	6			
			32				
			30				
			36				
3		0	41	7			
			34				
			32				
			34				
4		300	42	8			
			30				
			32				
			30				

Tested By: Yadvinder Singh Date: 26/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	705 S1 Manager West	Date:	26/10/22
Location/Description	Trench along driveway	Layer:	3

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/22
Criteria:	230	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1				5		300	37
							33
							35
							30
2				6			
3				7			
4		0	37	8			
			30				
			44				
			39				
Tested By: Yadvinder Singh				Date: 26/10/22			
Reviewed By:				Date:			

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	26/10/22
Location/Description	trench along driveway	Layer:	4

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1				5		0	32
							30
							36
							45
2				6			
3				7			
4				8			

Tested By: Yadwinder Singh Date: 26/10/22
Reviewed By: Date:

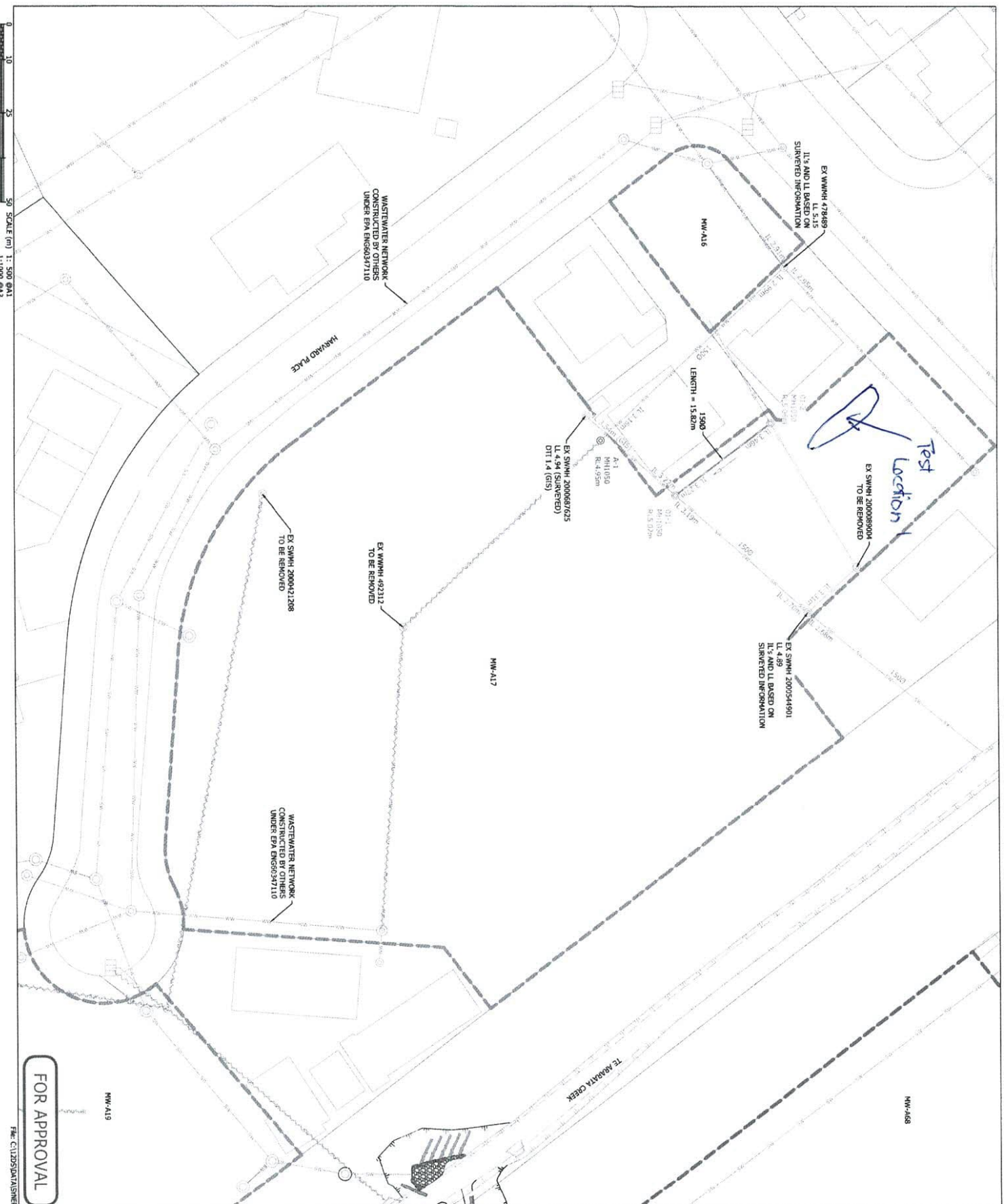
Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021



NOTES:

1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWINGS AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOXOS/WWA17-4001 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONTRACTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT
- STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT
- STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATCHPIT
- EXISTING OUTLET

Kainga Ora
Piritahi
Living the Groundwork

STAGE 4
MANGERE WEST DEVELOPMENT

REVISION DETAILS	BR	DATE
1 FOR ENGINEERING APPROVAL	CA	20.05.2022

DESCRIPTION:
STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

SURVEYED	AE	20.05.2022
DESIGNED	AE	20.05.2022
DRAWN	CA	20.05.2022
CHECKED	CA	20.05.2022
APPROVED	MW	20.05.2022
SCALE	1:500 @A1	1:1000 @A3
STATUS	FOR ENGINEERING APPROVAL	
PRECINCT	MANGERE WEST	
DWG NO	TOC057-MWA17-4001	1

FOR APPROVAL

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	12/9/22
Location/Description	9 Elmdon St	Layer:	1

Test Methods: (Lateral)

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		300	32	5			
			59				
			45				
			30				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 12/9/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	12/9/22
Location/Description	9 Elmdon St	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		0	39	5			
		0	31				
		0	33				
		0	30				
2				6			
3				7			
4				8			

Tested By: Yadvinder Singh Date: 12/9/22
Reviewed By: _____ Date: _____

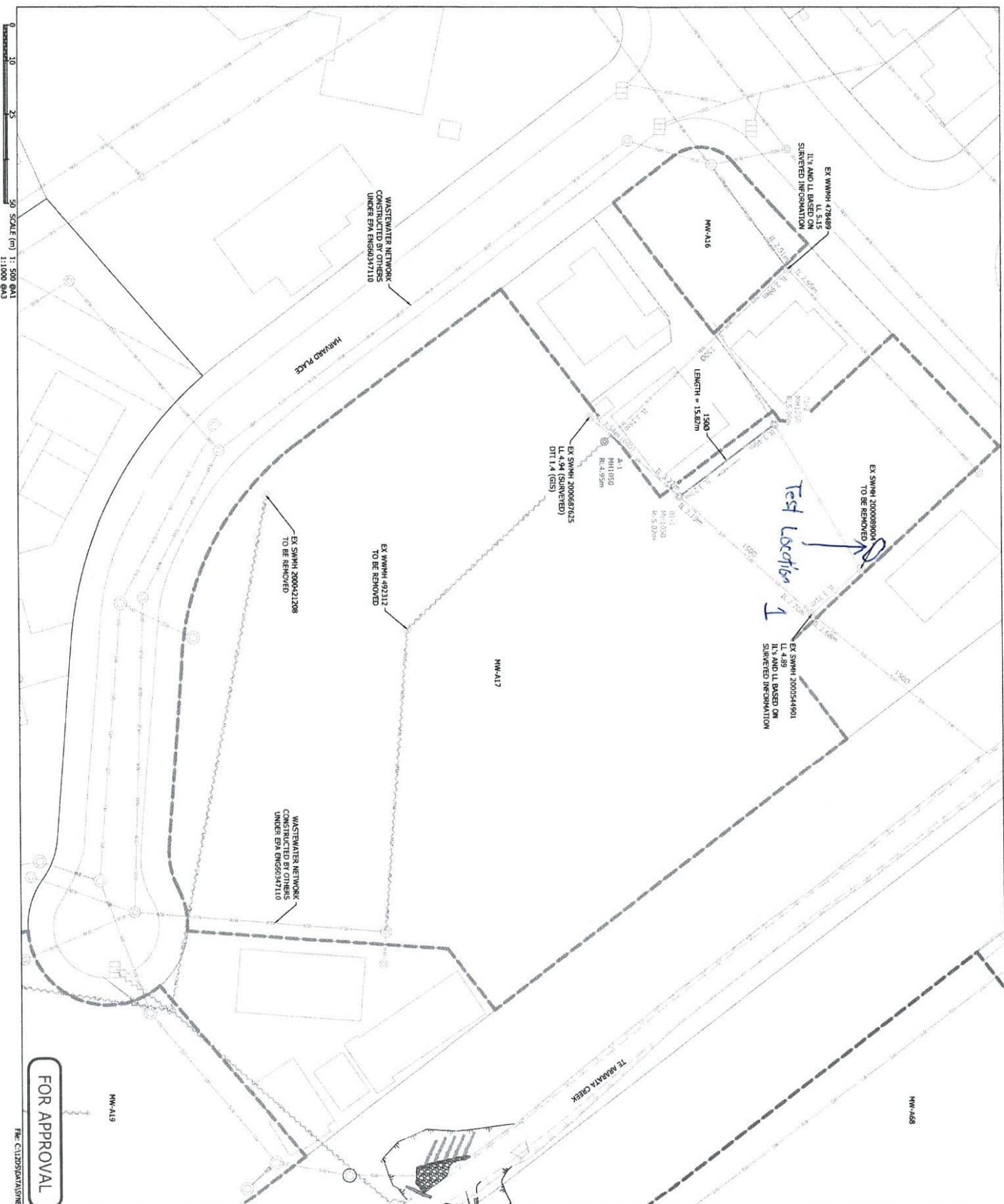
Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021



NOTES:

1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2019. ANY DEVIATIONS FROM THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2019 SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONSTRUCTION SHALL EXCAVATE AND COMPACT INVERTS TO MATCH LONGITUDINAL SECTIONS PRIOR TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.


LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & SHOUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & SHOUT FILLED
- EXISTING CATCHPIT
- EXISTING OUTLET



REVISION DETAILS			
1	FOR ENGINEERING APPROVAL	CA	20.05.2022
PROJECT:			
STAGE 4			
MANGERE WEST DEVELOPMENT			

DESCRIPTION:
STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

LAYOUT PLAN			
SUPERPLOT MW-A17			
	SURVEYED	-	-
	DESIGNED	AE	20.05.2022
	DRAWN	AE	20.05.2022
	CHECKED	CA	20.05.2022

FOR APPROVAL

DWG NO		TOC057-MWA17-4001
--------	--	-------------------

0 10 25 50 SCALE (m) 1: 500 @A1 1:1000 @A3

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	6/10/22
Location/Description	7a Elmdon (Lateral)	Layer:	Base 1st / 2nd

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	1	800	44	5			
			36				
			35				
			47				
2		500	32	6			
			30				
			34				
			31				
3		200	30	7			
			32				
			30				
			36				
4				8			

Tested By: Yadvinder Singh Date: 8/10/22

Reviewed By: Date:

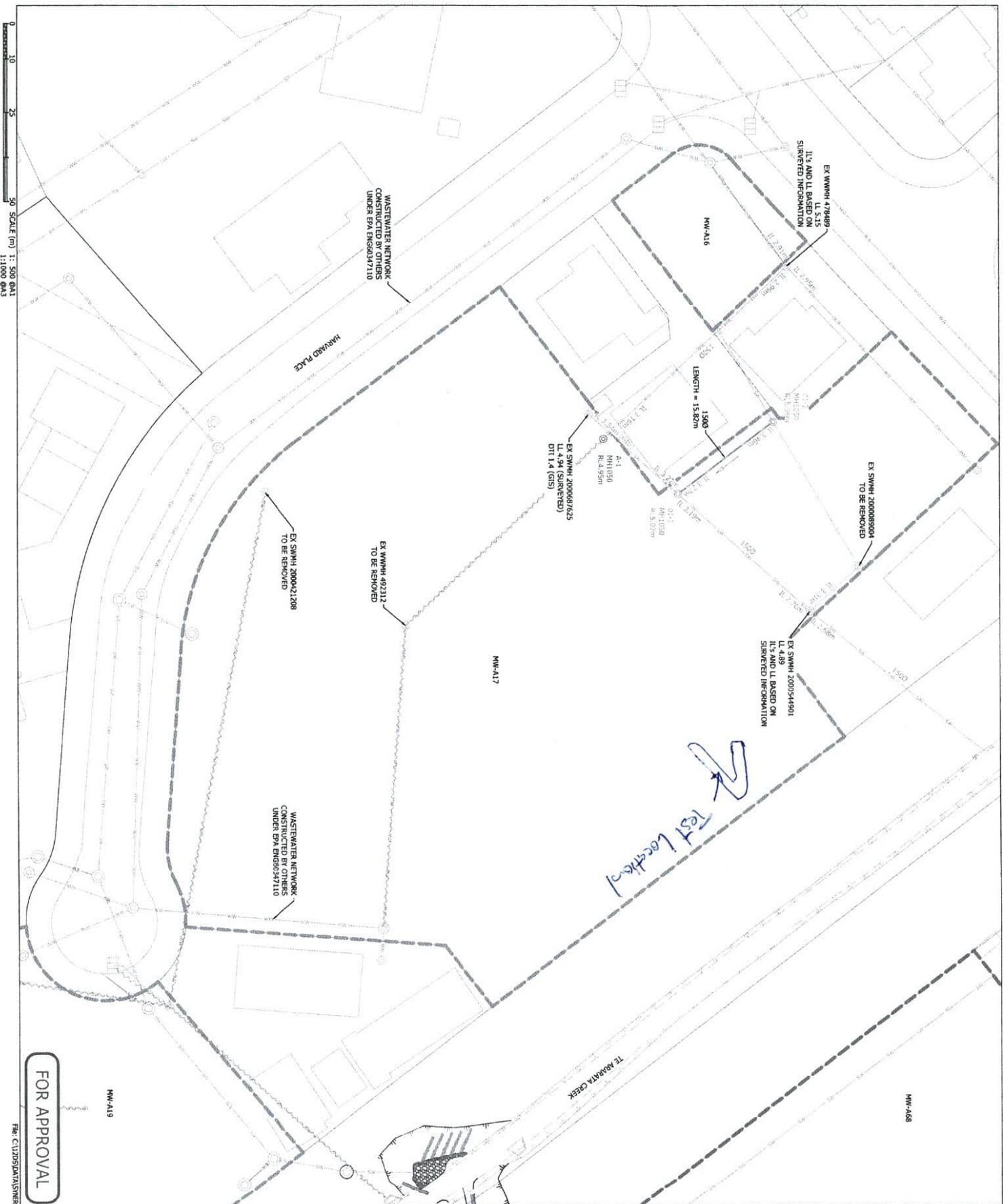
Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021



Test Location

NOTES:

1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON DRAWING 1100-1101 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONTRACTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR RESOLUTION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATCHMENT
- EXISTING OUTLET

E3 Kainga Ora
Homes and Communities
Piritahi
LAYING THE GROUNDWORK

REVISION DETAILS	BY	DATE
1 FOR ENGINEERING APPROVAL	CA	20.05.2022

STAGE 4
MANGERE WEST DEVELOPMENT

DESCRIPTION:
STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

SURVEYED	-	20.05.2022
DESIGNED	AE	20.05.2022
DRAWN	AE	20.05.2022
CHECKED	CA	20.05.2022
APPROVED	HW	20.05.2022

SCALE	1:500 (A4)	1:1000 (A3)
STATUS	FOR ENGINEERING APPROVAL	
PRECINCT	MANGERE WEST	

FOR APPROVAL

DWG NO: **TOC057-MWA17-4001**

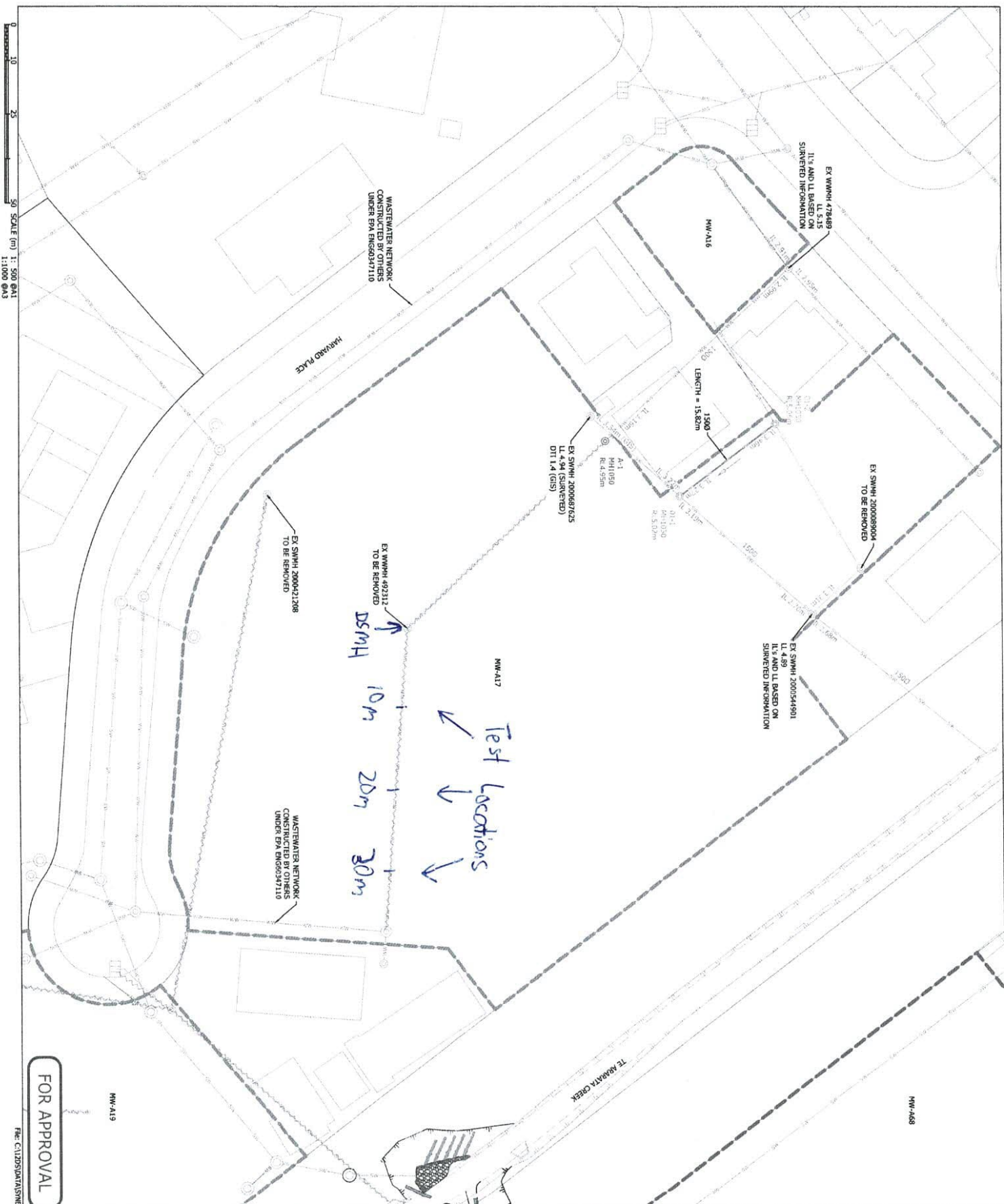
CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TBC 57 Manger West	Date:	6/10/22
Location/Description	Laterals 6 Howard Place	Layer:	Base, First

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/22
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1		500	39	5			
			37				
			34				
			36				
2		200	32	6			
			30				
			30				
			36				
3				7			
4				8			
Tested By: Yadvinder Singh				Date: 6/10/22			
Reviewed By:				Date:			



NOTES:

1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REFERRED TO IN THE STORMWATER MANAGEMENT PLAN AND THE STANDARD SPECIFICATIONS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONSTRUCTION SHALL EXCAVATE AND COMPRESS EXISTING STORMWATER NETWORKS TO THE DESIGNER'S SPECIFICATIONS. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & SHOUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & SHOUT FILLED
- EXISTING CATCHMENT
- EXISTING OUTLET



PROJECT:	
STAGE 4	
MANGERE WEST DEVELOPMENT	
REVISION DETAILS	
1 FOR ENGINEERING APPROVAL	CA 20.05.2022
BY	DATE

DESCRIPTION:

STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

SURVEYED	-	20.05.2022
DESIGNED	NE	20.05.2022
DRAWN	NE	20.05.2022
CHECKED	CA	20.05.2022
APPROVED	MW	20.05.2022
SCALE	1:500 @A1	1:1000 @A3
STATUS	FOR ENGINEERING APPROVAL	REVISION
PRECINCT	MANGERE WEST	1

FOR APPROVAL

DWG NO	TOC057-MWA17-4001
--------	-------------------

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	57 Mangere West	Date:	6/10/22
Location/Description	NW Trench	Layer:	Base

Test Methods:

Material Type:	Gap 6S	Clegg Hammer ID:	190007
Material Description:	Aggregate	Calibration Expiry Date:	23/11/22
Criteria:	> 230	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	1270	34	5			
			30				
			35				
			32				
2	20	1200	36	6			
			30				
			33				
			44				
3	30	1250	31	7			
			33				
			34				
			33				
4				8			

Tested By: Yadvinder Singh Date: 6/10/22

Reviewed By: Date:

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC S7 Mangere West	Date:	6/10/22
Location/Description	NW Trench	Layer:	1

Test Methods:

Material Type:	GAP65	Clegg Hammer ID:	19 00 07
Material Description:	Aggregate	Calibration Expiry Date:	23/11/22
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	950	44	5			
			61				
			34				
			32				
2	20	900	32	6			
			56				
			34				
			44				
3	30	890	41	7			
			37				
			40				
			35				
4				8			

Tested By: Yashinder Singh Date: 6/10/22

Reviewed By: Date:

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	70C S7 Margate West	Date:	10/10/22
Location/Description	WW Trench	Layer:	2

Test Methods:

Material Type:	Grp 65	Clegg Hammer ID:	190007
Material Description:	Aggregate	Calibration Expiry Date:	23/11/22
Criteria:	>= 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	650	35	5			
			31				
			40				
			38				
2	20	610	33	6			
			30				
			40				
			30				
3	30	620	40	7			
			32				
			45				
			30				
4				8			
Tested By: Yadvinder Singh				Date: 10/10/22			
Reviewed By:				Date:			

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	12/10/22
Location/Description	WW Trench	Layer:	3

Test Methods:

Material Type:	Gap 65	Clegg Hammer ID:	19 0007
Material Description:	Aggregate	Calibration Expiry Date:	23/11/22
Criteria:	> 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	350	31	5			
			33				
			40				
			31				
2	20	300	45	6			
			53				
			35				
			34				
3	30	300	36	7			
			31				
			50				
			32				
4				8			
Tested By: Yachinder S				Date: 12/10/22			
Reviewed By:				Date:			

NOTES:

- WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWING AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
- EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
- CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
- REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4101 FOR PIPE AND MANHOLE SPECIFICATIONS.
- CONTRACTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

	EXISTING BOUNDARIES
	SUPERLOT DEVELOPMENT STAGE 3 BOUNDARY
	SUPERLOT DEVELOPMENT STAGE 4 BOUNDARY
	PROPOSED STORMWATER NETWORK UPGRADES
	EXISTING STORMWATER NETWORK
	EXISTING STORMWATER NETWORK TO BE REMOVED
	EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
	PROPOSED WASTEWATER MANHOLE
	EXISTING WASTEWATER NETWORK
	EXISTING WASTEWATER NETWORK TO BE REMOVED
	EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
	EXISTING CATCHPIT
	EXISTING OUTLET

Kāinga Ora
Piritahi
Homes and Communities
LAYING THE GROUNDWORK

REVISION	DATE	BY
1 FOR ENGINEERING APPROVAL	20.05.2022	CA
REVISION DETAILS		

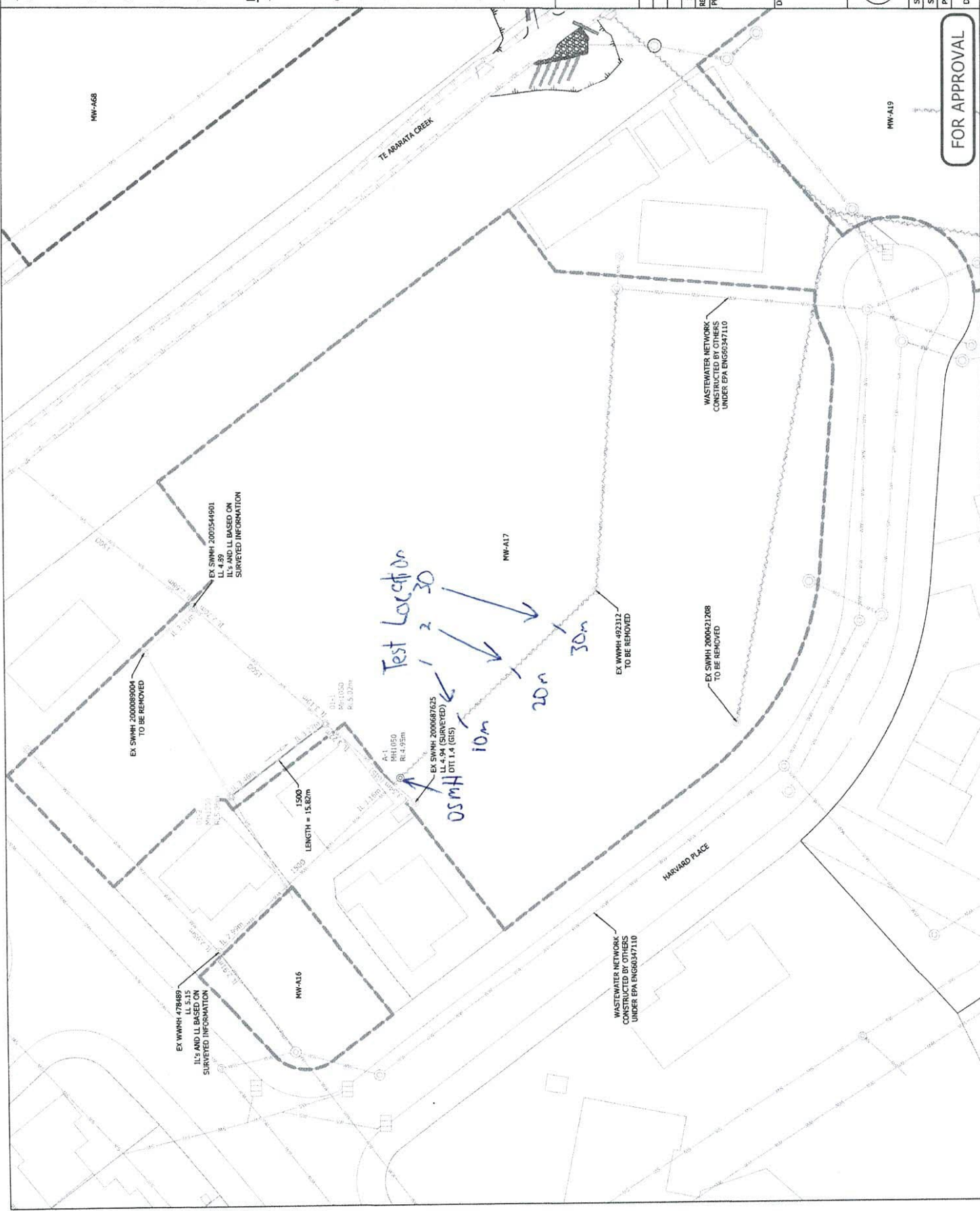
PROJECT:
STAGE 4
MANGERE WEST DEVELOPMENT

DESCRIPTION:
STORMWATER & WASTEWATER
LAYOUT PLAN
SUPERLOT MW-A17

SURVEYED	20.05.2022
DESIGNED	AE
DRAWN	AE
CHECKED	CA
APPROVED	FW
SCALE	1:500 @A1
STATUS	FOR ENGINEERING APPROVAL
PRECINCT	MANGERE WEST
DWG NO	1

TOC057-MWA17-4001

Plot Date: 4:25:29 pm, 20 May 2022, ANDRE ESSOP
SYNERY Version: 1.28102 DESIGN/AD (CURRENT)0057-A17-4001.DWG



FOR APPROVAL

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	12/10/22
Location/Description	Waste Water Main 4 Harvard Place	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	1600	34	5			
			35				
			53				
			45				
2	20	1650	32	6			
			50				
			31				
			36				
3	30	1600	33	7			
			32				
			41				
			38				
4				8			

Tested By: Yadwinder Singh Date: 12/10/22

Reviewed By: _____ Date: _____

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	13/11/22
Location/Description	WW Main 4 Forward Place	Layer:	1

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	1300	42	5			
			31				
			30				
			40				
2	20	1290	32	6			
			41				
			50				
			43				
3	30	1300	34	7			
			32				
			37				
			31				
4				8			
Tested By:				Date:			
Reviewed By:				Date:			

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Document No.: AAAA-CN-FRM-0006

Revision: 1

Page 1 of 1

August 2021

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57	Mangere West	Date:	13/10/22
Location/Description	WW Main	4 Harvord Place	Layer:	2

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	970	34	5			
			44				
			31				
			35				
2	20	1000	31	6			
			35				
			33				
			34				
3	30	1000	35	7			
			39				
			30				
			37				
4				8			

Tested By: Yadvinder Singh Date: 13/10/22

Reviewed By: Date:

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	14/10/22
Location/Description	WW Manh 4 Harvard Place	Layer:	3

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	700	35	5			
			25				
			36				
			36				
2	20	690	34	6			
			32				
			33				
			31				
3	30	690	35	7			
			47				
			33				
			152				
4				8			

Tested By: Yachinder Singh Date: 14/10/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57	Mangere West	Date:	14/10/22
Location/Description	WW Main	4 Howard Place	Layer:	4

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

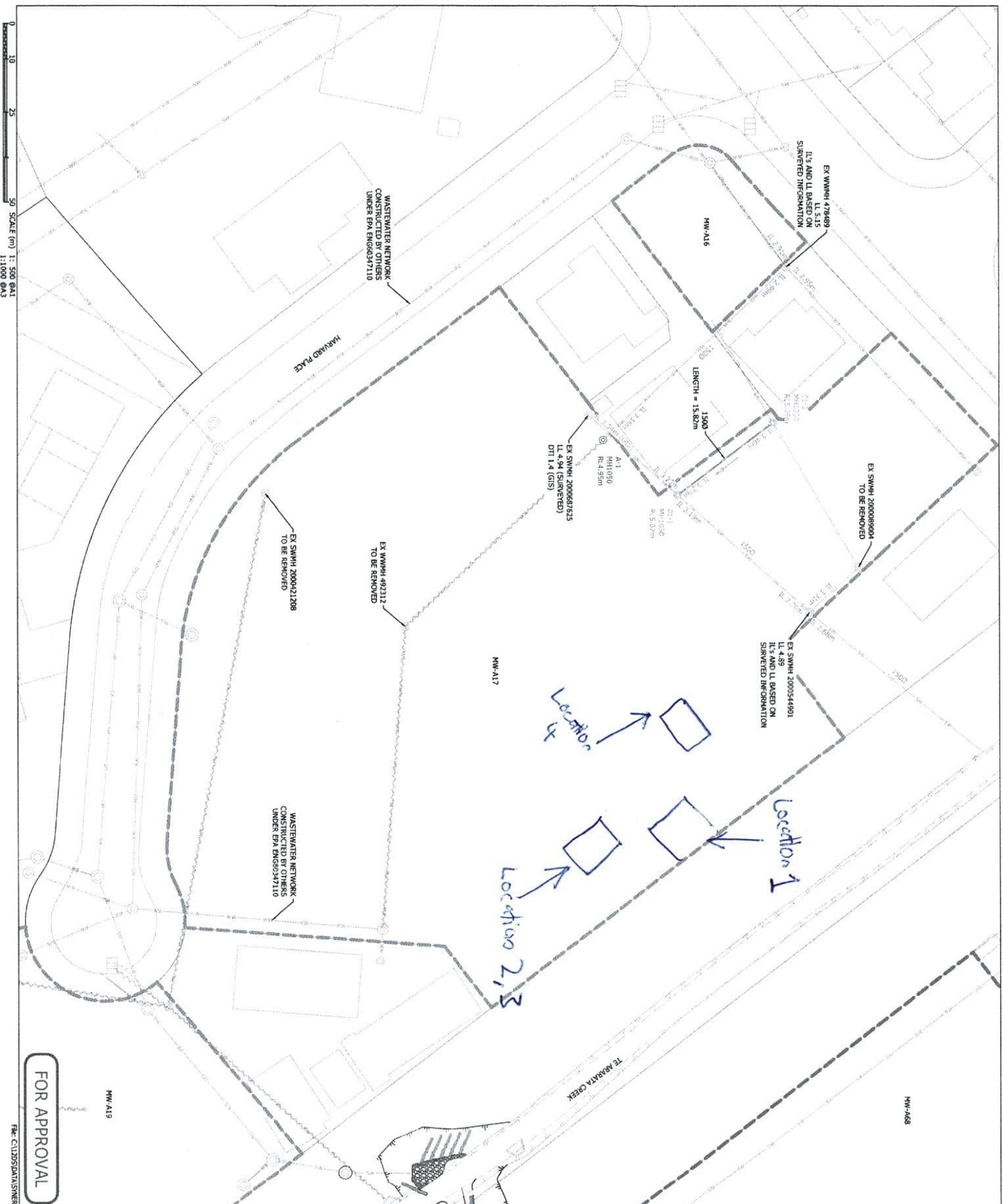
Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	10	400	33	5			
			41				
			34				
			41				
2	20	390	35	6			
			33				
			32				
			32				
3	30	390	34	7			
			43				
			32				
			34				
4				8			

Tested By: Yaduvinder Singh Date: 14/10/22

Reviewed By: Date:







NOTES:

1. WORKS, MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE AUCKLAND COUNCIL STORMWATER CODE OF PRACTICE REVISION 2 NOV 2015. ANY AMBIGUITY BETWEEN THESE DRAWINGS AND THE STANDARDS SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. EXISTING PIPE INFORMATION INDICATED ON THIS PLAN IS A COMBINATION OF AUCKLAND COUNCIL GIS DATA AND SURVEYED INFORMATION.
3. CONTRACTOR TO CONFIRM LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY DRAINAGE WORKS COMMENCING.
4. REFER TO DRAINAGE LONGITUDINAL SECTIONS ON TOC057-MWA17-4001 FOR PIPE AND MANHOLE SPECIFICATIONS.
5. CONTRACTOR SHALL EXCAVATE AND CONFIRM INVERTS BOTH UPSTREAM AND DOWNSTREAM PRIOR TO PIPE INSTALLATION. VARIATIONS IN INVERTS TO BE REPORTED TO THE ENGINEER FOR VERIFICATION.

LEGEND:

- EXISTING BOUNDARIES
- SUPERLOT DEVELOPMENT
- STAGE 3 BOUNDARY
- SUPERLOT DEVELOPMENT
- STAGE 4 BOUNDARY
- PROPOSED STORMWATER NETWORK UPGRADES
- EXISTING STORMWATER NETWORK
- EXISTING STORMWATER NETWORK TO BE REMOVED
- EXISTING STORMWATER NETWORK TO BE ABANDONED & GROUT FILLED
- PROPOSED WASTEWATER MANHOLE
- EXISTING WASTEWATER NETWORK
- EXISTING WASTEWATER NETWORK TO BE REMOVED
- EXISTING WASTEWATER NETWORK TO BE ABANDONED & GROUT FILLED
- EXISTING CATCHPIT
- EXISTING OUTLET

Kainga Ora
Home and Communities
Piritahi
LAYING THE GROUNDWORK

REVISION DETAILS			
NO	DESCRIPTION	BY	DATE
1	FOR ENGINEERING APPROVAL	CA	20.05.2022

STAGE 4
MANGERE WEST DEVELOPMENT

DESCRIPTION:
STORMWATER & WASTEWATER
LAYOUT PLAN

SUPERLOT MW-A17

SURVEYED		DESIGNED	
DATE	20.05.2022	DATE	20.05.2022
DRAWN	AE	CHECKED	CA
DATE	20.05.2022	DATE	20.05.2022

SCALE		1:500 @A1	
DATE	20.05.2022	DATE	20.05.2022

STATUS		FOR ENGINEERING APPROVAL	
DATE	20.05.2022	DATE	20.05.2022

PRECINCT		MANGERE WEST	
DATE	20.05.2022	DATE	20.05.2022

FOR APPROVAL

TOC057-MWA17-4001

CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	12/9/22
Location/Description	MW - A17	Layer:	Base

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	≥ 30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
Site 1		0	33	5		0	
			30			0	
			30			0	
			31			0	
2		300	68	6			
			30				
			31				
			30				
3		0	32	7			
			31				
			38				
			30				
4		0	41	8			
			31				
			51				
			56				

Tested By: Yaduvinder Singh Date: 12/9/22
Reviewed By: _____ Date: _____







CLEGG HAMMER TEST RECORD SHEET

TOC No & Name:	TOC 57 Mangere West	Date:	17/11/22
Location/Description	New WWMH	Layer:	1, 2, 3, 4

Test Methods:

Material Type:	Aggregate	Clegg Hammer ID:	19-0007
Material Description:	Gap 65	Calibration Expiry Date:	23/11/2022
Criteria:	>=30	Drops:	5

Test Location Number	Location		Clegg Impact Value (CIV)	Test Location Number	Location		Clegg Impact Value (CIV)
	Dist. from DS MH (m)	Depth (mm)			Dist. from DS MH (m)	Depth (mm)	
1	1	900	45	5			
			48				
			44				
			41				
2	1	600	47	6			
			30				
			31				
			30				
3	1	300	33	7			
			32				
			30				
			36				
4	1	0	31	8			
			33				
			32				
			38				

Tested By: Yachinder Singh Date: 17/11/22

Reviewed By: Date:

Once printed this document becomes uncontrolled. Refer to Piritahi Alliance QMS in 12D Synergy for controlled copy.

Appendix D – Geotechnics Test Results



Job: Mangere Precinct TOC57

Customer: Piritahi

Job #	1041000.0057.0.0/Rep1
Entered By	DAMC / KELF
Checked By	KELF
Approved By	DBRA

URN	Tech.	Date	Material Type	Location	Layer	Chainage	Offset	Nuclear Density (Backscatter)								Impact Value 1	Retest URN	PASS / FAIL	Comments
								Wet Density	Dry Density (t/m³)	Moisture Content (%)	Maximum Dry Density (t/m³)	% Maximum Dry Density	Solid Density (t/m³)	% Solid Density	% Total Voids			(P) Pass (F) Fail	
1.1	DAMC	8/09/2022	GAP65	Superlot MW-A17	First Lift	-	-	1.83	1.64	12.0	2.26	72.5%	-	-	-	-	2.1	F	Backfill: Compaction must be ≥ 92% of MDD.
1.2						-	-	1.78	1.59	12.1	2.26	70.4%	-	-	-	-	2.2	F	Retest on 09/09/2022. Retest = Pass
2.1	DAMC	9/09/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.16	2.04	5.8	2.26	90.3%	-	-	-	-	3.1	F	Retest on 09/09/2022. Retest = Pass
2.2						-	-	2.22	2.05	8.1	2.26	90.7%	-	-	-	-	3.2	F	Retest on 09/09/2022. Retest = Pass
3.1	DAMC	9/09/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.29	2.16	5.9	2.26	95.5%	-	-	-	-	-	P	
3.2						-	-	2.22	2.08	6.8	2.26	92.2%	-	-	-	-	-	P	
4.1	DAMC	16/09/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.22	2.08	6.8	2.26	92.0%	-	-	-	-	-	P	
4.2						-	-	2.25	2.11	6.6	2.26	93.3%	-	-	-	-	-	P	
5.1	DAMC	16/09/2022	GAP65	Superlot MW-A17	Second Lift	-	-	2.23	2.10	6.2	2.26	93.1%	-	-	-	-	-	P	
5.2						-	-	2.25	2.11	6.6	2.26	93.4%	-	-	-	-	-	P	
6.1	KELF	20/09/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.05	1.93	6.1	2.26	85.5%	-	-	-	-	6.3	F	Area retested 20/09/2022. Retest = Pass.
6.2						-	-	2.15	2.02	6.5	2.26	89.3%	-	-	-	-	6.4	F	Area retested 20/09/2022. Retest = Pass.
6.3						-	-	2.12	1.97	7.9	2.26	87.1%	-	-	-	-	6.5	F	Area retested 20/09/2022. Retest = Pass.
6.4						-	-	2.18	2.02	7.9	2.26	89.6%	-	-	-	-	7.1	F	Area retested 21/09/2022. Retest = Pass.
6.5						-	-	2.27	2.09	9.0	2.26	92.3%	-	-	-	-	-	P	
7.1	DAMC	21/09/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.31	2.13	8.2	2.26	94.4%	-	-	-	-	-	P	
8.1	DAMC	21/09/2022	GAP65	Superlot MW-A17	Second Lift	-	-	2.29	2.13	7.5	2.26	94.2%	-	-	-	-	-	P	
8.2						-	-	2.23	2.08	7.1	2.26	91.9%	-	-	-	-	-	P	
9.1	DAMC	5/10/2022	GAP65	Superlot MW-A17	First Lift	-	-	1.76	1.60	10.0	2.26	70.9%	-	-	-	-	10.7	F	Retest on 06/10/2022. Retest = Pass
9.2						-	-	2.06	1.78	15.7	2.26	78.8%	-	-	-	-	10.5	F	Retest on 06/10/2022. Retest = Pass
9.3						-	-	2.05	1.95	5.1	2.26	86.3%	-	-	-	-	10.1	F	Retest on 06/10/2022. Retest = Pass
9.4						-	-	2.01	1.89	6.4	2.26	83.5%	-	-	-	-	10.2	F	Retest on 06/10/2022. Retest = Pass
9.5						-	-	2.12	1.97	7.3	2.26	87.2%	-	-	-	-	10.3	F	Retest on 06/10/2022. Retest = Pass
9.6						-	-	2.04	1.89	7.8	2.26	83.5%	-	-	-	-	10.4	F	Retest on 06/10/2022. Retest = Pass



Job: Mangere Precinct TOC57

Customer: Piritahi

Job #	1041000.0057.0.0/Rep1
Entered By	DAMC / KELF
Checked By	KELF
Approved By	DBRA

URN	Tech.	Date	Material Type	Location	Layer	Chainage	Offset	Nuclear Density (Backscatter)								Impact Value 1	Retest URN	PASS / FAIL (P) Pass (F) Fail	Comments
								Wet Density	Dry Density (t/m ³)	Moisture Content (%)	Maximum Dry Density (t/m ³)	% Maximum Dry Density	Solid Density (t/m ³)	% Solid Density	% Total Voids				
10.1	DAMC	6/10/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.21	2.08	6.4	2.26	92.0%	-	-	-	-	-	P	Backfill: Compaction must be ≥ 92% of MDD.
10.2						-	-	2.28	2.13	7.4	2.26	94.1%	-	-	-	-	-	P	
10.3						-	-	2.23	2.08	7.3	2.26	92.0%	-	-	-	-	-	P	
10.4						-	-	2.32	2.14	8.4	2.26	94.6%	-	-	-	-	-	P	
10.5						-	-	2.23	2.09	6.4	2.26	92.6%	-	-	-	-	-	P	
10.6						-	-	2.27	2.12	7.0	2.26	94.0%	-	-	-	-	-	P	
10.7						-	-	2.24	2.08	7.6	2.26	92.1%	-	-	-	-	-	P	
10.8						-	-	2.29	2.15	6.3	2.26	95.2%	-	-	-	-	-	P	
10.9						-	-	2.33	2.15	8.5	2.26	95.0%	-	-	-	-	-	P	
11.1	DAMC	10/10/2022	GAP65	Superlot MW-A17	Second Lift	-	-	2.33	2.18	6.8	2.26	96.5%	-	-	-	-	-	P	
11.2						-	-	2.28	2.14	6.5	2.26	94.8%	-	-	-	-	-	P	
11.3						-	-	2.21	2.08	6.3	2.26	92.1%	-	-	-	-	-	P	
11.4						-	-	2.30	2.16	6.4	2.26	95.8%	-	-	-	-	-	P	
12.1	DAMC	14/10/2022	GAP65	Superlot MW-A17	First Lift	-	-	2.20	2.08	5.8	2.26	92.2%	-	-	-	-	-	P	
12.2						-	-	2.32	2.18	6.6	2.26	96.4%	-	-	-	-	-	P	
12.3						-	-	2.23	2.09	6.7	2.26	92.4%	-	-	-	-	-	P	
12.4						-	-	2.27	2.13	6.6	2.26	94.3%	-	-	-	-	-	P	
13.1	DAMC	14/10/2022	GAP65	Superlot MW-A17	Second Lift	-	-	2.23	2.11	6.0	2.26	93.2%	-	-	-	-	-	P	
13.2						-	-	2.20	2.08	5.7	2.26	92.0%	-	-	-	-	-	P	
13.3						-	-	2.29	2.17	5.5	2.26	96.1%	-	-	-	-	-	P	
13.4						-	-	2.30	2.18	5.5	2.26	96.4%	-	-	-	-	-	P	



Job: Mangere Precinct TOC57

Customer: Piritahi

Job #	1041000.0057.0.0/Rep1
Entered By	DAMC / KELF
Checked By	KELF
Approved By	DBRA

URN	Tech.	Date	Material Type	Location	Layer	Chainage	Offset	Nuclear Density (Backscatter)								Impact Value 1	Retest URN	PASS / FAIL	Comments	
								Wet Density	Dry Density (t/m³)	Moisture Content (%)	Maximum Dry Density (t/m³)	% Maximum Dry Density	Solid Density (t/m³)	% Solid Density	% Total Voids			(P) Pass (F) Fail		
14.1	DBRA	20/10/2022	GAP65	Superlot MW-A17 EX WW Line	Finished Level	-	-	2.22	2.11	5.5	2.26	93.2%	-	-	-	-	-	P	Backfill: Compaction must be ≥ 92% of MDD.	
14.2						-	-	2.25	2.13	5.9	2.26	94.1%	-	-	-	-	-	P		
14.3						-	-	2.19	2.09	4.6	2.26	92.5%	-	-	-	-	-	P		
14.4						-	-	2.20	2.10	4.9	2.26	92.9%	-	-	-	-	-	P		
14.5						-	-	2.19	2.09	4.7	2.26	92.7%	-	-	-	-	-	P		
14.6						-	-	2.27	2.16	5.0	2.26	95.6%	-	-	-	-	-	P		
14.7						-	-	2.19	2.09	4.8	2.26	92.3%	-	-	-	-	-	P		
14.8				Superlot MW-A17 EX SW Line		-	-	2.23	2.12	5.5	2.26	93.6%	-	-	-	-	-	P		
14.9						-	-	2.20	2.09	5.0	2.26	92.6%	-	-	-	-	-	P		
14.10						-	-	2.19	2.08	5.2	2.26	92.0%	-	-	-	-	-	P		
14.11						-	-	2.18	2.10	4.0	2.26	92.9%	-	-	-	-	-	P		
14.12						-	-	2.26	2.17	4.4	2.26	95.9%	-	-	-	-	-	P		
14.13						Superlot MW-A17 EX WW Lateral	-	-	2.24	2.15	4.1	2.26	95.1%	-	-	-	-	-		P
15.1						ROSM	31/10/2022	GAP65	See Site Plan	Finished Level	-	-	2.11	1.96	7.8	2.26	86.7%	-		-
15.2	-	-	1.95	1.88	3.9						2.26	83.0%	-	-	-	-	18.5	F	Retested on 01/11/2022. Retest = Pass	
15.3	-	-	2.01	1.90	6.1						2.26	84.0%	-	-	-	-	18.9	F	Retested on 01/11/2022. Retest = Pass	
15.4	-	-	1.94	1.83	6.0						2.26	81.1%	-	-	-	-	16.2	F	Retested on 31/10/2022. Retest = Pass	
15.5	-	-	2.04	1.93	5.5						2.26	85.5%	-	-	-	-	16.3	F	Retested on 31/10/2022. Retest = Pass	
15.6	-	-	1.95	1.76	10.9						2.26	77.9%	-	-	-	-	16.4	F	Retested on 31/10/2022. Retest = Pass	
15.7	-	-	2.26	2.12	6.7						2.26	93.8%	-	-	-	-	-	P		
15.8	-	-	1.98	1.85	7.0						2.26	82.0%	-	-	-	-	18.4	F	Retested on 01/11/2022. Retest = Pass	
15.9	-	-	2.13	1.95	9.4						2.26	86.2%	-	-	-	-	18.3	F	Retested on 01/11/2022. Retest = Pass	
15.10	-	-	2.03	1.81	11.8						2.26	80.2%	-	-	-	-	18.4	F	Retested on 01/11/2022. Retest = Pass	
15.11	-	-	2.08	1.92	8.5						2.26	84.7%	-	-	-	-	18.2	F	Retested on 01/11/2022. Retest = Pass	
15.12	-	-	1.98	1.80	9.8						2.26	79.7%	-	-	-	-	18.1	F	Retested on 01/11/2022. Retest = Pass	
15.13	-	-	2.01	1.85	8.6						2.26	82.0%	-	-	-	-	18.6	F	Retested on 01/11/2022. Retest = Pass	

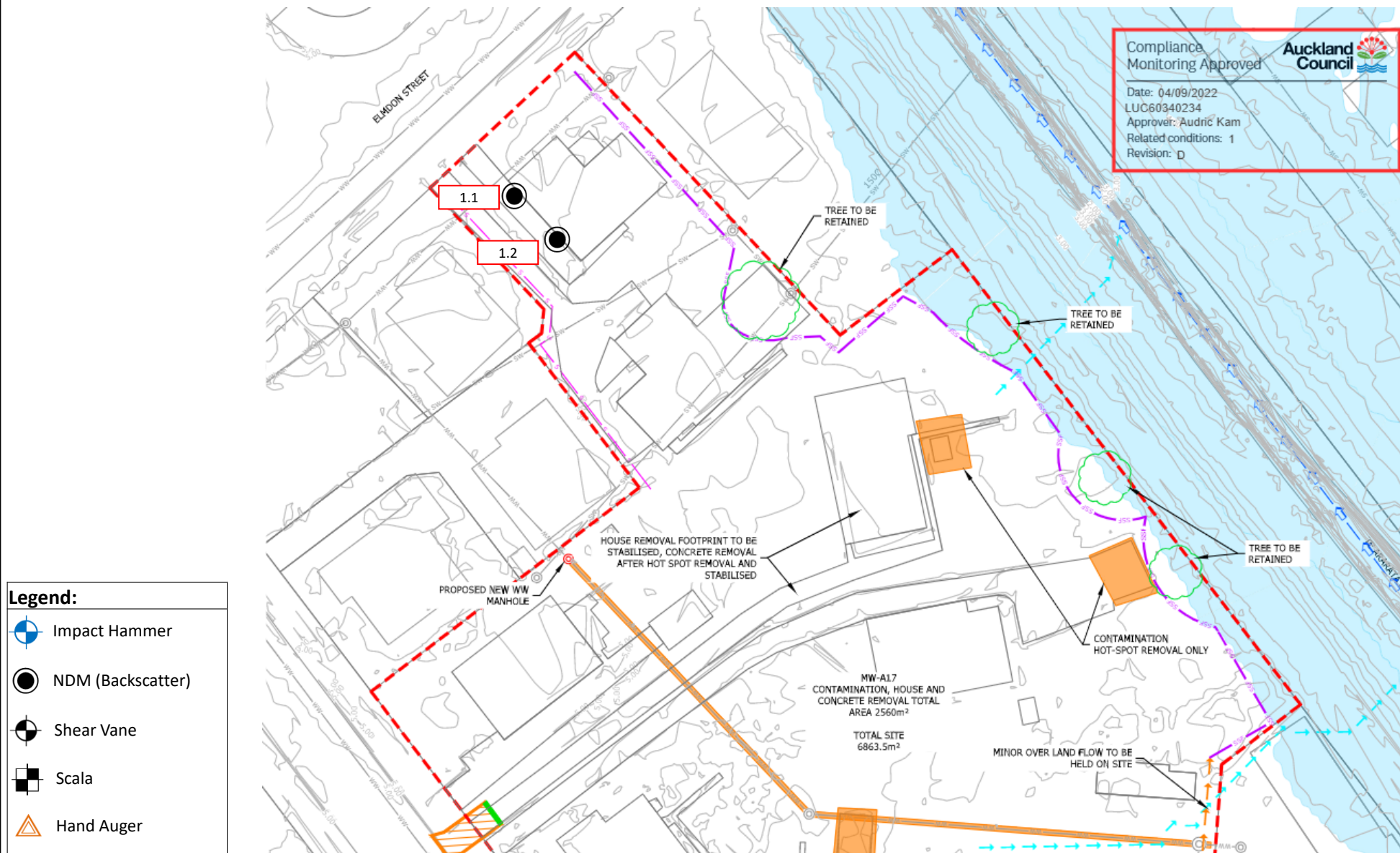







Job: Mangere Precinct TOC57

Customer: Piritahi

Job #	1041000.0057.0.0/Rep1
Entered By	DAMC / KELF
Checked By	KELF
Approved By	DBRA

URN	Tech.	Date	Material Type	Location	Layer	Chainage	Offset	Nuclear Density (Backscatter)								Impact Value 1	Retest URN	PASS / FAIL		Comments
								Wet Density	Dry Density (t/m³)	Moisture Content (%)	Maximum Dry Density (t/m³)	% Maximum Dry Density	Solid Density (t/m³)	% Solid Density	% Total Voids			(P) Pass (F) Fail		
16.1	ROSM	31/10/2022	GAP65	See Site Plan	Finished Level	-	-	2.36	2.14	10.2	2.26	94.9%	-	-	-	-	-	P	Backfill: Compaction must be ≥ 92% of MDD.	
16.2						-	-	2.23	2.09	6.8	2.26	92.3%	-	-	-	-	-	P		
16.3						-	-	2.26	2.08	8.6	2.26	92.0%	-	-	-	-	-	P		
16.4						-	-	2.32	2.17	7.0	2.26	95.9%	-	-	-	-	-	P		
17.1	MADA	1/11/2022	GAP65	See Site Plan	Finished Level	-	-	2.05	1.95	5.1	2.26	86.1%	-	-	-	-	18.6	F	Retested on 01/11/2022. Retest = Pass	
17.2				See Site Plan		-	-	1.97	1.86	5.8	2.26	82.2%	-	-	-	-	18.7	F	Retested on 01/11/2022. Retest = Pass	
17.3				See Site Plan		-	-	2.16	2.00	8.1	2.26	88.5%	-	-	-	-	18.5	F	Retested on 01/11/2022. Retest = Pass	
17.4				See Site Plan		-	-	1.96	1.89	4.0	2.26	83.6%	-	-	-	-	18.11	F	Retested on 01/11/2022. Retest = Pass	
17.5				7a Elmond St Lateral		-	-	2.25	2.10	7.2	2.26	93.0%	-	-	-	-	-	P		
18.1	ROSM	1/11/2022	GAP65	See Site Plan	Finished Level	-	-	2.25	2.15	4.9	2.26	95.0%	-	-	-	-	-	P		
18.2						-	-	2.23	2.09	7.0	2.26	92.3%	-	-	-	-	-	P		
18.3						-	-	2.25	2.09	7.9	2.26	92.3%	-	-	-	-	-	P		
18.4						-	-	2.33	2.15	8.5	2.26	95.1%	-	-	-	-	-	P		
18.5						-	-	2.21	2.09	6.0	2.26	92.4%	-	-	-	-	-	P		
18.6						-	-	2.22	2.10	5.5	2.26	93.1%	-	-	-	-	-	P		
18.7						-	-	2.20	2.08	5.9	2.26	92.0%	-	-	-	-	-	P		
18.8						-	-	2.28	2.13	7.3	2.26	94.1%	-	-	-	-	-	P		
18.9						-	-	2.18	2.09	4.5	2.26	92.3%	-	-	-	-	-	P		
18.10						-	-	2.20	2.09	5.3	2.26	92.3%	-	-	-	-	-	P		
18.11						-	-	2.18	2.08	5.0	2.26	92.0%	-	-	-	-	-	P		
19.1	ROSM	1/11/2022	GAP65	See Site Plan	Finished Level	-	-	2.18	2.08	4.7	2.26	92.0%	-	-	-	-	-	P		

**Legend:**

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

Test Location Plan

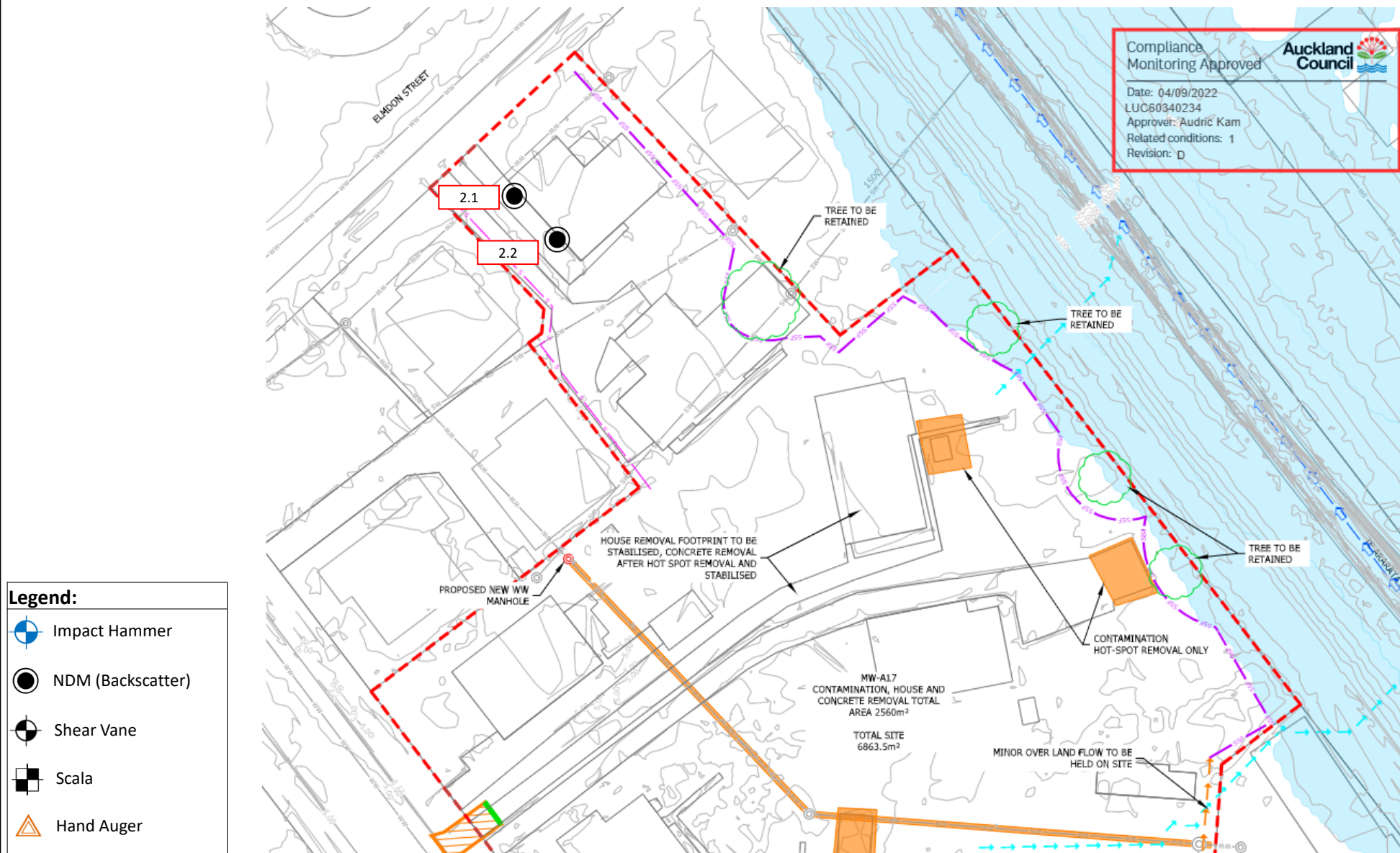
Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	08/09/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	1	Date:	08/09/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1






**GEOTECHNICS****GEOTECHNICS LTD.**

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz

**Legend:**

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

Test Location Plan

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	09/09/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	2	Date:	09/09/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1






**GEOTECHNICS****GEOTECHNICS LTD.**

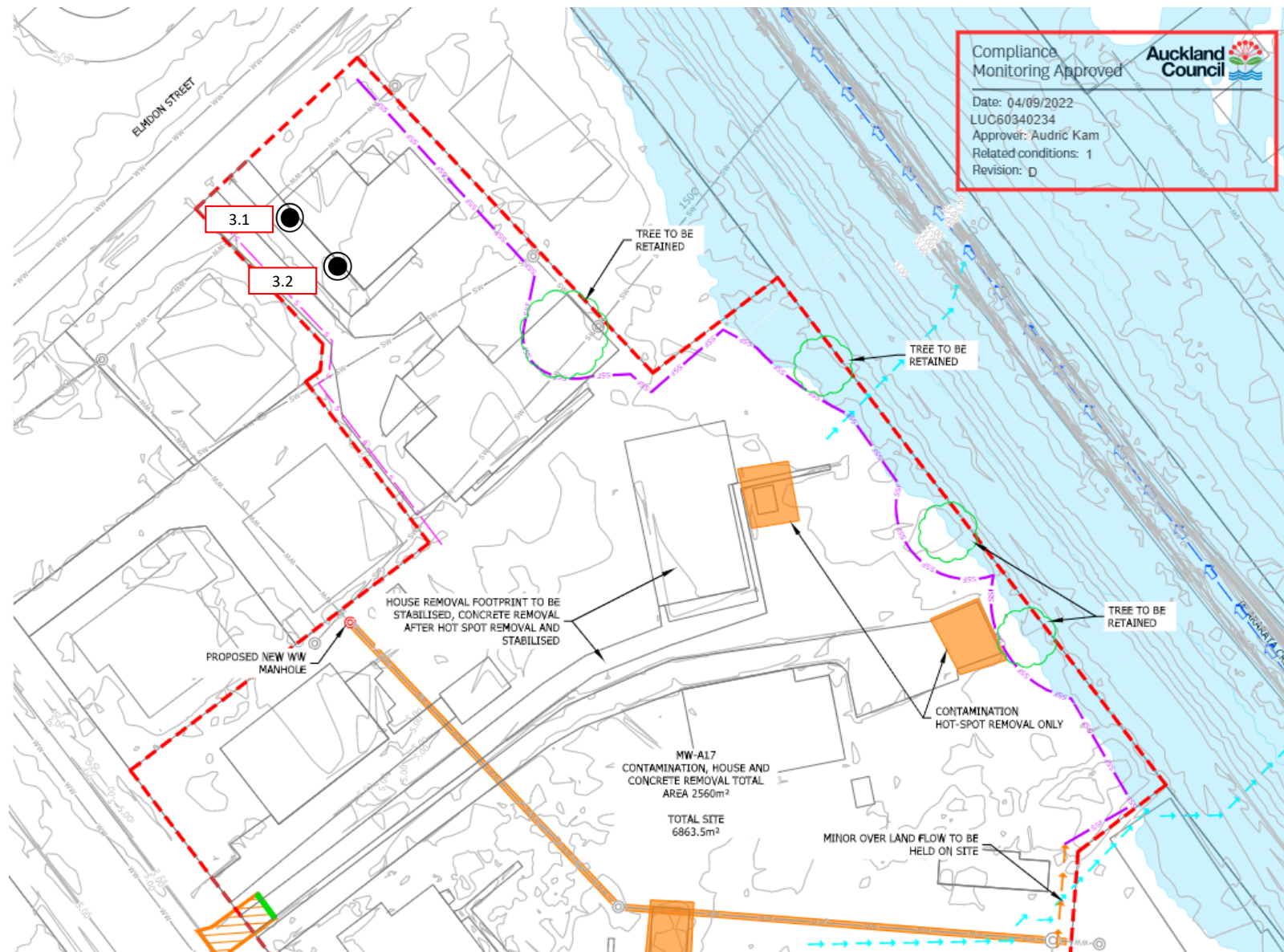
1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

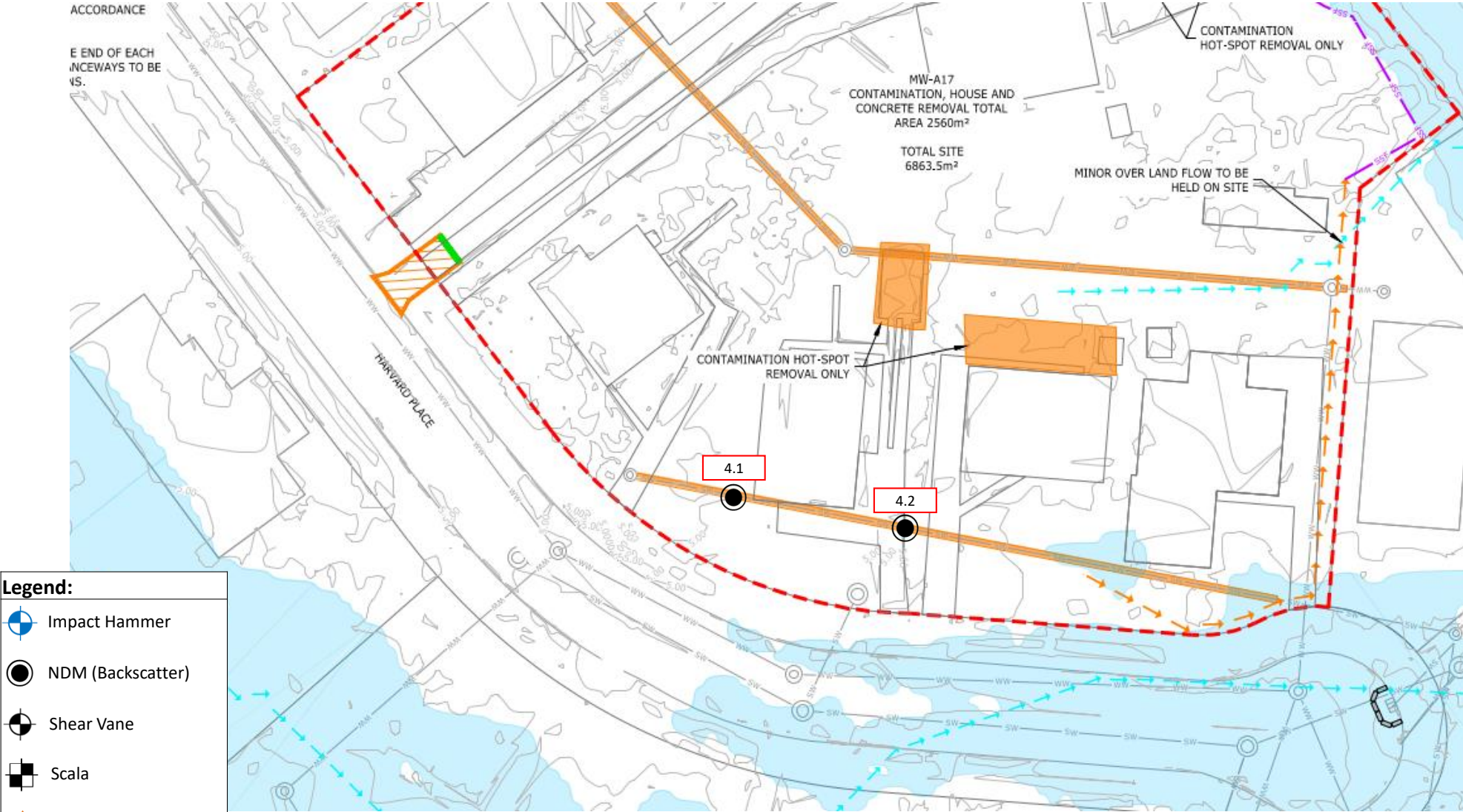
**Test Location Plan**


Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	09/09/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	3	Date:	09/09/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1

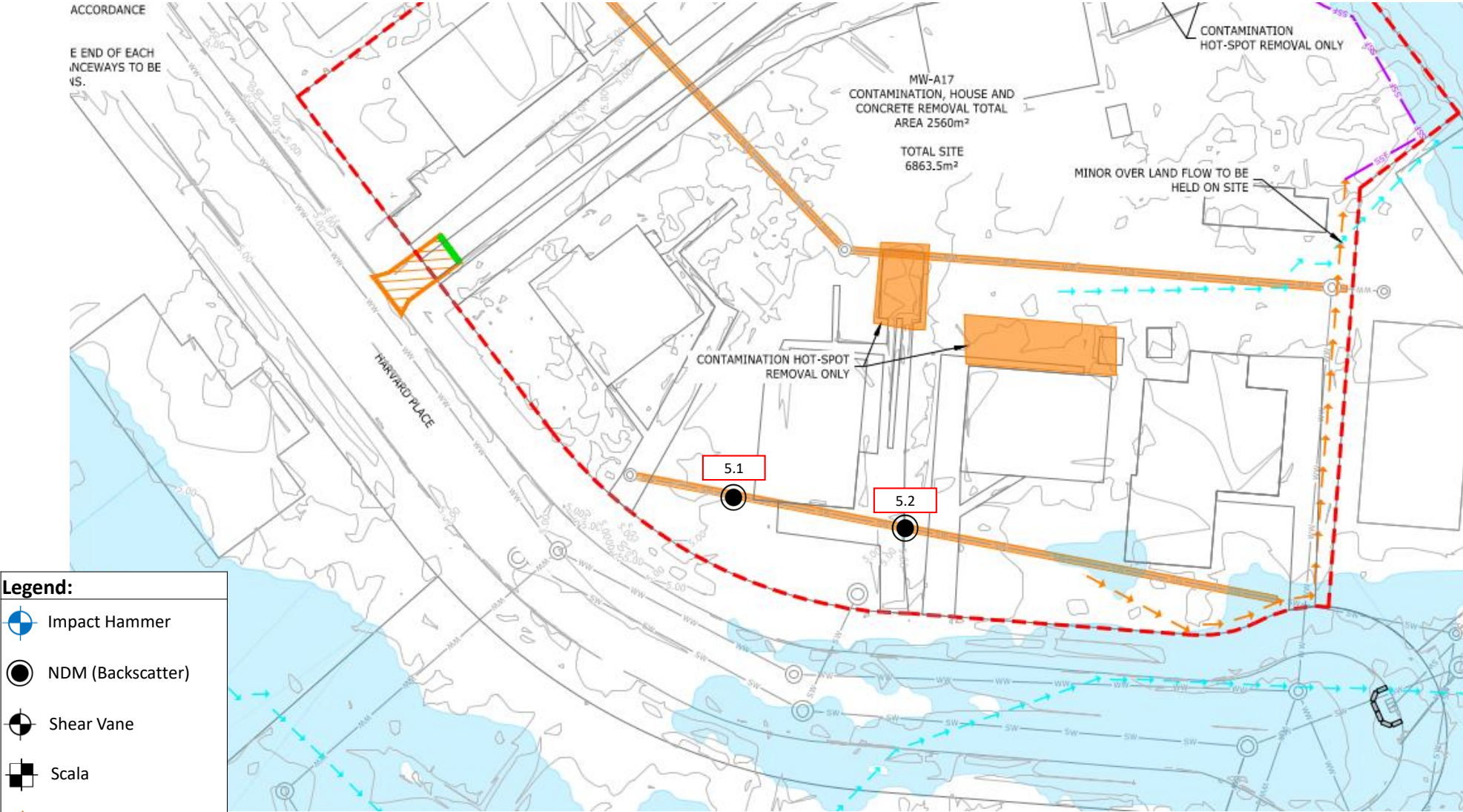
**GEOTECHNICS****GEOTECHNICS LTD.**


1 Hill Street, Onehunga
 Auckland, New Zealand
 ph. +64 (0)9 356 3510

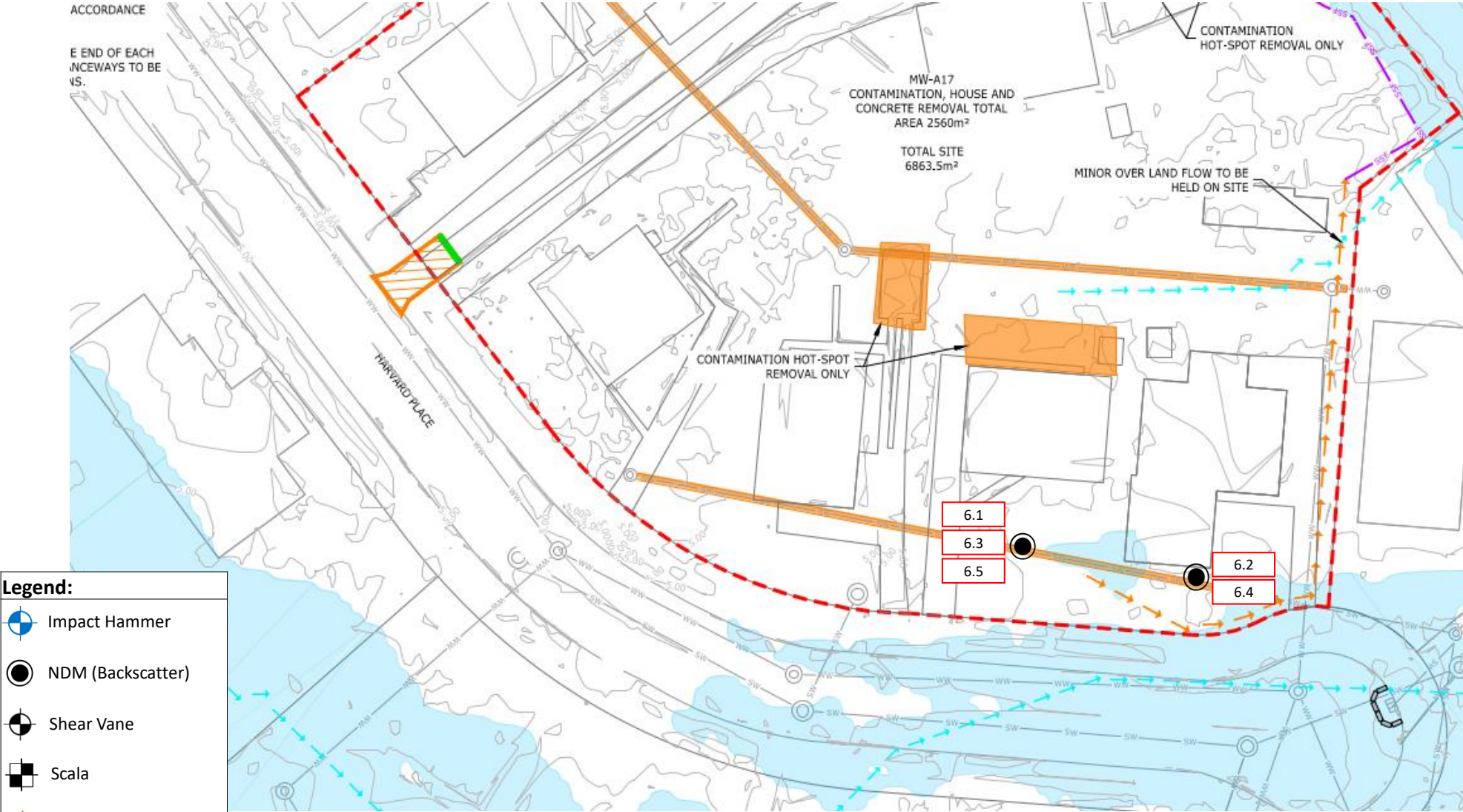
e. enquiry@geotechnics.co.nz
 w. www.geotechnics.co.nz




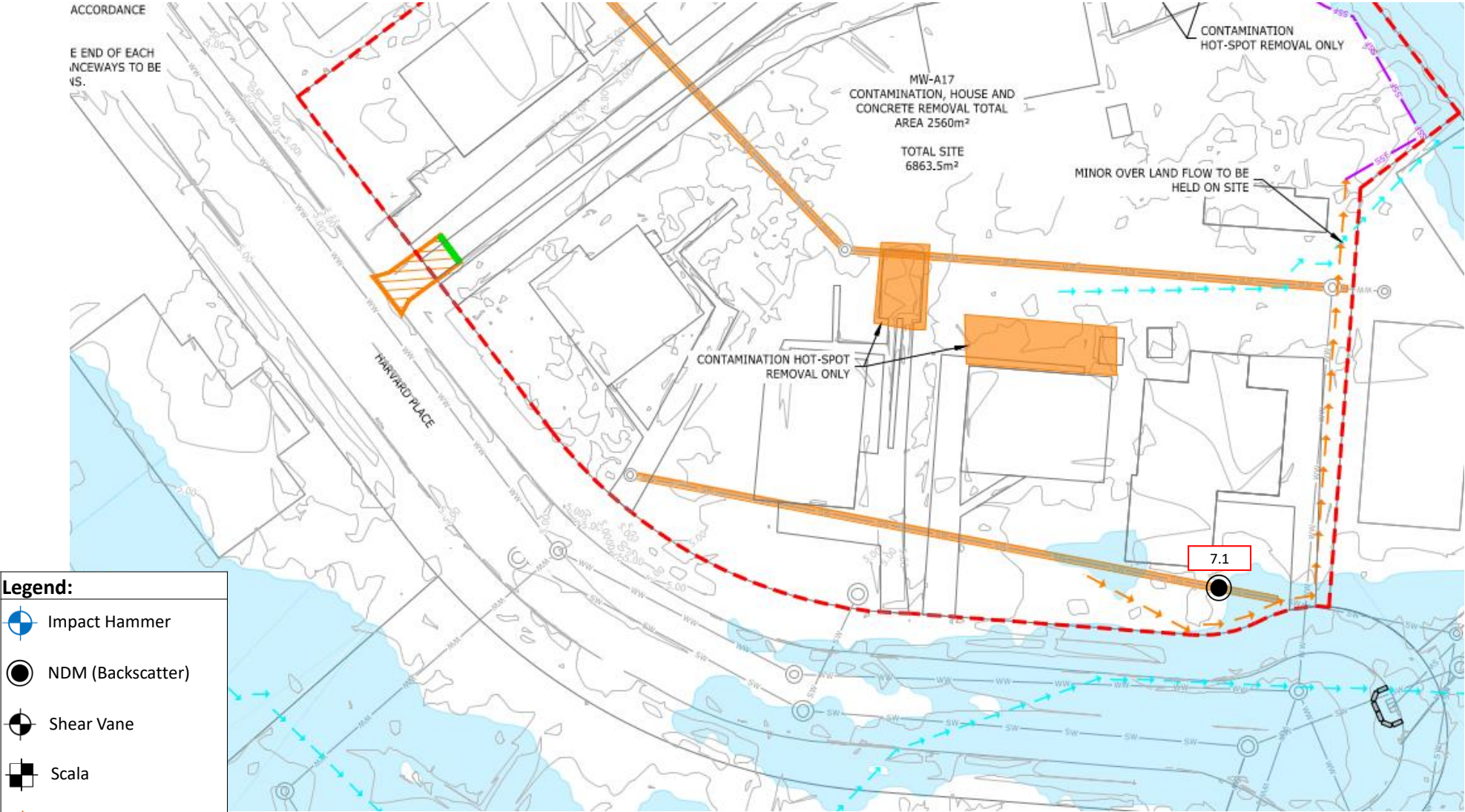
<div><div>GEOTECHNICS LTD. 1 Hill Street, Onehunga Auckland, New Zealand ph. +64 (0)9 356 3510 e. enquiry@geotechnics.co.nz w. www.geotechnics.co.nz</div></div>	Test Location Plan							<div>N</div> <div>↑</div>
	Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	16/09/2022
	Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	4	Date:	16/09/2022
			Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1




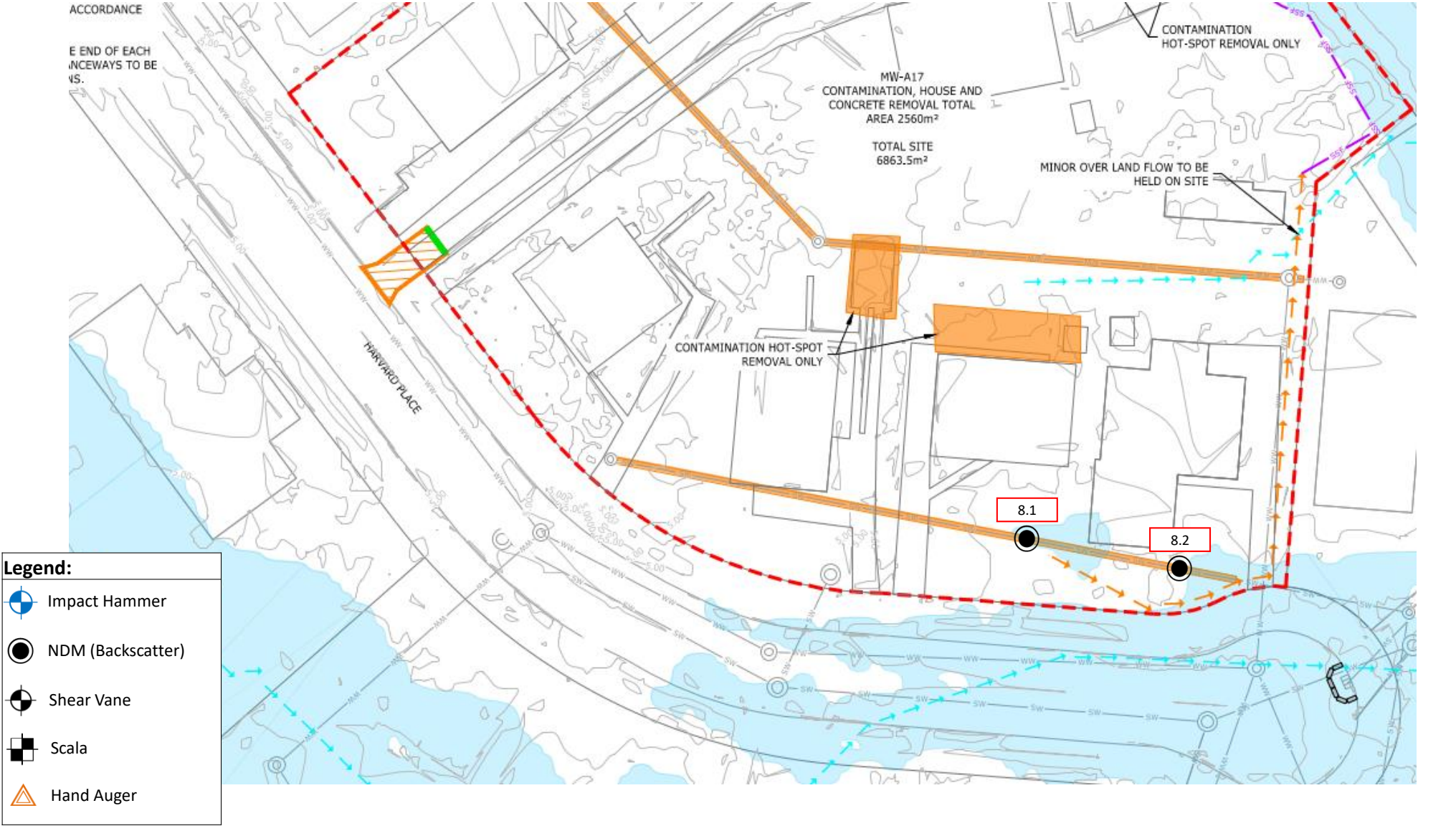
<div><div><div>GEOTECHNICS LTD.</div><div>1 Hill Street, Onehunga Auckland, New Zealand ph. +64 (0)9 356 3510</div><div>e. enquiry@geotechnics.co.nz</div><div>w. www.geotechnics.co.nz</div></div></div>	Test Location Plan							<div>N</div> <div></div>
	Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	16/09/2022
	Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	4	Date:	16/09/2022
			Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1




<div><div><div>GEOTECHNICS LTD.</div><div>1 Hill Street, Onehunga Auckland, New Zealand ph. +64 (0)9 356 3510</div><div>e. enquiry@geotechnics.co.nz</div><div>w. www.geotechnics.co.nz</div></div></div>	Test Location Plan							<div>N</div> <div>↑</div>
	Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	KELF	Date:	20/09/2022
	Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	6	Date:	20/09/2022
			Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1








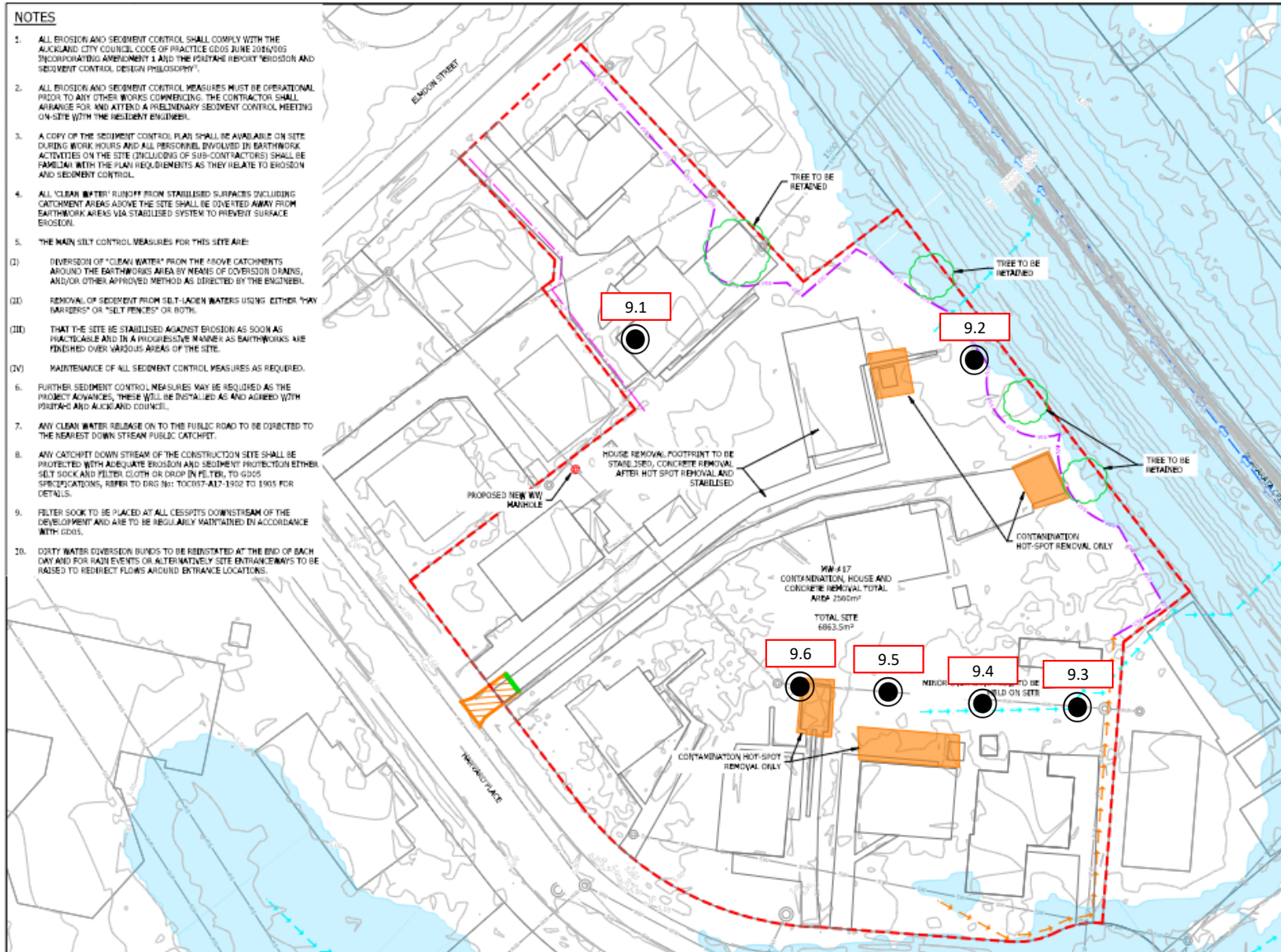
<div><div>GEOTECHNICS LTD. 1 Hill Street, Onehunga Auckland, New Zealand ph. +64 (0)9 356 3510 e. enquiry@geotechnics.co.nz w. www.geotechnics.co.nz</div></div>	Test Location Plan							<div>N</div> <div>↑</div>
	Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	21/09/2022
	Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	7	Date:	21/09/2022
			Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



<div><div>GEOTECHNICS LTD. 1 Hill Street, Onehunga Auckland, New Zealand ph. +64 (0)9 356 3510 e. enquiry@geotechnics.co.nz w. www.geotechnics.co.nz</div></div>	Test Location Plan							<div>N</div> <div></div>
	Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	21/09/2022
	Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	8	Date:	21/09/2022
			Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	05/10/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	9	Date:	05/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

GEOTECHNICS LTD.






1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

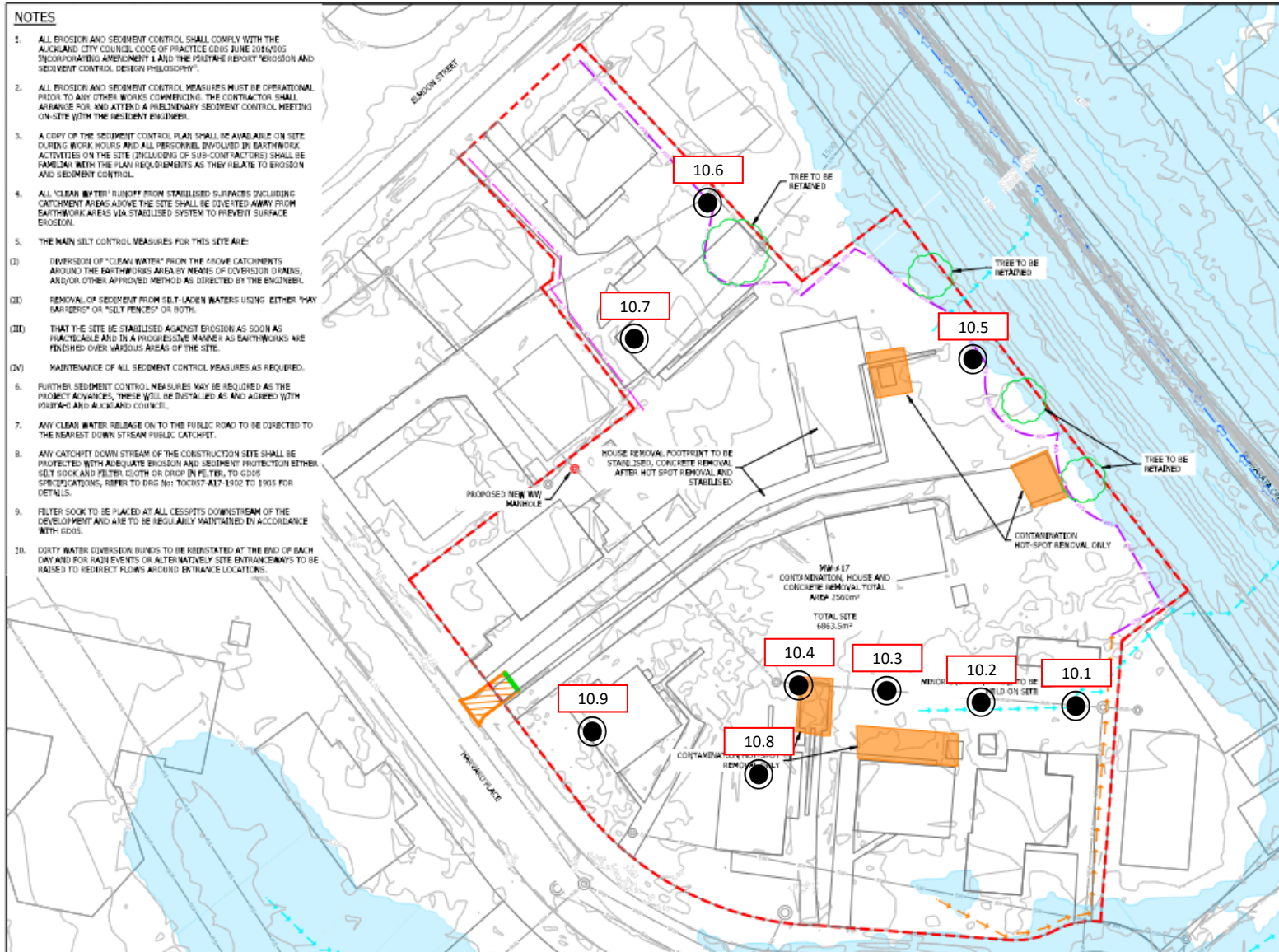
e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz



Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	06/10/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	10	Date:	06/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

GEOTECHNICS LTD.






1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

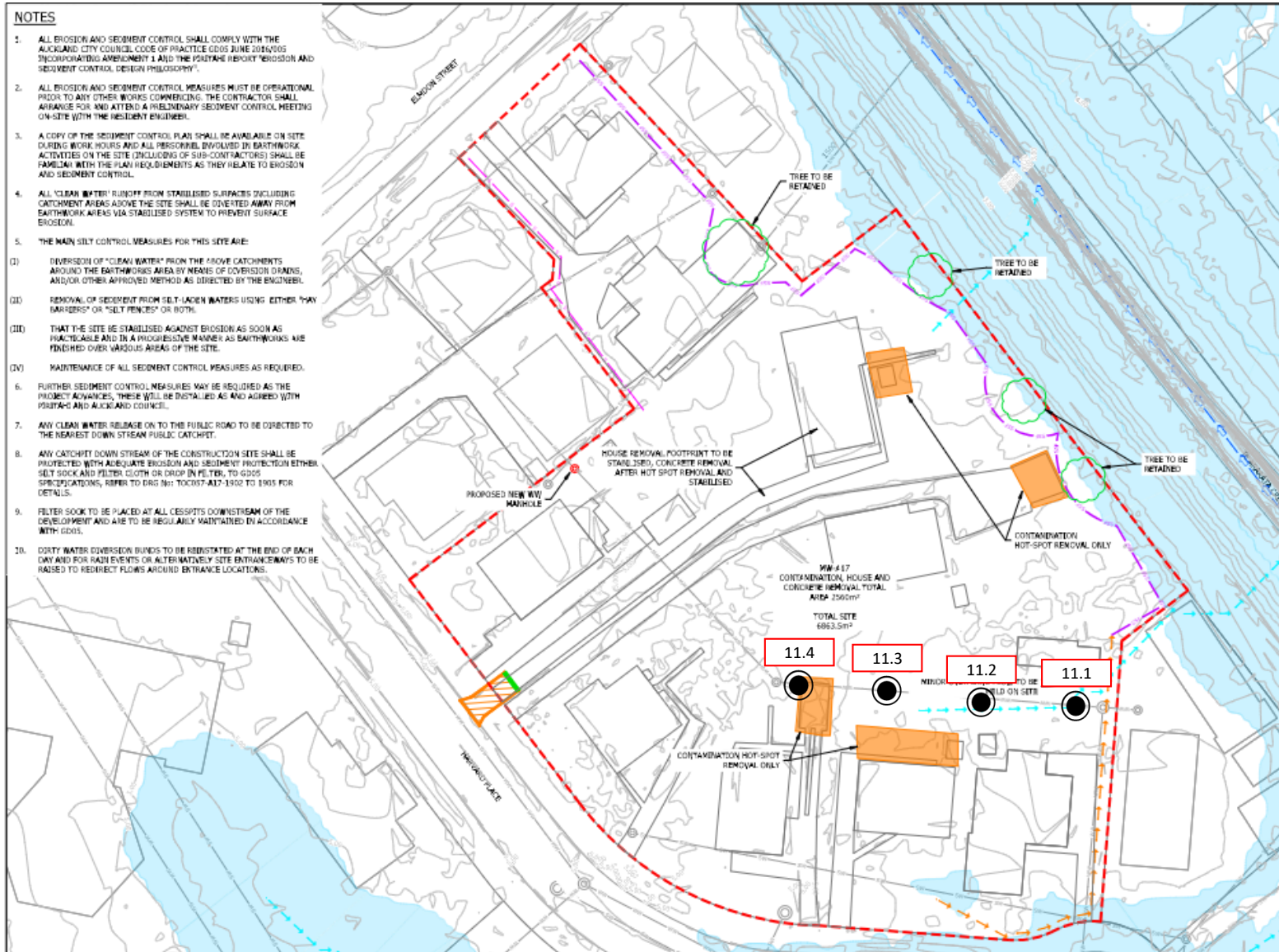
e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz



Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	10/10/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	11	Date:	10/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz






w. www.geotechnics.co.nz

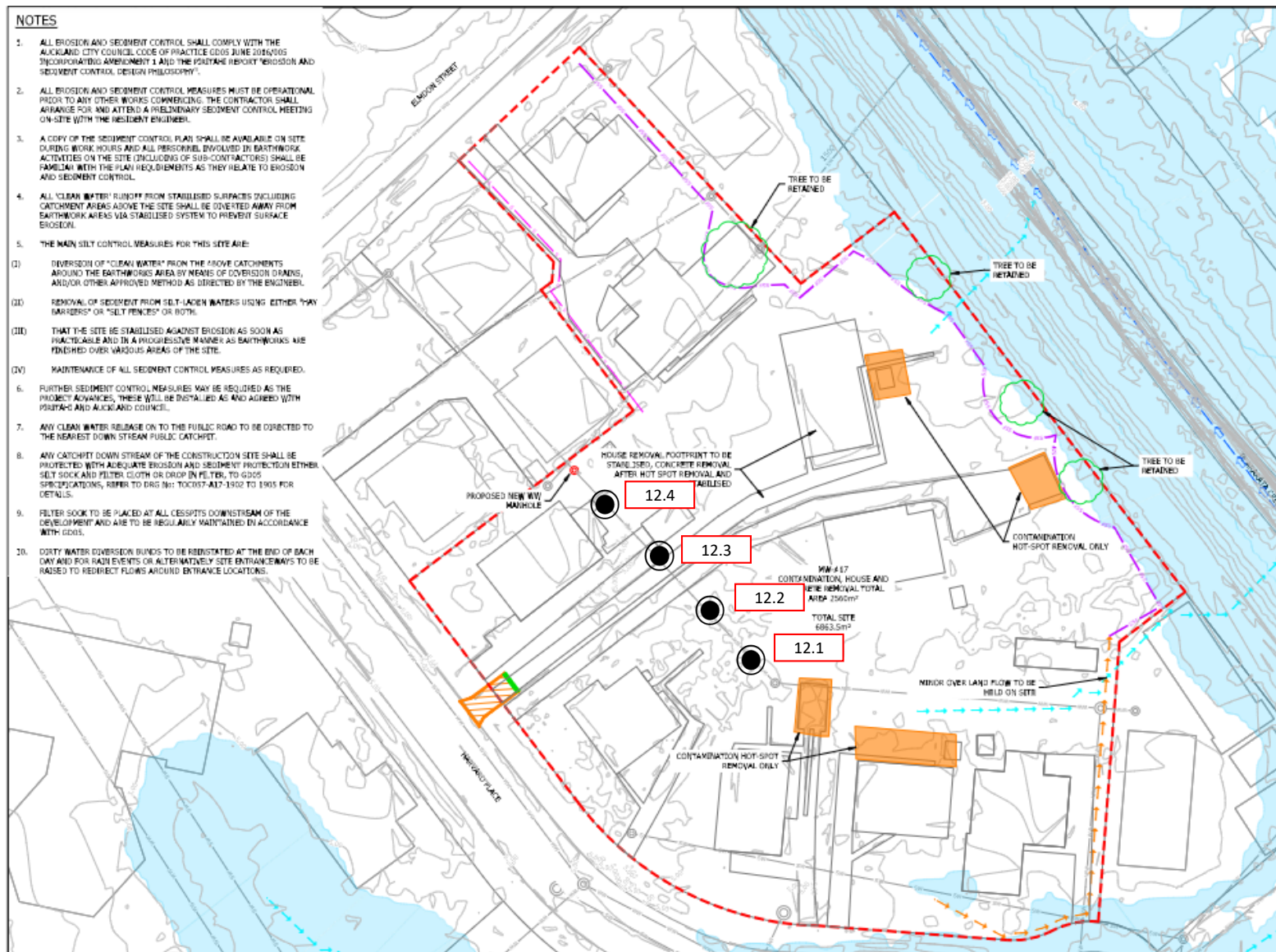


NOTES

- ALL EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH THE AUCKLAND CITY COUNCIL CODE OF PRACTICE GD05 JUNE 2016/005 INCORPORATING AMENDMENT 1 AND THE PRACTICE REPORT 'EROSION AND SEDIMENT CONTROL DESIGN PHILOSOPHY'.
- ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE OPERATIONAL PRIOR TO ANY OTHER WORKS COMMENCING. THE CONTRACTOR SHALL ADVANCE FOR AND ATTEND A PRELIMINARY SEDIMENT CONTROL MEETING ON-SITE WITH THE RESIDENT ENGINEER.
- A COPY OF THE SEDIMENT CONTROL PLAN SHALL BE AVAILABLE ON SITE DURING WORK HOURS AND ALL PERSONNEL INVOLVED IN EARTHWORK ACTIVITIES ON THE SITE (INCLUDING SUB-CONTRACTORS) SHALL BE FAMILIAR WITH THE PLAN REQUIREMENTS AS THEY RELATE TO EROSION AND SEDIMENT CONTROL.
- ALL 'CLEAN WATER' RUNOFF FROM STABILISED SURFACES INCLUDING CATCHMENT AREAS ABOVE THE SITE SHALL BE DIVERTED AWAY FROM EARTHWORK AREAS VIA STABILISED SYSTEM TO PREVENT SURFACE EROSION.
- THE MAIN SILT CONTROL MEASURES FOR THIS SITE ARE:
 - DIVERSION OF 'CLEAN WATER' FROM THE ABOVE CATCHMENTS AROUND THE EARTHWORKS AREA BY MEANS OF DIVERSION DRAINS, AND/OR OTHER APPROVED METHOD AS DIRECTED BY THE ENGINEER.
 - REMOVAL OF SEDIMENT FROM SILT-LADEN WATERS USING EITHER 'POY BARRIERS' OR 'SILT FENCES' OR BOTH.
 - THAT THE SITE BE STABILISED AGAINST EROSION AS SOON AS PRACTICABLE AND IN A PROGRESSIVE MANNER AS EARTHWORKS ARE FINISHED OVER VARIOUS AREAS OF THE SITE.
 - MAINTENANCE OF ALL SEDIMENT CONTROL MEASURES AS REQUIRED.
- FURTHER SEDIMENT CONTROL MEASURES MAY BE REQUIRED AS THE PROJECT ADVANCES, THESE WILL BE INSTALLED AS AND AGREED WITH POHUKU AND AUCKLAND COUNCIL.
- ANY CLEAN WATER RELEASE ON TO THE PUBLIC ROAD TO BE DIRECTED TO THE NEAREST DOWN STREAM PUBLIC CATCHMENT.
- ANY CATCHMENT DOWN STREAM OF THE CONSTRUCTION SITE SHALL BE PROTECTED WITH ADEQUATE EROSION AND SEDIMENT PROTECTION EITHER SILT SOCK AND FILTER CLOTH OR DROP IN PILE, TO GD05 SPECIFICATIONS, REFER TO GD05 IN: T00057-AD7-1902 TO 1905 FOR DETAILS.
- FILTER SOCK TO BE PLACED AT ALL CESSPITS DOWNSTREAM OF THE DEVELOPMENT AND ARE TO BE REGULARLY MAINTAINED IN ACCORDANCE WITH GD05.
- DIRTY WATER DIVERSION BUND TO BE REINTEGRATED AT THE END OF EACH DAY AND FOR RAIN EVENTS OR ALTERNATIVELY SITE ENTRANCEWAYS TO BE RAISED TO REDIRECT FLOWS AROUND ENTRANCE LOCATIONS.

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	14/10/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	12	Date:	14/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz






w. www.geotechnics.co.nz

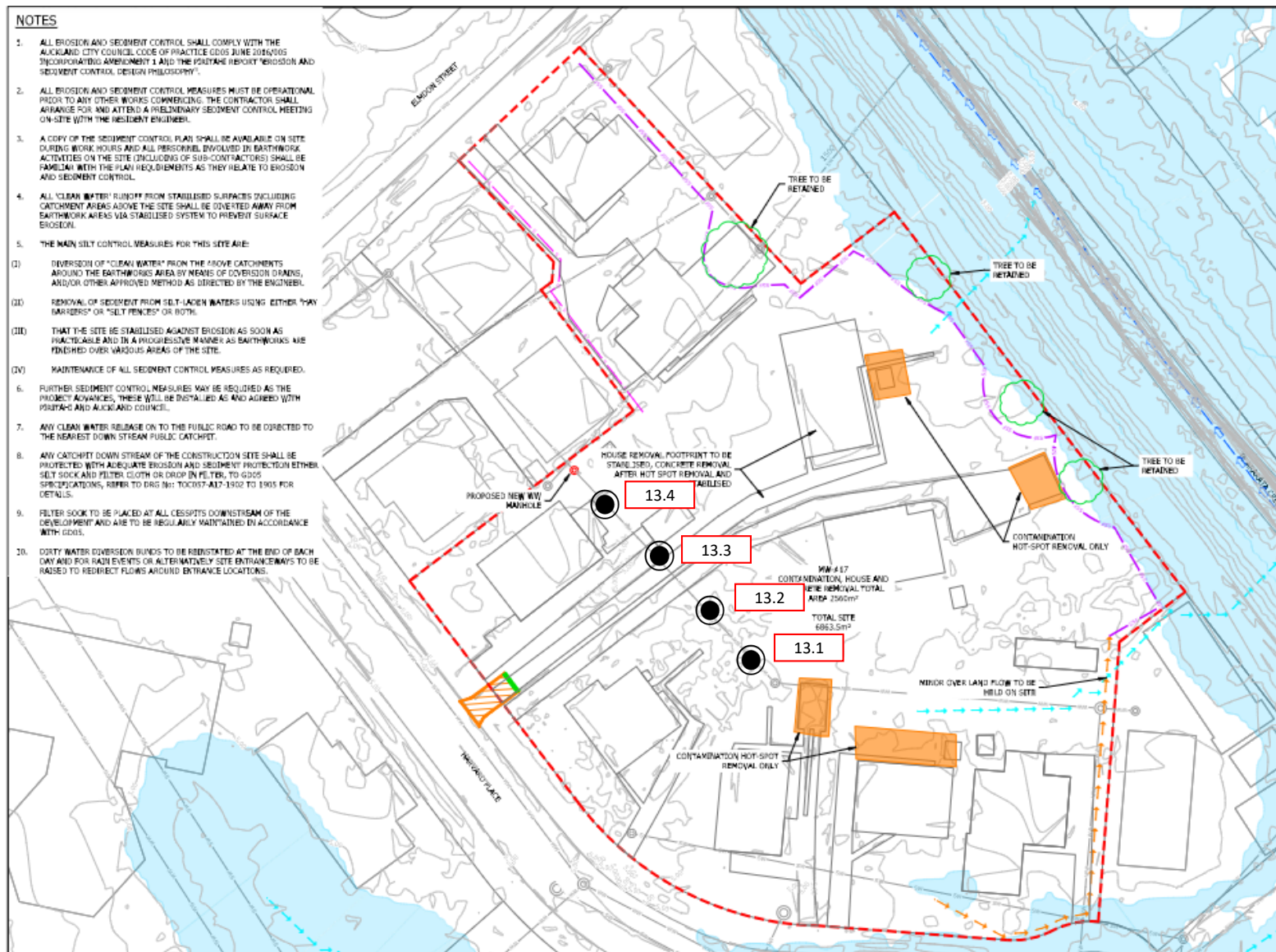


NOTES

- ALL EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH THE AUCKLAND CITY COUNCIL CODE OF PRACTICE GD05 JUNE 2016/0505 INCORPORATING AMENDMENT 1 AND THE PRACTICE REPORT 'EROSION AND SEDIMENT CONTROL DESIGN PHILOSOPHY'.
- ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE OPERATIONAL PRIOR TO ANY OTHER WORKS COMMENCING. THE CONTRACTOR SHALL ADVANCE FOR AND ATTEND A PRELIMINARY SEDIMENT CONTROL MEETING ON-SITE WITH THE RESIDENT ENGINEER.
- A COPY OF THE SEDIMENT CONTROL PLAN SHALL BE AVAILABLE ON SITE DURING WORK HOURS AND ALL PERSONNEL INVOLVED IN EARTHWORK ACTIVITIES ON THE SITE (INCLUDING SUB-CONTRACTORS) SHALL BE FAMILIAR WITH THE PLAN REQUIREMENTS AS THEY RELATE TO EROSION AND SEDIMENT CONTROL.
- ALL 'CLEAN WATER' RUNOFF FROM STABILISED SURFACES INCLUDING CATCHMENT AREAS ABOVE THE SITE SHALL BE DIVERTED AWAY FROM EARTHWORK AREAS VIA STABILISED SYSTEM TO PREVENT SURFACE EROSION.
- THE MAIN SILT CONTROL MEASURES FOR THIS SITE ARE:
 - DIVERSION OF 'CLEAN WATER' FROM THE ABOVE CATCHMENTS AROUND THE EARTHWORKS AREA BY MEANS OF DIVERSION DRAINS, AND/OR OTHER APPROVED METHOD AS DIRECTED BY THE ENGINEER.
 - REMOVAL OF SEDIMENT FROM SILT-LADEN WATERS USING EITHER 'POY BARRIERS' OR 'SILT FENCES' OR BOTH.
 - THAT THE SITE BE STABILISED AGAINST EROSION AS SOON AS PRACTICABLE AND IN A PROGRESSIVE MANNER AS EARTHWORKS ARE FINISHED OVER VARIOUS AREAS OF THE SITE.
 - MAINTENANCE OF ALL SEDIMENT CONTROL MEASURES AS REQUIRED.
- FURTHER SEDIMENT CONTROL MEASURES MAY BE REQUIRED AS THE PROJECT ADVANCES, THESE WILL BE INSTALLED AS AND AGREED WITH POHUKU AND AUCKLAND COUNCIL.
- ANY CLEAN WATER RELEASE ON TO THE PUBLIC ROAD TO BE DIRECTED TO THE NEAREST DOWN STREAM PUBLIC CATCHMENT.
- ANY CATCHMENT DOWN STREAM OF THE CONSTRUCTION SITE SHALL BE PROTECTED WITH ADEQUATE EROSION AND SEDIMENT PROTECTION EITHER SILT SOCK AND FILTER CLOTH OR DROP IN PILE, TO GD05 SPECIFICATIONS, REFER TO GIS IN: T00057-A17-1902 TO 1905 FOR DETAILS.
- FILTER SOCK TO BE PLACED AT ALL CESSPITS DOWNSTREAM OF THE DEVELOPMENT AND ARE TO BE REGULARLY MAINTAINED IN ACCORDANCE WITH GD05.
- DIRTY WATER DIVERSION BUND TO BE REINTEGRATED AT THE END OF EACH DAY AND FOR RAIN EVENTS OR ALTERNATIVELY SITE ENTRANCEWAYS TO BE RAISED TO REDIRECT FLOWS AROUND ENTRANCE LOCATIONS.

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DAMC	Date:	14/10/2022
Location:	Superlot MW-A17	Job No.:	1041000.0057.1.0/Rep1	URN:	13	Date:	14/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

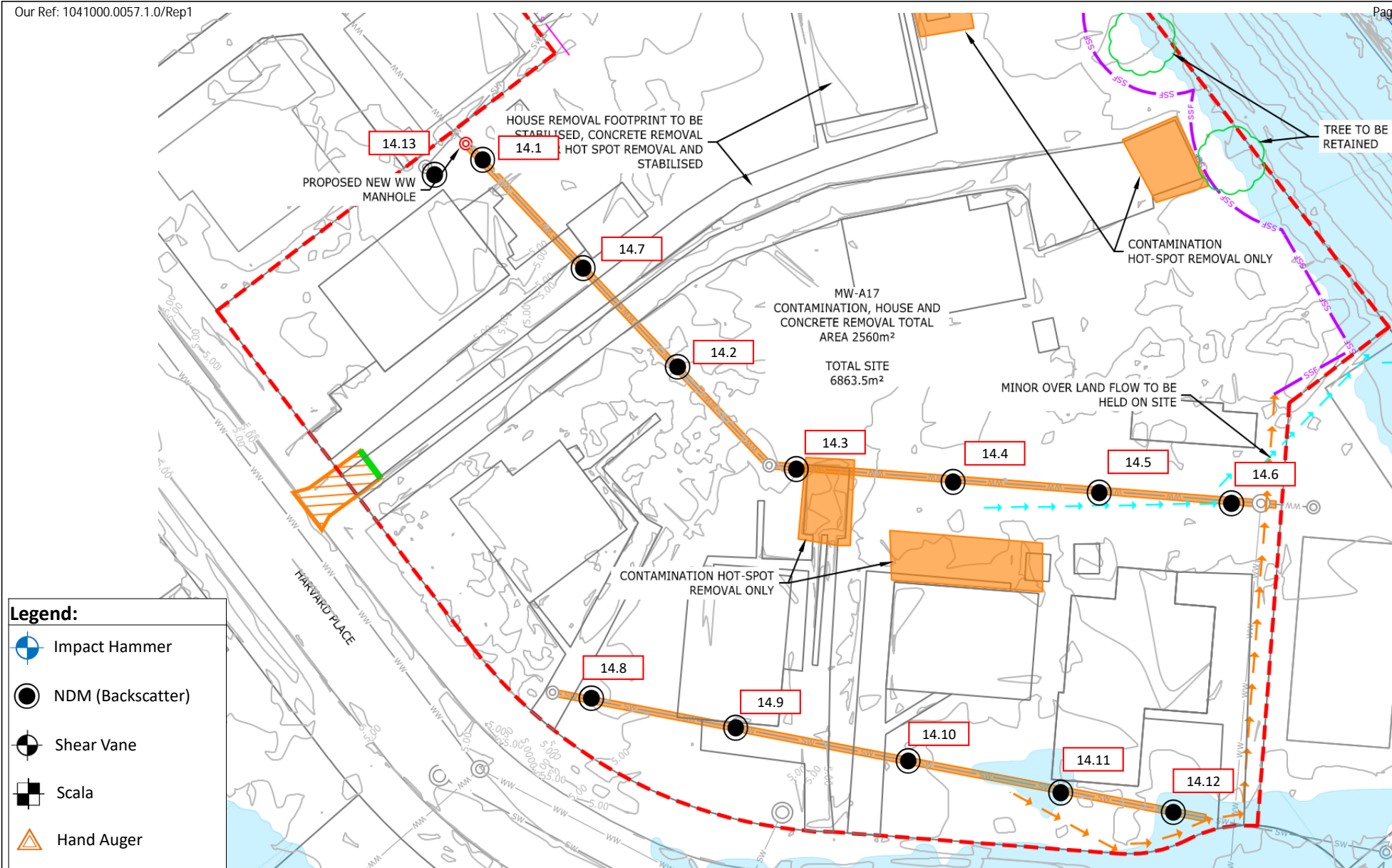
GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz





Test Location Plan

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	DBRA	Date:	20/10/2022
Location:	Superlot MW-A17 EX WW and SW Lines	Job No.:	1041000.0057.1.0/Rep1	URN:	14	Date:	20/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



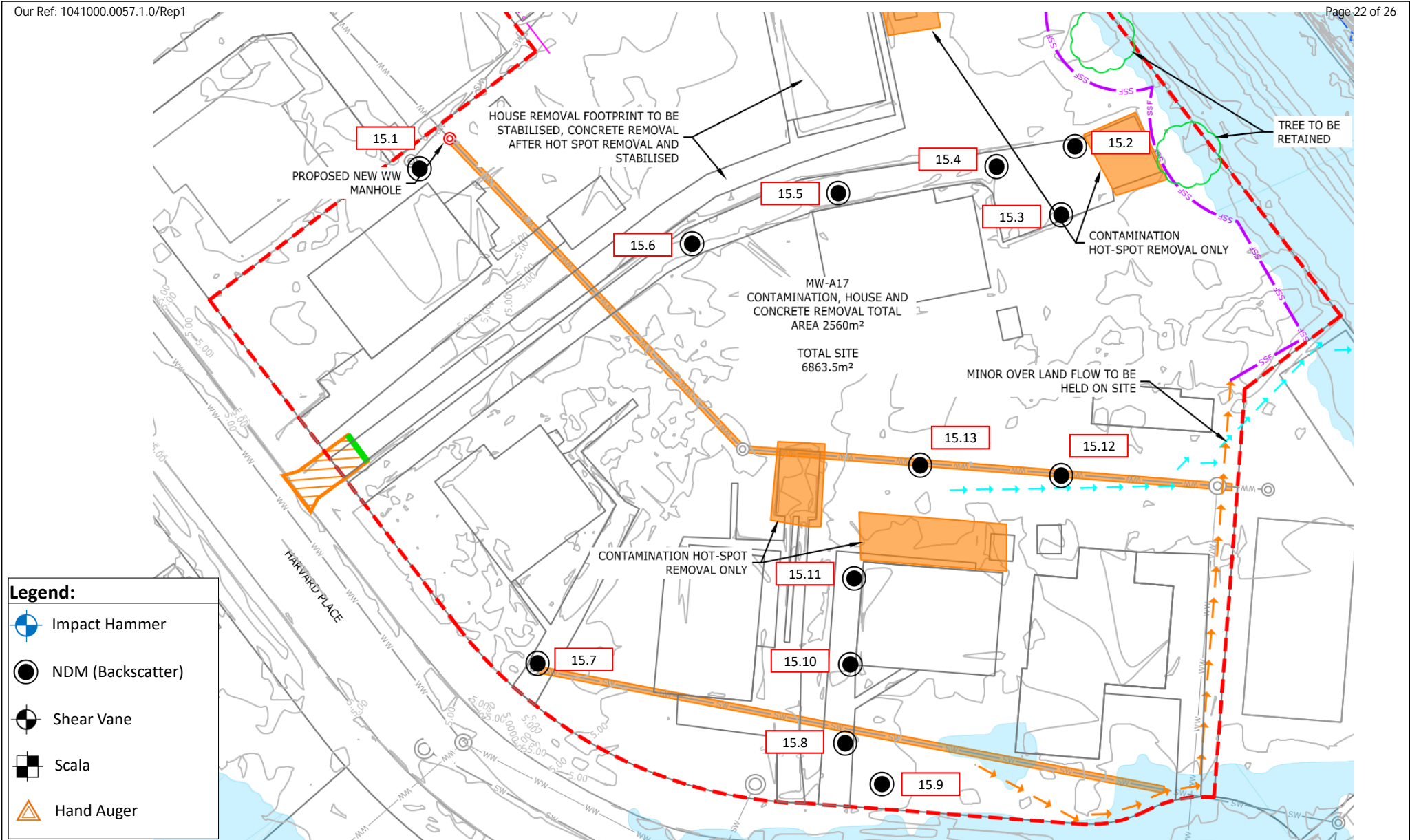
GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz



Test Location Plan

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	ROSM	Date:	31/10/2022
Location:	Superlot MW-A17 EX WW and SW Lines	Job No.:	1041000.0057.1.0/Rep1	URN:	15	Date:	31/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



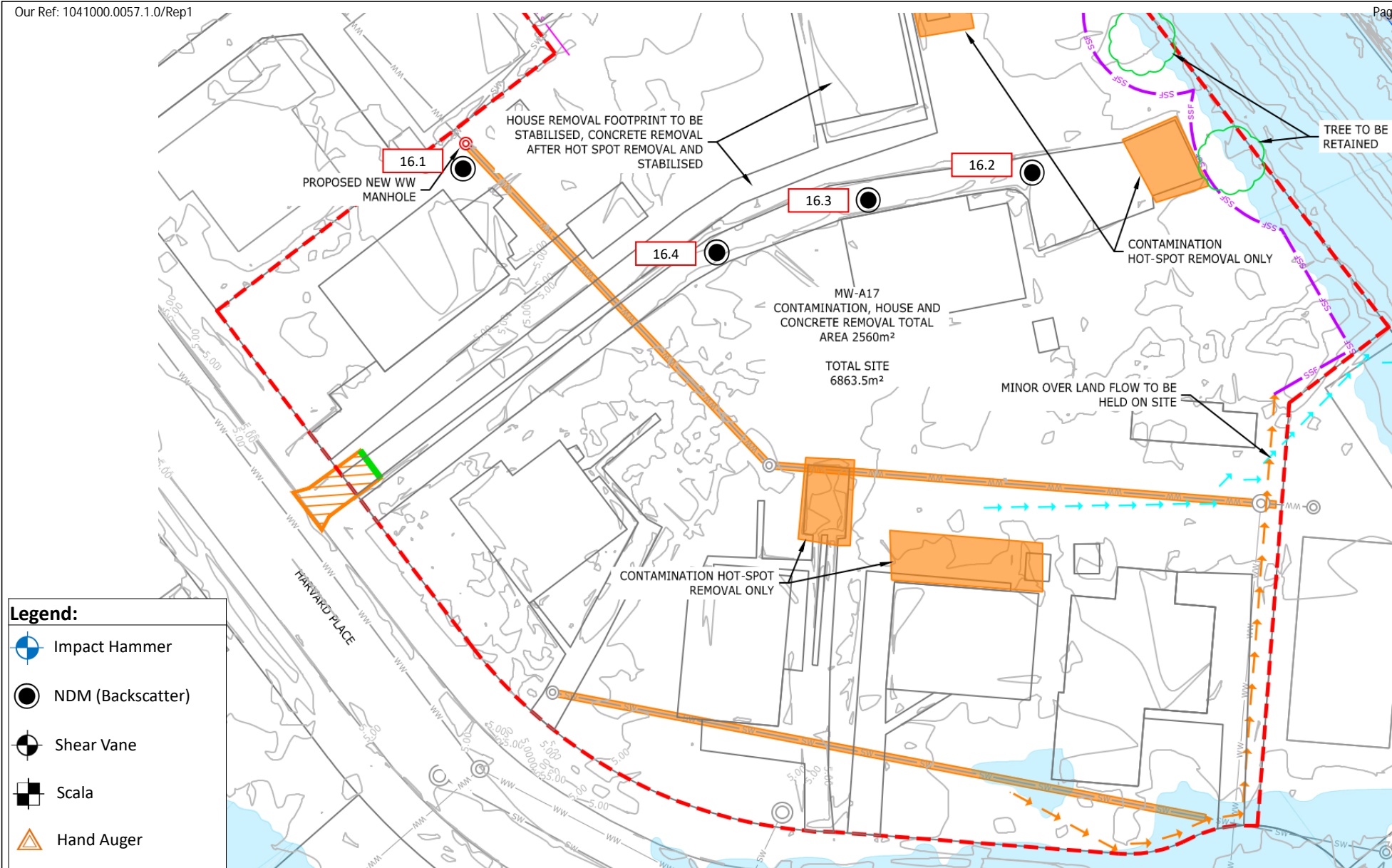
GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz



Test Location Plan

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	ROSM	Date:	31/10/2022
Location:	Superlot MW-A17 EX WW and SW Lines	Job No.:	1041000.0057.1.0/Rep1	URN:	16	Date:	31/10/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510






e. enquiry@geotechnics.co.nz

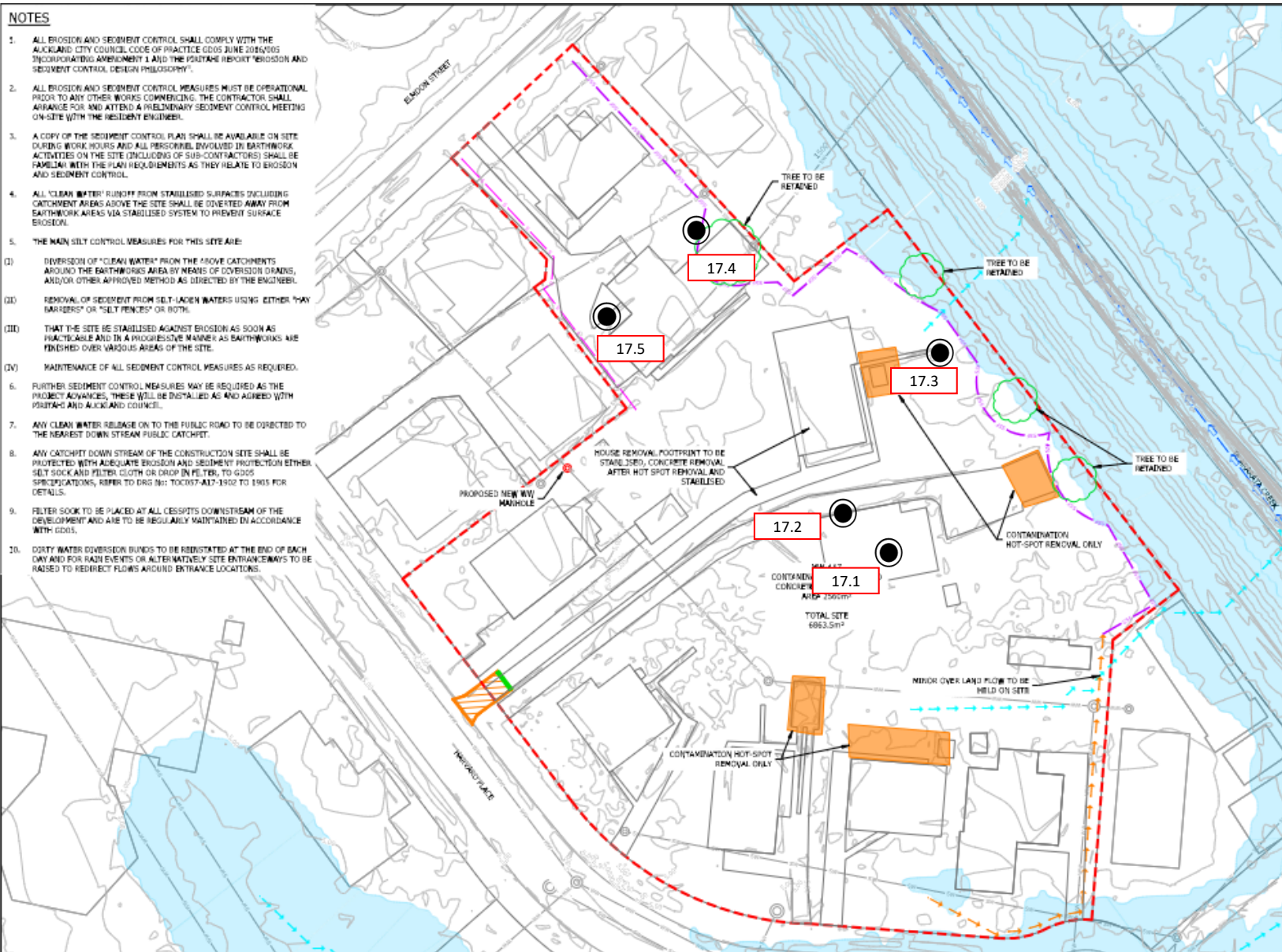
w. www.geotechnics.co.nz

NOTES

1. ALL EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH THE AUCKLAND CITY COUNCIL CODE OF PRACTICE GDOS JUNE 2016/2005 INCORPORATING AMENDMENT 1 AND THE PRACTICE REPORT 'EROSION AND SEDIMENT CONTROL DESIGN PHILOSOPHY'.
2. ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE OPERATIONAL PRIOR TO ANY OTHER WORKS COMMENCING. THE CONTRACTOR SHALL ARRANGE FOR AND ATTEND A PRELIMINARY SEDIMENT CONTROL MEETING ON-SITE WITH THE RESIDENT ENGINEER.
3. A COPY OF THE SEDIMENT CONTROL PLAN SHALL BE AVAILABLE ON SITE DURING WORK HOURS AND ALL PERSONNEL INVOLVED IN EARTHWORK ACTIVITIES ON THE SITE (INCLUDING OF SUB-CONTRACTORS) SHALL BE FAMILIAR WITH THE PLAN REQUIREMENTS AS THEY RELATE TO EROSION AND SEDIMENT CONTROL.
4. ALL 'CLEAN WATER' RUNOFF FROM STABILISED SURFACES INCLUDING CATCHMENT AREAS ABOVE THE SITE SHALL BE DIVERTED AWAY FROM EARTHWORK AREAS VIA STABILISED SYSTEM TO PREVENT SURFACE EROSION.
5. THE MAIN SILT CONTROL MEASURES FOR THIS SITE ARE:
 - (I) DIVERSION OF 'CLEAN WATER' FROM THE ABOVE CATCHMENTS AROUND THE EARTHWORKS AREA BY MEANS OF DIVERSION DRAINS, AND/OR OTHER APPROVED METHOD AS DIRECTED BY THE ENGINEER.
 - (II) REMOVAL OF SEDIMENT FROM SILT-LADEN WATERS USING EITHER 'MAY BARRIERS' OR 'SILT FENCES' OR BOTH.
 - (III) THAT THE SITE BE STABILISED AGAINST EROSION AS SOON AS PRACTICABLE AND IN A PROGRESSIVE MANNER AS EARTHWORKS ARE FINISHED OVER VARIOUS AREAS OF THE SITE.
 - (IV) MAINTENANCE OF ALL SEDIMENT CONTROL MEASURES AS REQUIRED.
6. FURTHER SEDIMENT CONTROL MEASURES MAY BE REQUIRED AS THE PROJECT ADVANCES, THESE WILL BE INSTALLED AS AND AGREED WITH PTSTARS AND AUCKLAND COUNCIL.
7. ANY CLEAN WATER RELEASE ON TO THE PUBLIC ROAD TO BE DIRECTED TO THE NEAREST DOWN STREAM PUBLIC CATCHPOT.
8. ANY CATCHPOT DOWN STREAM OF THE CONSTRUCTION SITE SHALL BE PROTECTED WITH ADEQUATE EROSION AND SEDIMENT PROTECTION EITHER SILT SOCK AND FILTER CLOTH OR DROP IN FILTER TO GDOS SPECIFICATIONS, REFER TO DRS NO: TOC057-A17-1902 TO 1905 FOR DETAILS.
9. FILTER SOCKS TO BE PLACED AT ALL CESSPITS DOWNSTREAM OF THE DEVELOPMENT AND ARE TO BE REGULARLY MAINTAINED IN ACCORDANCE WITH GDOS.
10. DIRTY WATER DIVERSION BUNDLS TO BE REINSTITUTED AT THE END OF EACH DAY AND FOR RAIN EVENTS OR ALTERNATIVELY SITE ENTRANCEWAYS TO BE RAISED TO REDIRECT FLOWS AROUND ENTRANCE LOCATIONS.

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	MADA	Date:	01/11/2022
Location:	Superlot MW-A17 EX WW and SW Lines	Job No.:	1041000.0057.1.0/Rep1	URN:	17	Date:	01/11/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



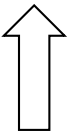
GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz






w. www.geotechnics.co.nz

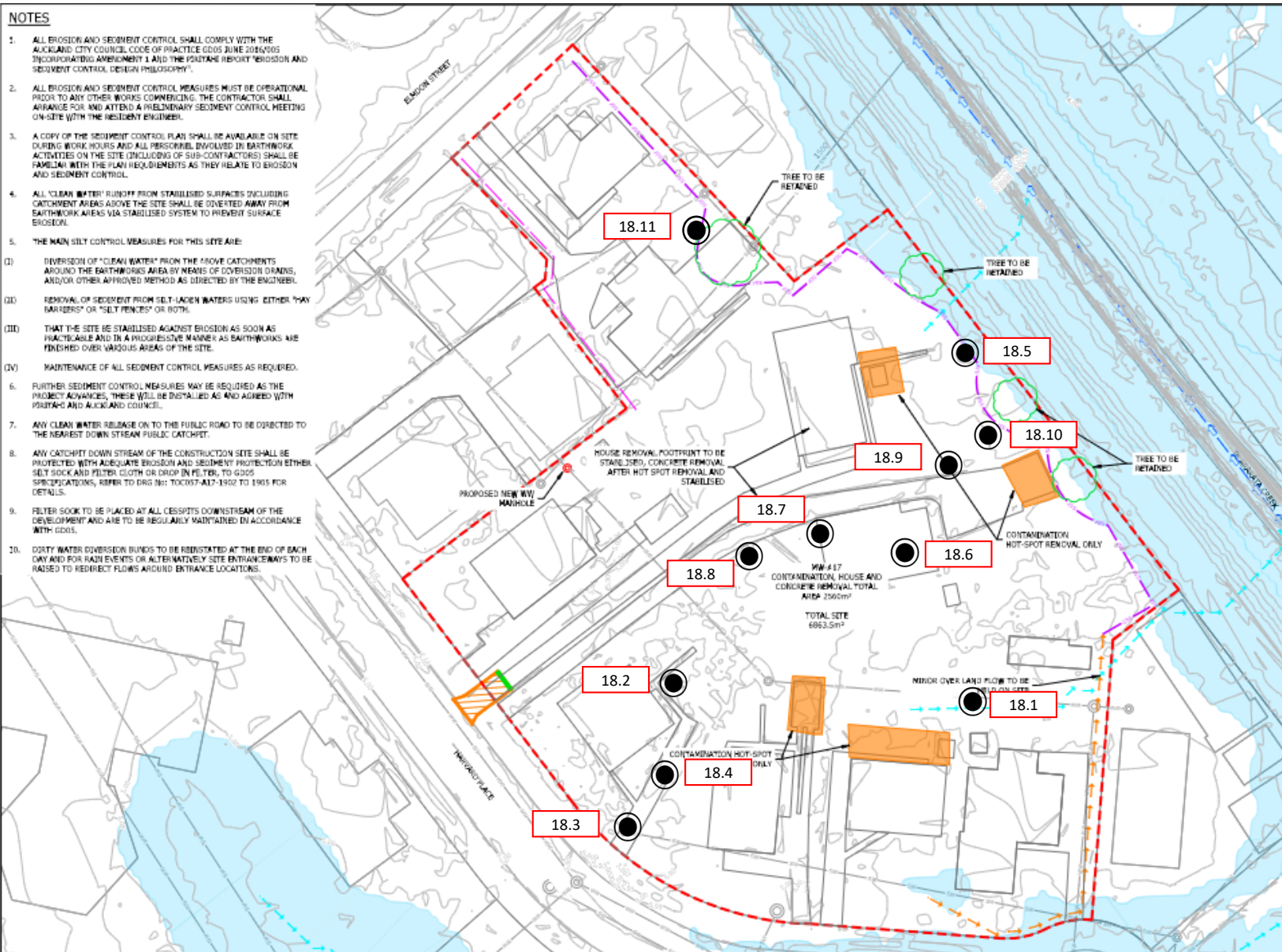
N

NOTES

1. ALL EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH THE AUCKLAND CITY COUNCIL CODE OF PRACTICE GDOS JUNE 2016/2015 INCORPORATING AMENDMENT 1 AND THE POLYMER REPORT "EROSION AND SEDIMENT CONTROL DESIGN PHILOSOPHY".
2. ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE OPERATIONAL PRIOR TO ANY OTHER WORKS COMMENCING. THE CONTRACTOR SHALL ARRANGE FOR AND ATTEND A PRELIMINARY SEDIMENT CONTROL MEETING ON-SITE WITH THE RESIDENT ENGINEER.
3. A COPY OF THE SEDIMENT CONTROL PLAN SHALL BE AVAILABLE ON SITE DURING WORK HOURS AND ALL PERSONNEL INVOLVED IN EARTHWORK ACTIVITIES ON THE SITE (INCLUDING OF SUB-CONTRACTORS) SHALL BE FAMILIAR WITH THE PLAN REQUIREMENTS AS THEY RELATE TO EROSION AND SEDIMENT CONTROL.
4. ALL 'CLEAN WATER' RUNOFF FROM STABILISED SURFACES INCLUDING CATCHMENT AREAS ABOVE THE SITE SHALL BE DIVERTED AWAY FROM EARTHWORK AREAS VIA STABILISED SYSTEM TO PREVENT SURFACE EROSION.
5. THE MAIN SILT CONTROL MEASURES FOR THIS SITE ARE:
 - (I) DIVERSION OF 'CLEAN WATER' FROM THE ABOVE CATCHMENTS AROUND THE EARTHWORKS AREA BY MEANS OF DIVERSION DRAINS, AND/OR OTHER APPROVED METHOD AS DIRECTED BY THE ENGINEER.
 - (II) REMOVAL OF SEDIMENT FROM SILT-LADEN WATERS USING EITHER 'MAY BARBERS' OR 'SILT FENCES' OR BOTH.
 - (III) THAT THE SITE BE STABILISED AGAINST EROSION AS SOON AS PRACTICABLE AND IN A PROGRESSIVE MANNER AS EARTHWORKS ARE FINISHED OVER VARIOUS AREAS OF THE SITE.
 - (IV) MAINTENANCE OF ALL SEDIMENT CONTROL MEASURES AS REQUIRED.
6. FURTHER SEDIMENT CONTROL MEASURES MAY BE REQUIRED AS THE PROJECT ADVANCES, THESE WILL BE INSTALLED AS AND AGREED WITH PTSTARS AND AUCKLAND COUNCIL.
7. ANY CLEAN WATER RELEASE ON TO THE PUBLIC ROAD TO BE DIRECTED TO THE NEAREST DOWN STREAM PUBLIC CATCHPOT.
8. ANY CATCHPOT DOWN STREAM OF THE CONSTRUCTION SITE SHALL BE PROTECTED WITH ADEQUATE EROSION AND SEDIMENT PROTECTION EITHER SILT SOCK AND FILTER CLOTH OR DROP IN FILTER, TO GDOS SPECIFICATIONS, REFER TO DRS NO: TOC057-A17-1902 TO 1905 FOR DETAILS.
9. FILTER SOCKS TO BE PLACED AT ALL CESSPITS DOWNSTREAM OF THE DEVELOPMENT AND ARE TO BE REGULARLY MAINTAINED IN ACCORDANCE WITH GDOS.
10. DIRTY WATER DIVERSION BUNDLS TO BE REINSTITUTED AT THE END OF EACH DAY AND FOR RAIN EVENTS OR ALTERNATIVELY SITE ENTRANCEWAYS TO BE RAISED TO REDIRECT FLOWS AROUND ENTRANCE LOCATIONS.

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	ROSM	Date:	01/11/2022
Location:	Superlot MW-A17 EX WW and SW Lines	Job No.:	1041000.0057.1.0/Rep1	URN:	18	Date:	01/11/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



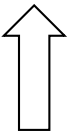
GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz






w. www.geotechnics.co.nz

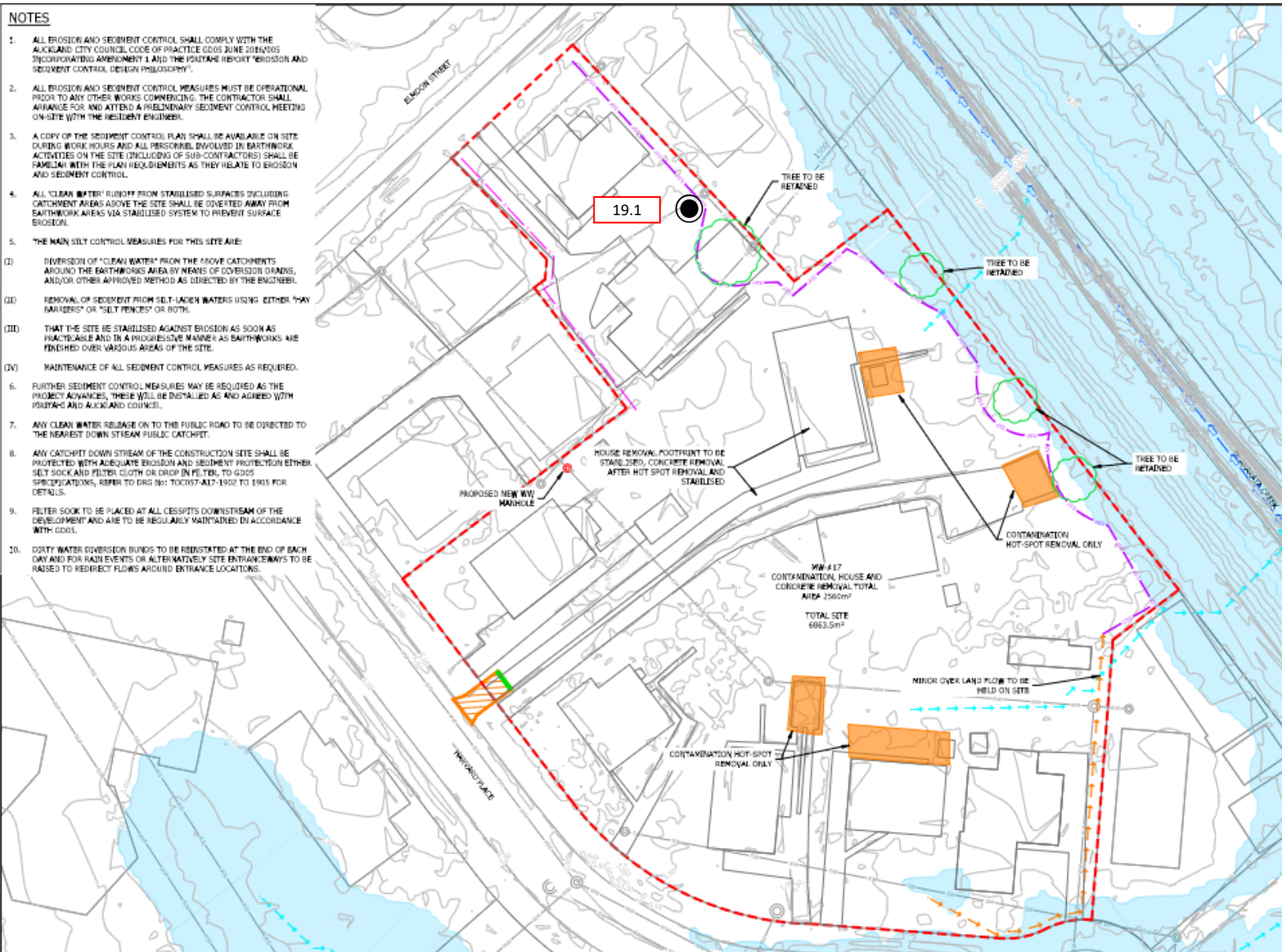
N

NOTES

1. ALL EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH THE AUCKLAND CITY COUNCIL CODE OF PRACTICE GDOS JUNE 2016/2005 INCORPORATING AMENDMENT 1 AND THE POLYMER REPORT "EROSION AND SEDIMENT CONTROL DESIGN PHILOSOPHY".
2. ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE OPERATIONAL PRIOR TO ANY OTHER WORKS COMMENCING. THE CONTRACTOR SHALL ARRANGE FOR AND ATTEND A PRELIMINARY SEDIMENT CONTROL MEETING ON-SITE WITH THE RESIDENT ENGINEER.
3. A COPY OF THE SEDIMENT CONTROL PLAN SHALL BE AVAILABLE ON SITE DURING WORK HOURS AND ALL PERSONNEL INVOLVED IN EARTHWORK ACTIVITIES ON THE SITE (INCLUDING OF SUB-CONTRACTORS) SHALL BE FAMILIAR WITH THE PLAN REQUIREMENTS AS THEY RELATE TO EROSION AND SEDIMENT CONTROL.
4. ALL 'CLEAN WATER' RUNOFF FROM STABILISED SURFACES INCLUDING CATCHMENT AREAS ABOVE THE SITE SHALL BE DIVERTED AWAY FROM EARTHWORK AREAS VIA STABILISED SYSTEM TO PREVENT SURFACE EROSION.
5. THE MAIN SILT CONTROL MEASURES FOR THIS SITE ARE:
 - (I) DIVERSION OF 'CLEAN WATER' FROM THE ABOVE CATCHMENTS AROUND THE EARTHWORKS AREA BY MEANS OF DIVERSION DRAINS, AND/OR OTHER APPROVED METHOD AS DIRECTED BY THE ENGINEER.
 - (II) REMOVAL OF SEDIMENT FROM SILT-LADEN WATERS USING EITHER 'MAY BARBERS' OR 'SILT FENCES' OR BOTH.
 - (III) THAT THE SITE BE STABILISED AGAINST EROSION AS SOON AS PRACTICABLE AND IN A PROGRESSIVE MANNER AS EARTHWORKS ARE FINISHED OVER VARIOUS AREAS OF THE SITE.
 - (IV) MAINTENANCE OF ALL SEDIMENT CONTROL MEASURES AS REQUIRED.
6. FURTHER SEDIMENT CONTROL MEASURES MAY BE REQUIRED AS THE PROJECT ADVANCES, THESE WILL BE INSTALLED AS AND AGREED WITH PTSTARS AND AUCKLAND COUNCIL.
7. ANY CLEAN WATER RELEASE ON TO THE PUBLIC ROAD TO BE DIRECTED TO THE NEAREST DOWN STREAM PUBLIC CATCHPOT.
8. ANY CATCHPOT DOWN STREAM OF THE CONSTRUCTION SITE SHALL BE PROTECTED WITH ADEQUATE EROSION AND SEDIMENT PROTECTION EITHER SILT SOCK AND FILTER CLOTH OR DROP IN FILTER TO GDOS SPECIFICATIONS, REFER TO DRS NO: TOC057-A17-1902 TO 1905 FOR DETAILS.
9. FILTER SOCKS TO BE PLACED AT ALL CESSPITS DOWNSTREAM OF THE DEVELOPMENT AND ARE TO BE REGULARLY MAINTAINED IN ACCORDANCE WITH GDOS.
10. DIRTY WATER DIVERSION BUNDLS TO BE REINSTITUTED AT THE END OF EACH DAY AND FOR RAIN EVENTS OR ALTERNATIVELY SITE ENTRANCEWAYS TO BE RAISED TO REDIRECT FLOWS AROUND ENTRANCE LOCATIONS.

Legend:

-  Impact Hammer
-  NDM (Backscatter)
-  Shear Vane
-  Scala
-  Hand Auger

**Test Location Plan**

Site:	Mangere Precinct TOC57	Job Name:	Mangere Precinct TOC57	Drawn:	ROSM	Date:	01/11/2022
Location:	Superlot MW-A17 EX WW and SW Lines	Job No.:	1041000.0057.1.0/Rep1	URN:	19	Date:	01/11/2022
		Lab Ref:	- N/A	Scale:	Not to Scale	Rev.:	1



GEOTECHNICS

GEOTECHNICS LTD.

1 Hill Street, Onehunga
Auckland, New Zealand
ph. +64 (0)9 356 3510

e. enquiry@geotechnics.co.nz

w. www.geotechnics.co.nz

N

Appendix E – Piritahi ITPs

INSPECTION AND TEST PLAN



TOC No.:		ITP No.:	AAAA-DS-ITP-0001 (Revision 2)					EPA No.:				
TOC Name:		ITP Title:	ITP for Earthworks - Cut					Scope of this ITP:				
NOTE: This ITP is to be signed off as one of superlot handover/bulk earthworks construction work pack closeout supporting QA documents at the completion of each superlot/construction work pack.												
Item No:	Inspection / Test Description	Hold(H), Witness(W), Review(R), Inspection(I)			Frequency	Test by Whom	Conformance Criteria	Reference Detail	Required Records	Compliance Verification		
		Constructor	CPS/Designer	Territory Authority						Constructor (Y/N/NA)	CPS (Y/N/NA)	Comments
0	Pre-construction Meeting	H	R	R	Prior to commencing the construction works	NA	Construction monitoring, surface surveys, testing frequency and expectations agreed and meeting minuted.	Auckland QAM	Meeting Minutes			
	Subcontractor Kick-off Meeting	H			Once prior to commencing the construction works	NA	Piritahi QA expectations and requirements addressed and meeting minuted	Specified	Meeting Minutes			
1	Cut/Excavation Materials											
1.1	Excavation Material Testing	H	H		Prior to cut	IANZ Laboratory	Material to be excavated shall be tested for contamination if exporting off superlot and/or use as site-won fill.	Site Specific Remediation Plans	Land Remediation Notice; IANZ Test Report(s); Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2	Construction											
2.1	Original Ground Level Survey and Setting Out	I	R		Prior to clearance and topsoil stripping	NA	Constructor and Designer may jointly visually inspect undertake check or take spot levels as they consider necessary to confirm the accuracy of these drawings and levels.	ATCOP / ACCOP	Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.2	Clearance and Topsoil Stripping	I	I		After clearance and topsoil stripping	NA	Topsoil (that does not require remediation) shall be removed within the limits of the earthworks and stockpiled within superlot boundaries clear of any 'contaminated' insitu or stockpiled material.	Site Specific Remediation Plans	Land Remediation Notice; Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.3	Post Topsoil Strip Survey and Setting Out	I	R		Prior to cut	NA	As per drawings	ATCOP / ACCOP	Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.4	Unsuitable Material Cut to Waste	I	R		As required	NA	Material identified as requiring remediation to be removed as instructed by CPS/Land Remediation Specialists.	Site Specific Remediation Plans	Land Remediation Notice; Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.5	Suitable Material Cut to Fill	I	R		Prior to excavation for use on site	IANZ Laboratory	Site won material that does not require remediation can be used within the superlot boundary. MDD and OMC are required for site-won fill material. If the site won material is to be exported, then environmental testing is required.	Site Specific Remediation Plans	Land Remediation Notice; IANZ Test Report(s); Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.6	Cut Subgrade Testing	R	R		As specified by Designer/Geotechnical Team at excavated subgrade level	Constructor/IANZ Laboratory	Specified by Designer/Geotechnical Team prior to commencement of construction (Subject to agreement with Kāinga Ora)	Specified	Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.7	Undercut & Backfilling Inspection and Testing	H	H		Before and after undercutting and when required (subject to CPS/Designer's instruction)	Constructor/IANZ Laboratory	Specified by CPS/Designer	Specified	Backfill compaction test report(s) as per AAAA-DS-ITP - Earthworks - Fill (if applicable) Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
2.8	As-built Survey	R	R		After cutting or backfilling of undercutting	NA	The top of embankment shall not vary more than 0.5m into the flatter area; Section areas (flatter than 1.5:1); levels shall be to within 150mm of the contours or spot levels indicated.	ATCOP / ACCOP	As-built Survey			
2.9	Stabilisation of Final Surfaces	I	I		At finished levels	NA	Smooth drum rolled surfaces with cross fall. Protected with mulch or temporary hardfill cover	Specified	Piritahi Construction Checklist (AAAA-CN-CHK-0008 - Earthworks - Cut)			
3	Post Construction											
3.1	Final Inspection (Piritahi Internal)	H	H		At the completion of cut (i.e., each superlot and/or construction work pack)	NA	No unacceptable defects	ACTOP Section 16.9.1	Photos			
									Constructor	Name:	Signature:	Date:
									CPS	Name:	Signature:	Date:
									QA	Name:	Signature:	Date:

INSPECTION AND TEST PLAN



TOC No.:		ITP No.:	AAAA-DS-ITP-0002 (Revision 2)				EPA No.:					
TOC Name:		ITP Title:	ITP for Earthworks - Fill (Including decanting Earth Bunds and Backfilled Redundant Service Trenches)				Scope of this ITP:					
NOTE: This ITP is to be signed off as one of superlot handover/bulk earthworks construction work pack closeout supporting QA documents at the completion of each superlot/construction work pack.												
Item No:	Inspection / Test Description	Hold(H), Witness(W), Review(R), Inspection(I)			Frequency	Test by Whom	Conformance Criteria	Reference Detail	Required Records	Compliance Verification		
		Constructor	CPS/Designer	Territory Authority						Constructor (Y/N/NA)	CPS (Y/N/NA)	Comments
0	Pre-construction Meeting	H	R	R	Prior to commencing the construction works	NA	Construction monitoring expectations, frequency and timeframes agreed between construction and testing teams and meeting minutes distributed	NA	Meeting Minutes			
	Subcontractor Kick-off Meeting	H			Once prior to commencing the construction works	NA	Piritahi QA expectations and requirements addressed and meeting minuted	Specified	Meeting Minutes			
1	Fill Materials											
1.1	Fill Materials	H	R		Prior to filling 1 initial test for each material and then 1 test per 5,000 m3 for that particular material type.	IANZ Laboratory	Prior to filling (site stockpile to be sampled); (1) Site won material: MDD and OMC (standard Proctor compaction test); (2) Imported cohesive fill: Natural Water Content, Atterberg Limits and Linear Shrinkage for NZS3604 expansivity, and Shrink Swell Test for AS2870; (3) Imported granular: PSD, MDD, OMC and Weathering Quality Index (NZS4407:2015 Test 3.11)	Specified	IANZ Test Report(s); Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2	Construction QA/QC Requirements											
2.1	Setting Out	I	I		Prior to undercutting/filling	NA	By Construction Surveyor as specified in Civil Specification	ACCOP ATCOP	Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.2	Inspection of subgrade or exposed undercut surface	H	H		Prior to filling or backfilling of undercutting	NA	By CPS and Geotechnical Engineer/Geologist prior to filling	Specified	Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.3	Testing of subgrade	R	R		Prior to filling: - 10 m by 10 m grid for bulk earthworks; or, - 1 test (Shear Vane&Scala) per 15m for trenches	Constructor	a) Shear Vane: >=60 kPa and b) Scala Penetrometer Test: >=1 blow per 50 mm to 1 m below base of fill	Specified	Shear Vane & Scala Test Records; Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.4	Testing of undercut surface (if applicable)	R	R		Prior to backfilling of undercutting	Constructor	Specified by CPS/Designer	Specified	Shear Vane/Scala Test Records when required; Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.5	Benching	I	I		As directed by CPS/Designer	NA	Any portion of the ground whose slope is steeper than three horizontal to one vertical shall be benched before filling is placed on it; The base of the benches shall be sloped inwards at a slope of 12 horizontal to 1 vertical. The longitudinal profile of each bench shall be graded to ensure adequate drainage and safe discharge of water.	Specified	Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.6	Inspection of Earthwork Filling in Layers	I	I		During filling at every 0.5m height intervals	NA	The thickness of each loose layer (lift) is to be approximately 250mm to 300mm achieve maximum 200mm thick compacted layers	Specified	Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.7	Compaction Testing in Layers	H	R		Testing undertaken at every 0.5 m height interval. Within Road Reserves: - Clegg 10m by 10m grid and NDM 20m by 20m grid for bulk earthworks; or, - 1 test (Clegg&NDM) per 15m for trenches Within Superlot Boundaries: <u>1. Cohesive fill (imported or site won):</u> - Shear vane 10m by 10m grid and NDM 20m by 20m grid for bulk earthworks; or, - 1 test (Shear vane&NDM) per 15m for trenches <u>2. Granular fill (imported):</u> - Clegg 10m by 10m grid and NDM 20m by 20m grid for bulk earthworks; or, - 1 test (Clegg&NDM) per 15m for trenches <u>3. SPR/ROP:</u> - Shear vane and Clegg 10m by 10m grid and NDM 20m by 20m grid for bulk earthworks; or, - 1 test (Shear vane, Clegg&NDM) per 15m for trenches NOTE: NDM not required for less than 600mm deep backfilled trenches within Superlots, however, Clegg or shear vane tests are required.	Constructor - Sher vane & Clegg; IANZ Laboratory - NDM	Within Road Reserves: GAP65: CIV (average) >= 30 and no single value < 28 and MDD > =95%; GAP40: CIV (average) >= 23 and no single value < 21 and MDD >= 95% Other approved materials: to be checked with CPS/Designer. Within Superlot Boundaries <u>1. Cohesive fill (imported or site won):</u> - Shear vane (average over 4 readings) >= 130kPa and no single reading < 120kPa; and, - NDM with Air Voids (average) < 8% and no single Air Void > 10% <u>2. Granular fill (imported):</u> - GAP65: CIV (average) > =30 and no single value < 28 and MDD >= 92% - GAP40: CIV (average) >= 23 and no single value < 21 and MDD >= 92% - GAP100: CIV (average) > =30 and no single value < 28 and MDD >= 92% <u>3. SPR/ROP:</u> - CIV (average) >= 30 and no single value < 28; and, - Shear vane (average over 4 readings) >= 130kPa and no single reading < 120kPa; and, - MDD >= 92% and Air Voids (Average) < 8% and no single Air Void > 10%	Specified	IANZ NDM Test Report(s); Shear Vane and/or Clegg Test Records; Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
2.8	Tolerances (As-built)	H	R		As specified	NA	Final Road Subgrades: -20 +0mm Fill; Batters: -0 +150mm; All other fill areas: +0 -75mm	ATCOP Section 16.9.1	As-built Survey			
2.9	Stabilisation of final surfaces	I	I		At finished levels	NA	Smooth drum rolled surfaces with cross fall. Protected with mulch or temporary hardfill cover	Specified	Piritahi Construction Checklist (AAAA-CN-CHK-0009 - Earthworks - Fill)			
3	Post Construction											
3.1	Final Inspection (Piritahi Internal)	H	H		At the completion of fill (i.e., each superlot and/or construction work pack)	NA	No unacceptable defects	ACTOP Section 16.9.1	Photos			
									Constructor	Name:	Signature:	Date:
									CPS	Name:	Signature:	Date:
									QA	Name:	Signature:	Date:

INSPECTION AND TEST PLAN - STORMWATER



TOC No.:		ITP No.:	AAAA-DS-ITP-0005 (Revision 6)					EPA No.:				
TOC Name:		ITP Title:	ITP for Stormwater					Scope of this ITP:				
NOTE: This ITP is to be signed off as one of CS3/CS4/CoA and/or EACC application supporting QA documents at the completion of each EPA.												
Item No:	Inspection / Test Description	Hold(H), Witness(W), Review(R), Inspection(I)			Frequency	Test by Whom	Conformance Criteria	Reference Detail	Required Records	Compliance Verification		
		Constructor	CPS/ Designer	Territory Authority						Constructor (Y/N/NA)	CPS (Y/N/NA)	Comments
0	Pre-construction Meeting	H	R	R	Prior to commencing the construction works	NA	Construction monitoring level agreed and meeting minuted	NA	Meeting Minutes			
	Subcontractor Kick-off Meeting	H			Once prior to commencing the construction works	NA	Piritahi QA expectations and requirements addressed and meeting minuted	Specified	Meeting Minutes			
1	Material Compliance											
1.1	Pipes and Miscellaneous Precast Units (Manhole, Lid, Catchpit/Cesspit, Inlet and Outlet, etc)	I/R	R		Material Certificate/Compliance Statement to cover all the pipes & other precast units is to be provided to Quality Engineer for each Precinct every 6 months or at a change of source.	NA	1. Types, sizes and classes are as per the design drawings. 2. Conformance criteria refer to relevant material standards.	NA	Material Certificate(s)/Compliance Statement(s) from Supplier			
1.2	Aggregates for Bedding, Haunch, Overlay and Backfill	I/R	R		Material Certificate/Compliance Statement is to be provided to Quality Engineer for each Precinct every 6 months or at a change of source.	IANZ Laboratory	1. The granular material for bedding, haunch, overlay and backfill shall be hard clean, chemically stable crushed stone that would not break down when wetted. Shale or gravely conglomerates are not suitable materials. 2. The granular materials agreed to use include GAP7, GAP20, GAP40, GAP65 and ROP/SPR. 3. Supplier shall provide IANZ Test Reports for PSD, MDD and DI (Density Index). 4. Aggregate MDD and DI test results will be accepted as they are. 5. Aggregate PSD shall meet the specified grading curve envelops as per Appendix A of this ITP (To be provided).	Specified	PSD, MDD and DI IANZ Test Report(s) from Supplier			
1.3	Insitu Concrete	I/R	R		When products are delivered to site and before products are incorporated into the works	NA	Insitu concrete for all drainage works shall be a minimum of 20MPa unless specified otherwise on the drawings.	Specified	Concrete Delivery Dockets			
1.4	Steel Reinforcement & Miscellaneous Steel Inc. Bolts and Nuts	I/R	R		When products are delivered to site and before products are incorporated into the works	NA	1. Types, sizes and classes are as per the design drawings. 2. Conformance criteria refer to relevant material standards.	NA	Material Certificate(s)/Compliance Statement(s) from Supplier			
2	Construction QA/QC Requirements											
2.1	Pipeline											
2.1.1	Trenching	I			After excavation	NA	1. Trench location, width level and depth as per drawing and setting out. 2. The minimum width of the trench should be such that the barrel of the pipe is not closer than 150mm to the trench wall or shoring. 3. Enough space for the trench shields should be allowed for.	Specified	Piritahi Construction Checklist for Stormwater			

INSPECTION AND TEST PLAN - STORMWATER

2.1.2	Trench Foundation & Undercutting	H	H		<div>Shear Vane for trench foundation to be tested: - For trenches ≥ 30m - every 15m - For trenches < 30m - min 2 tests</div> <div>Clegg for backfilling of undercut to be tested: - For trenches ≥30m - 1 test every 15m - For trenches <30m - min 2 tests</div>	Constructor	<div><div><table><tr><th>Shear vane strength (in clay/silt)</th><th>Scala Penetrometer (in sand/gravel)</th><th>Undercut and backfill</th></tr><tr><td>≥80 kPa</td><td>≤50mm per blow</td><td>No undercut required</td></tr><tr><td>60-80 kPa</td><td>60mm per blow</td><td>200mm compacted hardfill</td></tr><tr><td>40-60 kPa</td><td>80mm per blow</td><td>350mm compacted hardfill</td></tr><tr><td>20-40 kPa</td><td>100mm per blow</td><td>500mm compacted hardfill</td></tr><tr><td><20 kPa or highly organic</td><td>200mm per blow</td><td>Contact the design engineer</td></tr></table></div><div>1. Remove any unsuitable foundation material in accordance with the below table.</div><div>2. Undercutting to have a transition slope of 1:5 between the undercut section and the normal foundation.</div><div>3. Backfill material (GAP65 or GAP40) shall be selected as per the design drawings and the required compactness is as below:</div><div>For backfill (1) GAP 65: CIV (average over 30m length/average per manhole) > 30 & no single value < 28. OR: (2) GAP 40: CIV (average over 30m length/ average per manhole) > 23 & no single value < 21.</div><div>Note: If it is not possible to undertake the required Clegg tests, then a visual inspection – Hold Point shall be done by CPS Lead who may engage the geotechnical engineer when required.</div></div>	Shear vane strength (in clay/silt)	Scala Penetrometer (in sand/gravel)	Undercut and backfill	≥80 kPa	≤50mm per blow	No undercut required	60-80 kPa	60mm per blow	200mm compacted hardfill	40-60 kPa	80mm per blow	350mm compacted hardfill	20-40 kPa	100mm per blow	500mm compacted hardfill	<20 kPa or highly organic	200mm per blow	Contact the design engineer	Specified	Piritahi Construction Checklist for Stormwater; Shear Vane/Clegg Test Record			
Shear vane strength (in clay/silt)	Scala Penetrometer (in sand/gravel)	Undercut and backfill																												
≥80 kPa	≤50mm per blow	No undercut required																												
60-80 kPa	60mm per blow	200mm compacted hardfill																												
40-60 kPa	80mm per blow	350mm compacted hardfill																												
20-40 kPa	100mm per blow	500mm compacted hardfill																												
<20 kPa or highly organic	200mm per blow	Contact the design engineer																												
2.1.3	Pipe Bedding	I/H	R		<div>Clegg for bedding to be tested: - For trenches ≥30m - 1 test every 15m - For trenches <30m - min 2 tests</div> <div>Note: Every Clegg test shall have 4 readings recorded.</div>	Constructor	<div><div>H2 Support Type Bedding Depth: 100mm if $\phi < 1500\text{mm}$ 150mm if $\phi > 1500\text{mm}$ Max layer thickness 150mm</div><div>Bedding material (GAP7 or GAP20) shall be selected as per the design drawings and the required compactness is as below:</div><div>- GAP 7 & GAP 20: CIV (average over 30m length/ average per manhole) > 12 & CIV no less than 10.</div><div>Note: If it is not possible to undertake the required Clegg tests, then a visual inspection – Hold Point shall be done by CPS Lead who may engage the geotechnical engineer when required.</div></div>	Auckland Council SWCoP Drawing SW03 NZS3725 Table 5																						
2.1.4	Pipe Haunch	I/H	R		<div>Clegg for haunch to be tested: - For trenches ≥30m - 1 test every 15m per layer - For trenches <30m - min 2 tests per layer</div>	Constructor	<div><div>H2 Support Type Bedding Depth: Haunch Zone Depth = 0.3 x Pipe Ø Max layer thickness 150mm</div><div>Haunch material (GAP7 or GAP20) shall be selected as per the design drawings and the required compactness is as below:</div><div>- GAP 7 & GAP 20: CIV (average over 30m length/ average per manhole) > 12 & CIV no less than 10.</div><div>Note: If it is not possible to undertake the required Clegg tests, then a visual inspection – Hold Point shall be done by CPS Lead who may engage the geotechnical engineer when required.</div></div>	Auckland Council SWCoP Drawing SW03 NZS3725 Table 5	Piritahi Construction Checklist for Stormwater; Clegg Test Record																					
2.1.5	Pipe laying	H	H		After pipe laying	NA	<div>1. Pipe laying should be true to the line, levels and grades as per design drawings. 2. Pipe position tolerance: +/-50mm; pipe level tolerance: +/-30mm 3. Horizontal/Position tolerance for HDD, pipe jacking, boring or tunnelling: +/-100mm</div> <div>Note: AC SW CoP for Grade: As-built gradients shall be no less than 0.1% and no greater than 25%.</div>	Specified	Piritahi Construction Checklist for Stormwater																					

INSPECTION AND TEST PLAN - STORMWATER



2.1.6	Trench Backfill	I/R	R		<div>Within Road Corridor - Clegg to be tested (No need NDM):</div> <div>- For trenches in Berms every 15m min two per layer</div> <div>- For trenches in Carriageways and footpaths every 5m min two tests per layer</div> <div>Within Superlot Boundary - Clegg to be tested:</div> <div>- For trenches ≥30m of more - every 15m per layer</div> <div>- For trenches <30m - min 2 tests per layer</div>	Constructor	<div>Within Road Reserves Including Berms (Up to Subbase Level)</div> <div>Hardfill Backfill placed in layers not exceeding 200mm thickness & Compacted to:</div> <div>Carriageway CIV > 25 which is equivalent to 90% MDD - Under the Sub-Base</div> <div>Footpath CIV > 15 - Under the Sub-Base</div> <div>Bearm CIV > 10</div> <div>Within Superlot Boundaries</div> <div>1. Granular fill shall be free of organics (max particle size 150mm) and placed in layers not exceeding 200mm.</div> <div>2. Overlay material (GAP65, GAP40 or GAP20) shall be selected as per the design drawings and the required compactness is as below:</div> <div>(1) GAP 65: CIV (average over 30m length/average per manhole) > 30 & no single value < 28. OR:</div> <div>(2) GAP 40: CIV (average over 30m length/ average per manhole) > 23 & no single value < 21.</div> <div>(3) GAP 20: CIV (average over 30m length/ average per manhole) > 12 & CIV no less than 10.</div>	National Code of Practice Section 5.5.3, 5.5.4 and 5.5.5	Piritahi Construction Checklist for Stormwater; Clegg Test Record																					
2.2	Manhole																													
2.2.1	Manhole Excavation	I			After excavation	NA	As per drawing and setting out (location, width level and depth)	NA	Piritahi Construction Checklist for Stormwater																					
2.2.2	Manhole Foundation & Undercutting	H	H		<div>Shear Vane for manhole foundation to be tested:</div> <div>- Minimum 2 tests per manhole location</div> <div>Clegg for backfilling of undercut to be tested:</div> <div>- Minimum 2 tests per manhole location</div>	Constructor	<div>1. Remove any unsuitable foundation material in accordance with the below table:</div> <table><tr><th>Shear vane strength (in clay/silt)</th><th>Scala Penetrometer (in sand/gravel)</th><th>Undercut and backfill</th></tr><tr><td>≥80 kPa</td><td>≤50mm per blow</td><td>No undercut required</td></tr><tr><td>60-80 kPa</td><td>60mm per blow</td><td>200mm compacted hardfill</td></tr><tr><td>40-60 kPa</td><td>80mm per blow</td><td>350mm compacted hardfill</td></tr><tr><td>20-40 kPa</td><td>100mm per blow</td><td>500mm compacted hardfill</td></tr><tr><td><20 kPa or highly organic</td><td>200mm per blow</td><td>Contact the design engineer</td></tr></table> <div>2. 2. Undercutting to have a transition slope of 1:5 between the undercut section and the normal manhole or connecting pipeline foundation.</div> <div>3. Backfill material (GAP65 or GAP40) shall be selected as per the design drawings and the required compactness is as below:</div> <div>(1) GAP 65: CIV (average over 30m length/average per manhole) > 30 & no single value < 28. OR:</div> <div>(2) GAP 40: CIV (average over 30m length/ average per manhole) > 23 & no single value < 21.</div> <div>Note:</div> <div>If it is not possible to undertake the required Clegg tests, then a visual inspection – Hold Point shall be done by CPS Lead who may engage the geotechnical engineer when required.</div>	Shear vane strength (in clay/silt)	Scala Penetrometer (in sand/gravel)	Undercut and backfill	≥80 kPa	≤50mm per blow	No undercut required	60-80 kPa	60mm per blow	200mm compacted hardfill	40-60 kPa	80mm per blow	350mm compacted hardfill	20-40 kPa	100mm per blow	500mm compacted hardfill	<20 kPa or highly organic	200mm per blow	Contact the design engineer	Specified	Piritahi Construction Checklist for Stormwater; Shear Vane/Clegg Test Record			
Shear vane strength (in clay/silt)	Scala Penetrometer (in sand/gravel)	Undercut and backfill																												
≥80 kPa	≤50mm per blow	No undercut required																												
60-80 kPa	60mm per blow	200mm compacted hardfill																												
40-60 kPa	80mm per blow	350mm compacted hardfill																												
20-40 kPa	100mm per blow	500mm compacted hardfill																												
<20 kPa or highly organic	200mm per blow	Contact the design engineer																												
2.2.3	Manhole Bedding	I/H	R		<div>Clegg for bedding to be tested:</div> <div>- Minimum 2 tests per manhole location</div>	Constructor	<div>Bedding Depth and material as per detail drawing (min 75mm)</div> <div>Compaction values: CIV > 12 & CIV no less than 10.</div>	Specified	Construction Checklist for Stormwater; Clegg Test Record																					
2.2.4	Manhole Installation & As-builts	I/R	I		After installation and before backfilling	Constructor	<div>1. Manhole installation shall be as per the drawings with the top levelling with the surrounding surfacing and benching inside the manhole (which typically is after backfilling of manhole).</div> <div>2. Manhole position tolerance: +/-50mm</div> <div>3. Manhole lid level tolerance: +/-30mm</div>	Specified	Piritahi Construction Checklist for Stormwater																					

INSPECTION AND TEST PLAN - STORMWATER



2.2.5	Manhole Backfilling	I/R	R		<div>Within Road Reserves Including Berms - Compaction for backfilling to be tested using Clegg (No need NDM): - Minimum 2 tests per manhole location</div> <div>Within Superlot Boundaries - Compaction for backfilling to be tested using Clegg (aggregates) or Share Vane (cohesive fill) - No need NDM: - Minimum 2 tests per manhole location</div>	Constructor	<div>Within Road Reserves Including Berms (Up to Subbase Level) Hardfill Backfill placed in layers not exceeding 200mm thickness & compacted to CIV>25 which is equivalent to 90% MDD.</div> <div>Within Superlot Boundaries 1. Cohesive or granular fill shall be free of organics (max particle size 150mm) placed in layers not exceeding 300mm. 2. Lower backfill zone material (Cohesive, GAP65, GAP40, GAP20 or ROP/SPR) shall be selected as per the design drawings and the required compactness is as below: (1) Cohesive fill: Shear Vane (Average over 4 readings) >130 and no single reading < 120. OR: (2) GAP 65: CIV (average over 30m length/average per manhole) > 30 & no single value < 28. OR: (3) GAP 40: CIV (average over 30m length/ average per manhole) > 23 & no single value < 21. (4) GAP 20: CIV (average over 30m length/ average per manhole) > 12 & CIV no less than 10. (5) ROP/SPR: (To be provided by Designer)</div>	Specified	Piritahi Construction Checklist for Stormwater; Shear Vane/Clegg Test Record			
2.3	CCTV Inspection	I/R	H		After backfilling and/or before road surfacing as per Piritahi CCTV Process	NA	Meet Auckland Council relevant standards	SWCoP	CCTV Tapes and Logs			
2.4	As-built Survey	R	R		As required	NA	Meet Auckland Council relevant standards	SWCoP	As-built Site Checker & Certificated As-built Drawings			
3	Post Construction											
3.1	Final Inspection (Piritahi Internal)	H	H	H	At the completion of each EPA	NA	No unacceptable defects	SWCoP	Photos			

Appendix F – Foundation maintenance and footing performance: a homeowner's guide

Foundation Maintenance and Footing Performance: A Homeowner’s Guide



Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870-2011, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil’s lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume, particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.

In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building’s foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun’s heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpend).)

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

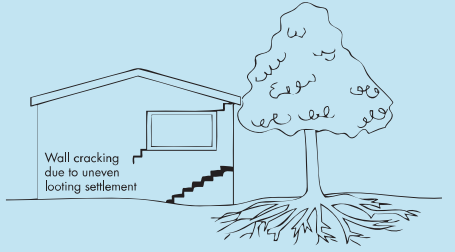
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun’s effect is strongest. This has the effect of lowering the

Trees can cause shrinkage and damage



external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

GENERAL DEFINITIONS OF SITE CLASSES	
Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes

Notes

1. Where controlled fill has been used, the site may be classified A to E according to the type of fill used.
2. Filled sites. Class P is used for sites which include soft fills, such as clay or silt or loose sands; landslide; mine subsidence; collapsing soils; soil subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.
3. Where deep-seated moisture changes exist on sites at depths of 3 m or greater, further classification is needed for Classes M to E (M-D, H1-D, H2-D and E-D).

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation causes a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem. Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.

- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870-2011.

AS 2870-2011 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

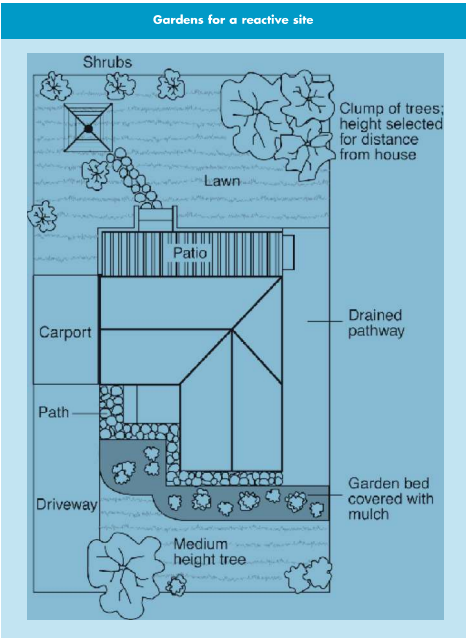
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter

It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving should



extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS		
Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly.	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired.	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 mm but also depends on number of cracks	4

The information in this and other issues in the series was derived from various sources and was believed to be correct when published.

The information is advisory. It is provided in good faith and not claimed to be an exhaustive treatment of the relevant subject.

Further professional advice needs to be obtained before taking any action based on the information provided.

Distributed by

CSIRO PUBLISHING Locked Bag 10, Clayton South VIC 3169
Tel (03) 9545 8400 1300 788 000 www.publish.csiro.au
Email: publishing.sales@csiro.au

© CSIRO 2003. Unauthorised copying of this Building Technology File is prohibited