

# Geotechnical Report

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The Kaikoura Trustee Company  
1516 State Highway 1, Mangamaunu

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October 2021

Issue 01

Our Ref: 7945

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Issue	Date	Detail	Author	Reviewed	Approved
01	18/10/21	Issued to client	TH	RE	RE

## 1 Summary

Smart Alliances Ltd have carried out a geotechnical appraisal of the proposed subdivision at 1516 State Highway 1, Mangamaunu for the Kaikoura Trustee Company (Client). It is considered that the site is suitable for the proposed residential subdivision, provided that all recommendations outlined herein are adhered to.

A review of the geological maps and the results of the site investigation completed, indicates that the site is underlain by Pleistocene to Holocene river and Holocene aged shoreline deposits.

The Hope Fault (seaward) is located to the north of the subject site of the site. A visual inspection of the proposed new allotment found no land damage that could be associated with the November 14 2016 earthquake and the land is considered stable in its present form, there was no sign of recent active instability, soil creep or slumping and not evidence of fault splay or near fault deformation found on the property. The proposed building site is located outside of the identified fault avoidance zone

Given that the subsoil profile is dominated by gravels at depth we do not consider the subsoils at the site to be susceptible to liquefaction or lateral spread.

We have completed site specific shallow geotechnical testing for a potentially developable area within the proposed new allotment. It is considered that the proposed building site is suitable for the proposed residential development. It is considered that the proposed building site is suitable for the proposed residential development and for construction on conventional foundations designed and constructed in accordance with NZS 3604:2011 at a minimum depth of 200 - 1150mm below ground level. Alternatively, foundation systems can be engineer designed with reference to the attached test results.

Should a building consent be lodged for a residential development on the remaining site in the future, standard site specific shallow geotechnical testing and analysis should be carried out once building plans are formed.

Flood hazard is addressed by Environment Canterbury in their flood hazard assessments completed based on flood hazard models put together through Lidar satellite imagery. At the time of building consent lodgement within any of the proposed Lots, one of these flood hazard assessments should be carried out to determine a suitable finished floor level for any new habitable buildings proposed for the property.

An on-site wastewater management system would be required for the proposed new allotment. A site and soil evaluation to AS/NZS1547:2012 has been carried out to assess the suitability of the site for wastewater disposal. Sufficient area is available for the disposal and to meet the minimum setback distances of 20m from open water courses and a vertical setback of 1m from the expected groundwater level. Suitable systems would include Primary Treatment Units (minimum 5,000 litre capacity with outlet filter) with dose loading to a Discharge Control Bed (with 600mm of sand fill media) or alternatively, a secondary treatment unit with disposal to drip lines. Sizing of the potential system and disposal area will be dependent on the number of occupants / bedrooms of any potential future dwelling and the design, in accordance with AS/NZS1547:2012, should be finalised at Building Consent stage.

General recommendations relating to access, excavation, filling, removal of vegetation and stormwater area provided.

## 2 Introduction

The Client proposes the subdivision of their property at 1516 State Highway 1, Mangamaunu (PT Lot 1 DP 1033). The proposal involves the subdivision of the 4387m<sup>2</sup> property into two allotments, with Lot 1 being 2440m<sup>2</sup> and Lot 2 being 1947m<sup>2</sup>. A site plan showing the approximate layout of the subdivision is attached in Appendix A.

The purpose of this report is to present the results of the site investigations undertaken on the 15 July 2021, in relation to geotechnical considerations for the proposed subdivision.

## 3 Location & Site Description

The subject property is located along State Highway 1, approximately thirteen kilometres north-east of the Kaikoura Township. The site is positioned between State Highway 1 and the Main North Line Railway. The property is an approximate rectangular shape and is orientated northeast – southwest.

The site is currently accessed directly from State Highway 1, via a driveway from the south-western boundary. An existing dwelling is located along the eastern boundary, in the southern portion of the site.

The topography of the site is relatively flat. The Pacific Ocean is located approximately 50m to the south-east of the site. An existing stream and stormwater channel is located to the south-west and north-east, respectively.

The proposed allotment boundary is located to the north-east of the existing dwelling (see appendix A). The access to the proposed new allotments will be via State Highway 1, at the boundary between the allotments. A potential building site was identified adjacent to the proposed new allotment boundary.

The site is well vegetated with trees, dense shrubs and grasses.

Photographs of the site are presented below.



Figure 1: Photograph looking north-east towards the new allotment, with tree and fence line forming the approximate boundary.





Figure 2: Photograph looking north across the proposed new allotment with proposed new build site in foreground.



Figure 3: Photograph looking south across the proposed new allotment.



Figure 4: Photograph looking north-west towards the proposed access of the new allotment.

## 4 Geological Setting

The Kaikoura peninsula is an outcrop extending in excess of four kilometres from the main eastern coastline of New Zealand. It consists of a number of marine terraces that were formed as the land was uplifted and tilted through tectonic processes. The dominant basement geology is sandstone (greywacke) and mudstone (argillite) aging in the region of 135 to 195 million years. Overlying this are tertiary aged limestones and siltstones covered with windblown silts (loess) and more recent alluvial and marine deposits in lower lying areas.

The geological map for the area (Rattenbury *et al.* 2006 and the GNS Science New Zealand Geology Web Map (1:250k)) indicates that the subject site is predominantly underlain by Undifferentiated Pleistocene to Holocene aged river deposits and Holocene aged shoreline deposits. The river deposits typically comprise poorly sorted gravels forming alluvial fans and colluvial deposits, while the shoreline deposits comprise marine gravels with sands and mud. The shoreline deposits typically form a narrow strip along much of the coast

The Kaikoura area is a highly tectonically active region and is part of what is commonly known as the Marlborough Fault Zone which includes at least 8 active faults capable of generating a Magnitude 7 or greater earthquake. The closest known fault, the Hope Fault (seaward) is located in north of the subject property boundary. The identified Kaikoura District fault avoidance zone is located along the northern boundary of the site.

Large earthquakes have occurred post European settlement, namely the 1848 M7.5 Marlborough earthquake and the 1888 M7.0-7.3 North Canterbury earthquake. However, these events did not generate the level of earthquake shaking and resulting damage within the Kaikoura region than that experienced from the 2016 M7.8 Kaikoura earthquake. The majority of damage to buildings in the area was shaking related or from differential settlement of older style foundations. No land damage resulting from this event was noted within the proposed new allotment site.

## 5 Geotechnical Assessment

A geotechnical assessment of the property was conducted, which included the visual assessment of the property together with invasive testing. A total of eight Scala Penetrometer tests, one hand dug test pit, and two machine excavated test pits were conducted within a nominal building platform for the new allotment. This was to determine the bearing capacity and the strata of the underlying soils. The locations of the testing positions are indicated on the attached site plan in Appendix A.

The results of the intrusive testing indicated a consistent soil profile across the site, with a general profile of:

- |              |  |
|--------------|--|
| 0.00 – 0.05m | Silty CLAY with organics; dark brown; soft to very soft; moist; low plasticity. Topsoil.   |
| 0.05 – 0.90m | Clayey SAND; light yellow brown; medium dense; moist; sand, fine to medium grained, clay, low plasticity. Colluvial / Alluvial.          |
| 0.90 – 1.60m | Gravelly SAND with cobbles; dark grey; loose; moist; sand, fine to coarse grained; gravel, subrounded, fine to coarse grained. Alluvial. |

The results of the intrusive testing indicate that the subsoil geology is consistent with the expected geology for the site. No groundwater was intersected during the on-site testing. A copy of the test pit logs have been included in Appendix B.

Fill material was noted along the eastern boundary of the site. the fill consisted of subangular gravels intermixed with clayey sand and extended to depths of 100 – 300mm before giving way to clayey SAND, consistent with the profile noted in the excavated test pits above. The fill material is likely associated with the railway line adjacent to the eastern boundary.

A potential building site was identified to the north-east of the proposed new property boundary (see Appendix A). This allows for suitable access from the new proposed property access point.

### 5.1 Land Stability

A visual inspection of the proposed new allotment site found no land damage that could be associated with the November 14, 2016 earthquake and the property is considered stable in its present form. There was no evidence of fault splay or near fault deformation found at the site. The identified Kaikoura Fault Avoidance Zone for the Hope Fault (seaward) is located along the western boundary of the site. This follows an approximate east-northeast orientation. The proposed build site falls outside of the identified avoidance zone.

Liquefaction is the loss of soil strength and stiffness during earthquake shaking events where the pore water pressures in the soil rise quicker than the soil can drain. Liquefaction is more frequently observed in geologically young (Holocene aged deposits), saturated and loose granular soils. Given the general age and nature of the subsoils encountered on the site, the risk of liquefaction is considered low for the subject site.

### 5.2 Foundation Requirements for Proposed New Allotment

The potential building site for the new allotment is located immediately northwards of the proposed new boundary (see Appendix A). A photograph of the potentially developable area is shown in Figure 2 above.



A total of eight Scala Penetrometer tests, labelled PT1 to PT8, were conducted on the site to assess the ground conditions. The test locations are indicated on the attached site plan in Appendix A.

The results were interpreted using the procedure presented by MJ Stockwell in 'Determination of Allowable Bearing Pressure Under Small Structures' – NZ Engineering, June 1977. The testing indicated that the subsoil profile exhibited a soil bearing resistance of 300kPa (ultimate bearing capacity) at depths of between 200 – 1150mm below ground level. Soil bearing resistance of 200kPa (ultimate bearing capacity) was generally achieved from depths of 150mm below ground level. A full set of the Scala Penetrometer results is attached as Appendix C.

A typical topsoil depth of 50 – 300mm was encountered on the site.

On the basis of the foregoing, it is considered that the proposed building site is suitable for the proposed residential development and for construction on conventional foundations designed and constructed in accordance with NZS 3604:2011 at a minimum depth of 200 - 1150mm below ground level. Alternatively, foundation systems can be engineer designed with reference to the attached test results.

Potential foundations may include, but not limited to, raft type foundations or pole foundations.

Future foundations may be sited in close proximity to the identified fill material along the eastern boundary of the site. Should fill material be encountered, it is recommended that all fill material be removed and replaced with suitably compacted hardfill up to the proposed build height. It is further recommended that excavations be inspected by a Chartered Professional Engineer to confirm bearing and the absence of fill material.

## **6 Access**

Access to the existing dwelling is provided via an unsealed driveway directly off State Highway 1, along the south-western boundary of the site. The existing access is considered suitable to provide year-round access to the dwelling.

New access is proposed along the western boundary, at the boundary between the proposed allotments. Access to the proposed building platform on the new allotment is currently provided via the existing driveway. It is recommended that all topsoil material (approximately 300mm) be excavated from the proposed new access footprint and replaced with suitably compacted A65 material, or equivalent, to create a surface for vehicles to pass over.

## **7 Excavation, Filling and Removal of Vegetation**

Given the topography of the proposed allotment, it is not expected that significant earthworks will be required to form a suitable building platform.

The excavation on site is likely to require the removal of shrubs, grasses and limited trees, depending upon the final layout. This removal of vegetation is not likely to cause stability issues provided best management practices are adhered to.

Earthworks to be undertaken on the property are expected to include:

- Excavation for proposed dwelling foundations.
- Trenching of water, power and telecom services.
- Trenching of the stormwater disposal.

- Trenching of the wastewater disposal and treatment system.

A number of general recommendations and mitigation measures should be incorporated into the proposed site development. These are outlined as follows:

- Structural fill areas should be designed by an engineer.
- Any exposed surfaces should be retained or planted as soon as possible after excavation.
- Batter slopes over 600mm high, not retained by a structure should be sloped at 1V:1.5H and the slope protected by geo-fabric to sustain plant growth.
- Batter slopes over 2.0m high should have a 1m wide bench mid height of the batter slope.
- All retaining walls with a height over 1500mm, or those with a surcharge applied to it, are to be designed and monitored by a Chartered Professional Engineer.
- Filter cloths to be laid behind any retaining structure.

Stormwater control should be managed appropriately directing water away from exposed soils and ensuring silt and soil are not transported away from the building area.

It is important that all workers, builders and contractors fully recognise the requirements and recommendations outlined in this report prior to undertaking any works. Any excavations which are not covered in this report should only be carried out in consultation with a Professional Chartered Engineer.

Provided the recommendations outlined above are adhered to then we consider the site suitable for the proposed excavation and filling.

## **8 Stormwater**

Stormwater from roof and hardstand areas could be conveyed directly to the existing open channels / swales to the north-east of the proposed build site. Some protection of the open drainage channel may be required to prevent any scour of the channel at the discharge points. Consideration can also be given to a ground soakage system, such as that utilised in a soak pit. Any soak pit design will need to take into account the drainage of the soils and the groundwater level within the proposed allotment.

Some protection of the existing stormwater network from silt run-off will be required during any excavations relating to the building construction. The contractor shall ensure that suitable silt protection is provided to trap silt before entry into the property drains or the roadside stormwater network.

## **9 On-Site Wastewater Management**

As no reticulated wastewater network is available in the area, all wastewater generated from any future dwelling will need to be managed and treated by a suitable on-site wastewater management system. The proposed new allotment was assessed to determine the site suitability for on-site wastewater disposal. The site has been assessed according to the relevant New Zealand Standard for On-site Domestic Wastewater Management (AS/NZS1547:2012) and the Canterbury Land and Water Regional Plan Volume 1 by Environment Canterbury.

## 9.1 Site and Soil Evaluation

The site was assessed by means of a desktop review of the available information, a visual assessment of the site and the intrusive investigation by means of both hand and machine-excavated test pits. The general site topography of the proposed allotment is relatively flat. The site is densely vegetated with grasses, trees and shrubs, and is exposed to sun and wind to allow for adequate evapotranspiration to occur.

Potential Land Application Areas (LAA's) were identified in the open grassed area to the north of the proposed build site. The area is relatively flat, well vegetated and exposed to sun and wind.

A hand dug test pit and two machine-excavated test pits were put down on site. The profiles of the auger and test pits are outlined in Section 5 and the full logs are presented in Appendix B. The subsoil profile consists of 250 – 300mm of topsoil overlying clayey sand and gravelly sand. The soils encountered on site correspond to a Category 2 soil, as per the soil category classifications provided in AS/NZS1547:2012. No groundwater was encountered during the subsurface investigation and no mottling was noted that would indicate the historical presence of groundwater or trapped surface water.

### 9.1.1 Assessment of Site Constraints

No known boreholes are located within the immediate vicinity of the potential LAA.

No groundwater was encountered during the intrusive investigation up to 1.6m below the ground level.

A stormwater channel is located to the north-east of the building site and potential LAA, while the Pacific Ocean is located to the east. Sufficient area is available to maintain 20m from open water bodies.

The ponding of effluent is unlikely provided the LAA is sized appropriately.

The potential LAA is currently in an open area and is densely vegetated with grass and shrubs and is well exposed to wind and sun.

## 9.2 Wastewater System Design

The results of the site and soil evaluation indicated that the site is suitable for the on-site disposal of wastewater given the site constraints and the soil conditions.

Sufficient area is available for the disposal and to meet the minimum setback distances of 20m from open water courses and a vertical setback of 1m from the expected groundwater level.

Suitable systems would include Primary Treatment Units (minimum 5,000 litre capacity with outlet filter) with dose loading to a Discharge Control Bed (with 600mm of sand fill media) or alternatively, a secondary treatment unit with disposal to drip lines. Sizing of the potential system and disposal area will be dependent on the number of occupants / bedrooms of any potential future dwelling and the design, in accordance with AS/NZS1547:2012, should be finalised at Building Consent stage.

As the proposed allotment will be less than 4 hectares, the potential wastewater management system would not satisfy the permitted activity conditions under Rule 5.8 of the proposed Land and Water Regional Plan (LWRP) and a resource consent with Environment Canterbury for the discharge would be required.

## **10 Addressing Section 106 of the RMA (1991)**

Section 106 of the RMA requires an assessment of a subdivision proposal in regard to the risk of natural hazards to the property concerned. In 2017 the natural hazards to be assessed were broadened to include:

'Any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.'

The relevant natural hazards to this proposal are:

Earthquake and subsidence - Being dominated by gravels at depth, we do not consider the subsoils at the site to be susceptible to liquefaction or lateral spreading.

The Hope Fault (seaward) is located northwards of the property. The subject property is located outside of the identified Kaikoura Fault Hazard Avoidance zone.

Site specific shallow geotechnical testing has been carried out for the potentially developable area within the proposed new allotment. The recommendations outlined in Section 5 are considered suitable to support a building consent application provided it is lodged within 3 years of the date on this report.

Should a building consent be lodged for a residential development on the remaining site in the future, standard site specific shallow geotechnical testing and analysis should be carried out once building plans are formed.

Flooding – Environment Canterbury complete flood hazard assessments based on their flood hazard models put together through Lidar satellite imagery. At the time of building consent lodgement one of these flood hazard assessments should be carried out to determine a suitable finished floor level.

The risk from the other natural hazards outlined above are considered to either be non-applicable or less than minor due to the location, geology and topography of the site

## **11 Conclusions**

Based on the above assessment completed by Smart Alliances Ltd, it is considered that the site is suitable for the proposed subdivision, and for residential development provided that all recommendations outlined herein are adhered to.

The conclusions and recommendations reported are based on a visual appraisal of the site and subsurface tests obtained from hand operated penetrometer, auger test equipment and machine-excavated test pits to meet the requirements of the clients brief. No site-specific Cone Penetrometer Testing (CPT's) or sampling and analysis of laboratory data was carried out and this report does not assert to completely quantify and qualify all the site geotechnical properties.

Although the opinions expressed in this report are based on the interpolation and extrapolation between the test locations, no guarantee as to the validity of this inference or the nature and continuity of the subsurface materials can be made, and the possibility that variation from the assumed conditions between the test locations may occur cannot be ruled out. If substantial variation between the assumed conditions expressed in this report is encountered, then it is recommended that Smart Alliances be consulted in order



to establish whether any revisions to the recommendations for the proposed development should be adopted.

## 12 Limitations

This report has been prepared for The Kaikoura Trustee Company (our Clients) with respect to geotechnical investigations relating to the proposed subdivision at 1516 State Highway 1, Mangamaunu. The report is valid for a period of three years from the dates of issue. The reliance by other parties on the information or opinions in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

The recommendations expressed herein have been prepared with respect to the proposed residential developments at the site and should not be taken out of context.

### SMART ALLIANCES LTD



**Tyrell Hayes**  
Geotechnical Engineer

### SMART ALLIANCES LTD



**Richard Evans**  
Chartered Professional Engineer

## 13 References

References used in compiling this report:

1. Rattenbury, M.S., Townsend, D.B., and Johnston, M.R. (compilers) 2006. *Geology of the Kaikoura area*. Institute of Geological & Nuclear Sciences 1:250 000 Geological Map 13. 1 Sheet + 70p. Lower Hutt, New Zealand.
2. Guideline for the Field Classification and Description of Soils and Rock for Engineering Purposes NZ Geotechnical Society Inc December. 2005.
3. Yetton, M.D. and McCahon, I.F., June 2009: Earthquake Hazard Assessment for Kaikoura. Environment Canterbury Report R09/31 ISBN 978-1-86937-960-5
4. Barrell, D. J. A. 2014. General distribution and characteristics of active faults and folds in the Kaikoura District, North Canterbury, *GNS Science Consultancy Report* 2014/210. 59 p.
5. Litchfield, N.J., Morgenstern, R., Van Dissen, R.J., Langridge, R.M. Pettinga, J.R., Jack, H., Barrell, D.J.A and Villamor, P. 2019. Updated assessment of active faults in the Kaikoura District. *GNS Science Consultancy Report* 2018/141. 71p.
6. US Geotechnical Extreme Events Reconnaissance (GEER) Association, 10 June 2017. General Reconnaissance of the Mw7.8 2016 Kaikoura New Zealand Earthquake, Version 1.0
7. Golder Associates (NZ) Ltd, 17 September 2019. Liquefaction Study for Kaikoura District, 1894330\_7407-003-R-Rev2

**Appendix A:**  
Drawings





**Property Information**  
 Address: 1516 State Highway 1, Mangamaunu  
 Legal Description: PT LOT 1 DP 1033

**Legend**  
 ▲ Penetrometer Test Location  
 ▣ Test Pit Location

**1**  
 C01  
**SITE PLAN**  
 Scale 1 : 800

Do not scale from this drawing.  
 Verify all dimensions on site prior to construction.

REV	DATE	DESCRIPTION
01	18/10/21	REPORT

**smartalliances**  
 ENGINEERING / RESOURCE MANAGEMENT / ARCHITECTURE LTD  
 1st Floor, Riverview House, 10 High Street, Blenheim, New Zealand  
 Website - www.smartalliances.co.nz  
 Phone - 03 579 6211

PROJECT  
**1516 STATE HIGHWAY 1  
 MANGAMAUNU**  
 CLIENT  
**THE KAIKOURA TRUSTEE  
 COMPANY**

DRAWING  
**SITE PLAN**  
 ORIGIN DATE  
 18/10/21

STATUS	
<b>REPORT</b>	
DESIGNED	SCALE (A3) 1 : 800
DRAWN	REVISION DATE 18/10/21
APPROVED	DWG NO. REVISION
RE	<b>7945-C01 01</b>





Note: All boundaries and areas are subject to Resource Consent approval  
A denotes Right of Way appt to Lot 2  
B denotes Right of Way appt to Lot 1

PREPARED BY:  
GILBERT, HAYMES & ASSOCIATES LTD  
REGISTERED PROFESSIONAL SURVEYORS  
P.O. BOX 380 - 181 HIGH STREET - BLENHEIM  
PHONE (03)5787984 - FAX (03)5787709  
E-MAIL [office@gilberthaymes.co.nz](mailto:office@gilberthaymes.co.nz)

PROPOSED SUBDN OF PT LOT 1 DP 1033  
1516 State Highway No. 1, Kaikoura


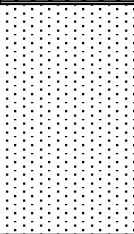
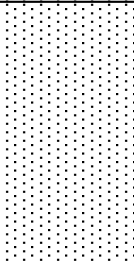
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DATE 1 MARCH 2021	
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CAD FILE	



**Appendix B:**  
Auger and Test Pit Profiles

**Client:** The Kaikoura Trustee Company  
**Project:** Proposed Subdivision  
**Site:** 1516 State Highway 1, Mangamaunu

**Date:** 15-Jul-21  
**Logged by:** TH  
**Project No:** 7945  
**Site No:** TP1

Horizon	Description	Depth (m)	Graphic Log	Comments
A	Silty CLAY; dark brown; soft to very soft; moist; low plasticity.			Topsoil
B	Clayey SAND; light yellow brown; homogenous; medium dense; moist; sand, fine to medium grained; clay, low plasticity.	0.50		Alluvial / Colluvial
C	Gravelly SAND with cobbles; dark grey; loose; moist; sand, fine to coarse grained; gravels, subrounded fine to coarse grained.	1.0 1.5		Alluvial
	Test Pit Terminated at 1.60m.	2.0 2.5 3.0		

**Notes:**

1. Weather overcast.
2. Minor collapse of sidewall in horizon C.
3. No Groundwater Encountered.

**Symbols:** Main Soil Type:    Organic    Fill    Gravel    Sand    Silt    Clay

Graphic:





**Client:** The Kaikoura Trustee Company  
**Project:** Proposed Subdivision  
**Site:** 1516 State Highway 1, Mangamaunu

**Date:** 15-Jul-21  
**Logged by:** TH  
**Project No:** 7945  
**Site No:** TP1



- Notes:**
1. Weather Overcast.
  2. Minor collapse of sidewall of horizon C.
  3. No Groundwater Encountered.


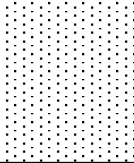
**Symbols:** Main Soil Type:    Organic    Fill    Gravel    Sand    Silt    Clay

Graphic:



**Client:** The Kaikoura Trustee Company  
**Project:** Proposed Subdivision  
**Site:** 1516 State Highway 1, Mangamaunu

**Date:** 15-Jul-21  
**Logged by:** TH  
**Project No:** 7945  
**Site No:** TP2

Horizon	Description	Depth (m)	Graphic Log	Comments
A	Silty CLAY; dark brown; soft to very soft; moist; low plasticity.			Topsoil
B1	Clayey SAND; light yellow brown; homogenous; loose; moist; sand, fine to medium grained; clay, low plasticity.	0.50		Alluvial / Colluvial
B2	Clayey SAND with gravels; dark grey to black with yellow brown; loose; moist; sand, fine to coarse. Intermixed.			
C	Gravelly SAND with cobbles; dark grey; loose; moist; sand, fine to coarse grained; gravels, subrounded fine to coarse grained.	1.0 1.5		
	Test Pit Terminated at 1.60m.	2.0 2.5 3.0		

- Notes:**
1. Weather Overcast.
  2. Minor collapse of sidewall in horizon D.
  3. No Groundwater Encountered.

**Symbols:** Main Soil Type: Organic    Fill    Gravel    Sand    Silt    Clay

Graphic:



**Client:** The Kaikoura Trustee Company  
**Project:** Proposed Subdivision  
**Site:** 1516 State Highway 1, Mangamaunu

**Date:** 15-Jul-21  
**Logged by:** TH  
**Project No:** 7945  
**Site No:** TP2



- Notes:**
1. Weather Overcast.
  2. Minor collapse of sidewall in horizon D.
  3. No Groundwater Encountered.

**Symbols:** Main Soil Type:    Organic    Fill    Gravel    Sand    Silt    Clay


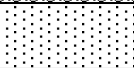
Graphic:





**Client:** The Kaikoura Trustee Company  
**Project:** Proposed Subdivision  
**Site:** 1516 State Highway 1, Mangamaunu

**Date:** 15-Jul-21  
**Logged by:** TH  
**Project No:** 7945  
**Site No:** TP3

Horizon	Description	Depth (m)	Graphic Log	Comments
A	Sandy CLAY; light yellow brown; medium dense; minor subangular gravels.			Topsoil
B	Gravelly sand; dark grey; loose; sand, fine to coarse; gravels, fine to coarse, subrounded.	0.50		Alluvial
	Test Pit Terminated at 0.50m.			
		1.0		
		1.5		
		2.0		
		2.5		
		3.0		

**Notes:**  
 1. Weather overcast.  
 2. No groundwater encountered.

**Symbols:** Main Soil Type: Organic Fill      Gravel      Sand      Silt      Clay

Graphic:



**Client:** The Kaikoura Trustee Company  
**Project:** Proposed Subdivision  
**Site:** 1516 State Highway 1, Mangamaunu

**Date:** 15-Jul-21  
**Logged by:** TH  
**Project No:** 7945  
**Site No:** TP3



- Notes:**
1. Weather overcast.
  2. No groundwater encountered.

**Symbols:** Main Soil Type:    Organic    Fill    Gravel    Sand    Silt    Clay

Graphic:



## **Appendix C:**

Scala Penetrometer Test Results



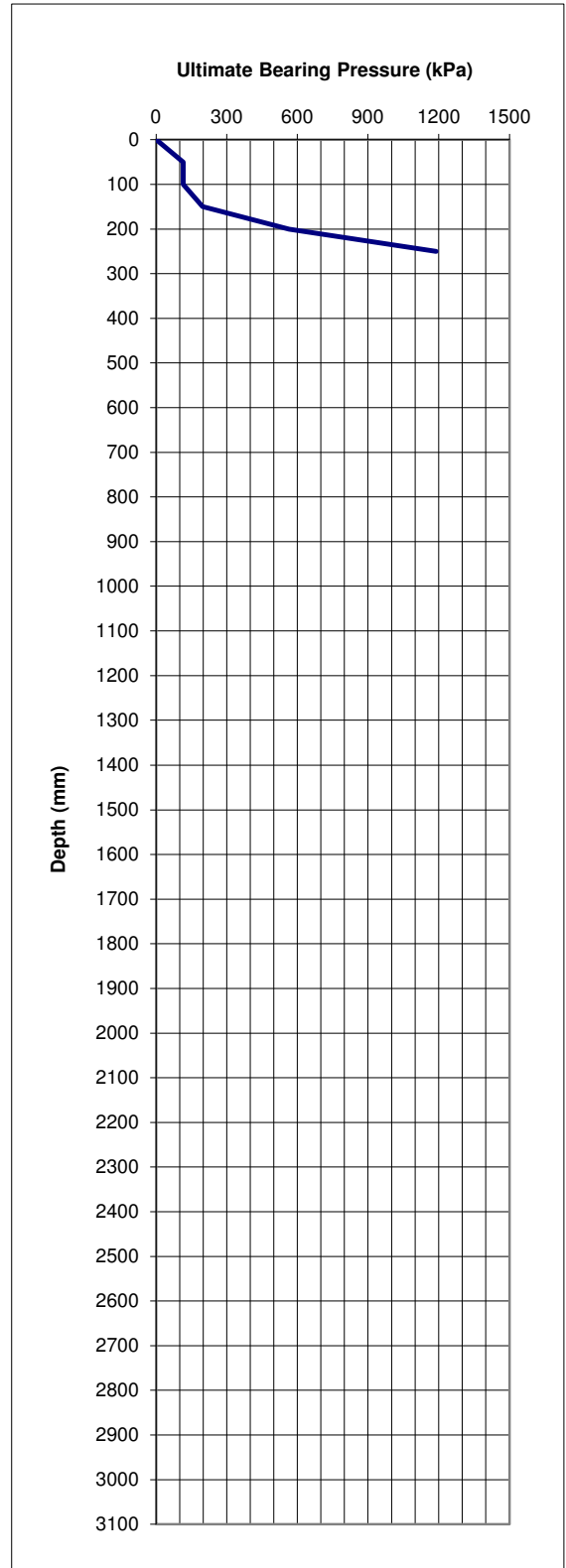
TEL 03 579 6211 FAX 03 579 6233  
 P.O. BOX 546 BLENHEIM NEW ZEALAND

<b>Project:</b>	1516 State Highway 1, Mangamaunu		
<b>Client:</b>	The Kaikoura Trustee Company		
<b>Ref:</b>	7945	<b>Eng:</b>	TH
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## PENETROMETER TEST RESULTS

Notes: PT1. No groundwater encountered.

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.5	100	115	50
0.5	100	115	100
1	50	198	150
4	13	565	200
10	5	1189	250



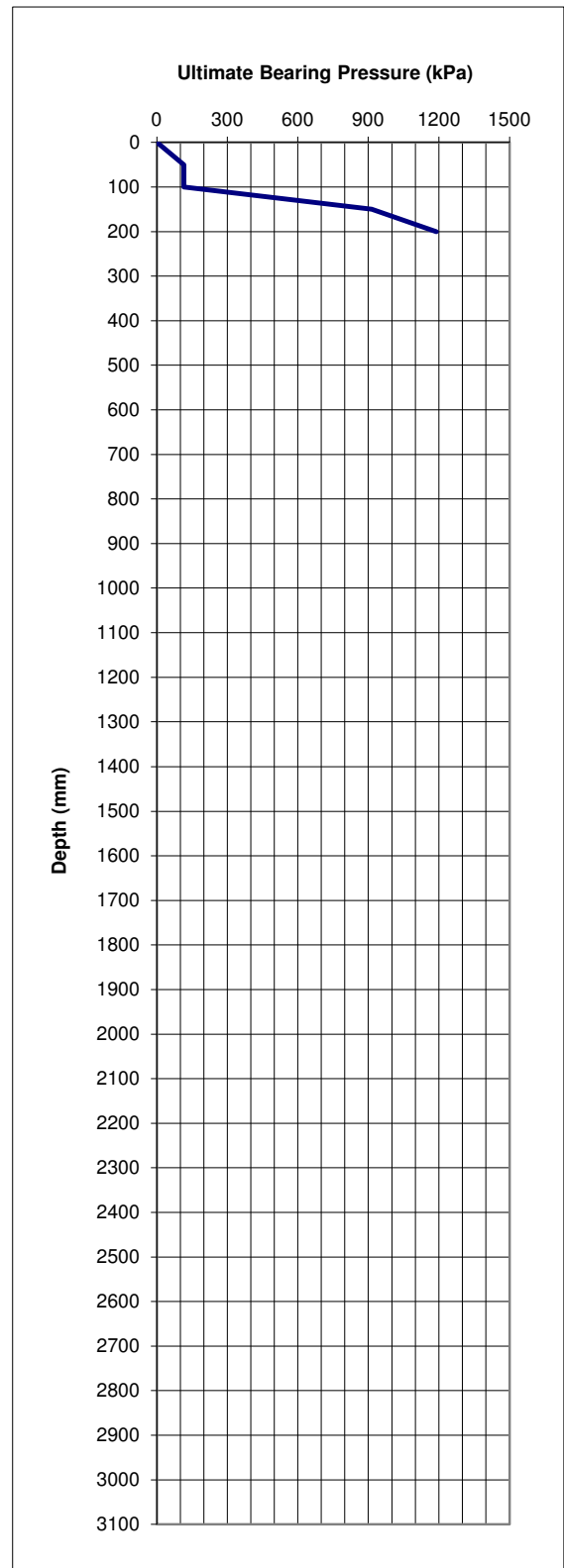


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## PENETROMETER TEST RESULTS

Notes: PT2. No groundwater encountered.

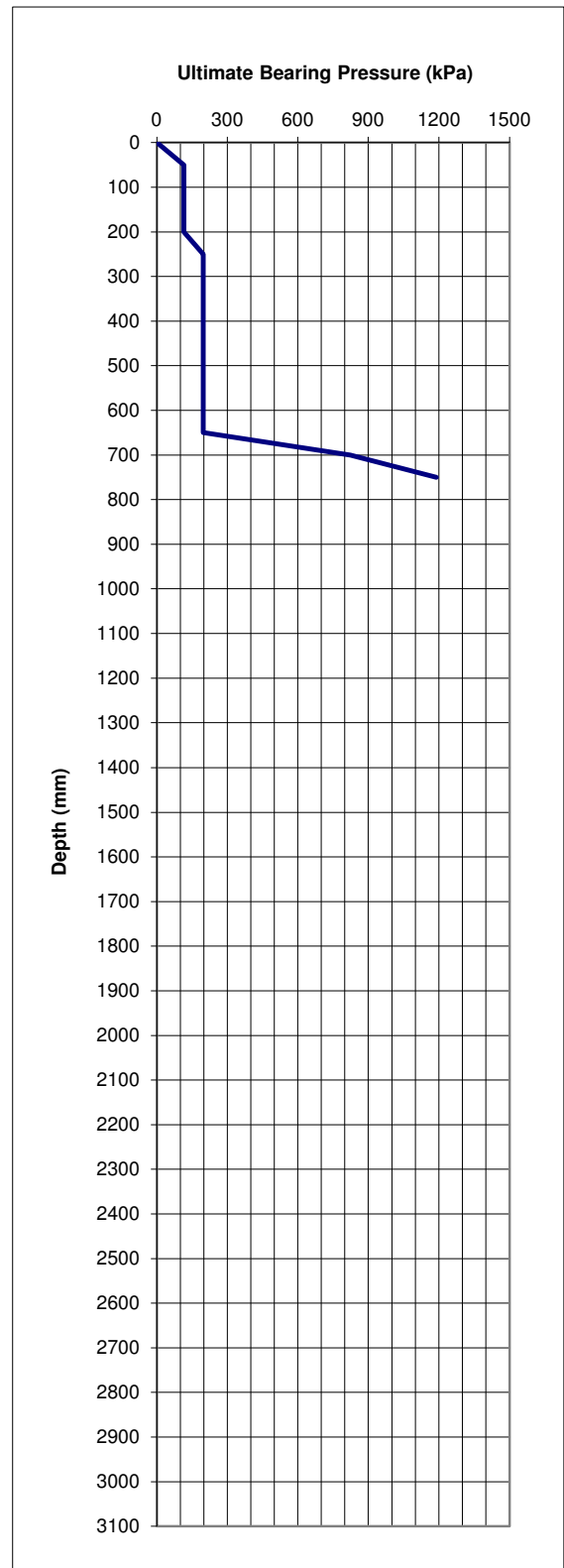
No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.5	100	115	50
0.5	100	115	100
7	7	915	150
10	5	1189	200



## PENETROMETER TEST RESULTS

Notes: PT3. No groundwater encountered.

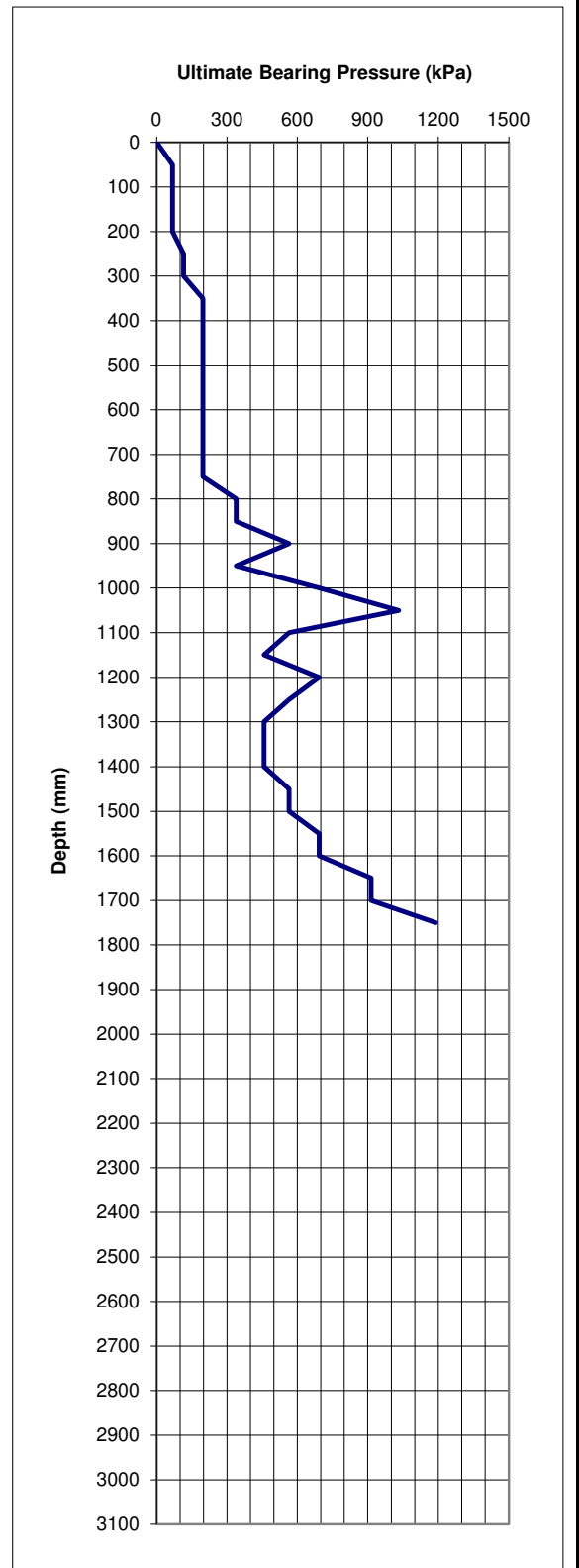
No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.5	100	115	50
0.5	100	115	100
0.5	100	115	150
0.5	100	115	200
1	50	198	250
1	50	198	300
1	50	198	350
1	50	198	400
1	50	198	450
1	50	198	500
1	50	198	550
1	50	198	600
1	50	198	650
6	8	824	700
10	5	1189	750



## PENETROMETER TEST RESULTS

Notes: PT4. No groundwater encountered.

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.25	200	67	50
0.25	200	67	100
0.25	200	67	150
0.25	200	67	200
0.5	100	115	250
0.5	100	115	300
1	50	198	350
1	50	198	400
1	50	198	450
1	50	198	500
1	50	198	550
1	50	198	600
1	50	198	650
1	50	198	700
1	50	198	750
2	25	339	800
2	25	339	850
4	13	565	900
2	25	339	950
5	10	693	1000
9	6	1031	1050
4	13	565	1100
3	17	458	1150
5	10	693	1200
4	13	565	1250
3	17	458	1300
3	17	458	1350
3	17	458	1400
4	13	565	1450
4	13	565	1500
5	10	693	1550
5	10	693	1600
7	7	915	1650
7	7	915	1700
10	5	1189	1750

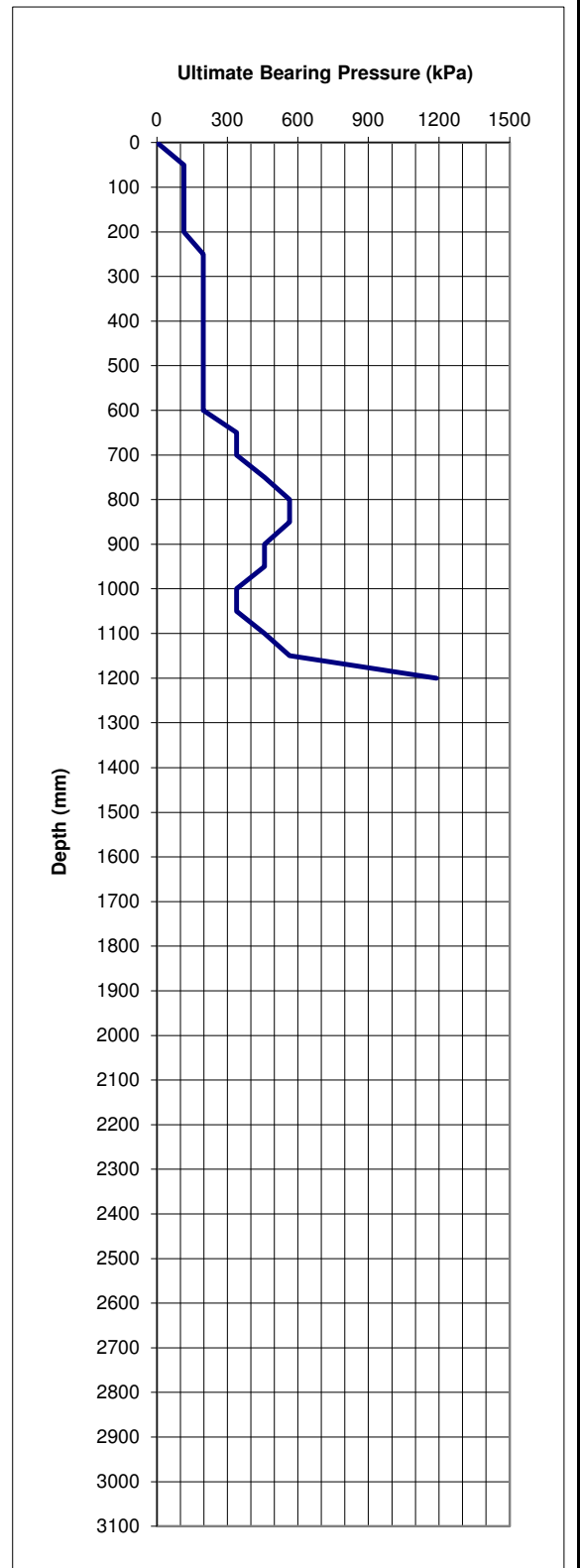


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## PENETROMETER TEST RESULTS

Notes: PT5. No groundwater encountered.

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.5	100	115	50
0.5	100	115	100
0.5	100	115	150
0.5	100	115	200
1	50	198	250
1	50	198	300
1	50	198	350
1	50	198	400
1	50	198	450
1	50	198	500
1	50	198	550
1	50	198	600
2	25	339	650
2	25	339	700
3	17	458	750
4	13	565	800
4	13	565	850
3	17	458	900
3	17	458	950
2	25	339	1000
2	25	339	1050
3	17	458	1100
4	13	565	1150
10	5	1189	1200

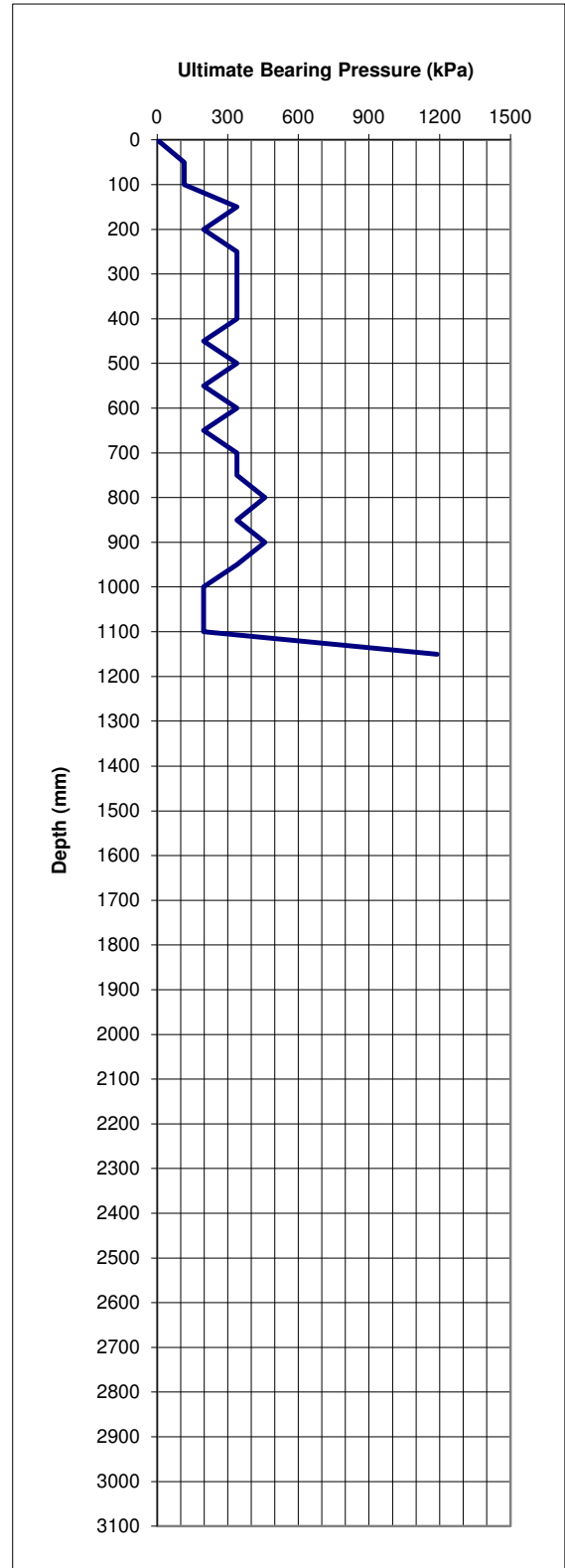


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## PENETROMETER TEST RESULTS

Notes: PT6. No groundwater encountered.

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.5	100	115	50
0.5	100	115	100
2	25	339	150
1	50	198	200
2	25	339	250
2	25	339	300
2	25	339	350
2	25	339	400
1	50	198	450
2	25	339	500
1	50	198	550
2	25	339	600
1	50	198	650
2	25	339	700
2	25	339	750
3	17	458	800
2	25	339	850
3	17	458	900
2	25	339	950
1	50	198	1000
1	50	198	1050
1	50	198	1100
10	5	1189	1150

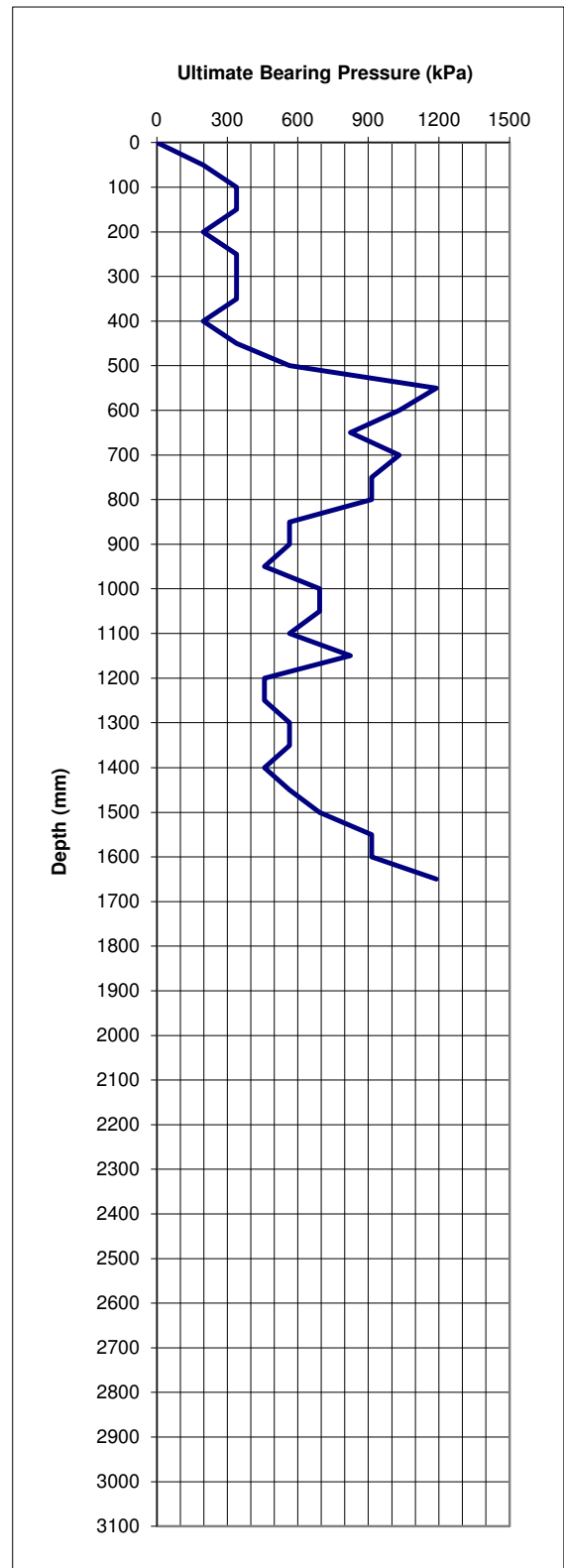


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## PENETROMETER TEST RESULTS

Notes: PT7. No groundwater encountered.

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
1	50	198	50
2	25	339	100
2	25	339	150
1	50	198	200
2	25	339	250
2	25	339	300
2	25	339	350
1	50	198	400
2	25	339	450
4	13	565	500
10	5	1189	550
8	6	1031	600
6	8	824	650
8	6	1031	700
7	7	915	750
7	7	915	800
4	13	565	850
4	13	565	900
3	17	458	950
5	10	693	1000
5	10	693	1050
4	13	565	1100
6	8	824	1150
3	17	458	1200
3	17	458	1250
4	13	565	1300
4	13	565	1350
3	17	458	1400
4	13	565	1450
5	10	693	1500
7	7	915	1550
7	7	915	1600
10	5	1189	1650



## PENETROMETER TEST RESULTS

Notes: PT8. No groundwater encountered.

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
0.5	100	115	50
0.5	100	115	100
3	17	458	150
3	17	458	200
5	10	693	250
2	25	339	300
10	5	1189	350

