Prestons Park Subdivision

Stages T6, T7 & U2
Geotechnical Completion Report

CDL Land Development NZ Ltd

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Contents

Executive Summary

CDL Land New Zealand Limited is developing Stages T6, T7 & U2 of the Prestons Park Subdivision, located on Prestons Road, Christchurch. As part of the work, a geotechnical completion report is required to confirm that the site works have been carried out to the required standard and provide recommendations for building developments. This report describes earthworks and ground improvement involved with Stages T6, T7 & U2 of the Prestons Park Subdivision.

The client's brief indicated that the land shall be developed to TC1 equivalent performance using appropriate ground improvement techniques. Aurecon's role was to monitor the ground improvement quality assurance testing, which included cone penetration testing (CPT) and fill compaction testing. Assessment of the results indicates that TC1 categorisation has been achieved on all lots in Stages T6, T7 & U2.

In addition to ground improvement, extensive earthworks including cutting and filling have occurred on the site. The quality assurance testing of the engineered earthfill indicates that the earthfill placed within the Stages T6, T7 & U2 area has achieved the required compaction levels as per NZS4431:1989.

Following completion of the earthworks and topsoil placement throughout the subdivision, a series of CPT tests were carried out to confirm the ground conditions. The purpose of the CPTs was to allow an assessment of the future land performance during large earthquakes and to determine the equivalent technical category of the land. Assessments of these results indicate the liquefaction deformation limits fit within those of TC1 and therefore Aurecon considers the site is likely to perform to the level of TC1.

From the monitoring and testing undertaken as part of the development of Stages T6, T7 & U2 the following is concluded:

Certificate of Compliance

The standard of bulk earthworks generally meets the earthworks specification and the applicable codes, including NZS4431:1989.

Land Performance

In line with the subdivision consent investigation results and following the ground improvement carried out as part of the site development, the residential lots within Stages T6, T7 & U2 are likely to perform to a level equivalent to TC1 as per MBIE (2012).

Building Considerations

As the residential lots are likely to perform to a level of TC1 and are underlain by earthfill that has achieved compaction per NZS4431:1989, Aurecon recommends that NZS 3604:2011 type foundations are used for residential buildings in Stages T6, T7 & U2. We note that at the time of writing this report, the location and structural form of the future dwelling on the lots are unknown and our recommendations relate to NZS3604:2011 type lightweight timber or steel framed residential buildings only.

This report shall not be used for building consent application for buildings on individual lots. Site specific geotechnical investigations, in-line with NZS3604:2011 shall be undertaken at building consent application stage.

Explanatory Statement

This report shall be read as a whole. Our explanatory statement is presented in Section 8.

1. Introduction

1.1 Geotechnical Completion

CDL Land New Zealand Limited are developing Stages T6, T7 & U2 of the Prestons Park Subdivision, located on Prestons Road, Christchurch. The site works in Stages T6, T7 & U2 have included ground improvement and bulk earthworks. As part of this work, a geotechnical completion report is required to certify the site works have been carried out to the required standard and provide recommendations for building developments.

This report has been prepared for CDL Land New Zealand Limited and issued to Christchurch City Council (CCC). It describes earthworks and ground improvement involved with Stages T6, T7 & U2 of the Prestons Park Subdivision (see Figure 1 in Appendix A).

The purpose of this geotechnical completion report is to present the following:

- Summarise information from previous investigations carried out as part of the subdivision consent and detailed design;
- Summarise the ground conditions and liquefaction risk;
- Extent of ground improvement and quality assurance testing of the ground improvement;
- Extent of earthworks on the lots and compliance testing of bulk earthworks;
- Summary of the findings, land technical category and recommendations for building development.

This report has been prepared based on geotechnical data from observations and compaction testing during and after earthworks construction and ground improvements. All references to cut-fill depths are based on the original (pre-2011) ground levels.

This report shall be read as a whole. Our explanatory statement is presented in Section 8.

1.2 Site Description

The Prestons Road subdivision is located on the northern fringes of Christchurch City. The site is made up of a series of adjacent properties forming an irregular and elongated rectangle shape, orientated approximately north to south. The total area of the overall Prestons Subdivision site is approximately 190ha. The site can be separated into two distinct blocks. Prestons North runs from the Lower Styx Road in the north through to Prestons Road in the south. Prestons Park continues from Prestons Road, through to Mairehau Road to the south.

The focus of the geotechnical completion report is on Stages T6, T7 & U2 of the Prestons Park Subdivision. Stages T6, T7 & U2 incorporates a moderate sized block in the southwestern area of the Prestons Park subdivision (see Figure 1 in Appendix A).

2. Pre-Development Geotechnical Work

2.1 Geotechnical Testing

The subdivision consent and detailed geotechnical design for the subdivision included an extensive series of geotechnical investigations. These comprised cone penetration tests (CPT), test pits, groundwater measurements and laboratory testing.

The details of these investigations are presented in the following Aurecon reports:

- "Prestons Road Subdivision, Geotechnical Assessment Report for Resource Consent", Revision 2 dated 5 March 2012.
- "Prestons Road Subdivision, Detailed Geotechnical Design Report", Revision 2 dated 12 July 2012.
- "Prestons South Subdivision, Resource Consent Geotechnical Report", Revision 1 dated 6 June 2013.

The investigation tests carried out within Stages T6, T7 & U2 of the Prestons Park area are presented in Figure 2 in Appendix A.

2.2 Ground Conditions

From the extensive geotechnical investigations, the ground conditions within the Prestons Park Subdivision were defined into various geological areas. The geological area within Stages T6, T7 & U2 is presented in Figure 2 in Appendix A. The typical ground conditions in the area are presented in Table 1. The geological area numbering is the same as those used in the geotechnical reports above.

Table 1: Typical ground conditions within Geological Area S1

Depth to Top of Unit (m)	Depth to Base of Unit (m)	Soil Unit
0	0.2 to 0.75	TOPSOIL.
0.2 to 0.75	3	SAND, loose to medium dense, with silty PEAT layers up to 0.3m thick within the upper 3m.
3	15+	SAND, medium dense to dense, becoming very dense with depth. Trace PEAT and SILT layers at depths of 10m+.

Groundwater levels ranged from 0.5m to 2.5m below ground level. During the site earthworks the above soil profile and groundwater levels were typically encountered within the area of interest.

2.3 Liquefaction Potential

As part of the geotechnical assessment and detailed design a liquefaction assessment was carried out. The details of the liquefaction assessments are presented in the above reports. The land categorisation was based on the criteria of Ministry of Business, Innovation and Development (MBIE), Technical Category deformation performance limits are set out in Table 2.

Table 2: Technical category definitions and foundation implications (MBIE, 2012)

Technical Category	Liquefaction Deformation Limits				Likely Implications for House Foundations (Subject to individual assessment)
	Vertical		Lateral Spread		
	SLS	ULS	SLS	ULS	
TC1	15mm	25mm	nil	nil	Standard 3604-like foundation with tied slabs
TC2	50mm	100mm	50mm	100mm	MBIE Enhanced Foundation Solutions
TC3	>50mm	>100mm	>50mm	>100mm	Site Specific Measures – Piles or Ground Improvement

The results from the liquefaction assessment indicated that the Prestons Park Subdivision can be classified as Technical Category 1 (TC1) and Technical Category 2 (TC2).

3. Ground Improvement

3.1 Introduction

Cone penetrometer testing (CPT) at the site was completed over a number of stages, for the purpose of both subdivision consenting and detailed design of the required earthworks. An assessment of the ground improvement requirements from the CPT results was completed prior to the commencement earthworks in Stage 2. This assessment was summarised in the report *235361 Prestons Park Subdivision Stage 2 Earthworks Design Report Rev 1*, dated 12 March 2018.

The soil layers susceptible to seismically triggered liquefaction were typically located within the upper 2m to 3m of the soil column and therefore it was considered that ground improvement carried out by an excavate and replace methodology could effectively reduce the liquefaction susceptibility of the site.

The clients brief for the Prestons Park subdivision was to develop the land to Technical Category 1 performance where possible. In order to do this, liquefaction was mitigated using ground improvement measures specified in Section 3.2. Ground improvement was carried out in T6, T7 and U2 as detailed below and shown in Figure 3 in Appendix A.

3.2 Methodology

Our detailed geotechnical assessment summarised in Section 2 identified that ground improvement would be required to ensure that TC1 performance level would be achieved. Ground improvement typically involved the compaction of fill material after undercutting the original ground level to remove shallow in-situ organic material. The ground improvement methodology carried out for ground improvement for Stages T6, T7 & U2 comprised of the following:

- Undercut the original ground level to remove shallow organic material.
- Place suitable fill materials in layers up to 700mm thick.
- Compact the placed fill material using a Broons 4-Sided impact compactor, carrying out 40 passes over the required area, in a staged approach.
- Use a water cart to wet the compaction area, as required, to improve workability.
- Where the Broons impact compactor could not be used due to site constraints or unsuitable fill material, ‘traditional’ earthworks vibratory rolling was used on thinner lifts of up to 300mm thickness.

Field trials completed in Stage U1 and implemented in Substages R1 and Q1 to Q3 identified that a Broons four-sided impact compactor sufficiently densified a 700mm layer of loosely placed sand, such that this sand was no longer prone to seismically induced liquefaction in an ultimate limit state event.

Where traditional earthworks lifts were placed, a variety of engineered fill materials were used. Lots completed in Stage T7 and the southern extent of T6 were filled using pit run granular hardfill material, while the remainder were filled using site-won sand material.

The following ground improvement extent has been completed in Stages T7, T6 & U2, as shown in Figure 3 in Appendix A:

- Excavation followed by impact compaction in Lots 457 to 464 of Stage U2, and Lots 404 to 406 of Stage T6.
- Excavation followed by traditional compaction with pit-run gravel in Lots 398 to 403 of Stage T6 and Lots 473 to 479 of Stage T7.

- Excavation followed by traditional compaction with pit-run gravel? in Lots 465 to 472 of Stage T6.

3.3 Quality Assurance

On completion of the above methodology and general site earthworks, post compaction CPTs were carried out across the stages at chosen locations. The CPT logs are presented in Appendix B. A review of the results of these post-improvement CPT tests are provided in Section 5.

4. Subdivision Earthworks

4.1 General

Bulk earthworks for Stages T6, T7 & U2 of Prestons were carried out in accordance with the requirements of NZS 4404:2010, "*Code of Practice for Urban Subdivision*" and NZS4431:1989 "*Code of Practice for Earthfill for Residential Development*". The earthworks comprised excavation to remove in-situ organic material and then filling to the design level using the previously mentioned filling and ground improvement techniques. Regrading of the site contours from the original site levels has occurred, however this was predominantly completed during the backfilling to replace the material excavated for the removal of organics.

On those occasions where quality control testing did not meet the specification, the Contractor was required to rework the fill to achieve the required compaction.

4.2 Areas of Cut and Fill

Site earthworks within Stages T6, T7 & U2 has included significant filling and some minor cutting, in comparison to the original site levels. The fill material comprises site-won sand or pit run gravel overlying a natural sand subgrade. A layer of topsoil overlies the fill material. The extent of cutting and filling is shown in Figure 4 in Appendix A.

4.3 Compaction Quality Control Testing

Independent testing of earthfill compaction completed using traditional earthworks techniques was carried out using a Nuclear Densometer (NDM). The acceptance criterion was based on the Prestons Subdivision earthworks specification as follows:

- Compaction of fill is to be in accordance with NZS 4431: 1989.
- Compaction standard is 95% Maximum Dry Density (MDD) for all areas of bulk filling, per NZS4402 Test 4.1.3.

Fill materials comprised of site-won sand and imported pit run gravel. Compaction curves for each of the fill material are presented in Appendix C.

The MDD from the compaction curves were used to determine the level of compaction required for the fill material. A summary of these NDM results are presented in Appendix D and the NDM testing locations are presented in Figure 5 in Appendix A. The NDM compaction tests were undertaken at a test frequency of approximately 1 test per 1,000m^3.

NDM testing results completed on site-won sand targeted an MDD of 1,660kg/m^3. The MDD values obtained from laboratory testing, provided by KB Contracting & Quarries indicate the MDD of the sand varies between 1,600kg/m^3 and 1,700kg/m^3. Based on Aurecon's experience with use of site-won sand as fill material on this site, the target MDD of 1,660kg/m^3 is considered to be applicable for compaction testing of fill.

4.4 Compaction Results

The results presented in Appendix D indicate that 95% MDD or greater compaction has been consistently achieved in the areas of bulk fill. Where NDM results indicated the required compaction had not been achieved, the contractor completed additional compaction effort and conforming NDM results were achieved. From these results and our site observations we confirm that all the earthfill placed within Stages T6, T7 & U2 has achieved the required compaction.

5. Post Earthworks CPT

5.1 Introduction

Following completion of the earthworks and topsoil placement throughout Stages T6, T7 & U2, a series of CPT tests have been carried out to confirm the ground conditions. The frequency of the CPT testing carried out was approximately three tests per hectare for the post earthworks assessment. The post earthworks CPTs are presented in Appendix B and the locations are shown in Figure 6 in Appendix A.

The purpose of the CPTs were to allow an updated assessment of the land technical category, further to that already undertaken as part of the subdivision consent and detailed geotechnical design, after the completion of ground improvement and site earthworks.

5.2 Liquefaction Assessment

To allow an assessment of the land technical category, a liquefaction assessment has been carried out on the post earthworks CPTs. The liquefaction assessment methodology has been discussed below.

Introduction

As technical categories are derived by liquefaction induced deformation limits, a liquefaction assessment on the post compaction CPTs have been carried out to determine the extent of liquefaction and the induced settlements.

Earthquake Cases

Earthquake induced ground acceleration and sustained shaking, leading to sufficient load cycles, is a requirement and a potential trigger of liquefaction. For the assessment we have reviewed three levels of seismic shaking.

1. Serviceability Limit State (SLS) design level earthquake, as defined by MBIE.
2. Intermediate design level earthquake, as defined by the subdivision consent conditions.
3. Ultimate Limit State (ULS) design level earthquake, as defined by MBIE.

Each of these earthquake cases is discussed in detail below:

Serviceability Limit State (SLS) Earthquake

From the MBIE Guidelines, a Peak Ground Acceleration (PGA) of 0.13g has been derived for a SLS event with a Magnitude 7.5 earthquake.

Intermediate Level (Int) Earthquake

Subdivision consent conditions indicate that liquefaction mitigation measures for the subdivision infrastructure shall be designed for a 1 in 150-year period of return under the serviceability limit state (SLS) and as defined by NZS1170.5:2004.

Based on NZS1170.5:2004 for an Importance Level 2 (IL2) structure, with an increased Z hazard factor of 0.3, a PGA of 0.2g has been derived for a 1 in 150-year period of return. A Magnitude 7.5 has been used.

This PGA is equivalent to the assumed SLS design level earthquake used for the liquefaction analysis as part of our assessment for the subdivision consent and detailed geotechnical design.

Ultimate Limit State (ULS) Earthquake

The MBIE Guidelines (2012) recommend a PGA of 0.35g for residential buildings in Christchurch. This PGA value with a magnitude 7.5 earthquake has been adopted for the ULS assessment.

The liquefaction analysis as part of the assessment for the subdivision consent and detailed geotechnical design used a PGA of 0.34g for ULS, which was based on NZS1170.5:2002. This is slightly less than recommended guidelines and as the difference is 0.01g, Aurecon considers that this will not alter our original assessment or recommendations. However, to be in line with current MBIE Guidelines a PGA of 0.35g has been used.

Liquefaction Methodology

In assessing the liquefaction potential, the method of Boulanger and Idriss (2014) has been utilised to assess the potential settlement for each of the design level events, as per the MBIE Guidelines (2012) for residential properties. The assessment was carried out using an excel spreadsheet developed by Aurecon. The method of Robertson and Wride (1998) with the modified fines content was used to assess the liquefaction potential from the CPT results. The method of Zhang et al (2002) was used for estimating the liquefaction induced settlements from CPT results.

The CPT analysis has been performed to a depth of 10m, as this is the required depth in the MBIE Guidelines for technical category assessment.

In addition to determining the liquefaction induced reconsolidation settlement, we have assessed the potential for liquefaction induced ground damage based on the Liquefaction Severity Number (LSN), as defined by Tonkin and Taylor (2013). Other ground damage potential methods (such as Ishihara, 1985) were assessed but LSN was considered the more appropriate method. Tonkin & Taylor (T&T) developed the Liquefaction Severity Number (LSN) based on investigation data and observations made following major earthquake events in Christchurch. The LSN number is an index number which qualitatively assesses the effects of liquefaction on a site and on a shallow founded building. The LSN number is calculated by the equation below.

$$LSN = 1000 \int \frac{\varepsilon_v}{z} . dz$$

Where: $\varepsilon_v = \text{volumetric reconsolidation strain}$

$z = \text{depth of liquefaction below ground level}$

The LSN number is likely to be a better index of surface damage than reconsolidation settlement because the LSN number is affected more by shallow liquefaction and less by liquefaction at depth, which is less likely to affect the ground surface or shallow founded buildings. Reconsolidation settlement places the same weighting on deep liquefaction as shallow liquefaction, even though settlement will have less impact at the ground surface with increasing depth. LSN numbers have been correlated to observed liquefaction effects during recent earthquakes in Christchurch as shown in Table 3 below.

Table 3: LSN Ranges and Observed Effects (Tonkin and Taylor, 2013)

LSN Range	Predominant Performance
0-10	Little to no expression of liquefaction, minor effects
10-20	Minor expression of liquefaction, some sand boils
20-30	Moderate expression of liquefaction, with sand boils and some structural damage
30-40	Moderate to severe expression of liquefaction, settlement can cause structural damage
40-50	Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures
>50	Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlements affecting structures, damage to services

When compared to the broad descriptions of expected land performance in TC1, TC2 and TC3, as outlined in Section 2.3, the LSN number can be approximately correlated to technical categories as follows:

- TC1 = $LSN_{(ULS)} < 10$
- TC2 = $LSN_{(SLS)} < 20$ and $LSN_{(ULS)} < 30$
- TC3 = $LSN_{(SLS)} > 20$ or $LSN_{(ULS)} > 30$

A groundwater depth of 2.0m below finished earthworks level has been used for the purposes of this liquefaction assessment. Testing information throughout Stages T6, T7 & U2 indicates the groundwater level is typically greater than 2.0m depth (more likely to be at depths of 2.5m or greater) therefore a conservative groundwater level has been used for the assessment.

Liquefaction Assessment Results

The results for the liquefaction induced reconsolidation settlement are presented in Table 4. The results for the liquefaction induced ground damage potential (based on LSN numbers) are presented in Table 5.

Table 4: Liquefaction induced settlements for post earthworks CPTs to 10m depth

Earthquake Magnitude 7.5, Water Depth 2m, 10m Analysis			
CPT	**SLS Design Event (0.13g)**	**Intermediate Design Event (0.20g)**	**ULS Design Event (0.35g)**
	Settlement (mm)	Settlement (mm)	Settlement (mm)
CPTPF80	0	0	<5
CPTPF81	0	<5	10
CPTPF82	0	5	10
CPTPF83(1)	0	0	5

Notes:

1) CPTPF80, CPTPF81 and CPTPF83 were completed where pit run gravel had been used as a fill material. This pit run gravel was predrilled to allow the CPTs to be undertaken on the underlying soil. Pit run gravel is considered non-liquefiable from a density standpoint for the purposes of this assessment.

Table 5: LSN for post earthworks CPTs to 10m depth

Earthquake Magnitude 7.5, Water Depth 2m, 10m Analysis			
CPTs	**SLS Design Event (0.13g)**	**Intermediate Design Event (0.20g)**	**ULS Design Event (0.35g)**
	LSN	*LSN*	*LSN*
CPTPF80	0	0	0
CPTPF81	0	0	2
CPTPF82	0	1	3
CPTPF83	0	0	1

Based on the post earthworks CPT testing, the lots within Stages T6, T7 & U2 are likely to perform to the level equivalent to TC1.

6. Building Development

6.1 Technical Category

Geotechnical testing has been carried out as part of the subdivision development. The testing indicates the lots within Stages T6, T7 & U2 are likely to perform to the level equivalent to TC1.

6.2 Earthworks on Building Lots

The extent of earthfill on the lots in Stages T6, T7 & U2 is shown on Figure 4 in Appendix A.

The fill areas have been constructed using materials and processes that have been randomly measured by independent testing. The testing shows that the placement of filling is generally in accordance with the specification and relevant standards.

6.3 Soil Suitability Criteria

Section 3 of New Zealand Standard NZS 3604:2011 "*Timber Framed Buildings not requiring specific Engineering Design*" provides several criteria for defining foundation soil suitability for lightweight timber or steel framed residential buildings.

Clauses 3.1.3 and 3.3 of NZS 3604:2011 provide criteria for determining strength and suitability of founding soils. Clauses 3.4.1 and 3.4.2 of NZS 3604:2011 discuss depths to competent founding. For purposes of this report, we have interpreted these clauses as meaning that for sound bearing at depths of 200mm to 600mm, standard shallow type foundations can be utilised. For depths greater than this, specific foundation designs could be used or alternatively excavations can be backfilled to the required level with 10MPa site concrete or compacted hardfill. In line with the client's brief Aurecon will be undertaking site specific investigations on each residential lot. We will prepare site specific geotechnical reports addressing the foundation requirements on individual building lots. The testing data for the lot specific investigations will be uploaded to the New Zealand Geotechnical Database. For building consent purposes reports prepared for individual lots shall be used.

6.4 Building Considerations

As the land is likely to perform to a level of TC1 and a number of the lots are underlain by earthfill that has achieved the required compaction, NZS 3604:2011 type foundations are considered suitable. We note that at the time of writing this report, the location and structural form of the future dwelling on the lots are unknown and our recommendations relate to NZS3604:2011 type lightweight timber or steel framed residential buildings only.

The recommendations in this report shall not be used for individual building consent applications. Site specific investigations in accordance with NZS 3604:2011 are required.

6.5 Future Earthworks

We do not anticipate that future earthworks will be required on the majority of the lots however should such work be required the following should be noted.

- All earthworks should be carried out in accordance with the Health and Safety at Work Act 2015 and the Worksafe New Zealand Excavation Safety Good Practice Guidelines, 2016.
- Cuts that exceed 0.6m high around any of the house sites must be retained by a suitable retaining wall designed by a Chartered Professional Engineer.
- We recommend that no more than 450mm of fill is placed on the allotment without detailed engineering design.

- Fill should not be placed adjacent to any timber retaining wall, if present.
- Any development where excavations greater than 1.2m in depth are proposed, must be subject to specific investigation and design to confirm these works will have no adverse effect on land stability, infrastructure and/or structures on adjacent lots. Excavations near sensitive structures or near boundaries may require geotechnical engineering input even if shallower than 1.2m.

6.6 Construction Observations

The suitability of foundation conditions must be verified at the time of construction. Foundation inspections by a Building Inspector or a Chartered Professional Engineer who are familiar with this report must be carried out to ensure the adequacy of the foundation subgrade prior to the placement of granular hardfill or the construction of foundations.

7. References

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Robertson and Wride, 1998. *Evaluating cyclic liquefaction potential using the cone penetration test*. Canadian Geotechnical Journal, Vol. 35, pp. 442 – 459.

Tonkin and Taylor (2013) *Liquefaction Vulnerability Study*, Tonkin and Taylor Report 52020.0200/v1.0. February 2013. 52 pages and 14 appendices.

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8. Explanatory Statement

This report has been prepared for CDL Land New Zealand Limited. It may be made available to others but only in full. As noted above, it shall not be used by any person as a substitute for specific field observations and testing once house sites are confirmed.

This report has been prepared as part of the development of the Prestons Park Stages T6, T7 & U2 Subdivision. It has been prepared to provide the following information:

- To report on the management of the earthworks during construction, including compaction standards of fills.
- To report on the extent of ground improvement and the resulting land technical category.

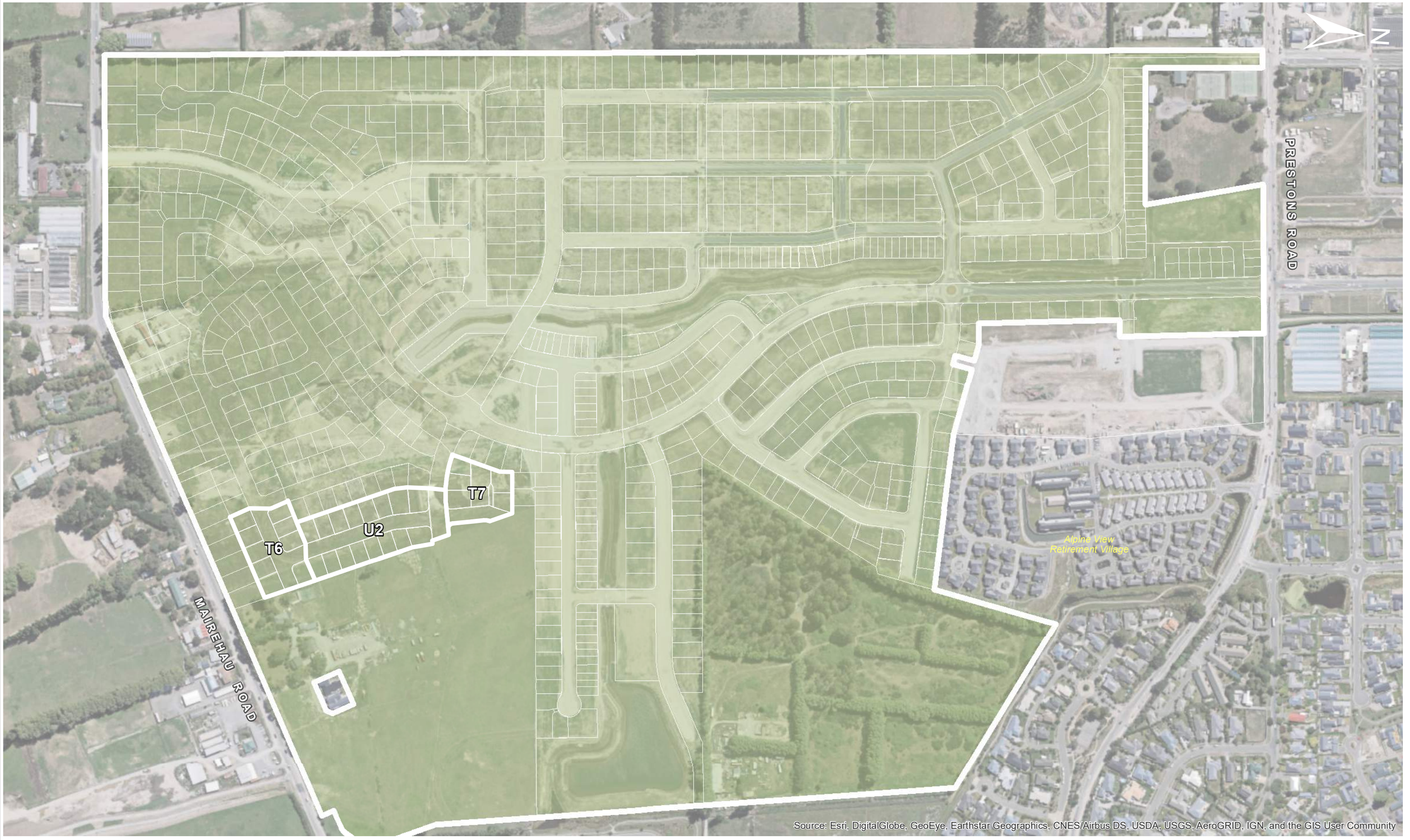
This report does not remove the responsibility of the Owner / Builder / Building Certifier to satisfy themselves of foundation depth and suitability at the finally selected house location.

Subsurface conditions relevant to construction works should be assessed by experienced contractors and designers who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes. Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the report is used after a protracted delay or in wet weather.

It is strongly recommended that any plans and specifications prepared by others and relating to the content of this report, or amendments to the original plans and specifications, are reviewed by Aurecon to verify that the intent of our recommendations is properly reflected in the design. During construction we request the opportunity to review our interpretations if the exposed site conditions are significantly different from those inferred in this report.

This report is not to be reproduced either wholly or in part without our prior written permission.

Appendix A
Figures



Meters
0 60 120 180 240

NOTES - PROPERTY DATA FROM LINZ

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CLIENT
CDL LAND NEW ZEALAND LIMITED

REV	DATE	REVISION DETAILS	APPROVED
A	06.20	ISSUE	J. Kupec

DRAWN	DESIGNED
R.Dawson	K Foote
CHECKED	
J. Muirson	
APPROVED	DATE
J. Kupec	*JUNE 2020*

PROJECT
PRESTONS SOUTH STAGES T6, T7 & U2

TITLE
SITE LOCATION PLAN

PROJECT No.	
235361	
SCALE	SIZE
AS SHOWN	A3
DRAWING No.	REV
FIG 1	A

Path: C:\Users\Ros.Dawson\OneDrive - Aurecon Group\Backups\235361\SOUTH STAGES T567U2\FIG 1 SITE.mxd

Meters
0 20 40 60 80

LEGEND

- CPT LOCATION
- TEST PIT LOCATION
- TEST PITS WITH STANDPIPE PIEZOMETERS
- GEOLOGICAL AREAS

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REV	DATE	REVISION DETAILS	APPROVED
A	06.20	ISSUE	J. Kupec

DRAWN	DESIGNED
R.Dawson	K. Foote
CHECKED	
J. Muirson	
APPROVED	DATE
J. Kupec	JUNE 2020

PROJECT: PRESTONS SOUTH STAGES T6, T7 & U2

TITLE: PREVIOUS INVESTIGATIONS

PROJECT No.	
235361	
SCALE	SIZE
AS SHOWN	A3
DRAWING No.	REV
FIG 2	A

Path: C:\Users\Ros.Dawson\OneDrive - Aurecon Group\Backups\235361\SOUTH STAGES T567U2\FIG 2 PREVIOUS INVESTIGATIONS.mxd

NOTES:

1. IMPACT COMPACTION METHODOLOGY INVOLVED EXCAVATION TO THE BOTTOM OF INSITU ORGANIC MATERIAL BEFORE FILLING TO THE DESIGN LEVEL WITH SITE-WON SAND. SAND WAS COMPACTED IN 700mm LIFTS USING A FOUR-SIDED IMPACT COMPACTOR.
2. STANDARD COMPACTION METHODOLOGY INVOLVED EXCAVATION TO THE BOTTOM OF INSITU ORGANIC MATERIAL BEFORE FILLING TO THE DESIGN LEVEL WITH SITE WON SAND OR IMPORTED GRAVEL. FILL WAS THEN COMPACTED IN 300mm LIFTS USING A VIBRATORY ROLLER.
3. SEE SECTION THREE OF PRESTONS PARK SUBDIVISION, STAGE T1 & Z1 GEOTECHNICAL COMPLETION REPORT FOR FURTHER DETAILS.

LEGEND

- IMPACT COMPACTION
- STANDARD COMPACTION

Meters
0 25 50 75 100

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J. Muirson	
APPROVED	DATE
J. Kupec	JUNE 2020

PROJECT: PRESTONS SOUTH STAGES T6, T7 & U2

TITLE: GROUND IMPROVEMENT

PROJECT No.: 235361
SCALE: AS SHOWN
SIZE: A3
DRAWING No.: FIG 3
REV: A

Path: C:\Users\Ros.Dawson\OneDrive - Aurecon Group\Backups\235361\SOUTH STAGES T567U2\FIG 3 GROUND IMPROVEMENT.mxd

-3.5
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
+0.0
+0.5
+1.0
+1.5
+2.0
+2.5

CUT FILL DEPTH BANDS

0 25 50 75 100 Meters

NOTES - PROPERTY DATA FROM LINZ
- DEPTH BANDING DATA EXISTING TO FINISHED SURFACE

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REV	DATE	REVISION DETAILS	APPROVED
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R.Dawson	K. Foote
CHECKED	
J. Muirson	
APPROVED	DATE
J. Kupec	*JUNE 2020*

PROJECT: PRESTONS SOUTH STAGES T6, T7 & U2

TITLE: CUT FILL BANDING

PROJECT No.: 235361
SCALE: AS SHOWN
SIZE: A3
DRAWING No.: FIG 4
REV: A

Path: C:\Users\Ros.Dawson\OneDrive - Aurecon Group\Backups\235361\SOUTH STAGES T567U2\FIG 4 CUT FILL BANDING.mxd

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DRAWN	DESIGNED
R.Dawson	K. Foote
CHECKED	
J.Muirson	
APPROVED	DATE
J. Kupec	JUNE 2020

PROJECT: PRESTONS SOUTH STAGES T6, T7 & U2

TITLE: NDM TESTING LOCATIONS

PROJECT No.: 235361
SCALE: AS SHOWN
SIZE: A3
DRAWING No.: FIG 5
REV: A

Path: C:\Users\Ros.Dawson\OneDrive - Aurecon Group\Backups\235361\SOUTH STAGES T567U2\FIG 5 NDM.mxd

LEGEND

POST FILLING CPT

Meters

0 25 50 75 100

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REV	DATE	REVISION DETAILS	APPROVED
A	02.20	ISSUE	J. Kupec

DRAWN	DESIGNED
R.Dawson	K. Foote

CHECKED: J.Muirson

APPROVED: J. Kupec DATE: *JUNE 2020*

PROJECT: PRESTONS SOUTH STAGES T6, T7 & U2

TITLE: POST EARTHWORKS CPT

PROJECT No.: 235361

SCALE: AS SHOWN | SIZE: A3

DRAWING No.: FIG 6 | REV: A

Path: C:\Users\Ros.Dawson\OneDrive - Aurecon Group\Backups\235361\SOUTH STAGES T567U2\FIG 6 POST EW CPTS.mxd

Appendix B
Post Earthworks CPT Logs

CONE PENETRATION TEST (CPT) REPORT

Client: Aurecon NZ Ltd

Location: Stage U2, T6 and T7
Prestons Park, Christchurch

Printed: 05/08/2020

McMILLAN Drilling
LandTest

CONE PENETRATION TEST

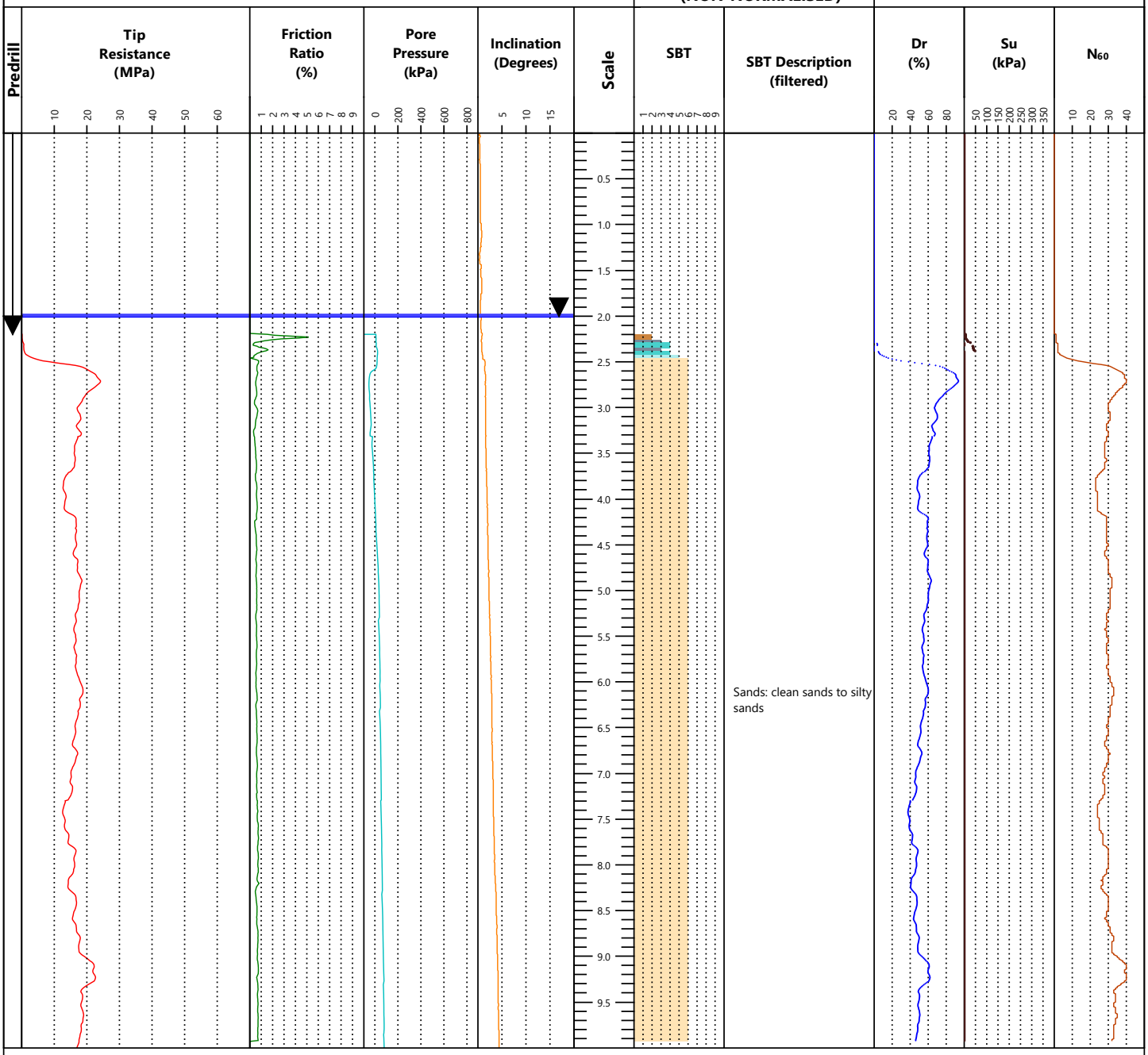
Job: 19023
CPT No.: CPTu298-PF82

Name: Stage U2, T6 and T7
Client: Aurecon NZ Ltd
Location: Prestons Park, Christchurch

Hole Depth (m): 10.00
Elevation (m): 0.00
Datum: Ground

North (m): 5185510.72
East (m): 1573588.22
Grid: NZTM

RAW DATA | **SOIL BEHAVIOUR TYPE (NON-NORMALISED)** | **ESTIMATED PARAMETERS**



EOH: 10m

Operator: S. Cardona
Rig: 14t truck mounted rig
Cone Reference: 100992
Cone Area Ratio: 0.75
Cone Type: I-CFXYP20-10
Tip Resistance (MPa) Initial: 0.9057
Local Friction (MPa) Initial: 0.0347
Pore Pressure (MPa) Initial: -0.0056

Date: 22/07/2020
Predrill: 2.20
Water Level: 2.00
Collapse:
Final: 0.9324
Final: 0.0321
Final: -0.0094

Effective Refusal
Tip:
Gauge:
Inclinometer:
Other:
Target Depth: ✓

Soil Behaviour Type (SBT) - Robertson et al. 1986

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes & Limitations
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. No warranty is provided as to the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

McMILLAN Drilling
LandTest

CONE PENETRATION TEST

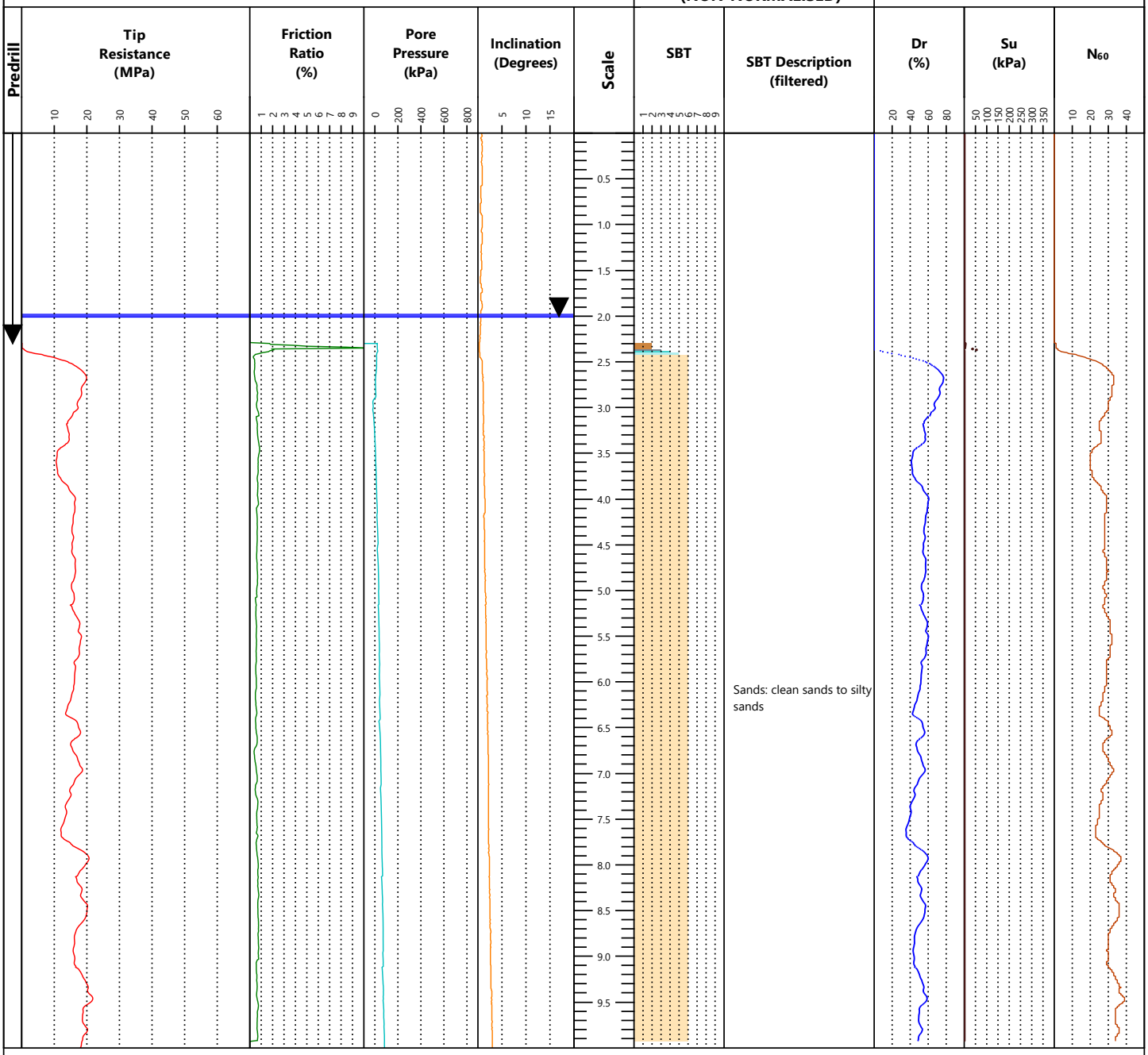
Job: 19023
CPT No.: CPTu299-PF81

Name: Stage U2, T6 and T7
Client: Aurecon NZ Ltd
Location: Prestons Park, Christchurch

Hole Depth (m): 10.00
Elevation (m): 0.00
Datum: Ground

North (m): 5185474.40
East (m): 1573646.15
Grid: NZTM

RAW DATA | **SOIL BEHAVIOUR TYPE (NON-NORMALISED)** | **ESTIMATED PARAMETERS**



EOH: 10m

Operator: S. Cardona
Rig: 14t truck mounted rig
Cone Reference: 100992
Cone Area Ratio: 0.75
Cone Type: I-CFXYP20-10
Tip Resistance (MPa) Initial: 0.9257
Local Friction (MPa) Initial: 0.032
Pore Pressure (MPa) Initial: -0.0025

Date: 23/07/2020
Predrill: 2.30
Water Level: 2.00
Collapse: 2.30
Final: 0.9512
Final: 0.0321
Final: -0.0109

Effective Refusal
Tip:
Gauge:
Inclinometer:
Other:
Target Depth: ✓

Soil Behaviour Type (SBT) - Robertson et al. 1986

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes & Limitations
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. No warranty is provided as to the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

McMILLAN Drilling LandTest

CONE PENETRATION TEST

Job: 19023

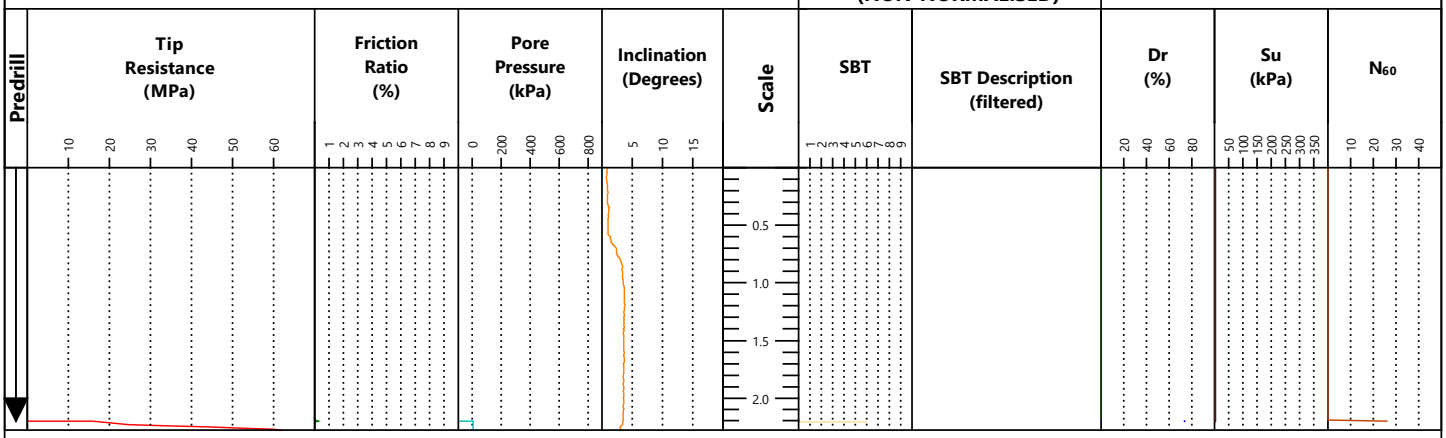
CPT No.: CPTu301-PF80

Name: Stage U2, T6 and T7
Client: Aurecon NZ Ltd
Location: Prestons Park, Christchurch

Hole Depth (m): 2.28
Elevation (m): 0.00
Datum: Ground

North (m): 5185374.39
East (m): 1573634.70
Grid: NZTM

RAW DATA | **SOIL BEHAVIOUR TYPE (NON-NORMALISED)** | **ESTIMATED PARAMETERS**



EOH: 2.28m

Operator: S. Cardona
Rig: 14t truck mounted rig
Cone Reference: 151125
Cone Area Ratio: 0.75
Cone Type: I-CFXYP20-10
Tip Resistance (MPa) Initial: -0.188
Local Friction (MPa) Initial: 0
Pore Pressure (MPa) Initial: -0.02

Date: 22/07/2020
Predrill: 2.20
Water Level: -
Collapse: 0.40
Final: -0.0736
Final: 0.0039
Final: -0.0245

Effective Refusal
Tip: ✓
Gauge:
Inclinometer:
Other:
Target Depth:

Soil Behaviour Type (SBT) - Robertson et al. 1986

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. No warranty is provided as to the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

McMILLAN Drilling
LandTest

CONE PENETRATION TEST

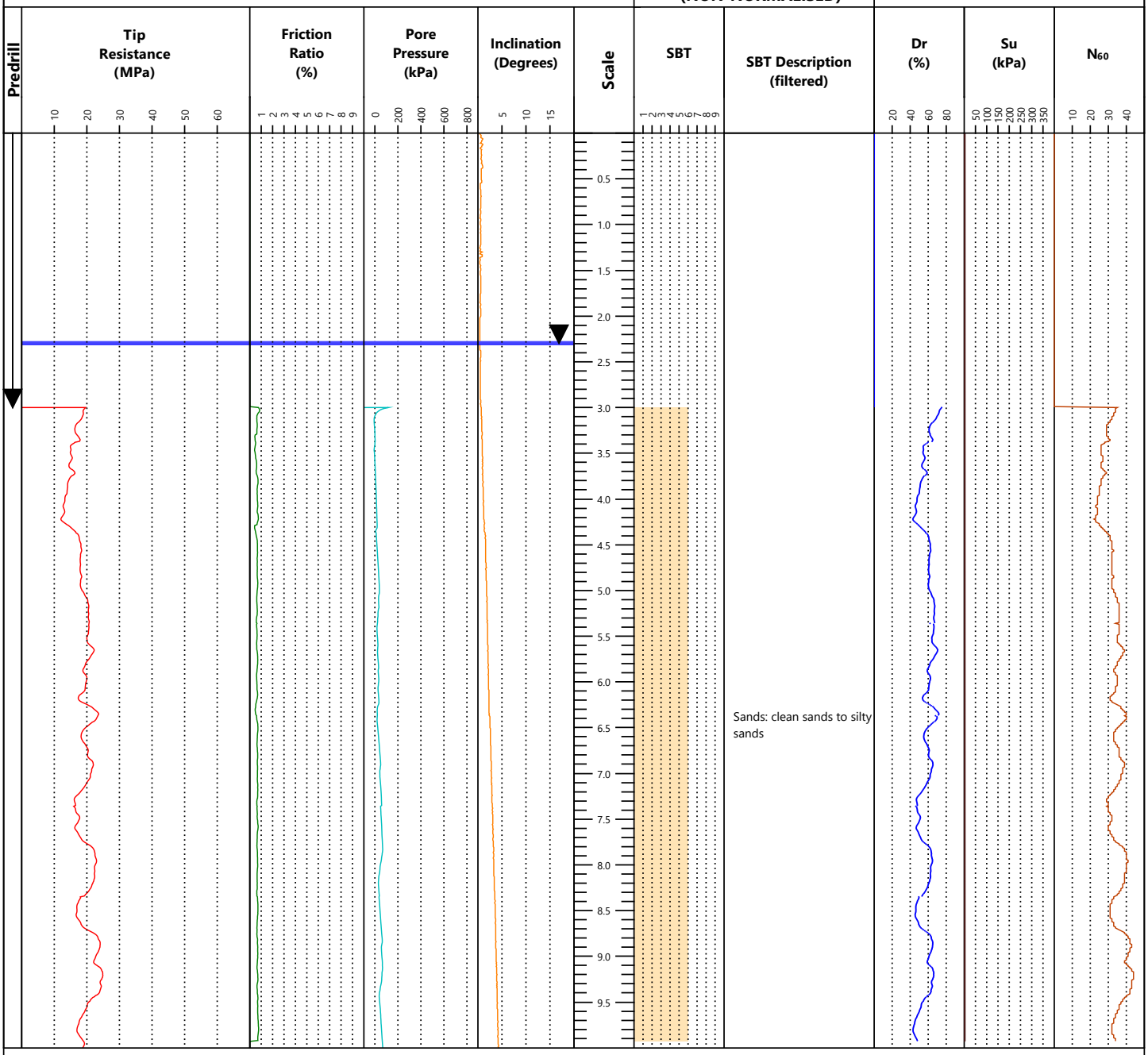
Job: 19023
CPT No.: CPTu301-PF80A

Name: Stage U2, T6 and T7
Client: Aurecon NZ Ltd
Location: Prestons Park, Christchurch

Hole Depth (m): 10.00
Elevation (m): 0.00
Datum: Ground

North (m): 5185369.03
East (m): 1573620.39
Grid: NZTM

RAW DATA | **SOIL BEHAVIOUR TYPE (NON-NORMALISED)** | **ESTIMATED PARAMETERS**



EOH: 10m

Operator: S. Cardona
Rig: 14t truck mounted rig
Cone Reference: 151125
Cone Area Ratio: 0.75
Cone Type: I-CFXYP20-10
Tip Resistance (MPa) Initial: 0.3222
Local Friction (MPa) Initial: 0.0153
Pore Pressure (MPa) Initial: -0.0164

Date: 03/08/2020
Predrill: 3.00
Water Level: 2.30
Collapse: 2.90
Final: 0.3102
Final: 0.0141
Final: -0.0229

Effective Refusal
Tip:
Gauge:
Inclinometer:
Other:
Target Depth: ✓

Soil Behaviour Type (SBT) - Robertson et al. 1986

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes & Limitations
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. No warranty is provided as to the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

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CONE PENETRATION TEST

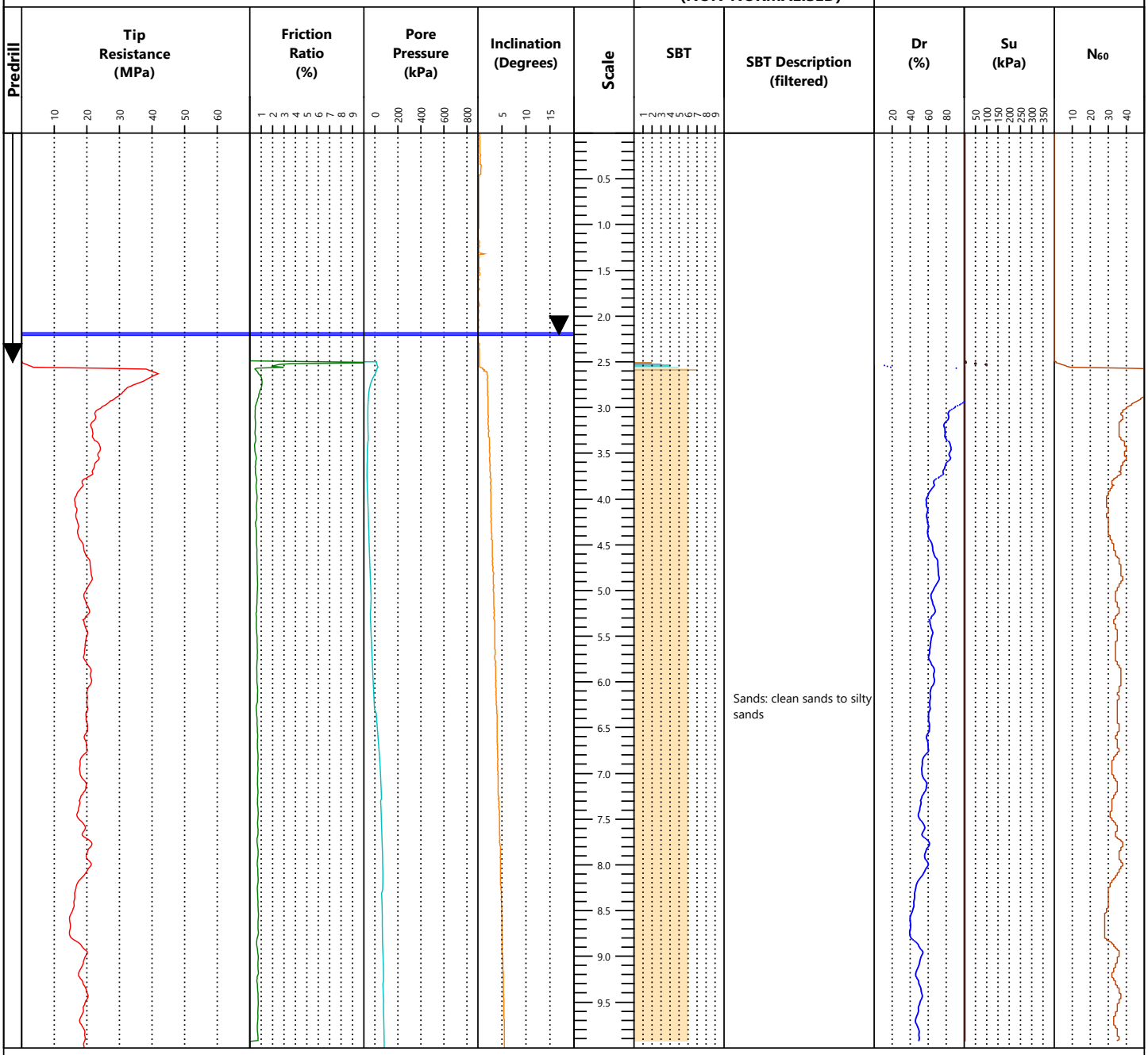
Job: 19023
CPT No.: CPTu302-PF83

Name: Stage U2, T6 and T7
Client: Aurecon NZ Ltd
Location: Prestons Park, Christchurch

Hole Depth (m): 10.00
Elevation (m): 0.00
Datum: Ground

North (m): 5185614.23
East (m): 1573552.93
Grid: NZTM

RAW DATA | **SOIL BEHAVIOUR TYPE (NON-NORMALISED)** | **ESTIMATED PARAMETERS**



Operator: S. Cardona
Rig: 14t truck mounted rig
Cone Reference: 151125
Cone Area Ratio: 0.75
Cone Type: I-CFXYP20-10
Tip Resistance (MPa) Initial: -0.0866
Local Friction (MPa) Initial: 0.002
Pore Pressure (MPa) Initial: -0.0154

Date: 23/07/2020
Predrill: 2.50
Water Level: 2.20
Collapse:
Final: -0.1121
Final: 0.0025
Final: -0.0253

Effective Refusal
Tip:
Gauge:
Inclinometer:
Other:
Target Depth: ✓

Soil Behaviour Type (SBT) - Robertson et al. 1986

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes & Limitations
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. No warranty is provided as to the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

TEST DETAIL

PointID: CPTu298-PF82
Sounding: 298

Operator: S. Cardona | **Date:** 22/07/2020 | **Effective Refusal**
Cone Reference: 100992 | **Predrill:** 2.20 | **Tip:**
Cone Area Ratio: 0.75 | **Water Level:** 2.00 | **Gauge:**
Cone Type: I-CFXYP20-10 | **Collapse:** | **Inclinometer:**
Other:

Tip Resistance (MPa) Initial: 0.9057 | **Final:** 0.9324
Local Friction (MPa) Initial: 0.0347 | **Final:** 0.0321
Pore Pressure (MPa) Initial: -0.0056 | **Final:** -0.0094 | **Target Depth:** ✓

PointID: CPTu299-PF81
Sounding: 299

Operator: S. Cardona | **Date:** 23/07/2020 | **Effective Refusal**
Cone Reference: 100992 | **Predrill:** 2.30 | **Tip:**
Cone Area Ratio: 0.75 | **Water Level:** 2.00 | **Gauge:**
Cone Type: I-CFXYP20-10 | **Collapse:** 2.30 | **Inclinometer:**
Other:

Tip Resistance (MPa) Initial: 0.9257 | **Final:** 0.9512
Local Friction (MPa) Initial: 0.032 | **Final:** 0.0321
Pore Pressure (MPa) Initial: -0.0025 | **Final:** -0.0109 | **Target Depth:** ✓

PointID: CPTu301-PF80
Sounding: 301

Operator: S. Cardona | **Date:** 22/07/2020 | **Effective Refusal**
Cone Reference: 151125 | **Predrill:** 2.20 | **Tip:** ✓
Cone Area Ratio: 0.75 | **Water Level:** - | **Gauge:**
Cone Type: I-CFXYP20-10 | **Collapse:** 0.40 | **Inclinometer:**
Other:

Tip Resistance (MPa) Initial: -0.188 | **Final:** -0.0736
Local Friction (MPa) Initial: 0 | **Final:** 0.0039
Pore Pressure (MPa) Initial: -0.02 | **Final:** -0.0245 | **Target Depth:**

PointID: CPTu301-PF80A
Sounding: 31

Operator: S. Cardona | **Date:** 03/08/2020 | **Effective Refusal**
Cone Reference: 151125 | **Predrill:** 3.00 | **Tip:**
Cone Area Ratio: 0.75 | **Water Level:** 2.30 | **Gauge:**
Cone Type: I-CFXYP20-10 | **Collapse:** 2.90 | **Inclinometer:**
Other:

Tip Resistance (MPa) Initial: 0.3222 | **Final:** 0.3102
Local Friction (MPa) Initial: 0.0153 | **Final:** 0.0141
Pore Pressure (MPa) Initial: -0.0164 | **Final:** -0.0229 | **Target Depth:** ✓

PointID: CPTu302-PF83
Sounding: 302

Operator: S. Cardona | **Date:** 23/07/2020 | **Effective Refusal**
Cone Reference: 151125 | **Predrill:** 2.50 | **Tip:**
Cone Area Ratio: 0.75 | **Water Level:** 2.20 | **Gauge:**
Cone Type: I-CFXYP20-10 | **Collapse:** | **Inclinometer:**
Other:

Tip Resistance (MPa) Initial: -0.0866 | **Final:** -0.1121
Local Friction (MPa) Initial: 0.002 | **Final:** 0.0025
Pore Pressure (MPa) Initial: -0.0154 | **Final:** -0.0253 | **Target Depth:** ✓

McMILLAN Drilling
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CPT CALIBRATION AND TECHNICAL NOTES

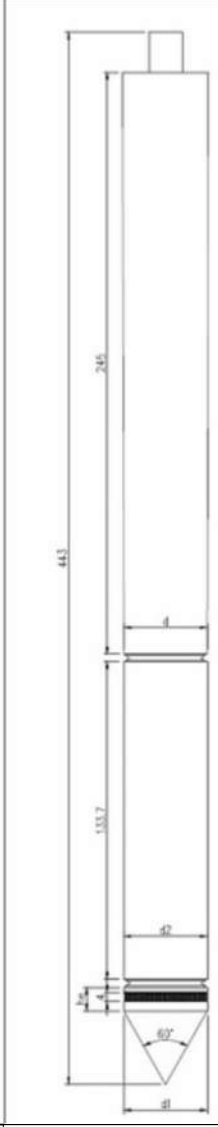
These notes describe the technical specifications and associated calibration references pertaining to the following cone types:

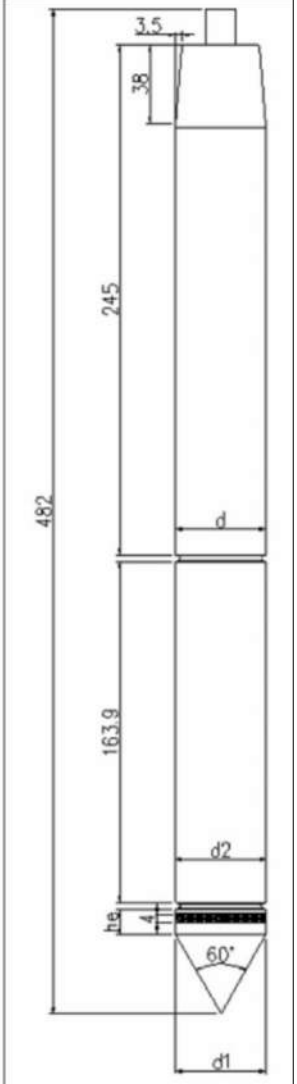
- I-CFXY-10 measuring cone resistance, sleeve friction and inclination (standard cone, 10cm²);
- I-CFXY-15 measuring cone resistance, sleeve friction and inclination (standard cone, 15cm²);
- I-CFXYP20-10 / I-CFXYP100-10 measuring cone resistance, sleeve friction, inclination and pore pressure (piezocone, 10cm²);
- I-CFXYP20-15 measuring cone resistance, sleeve friction, inclination and pore pressure (piezocone, 15cm²);
- I-C5F0p15XYP20-10 measuring sensitive cone resistance, sleeve friction, inclination and pore pressure (piezocone, 10cm²).

Dimensions

Dimensional specifications for all cone types are detailed below. All tolerances are routinely checked prior to testing and measurements

A.P. van den Berg Machinefabriek tel.: +31 (0)513-631355 info@apvandenberg.com	**DEVIATION of Straightness + MINIMUM Dimensions tip, friction jacket, cone adapter**	Standards: EN ISO 22476-1 APB-standard	
Type of cone:	Icone 10 cm²		Icone 15 cm²
ALLOWABLE SIZE VARIATION			
Diameter of tip:	35,3 ≤ d1 ≤ 36,0		43,2 ≤ d_1 ≤ 44,1
Diameter of centering ring CFP	35,3 ≤ d1 ≤ 36,0		43,2 ≤ d_1 ≤ 44,1
Diameter of friction jacket:	$d_1 \leq d_2 < d_1 + 0{,}35$		$d_1 \leq d_2 < d_1 + 0{,}43$
Height dimension of tip edge:	$7 \leq h_e \leq 10$		$9 \leq h_e \leq 12$
PRODUCTION DIMENSIONS			
Tip:	$d_1 = 35{,}7\ ^{+0,2}_{0}$		$d_1 = 43{,}8\ ^{+0,2}_{0}$
Jacket (C-cone):	$d_2 = 35{,}7\ ^{+0,2}_{0}$		$d_2 = 43{,}7\ ^{+0,2}_{0}$
Friction jacket (CF-cone):	$d_2 = 35{,}9\ ^{+0,1}_{0}$		$d_2 = 44{,}0\ ^{+0,1}_{0}$
Tip for used cone:	$d_1 = 35{,}5\ ^{+0,1}_{0}$		$d_1 = 43{,}5\ ^{+0,1}_{0}$
MINIMUM DIMENSIONS			
Minimum diameter jacket (C-cone):	d_2 = 35,2 (APB standard)		d_2 = 43,0 (APB standard)
Minimum diameter friction jacket (CF-cone):	d_2 = 35,3		d_2 = 43,2
Use "used cone"-tip when friction jacket diameter:	$d_2 \leq 35{,}65$		$d_2 \leq 43{,}7$
Minimum diameter of cone adaptor:	d = 35,3		d = 43,8
Maximum deviation of straightness:	1 mm on a length of 1000 mm (max. oscillation 1,0 mm.)		1 mm on a length of 1000 mm (max. oscillation: 2.0 mm)

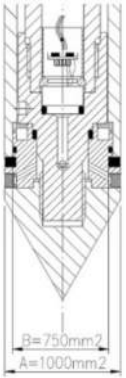




Tip and Local Friction sensor displacement

The different distances of the sensors are compensated depending on the cone types:

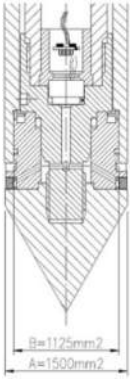
- 10cm² cones: 80mm
- 15cm² cones: 100mm



Cone area ratio

α = B / A = 0.75

β = 1 - B / A = 0.25



McMILLAN Drilling

LandTest

CPT CALIBRATION AND TECHNICAL NOTES

Calibration

Each cone has a unique identification number that is electronically recorded and reported for each CPT test. The identification number enables the operator to compare 'zero-load offsets' to manufacturer calibrated zero-load offsets.

The recommended maximum zero-load offset for each sensor is determined as ± 5% of the nominal measuring range.

In addition to maximum zero-load offsets, the difference in zero load offset before and after the test is limited as ± 2% of the maximum measuring range. See table below:

	Tip (MPa)	Friction (MPa)	Pore Pressure (MPa)
Maximum Measuring Range:	150	1.50	3.00
Nominal Measuring Range:	75	1.00	2.00
Max. 'zero-load offset':	7.5	0.10	0.20
Max 'before and after test':	3	0.03	0.06

Note: The zero offsets are electronically recorded and reported for each test in the same units as that of each sensor.

Land Test McMILLAN Drilling

Calibration Certificate

a.p. van den berg

1.1 General

Cone number:	100992
Cone type:	I-CFXYP20-10
Description:	Tip 75 MPa Sleeve 1.00 MPa Inclinometer 20° Pore 2MPa
Part number:	0100277B
Certificate number:	100992-12
Client:	McMillan

1.2 Calibration equipment

	calibrated
Autolog 3000	
Autolog 3000	August 2017 (Peekel: SN# 2628009)
Autolog 3000	August 2017 (Peekel: SN# 2628009)
Autolog 3000	August 2017 (Peekel: SN# 2628009)
Reference Loadcell 100kN 93280	Sept 2017 (HBM: 64604 2017-09)
Reference Loadcell 20kN H22789	Sept 2017 (HBM: 64667 2017-09)
Reference Sensor 40 Bar 5447380	Aug 2018 (GE Druck: 0079091)
Reference ACS-080-SC00-HP2-PM 08/11 470481	March 2015 (Trescal: 1503-02689)
Reference ACS-080-SC00-HP2-PM 08/11 470481	March 2015 (Trescal: 1503-02689)

1.3 Standard
EN ISO 22476-1 2012 Class 2

1.4 Result
The sensor complies to the above standard

Calibrated by:	C.J. Ouwejan
Date:	09/04/2019
Signature:	
QA Manager:	N.R.E. de Jong
Date:	09/04/2019
Signature:	

Calibration Certificate

a.p. van den berg

Zero Value	Cone	-0.10 [MPa]	**Max. Deviation from Zero Value**	Cone	3.75 [MPa]
	Sleeve	0.01 [MPa]		Sleeve	0.05 [MPa]
	Pore(u2)	3.4 [kPa]		Pore(u2)	100.0 [kPa]

Ref [MPa]	Cone [MPa]	Cone-Ref [kPa]	Ref [MPa]	Sleeve [MPa]	Sleeve-Ref [kPa]
0.001	-0.006	-7	0.000	0.000	0
1.139	1.150	11	0.040	0.041	1
2.225	2.233	8	0.068	0.070	2
4.006	4.020	14	0.095	0.097	2
7.153	7.162	9	0.140	0.141	1
12.303	12.310	7	0.222	0.224	2
19.866	19.868	2	0.290	0.293	3
30.997	30.985	-12	0.413	0.416	3
40.210	40.212	2	0.585	0.588	3
47.492	47.498	6	0.704	0.707	3
61.656	61.667	11	0.792	0.794	2
77.553	77.548	-5	1.026	1.026	0

Ref [MPa]	Pore(u2) [MPa]	Pore(u2)-Ref [kPa]
0.000	0.002	2
0.101	0.102	1
0.205	0.206	1
0.304	0.305	1
0.412	0.413	1
0.608	0.611	3
0.802	0.805	3
0.965	0.969	4
1.217	1.219	2
1.320	1.323	3
1.631	1.634	3
2.027	2.027	0

Calibration Certificate

a.p. van den berg

1.1 General

Sensor number:	151125
Sensor type:	I-CFXYP20-10
Description:	Tip 75 MPa Sleeve 1.00 MPa Inclinometer 20° Pore 2MPa
Part number:	0100277B
Certificate number:	151125-1
Client:	McMillan Drilling Ltd 120 High Street SOUTHBRIDGE, CANTERBURY New Zealand

1.2 Calibration equipment

	calibrated	
DAQ MX238B 00E816	*january 2019 (HBM: QW0467)*	*0,0025% FRO*
DAQ MX440B 00FCAA	*february 2019 (HBM: QW0939)*	*0,05% FRO*
Reference Loadcell 100kN F34717	*August 2019 (HBM: 79169 2019-08)*	*0,02% FRO*
Reference Loadcell 20kN H22789	*August 2019 (HBM: 79121 2019-08)*	*0,03% FRO*
Reference Sensor 40 Bar 5447380	*August 2018 (GE Druck 0079091)*	*0,1% FRO*
Reference ACS-080-SC00-HP2-PM 08/11 470481	*Sept. 2019 (Trescal: 1908-15578)*	*0,2°*

1.3 Standard
EN ISO 22476-1 2012 Class 2

1.4 Result
The sensor complies to the above standard

Calibrated by: D. Hofman
Date: 15/10/2019
Signature:

QA Manager: N.R.E. de Jong
Date: 15/10/2019
Signature:

Calibration Certificate

a.p. van den berg

Zero Value	Cone	0.009 [MPa]	**Max. Deviation from Zero Value**	Cone	3.75 [MPa]
	Sleeve	0.001 [MPa]		Sleeve	0.05 [MPa]
	Pore(u2)	0.001 [MPa]		Pore(u2)	0.1 [MPa]

Ref [MPa]	Cone [MPa]	Cone-Ref [kPa]
-0.001	0.009	10
1.041	1.081	40
2.148	2.201	53
4.043	4.119	76
8.499	8.557	58
11.309	11.356	47
20.085	20.260	175
30.386	30.439	53
37.948	38.017	69
49.436	49.527	91
55.990	56.099	109
76.848	76.845	-3

Ref [MPa]	Sleeve [MPa]	Sleeve-Ref [kPa]
0.000	0.001	1
0.043	0.042	-1
0.073	0.073	0
0.100	0.101	1
0.138	0.140	2
0.206	0.209	3
0.246	0.249	3
0.410	0.414	4
0.543	0.547	4
0.711	0.715	4
0.833	0.836	3
1.024	1.025	1

Ref [MPa]	Pore(u2) [MPa]	Pore(u2)-Ref [kPa]
0.000	0.001	1
0.105	0.107	2
0.209	0.212	3
0.299	0.301	2
0.417	0.420	3
0.632	0.635	3
0.815	0.818	3
1.028	1.031	3
1.236	1.238	3
1.460	1.461	1
1.618	1.620	2
2.023	2.023	0

Appendix C
Compaction Curves

Canterbury Laboratory

24 Miners Road, Templeton, Christchurch
PO Box 16-064, Christchurch 8441
Telephone: +64 3 349 9142
Facsimile: +64 3 349 9143
www.fultonhogan.com
0800 LABORATORY

Maximum Dry Density Report

Report No: MDD:CAN18S-14541
Issue No: 1

Client:	Toni O'Regan City Care Limited PO Box 7669 Sydenham Christchurch 8240 NZ
Project:	QA Testing - City Care Ltd

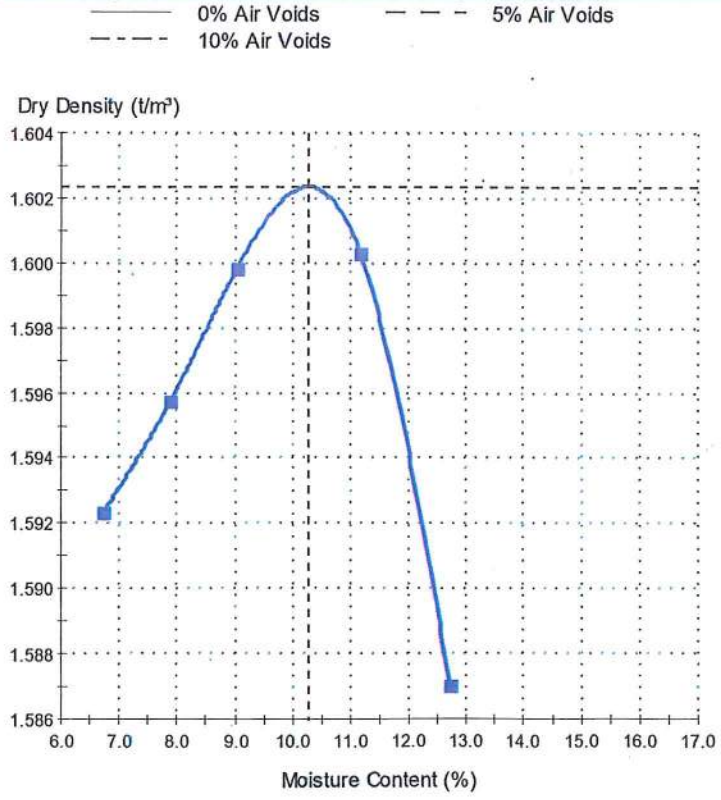
IANZ ACCREDITED LABORATORY

Approved Signatory: Max Burford (Supervisor)
IANZ Accreditation No:200
Date of Issue: 21/06/2018

Sample Details

Sample ID:	CAN18S-14541	**Client Sample ID:**	1208/18
Material:	Sand	**Sample Source:**	Miscellaneous Material Source
Site/Sampled From:	Lot 264 (mix) (sample 1)	**Date Sampled:**	13/06/2018
Specification:	Vibrating Hammer Compaction Test	**Sampled By:**	Advised - See Comments
Sampling Method:	Not Advised - Not Accredited	**Date Tested:**	19/06/2018
Technician:	Johny Slade	**Sampling Endorsed?:**	No

Dry Density - Moisture Relationship



Test Results

NZS 4402:1986 Test 4.1.3 - 1986

Maximum Dry Density (t/m³):	**1.60**
Optimum Moisture Content (%):	**10**
Solid Density (t/m³):	2.68 assumed
Fraction Tested Passes (mm):	37.5
Material Removed (%):	0
Sample History:	Natural

275 2.79? 1660 AW

Comments

Sampled by Clive

Canterbury Laboratory

24 Miners Road, Templeton, Christchurch
PO Box 16-064, Christchurch 8441
Telephone: +64 3 349 9142
Facsimile: +64 3 349 9143
www.fultonhogan.com
0800 LABORATORY

Maximum Dry Density Report

Report No: MDD:CAN18S-14543
Issue No: 1

Client: Toni O'Regan
City Care Limited
PO Box 7669
Sydenham

Christchurch 8240
NZ

Project: QA Testing - City Care Ltd

IANZ ACCREDITED LABORATORY

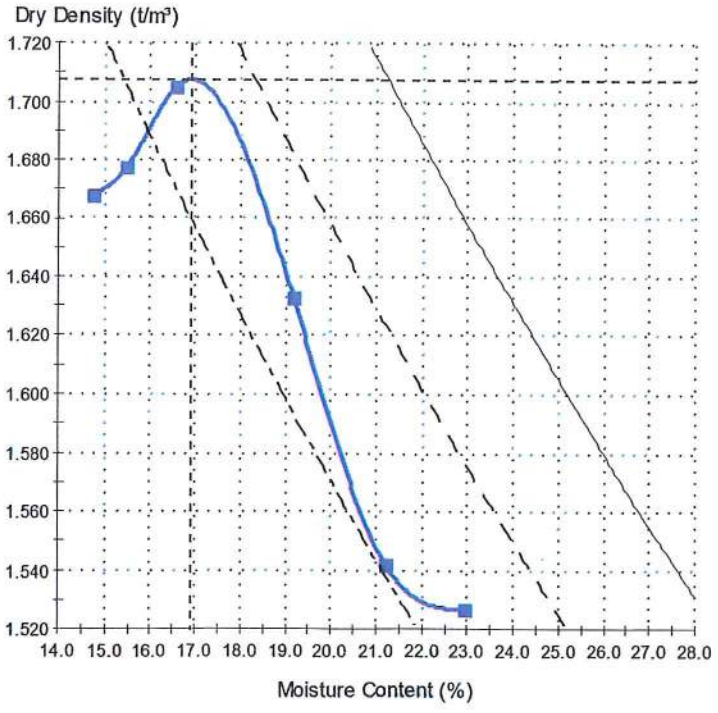
Approved Signatory: Max Burford (Supervisor)
IANZ Accreditation No:200
Date of Issue: 21/06/2018

Sample Details

Sample ID:	CAN18S-14543	**Client Sample ID:**	1210/18
Material:	Sand	**Sample Source:**	Miscellaneous Material Source
Site/Sampled From:	Caldwell Bdy (sample 3)	**Date Sampled:**	13/06/2018
Specification:	Vibrating Hammer Compaction Test	**Sampled By:**	Advised - See Comments
Sampling Method:	Not Advised - Not Accredited	**Date Tested:**	19/06/2018
Technician:	Johny Slade	**Sampling Endorsed?:**	No

Dry Density - Moisture Relationship

0% Air Voids — — — 5% Air Voids
10% Air Voids



Test Results

NZS 4402:1986 Test 4.1.3 - 1986

Maximum Dry Density (t/m³):	**1.70**
Optimum Moisture Content (%):	**17**
Solid Density (t/m³):	2.68 assumed
Fraction Tested Passes (mm):	37.5
Material Removed (%):	0
Sample History:	Natural

Comments

Sampled by Clive
Compaction for test points @ 21.2% & 23.2% ceased prior to 3 minutes due to oversaturation causing ejection of fines from sample.

Canterbury Laboratory

24 Miners Road, Templeton, Christchurch
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0800 LABORATORY

Maximum Dry Density Report

Report No: MDD:CAN18S-14542
Issue No: 1

Client: Toni O'Regan
City Care Limited
PO Box 7669
Sydenham

Christchurch 8240
NZ

Project: QA Testing - City Care Ltd

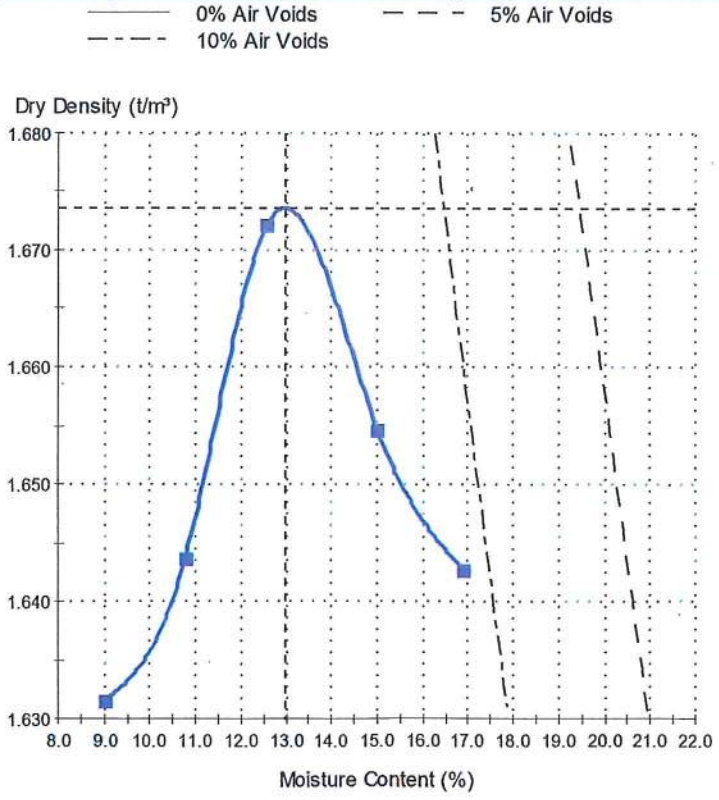
IANZ ACCREDITED LABORATORY

Approved Signatory: Max Burford (Supervisor)
IANZ Accreditation No:200
Date of Issue: 21/06/2018

Sample Details

Sample ID:	CAN18S-14542	**Client Sample ID:**	1209/18
Material:	Sand	**Sample Source:**	Miscellaneous Material Source
Site/Sampled From:	Large stripped stockpile (sample 2)	**Date Sampled:**	13/06/2018
Specification:	Vibrating Hammer Compaction Test	**Sampled By:**	Advised - See Comments
Sampling Method:	Not Advised - Not Accredited	**Date Tested:**	19/06/2018
Technician:	Johny Slade	**Sampling Endorsed?:**	No

Dry Density - Moisture Relationship



Test Results

NZS 4402:1986 Test 4.1.3 - 1986

Maximum Dry Density (t/m³):	**1.68**
Optimum Moisture Content (%):	**13**
Solid Density (t/m³):	2.68 assumed
Fraction Tested Passes (mm):	37.5
Material Removed (%):	0
Sample History:	Natural

Comments

Sampled by Clive
Compaction for test point @ 16.9% ceased prior to 3 minutes due to oversaturation causing ejection of fines from sample.

Canterbury Laboratory

325 Pound Rd, Yaldhurst
PO Box 16-064, Christchurch 8441
Telephone: +64 3 349 9142
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www.fultonhogan.com
0800 LABORATORY

Maximum Dry Density Report

Report No: MDD:CAN14S-05061
Issue No: 1

Client: Toni O'Regan
City Care Limited
PO Box 7669
Sydenham

Christchurch 8240

Project: QA Testing - City Care Ltd

The test (s) reported herein (unless indicated) have been performed in accordance with the laboratory's scope of accreditation. Results only apply to samples as received. This report must be reproduced in full.

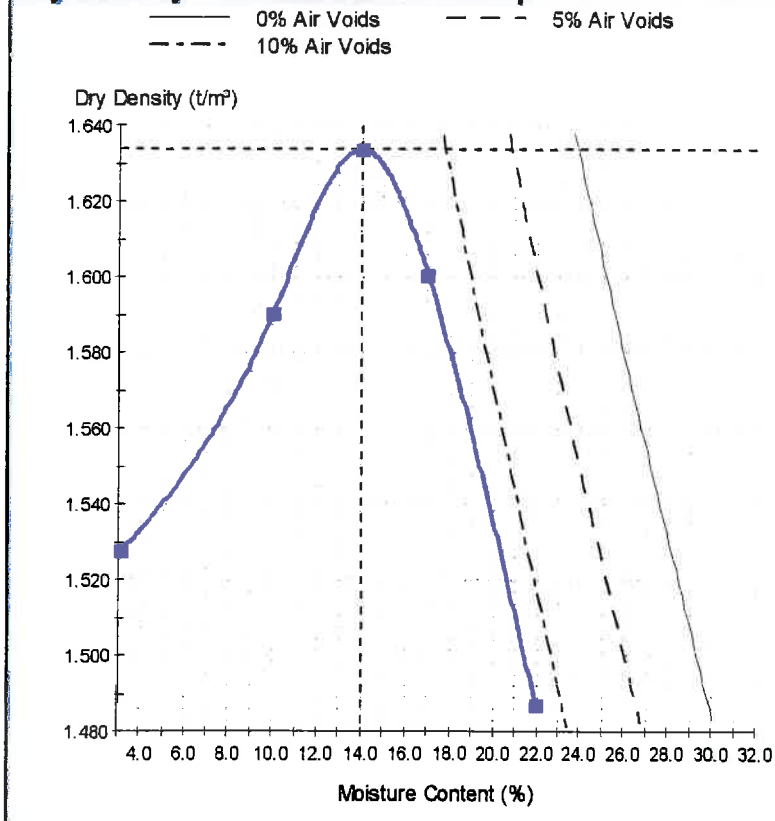
IANZ ACCREDITED LABORATORY

Approved Signatory: Max Burford (Supervisor)
IANZ Accreditation No:200
Date of Issue: 06/03/14

Sample Details

Sample ID:	CAN14S-05061	**Client Sample ID:**	0429/14 Site B
Material:	BEACH SAND	**Sample Source:**	Field Sample [Taken From Site]
Site/Sampled From:	Prestons Road Alpine V Site B	**Date Sampled:**	25/02/2014
Specification:	No Specification	**Sampled By:**	Advised - See Comments
Sampling Method:	As Received - Not Accredited	**Date Tested:**	06/03/2014
Technician:	Daniel Daly	**Sampling Endorsed?:**	No

Dry Density - Moisture Relationship



Test Results

NZS 4402:1986 Test 4.1.3 - 1986

Maximum Dry Density (t/m³):	1.64
Optimum Moisture Content (%):	14
Solid Density (t/m³):	2.68 assumed
Fraction Tested Passes (mm):	37.5
Material Removed (%):	0
Sample History:	Natural

Comments

50% MEDIUM SAND 46% fine sand & 4% silt

Road Science
Leading Transport Technology

CHRISTCHURCH LABORATORY

397 Mcleans Island Road, Harewood
P O Box 11-326, Sockburn, Christchurch 8443
Phone: (03) 359-0757

Test Report

Client:	K.B. Contracting & Quarries Limited	**Sample Date:**	08/12/2017	08:00
Address:	PO Box 19746, Woolston, Christchurch 8241	**Sampled By:**	Pete Haward	
Client Ref:	Not advised	**Laboratory No:**	C17/3810	
Job Location:	McLeans Island	**Report No:**	257833	**Final**
Material:	Pit Run	**Report Date:**	15/12/2017	Page 1 of 2
Material Source:	McLeans Island			

Test Methods:

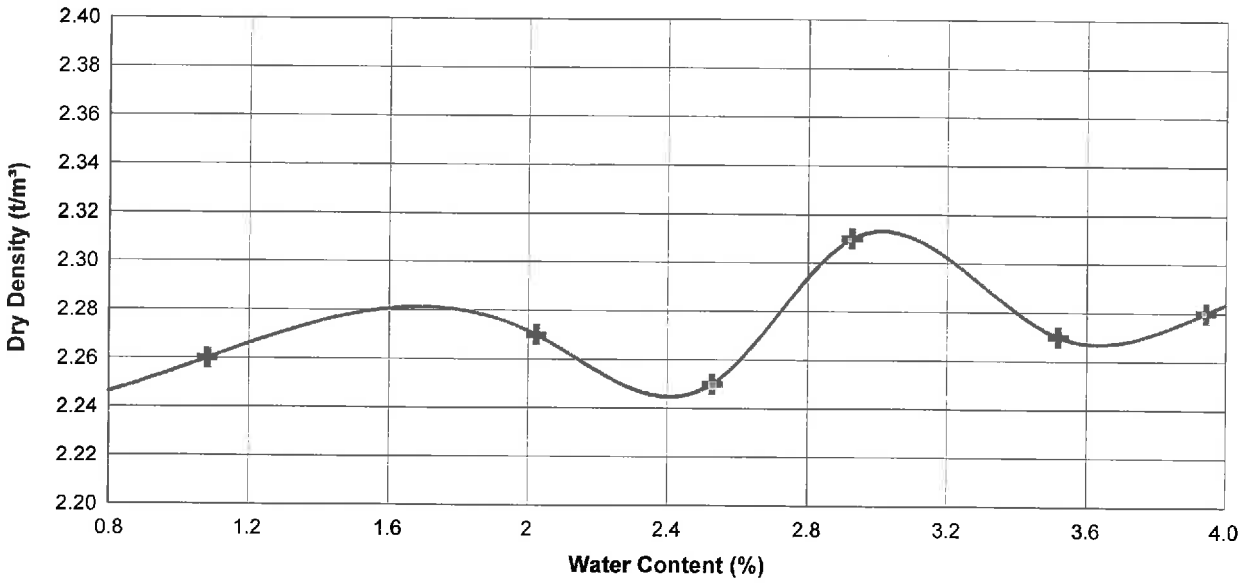
1#	Sampling from stockpiles of well graded aggregate - machine method	NZS4407:2015 2.4.6.3.2
2	Determination of the Dry Density/Water Content Relationship - New Zealand Vibrating Hammer Compaction Test	NZS4402:1986 Test 4.1.3

Test methods marked with a hash are not accredited.

Results

Water Content (%)	1.08	2.02	2.53	2.93	3.52	3.94
Dry Density (t/m³)	2.26	2.27	2.25	2.31	2.27	2.28

Dry Density/Water Content Relationship



Maximum Dry Density (t/m³)	2.32
Optimum Water Content (%)	3.0
History of Sample	Result obtained from oven-dried sample.
Test Fraction	Passing 37.5mm sieve
Test Date:	13/12/2017

Notes

Date of sample receipt: 08/12/2017

Vicky Henderson
Approved Signatory
Laboratory Manager
IANZ Accreditation No: 439
Date of Issue: 10/04/92

IANZ ACCREDITED LABORATORY

Appendix D
NDM Test Results

Project Prestons South Subdivision
Project No. 235361
Date 13-Aug-20
Title Summary of Compaction

Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction	Retest
13/08/2019	1988/19	9	207	395694.74	811815.76	T6	2320	PIT RUN	LIFT 4	Lot 399	96	
		10	208	395701.18	811803.20	T6	2320	PIT RUN	LIFT 4		98	
		11	209	395719.53	811813.02	T6	2320	PIT RUN	LIFT 4	Lot 400	97	
		12	210	395712.61	811825.89	T6	2320	PIT RUN	LIFT 4		96	
		13	211	395730.79	811835.07	T6	2320	PIT RUN	LIFT 4	Lot 401	98	
		14	212	395736.91	811822.52	T6	2320	PIT RUN	LIFT 4		97	
		15	213	395753.00	811829.92	T6	2320	PIT RUN	LIFT 4	Lot 402	98	
		16	214	395746.56	811843.92	T6	2320	PIT RUN	LIFT 4		99	
		7	221	395683.39	811793.49	T6	2320	PIT RUN		LOT 398	96	
		8	222	395676.25	811806.36	T6	2320	PIT RUN			96	
		9	223	395694.74	811815.76	T6	2320	PIT RUN		LOT 399	96	
		10	224	395701.18	811803.20	T6	2320	PIT RUN			96	
		11	225	395754.78	811848.55	T6	2320	PIT RUN		LOT 402	97	
		12	226	395760.60	811833.84	T6	2320	PIT RUN			97	
		11	237	395677.25	811790.45	T6	2320	PIT RUN		LOT 398	101	
		12	238	395682.96	811806.74	T6	2320	PIT RUN			97	
26/06/2019	1539/19	1	239	395753.00	811829.92	T6	2320	PIT RUN	LIFT 2	LOT 402 RETE	96	
		2	240	395746.56	811843.92	T6	2320	PIT RUN			97	
		11	249	395676.25	811806.36	T6	2320	PIT RUN	LIFT 2	LOT 398	97	
		12	250	395683.39	811793.49	T6	2320	PIT RUN			97	
		13	251	395701.18	811803.20	T6	2320	PIT RUN	LIFT 2	LOT 399	96	
		14	252	395694.74	811815.76	T6	2320	PIT RUN			97	
27/06/2019	1565/19	1	267	395746.56	811843.92	T6	2320	PIT RUN	LIFT 2	LOT 402	96	
		2	268	395753.00	811829.92	T6	2320	PIT RUN			96	
		3	269	395736.91	811822.52	T6	2320	PIT RUN	LIFT 2	LOT 401	95	
		4	270	395730.79	811835.07	T6	2320	PIT RUN			95	
		5	271	395712.61	811825.89	T6	2320	PIT RUN	LIFT 2	LOT 400	97	
		6	272	395719.53	811813.02	T6	2320	PIT RUN			97	
2/07/2019	1607/19	1	279	395676.25	811806.36	T6	2320	PIT RUN	LIFT 2	LOT 398	101	
		2	280	395683.39	811793.49	T6	2320	PIT RUN			99	
		3	281	395701.18	811803.20	T6	2320	PIT RUN	LIFT 2	LOT 399	104	

Project Prestons South Subdivision
Project No. 235361
Date 13-Aug-20
Title Summary of Compaction

Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction	Retest
		4	282	395694.74	811815.76	T6	2320	PIT RUN			101	
		5	283	395712.61	811825.89	T6	2320	PIT RUN	LIFT 2	LOT 400	99	
		6	284	395719.53	811813.02	T6	2320	PIT RUN			100	
		7	285	395736.91	811822.52	T6	2320	PIT RUN	LIFT 2	LOT 401	99	
		8	286	395730.79	811835.07	T6	2320	PIT RUN			100	
		9	287	395746.56	811843.92	T6	2320	PIT RUN	LIFT 2	LOT 402	100	
		10	288	395753.00	811829.92	T6	2320	PIT RUN			98	
25/06/2019	1534/19	1	297	395705.84	811822.60	T6	2320	PIT RUN	LIFT 2	LOT 400	97	
		2	298	395724.24	811815.64	T6	2320	PIT RUN			96	
		3	299	395730.80	811819.08	T6	2320	PIT RUN	LIFT 2	LOT 401	97	
		4	300	395734.88	811837.49	T6	2320	PIT RUN			98	
		5	301	395743.04	811841.65	T6	2320	PIT RUN	LIFT 2	LOT 402	93	
		6	302	395749.85	811828.20	T6	2320	PIT RUN			95	
		3	322	395719.53	811813.02	T6	2320	PIT RUN	LIFT 5	LOT 400	101	
		4	323	395712.61	811825.89	T6	2320	PIT RUN			101	
		6	325	395736.91	811822.52	T6	2320	PIT RUN			99	
23/07/2019	1810/19	1	352	395676.25	811806.36	T6	2320	PIT RUN	LIFT 5	LOT 398	102	
		2	353	395683.39	811793.49	T6	2320	PIT RUN			103	
12/07/2019	1715/19	1	459	395696.66	811800.75	T6	1660	PIT RUN		LOT 399	96	
		2	460	395699.34	811817.95	T6	1660	PIT RUN			96	
5/08/2019	1905/19	1	582	395742.83	811877.45	T6	2320	PIT RUN	LIFT 3	LOT 403	95	
		2	583	395730.31	811871.12	T6	2320	PIT RUN			96	
9/08/2019	1954/19	1	594	395732.03	811866.18	T6	2320	PIT RUN	LIFT 5	LOT 403	100	
		2	595	395741.60	811881.45	T6	2320	PIT RUN			98	
25/07/2019	1828/19	1	638	395671.18	811835.95	T6	1660	SAND	FINAL LIFT	LOT 406	99	
		2	639	395664.20	811849.30	T6	1660	SAND			103	
		3	640	395680.10	811857.42	T6	1660	SAND	FINAL LIFT	LOT 405	104	
		4	641	395686.38	811845.14	T6	1660	SAND			100	
		5	662	395732.03	811866.18	T6	2320	PIT RUN	LIFT 3	LOT 403	97	
		6	663	395741.60	811881.45	T6	2320	PIT RUN			96	
		7	783	395730.31	811871.12	T6	2320	PIT RUN	Lift 4	Lot 403	97	

Project Prestons South Subdivision
Project No. 235361
Date 13-Aug-20
Title Summary of Compaction

Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction Retest
		8	784	395742.83	811877.45	T6	2320	PIT RUN			99
17/07/2020	KB20/0220	1	913	395754.78	811848.55	T6	2320	PIT RUN	Lift 1	Lot 402	97
		2	914	395760.60	811833.84	T6	2320	PIT RUN			97
17/07/2020	KB20/0221	1	917	395754.78	811848.55	T6	2320	PIT RUN	Lift 2	Lot 402	98
		2	918	395760.60	811833.84	T6	2320	PIT RUN			97
21/07/2020	KB20/0223	1	921	395754.78	811848.55	T6	2320	PIT RUN	Lift 3	Lot 402	99
		2	922	395760.60	811833.84	T6	2320	PIT RUN			99
15/08/2019	2008/19	1	664	395611.88	812046.47	T7	2320	PIT RUN	LIFT 2	LOT 479	102
		2	665	395597.71	812046.54	T7	2320	PIT RUN			102
		3	666	395601.32	812073.60	T7	2320	PIT RUN	LIFT 2	LOT 478	100
		4	667	395616.08	812074.20	T7	2320	PIT RUN			97
		5	668	395621.37	812098.14	T7	2320	PIT RUN	LIFT 2	LOT 477	99
		6	669	395606.33	812096.92	T7	2320	PIT RUN			100
30/08/2019	2171/19	1	789	395602.92	812040.29	T7	2320	PIT RUN	Lift 3	Lot 475	98
		2	790	395595.72	812056.34	T7	2320	PIT RUN			99
		3	791	395615.45	812067.61	T7	2320	PIT RUN	Lift 3	Lot 477	99
		4	792	395601.32	812073.60	T7	2320	PIT RUN			100
		5	793	395620.93	812092.36	T7	2320	PIT RUN	Lift 3	Lot 478	97
		6	794	395605.90	812104.14	T7	2320	PIT RUN			97
		7	795	395630.28	812106.79	T7	2320	PIT RUN	Lift 3	Lot 479	96
		8	796	395641.57	812095.86	T7	2320	PIT RUN			98
		9	797	395636.71	812079.73	T7	2320	PIT RUN	Lift 3	Lot 476	98
		10	798	395626.95	812067.51	T7	2320	PIT RUN			100
		11	799	395637.01	812057.75	T7	2320	PIT RUN	Lift 3	Lot 473	99
		12	800	395631.88	812038.03	T7	2320	PIT RUN			96
		13	801	395612.78	812057.13	T7	2320	PIT RUN	Lift 3	Lot 474	97
		14	802	395621.94	812037.40	T7	2320	PIT RUN			98
2/09/2019	2190/19	1	803	395602.92	812040.29	T7	2320	PIT RUN	Lift 4	Lot 475	99
		2	804	395595.72	812056.34	T7	2320	PIT RUN			98
		3	805	395615.45	812067.61	T7	2320	PIT RUN	Lift 4	Lot 477	98
		4	806	395601.32	812073.60	T7	2320	PIT RUN			97

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Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction	Retest
		5	807	395620.93	812092.36	T7	2320	PIT RUN	Lift 4	Lot 478	100	
		6	808	395605.90	812104.14	T7	2320	PIT RUN			98	
		7	809	395630.28	812106.79	T7	2320	PIT RUN	Lift 4	Lot 479	97	
		8	810	395641.57	812095.86	T7	2320	PIT RUN			100	
		9	811	395636.71	812079.73	T7	2320	PIT RUN	Lift 4	Lot 476	97	
		10	812	395626.95	812067.51	T7	2320	PIT RUN			98	
		11	813	395631.08	812057.01	T7	2320	PIT RUN	Lift 4	Lot 473	101	
		12	814	395642.27	812041.50	T7	2320	PIT RUN			99	
		13	815	395612.78	812057.13	T7	2320	PIT RUN	Lift 4	Lot 474	99	
		14	816	395621.94	812037.40	T7	2320	PIT RUN			98	
26/08/2019	2116/19	1	817	395621.94	812037.40	T7	2320	PIT RUN	Lift 1	Lot 474	95	
		2	818	395612.78	812057.13	T7	2320	PIT RUN			96	
		3	819	395620.93	812092.36	T7	2320	PIT RUN	Lift 1	Lot 478	97	
		4	820	395605.90	812104.14	T7	2320	PIT RUN			98	
		5	821	395630.28	812106.79	T7	2320	PIT RUN	Lift 1	Lot 479	95	
		6	822	395641.57	812095.86	T7	2320	PIT RUN			93	2117/19
		7	823	395636.71	812079.73	T7	2320	PIT RUN	Lift 1	Lot 476	92	2117/19
		8	824	395626.95	812067.51	T7	2320	PIT RUN			97	
		9	825	395631.08	812057.01	T7	2320	PIT RUN	Lift 1	Lot 473	97	
		10	826	395642.27	812041.50	T7	2320	PIT RUN			98	
27/08/2019	2117/19	1	827	395630.28	812106.79	T7	2320	PIT RUN	Lift 1	Lot 479	98	Retest
		2	828	395641.57	812095.86	T7	2320	PIT RUN			100	Retest
		3	829	395636.71	812079.73	T7	2320	PIT RUN	Lift 1	Lot 476	99	
		4	830	395626.95	812067.51	T7	2320	PIT RUN			97	
4/09/2019	2201/19	1	831	395602.92	812040.29	T7	2320	PIT RUN	Lift 5	Lot 475	100	
		2	832	395595.72	812056.34	T7	2320	PIT RUN			101	
		3	833	395615.45	812067.61	T7	2320	PIT RUN	Lift 5	Lot 477	102	
		4	834	395601.32	812073.60	T7	2320	PIT RUN			99	
		5	835	395620.93	812092.36	T7	2320	PIT RUN	Lift 5	Lot 478	100	
		6	836	395605.90	812104.14	T7	2320	PIT RUN			99	
		7	837	395630.28	812106.79	T7	2320	PIT RUN	Lift 5	Lot 479	101	

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Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction Retest
		8	838	395641.57	812095.86	T7	2320	PIT RUN			101
		9	839	395636.71	812079.73	T7	2320	PIT RUN	Lift 5	Lot 476	102
		10	840	395626.95	812067.51	T7	2320	PIT RUN			100
		11	841	395631.08	812057.01	T7	2320	PIT RUN	Lift 5	Lot 473	100
		12	842	395642.27	812041.50	T7	2320	PIT RUN			101
		13	843	395612.78	812057.13	T7	2320	PIT RUN	Lift 5	Lot 474	101
		14	844	395621.94	812037.40	T7	2320	PIT RUN			99
28/08/2019	2139/19	1	845	395621.04	812058.02	T7	2320	PIT RUN	Lift 2	Lot 474	103
		2	846	395613.72	812037.95	T7	2320	PIT RUN			97
		3	847	395631.88	812038.03	T7	2320	PIT RUN	Lift 2	Lot 473	98
		4	848	395637.01	812057.75	T7	2320	PIT RUN			96
		5	849	395638.84	812068.53	T7	2320	PIT RUN	Lift 2	Lot 476	99
		6	850	395627.50	812078.78	T7	2320	PIT RUN			97
		7	851	395631.38	812094.26	T7	2320	PIT RUN	Lift 2	Lot 479	100
		8	852	395640.83	812108.22	T7	2320	PIT RUN			95
		9	853	395620.93	812092.36	T7	2320	PIT RUN	Lift 2	Lot 478	95
		10	854	395605.90	812104.14	T7	2320	PIT RUN			96
9/09/2019	2222/19	1	855	395602.92	812040.29	T7	2320	PIT RUN	Lift 6	Lot 475	97
		2	856	395595.72	812056.34	T7	2320	PIT RUN			95
		3	857	395615.45	812067.61	T7	2320	PIT RUN	Lift 6	Lot 477	98
		4	858	395601.32	812073.60	T7	2320	PIT RUN			99
		5	859	395620.93	812092.36	T7	2320	PIT RUN	Lift 6	Lot 478	99
		6	860	395605.90	812104.14	T7	2320	PIT RUN			97
		7	861	395630.28	812106.79	T7	2320	PIT RUN	Lift 6	Lot 479	97
		8	862	395641.57	812095.86	T7	2320	PIT RUN			97
		9	863	395636.71	812079.73	T7	2320	PIT RUN	Lift 6	Lot 476	99
		10	864	395626.95	812067.51	T7	2320	PIT RUN			100
		11	865	395631.08	812057.01	T7	2320	PIT RUN	Lift 6	Lot 473	98
		12	866	395642.27	812041.50	T7	2320	PIT RUN			99
		13	867	395612.78	812057.13	T7	2320	PIT RUN	Lift 6	Lot 474	96
		14	868	395621.94	812037.40	T7	2320	PIT RUN			98

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Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction Retest
6/07/2020	KB20/0203	1	869	395669.37	812045.07	T7	2320	PIT RUN	Lift 1	Lot 974	103
		2	870	395664.04	812069.15	T7	2320	PIT RUN		Lot 975	98
		3	871	395663.92	812084.77	T7	2320	PIT RUN	Lift 1	Lot 974	100
		4	872	395672.03	812062.78	T7	2320	PIT RUN		Lot 975	96
		3	514	395722.92	811884.12	U2	2320	PIT RUN	LIFT 1	LOT 465	98
		9	568	395734.27	811894.04	U2	2320	PIT RUN	LIFT 2	LOT 465	101
		10	569	395720.59	811888.60	U2	2320	PIT RUN			99
		11	570	395715.33	811904.88	U2	2320	PIT RUN	LIFT 2	LOT 466	99
		12	571	395727.61	811910.17	U2	2320	PIT RUN			100
		13	572	395720.73	811926.99	U2	2320	PIT RUN	LIFT 2	LOT 467	97
		14	573	395707.82	811922.34	U2	2320	PIT RUN			98
		3	584	395720.59	811888.60	U2	2320	PIT RUN	LIFT 3	LOT 465	98
		4	585	395734.27	811894.04	U2	2320	PIT RUN			95
		5	586	395727.61	811910.17	U2	2320	PIT RUN	LIFT 3	LOT 466	96
		6	587	395715.33	811904.88	U2	2320	PIT RUN			96
		3	596	395734.27	811894.04	U2	2320	PIT RUN	LIFT 5	LOT 465	98
		4	597	395720.59	811888.60	U2	2320	PIT RUN			98
		5	598	395716.97	811899.66	U2	2320	PIT RUN	LIFT 5	LOT 466	99
		6	599	395726.32	811914.48	U2	2320	PIT RUN			101
		7	600	395722.91	811921.89	U2	2320	PIT RUN	LIFT 5	LOT 467	100
		8	601	395706.03	811926.31	U2	2320	PIT RUN			99
29/07/2019	1851/19	1	622	395715.33	811904.88	U2	2320	PIT RUN	LIFT 1	LOT 468	99
		2	623	395727.61	811910.17	U2	2320	PIT RUN			99
		3	624	395720.73	811926.99	U2	2320	PIT RUN	LIFT 1	LOT 467	100
		4	625	395707.82	811922.34	U2	2320	PIT RUN			100
		5	642	395693.03	811880.61	U2	1660	SAND	FINAL LIFT	LOT 464	96
		6	643	395680.27	811874.70	U2	1660	SAND			97
		7	644	395673.68	811889.75	U2	1660	SAND	FINAL LIFT	LOT 463	104
		8	645	395685.10	811895.79	U2	1660	SAND			97
		9	646	395678.12	811912.99	U2	1660	SAND	FINAL LIFT	LOT 462	97
		10	647	395666.56	811908.02	U2	1660	SAND			99

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Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction Retest
		11	648	395661.51	811924.45	U2	1660	SAND	FINAL LIFT	LOT 461	95
		12	649	395671.72	811930.10	U2	1660	SAND			97
		13	650	395664.06	811945.82	U2	1660	SAND	FINAL LIFT	LOT 460	97
		14	651	395653.72	811941.52	U2	1660	SAND			97
		15	652	395646.85	811959.08	U2	1660	SAND	FINAL LIFT	LOT 459	97
		16	653	395657.05	811963.56	U2	1660	SAND			99
		17	654	395650.87	811983.34	U2	1660	SAND	FINAL LIFT	LOT 458	99
		18	655	395638.83	811979.40	U2	1660	SAND			100
		19	656	395649.31	811999.03	U2	1660	SAND	FINAL LIFT	LOT 457	98
		20	657	395634.79	812007.10	U2	1660	SAND			100
6/08/2019	1912/19	1	777	395720.73	811926.99	U2	2320	PIT RUN	Lift 4	Lot 467	97
		2	778	395707.82	811922.34	U2	2320	PIT RUN			95
		3	779	395715.33	811904.88	U2	2320	PIT RUN	Lift 4	Lot 466	98
		4	780	395727.61	811910.17	U2	2320	PIT RUN			97
		5	781	395734.27	811894.04	U2	2320	PIT RUN	Lift 4	Lot 465	98
		6	782	395720.59	811888.60	U2	2320	PIT RUN			97
8/07/2020	KB20/0208	1	873	395676.94	812013.26	U2	2320	PIT RUN	Lift 3	Lot 472	98
		2	874	395680.16	811992.74	U2	2320	PIT RUN		Lot 471	97
		3	875	395684.60	811971.31	U2	2320	PIT RUN		Lot 470	97
		4	876	395691.03	811957.38	U2	2320	PIT RUN		Lot 469	98
		5	877	395697.46	811941.00	U2	2320	PIT RUN		Lot 468	97
		6	878	395716.75	811939.62	U2	2320	PIT RUN		Lot 468	98
		7	879	395710.16	811956.62	U2	2320	PIT RUN		Lot 469	100
		8	880	395702.66	811972.23	U2	2320	PIT RUN		Lot 470	98
		9	881	395697.61	811985.70	U2	2320	PIT RUN		Lot 471	98
		10	882	395689.34	812004.22	U2	2320	PIT RUN	Lift 3	Lot 472	99
8/07/2020	KB20/0212	1	883	395676.94	812013.26	U2	2320	PIT RUN	Lift 4	Lot 472	98
		2	884	395680.16	811992.74	U2	2320	PIT RUN		Lot 471	98
		3	885	395684.60	811971.31	U2	2320	PIT RUN		Lot 470	99
		4	886	395691.03	811957.38	U2	2320	PIT RUN		Lot 469	101
		5	887	395697.46	811941.00	U2	2320	PIT RUN		Lot 468	99

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Date	Test ID#	Test #	Unique ID#	mE	mN	Stage	MDD	Type	Lift #	Lot ID	Compaction	Retest
		6	888	395716.75	811939.62	U2	2320	PIT RUN		Lot 468	97	
		7	889	395710.16	811956.62	U2	2320	PIT RUN		Lot 469	99	
		8	890	395702.66	811972.23	U2	2320	PIT RUN		Lot 470	101	
		9	891	395697.61	811985.70	U2	2320	PIT RUN		Lot 471	97	
		10	892	395689.34	812004.22	U2	2320	PIT RUN	Lift 4	Lot 472	101	
24/06/2020	KB20/0189	1	893	395714.40	811944.30	U2	2320	PIT RUN	Lift 1	Lot 468	95	
		2	894	395707.47	811960.97	U2	2320	PIT RUN		Lot 469	96	
		3	895	395700.73	811975.70	U2	2320	PIT RUN		Lot 470	96	
		4	896	395695.39	811990.73	U2	2320	PIT RUN		Lot 471	97	
		5	897	395687.64	812009.55	U2	2320	PIT RUN		Lot 472	95	
		6	898	395678.07	812005.63	U2	2320	PIT RUN		Lot 472	97	
		7	899	395682.00	811985.49	U2	2320	PIT RUN		Lot 471	98	
		8	900	395687.08	811967.91	U2	2320	PIT RUN		Lot 470	95	
		9	901	395692.70	811953.51	U2	2320	PIT RUN		Lot 469	98	
		10	902	395698.79	811937.60	U2	2320	PIT RUN	Lift 1	Lot 468	97	
2/07/2020	KB20/0202	1	903	395678.56	812017.49	U2	2320	PIT RUN	Lift 4	Lot 472	98	
		2	904	395683.81	811993.42	U2	2320	PIT RUN		Lot 471	96	
		3	905	395690.61	811974.26	U2	2320	PIT RUN		Lot 470	98	
		4	906	395696.34	811960.84	U2	2320	PIT RUN		Lot 469	97	
		5	907	395703.20	811943.83	U2	2320	PIT RUN		Lot 468	98	
		6	908	395703.47	811934.37	U2	2320	PIT RUN		Lot 468	97	Retest 3034/19
		7	909	395694.07	811948.94	U2	2320	PIT RUN		Lot 469	97	Retest .3034/19
		8	910	395687.90	811964.60	U2	2320	PIT RUN		Lot 470	97	Retest 3026/19
		9	911	395681.45	811980.80	U2	2320	PIT RUN		Lot 471	97	Retest 3034/19
		10	912	395678.07	812005.63	U2	2320	PIT RUN	Lift 4	Lot 472	97	
		4	515	395734.70	811899.49	U2	2320	PIT RUN			98	

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