REPORT

Tonkin+Taylor

Centennial Park Earthworks Geotechnical Completion Report

Stage 1 Lots 1 to 16 and 19 to 28

Prepared for
Wallace Development Company Ltd.
Prepared by
Tonkin & Taylor Ltd
Date
August 2020
Job Number
1004625.003.v7

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Document Control

Title: Centennial Park Earthworks Geotechnical Completion Report - Stage 1 Lots 1 to 16 and 19 to 28					
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Distribution:

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Table of contents

1 Introduction

1.1 Background

This report relates to earthworks areas associated with Lots 1 to 16 and 19 to 28 of the Stage 1 works of the Centennial Park Development in Palmerston North, undertaken between April 2019 and May 2020. The location and extents of the Stage 1 subdivision earthworks covered by this report are shown on the GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020, provided in Appendix A.

The Stage 1 earthworks consist of demolition of existing minor structures and minor cuts and fills (up to approximately 1.5m in height) to form level building platforms for sale.

Subdivision earthworks have been undertaken in accordance with Resource Consent SUB4799 – LU4821 (26 March 2019) to Wallace Development Company Limited, the subdivision developer.

1.2 Roles and responsibilities

- GHD designed the overall subdivision layout and were responsible for monitoring and administration of the earthworks (and subsequent civil works including services).
- Hoult Construction were the main contractor responsible for construction of the earthworks.
- Resonant undertook geotechnical quality control tests.
- Tonkin & Taylor Ltd (T+T) was engaged as geotechnical consultant to the project. Our scope of work is summarised in Section 1.5 below, and more fully described in T+T's letter of engagement dated 23 August 2018 (T+T Ref: 1004625.003).
- Specific engineering design will be required for all buildings in Stage 1, to be undertaken by a ***CPEng. Engineer***. This design will require input from a ***Geotechnical Engineer*** for all lots in Stage 1-West (yellow area in Figure 1.1), as discussed in Section 3.2.1. Input from a ***Geotechnical Engineer*** may also be required in some situations for lots in Stage 1-East (blue area in Figure 1.1), as discussed in Section 3.2.2.
- In this completion report, the term "***CPEng. Engineer***" refers to a Chartered Professional Engineer engaged by (or on behalf of) an individual lot owner, responsible for undertaking specific engineering design of a particular building on a particular site. This will typically include specification of foundation and superstructure details for Building Consent, and accompanying Producer Statements PS1 (Design) and PS4 (Construction Review). This engineer will typically have primary competence in structural or general civil engineering design, with no specific competence in geotechnical engineering. This engineer is responsible for recognising any matters which are outside their expertise (e.g. specialist geotechnical assessment) and seeking any specialist input needed.
- In this completion report, the term "***Geotechnical Engineer***" refers to a Chartered Professional Engineer with competence in geotechnical engineering engaged by (or on behalf of) an individual lot owner. This engineer is responsible for providing specialist geotechnical input to help inform the ***CPEng. Engineer*** undertaking building design.

1.3 Content of report

This report provides T+T's statement of suitability for the earth fill for subdivision Lots 1 to 16 and 19 to 28 as shown on GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020. These drawings are attached for reference in Appendix A.

It also includes an assessment of cuts and fills undertaken as part of the Stage 1 earthworks relative to the Resource Consent conditions, Drawings and Specification.

1.4 Limitations of report

This report relates only to the extent of earth fill that T+T has been directly engaged to assess (the Stage 1 earthworks, Residential platforms only, as shown on GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020. Earthworks outside residential platforms, such as local excavations within the road reserve, construction of the retaining walls or excavation and backfilling of services trenches, is not included in this report.

This report relates to the general suitability of the prepared ground for development; it does not remove the need for specific site investigation, design and inspection as required by the NZ Building Code, NZS3604:2011 and NZS 4431:1989. Individual lot owners require site-specific technical advice and Producer Statements for building consent, to be provided by others. Indicative minimum requirements for development of individual building sites (to be confirmed during design for each building) are outlined in Section 3 and Appendix E.

1.5 Scope of works

For the purposes of this geotechnical completion report Stage 1 has been divided into two portions as shown in Figure 1.1. These are referred to in this report as Stage 1-West and Stage 1-East.

Figure 1.1: Layout of Centennial Park Stage 1 subdivision. Two portions of Stage 1 have been defined for the purposes of this geotechnical completion report: Stage 1-West shaded yellow, and Stage 1-East shaded blue. Subdivision layout is as per the GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020, provided in Appendix A

T+T has undertaken the following work directly relating to the Stage 1 Development:

- Specific subsurface ground investigations for liquefaction assessment;
- Preparation of a geotechnical liquefaction assessment report in support of the subdivision consent application (T+T Ref: 1004625.003, January 2019);
- Site observations of the earthworks construction at approximately monthly intervals;
- Construction observations of key geotechnical related aspects of the earthworks when requested by GHD or Wallace Development Company;
- Review of compaction control testing (Troxler 3440 nuclear density gauge) undertaken by Resonant in fill areas; and
- Undertake dynamic cone Scala penetrometer testing in cut and fill areas.
- For Stage 1-East, provide general information regarding load bearing capacity of the ground and liquefaction-related settlement and lateral spreading, to assist designers engaged by individual property owners to undertake specific engineering design of foundations for individual lots.

2 Earthworks certification

2.1 General

This section provides certification that the cuts and fills completed as part of the Stage 1 Lots 1 to 16 and 19 to 28 earthworks meet the requirements of the Specification (refer Appendix B), Resource Consent RC 7791 and the general requirements of the following documents:

- NZS 4431:1989 Code of Practice for Earthfill for Residential Development
- NZS 4402 Methods of Testing Soils for Civil Engineering Purposes
- BS 1377 Methods of Testing Soils for Civil Engineering Purposes
- Palmerston North CC Engineering Standards for Land Developments, Third edition 2019

This certification does not remove the necessity for the normal inspection and design of foundations as would be made in natural ground.

The surface of the as-built levels of the certified earthworks is set out on GHD Drawing 51-37652 Sheets -C003 to -C008 dated 26 June 2020. Any subsequent earthworks such as excavation and backfilling of services trenches or fill placed to level a building platform is not covered by this report and will require additional design, monitoring and testing in accordance with Section 3.

2.2 Basis for certification

The following information forms the basis for certification:

- Contract works specification Section 6.5 (Earthworks) by GHD (refer Appendix B);
- Earthworks control testing undertaken by Resonant (refer Appendix C);
- Confirmatory Scala penetrometer testing undertaken by T+T (refer Appendix D); and
- Construction observations undertaken by T+T comprising of 11 site visits during the 12 month construction period.

2.3 Earth fill certification

In accordance with Resource Consent SUB4799 – LU4821 (26 March 2019) and on the basis of certification described in Section 2.2 we confirm that engineered earth fill shown on GHD Drawing 51-37652 Sheets -C003 to -C008 dated 26 June 2020 was generally constructed in accordance with the Specification and the Code of Practice for Earth Fill for Residential Development NZS 4431:1989.

A Statement of Suitability of Earth Fill for Residential Development is supplied in Appendix F.

All fill in Stage 1 was specified as “General Bulk Fill” (refer Appendix B and C). The higher standard of “General Structural Fill” was not specified because ground improvement for liquefaction mitigation was likely to be required under each specific building footprint for many lots (so this fill would be excavated and/or further compacted in future), and enhanced foundations were recommended for all lots (these foundations have lower bearing capacity requirements). Refer Table E2 and E3 in Appendix E for details of ground improvement and enhanced foundation recommendations.

The Earth fill certification relates to the general suitability for development; it does not remove the need for specific site investigation, design and inspection as required by the NZ Building Code, NZS3604:2011 and NZS 4431:1989.Section 3 below summaries the specific investigation and design required for building site development.

3 Building site development requirements

3.1 General requirements

3.1.1 Earthworks – cut

The heights of any future cuts below the certified as-built levels shown in Appendix A, including cuts to be retained, shall be measured from the certified as-built levels. Earthworks on site can change the ground surface profile so offset from the existing ground surface should not be relied upon. If in doubt seek the advice of a Registered Surveyor and/or a ***Geotechnical Engineer***.

All future temporary and permanent cuts exceeding 1.2 m in height, including cuts to be retained, shall be specifically investigated and designed by a ***Geotechnical Engineer***. Retaining walls greater than 1.5 m in height shall be specifically investigated and designed by a ***Geotechnical Engineer***. The ***Geotechnical Engineer*** shall consider the effect of the earthworks on global stability, i.e. the effect of the works on the stability of the lot and adjacent land.

3.1.2 Earthworks – fill

The depths of any future fills above the certified as-built levels shown in Appendix A shall be measured from the certified as-built levels. Earthworks on site can change the ground surface profile so offset from the existing ground surface should not be relied upon. If in doubt seek the advice of a Registered Surveyor and/or a ***Geotechnical Engineer***.

As part of building construction on each site it may be necessary to undertake minor excavation and filling works (such as trenching and backfilling for services or footings, or raising the land to foundation formation level). In this situation the following requirements may apply, as determined by the ***CPEng. Engineer***:

1. Fill shall be granular fill in accordance with Clause 7.5.3 of NZS3604:2011, or as otherwise specified and certified by a ***Geotechnical Engineer***.
2. Where excavations are made into the certified prepared ground (including both fill and natural ground), care should be taken to minimise disturbance to the surrounding material, and backfill must be compacted to achieve performance similar or better than the adjacent ground. For an indication of expected performance of existing fill material, refer to the specification for “General Bulk Fill “ in Appendix C (these specific testing requirements do not necessarily apply to new backfill; the key requirement is that backfill through existing fill achieves similar performance, as determined by the ***CPEng. Engineer***).
3. For situations where the total thickness of fill is greater than 0.6m (except trenches less than 1.0m wide backfilled as above) the fill shall be specified and certified by a ***Geotechnical Engineer***.

As part of building construction on some sites (particularly Stage 1-West) it may be necessary to undertake major excavation, filling or other ground preparation works (such as ground improvement using reinforcement or densified crust options as described in Table E3 of Appendix E). These works shall be specified and certified by a ***Geotechnical Engineer***.

3.1.3 Variable ground conditions

Specific attention shall be given to boundaries between fill and cut/natural ground because weaker ground and groundwater seepage may occur in these areas. Fill and cut/natural ground boundary locations are shown in T+T sketch plans Sheet 1 to 3 in Appendix D. Where these boundaries occur

under or in close proximity to building foundations there shall be provision for specific subsurface testing. It may be required to locally deepen foundations where weak ground is encountered.

3.1.4 Stormwater control

All stormwater from roofs, hard-standing or impermeable areas, retaining wall drainage, surface drains and subsoil drains and from standing water such as swimming pools and ponds, shall be collected and discharged in a controlled manner in accordance with Palmerston North City Council stormwater and wastewater requirements.

All stormwater from other areas such as vegetated surfaces shall be in a dispersed manner that will not give rise to concentrated stormwater flows and shall be limited to an individual lot area.

3.2 Specific building development requirements for each lot

A summary of the ground conditions and development requirements specific to each lot within Stage 1 is given in Appendix E. The geotechnical liquefaction assessment report in support of the subdivision consent application (T+T Ref: 1004625.003, January 2019) is to be read in conjunction with the other parts of this report.

3.2.1 Stage 1-West (Yellow area in Figure 1.1)

For Stage 1-West, the January 2019 liquefaction assessment report identified the potential for Medium or High liquefaction vulnerability and lateral spreading susceptibility. There is no "one size fits all" foundation option in this situation, as the best option will depend on the site-specific ground conditions and details of the particular building. Therefore design of the building for each lot will require site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

Accordingly, the ground preparation for Stage 1-West has been certified in this completion report as suitable for residential development subject to site-specific geotechnical assessment and specific engineering design (rather than NZS3604 foundations).

Information regarding the process for geotechnical input and foundation design for each individual lot has been provided separately to Wallace Development Company (attached as Appendix G), and this information should be read in conjunction with this completion report.

3.2.2 Stage 1-East (Blue area in Figure 1.1)

For Stage 1-East, the January 2019 liquefaction assessment report concluded that the liquefaction vulnerability was likely to be Low, with potential lateral spreading susceptibility at the western margin. This assessment was sufficiently conclusive to support the subdivision consent application, however residual uncertainty remained regarding the presence of a thin liquefiable soil layer between approximately 2m and 3m below ground and potential effects from lateral spreading of adjacent land towards the Hokowhitu Lagoon. Also, as discussed in Section 2.3 of the current report, all fill in Stage 1 was specified as "General Bulk Fill" (although the compaction test results in Appendix C suggest that much of the fill has actually achieved the criteria for "General Structural Fill").

These uncertainties mean there is not yet sufficient site-specific certainty to allow "good ground" to be assumed for Building Consent purposes. Accordingly, the ground preparation for Stage 1-East has been certified in this completion report as suitable for residential development using TC2-type enhanced foundations as described in Section 3.2.2.1 (rather than NZS3604 foundations). Alternatively, other foundation options may be possible subject to site-specific geotechnical assessment and specific engineering design as described in Section 3.2.2.2.

3.2.2.1 TC2-type enhanced foundation option

In Stage 1-East we consider that TC2-type enhanced foundations would be suitable for typical residential buildings (i.e. NZS3604 type superstructure from the ground floor plate up). In this case we expect that the general information about site conditions provided below will enable foundation designers engaged by individual lot owners to complete their design without the need for site-specific specialist geotechnical advice regarding liquefaction-related hazards and compaction of the existing fill.

Enhanced foundations require specific engineering design, with structural engineering input from a ***CPEng. Engineer***. However, in many cases, the primary focus of specific foundation design will be selecting an appropriate option from the standard "off the shelf" foundation concepts presented in the MBIE Canterbury Guidance, and detailing to suit the specific building and site.

If this approach is adopted, the following geotechnical inputs into foundation and building design are likely to be suitable (subject to site-specific confirmation by the ***CPEng. Engineer*** during construction as described below):

(a) The ground in Stage 1 has been prepared as described in this report, including stripping of unsuitable material from the original ground surface and cutting or filling to the certified as-built levels shown in Appendix A.

(b) The prepared ground is considered suitable founding material for a TC2 Option 4 enhanced reinforced concrete slab on grade foundation, as detailed in in Section 5.3.1 of the MBIE residential construction guidance for Canterbury[(1)].

(c) Please note that there is a difference between a TC2 Option 4 slab (e.g. designed for liquefaction) and the less robust kinds of waffle slabs that have traditionally been used around NZ in the past (e.g. designed for shrink-swell soils). Differences include a greater rib depth, increased longitudinal reinforcing steel, and detailing of shear and lateral ties.

(d) As an alternative to a TC2 Option 4 slab, the ***CPEng. Engineer*** may choose to develop a bespoke design which meets the performance requirements detailed in Section 5.4 and 5.7 of the MBIE guidance, taking into account the geotechnical inputs provided in items (e) to (j) below. It will be necessary to demonstrate "from first principles" that the proposed foundation meets the performance requirements detailed in Section 5.4 and 5.7 of the MBIE guidance and/or the Building Code, given the geotechnical inputs below.

(e) Design for index liquefaction-related land settlement values of 10mm for SLS design earthquake (25 year) and 30mm for ULS design earthquake (500 year).

(f) Design for lateral stretch of 25mm across the building footprint for ULS earthquake (no significant lateral spreading effects expected in Stage 1-East at SLS).

(g) With regard to lateral spreading, the foundation system should have sufficient tensile strength to permit sliding of the house in relation to the ground without breaking or distorting. The strength should be sufficient to withstand forces equal to frictional resistance to sliding over half the house footprint, assuming a friction angle of 45° (a friction coefficient of 1.0) across the entire foundation footprint (including beneath polystyrene pods).

(h) The prepared ground can be assumed to provide geotechnical ultimate bearing capacity of 200kPa for foundation design[2].

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(1) "Repairing and rebuilding houses affected by the Canterbury earthquakes", Part A and C, Ministry of Business, Innovation and Employment, 3rd Edition, Published on 1 December 2012, Updated on 29 May 2018. https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/repairing-and-rebuilding-houses-affected-by-the-canterbury-earthquakes/

[2] As recommended in Section 3.4.1 of the MBIE Canterbury Guidance, Scala blows per 100 mm shall be minimum 2 blows (i.e. 50 mm per blow) for ground deemed to have 200 kPa geotechnical ultimate bearing capacity.

(i) Follow recommendations for detailing of services provided in Section 5.7 of the MBIE Canterbury Guidance, allowing for the settlement and lateral stretch magnitudes provided above.

(j) The building superstructure (from the from the ground floor plate up) should be in accordance with NZS3604, unless the ***CPEng. Engineer*** determines that any non-NZS3604 aspects of the building will also meet the performance requirements of the Building Code. This may require input from a ***Geotechnical Engineer*** regarding non-NZS3604 details (for matters of liquefaction and ground preparation as discussed in this completion report, and also for matters of general geotechnical design).

Site-specific shallow ground testing and observation of the exposed founding material must be undertaken during construction, to confirm that ground conditions encountered beneath building footprints are consistent with the assumptions on which our recommendations are based, as determined by the ***CPEng. Engineer***. This can be carried out by a soils technician or other suitably trained and supervised person, under the guidance of the ***CPEng. Engineer***. If ground conditions encountered on site are not consistent with the assumptions on which our recommendations are based then additional undercut, compaction or support may be required, as determined by the ***CPEng. Engineer***.

Information regarding the assumptions on which our recommendations are based and other geotechnical considerations for specific engineering design has been provided separately to Wallace Development Company (attached as Appendix G), and this information should be read in conjunction with this completion report.

3.2.2.2 Option for site-specific geotechnical assessment and specific engineering design

As the Building Code uses a performance-based framework, there is an option to undertake completely independent specific engineering design to design a bespoke foundation/building solution. The design of the building for each lot will require site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

It is possible that site-specific geotechnical assessment by a ***Geotechnical Engineer*** (including additional deep ground investigations) might determine that "good ground" [(3)] can be assumed for a specific building footprint location. In this case the ***CPEng. Engineer*** might determine that it is possible to proceed with an NZS3604 building without the need for further specific engineering design.

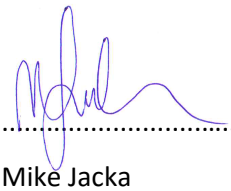
[(3)] The Building Code has recently been updated to exclude liquefaction-prone ground from the definition of "good ground". For details refer to https://www.building.govt.nz/building-code-compliance/annual-building-code-updates/november-2019-building-code-update/

4 Applicability

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

We understand and agree that our report will be used by Palmerston North City Council in undertaking its regulatory functions in connection with the Centennial Park Stage 1 subdivision. We also understand and agree that our report will be provided to designers engaged by individual lot owners for the purpose of providing information about general conditions on the site, on the basis that any use or reliance on this report is at that party's sole risk. The responsibility for specific engineering design and construction review of foundations for individual buildings remains with the designers.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
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Christopher Sandoval	Mike Jacka
Civil / Geotechnical Engineer	Project Director

Reviewed by Hugh Cherrill, (Geotechnical Engineer, CPEng)

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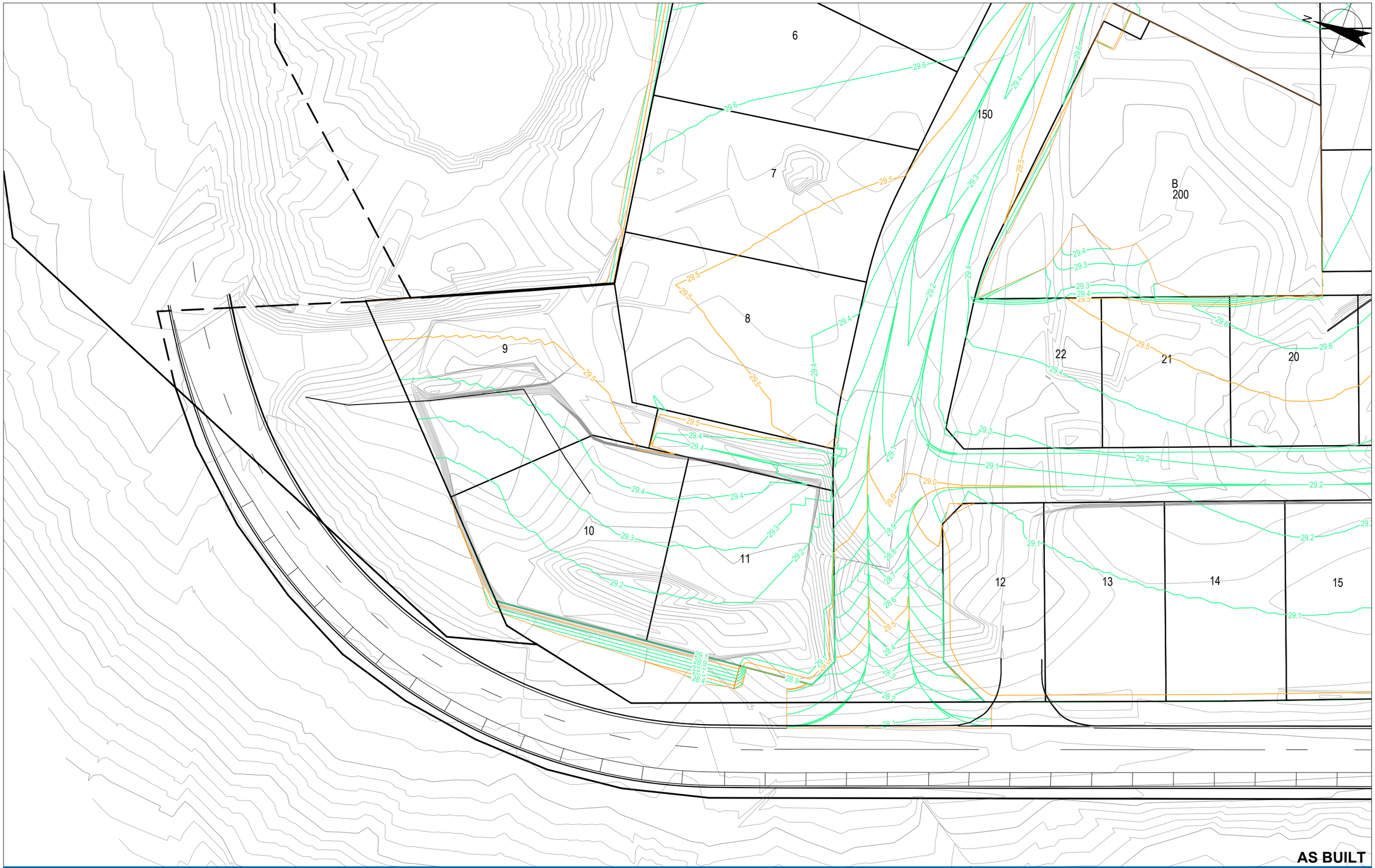
Appendix A: Asbuilt drawings provided by GHD



AS BUILT

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AB	ASBUILT		PK	SD	AC	26/06/20

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Drawn	P KENDALL	Designer	S DOIDGE
Drafting Check		Design Check	A CHISHOLM
Approved (Project Director)			
Date	26/06/20		
Scale	1:250 @ A1	This Drawing must not be used for Construction unless signed as Approved	

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Project: CENTENNIAL PARK - STAGE 1
Title: EXISTING AND PROPOSED CONTOURS

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Rev: AB

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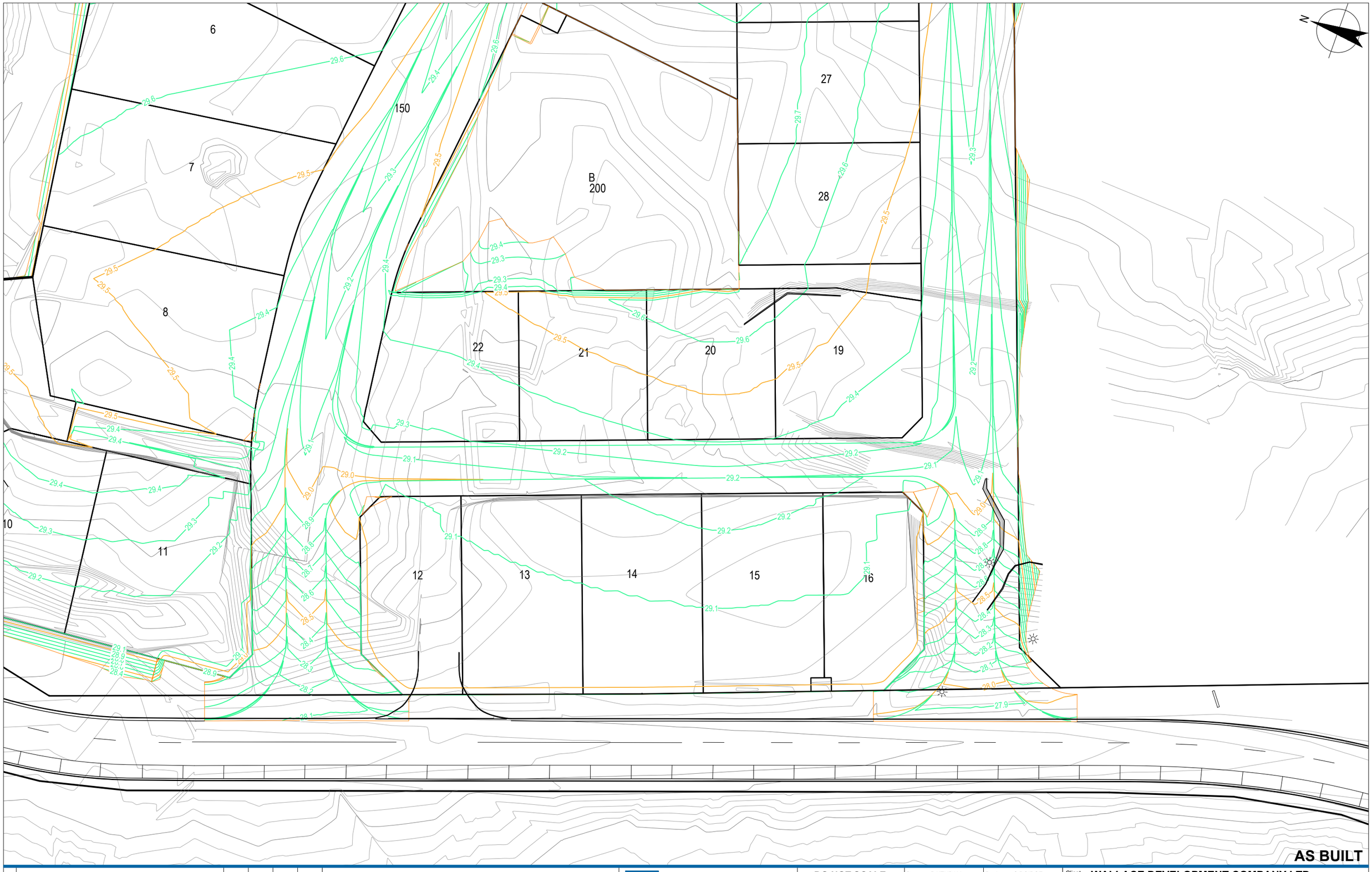

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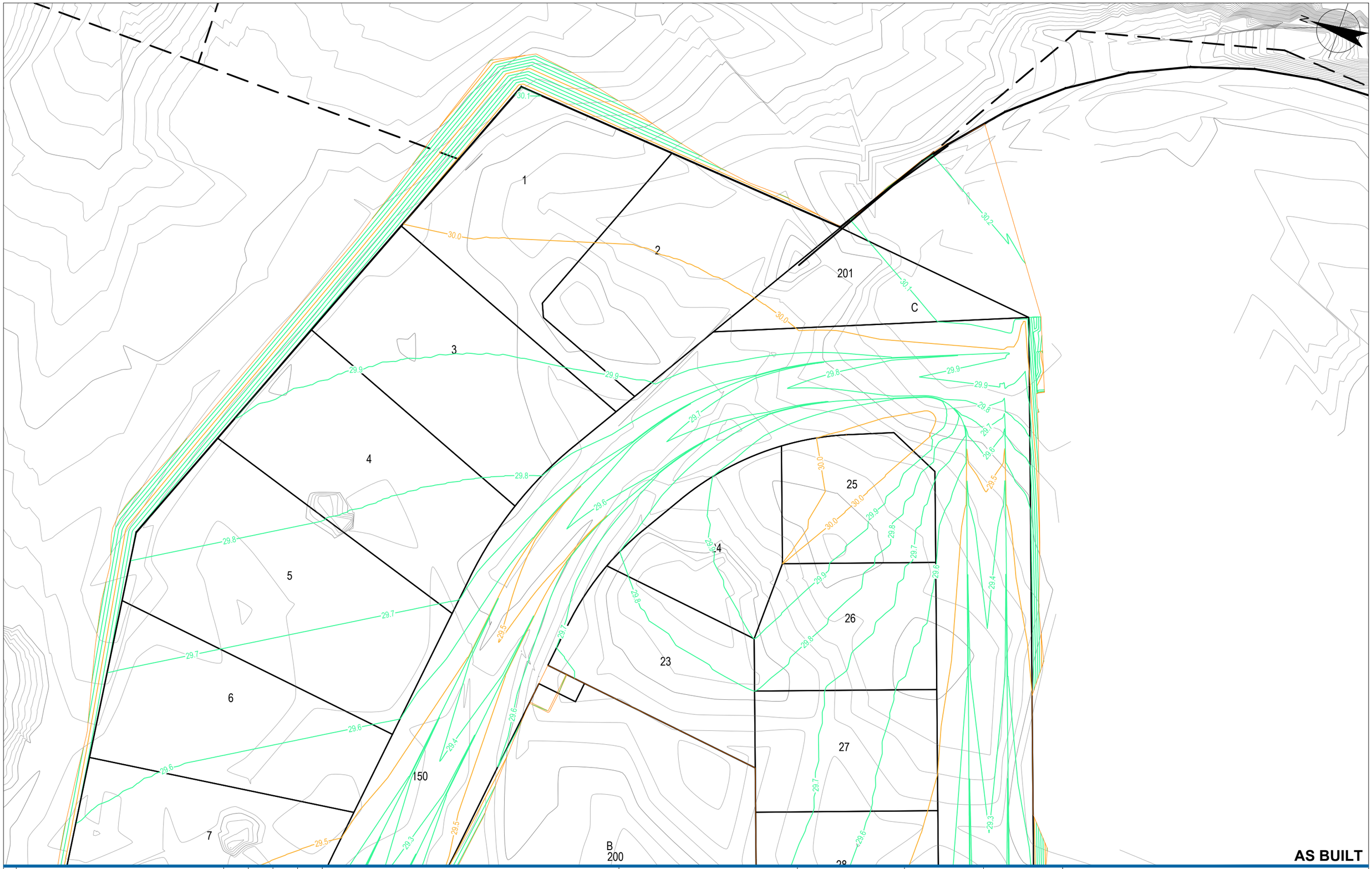

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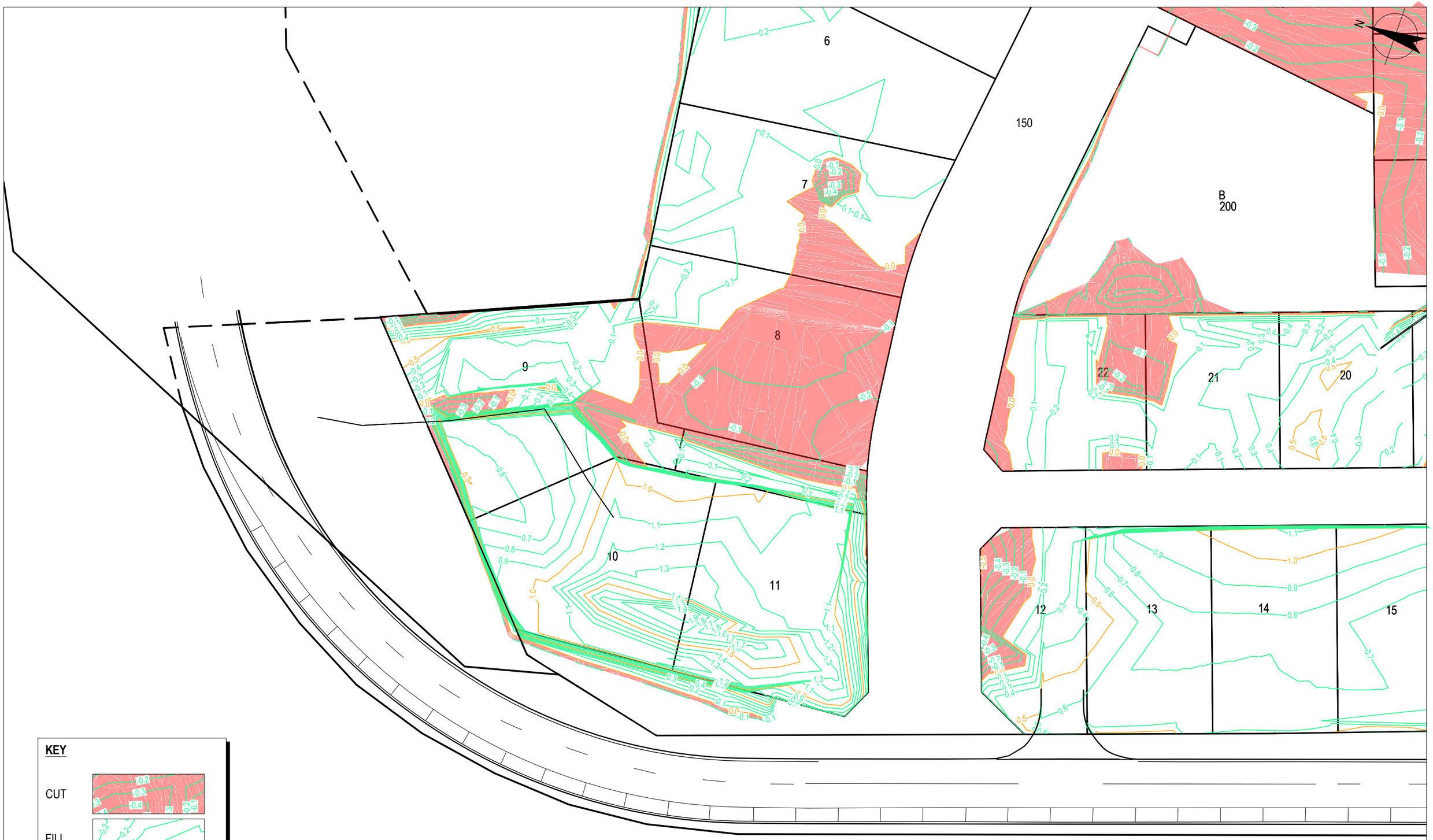

KEY

CUT

FILL

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Project: CENTENNIAL PARK - STAGE 1
Title: CUT / FILL DEPTHS

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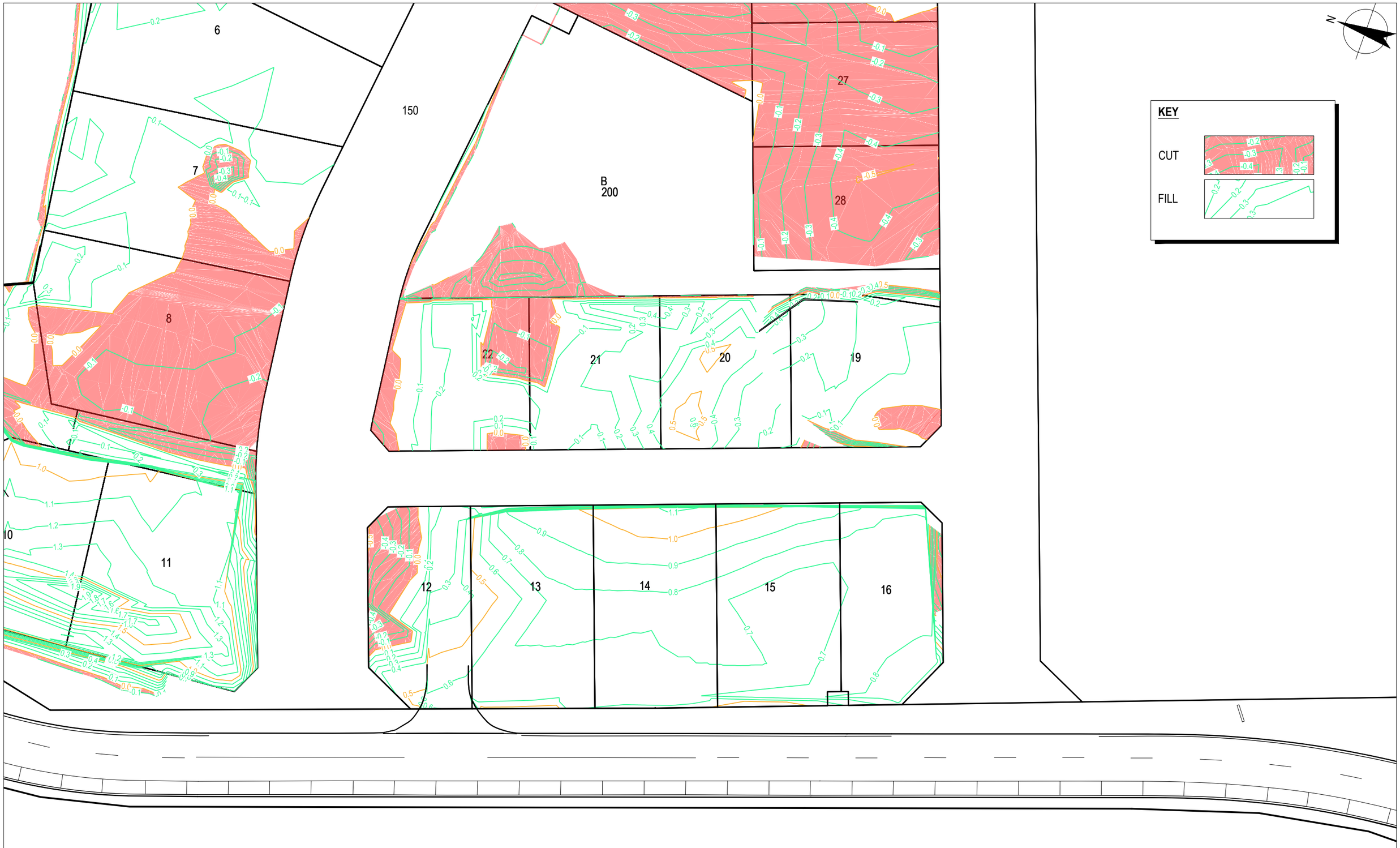

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Client WALLACE DEVELOPMENT COMPANY LTD
Project CENTENNIAL PARK - STAGE 1
Title CUT / FILL DEPTHS

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Rev: AB

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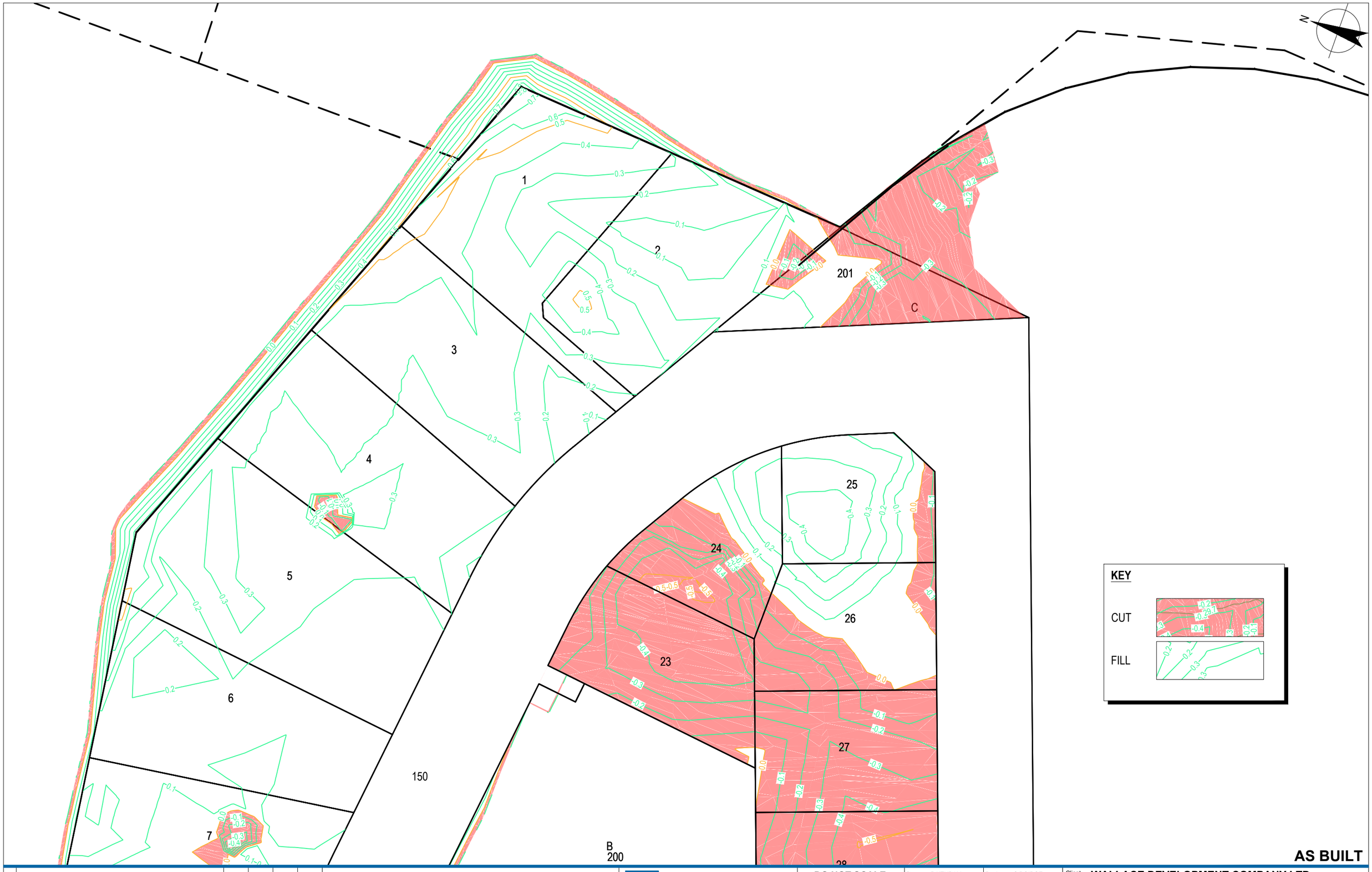

AS BUILT

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
AB	ASBUILT		PK	SD	AC	26/06/20

WALLACE DEVELOPMENT Company Limited

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Drawn	P KENDALL	Designer	S DOIDGE
Drafting Check		Design Check	A CHISHOLM
Approved (Project Director)			
Date	26/06/20		
Scale	1:250 @ A1	This Drawing must not be used for Construction unless signed as Approved	

Client WALLACE DEVELOPMENT COMPANY LTD
Project CENTENNIAL PARK - STAGE 1
Title CUT / FILL DEPTHS

Original Size A1 Drawing No: 51-37652-C008 Rev: AB

Plot Date: 8 July 2020 - 10:42 AM Plotted by: Pirran Charles Kendall Cad File No: N:\NZ\Palmerston North\Projects\51\37652\CADD\Drawings_STAGE 1\ASBUILTS\51-37652 - ASBUILT EARTHWORKS.dwg

Appendix B: Specification – geotechnical section

WALLACE DEVELOPMENT COMPANY LIMITED

CENTENNIAL PARK DEVELOPMENT - STAGE 1

Construction Issue

Prepared by:
GHD Limited
52 The Square
Palmerston North 4440

Table of contents

6.5 Earthworks

6.5.1 Scope

This specification covers the clearing and disposal of vegetation and other unwanted material, stripping and stockpiling of topsoil, and excavation of and filling with earth and rock to form the surfaces detailed on the Drawings or directed by the Engineer

6.5.2 General

6.5.2.1 Nature of the Ground

The Contractor shall inform and satisfy himself as to the character, quantity and distribution of all material to be excavated and to the accuracy or completeness of the information provided. No payment will be made for any excavated material which is used for purposes other than those designated.

The Contractor shall consider all available geotechnical reports, investigation and testing results and the like when planning its earthworks. In particular, the varying material types on site. The Contractor needs to assess the degree of selecting, blending, drying and conditioning required, the location and volume of cut available, and haul distances when assessing the best use of the cut material available.

6.5.2.2 Areas of Work

The Contractor shall manage all earthworks operations within the designated works area. The Contractor shall not dispose of fill or waste materials outside the designated works area without the written approval of the Engineer.

The Contractor shall stockpile only in areas approved by the Engineer.

6.5.2.3 Drainage

During construction, the Contractor shall take all necessary measures to comply with the requirements of the Environmental Management section of the specification.

At all times the excavation and fill areas shall be maintained with adequate falls and drainage to minimise any penetration of water and to allow the ready runoff of water.

6.5.3 Material Classification

Unless otherwise stated in the Schedule of Prices, materials excavated will not be classified for payment.

If however, classification is provided for in the Schedule of Prices, the following definitions shall apply:

Common material excavation includes, but is not restricted to, earth, gravel, and also such hard and compacted material as cemented gravel and weathered or soft rock which required loosening by ripping before excavation. Common material excavation also includes all boulders or detached pieces of solid rock not exceeding one cubic metre in volume.

Unsuitable material shall be restricted to material which by virtue of its inherent properties of moisture content, organic content or grain size can only be excavated by a dragline, back hoe or other specially adapted plant. The Engineer will only classify material as “Unsuitable Material” if satisfied that its condition is not due to the Contractor’s neglect or of surface drainage, and that reasonable time has been allowed after rainfall to return the material to its normal condition.

Hard Rock excavation involves solid rock in place which cannot be removed until loosened by pneumatic equipment or blasting, and all boulders and detached pieces of solid rock more than one

cubic metre in volume. Solid rock in this definition is rock of such hardness or texture that it cannot be loosened or broken down by hand picks.

Topsoil is defined as the layer of material immediately below the ground surface down to the subsoil layer comprising vegetation, tree roots, other non-decomposed organic matter, turf and humus.

Imported Clean Fill is clean fill material sourced from off site and complying with the requirements for the material type for use in the specified locations. All imported fill shall comply with 'clean fill' definition as defined by the Ministry for the Environment and local councils.

Granular Fill where directed by the Engineer, granular fill may be placed in selected areas. The compaction of such material will be to F/1 Clause 10.5.1.

Rubbish is defined as material e.g. steel, concrete or rubble, plastic, refuse found during cut and fill operations. Rubbish shall be removed offsite.

6.5.4 Site clearing

Site clearing covers the complete removal of buildings, foundations, trees, logs, scrub, grass, roots and other vegetation, farm culverts, water pipes, paving materials, fences, gates and other organic and inorganic material or rubbish above ground level.

Burning and/or burying of cleared materials is not permitted.

All material resulting from site clearing shall be disposed of by the Contractor off the site at the nearest refuse tip or any other suitable site for which appropriate approvals have been obtained. On no account is surplus excavation to be dumped on any road reserve or other public or private property unless all necessary consents are first obtained.

The Contractor may recover the salvageable value of any other cleared materials removed from site.

Before clearing commences, the Contractor shall establish by pegging the extent of all areas for clearing. There shall be no clearing beyond the specified limits without the written approval of the Engineer.

All tree stumps and roots resulting from felled or cleared trees shall be removed to a depth of at least 750mm below existing ground surface or 750mm below design level, whichever is the lower. The resulting cavities from the removal of tree stumps, roots and debris layer shall be backfilled to the standard required by the Earthworks specification.

The Contractor shall ensure that all personnel are fully aware of any requirements of the Consent Conditions, Resource Consents and the PEMP with regard to controlling clearing and vegetation removal operations.

No tree and habitat area identified for protection shall be cleared without the prior written approval of the Engineer.

6.5.5 Topsoil stripping

Areas for earthworks and temporary erosion and sediment control areas shall be stripped of topsoil unless otherwise directed by the Engineer.

Stockpiles shall not be placed in locations that may endanger the stability of the stockpile or supporting ground. Stockpiles shall be shaped to be free draining and rolled smooth to minimise erosion.

No topsoil shall be removed from the site without the prior approval of the Engineer.

6.5.6 Excavating, placing, spreading, and conditioning

6.5.6.1 Excavating for fill

Cut areas shall be excavated to form a uniformly graded surface to the lines, grades and levels shown on the drawings.

Materials shall be selectively won, for the intended fill type and compacted without undue delay. All cut areas shall be progressively trimmed to meet the final profiles.

The Contractor shall take all reasonable care and precautions in regard to weather conditions, haul roads and type of earthmoving equipment to avoid damaging the soils within the cut areas. Where material is workable under favourable weather conditions, the Contractor shall make every effort to take best advantage of these materials during good weather.

Should the Contractor, through negligence or other fault, excavate below or outside the designated lines, he shall replace the excavation with approved materials, in an approved manner and condition, at his own expense.

6.5.6.2 Placing of fill

No fill shall be placed on new foundation areas without prior to inspection and approval from the Engineer.

No fill shall be spread over surfaces which have deteriorated from their specified condition, and where necessary, the old surface shall be scarified and conditioned and recompacted before placing new fill.

No new fill shall be placed over previously placed fill that:

1. has not achieved the required standard of compaction;
2. has become contaminated or has deteriorated from the required fill standards.

Erosion damage to fills resulting from surface water flows shall be repaired by trimming to remove all loose and wet material, benching as necessary, backfilling, compacting and trimming to achieve the specified compaction standards and profile. The repair of erosion damage will be at the Contractor's cost.

When the fill operation has ceased in any area for more than 8 hours, for example overnight, then immediately before recommencing the fill operation, the fill surface shall be scarified to a depth of 100mm, conditioned and compacted to achieve the required standard of compaction.

Where fill is to be placed against sloping surfaces steeper than 3H:1V, the sloping surface shall be "benched" such that the vertical height of the bench is less than 0.5 m.

6.5.6.3 Spreading and Shaping

Fill shall spread uniformly be raised in horizontal layers that do not exceed 200mm loose thickness.

Prior to compaction, all structural fill shall be broken into fragments of less than 100mm maximum dimension. Any lumps or rocks that cannot be broken down may be removed or used as directed by the Engineer.

All new earthworks shall be shaped and contoured to visually blend in with adjacent natural landforms. All changes in slope shall be smoothly rounded as a continuous curve

6.5.6.4 Conditioning

Conditioning of the materials may be required to ensure that the materials are within the required water content ranges prior to compaction. The Contractor shall allow for conditioning of all materials to achieve the required water content without additional payment.

When soil is to be dried, the Contractor shall disc the soil and allow it to dry uniformly to its full depth. When the soil is to be wetted, this shall be done with sprinkling equipment ensuring uniform and controlled distribution of water in conjunction with blading and discing.

The water content shall be kept low enough to provide stable working surface for the hauling and compacting plant, free from heaving, weaving and excessive rutting.

6.5.7 Compaction

After each layer of fill has been placed, spread evenly and brought to a suitable water content, it shall be compacted to at least the specified relative compaction.

Compaction shall be accomplished with approved, special-purpose compaction equipment. Equipment used in transportation and spreading will not be permitted as compaction equipment. The equipment shall make sufficient passes to ensure that the required compaction has been uniformly obtained everywhere.

Fill batter faces shall be compacted as a separate operation, or alternatively, shall be overfilled and trimmed at successive lift heights to achieve the design cross section.

Fill surfaces shall be maintained at all times to avoid ponding of surface water and shed water in a controlled manner to erosion and sediment control works. Surfaces shall be rolled to seal the exposed surface at the end of each day.

6.5.8 Testing

6.5.8.1 Pre-construction Testing

Prior to placing fill material the Contractor shall, using three samples of material sourced from the proposed cut areas, provide to the Engineer for each of those samples of on-site material:

Standard compaction curves showing the maximum dry density and optimum moisture content. The maximum dry density and optimum water content will be determined by NZS4402:1986 Test 4.1.1 (NZ Standard compaction for Cohesive Material) or Test 4.1.3 (NZ Vibrating Hammer Compaction for Non-cohesive Material).

For calculation of air voids, determine the Solid Density of Soil Particles by the methods specified in NZS 4402: 1986, test 2.7.

The Engineer will review the results and in turn advise the Contractor of the target dry density and moisture content for the testing of completed fill material.

Where volumes of on-site material to be used for filling are greater than 5000m3, the Contactor shall provide the Engineer with one (1) standard compaction curve for each subsequent 5000m3 lot of on-site fill material. The Engineer may or may not alter the target dry density.

6.5.8.2 Construction Testing

The Contractor shall forward test results to the Engineer within 24 hours of testing, with final results reported within 48 hours. Any non-compliant tests shall be reported immediately to the Engineer and appropriate remedial action undertaken immediately. When remedial actions are complete, the Contractor shall undertake additional tests and submit those results to the Engineer prior to recommencing works in the affected area. No additional payment will be made to the Contractor for the additional tests required as a result of remedial actions on non-compliant work.

A minimum of four (4) test sets shall be carried out for every 1,500m3 of completed fill. Where the volume of compacted fill per metre of fill lift is less than 1,500m3, then there shall be a minimum of two (2) test sets per metre of fill lift or one (1) test per 375m3, whichever provides the greater number of test sets.

A test set shall comprise the following individual tests made within an area no greater than 3m2:

1. 2x NDM (the 2nd test orientated at 90o to the 1st using the same probe hole)
2. 2x Vane Shear within 0.5m of the NDM above
3. 1x Scala penetrometer
4. 1x laboratory water content for the 1st test set followed by every 5th test set thereafter.

The compacted fill shall achieve the following nominated minimum standard for each test set:

1. Air voids Shall not exceed 10% (Derived from the NDM results above)
2. Shear strength The average per test set shall not be less than 80kPa with a minimum allowable reading of 70kPa for either of the 2 results.
3. Relative density The average per test set shall not be less than 92% of the Maximum Dry Density established by sample testing.
4. Moisture Content The average per test set shall be within the range of -4% to +2% of the Optimum established by sample testing.
5. Scala penetrometer tests Results shall not be less than 3 blows/150mm in silt fill material or 5 blows/150mm in granular fill material.

Where field tests indicate that the specified standard of compaction has not been achieved, corrective action shall be taken to bring the fill to the required standard and as required by the Engineer. This may require the excavation and removal of the non-compliant fill.

The Engineer's Representative may reduce or increase the frequency of testing as they judge appropriate, depending on the consistency of results. The scope and frequency of testing shall only be altered at the instruction of the Engineer.

The Contractor shall interrupt or divert his operations as necessary to permit the Engineer's Representative to carry out check tests of compaction at any time with complete safety.

6.5.8.3 Fill Control Tests and Test Methods

The tests and test methods for earthworks / fill control shall be as set out in the following table.

Item	Test	Test Method
1	Shear Strength (using hand vane)	Determining the Vane Shear Strength of a Cohesive Soil using a hand Held Shear Vane, NZ Geomechanical Society, August 2001
2	Air Voids	NZS 4402:1986 and involving intermediate tests 3A (in situ density), 3B (water content) and 3C (solid density) as below
3	In-situ Density	NZS 4402:1986 Test 5.1.1 Sand replacement method OR NZS4407: 1191 Test 4.2.1 and 4.2.1 (Nuclear Density Gauges)
4	Water Content	NZS 4402:1986 Test 2.1
5	Solid Density	NZS 4402: 1986 Test 2.7.2
6	Scala penetrometer	NZS 4402:1988, Part 6
7	CBR	NZS 4402:1986 Test 6.1.

		OR FWD Test Method
8	Clegg Impact Value	ASTM D5874: 95 Determination of Impact Value (IV) of a Soil

The operators of NDM equipment shall hold current operator certificates. NDM, shear vane equipment shall have current calibration certificates.

6.5.9 Tolerances

All earthworks shall be carried out to the lines levels and grades shown on the Drawings. The accuracy of surfaces to be overlaid by metal course or concrete structures shall be such as to preserve the minimum thicknesses of the overlying layers.

Unless specified otherwise, tolerances shall be as follows:

Surface Type	Tolerance
Road subgrade	+0mm to -20mm
Road berm	+0mm to -50mm
Batters	-0mm to +100mm
Rockfill surfaces	-200mm to +200mm
Other surfaces	-0mm to +50mm

Upon completion of earthworks the Contractor shall provide the Engineer with an as-built of spot levels on the finished surfaces as follows:

1. For earthwork areas outside the road boundaries, spot levels on a maximum 10m by 10m grid plus levels at other created features e.g. top of bank, bottom of bank, drain inverts etc
2. For the road carriageway, at 10m intervals along the road centreline, spot levels on the prepared subgrade at the kerb line on each side and the centreline. Where the road carriageway is greater than 9m wide there shall be an additional spot level each side of the centreline half way between the centreline and the kerbline
3. As-built levels shall be provided in a drawing format acceptable to the Engineer.

Where as-built levels indicate that the specified level tolerances have not been achieved, corrective action shall be taken to bring the finished surfaces within the required tolerances and as required by the Engineer. This may require stripping and later respreading of topsoil and raising or lowering of the underlying surface.

6.5.10 Pavement Subgrade

In addition to other requirements detailed in this specification pavement subgrades (excavated or filled) shall be trimmed to line and level to achieve an even grade between level control points. During trimming and compaction of the subgrade, care shall be taken to ensure that the subgrade is not damaged or overstressed by construction vehicles or plant. Where overstressing of the subgrade is determined to have occurred, the Contractor shall make good these areas to the satisfaction of the Engineer.

The subgrade shall be dried back as required, and compacted to achieve not less than 98% of the Maximum Dry Density (MDD). The subgrade shall then be proof rolled in the presence of the Engineer using a static steel wheel roller.

The Engineer shall undertake scala penetrometer testing of the subgrade to determine the CBR strength of the subgrade soils. The Engineer shall then review the results of the scala penetrometer tests and proof rolling to determine the extent of any further undercuts required, or alternatively recommend a modification of the pavement layer thicknesses.

The Contractor shall not commence pavement construction until the Engineer's acceptance and approval of the subgrade is obtained.

6.5.11 Excavate to Waste

Low density, highly plastic, saturated, weak or organic soils exposed by clearing and stripping shall be excavated and considered by the Engineer to be unsuitable for use as filling, shall as directed by the Engineer be disposed of off-site by the contractor or placed in designated waste areas within the site.

The Contractor at the nearest refuse tip or any other suitable site for which appropriate approvals have been obtained shall dispose of material excavated as waste. On no account is surplus excavation to be dumped on any road reserve or other public or private property unless all necessary consents are first obtained.

When directed by the Engineer areas on site designated to receive waste material shall be stripped of topsoil and have accepted erosion and sediment control constructed prior to receiving waste material. The waste material shall be compacted to a standard acceptable to the Engineer. Surfaces of waste areas shall be rolled smooth to minimise erosion. When earthworks are complete the waste areas shall be topsoiled and grassed as described in other sections of this specification.

6.5.12 Spread topsoil

The Contractor shall uplift topsoil from stockpiles and cover all earthwork areas with the depth of topsoil removed (or as directed by the Engineer or otherwise shown on the drawings)

All other areas on the site outside the earthwork areas but disturbed by earthwork operations shall be included in this work.

For roads berms, from the back of kerb to 1m inside the lot, the topsoil is to be worked to a uniform fine tilth, raked and rolled to present a firm, evenly graded surface. All stones and rubble over 20mm in diameter shall be removed from the prepared surface.

Hoeing or harrowing shall not be carried out until the ground has dried out sufficiently to do so without causing compaction.

6.5.13 Grassing

The Contractor shall programme the grassing to co-ordinate with earthworks and to be optimal for grass strike and growth.

The Contractor's attention is drawn to the fact that to fulfill his obligations under the erosion and sediment control requirements of this specification, the Contractor must seed, mulch or grass all batters as soon as practicable and in a progressive manner as earthworks are completed over various areas of the site in accordance with Contract Specification.

Areas to be grassed shall be sown with grass seed comprising of a 85% rye 15% clover 15% mixture a rate of 1 kg per 30 square metre.

Hydroseeding shall be used where shown on the contract plans or on areas as directed by the Engineer.

Successful establishment shall be a 95% growth of a satisfactory sward and if necessary oversowing shall be carried out at the Contractors expense.

The Contractor shall maintain the surface of all berms and lawns covered by this Contract, and when the sole of grass is established the areas shall be mowed weekly in the spring and fortnightly in the winter during the contract and Defects Notification Period. A final cut shall be made just prior to the expiration of the Defects Notification period.

Appendix C: Compaction control testing provided by Resonant

Table C1 - Compaction criteria (refer GHD Specification in Appendix B)

Parameter		Fill Type	
		General Bulk Fill *All Stage 1 fill was specified as General Bulk Fill*	**General Structural Fill** *Structural fill was not specified for Stage 1*
Moisture Content		-4 to +2% of optimum	-4 to +2% of optimum
Minimum Scala (where instructed by the Engineer)	Average	5 blows per 150mm	7 blows per 150mm
	Single interval	1 blows per 50 mm	2 blows per 50 mm
In-situ Dry Density		> 92% MDD (Standard)	> 95% MDD (Standard)
Particle Size Distribution (PSD)		N/A	N/A

Note 1: Tests largely undertaken when minimum compaction anticipated (i.e. at turning areas of compaction plant).

Refer to attached reference density testing undertaken by Resonant

NORTH

IT 2 SO 496714
28.38

SWMH ID: 9055
(Height Datum)
28.35

28.43
SWMH

CENTENNIAL DRIVE

NDM 97 29.20
NDM 93 29.07
NDM 88 28.85
NDM 98 29.45
NDM 42 29.63
9
NDM 92 28.92
NDM 91 28.80
NDM 87 28.50
10
NDM 12 29.29
NDM 96 29.34
NDM 11 29.22
NDM 41 29.52
8
NDM 40 29.53
7
29.27 NDM 2
29.24 NDM 10
6
NDM 39 29.64
29.35 NDM 23
29.31 NDM 9
5
NDM 38 29.57
NDM 3 29.33
29.42 NDM 24
NDM 8 29.29
4
29.69 NDM 37
NDM 4B 29.26
NDM 4A 29.30
29.46 NDM 25
NDM 26 29.49
NDM 7 29.35
3
NDM 36 29.75
29.84 NDM 34
1
29.27 NDM 27
29.58 NDM 28
NDM 33 29.93
NDM 5 29.36
2
NDM 6 29.27
NDM 35 29.95
28.89 NDM 90
NDM 95 29.12
NDM 89 29.16
NDM 94 29.20
11
NDM 1 29.36
NDM 43 29.43
NDM 68 28.70
NDM 86 28.96
NAIL (Height Datum) 30.00
22
200
201
NDM 80 28.97
NDM 67
NDM 85 29.03
12
NDM 74 28.58
28.38
NDM 79 29.00
NDM 66 28.50
NDM 73 28.65
13
NDM 84 29.05
NDM 60 29.15
21
NDM 59 29.20
NDM 88 29.07
NDM 65 28.50
NDM 78 28.96
NDM 72 28.54
14
NDM 64 28.55
20
NDM 58 29.27
NDM 77 28.98
NDM 71 28.68
NDM 63 28.48
15
NDM 82 29.09
NDM 57 29.24
NDM 56 29.18
19
28.50
NDM 62
NDM 76 28.84
NDM 70 28.54
NDM 61 28.53
NDM 69 28.59
NDM 75 28.91
16
NDM 81 29.03
NDM 49 29.34
23
NDM 50 29.59
TEST 17 28.97
NDM 48 29.37
TEST 20 29.09
NDM 51 29.61
24
TEST 18 28.29
TEST 21 28.90
NDM 45 29.38
28
NDM 55 29.25
28.95
NDM 44
27
NDM 54 29.40
NDM 46 29.09
29.22
NDM 47
26
NDM 53 29.55
TEST 22 28.90
NDM 52 29.68
25
TEST 19 28.28
NDM 29 28.36
NDM 31 28.94
NDM 30 28.36
NDM 32 28.94

SURVEY ORIGIN DATA

HORIZONTAL COORDINATES ARE IN TERMS OF WANGANUI CIRCUIT 2000

HEIGHTS ARE IN TERMS OF MOTURIKI 1953 (PNCC SWMH ID 9055, RL = 28.35)

100 50 25 0

A3 ORIGINAL SIZE mm

J:\200\219\219037 Hoult 179 CENTENNIAL DR,PN_PARK DEVELOPMENT TESTING_CJ\F\04 Civil Engineering_219037 PROJECT\Production Drawings\219037 Bulk Fill Testing.dwg 7/6/2020 3:30 p.m.

Rev	Details	Drawn	Date
1	ISSUED FOR INFORMATION		06/07/2020

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MULTI-DISCIPLINARY ENGINEERING & SURVEYING SERVICES
Bringing places & spaces to life

The Contractor shall check all dimensions on site.

71 Pitt Street, PO Box 600 Palmerston North
06 356 7000 info@resonant.co.nz
www.resonant.co.nz

CENTENNIAL PARK DEVELOPMENT
179 CENTENNIAL DRIVE
PALMERSTON NORTH
DEVELOPMENT TESTING

HOULTS CONTRACTORS LIMITED

	Initials	Date
Surveyed	DBR	02/20
Designed	N/A	N/A
Drawn	DBR	07/20
Checked	Geotech	07/20
Approved		

DO NOT SCALE, If in doubt ask for dimensions

Scales A3	Job No.
1:750	219037

CAD Path/File	Sheet	of	Sheets	Rev.
219037 Bulk Fill Testing	1	1		1

CENTENNIAL DRIVE DEVELOPMENT
219037
BULK FILL TESTING - NDM's

resonant
MULTI-DISCIPLINARY ENGINEERING & SURVEYING SERVICES

Test ID	Date of Test	NDM Field Dry Density (kg/m3)	NDM Field Bulk Density	NDM Field Moisture Content (%)	Maximum Dry Density	Relative Compaction %	% Field Air Voids	RL	Pass / Fail	Comments
NDM 1	23-May-19	2071	2165	4.5	2175	95.2	12.8%	29.36	Pass	Ex. material from site (Lot 8)
NDM 2	23-May-19	2037	2147	5.4	2175	93.7	12.4%	29.27	Pass	Ex. material from site (Lot 7)
NDM 3	23-May-19	2112	2238	6	2175	97.1	7.9%	29.33	Pass	Ex. material from site (Lot 5)
NDM 4A	23-May-19	1984	2059	3.8	2175	91.2	17.9%	29.28	Pass	Contractors own imported fill (river-run) (Lot 4)
NDM 4B		2018	2110	4.6	2175	92.8	14.9%			
NDM 5	23-May-19	2074	2187	5.5	2175	95.4	10.6%	29.36	Pass	Ex. material from site (Lot 1 / 2)
NDM 6	23-May-19	2069	2183	5.5	2175	95.1	10.8%	29.27	Pass	Ex. material from site (Lot 1)
NDM 7	23-May-19	2048	2130	4	2175	94.2	14.8%	29.35	Pass	Ex. material from site (Lot 3)
NDM 8	23-May-19	2030	2192	8	2175	93.3	7.4%	29.29	Pass	Ex. material from site (Lot 4)
NDM 9	23-May-19	2040	2134	4.6	2175	93.8	13.9%	29.31	Pass	Ex. material from site (Lot 5)
NDM 10	23-May-19	2015	2130	5.2	2175	92.6	13.8%	29.24	Pass	Ex. material from site (Lot 6)
NDM 11	23-May-19	2062	2132	3.4	2175	94.8	15.5%	29.22	Pass	Ex. material from site (Lot 8)
NDM 12	23-May-19	2091	2186	4.5	2175	96.1	12.0%	29.29	Pass	Ex. material from site (Lot 9)
NDM 13	14-Jun-19	2113	2288	8.3	2175	97.1	3.0%	NO GPS USED	Pass	Old pipes removed, trench re-compacted. LOCATION UNKNOWN
NDM 14	14-Jun-19	2111	2293	8.6	2175	97.1	2.5%	NO GPS USED	Pass	Old pipes removed, trench re-compacted. LOCATION UNKNOWN
NDM 15	14-Jun-19	2122	2247	5.9	2175	97.6	7.7%	NO GPS USED	Pass	Old pipes removed, trench re-compacted. LOCATION UNKNOWN
NDM 16	14-Jun-19	2159	2298	6.4	2175	99.3	5.0%	NO GPS USED	Pass	Old pipes removed, trench re-compacted. LOCATION UNKNOWN
NOTE: Clegg used to gauge whether sandy material a pass or not. Formula used: CBR = (CIV)² x 0.07										
		CLEGG IMPACT VALUE (CIV)			**CBR = (CIV)² x 0.07**					
TEST 17	18-Jun-19	19			25			28.97	Pass	Sandy material Proctor? (Lot 24)
TEST 18	18-Jun-19	12			10			28.29	Pass	Sandy material Proctor? (Lot 24)
TEST 19	18-Jun-19	12			10			28.28	Pass	Sandy material Proctor? (Lot 25)
TEST 20	18-Jun-19	11			8			29.09	Pass	Sandy material Proctor? (Lot 24)
TEST 21	18-Jun-19	14			14			28.90	Pass	Sandy material Proctor? (Lot 24)
TEST 22	18-Jun-19	24			40			28.90	Pass	Sandy material Proctor? (Lot 25)
NDM 23	22-Jul-19	1958	2090	6.8	2100	93.2	13.1%	29.35	Pass	Testing of batter adjacent to golf course
NDM 24	22-Jul-19	2083	2237	7.4	2100	99.2	6.3%	29.42	Pass	Testing of batter adjacent to golf course
NDM 25	22-Jul-19	2138	2313	8.2	2100	101.8	2.1%	29.46	Pass	Testing of batter adjacent to golf course
NDM 26	22-Jul-19	1953	2132	9.2	2100	93.0	8.6%	29.49	Pass	Testing of batter adjacent to golf course
NDM 27	22-Jul-19	2032	2226	9.6	2100	96.8	4.1%	29.27	Pass	Testing of batter adjacent to golf course
NDM 28	22-Jul-19	1982	2136	7.8	2100	94.4	10.0%	29.58	Pass	Testing of batter adjacent to golf course
NDM 29	03-Sep-19	2144	2293	6.9	2175	98.6	4.6%	28.36	Pass	Tests on Road 2
NDM 30	03-Sep-19	2224	2356	6	2175	102.3	3.0%	28.36	Pass	Tests on Road 2
NDM 31	03-Sep-19	2094	2211	5.6	2175	96.3	9.6%	28.94	Pass	Tests on Road 2
NDM 32	03-Sep-19	2068	2169	4.9	2175	95.1	12.1%	28.95	Pass	Tests on Road 2
NDM 33	01-Oct-19	2138	2274	6.3	2175	98.3	6.2%	29.93	Pass	Lot 1
NDM 34	01-Oct-19	2125	2286	7.6	2175	97.7	4.0%	29.84	Pass	Lot 1
NDM 35	01-Oct-19	2017	2179	8	2175	92.7	8.0%	29.95	Pass	Lot 3

NDM 36	01-Oct-19	2125	2262	6.5	2175	97.7	6.3%	29.75	Pass	Lot 2
NDM 37	01-Oct-19	2012	2216	10.1	2175	92.5	4.0%	29.69	Pass	Lot 4
NDM 38	01-Oct-19	1994	2185	9.5	2175	91.7	6.1%	29.57	Pass	Lot 5
NDM 39	01-Oct-19	2052	2192	6.8	2175	94.3	8.9%	29.64	Pass	Lot 6
NDM 40	01-Oct-19	2138	2317	8.4	2175	98.3	1.7%	29.53	Pass	Lot 7
NDM 41	01-Oct-19	2082	2249	8	2175	95.7	5.1%	29.52	Pass	Lot 8
NDM 42	01-Oct-19	1921	2060	7.2	2000	96.1	14.0%	29.63	Pass	Lot 9 - Different Material (Sandier Matrix)
NDM 43	01-Oct-19	2205	2288	3.8	2175	101.4	8.7%	29.43	Pass	Lot 8
NDM 44	07-Nov-19	2096	2240	6.9	2175	96.4	7.0%	28.45	Pass	Lot 28
NDM 45	07-Nov-19	1792	1967	9.8	1950	91.9	15.3%	29.38	Pass	Lot 28
NDM 45R	13-Nov-19	1747	1877	7.4	1950	89.6	21.6%	29.38	Pass	Lot 28
NDM 46	07-Nov-19	1950	2122	8.8	1950	100.0	9.8%	29.09	Pass	Lot 27
NDM 47	07-Nov-19	1935	2034	5.1	1950	99.2	17.7%	29.22	Pass	Lot 26
NDM 48	07-Nov-19	1829	2029	10.9	1950	93.8	11.6%	29.37	Pass	Lot 24
NDM 48R	13-Nov-19	1796	1954	8.8	1950	92.1	16.9%	29.37	Pass	Lot 24
NDM 49	07-Nov-19	1754	1907	8.7	1950	89.9	19.0%	29.34	Pass	Lot 23
NDM 49R	13-Nov-19	1764	1958	11.0	1950	90.5	14.5%	29.34	Pass	Lot 23
NDM 50	09-Dec-19	1861	1998	7.3	1950	95.4	16.7%	29.59		Lot 23
NDM 51	09-Dec-19	1925	2030	5.4	1950	98.7	17.5%	29.61		Lot 24
NDM 52	09-Dec-19	1915	2051	7.1	1950	98.2	14.7%	29.68		Lot 25
NDM 53	09-Dec-19	1871	2026	8.2	1950	95.9	14.6%	29.55		Lot 26
NDM 54	09-Dec-19	1758 1789	1890 1912	7.5 6.8	1950 1950	90.2 91.7	21.0% 20.8%	29.40		Lot 27
NDM 55	09-Dec-19	1788 1846	1907 1965	6.6 6.4	1950 1950	91.7 94.7	21.2% 19.0%	29.25		Lot 28
NDM 56	09-Dec-19	1926	2042	6.0	1950	98.8	16.3%	29.18		Lot 18
NDM 57	09-Dec-19	1866	2028	8.7	1950	95.7	13.9%	29.24		Lot 19
NDM 58	09-Dec-19	1922	2067	7.5	1950	98.6	13.6%	29.27		Lot 19
NDM 59	09-Dec-19	1982	2128	7.4	1950	101.6	11.1%	29.20		Lot 20
NDM 60	09-Dec-19	2027	2154	6.3	1950	103.9	11.3%	29.15		Lot 21
NDM 61	30-Jan-20	1790 1864	2000 2124	11.7 13.9	1950 1950	91.8 95.6	12.0% 4.3%	28.53		Lot 17
NDM 62	30-Jan-20	1890 1777	2114 1998	11.9 12.4	1950 1950	96.9 91.1	6.7% 11.4%	28.50		Lot 16
NDM 63	30-Jan-20	2000 1936	2208 2126	10.4 9.8	2000 2000	100.0 96.8	4.3% 8.5%	28.48		Lot 15
NDM 64	30-Jan-20	1976 1961	2184 2164	10.5 10.3	2000 2000	98.8 98.1	5.2% 6.4%	28.55		Lot 15
NDM 65	30-Jan-20	1888 2043	2037 2207	7.9 8	2000 2000	94.4 102.2	14.4% 7.1%	28.50		Lot 14
NDM 66	30-Jan-20	1951 1931	2124 2102	8.9 8.9	1950 1950	100.1 99.0	9.6% 10.5%	28.50		Lot 13
NDM 67	30-Jan-20	1886 1844	2061 2019	9.3 9.5	1950 1950	96.7 94.6	11.8% 13.4%	28.38		Lot 12
NDM 68	30-Jan-20	1823 1858	2014 2061	10.5 10.9	1950 1950	93.5 95.3	12.6% 10.2%	28.70		Lot 11
NDM 69	31-Jan-20	1990 2243	2181 2447	9.6 9.1	2000 2000	99.5 112.2	6.4% -4.4%	28.59		Lot 17
NDM 70	31-Jan-20	1974 2000	2185 2205	10.7 10.3	2000 2000	98.7 100.0	4.9% 4.5%	28.54		Lot 16
NDM 71	31-Jan-20	2001 1982	2010 2194	10.4 10.7	2000 2000	100.1 99.1	4.2% 4.6%	28.68		Lot 15
NDM 72	31-Jan-20	2050 2250	2236 2445	9.1 8.7	2000 2000	102.5 112.5	4.6% -3.8%	28.54		Lot 14
NDM 73	31-Jan-20	1980 2007	2160 2195	9.1 9.4	2000 2000	99.0 100.4	7.8% 6.0%	28.65		Lot 13
NDM 74	31-Jan-20	2010 2009	2188 2200	8.9 9.5	2000 2000	100.5 100.5	6.8% 5.7%	28.58		Lot 12
NDM 75	04-Feb-20	1950	2085	6.9	2000	97.5	13.5%	28.91		Lot 17
NDM 76	04-Feb-20	1927	2041	5.9	2000	96.4	16.5%	28.84		Lot 16
NDM 77	04-Feb-20	2029	2136	5.3	2000	101.5	13.3%	28.98		Lot 15
NDM 78	04-Feb-20	1947	2072	6.4	2000	97.4	14.6%	28.96		Lot 14

NDM 79	04-Feb-20	2005	2125	6.0	2000	100.3	12.9%	29.00	Lot 13
NDM 80	04-Feb-20	1964	2103	7.1	2000	98.2	12.5%	28.97	Lot 12
NDM 81	07-Feb-20	1864	1965	5.4	1950	95.6	20.1%	29.03	Lot 17
NDM 82	07-Feb-20	1922	2046	6.4	1950	98.6	15.7%	29.09	Lot 16
NDM 83	07-Feb-20	1875	1997	6.5	1950	96.2	17.6%	29.07	Lot 14
NDM 84	07-Feb-20	1848	2017	9.2	1950	94.8	13.8%	29.05	Lot 13
NDM 85	07-Feb-20	1938	2111	8.9	1950	99.4	10.2%	29.03	Lot 12
NDM 86	07-Feb-20	1945	2096	7.8	1950	99.7	12.0%	28.96	Lot 11
NDM 87	07-Feb-20	1978	2133	7.8	1950	101.4	10.5%	28.50	Lot 10
NDM 88	07-Feb-20	1873	2010	7.3	1950	96.1	16.2%	28.85	Lot 9
NDM 89	11-Feb-20	1860	2101	13.0	1950	95.4	6.2%	29.16	Lot 11
NDM 90	11-Feb-20	1807	1976	9.4	1950	92.7	15.3%	28.89	Lot 11
NDM 91	11-Feb-20	1830	1967	7.5	1950	93.8	17.7%	28.80	Lot 10
NDM 92	11-Feb-20	1796	1951	8.6	1950	92.1	17.3%	28.92	Lot 10
NDM 93	11-Feb-20	1841	1968	6.9	1950	94.4	18.3%	29.07	Lot 10
NDM 94	20-Feb-20	1916	2094	9.3	1950	98.3	10.4%	29.20	Lot 11
NDM 95	20-Feb-20	1889	2079	10.1	1950	96.9	10.2%	29.12	Lot 11
NDM 96	20-Feb-20	2104	2237	6.3	2100	100.2	7.9%	29.34	Proctor not consistent with 1950, 3x tests undertaken, all similar readings. Rock present. (Lot 10)
NDM 97	20-Feb-20	1906	2039	7.0	1950	97.7	15.3%	29.20	Lot 10
NDM 98	20-Feb-20	1941	2106	8.5	1950	99.5	10.8%	29.45	Lot 9

NOTE: **Maximum Target Dry Density figure generally used is 2.175 t/m³. This was assumed for the material, but agrees well based on comparisons made with l results, which was imported riverrun material (known target density of 2.175 t/m³)**
Subsequent Target Dry Density figures have been attained from samples sent off to Opus Lab (3x samples sent 24-06-2019; 2x samples sent 11-09-2019

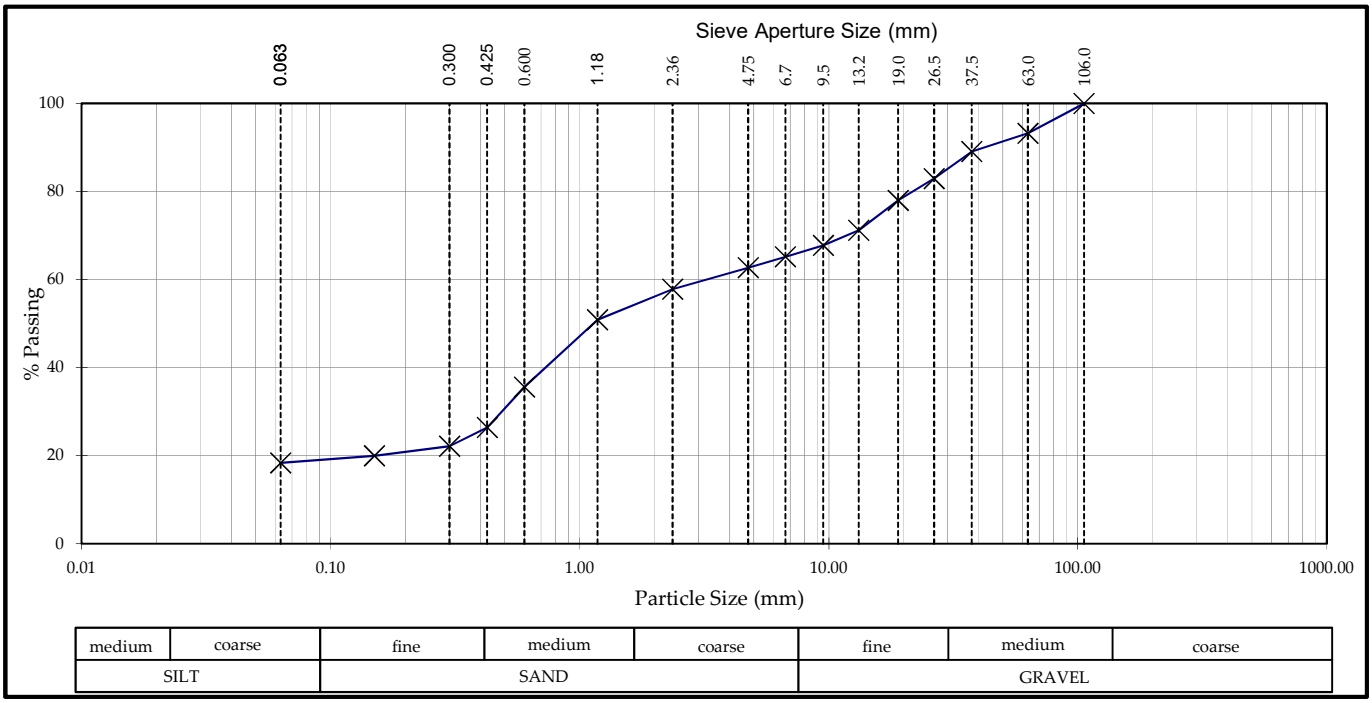
WET SIEVE ANALYSIS
TEST REPORT

Project :	**Centennial Drive, 219037**
Location :	**Palmerston North**
Client :	**Resonant Consulting Limited**
Contractor :	**Resonant Consulting Limited**
Sampled by :	**Client**
Date sampled :	**24/06/19**
Sampling method :	**Unknown**
Sample description :	**Gravelly SAND/Sandy GRAVEL, some silt; brown.**
Sample condition	**As received, sealed, moist**
Bore hole no :	**-**
Depth (m) :	**-**

Project No :	**5-WTLRE.00**
Lab Ref No :	**WA602.1**
Client Ref No :	**Metal, #1**

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
106.00	100	19.00	78	4.75	63	0.425	26
63.00	93	13.20	71	2.36	58	0.300	22
37.50	89	9.50	68	1.18	51	0.150	20
26.50	83	6.70	65	0.600	36	0.063	18



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received Fraction tested: Whole soil Dispersant Used: SHMP *Fraction passing finest sieve is by difference.*

Date tested : 08/07/19 - 11/07/19
Date reported : 11/07/19

Approved

R Jones
Designation : *Laboratory Manager*
Date : 12/07/19

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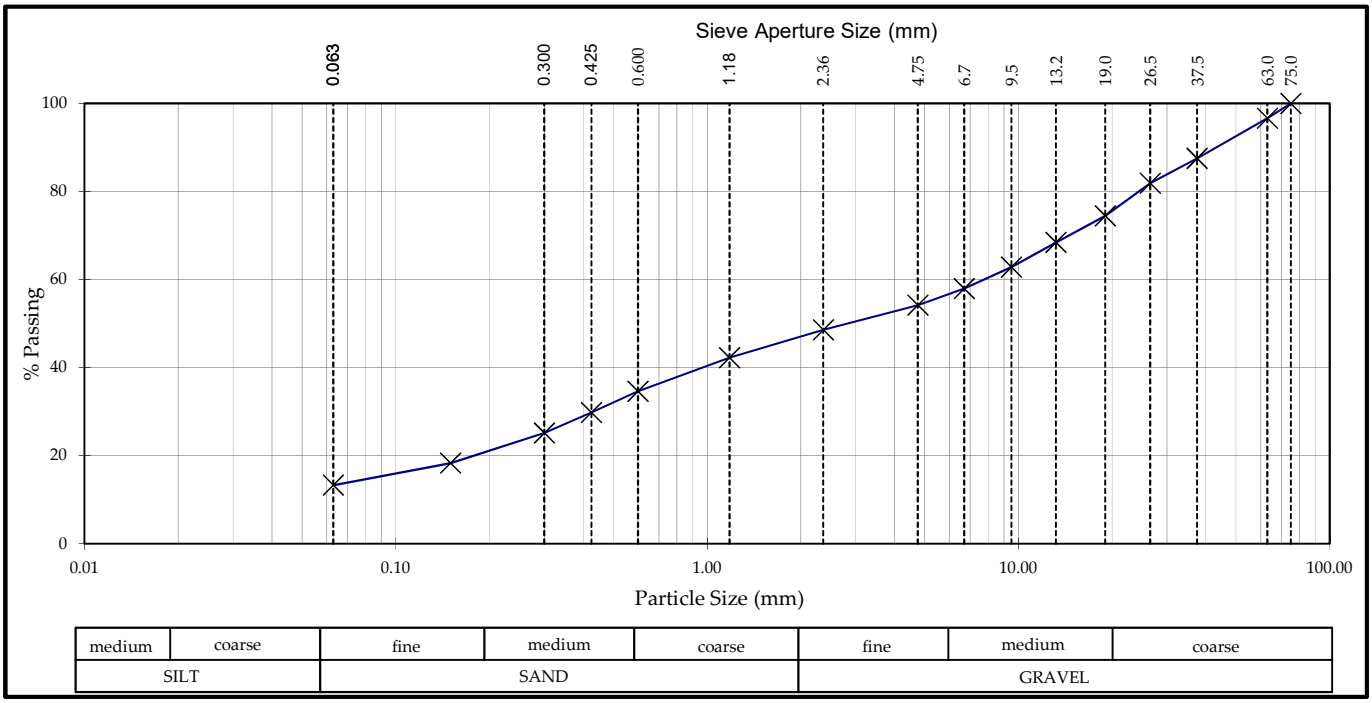
WET SIEVE ANALYSIS
TEST REPORT

Project :	**Centennial Drive, 219037**
Location :	**Palmerston North**
Client :	**Resonant Consulting Limited**
Contractor :	**Resonant Consulting Limited**
Sampled by :	**Client**
Date sampled :	**24/06/19**
Sampling method :	**Unknown**
Sample description :	**Sandy GRAVEL, some silt; brown.**
Sample condition	**As received, sealed, moist**
Bore hole no :	**-**
Depth (m) :	**-**

Project No :	**5-WTLRE.00**
Lab Ref No :	**WA602.2**
Client Ref No :	**Metal, #2**

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	100	19.00	74	4.75	54	0.425	30
63.00	97	13.20	68	2.36	49	0.300	25
37.50	88	9.50	63	1.18	42	0.150	18
26.50	82	6.70	58	0.600	35	0.063	13



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received Fraction tested: Whole soil Dispersant Used: SHMP *Fraction passing finest sieve is by difference.*

Date tested : 08/07/19 - 11/07/19
Date reported : 11/07/19

Approved

R Jones
Designation : *Laboratory Manager*
Date : 12/07/19

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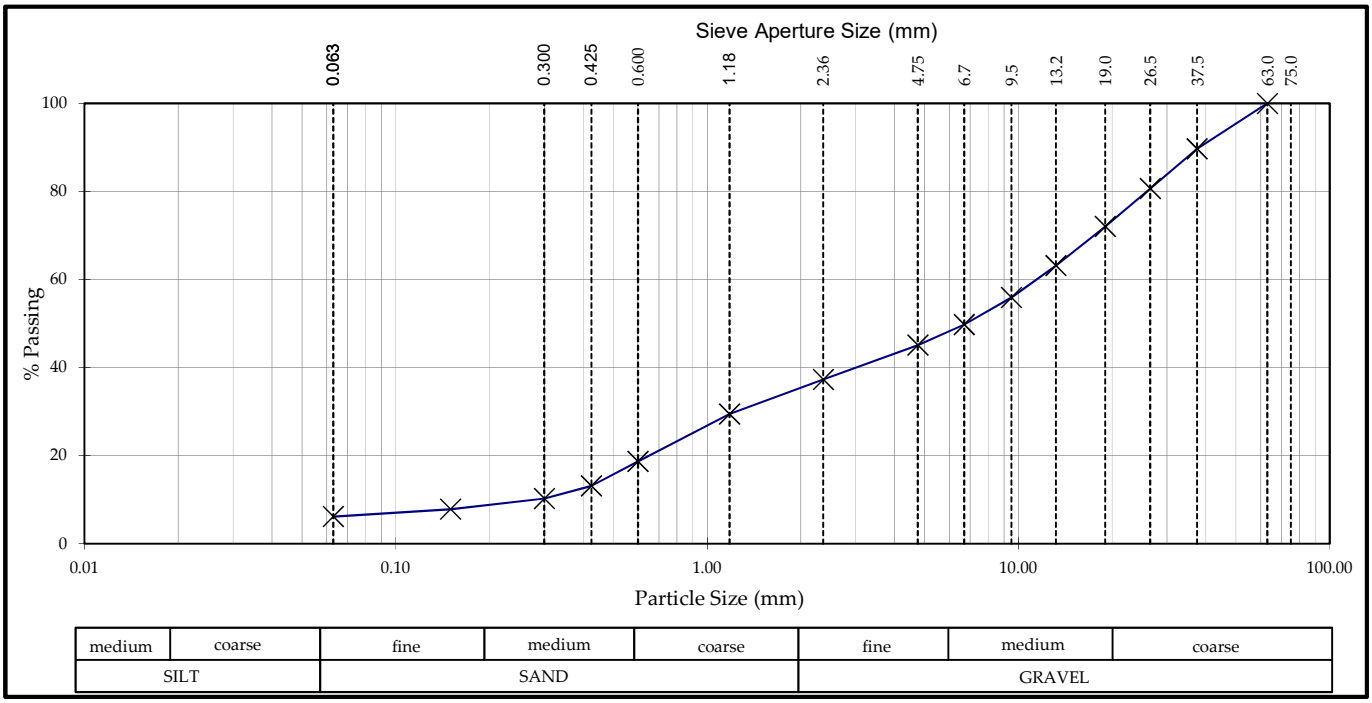
WET SIEVE ANALYSIS
TEST REPORT

Project :	**Centennial Drive, 219037**
Location :	**Palmerston North**
Client :	**Resonant Consulting Limited**
Contractor :	**Resonant Consulting Limited**
Sampled by :	**Client**
Date sampled :	**24/06/19**
Sampling method :	**Unknown**
Sample description :	**Sandy GRAVEL, minor silt; brown.**
Sample condition	**As received, sealed, moist**
Bore hole no :	**-**
Depth (m) :	**-**

Project No :	**5-WTLRE.00**
Lab Ref No :	**WA602.3**
Client Ref No :	**Metal, #3**

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	72	4.75	45	0.425	13
63.00	100	13.20	63	2.36	37	0.300	10
37.50	90	9.50	56	1.18	29	0.150	8
26.50	81	6.70	50	0.600	19	0.063	6



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: As received Fraction tested: Whole soil Dispersant Used: SHMP *Fraction passing finest sieve is by difference.*

Date tested : 08/07/19
Date reported : 11/07/19

Approved

R Jones
Designation : *Laboratory Manager*
Date : 12/07/19

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DRY DENSITY / WATER CONTENT RELATIONSHIP
STANDARD COMPACTION

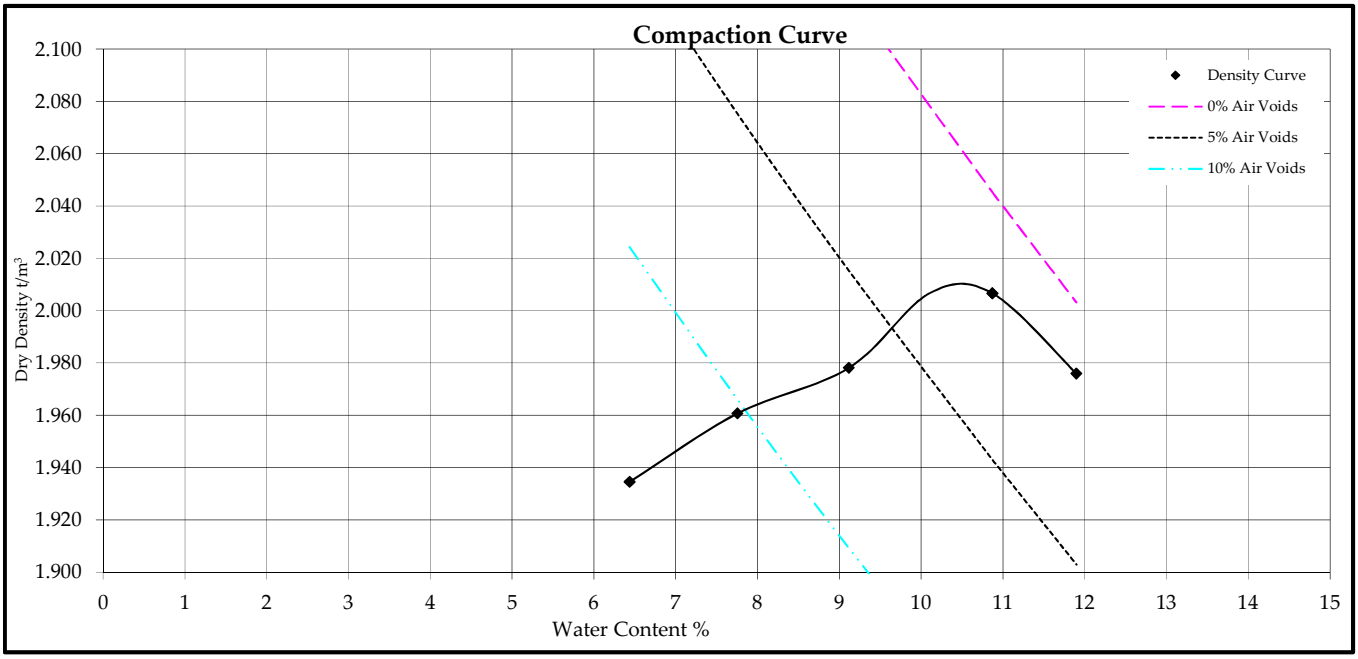
Project :	**Centennial Drive, 219037**
Location :	**Palmerston North**
Client :	**Resonant Consulting Limited**
Contractor :	**Resonant Consulting Limited**
Sampled by :	**Client**
Date sampled :	**24/06/19**
Sampling method :	**Unknown**
Sample description :	**Gravelly SAND/Sandy GRAVEL, some silt; brown.**
Sample condition :	**As received, sealed, moist**
Solid density :	**2.63 t/m³ (Assumed)**
Source :	**Site**

Project No :	**5-WTLRE.00**
Lab Ref No :	**WA602.4**
Client Ref No :	**Metal, #1**

Test Results

Maximum dry density	2.01	t/m³	Natural water content	6.4	%
Optimum water content	10	%	Fraction tested	Minus 19 mm	

Sample ID		Nat	1.5	3	4.5	6		
Bulk density	t/m³	2.059	2.113	2.158	2.225	2.211		
Water content	%	6.4	7.8	9.1	10.9	11.9		
Dry density	t/m³	1.935	1.961	1.978	2.007	1.976		
Sample condition					Spongy	Free water		



Test Methods		Notes
Compaction	NZS 4402 : 1986 Test 4.1.1 (Standard)	

Date tested : 08/07/19 - 11/07/19
Date reported : 11/07/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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IANZ Approved Signatory
R Jones
Designation : *Laboratory Manager*
Date : 12/07/19

IANZ ACCREDITED LABORATORY

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

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DRY DENSITY / WATER CONTENT RELATIONSHIP
STANDARD COMPACTION

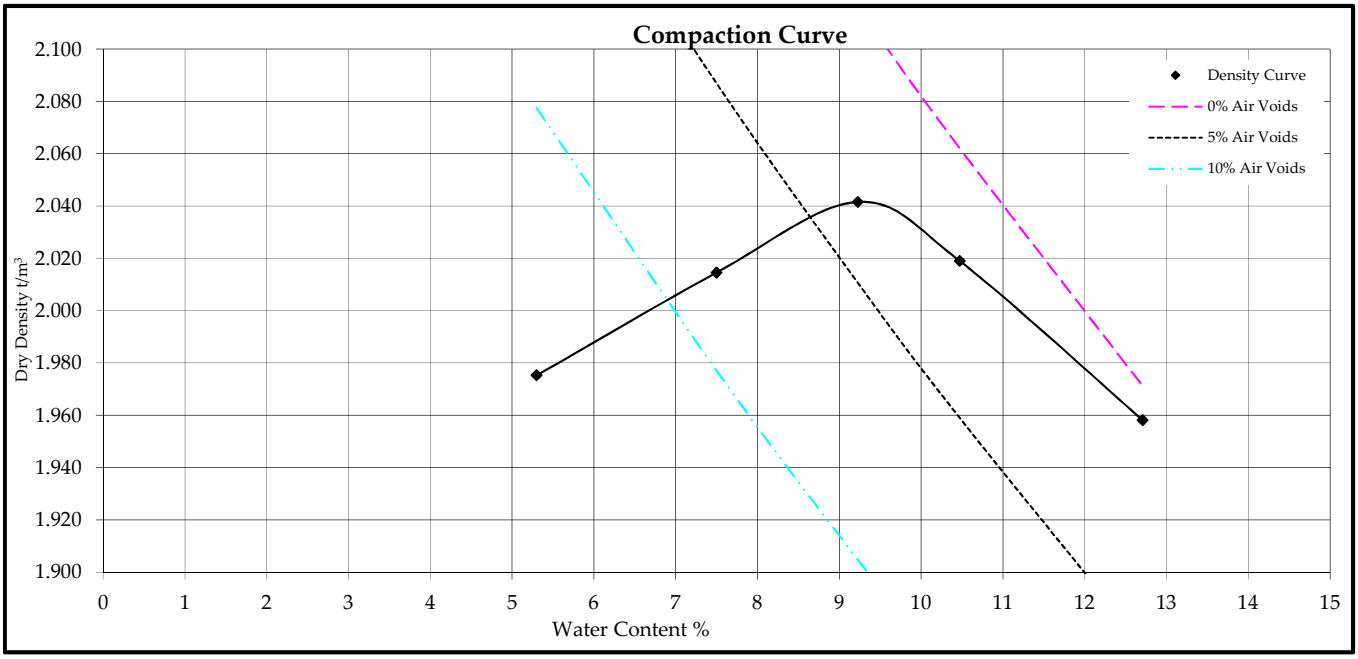
Project :	**Centennial Drive, 219037**
Location :	**Palmerston North**
Client :	**Resonant Consulting Limited**
Contractor :	**Resonant Consulting Limited**
Sampled by :	**Client**
Date sampled :	**24/06/19**
Sampling method :	**Unknown**
Sample description :	**Sandy GRAVEL, some silt; brown.**
Sample condition :	**As received, sealed, moist**
Solid density :	**2.63 t/m³ (Assumed)**
Source :	**Site**

Project No :	**5-WTLRE.00**
Lab Ref No :	**WA602.5**
Client Ref No :	**Metal, #2**

Test Results

Maximum dry density	2.04	t/m³	Natural water content	12.7 %
Optimum water content	9.0	%	Fraction tested	Minus 19 mm

Sample ID		-6	-4.5	-3	-1.5	Nat		
Bulk density	t/m³	2.080	2.166	2.230	2.230	2.207		
Water content	%	5.3	7.5	9.2	10.5	12.7		
Dry density	t/m³	1.975	2.015	2.042	2.019	1.958		
Sample condition					Soft	Spongy		



Test Methods		Notes
Compaction	NZS 4402 : 1986 Test 4.1.1 (Standard)	

Date tested : 08/07/19 - 11/07/19
Date reported : 11/07/19

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IANZ Approved Signatory
R Jones
Designation : *Laboratory Manager*
Date : 12/07/19

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DRY DENSITY / WATER CONTENT RELATIONSHIP
STANDARD COMPACTION

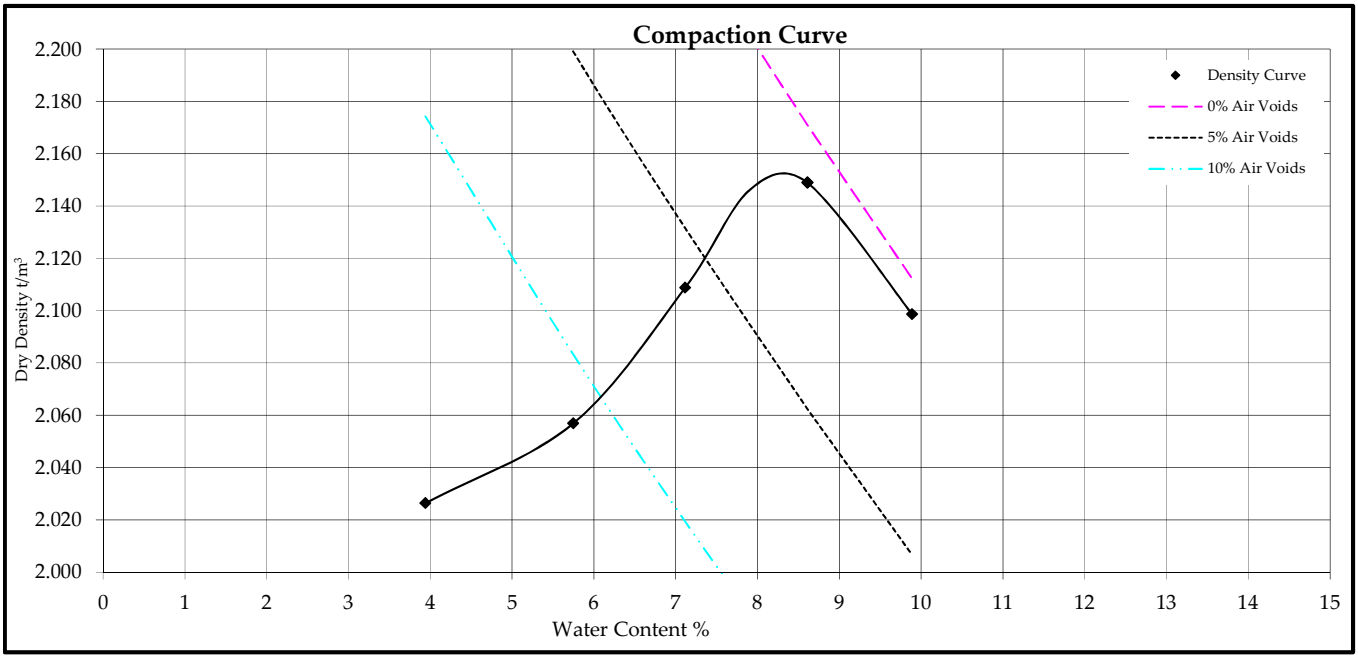
Project :	**Centennial Drive, 219037**
Location :	**Palmerston North**
Client :	**Resonant Consulting Limited**
Contractor :	**Resonant Consulting Limited**
Sampled by :	**Client**
Date sampled :	**24/06/19**
Sampling method :	**Unknown**
Sample description :	**Sandy GRAVEL, minor silt; brown.**
Sample condition :	**As received, sealed, moist**
Solid density :	**2.67 t/m³ (Assumed)**
Source :	**Site**

Project No :	**5-WTLRE.00**
Lab Ref No :	**WA602.6**
Client Ref No :	**Metal, #3**

Test Results

Maximum dry density		2.15	t/m³		Natural water content	8.6	%	
Optimum water content		8.5	%		Fraction tested	Minus 19 mm		

Sample ID		-4.5	-3	-1.5	Nat	1.5		
Bulk density	t/m³	2.106	2.175	2.259	2.334	2.306		
Water content	%	3.9	5.7	7.1	8.6	9.9		
Dry density	t/m³	2.026	2.057	2.109	2.149	2.099		
Sample condition						Spongy		



Test Methods		Notes
Compaction	NZS 4402 : 1986 Test 4.1.1 (Standard)	

Date tested : 08/07/19 - 11/07/19
Date reported : 11/07/19

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IANZ Approved Signatory
R Jones
Designation : *Laboratory Manager*
Date : 12/07/19

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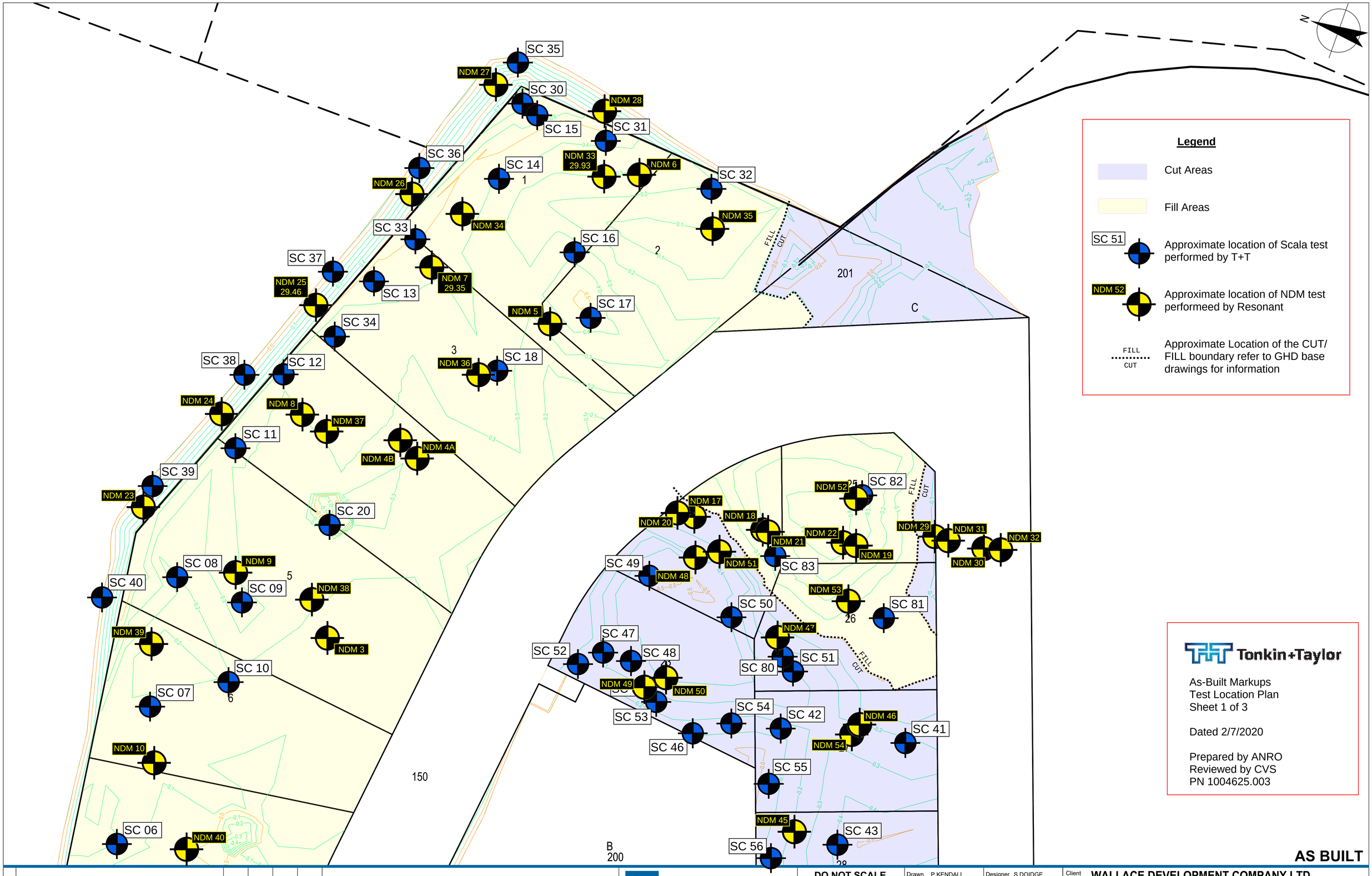
Appendix D: Dynamic cone (scala) penetrometer test results

Date	SC # OLD (on original field sheets)	SC # NEW (on sketch plans Sheets 1 to 3)	Depth (m)
21/05/2019	1	SC 01	0.7
	2	SC 02	2.0
	3	SC 03	0.4
	4	SC 04	1.0
	5	SC 05	0.8
	6	SC 06	0.8
	7	SC 07	0.5
	8	SC 08	0.9
	9	SC 09	1.9
	10	SC 10	0.5
	11	SC 11	0.5
	12	SC 12	0.9
	13	SC 13	0.6
	14	SC 14	0.7
	15	SC 15	0.9
	16	SC 16	0.5
	17	SC 17	1.4
	18	SC 18	0.5
	19	SC 19	0.9
	20	SC 20	0.6
	Numbers 21 to 29 not used		
16/07/2019	30	SC 30	0.9
	31	SC 31	0.6
	32	SC 32	0.5
	33	SC 33	0.7
	34	SC 34	0.4
	35	SC 35	1.5
	36	SC 36	1.8
	37	SC 37	2.0
	38	SC 38	1.5
	39	SC 39	1.3
	40	SC 40	1.6

Date	SC # OLD (on original field sheets)	SC # NEW (on sketch plans Sheets 1 to 3)	Depth (m)
29/10/2019	A	SC 41	1.9
	B	SC 42	1.9
	C	SC 43	1.9
	D	SC 44	1.9
	E	SC 45	1.9
	F	SC 46	1.9
	G	SC 47	1.5
	H	SC 48	1.9
	I	SC 49	0.9
	J	SC 50	0.9
	K	SC 51	0.9
15/11/2019	A	SC 52	0.9
	B	SC 53	0.9
	C	SC 54	0.9
	D	SC 55	0.9
	E	SC 56	0.9
	F	SC 57	0.9
	G	SC 58	0.9
	H	SC 59	0.9
	I	SC 60	0.9
	J	SC 61	0.5
	K	SC 62	0.9
	L	SC 63	1.1
	M	SC 64	0.9
	N	SC 65	0.9
	O	SC 66	0.9
	P	SC 67	0.9
	Q	SC 68	0.9
	R	SC 69	0.9
	S	SC 70	0.9

Date	SC # OLD (on original field sheets)	SC # NEW (on sketch plans Sheets 1 to 3)	Depth (m)
13/01/2020	A	SC 71	0.9
	B	SC 72	0.2
	C	SC 73	0.9
	A (D)	SC 74	0.9
	E	SC 75	0.9
	F	SC 76	0.9
	G	SC 77	0.2
	H	SC 78	0.2
	I	SC 79	1.0
	J	SC 80	0.9
	K	SC 81	0.6
	L	SC 82	0.3
	M	SC 83	0.9
	N	SC 84	0.5
	O	SC 85	0.5
25/02/2020	A	SC 86	0.6
	B	SC 87	0.4
	C	SC 88	0.5
	A (D)	SC 89	0.3
	A (E)	SC 90	0.4
	F	SC 91	0.5
	G	SC 92	0.5
	H	SC 93	0.8
	I	SC 94	0.9
	J	SC 95	0.7
	K	SC 96	0.4
	L	SC 97	0.5
	M	SC 98	0.6
10/06/2020	SC1	SC 99	0.4
	SC2	SC 100	0.4
	SC3	SC 101	0.3
	SC4	SC 102	0.7



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As-Built Markups
Test Location Plan
Sheet 1 of 3

Dated 2/7/2020

Prepared by ANRO
Reviewed by CVS
PN 1004625.003

AS BUILT

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
AB	ASBUILT		PK	SD	AC	26/06/20

WALLACE DEVELOPMENT Company Limited

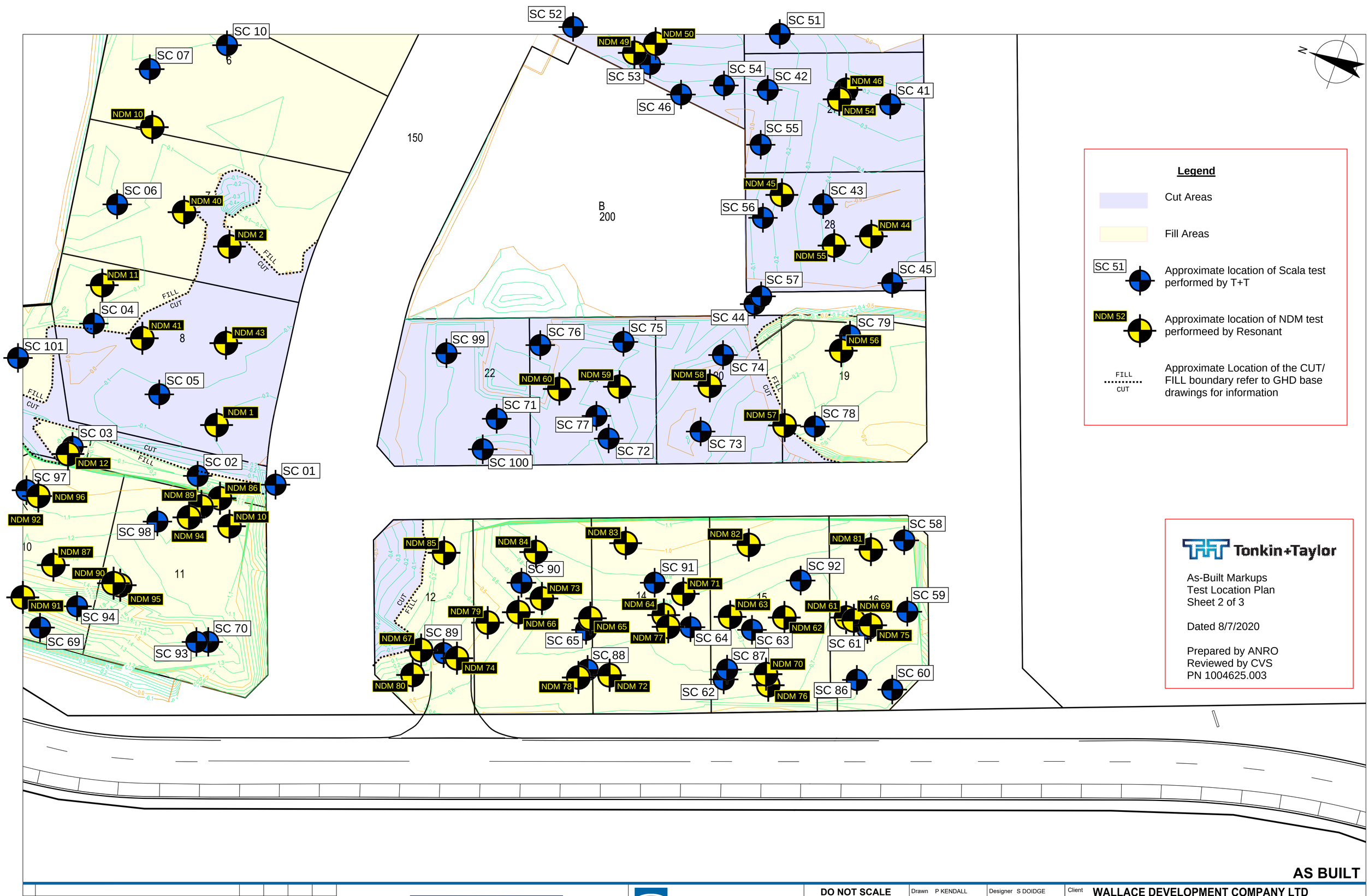
GHD
Level 2, 57-64 The Square, Palmerston North New Zealand
PO Box 447 Palmerston North
T 64 6 353 1800 F 64 6 353 1801
E palmmail@ghd.com W www.ghd.com

Drawn	P KENDALL	Designer	S DOIDGE
Drafting Check		Design Check	A CHISHOLM
Approved (Project Director)			
Date	26/06/20		
Scale	1:250 @ A1	This Drawing must not be used for Construction unless signed as Approved	

Client: WALLACE DEVELOPMENT COMPANY LTD
Project: CENTENNIAL PARK - STAGE 1
Title: CUT / FILL DEPTHS

Original Size: A1
Drawing No: ~~51-37652-C008~~
Rev: AB

Plot Date: 26 June 2020 - 11:39 AM Plotted by: Pirran Charles Kendall Cad File No: G:\51\37652\CADD\Drawings_STAGE 1\ASBUILTS\51-37652 - ASBUILT EARTHWORKS.dwg



N

Legend

- Cut Areas
- Fill Areas
- SC 51 — Approximate location of Scala test performed by T+T
- NDM 52 — Approximate location of NDM test performeed by Resonant
- FILL / CUT — Approximate Location of the CUT/ FILL boundary refer to GHD base drawings for information

Tonkin+Taylor

As-Built Markups
Test Location Plan
Sheet 2 of 3

Dated 8/7/2020

Prepared by ANRO
Reviewed by CVS
PN 1004625.003

AS BUILT

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
AB	ASBUILT		PK	SD	AC	26/06/20

WALLACE DEVELOPMENT Company Limited

GHD
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Drawn	P KENDALL	Designer	S DOIDGE
Drafting Check		Design Check	A CHISHOLM
Approved (Project Director)			
Date	26/06/20		
Scale	1:250 @ A1	This Drawing must not be used for Construction unless signed as Approved	

Client: WALLACE DEVELOPMENT COMPANY LTD
Project: CENTENNIAL PARK - STAGE 1
Title: CUT / FILL DEPTHS

Original Size: A1
Drawing No: ~~51-37652-C007~~
Rev: AB

Plot Date: 26 June 2020 - 11:39 AM Plotted by: Pirran Charles Kendall Cad File No: G:\51\37652\CADD\Drawings_STAGE 1\ASBUILTS\51-37652 - ASBUILT EARTHWORKS.dwg

Legend

- Cut Areas
- Fill Areas
- SC 51 — Approximate location of Scala test performed by T+T
- NDM 52 — Approximate location of NDM test performeed by Resonant
- FILL / CUT — Approximate Location of the CUT/ FILL boundary refer to GHD base drawings for information

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As-Built Markups
Test Location Plan
Sheet 3 of 3

Dated 8/7/2020

Prepared by ANRO
Reviewed by CVS
PN 1004625.003

AS BUILT

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
AB	ASBUILT		PK	SD	AC	26/06/20

WALLACE DEVELOPMENT Company Limited

GHD
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E palmmail@ghd.com W www.ghd.com

Drawn	P KENDALL	Designer	S DOIDGE
Drafting Check		Design Check	A CHISHOLM
Approved (Project Director)			
Date	26/06/20		
Scale	1:250 @ A1	This Drawing must not be used for Construction unless signed as Approved	

Client: WALLACE DEVELOPMENT COMPANY LTD
Project: CENTENNIAL PARK - STAGE 1
Title: CUT / FILL DEPTHS

Original Size: A1
Drawing No: ~~51-37652-C006~~
Rev: AB

Plot Date: 26 June 2020 - 11:38 AM Plotted by: Pirran Charles Kendall Cad File No: G:\51\37652\CADD\Drawings_STAGE 1\ASBUILTS\51-37652 - ASBUILT EARTHWORKS.dwg

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TONKIN & TAYLOR

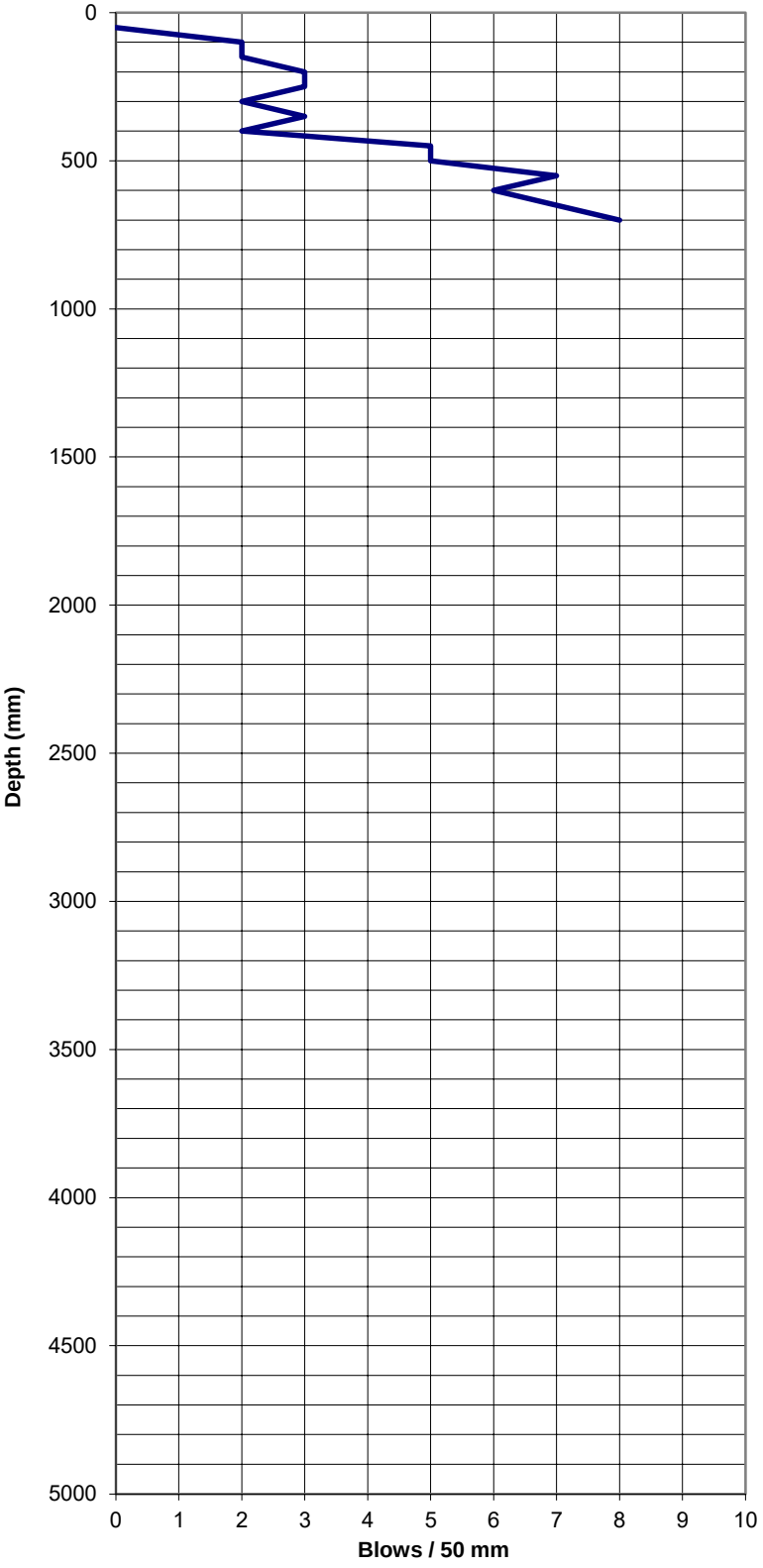
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	1
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	*2*	2600	
150	*2*	2650	
200	*3*	2700	
250	*3*	2750	
300	*2*	2800	
350	*3*	2850	
400	*2*	2900	
450	*5*	2950	
500	*5*	3000	
550	*7*	3050	
600	*6*	3100	
650	*7*	3150	
700	*8*	3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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TONKIN & TAYLOR

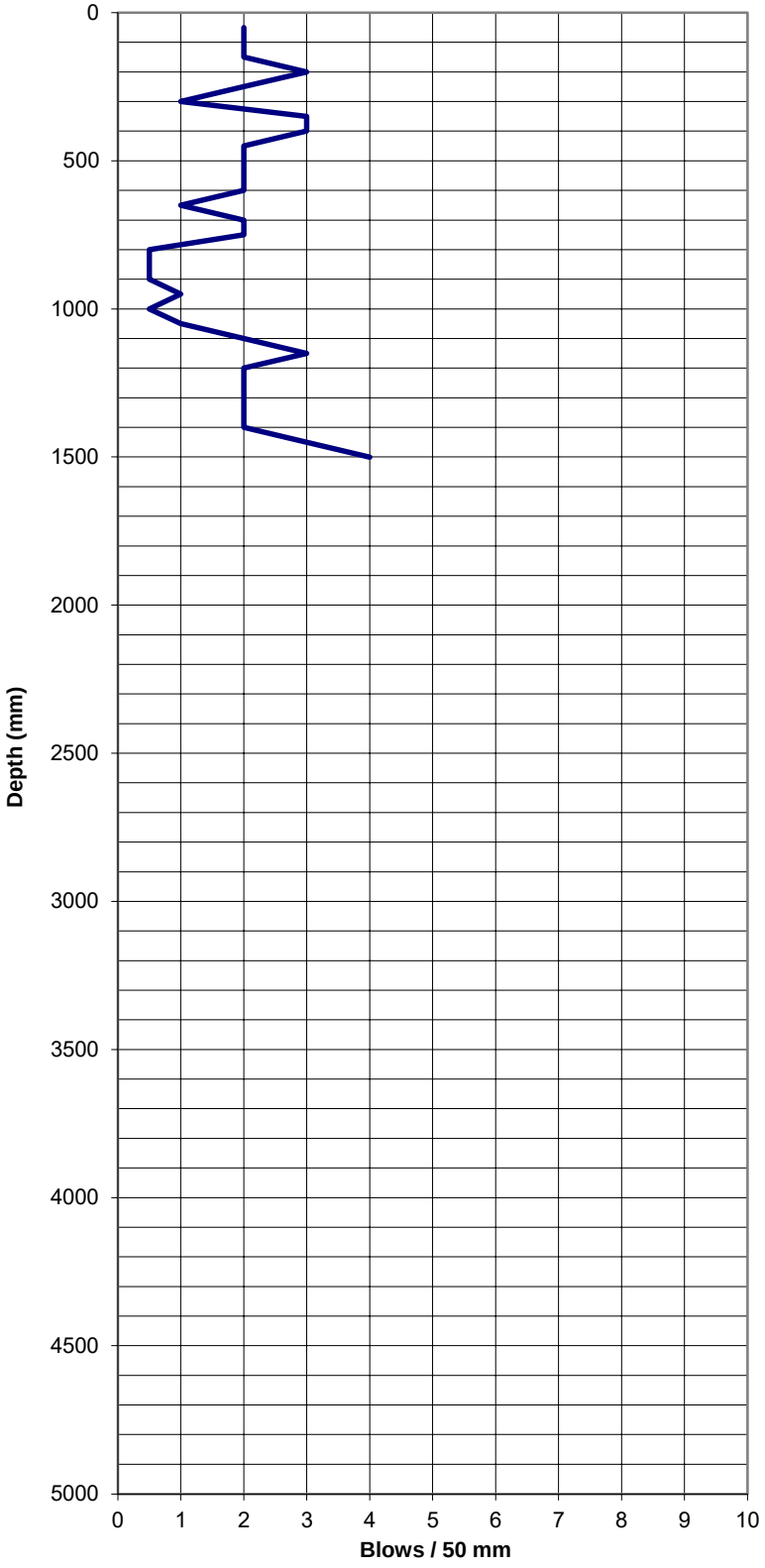
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	2
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*2*	2600	
150	*2*	2650	
200	*3*	2700	
250	*2*	2750	
300	*1*	2800	
350	*3*	2850	
400	*3*	2900	
450	*2*	2950	
500	*2*	3000	
550	*2*	3050	
600	*2*	3100	
650	*1*	3150	
700	*2*	3200	
750	*2*	3250	
800	*0.5*	3300	
850	*0.5*	3350	
900	*0.5*	3400	
950	*1*	3450	
1000	*0.5*	3500	
1050	*1*	3550	
1100	*2*	3600	
1150	*3*	3650	
1200	*2*	3700	
1250	*2*	3750	
1300	*2*	3800	
1350	*2*	3850	
1400	*2*	3900	
1450	*3*	3950	
1500	*4.0*	4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

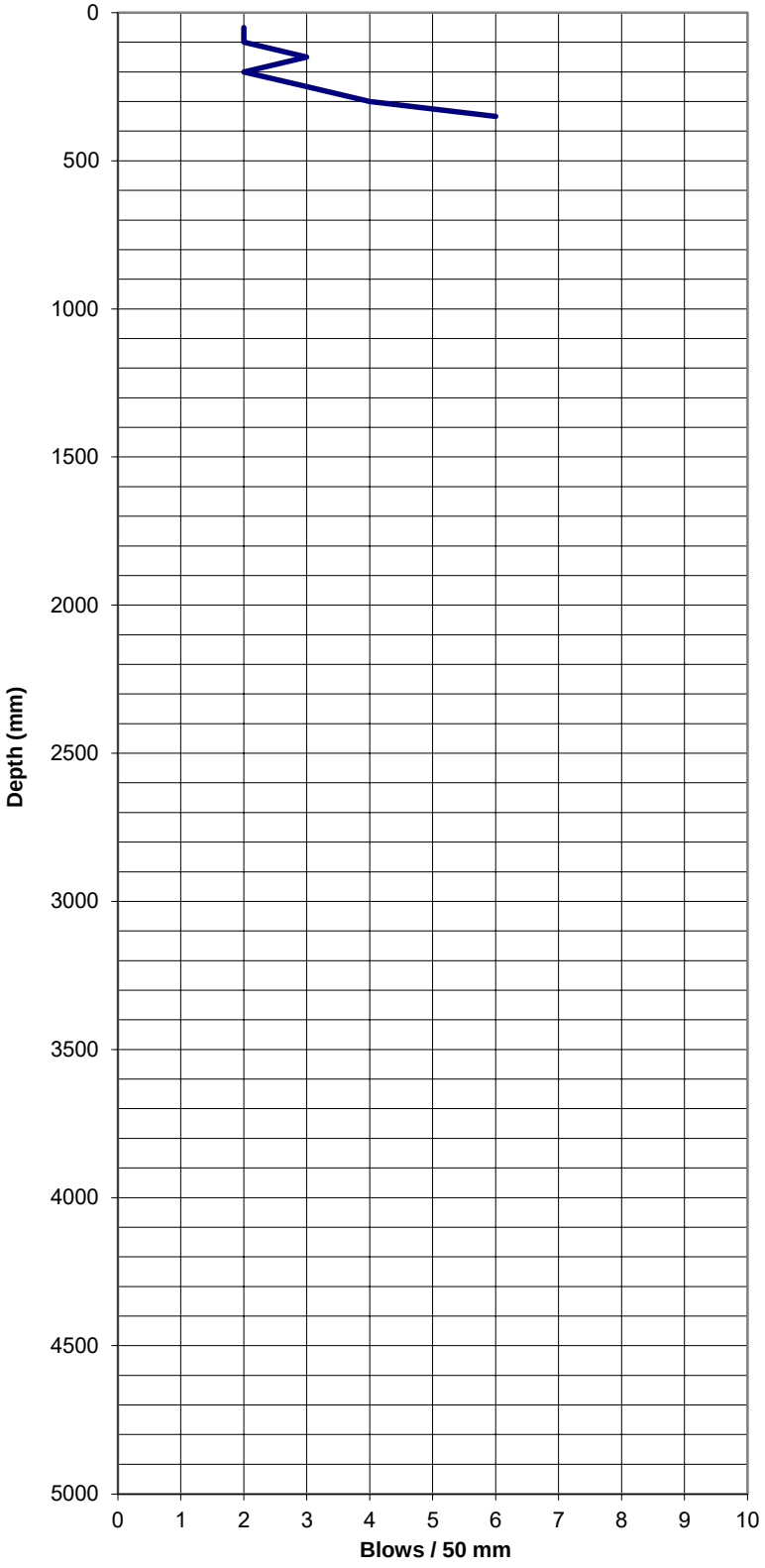
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	3
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*2*
150	*3*
200	*2*
250	*3*
300	*4*
350	*6*
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

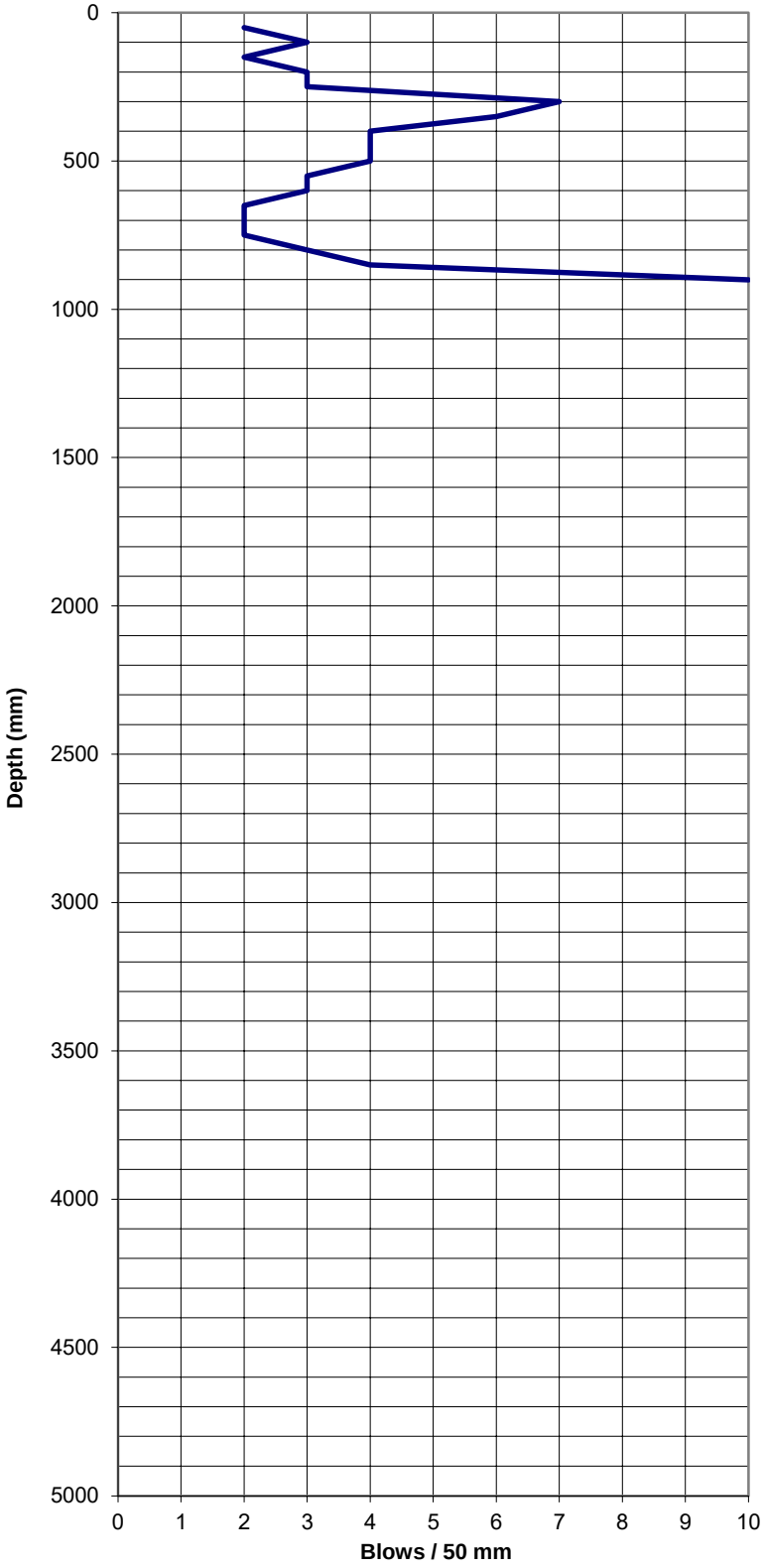
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	4
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*3*
150	*2*
200	*3*
250	*3*
300	*7*
350	*6*
400	*4*
450	*4*
500	*4*
550	*3*
600	*3*
650	*2*
700	*2*
750	*2*
800	*3*
850	*4*
900	*10*
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

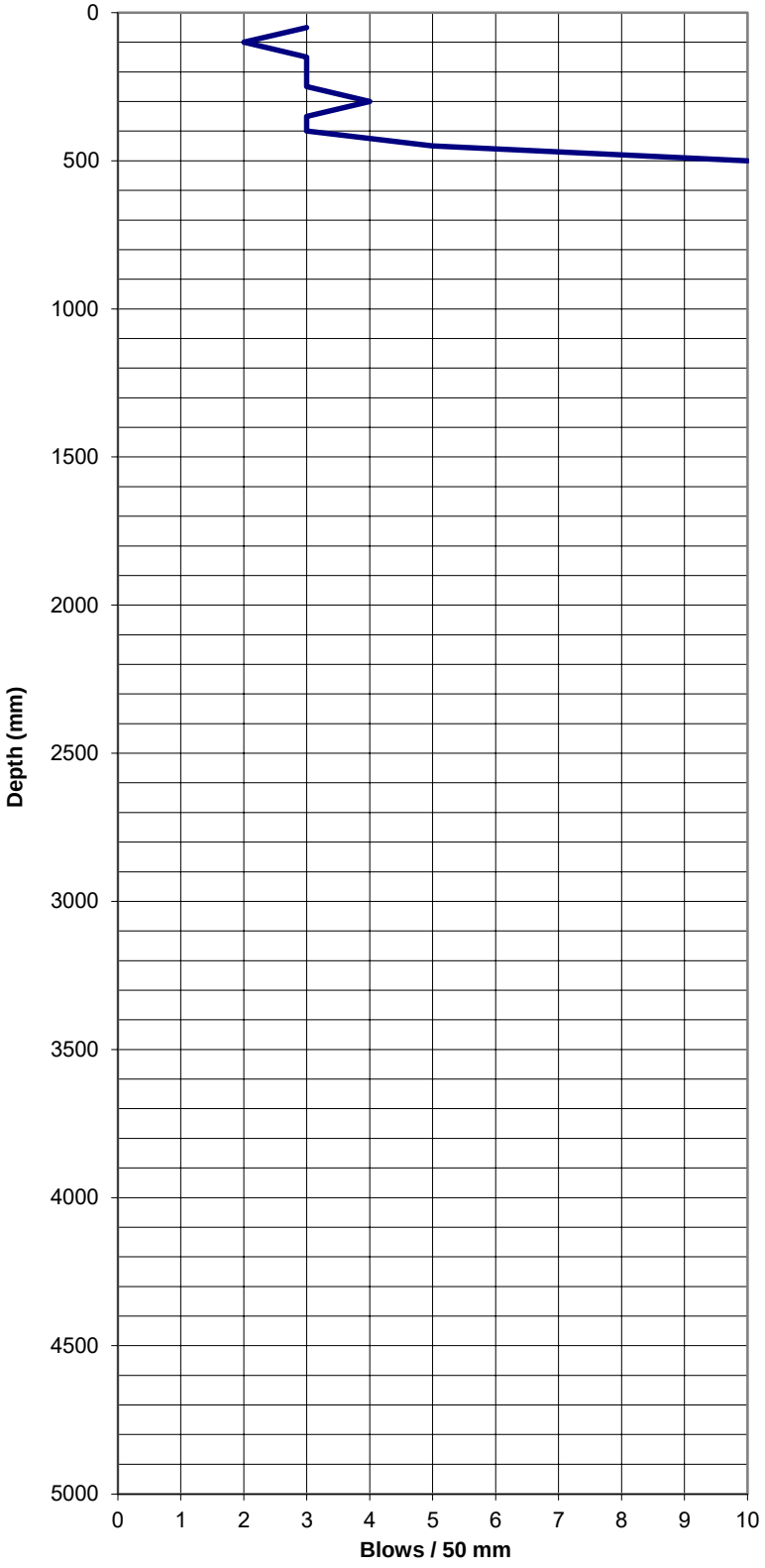
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	5
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*3*
100	*2*
150	*3*
200	*3*
250	*3*
300	*4*
350	*3*
400	*3*
450	*5*
500	*10*
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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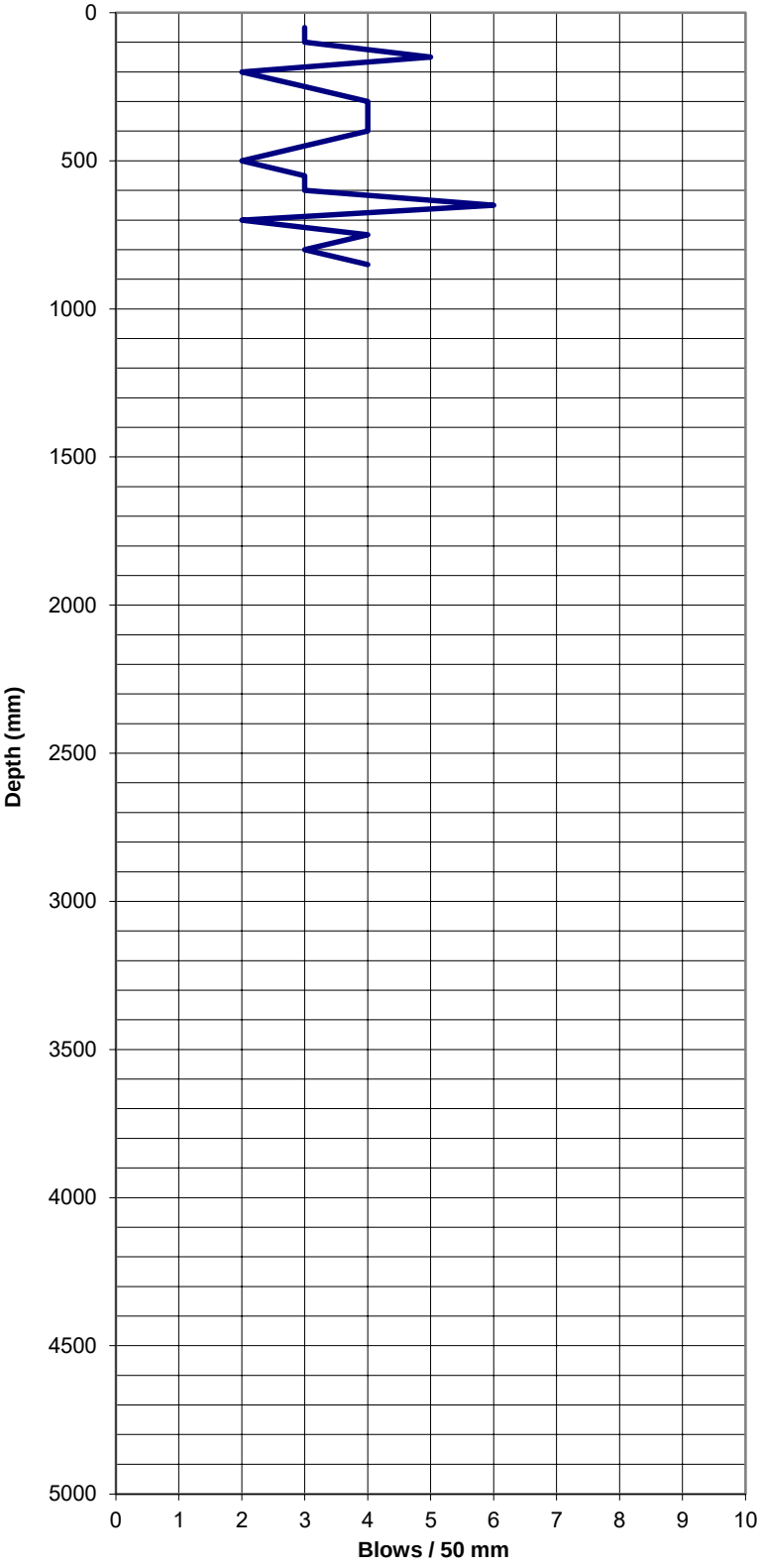
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	6
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*3*	2550	
100	*3*	2600	
150	*5*	2650	
200	*2*	2700	
250	*3*	2750	
300	*4*	2800	
350	*4*	2850	
400	*4*	2900	
450	*3*	2950	
500	*2*	3000	
550	*3*	3050	
600	*3*	3100	
650	*6*	3150	
700	*2*	3200	
750	*4*	3250	
800	*3*	3300	
850	*4*	3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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TONKIN & TAYLOR

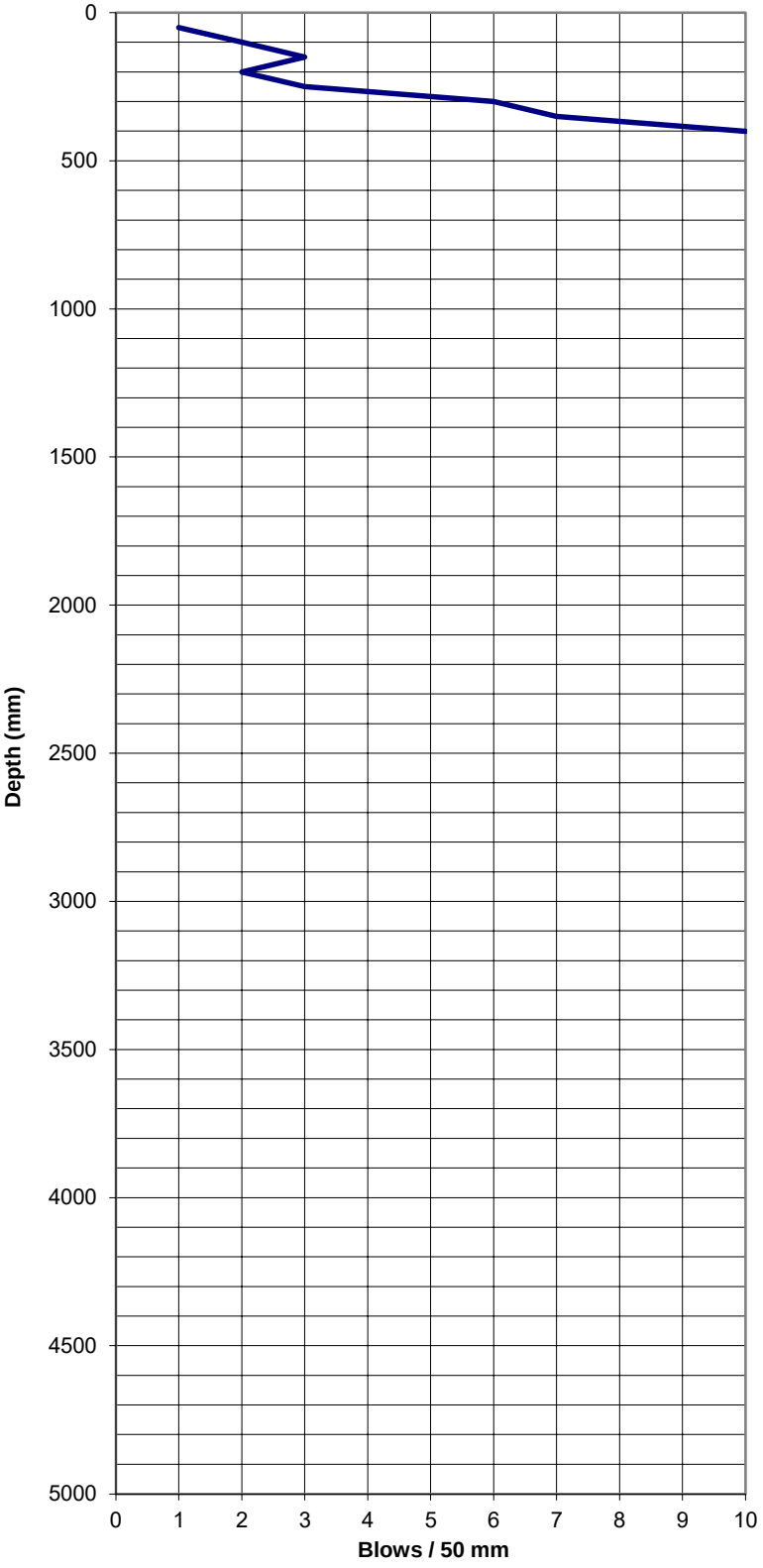
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	7
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*3*	2650	
200	*2*	2700	
250	*3*	2750	
300	*6*	2800	
350	*7*	2850	
400	*10*	2900	
450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

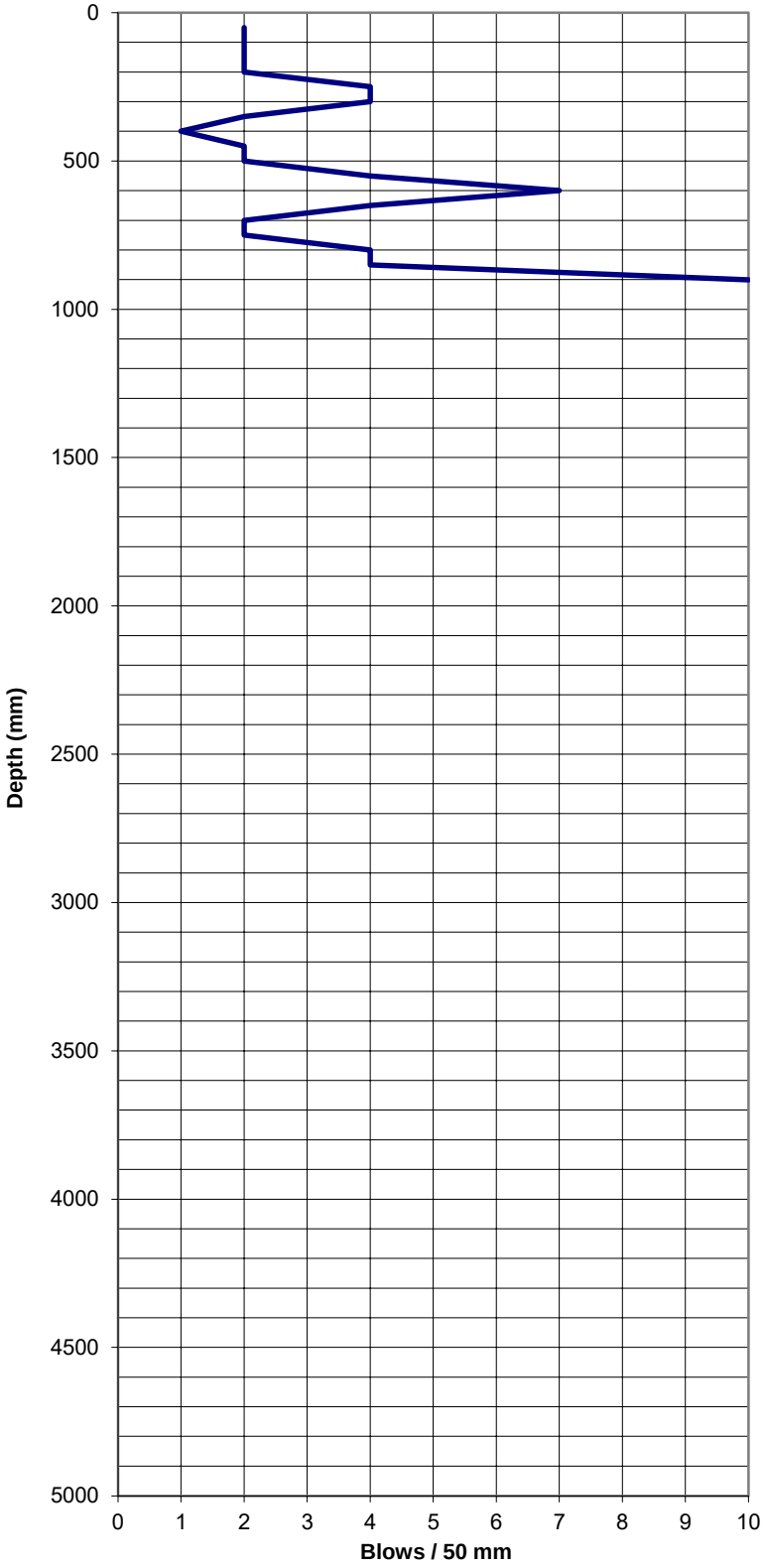
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	8
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*2*
150	*2*
200	*2*
250	*4*
300	*4*
350	*2*
400	*1*
450	*2*
500	*2*
550	*4*
600	*7*
650	*4*
700	*2*
750	*2*
800	*4*
850	*4*
900	*10*
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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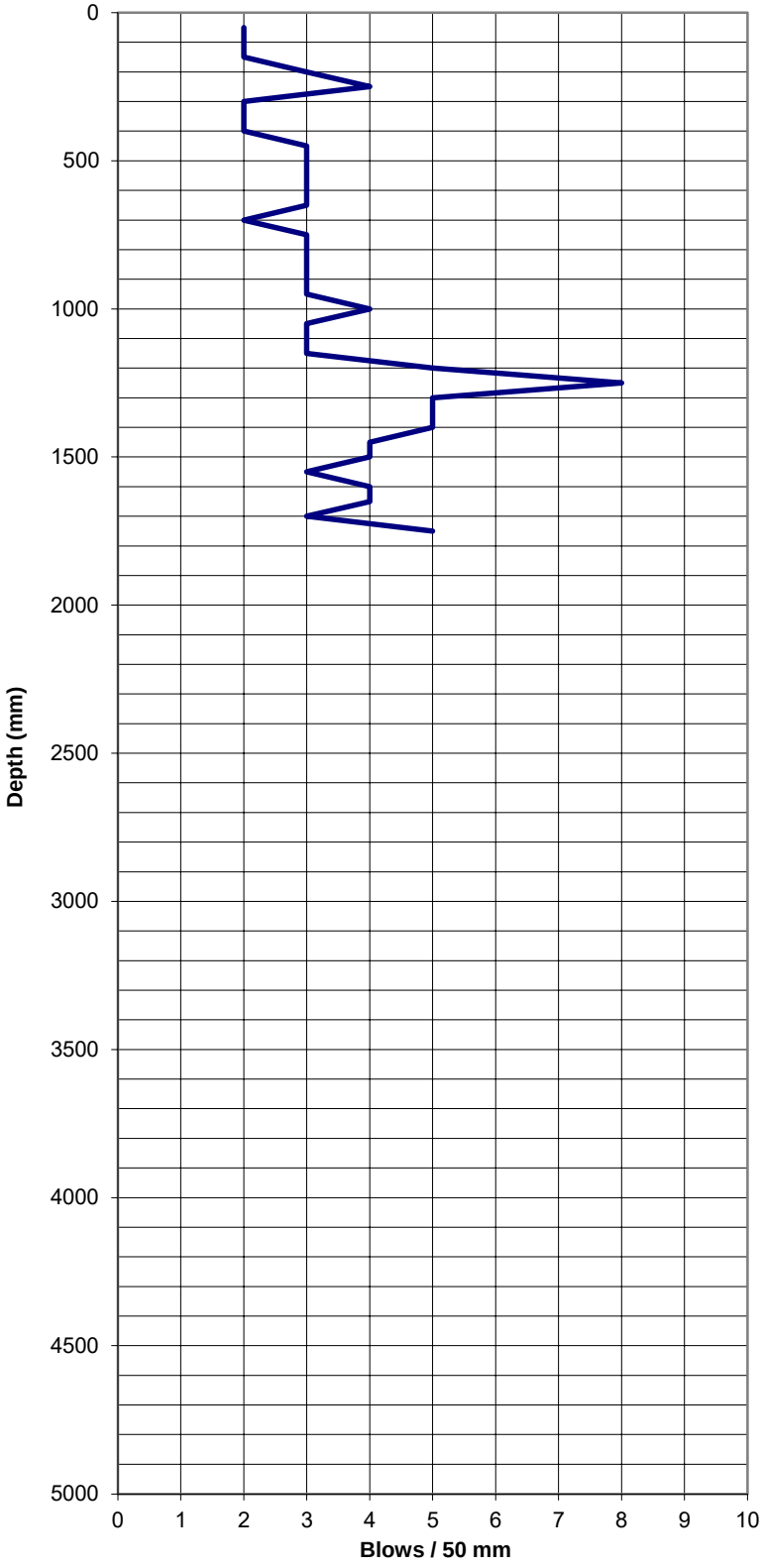
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	9
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*2*	2600	
150	*2*	2650	
200	*3*	2700	
250	*4*	2750	
300	*2*	2800	
350	*2*	2850	
400	*2*	2900	
450	*3*	2950	
500	*3*	3000	
550	*3*	3050	
600	*3*	3100	
650	*3*	3150	
700	*2*	3200	
750	*3*	3250	
800	*3*	3300	
850	*3*	3350	
900	*3*	3400	
950	*3*	3450	
1000	*4*	3500	
1050	*3*	3550	
1100	*3*	3600	
1150	*3*	3650	
1200	*5*	3700	
1250	*8*	3750	
1300	*5*	3800	
1350	*5*	3850	
1400	*5*	3900	
1450	*4*	3950	
1500	*4*	4000	
1550	*3*	4050	
1600	*4*	4100	
1650	*4*	4150	
1700	*3*	4200	
1750	*5*	4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

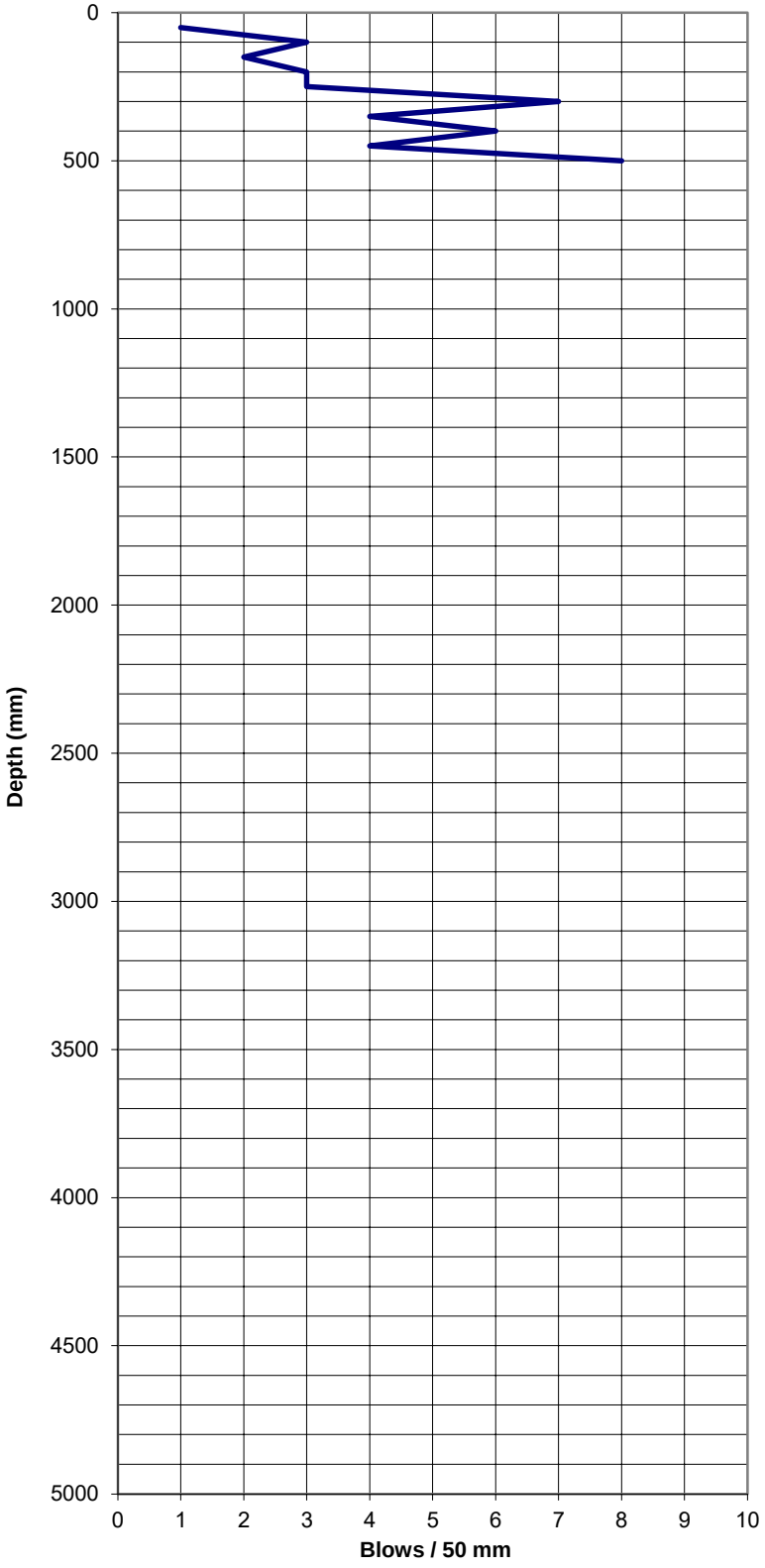
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	10
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*3*
150	*2*
200	*3*
250	*3*
300	*7*
350	*4*
400	*6*
450	*4*
500	*8*
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

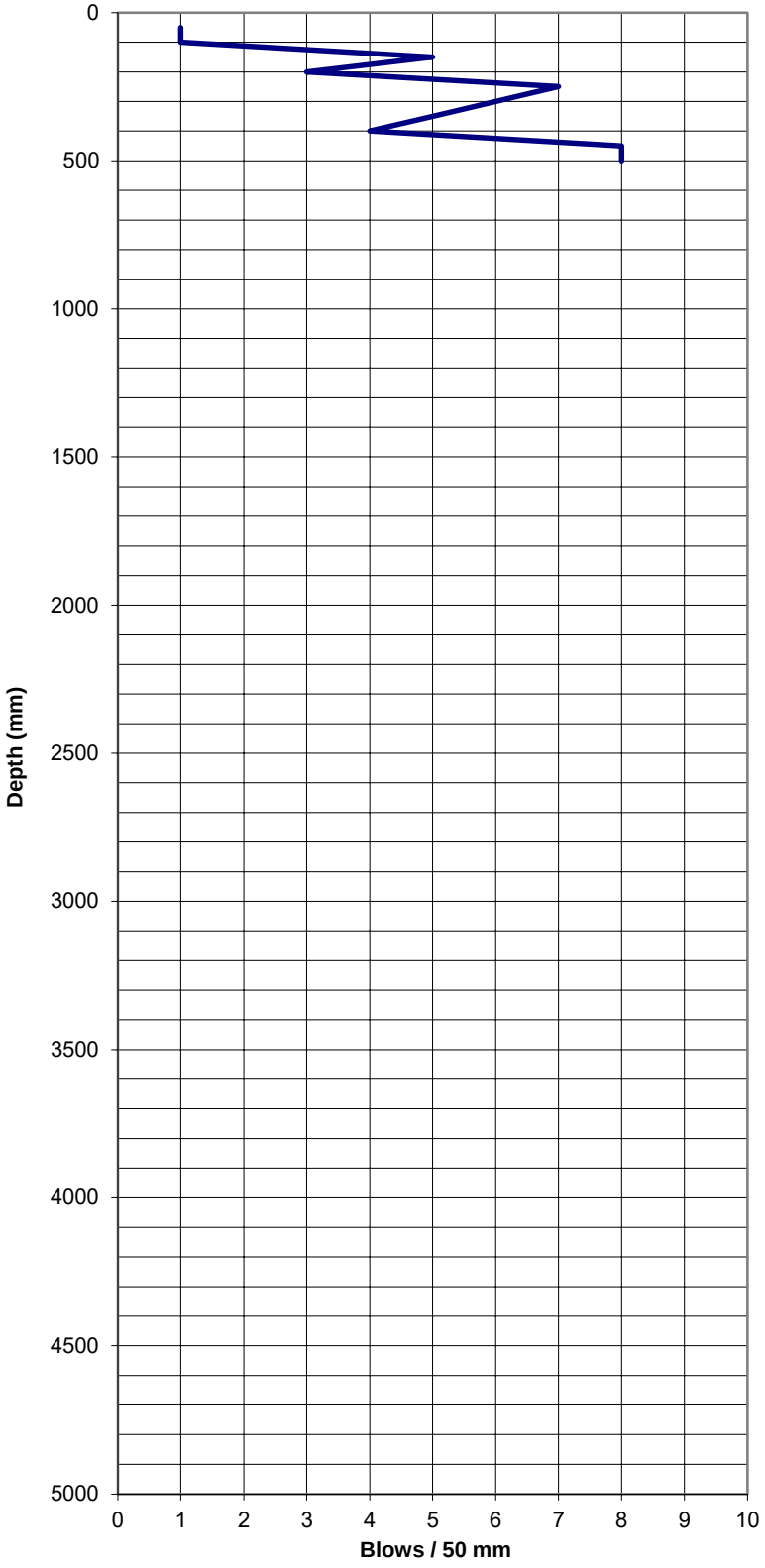
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	11
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*1*
150	*5*
200	*3*
250	*7*
300	*6*
350	*5*
400	*4*
450	*8*
500	*8*
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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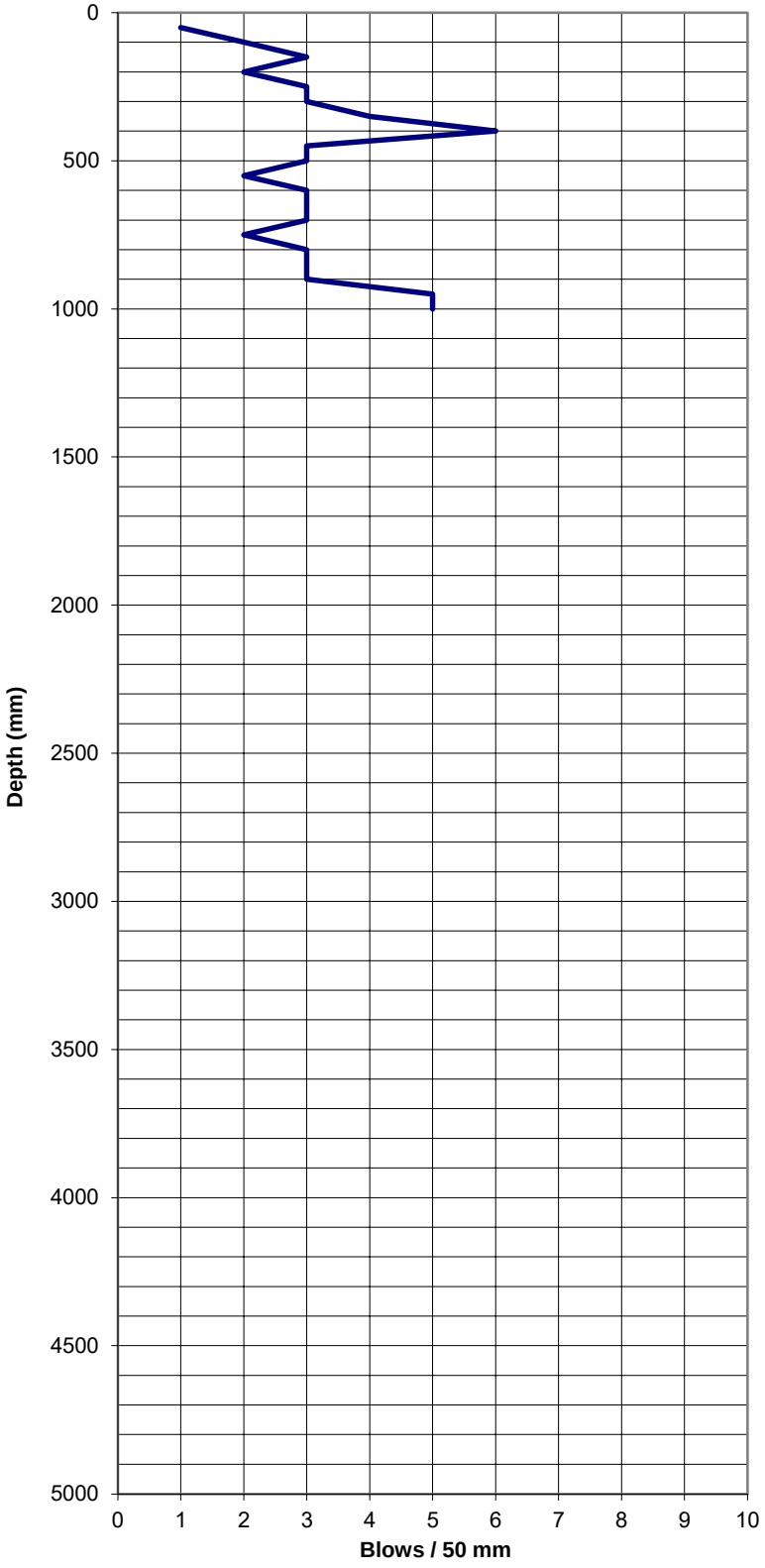
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	12
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*3*	2650	
200	*2*	2700	
250	*3*	2750	
300	*3*	2800	
350	*4*	2850	
400	*6*	2900	
450	*3*	2950	
500	*3*	3000	
550	*2*	3050	
600	*3*	3100	
650	*3*	3150	
700	*3*	3200	
750	*2*	3250	
800	*3*	3300	
850	*3*	3350	
900	*3*	3400	
950	*5*	3450	
1000	*5*	3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

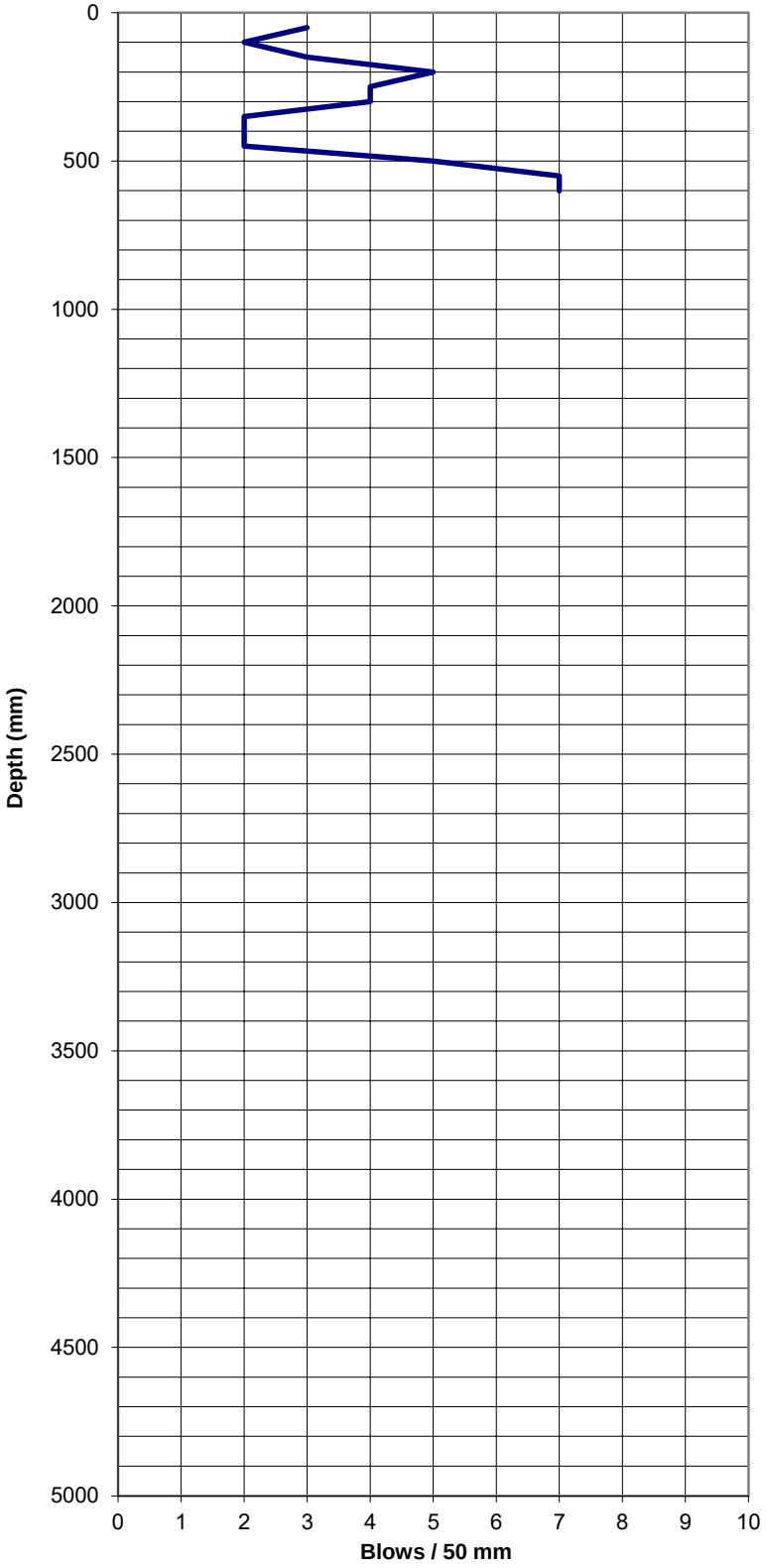
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	13
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*3*
100	*2*
150	*3*
200	*5*
250	*4*
300	*4*
350	*2*
400	*2*
450	*2*
500	*5*
550	*7*
600	*7*
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

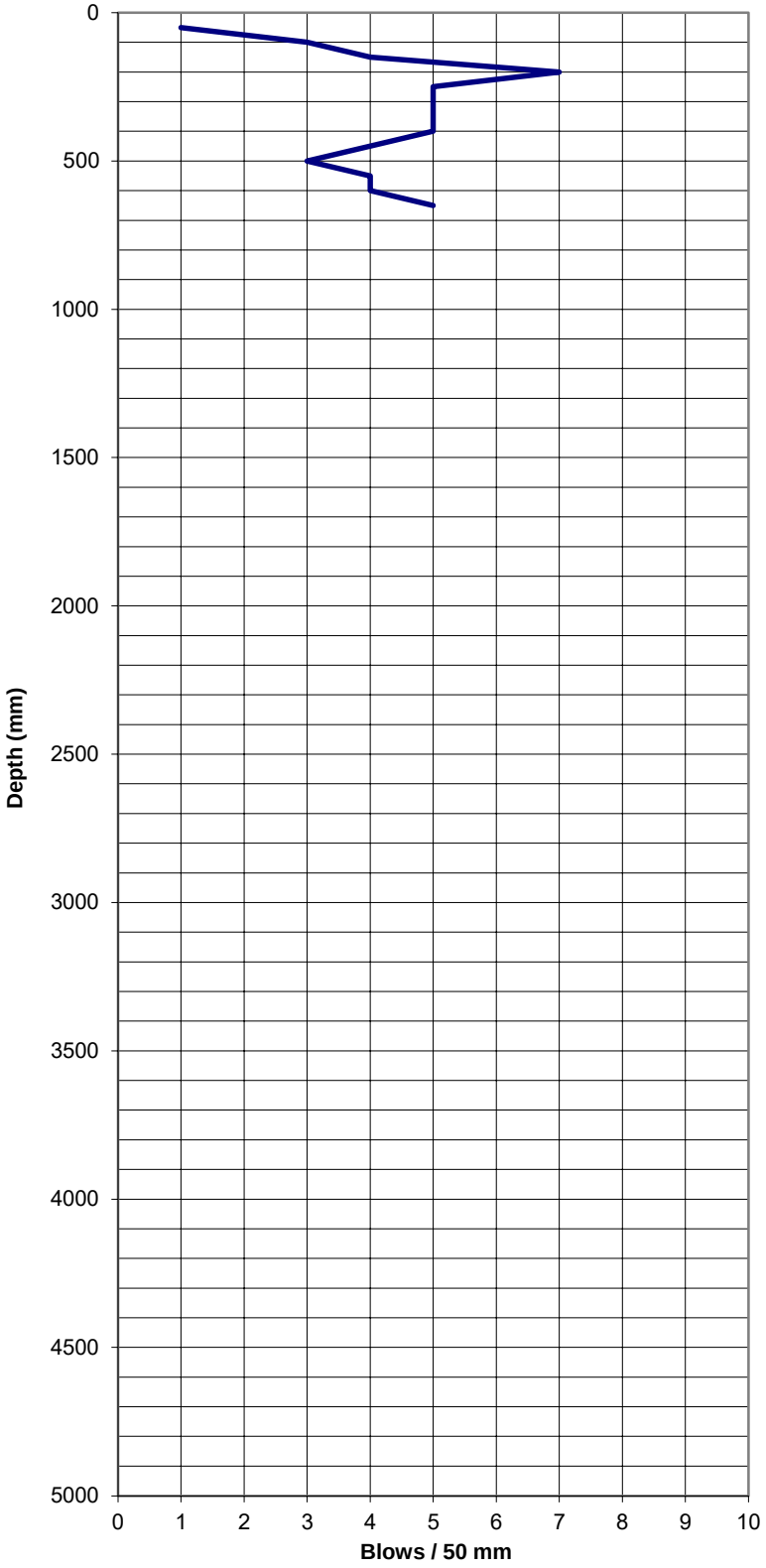
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	14
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*3*
150	*4*
200	*7*
250	*5*
300	*5*
350	*5*
400	*5*
450	*4*
500	*3*
550	*4*
600	*4*
650	*5*
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

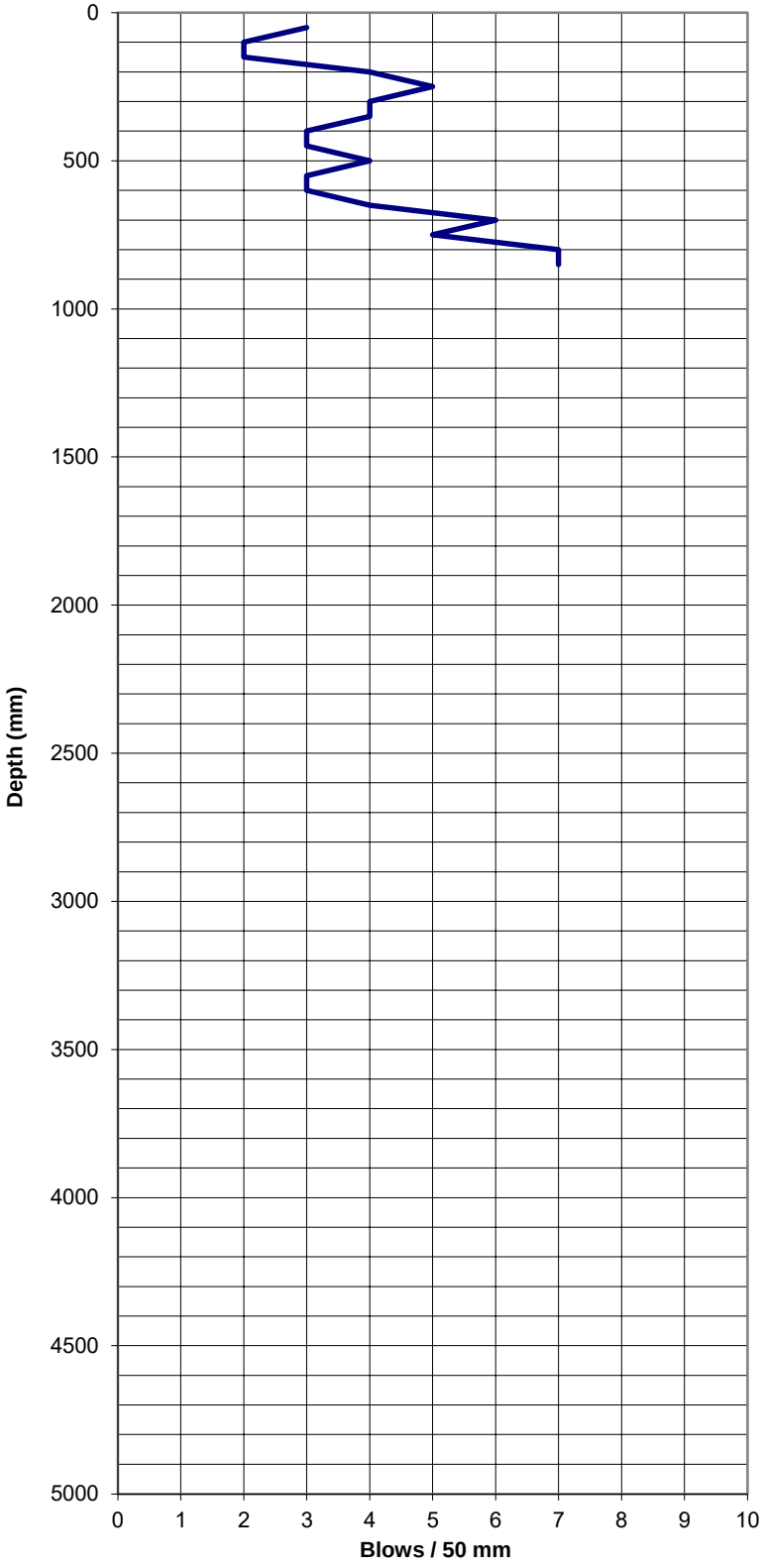
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	15
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*3*
100	*2*
150	*2*
200	*4*
250	*5*
300	*4*
350	*4*
400	*3*
450	*3*
500	*4*
550	*3*
600	*3*
650	*4*
700	*6*
750	*5*
800	*7*
850	*7*
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

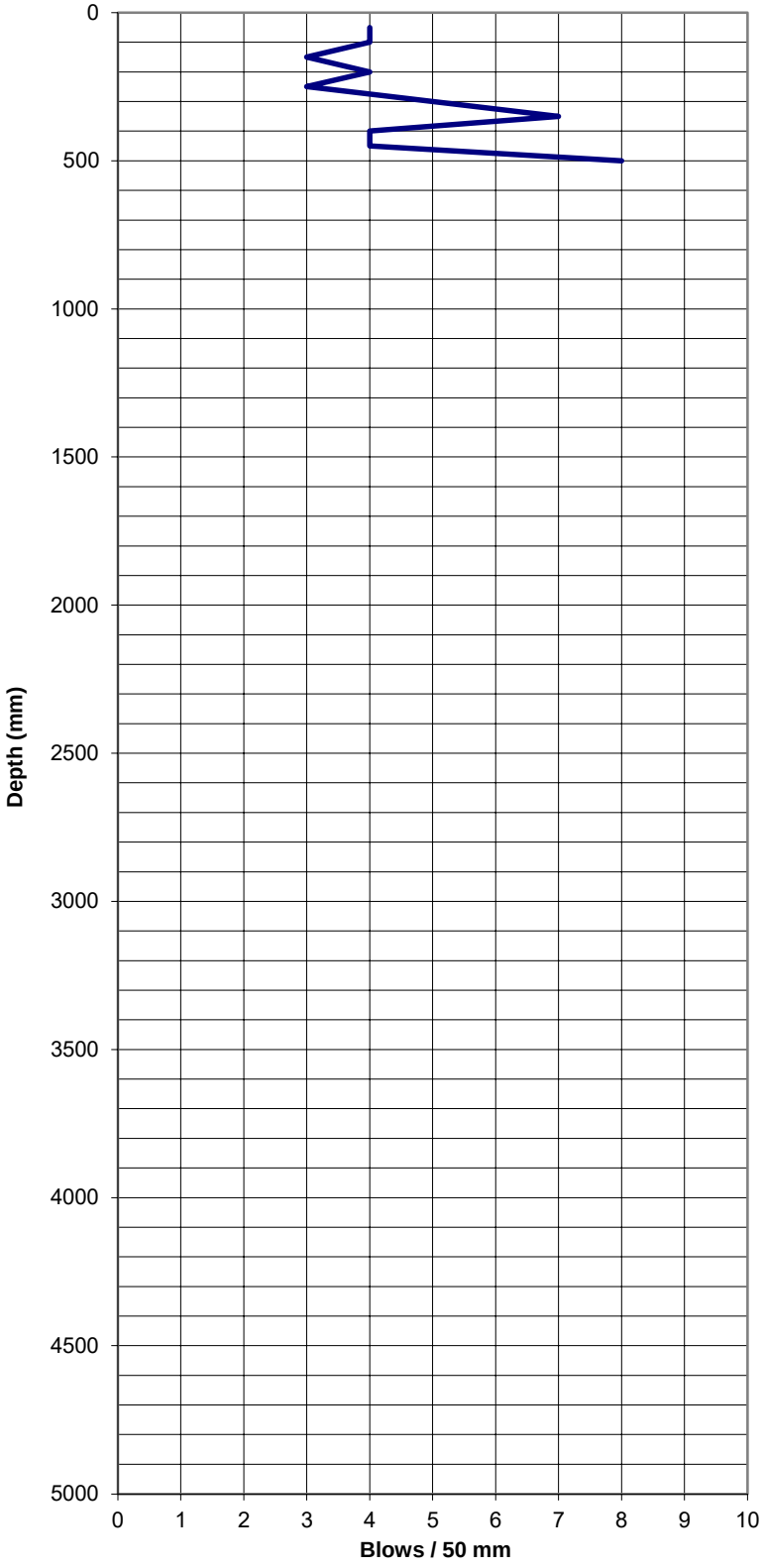
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	16
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*4*
100	*4*
150	*3*
200	*4*
250	*3*
300	*5*
350	*7*
400	*4*
450	*4*
500	*8*
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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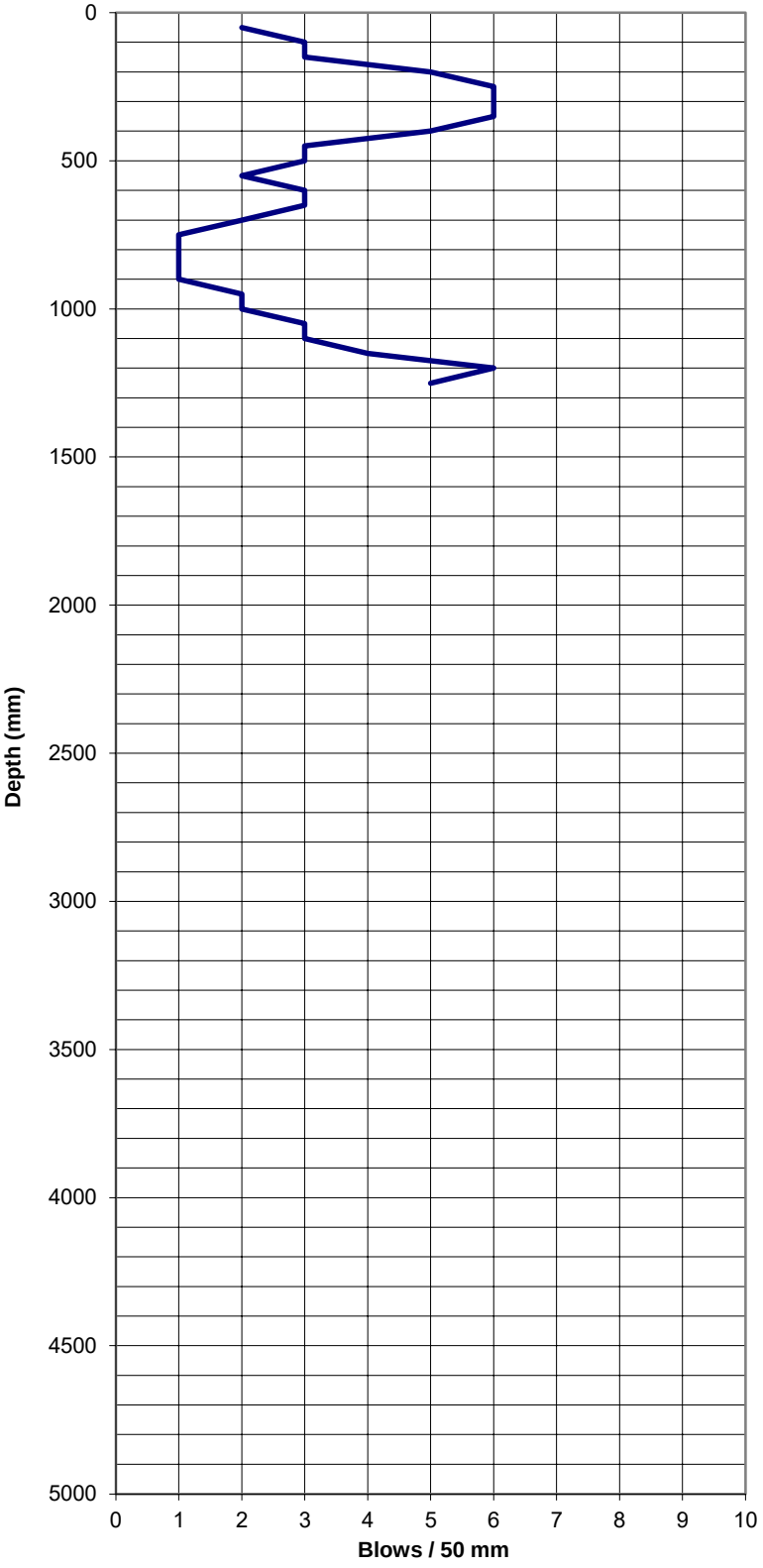
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	17
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*3*	2600	
150	*3*	2650	
200	*5*	2700	
250	*6*	2750	
300	*6*	2800	
350	*6*	2850	
400	*5*	2900	
450	*3*	2950	
500	*3*	3000	
550	*2*	3050	
600	*3*	3100	
650	*3*	3150	
700	*2*	3200	
750	*1*	3250	
800	*1*	3300	
850	*1*	3350	
900	*1*	3400	
950	*2*	3450	
1000	*2*	3500	
1050	*3*	3550	
1100	*3*	3600	
1150	*4*	3650	
1200	*6*	3700	
1250	*5*	3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

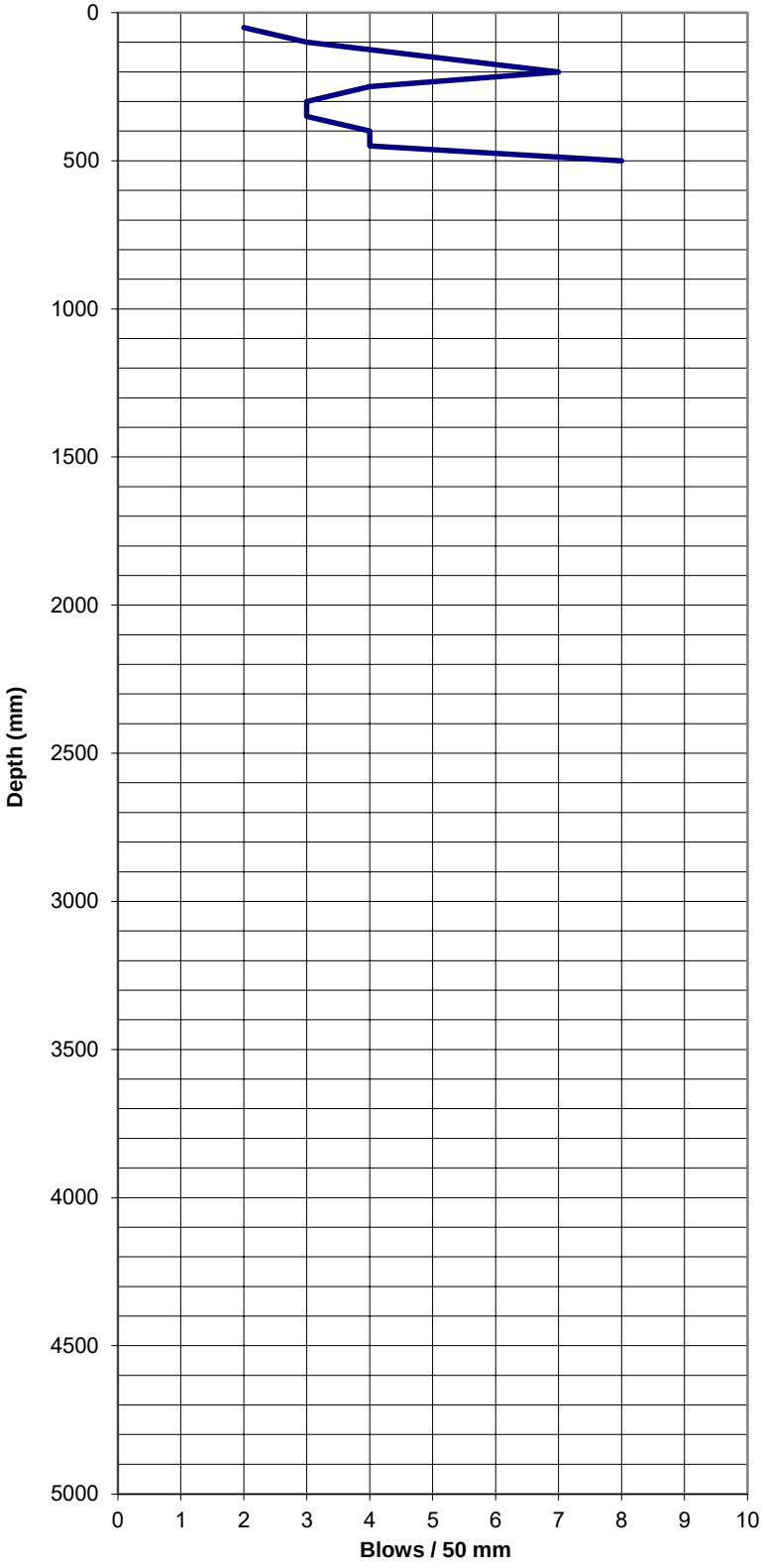
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	18
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*3*
150	*5*
200	*7*
250	*4*
300	*3*
350	*3*
400	*4*
450	*4*
500	*8*
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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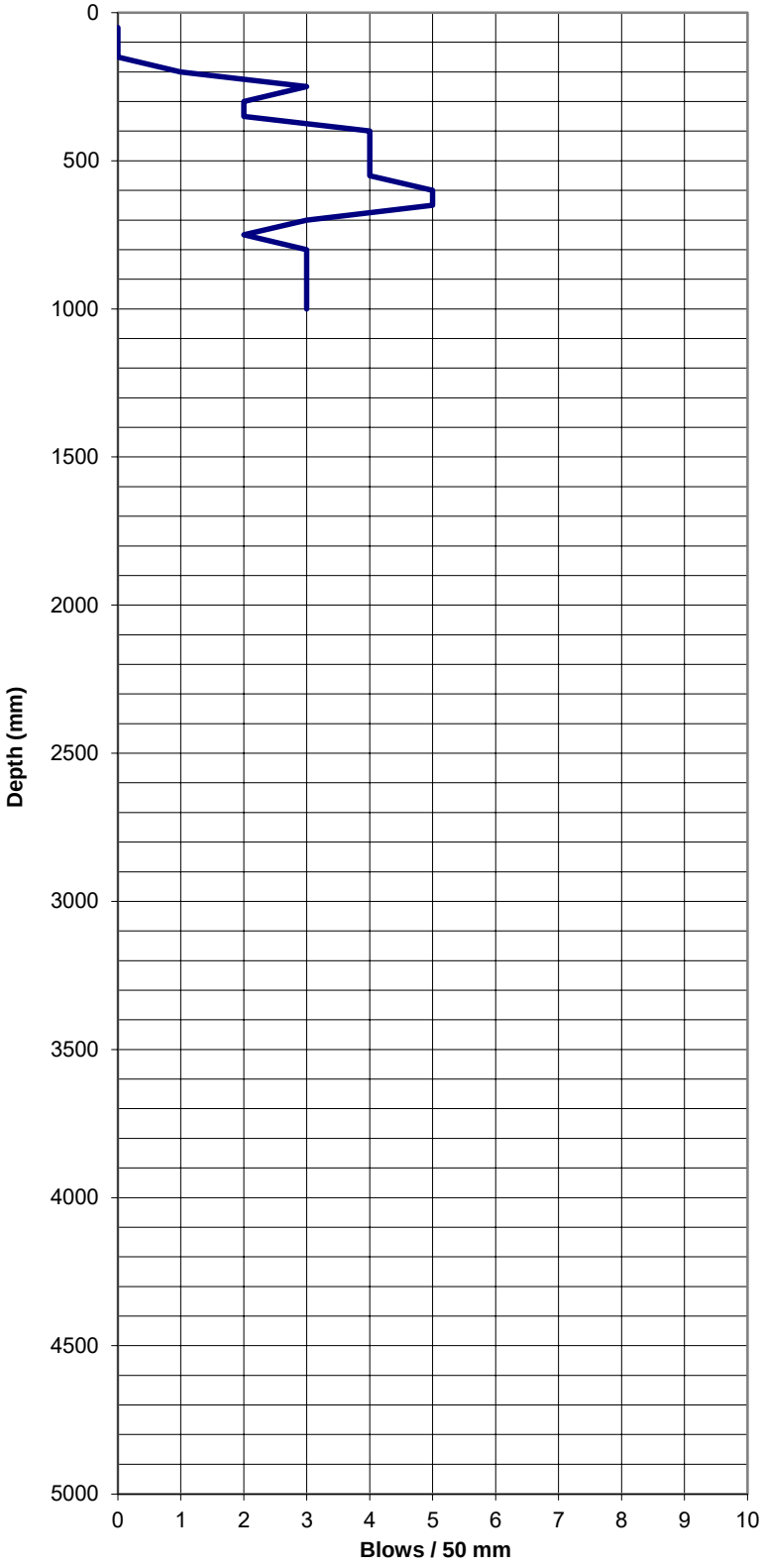
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	19
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100		2600	
150		2650	
200	*1*	2700	
250	*3*	2750	
300	*2*	2800	
350	*2*	2850	
400	*4*	2900	
450	*4*	2950	
500	*4*	3000	
550	*4*	3050	
600	*5*	3100	
650	*5*	3150	
700	*3*	3200	
750	*2*	3250	
800	*3*	3300	
850	*3*	3350	
900	*3*	3400	
950	*3*	3450	
1000	*3*	3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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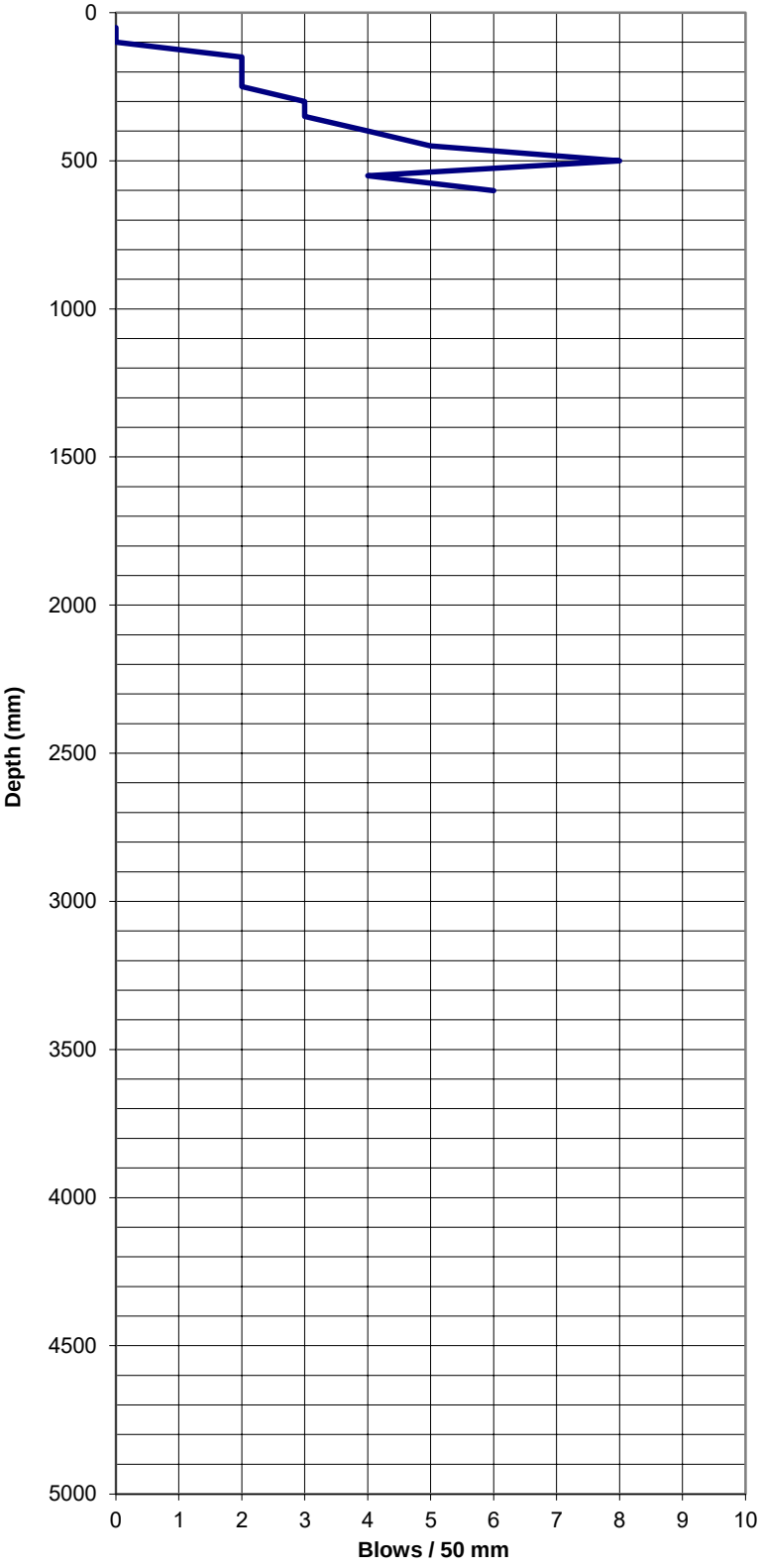
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *21/05/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	20
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100		2600	
150	*2*	2650	
200	*2*	2700	
250	*2*	2750	
300	*3*	2800	
350	*3*	2850	
400	*4*	2900	
450	*5*	2950	
500	*8*	3000	
550	*4*	3050	
600	*6*	3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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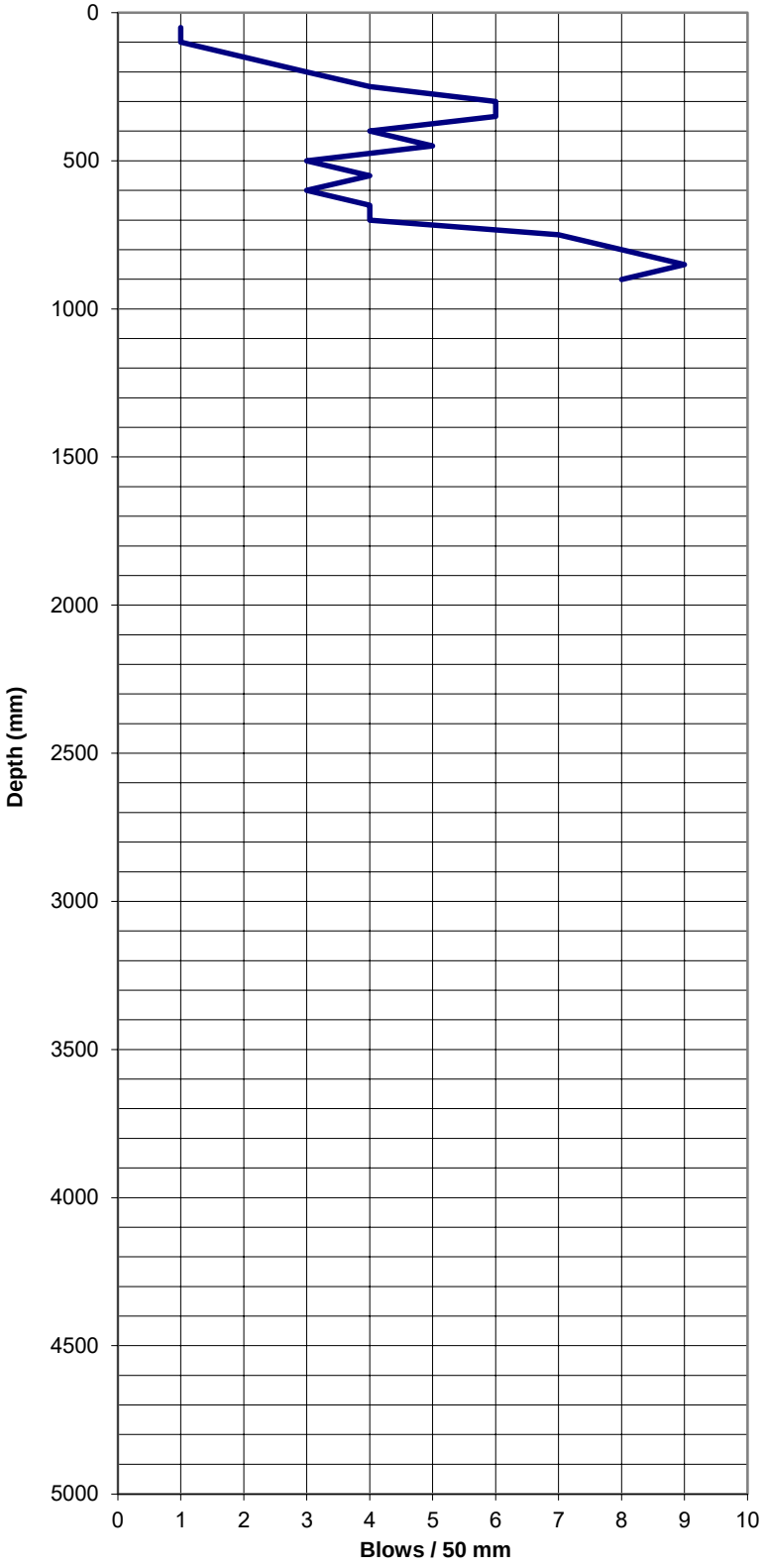
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	30
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*1*	2600	
150	*2*	2650	
200	*3*	2700	
250	*4*	2750	
300	*6*	2800	
350	*6*	2850	
400	*4*	2900	
450	*5*	2950	
500	*3*	3000	
550	*4*	3050	
600	*3*	3100	
650	*4*	3150	
700	*4*	3200	
750	*7*	3250	
800	*8*	3300	
850	*9*	3350	
900	*8*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

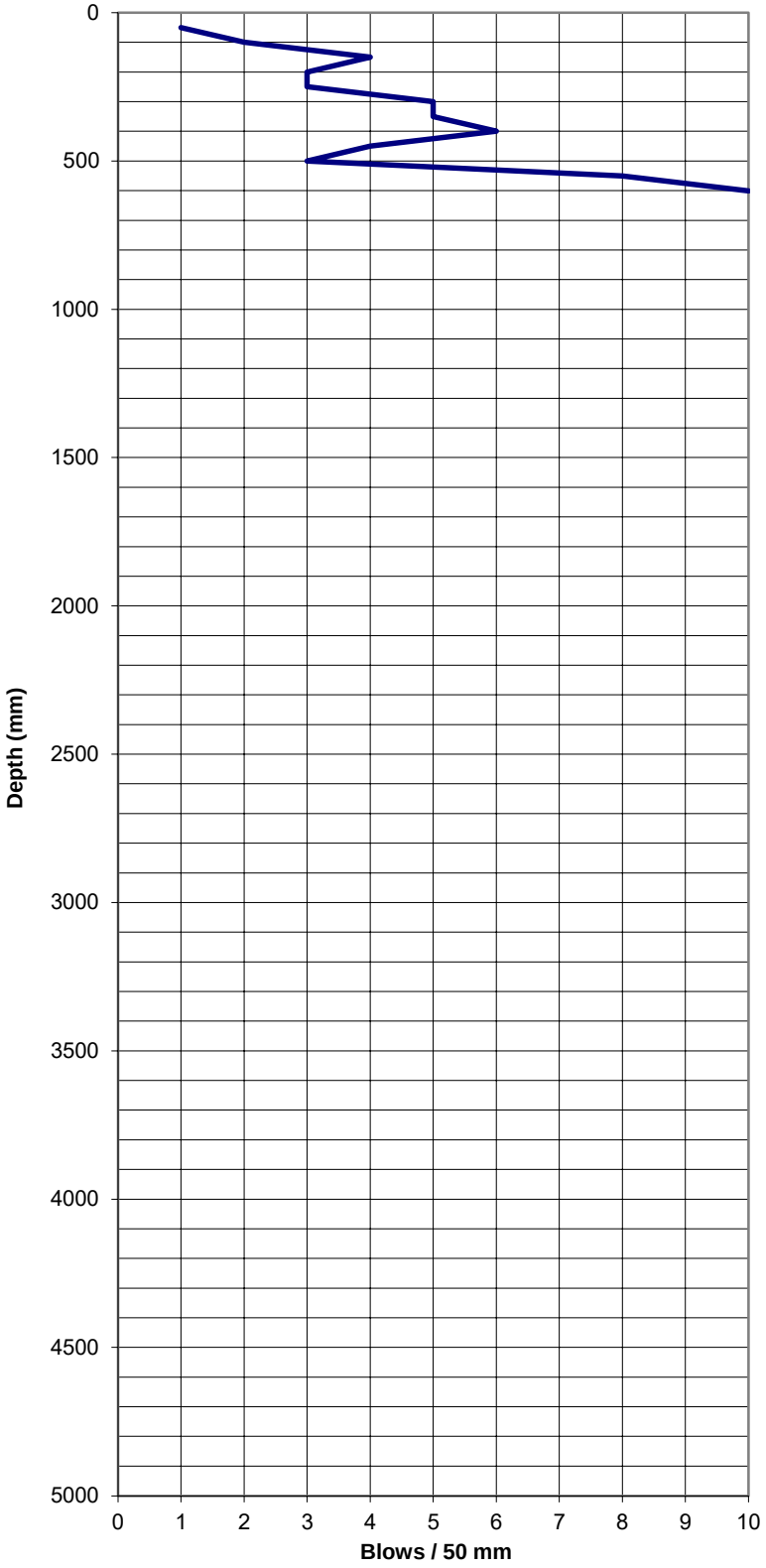
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	31
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*2*
150	*4*
200	*3*
250	*3*
300	*5*
350	*5*
400	*6*
450	*4*
500	*3*
550	*8*
600	*10*
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

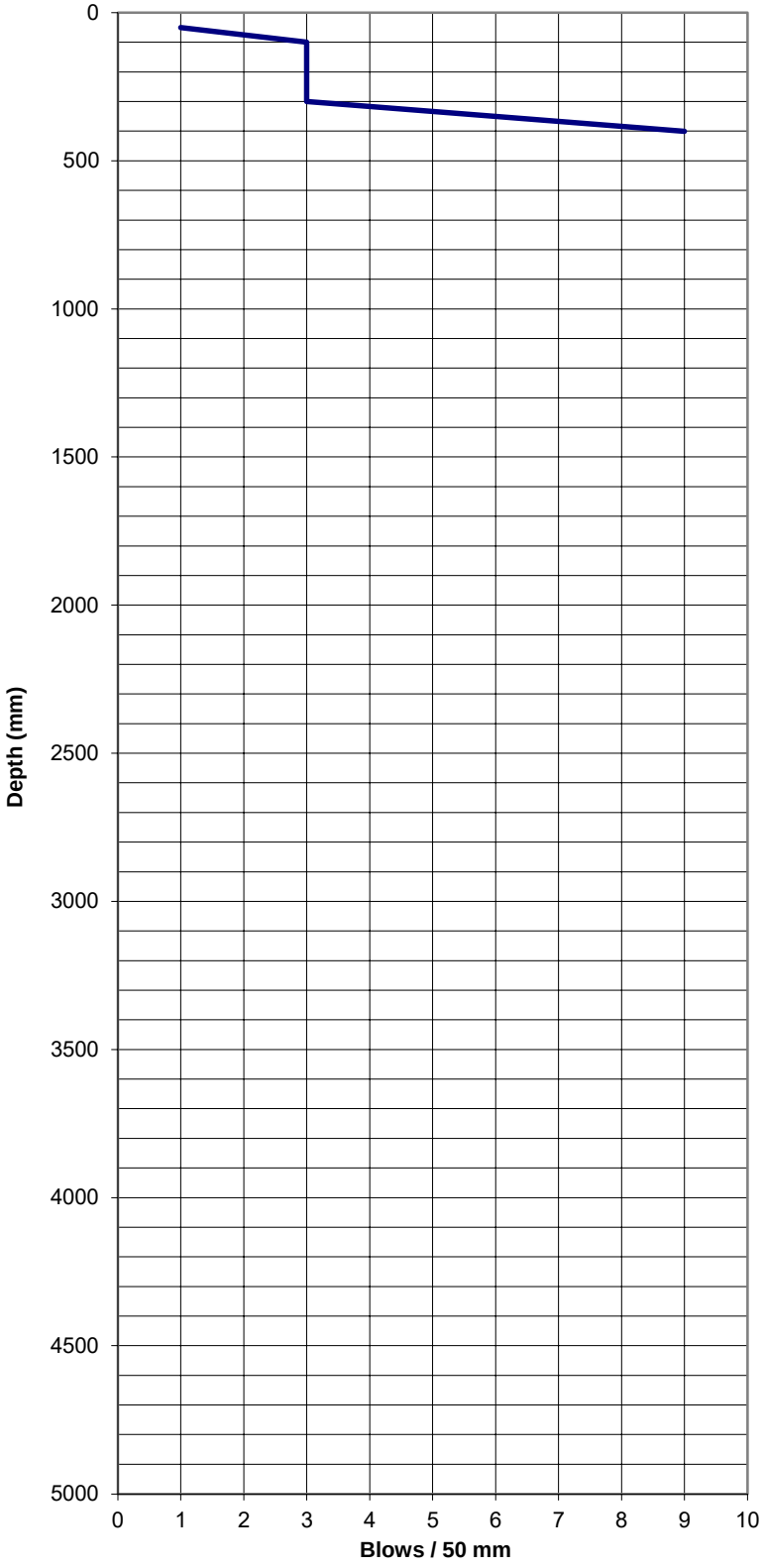
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	32
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*3*
150	*3*
200	*3*
250	*3*
300	*3*
350	*6*
400	*9*
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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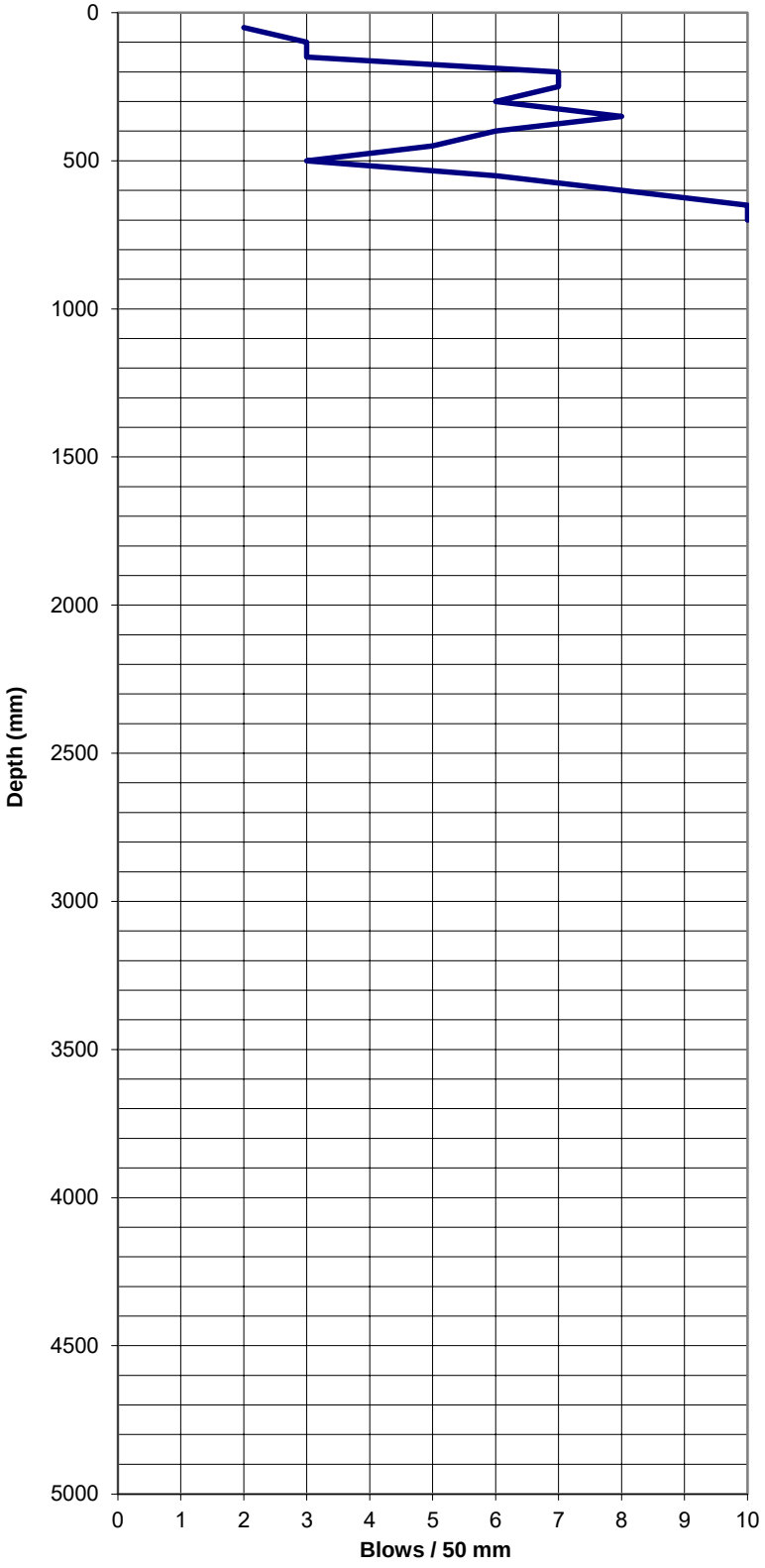
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	33
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*3*	2600	
150	*3*	2650	
200	*7*	2700	
250	*7*	2750	
300	*6*	2800	
350	*8*	2850	
400	*6*	2900	
450	*5*	2950	
500	*3*	3000	
550	*6*	3050	
600	*8*	3100	
650	*10*	3150	
700	*10*	3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

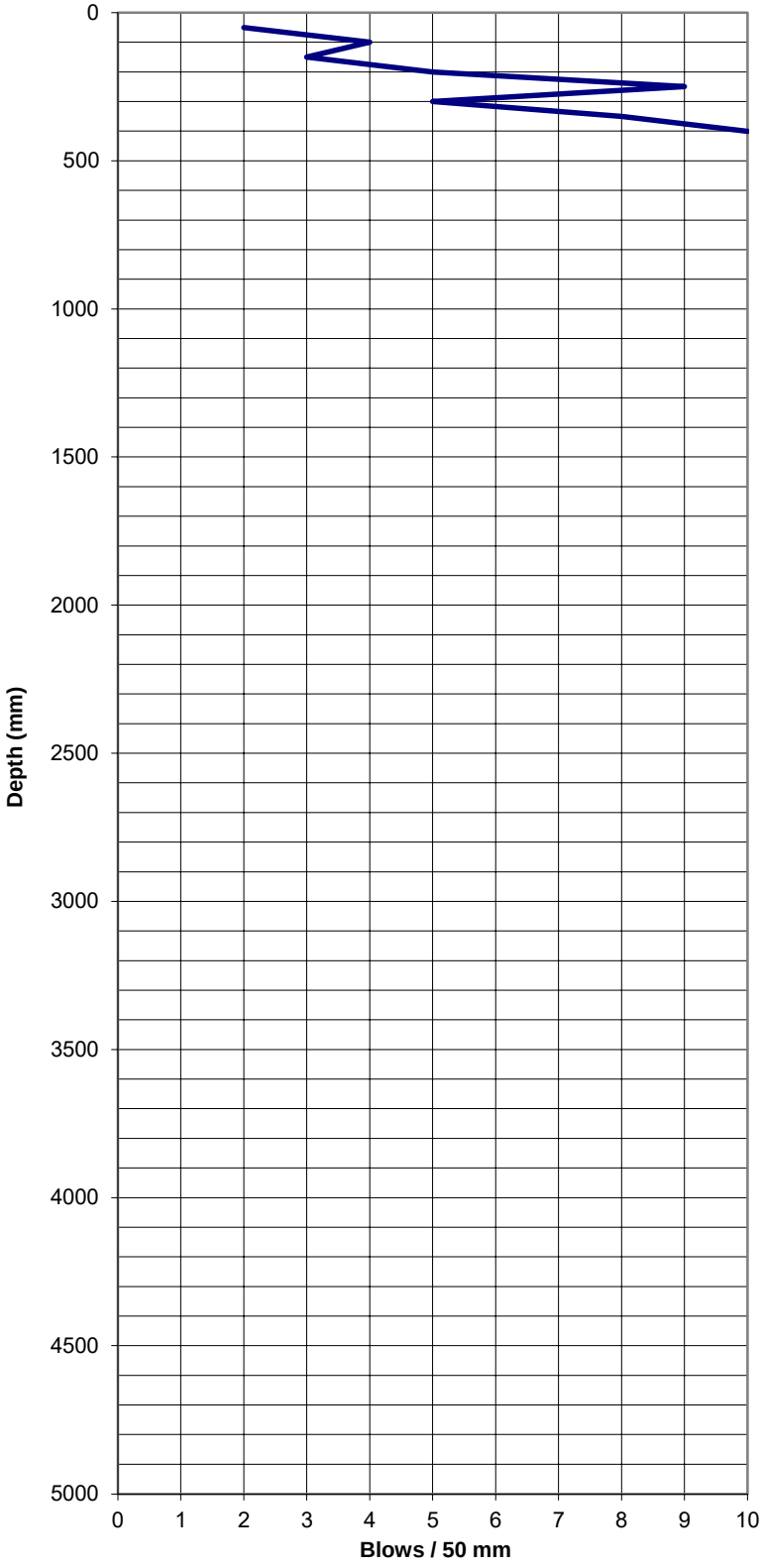
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	34
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*4*
150	*3*
200	*5*
250	*9*
300	*5*
350	*8*
400	*10*
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

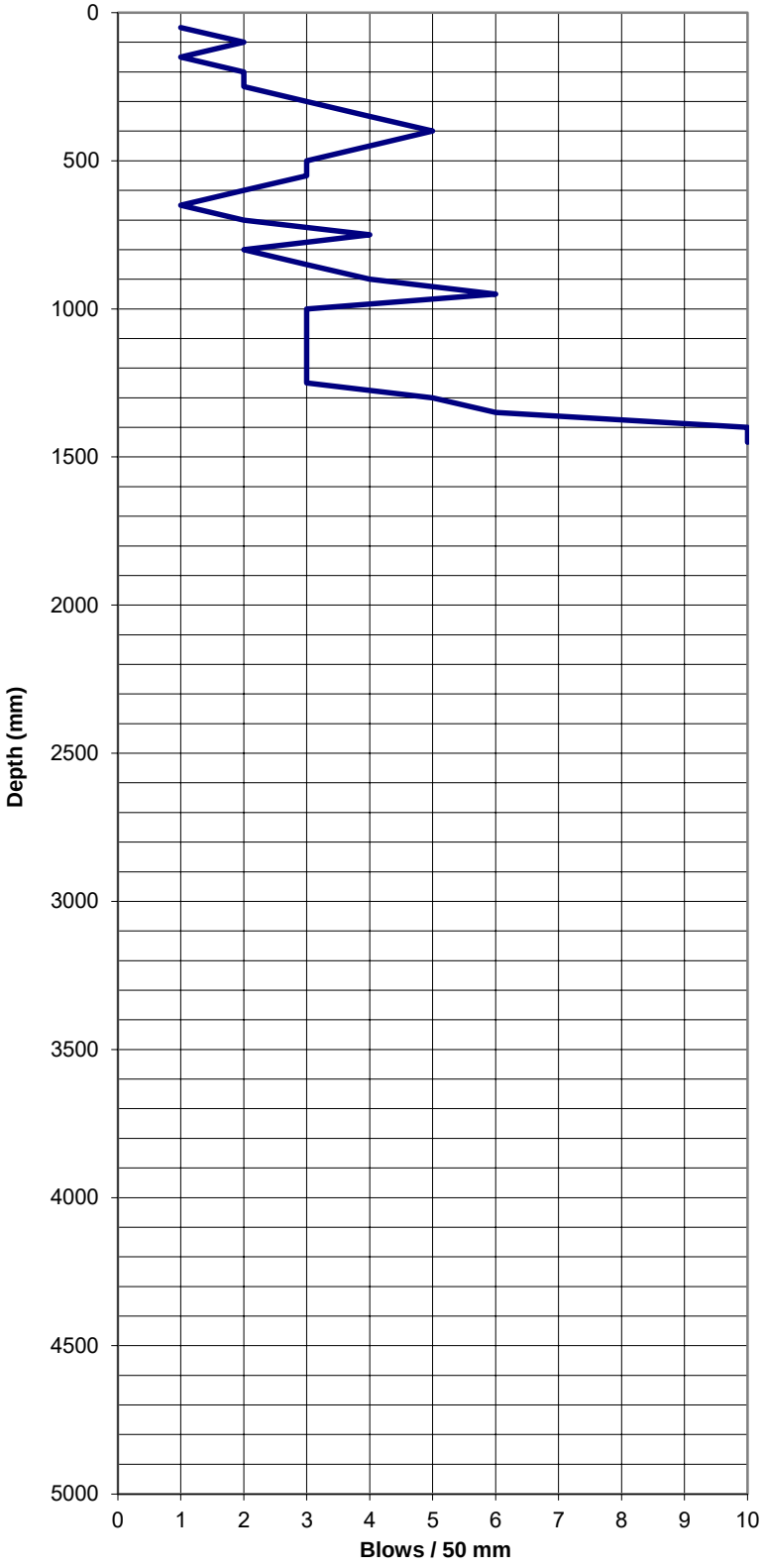
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	35
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*2*
150	*1*
200	*2*
250	*2*
300	*3*
350	*4*
400	*5*
450	*4*
500	*3*
550	*3*
600	*2*
650	*1*
700	*2*
750	*4*
800	*2*
850	*3*
900	*4*
950	*6*
1000	*3*
1050	*3*
1100	*3*
1150	*3*
1200	*3*
1250	*3*
1300	*5*
1350	*6*
1400	*10*
1450	*10*
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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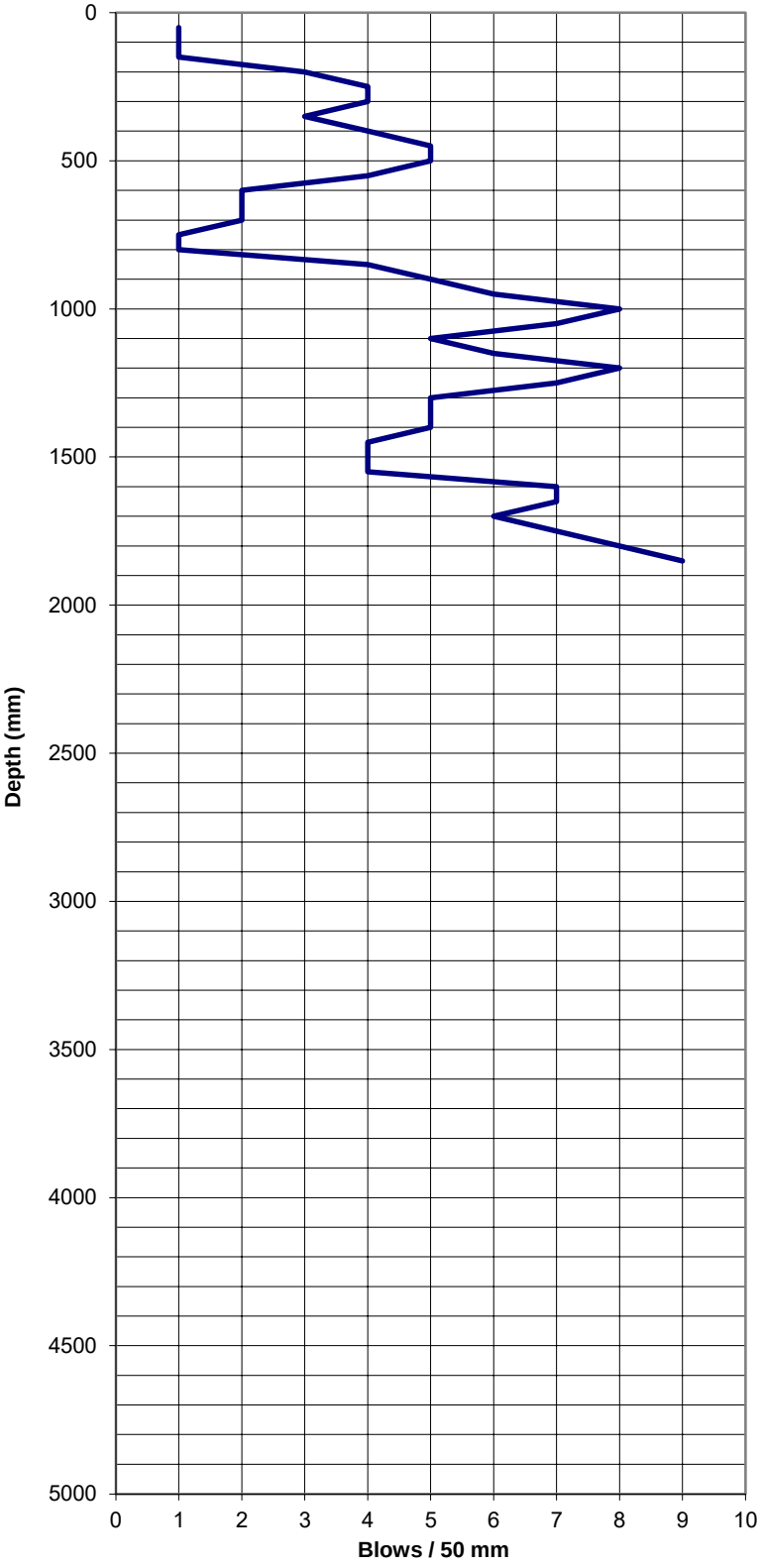
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	36
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*1*	2600	
150	*1*	2650	
200	*3*	2700	
250	*4*	2750	
300	*4*	2800	
350	*3*	2850	
400	*4*	2900	
450	*5*	2950	
500	*5*	3000	
550	*4*	3050	
600	*2*	3100	
650	*2*	3150	
700	*2*	3200	
750	*1*	3250	
800	*1*	3300	
850	*4*	3350	
900	*5*	3400	
950	*6*	3450	
1000	*8*	3500	
1050	*7*	3550	
1100	*5*	3600	
1150	*6*	3650	
1200	*8*	3700	
1250	*7*	3750	
1300	*5*	3800	
1350	*5*	3850	
1400	*5*	3900	
1450	*4*	3950	
1500	*4*	4000	
1550	*4*	4050	
1600	*7*	4100	
1650	*7*	4150	
1700	*6*	4200	
1750	*7*	4250	
1800	*8*	4300	
1850	*9*	4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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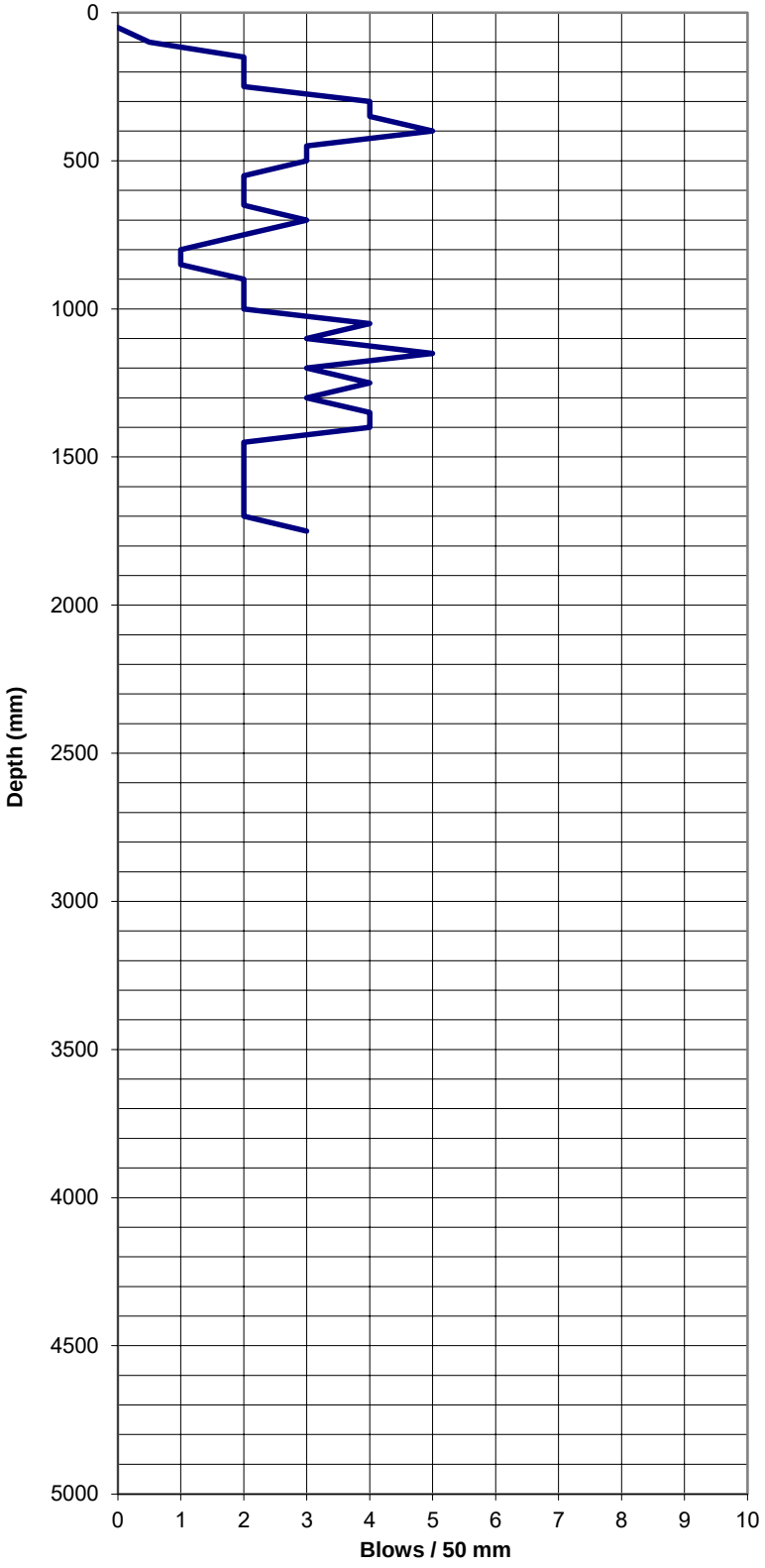
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	37
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	*0.5*	2600	
150	*2*	2650	
200	*2*	2700	
250	*2*	2750	
300	*4*	2800	
350	*4*	2850	
400	*5*	2900	
450	*3*	2950	
500	*3*	3000	
550	*2*	3050	
600	*2*	3100	
650	*2*	3150	
700	*3*	3200	
750	*2*	3250	
800	*1*	3300	
850	*1*	3350	
900	*2*	3400	
950	*2*	3450	
1000	*2*	3500	
1050	*4*	3550	
1100	*3*	3600	
1150	*5*	3650	
1200	*3*	3700	
1250	*4*	3750	
1300	*3*	3800	
1350	*4*	3850	
1400	*4*	3900	
1450	*2*	3950	
1500	*2*	4000	
1550	*2*	4050	
1600	*2*	4100	
1650	*2*	4150	
1700	*2*	4200	
1750	*3*	4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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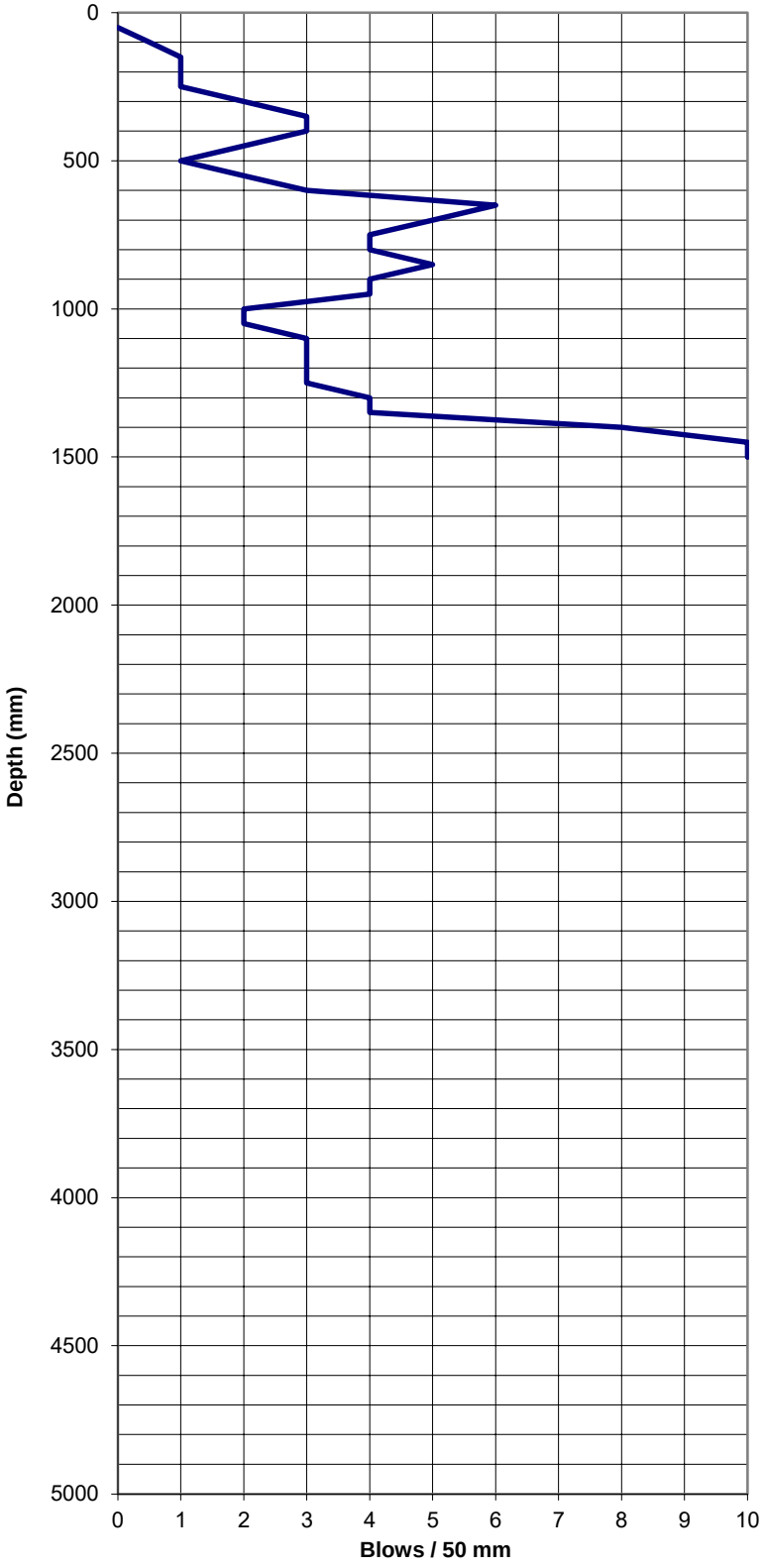
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	38
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	*0.5*	2600	
150	*1*	2650	
200	*1*	2700	
250	*1*	2750	
300	*2*	2800	
350	*3*	2850	
400	*3*	2900	
450	*2*	2950	
500	*1*	3000	
550	*2*	3050	
600	*3*	3100	
650	*6*	3150	
700	*5*	3200	
750	*4*	3250	
800	*4*	3300	
850	*5*	3350	
900	*4*	3400	
950	*4*	3450	
1000	*2*	3500	
1050	*2*	3550	
1100	*3*	3600	
1150	*3*	3650	
1200	*3*	3700	
1250	*3*	3750	
1300	*4*	3800	
1350	*4*	3850	
1400	*8*	3900	
1450	*10*	3950	
1500	*10*	4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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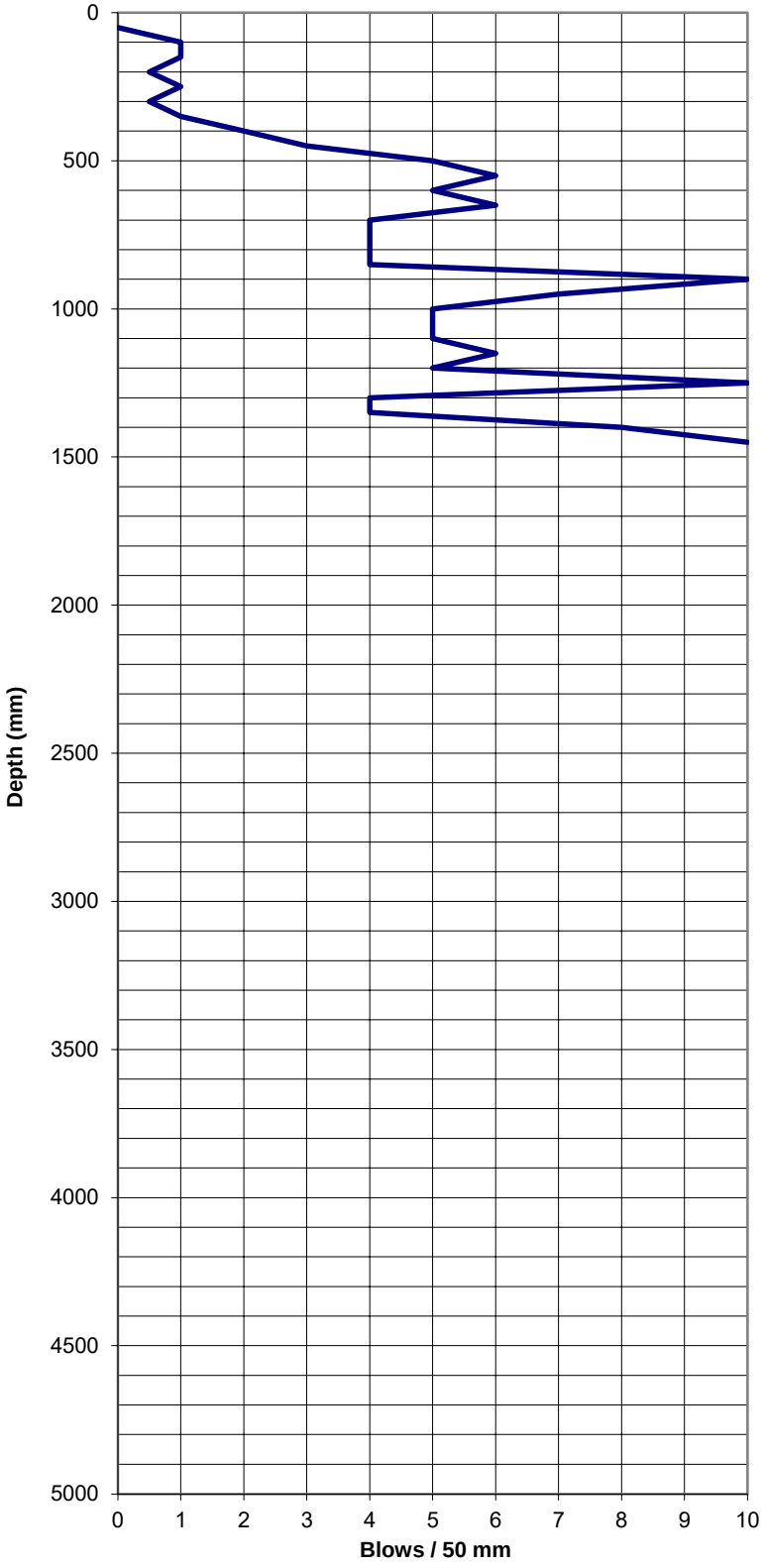
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	39
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	*1*	2600	
150	*1*	2650	
200	*0.5*	2700	
250	*1*	2750	
300	*0.5*	2800	
350	*1*	2850	
400	*2*	2900	
450	*3*	2950	
500	*5*	3000	
550	*6*	3050	
600	*5*	3100	
650	*6*	3150	
700	*4*	3200	
750	*4*	3250	
800	*4*	3300	
850	*4*	3350	
900	*10*	3400	
950	*7*	3450	
1000	*5*	3500	
1050	*5*	3550	
1100	*5*	3600	
1150	*6*	3650	
1200	*5*	3700	
1250	*10*	3750	
1300	*4*	3800	
1350	*4*	3850	
1400	*8*	3900	
1450	*10*	3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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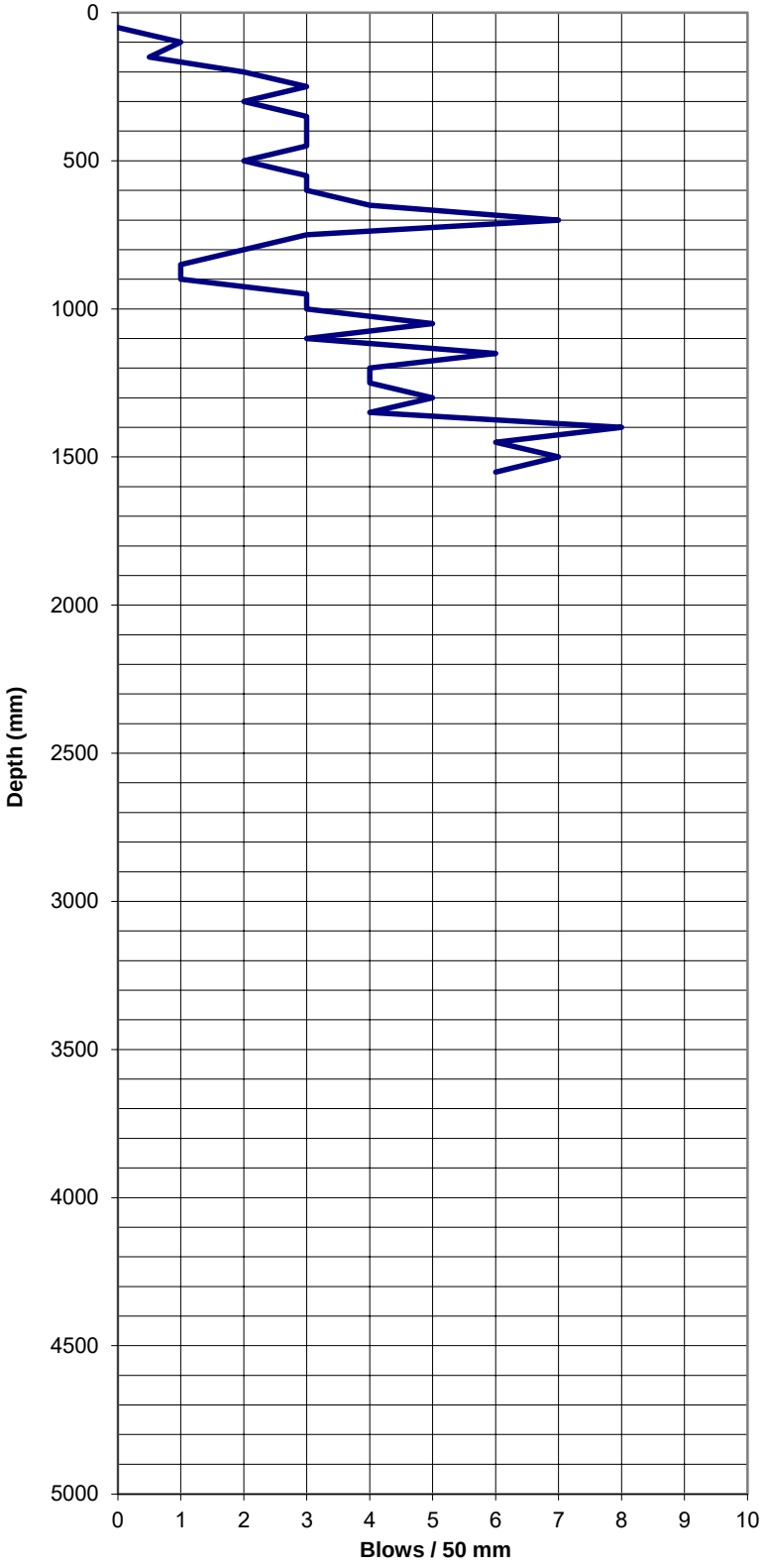
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *16/07/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC*
Test No:	40
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	*1*	2600	
150	*0.5*	2650	
200	*2*	2700	
250	*3*	2750	
300	*2*	2800	
350	*3*	2850	
400	*3*	2900	
450	*3*	2950	
500	*2*	3000	
550	*3*	3050	
600	*3*	3100	
650	*4*	3150	
700	*7*	3200	
750	*3*	3250	
800	*2*	3300	
850	*1*	3350	
900	*1*	3400	
950	*3*	3450	
1000	*3*	3500	
1050	*5*	3550	
1100	*3*	3600	
1150	*6*	3650	
1200	*4*	3700	
1250	*4*	3750	
1300	*5*	3800	
1350	*4*	3850	
1400	*8*	3900	
1450	*6*	3950	
1500	*7*	4000	
1550	*6*	4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

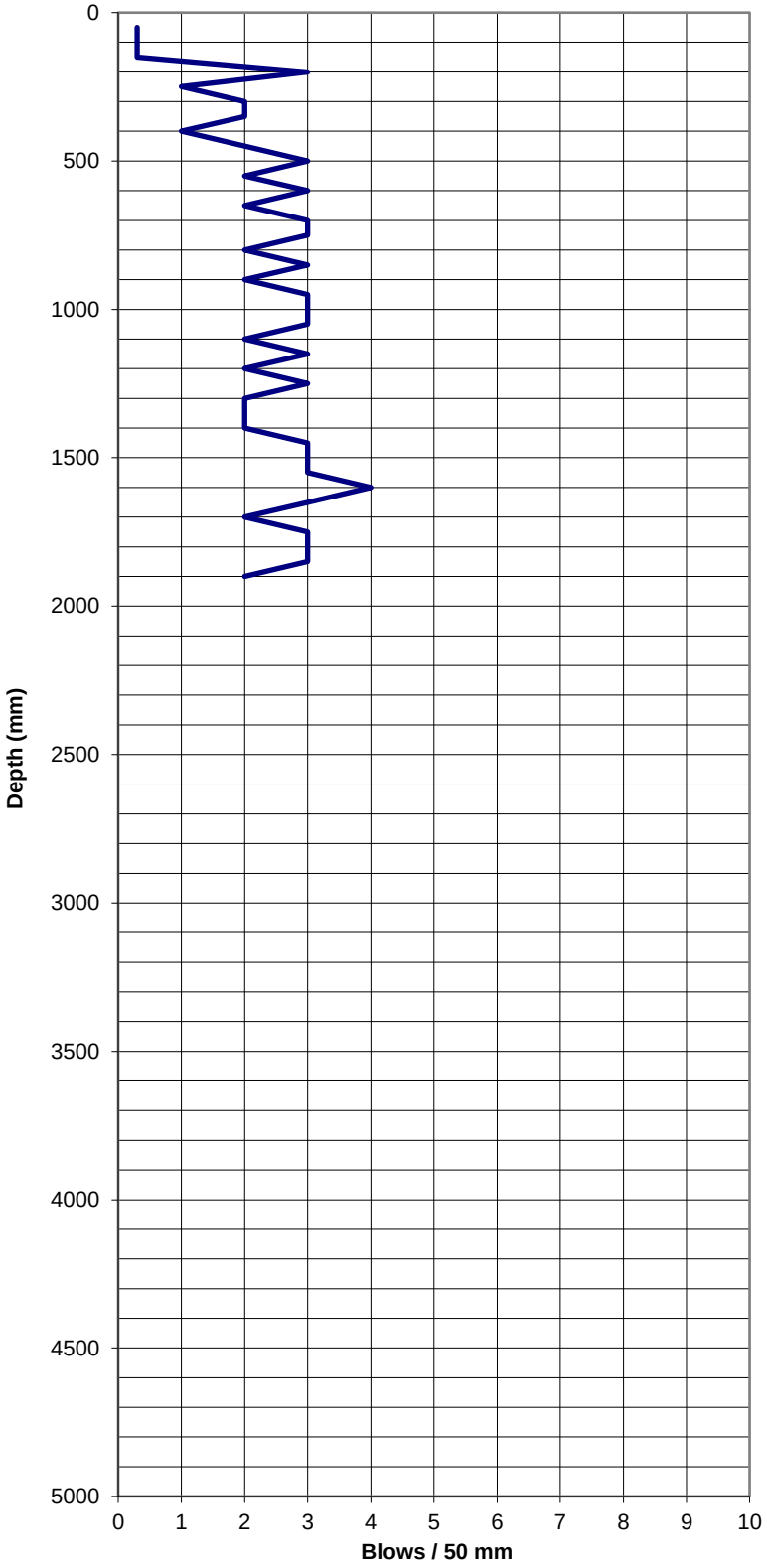
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	A
Sheet	1 of 1

mm Driven	No. of Blows
50	0.3
100	0.3
150	0.3
200	3
250	1
300	2
350	2
400	1
450	2
500	3
550	2
600	3
650	2
700	3
750	3
800	2
850	3
900	2
950	3
1000	3
1050	3
1100	2
1150	3
1200	2
1250	3
1300	2
1350	2
1400	2
1450	3
1500	3.0
1550	3.0
1600	4
1650	3
1700	2
1750	3
1800	3
1850	3
1900	2
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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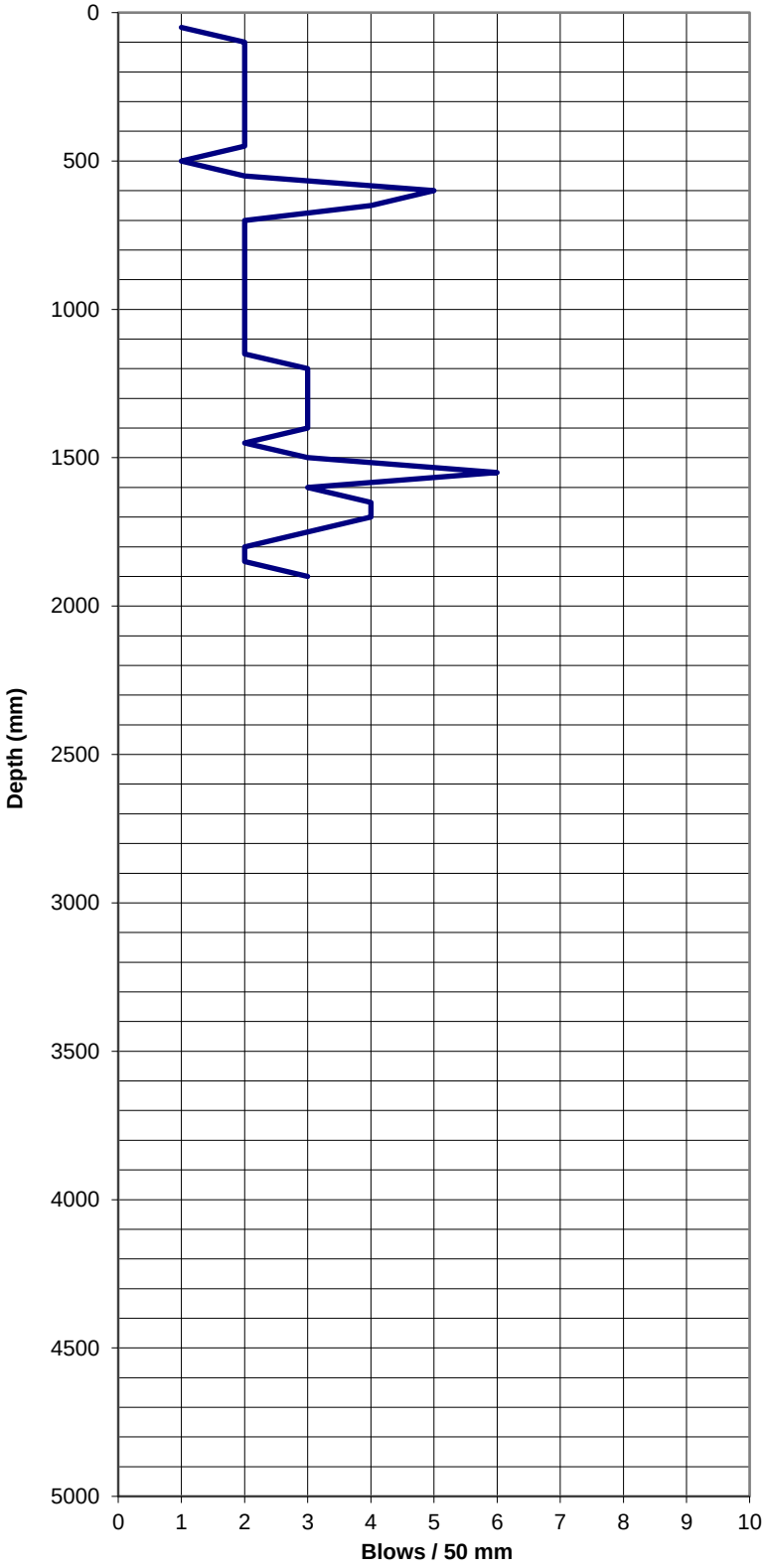
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	B
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	1	2550	
100	2	2600	
150	2	2650	
200	2	2700	
250	2	2750	
300	2	2800	
350	2	2850	
400	2	2900	
450	2	2950	
500	1	3000	
550	2	3050	
600	5	3100	
650	4	3150	
700	2	3200	
750	2	3250	
800	2	3300	
850	2	3350	
900	2	3400	
950	2	3450	
1000	2	3500	
1050	2	3550	
1100	2	3600	
1150	2	3650	
1200	3	3700	
1250	3	3750	
1300	3	3800	
1350	3	3850	
1400	3	3900	
1450	2	3950	
1500	3	4000	
1550	6	4050	
1600	3	4100	
1650	4	4150	
1700	4	4200	
1750	3	4250	
1800	2	4300	
1850	2	4350	
1900	3	4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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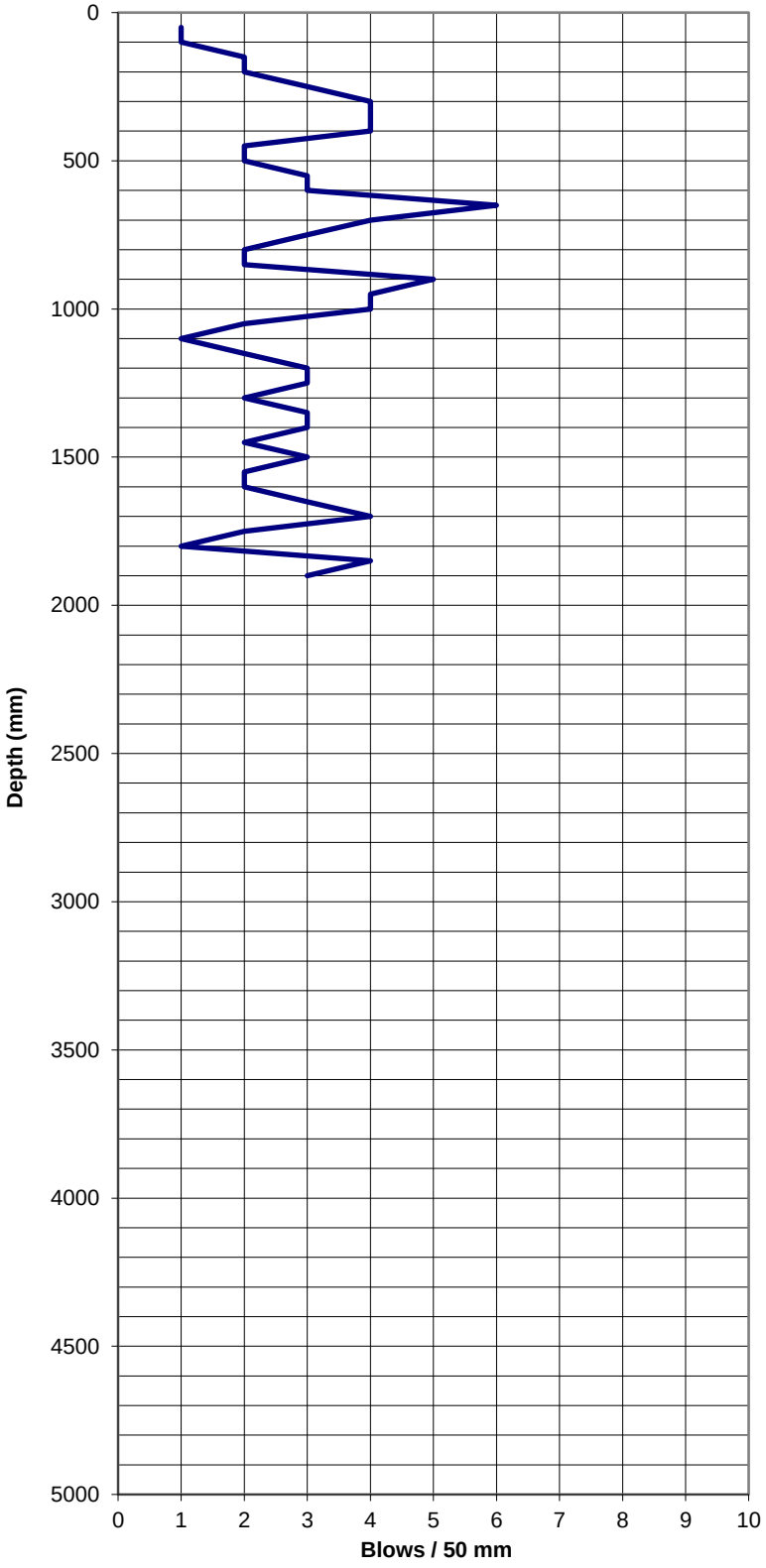
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	C
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	1	2550	
100	1	2600	
150	2	2650	
200	2	2700	
250	3	2750	
300	4	2800	
350	4	2850	
400	4	2900	
450	2	2950	
500	2	3000	
550	3	3050	
600	3	3100	
650	6	3150	
700	4	3200	
750	3	3250	
800	2	3300	
850	2	3350	
900	5	3400	
950	4	3450	
1000	4	3500	
1050	2	3550	
1100	1	3600	
1150	2	3650	
1200	3	3700	
1250	3	3750	
1300	2	3800	
1350	3	3850	
1400	3	3900	
1450	2	3950	
1500	3	4000	
1550	2	4050	
1600	2	4100	
1650	3	4150	
1700	4	4200	
1750	2	4250	
1800	1	4300	
1850	4	4350	
1900	3	4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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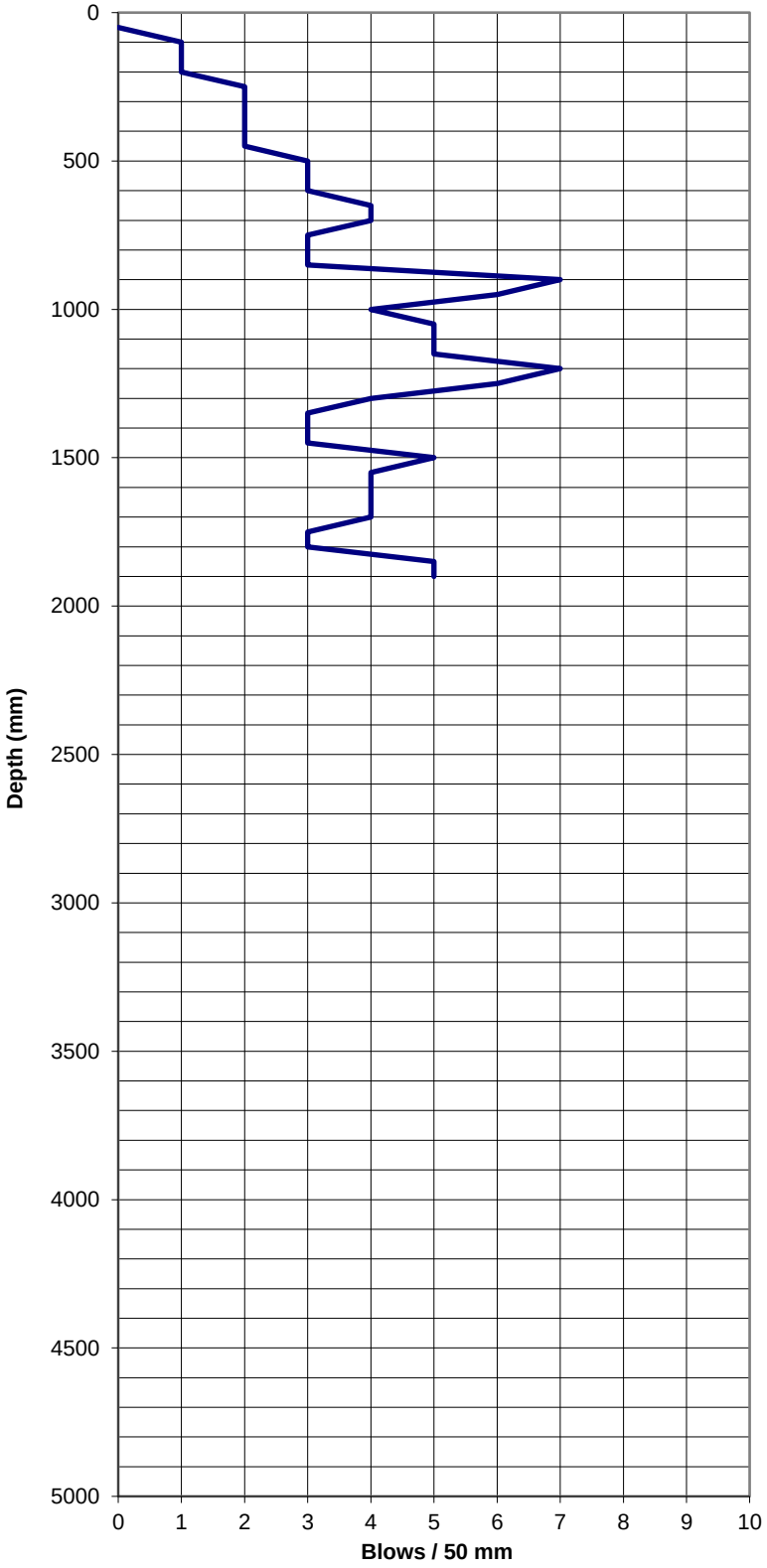
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	D
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	1	2600	
150	1	2650	
200	1	2700	
250	2	2750	
300	2	2800	
350	2	2850	
400	2	2900	
450	2	2950	
500	3	3000	
550	3	3050	
600	3	3100	
650	4	3150	
700	4	3200	
750	3	3250	
800	3	3300	
850	3	3350	
900	7	3400	
950	6	3450	
1000	4	3500	
1050	5	3550	
1100	5	3600	
1150	5	3650	
1200	7	3700	
1250	6	3750	
1300	4	3800	
1350	3	3850	
1400	3	3900	
1450	3	3950	
1500	5	4000	
1550	4	4050	
1600	4	4100	
1650	4	4150	
1700	4	4200	
1750	3	4250	
1800	3	4300	
1850	5	4350	
1900	5	4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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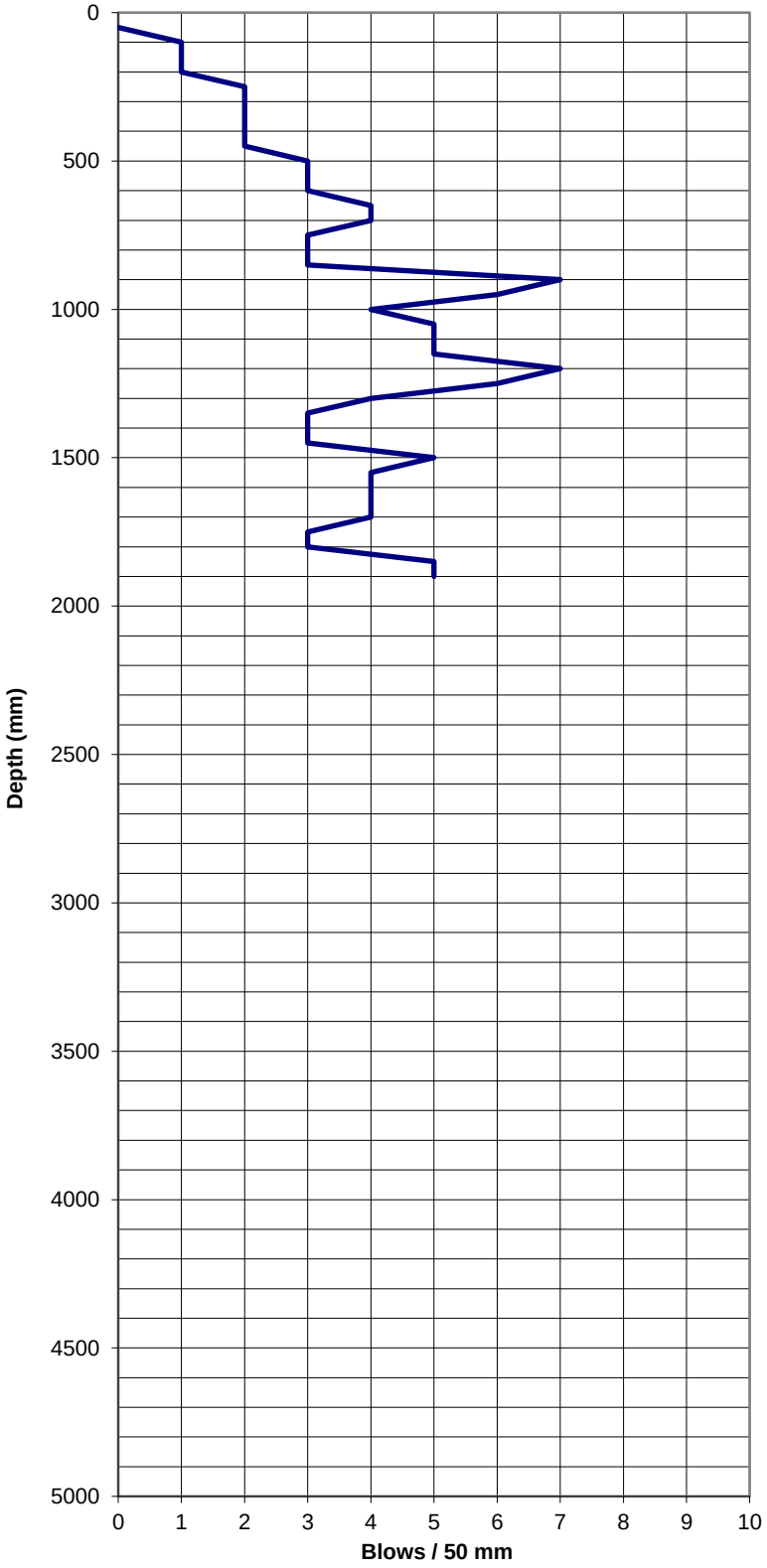
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	E
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	1	2600	
150	1	2650	
200	1	2700	
250	2	2750	
300	2	2800	
350	2	2850	
400	2	2900	
450	2	2950	
500	3	3000	
550	3	3050	
600	3	3100	
650	4	3150	
700	4	3200	
750	3	3250	
800	3	3300	
850	3	3350	
900	7	3400	
950	6	3450	
1000	4	3500	
1050	5	3550	
1100	5	3600	
1150	5	3650	
1200	7	3700	
1250	6	3750	
1300	4	3800	
1350	3	3850	
1400	3	3900	
1450	3	3950	
1500	5	4000	
1550	4	4050	
1600	4	4100	
1650	4	4150	
1700	4	4200	
1750	3	4250	
1800	3	4300	
1850	5	4350	
1900	5	4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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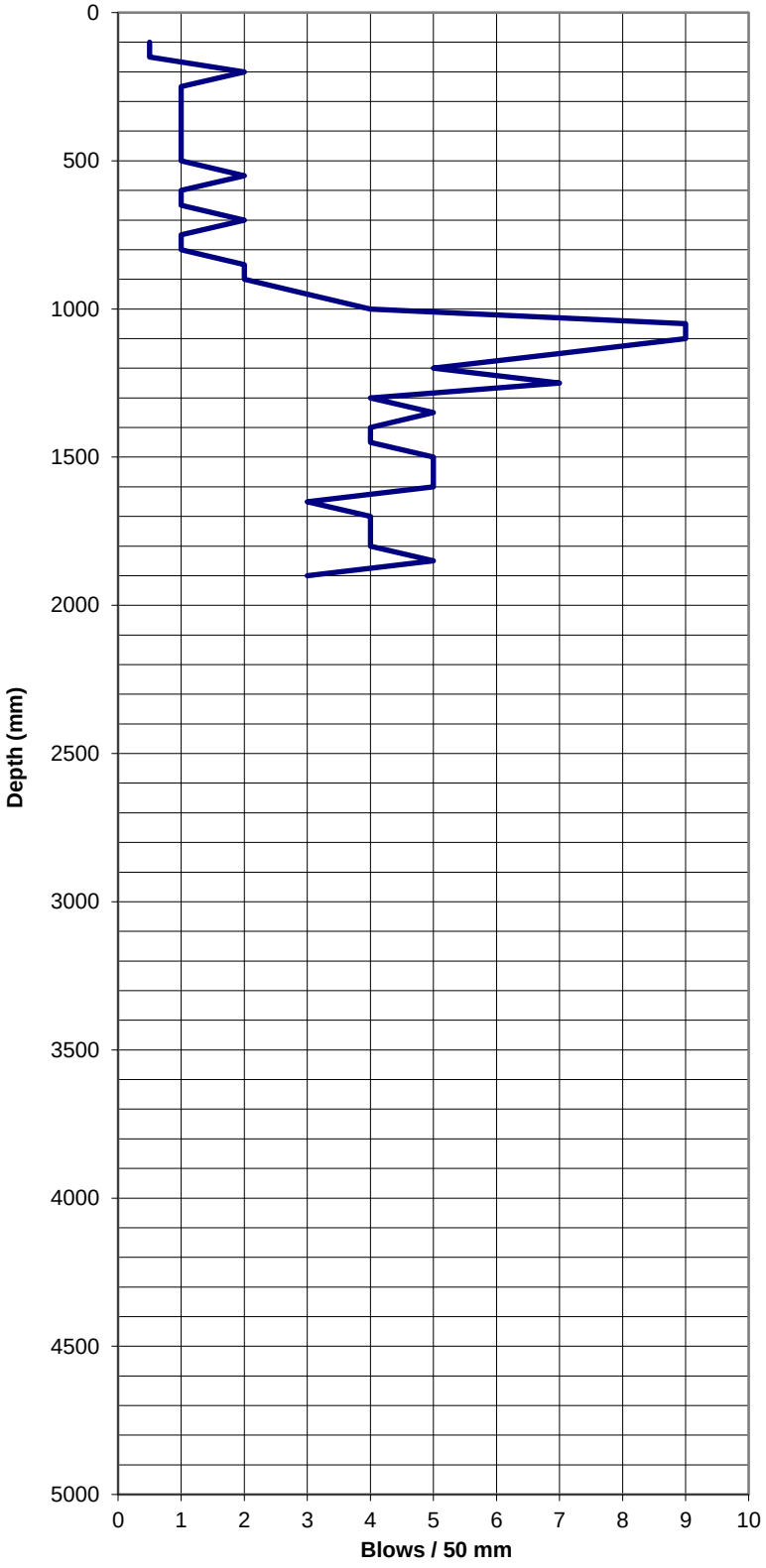
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC_2019_10_29*
Test No:	F
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	*0.5*	2600	
150	*0.5*	2650	
200	*2*	2700	
250	*1*	2750	
300	*1*	2800	
350	*1*	2850	
400	*1*	2900	
450	*1*	2950	
500	*1*	3000	
550	*2*	3050	
600	*1*	3100	
650	*1*	3150	
700	*2*	3200	
750	*1*	3250	
800	*1*	3300	
850	*2*	3350	
900	*2*	3400	
950	*3*	3450	
1000	*4*	3500	
1050	*9*	3550	
1100	*9*	3600	
1150	*7*	3650	
1200	*5*	3700	
1250	*7*	3750	
1300	*4*	3800	
1350	*5*	3850	
1400	*4*	3900	
1450	*4*	3950	
1500	*5*	4000	
1550	*5*	4050	
1600	*5*	4100	
1650	*3*	4150	
1700	*4*	4200	
1750	*4*	4250	
1800	*4*	4300	
1850	*5*	4350	
1900	*3*	4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

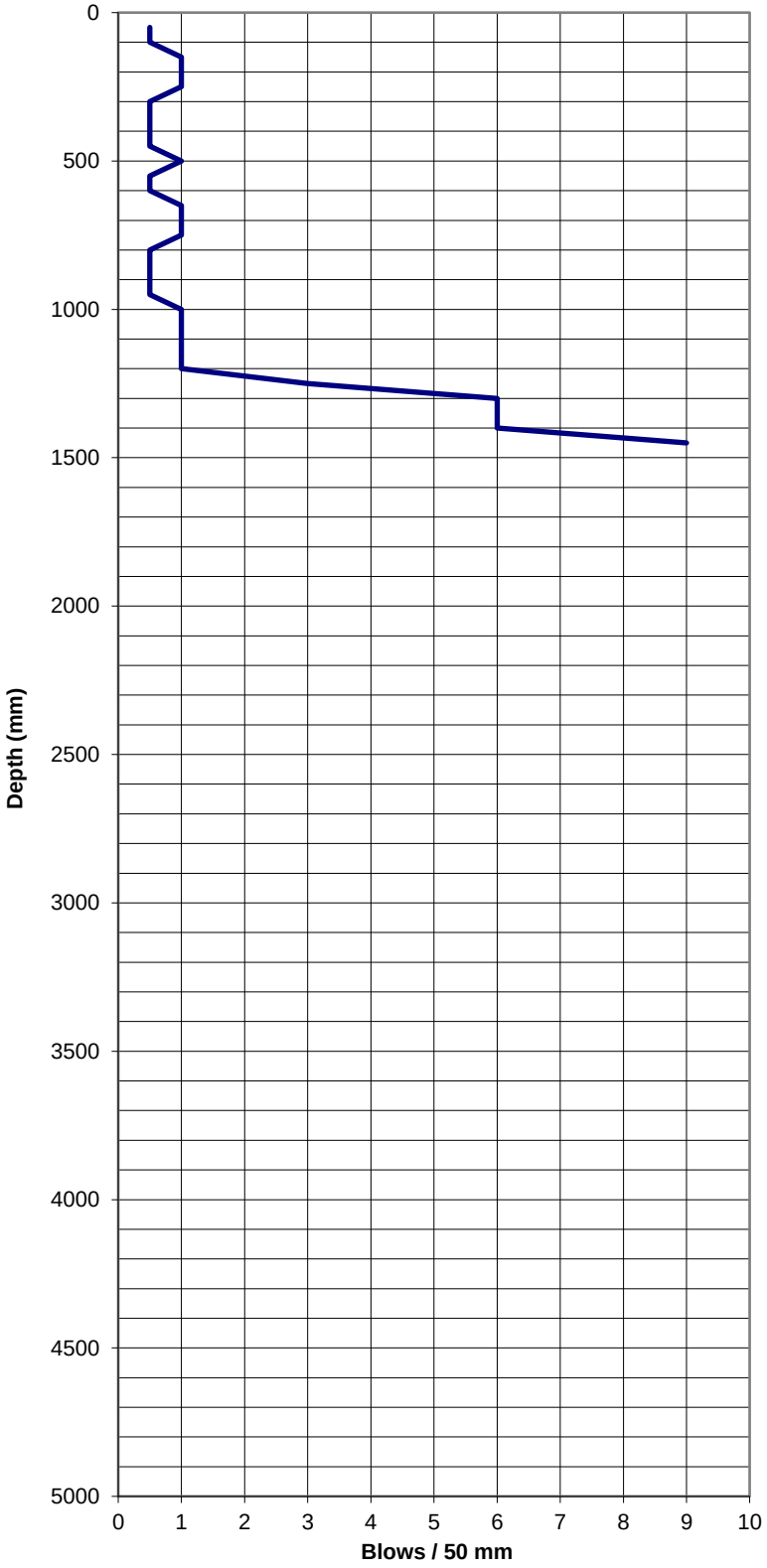
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	G
Sheet	1 of 1

mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1
300	0.5
350	0.5
400	0.5
450	0.5
500	1
550	0.5
600	0.5
650	1
700	1
750	1
800	0.5
850	0.5
900	0.5
950	0.5
1000	1
1050	1
1100	1
1150	1
1200	1
1250	3
1300	6
1350	6
1400	6
1450	9
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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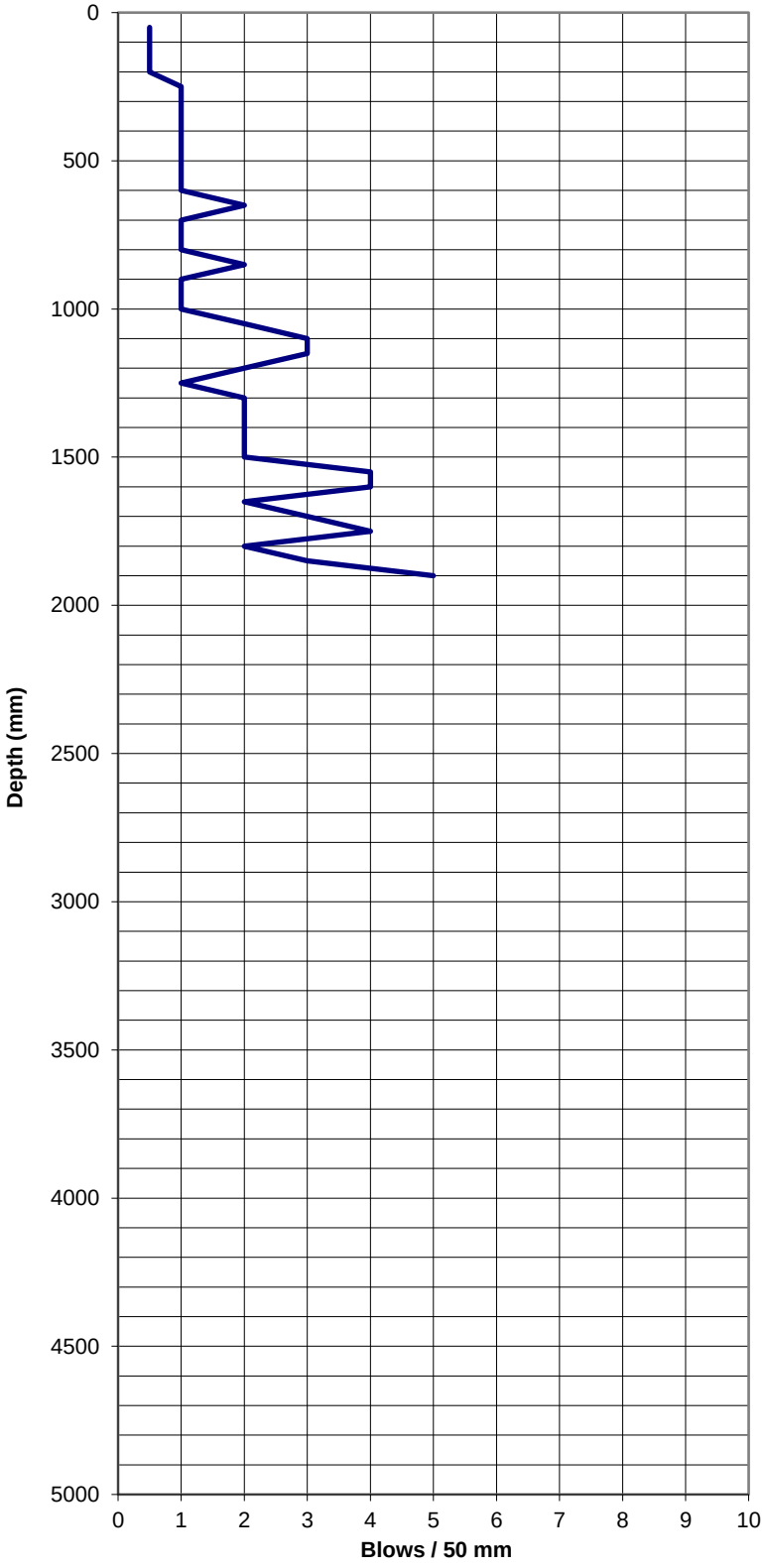
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	H
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	0.5	2550	
100	0.5	2600	
150	0.5	2650	
200	0.5	2700	
250	1	2750	
300	1	2800	
350	1	2850	
400	1	2900	
450	1	2950	
500	1	3000	
550	1	3050	
600	1	3100	
650	2	3150	
700	1	3200	
750	1	3250	
800	1	3300	
850	2	3350	
900	1	3400	
950	1	3450	
1000	1	3500	
1050	2	3550	
1100	3	3600	
1150	3	3650	
1200	2	3700	
1250	1	3750	
1300	2	3800	
1350	2	3850	
1400	2	3900	
1450	2	3950	
1500	2	4000	
1550	4	4050	
1600	4	4100	
1650	2	4150	
1700	3	4200	
1750	4	4250	
1800	2	4300	
1850	3	4350	
1900	5	4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

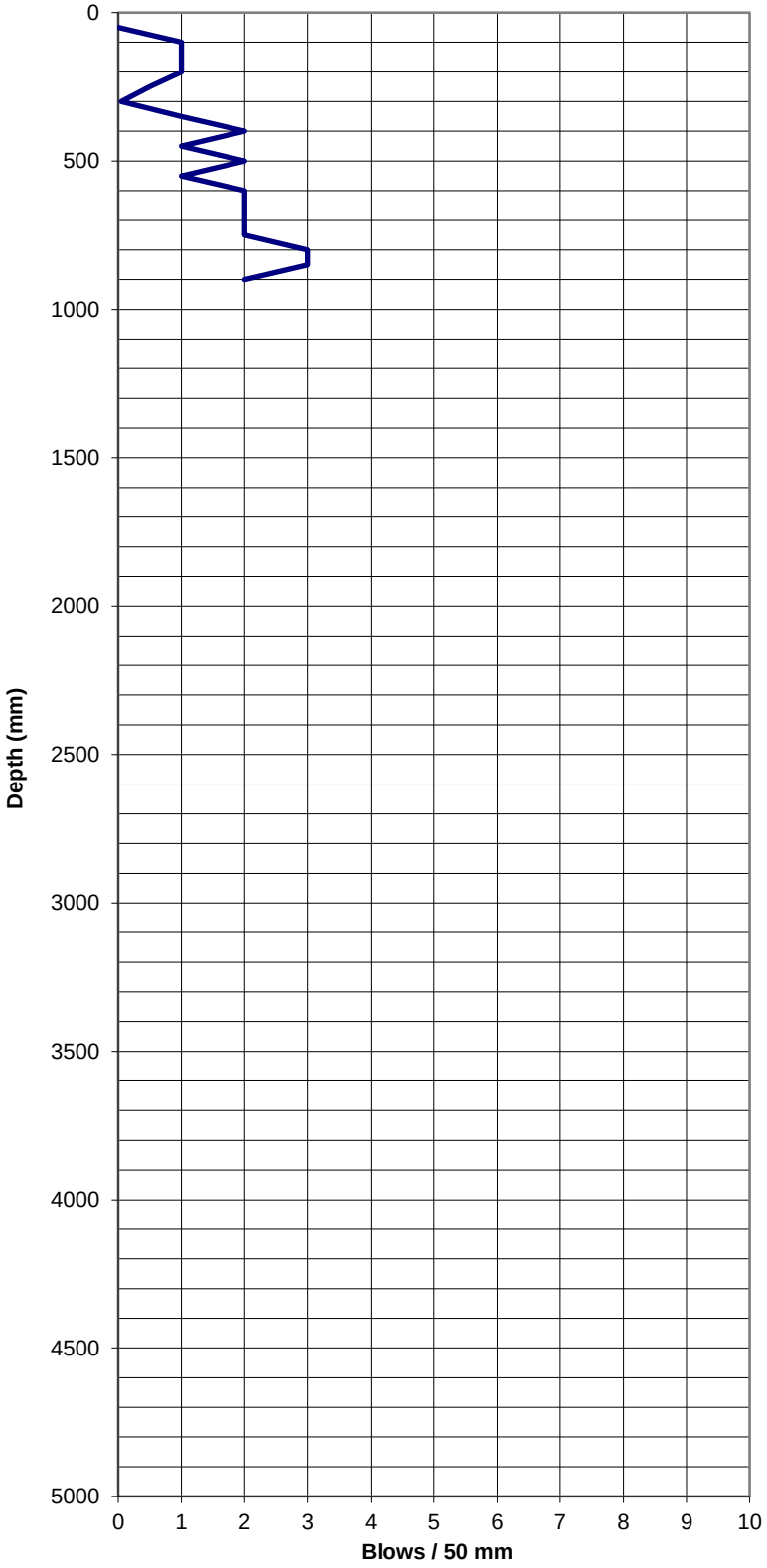
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	I
Sheet	1 of 1

mm Driven	No. of Blows
50	
100	1
150	1
200	1
250	0.5
300	0.05
350	1
400	2
450	1
500	2
550	1
600	2
650	2
700	2
750	2
800	3
850	3
900	2
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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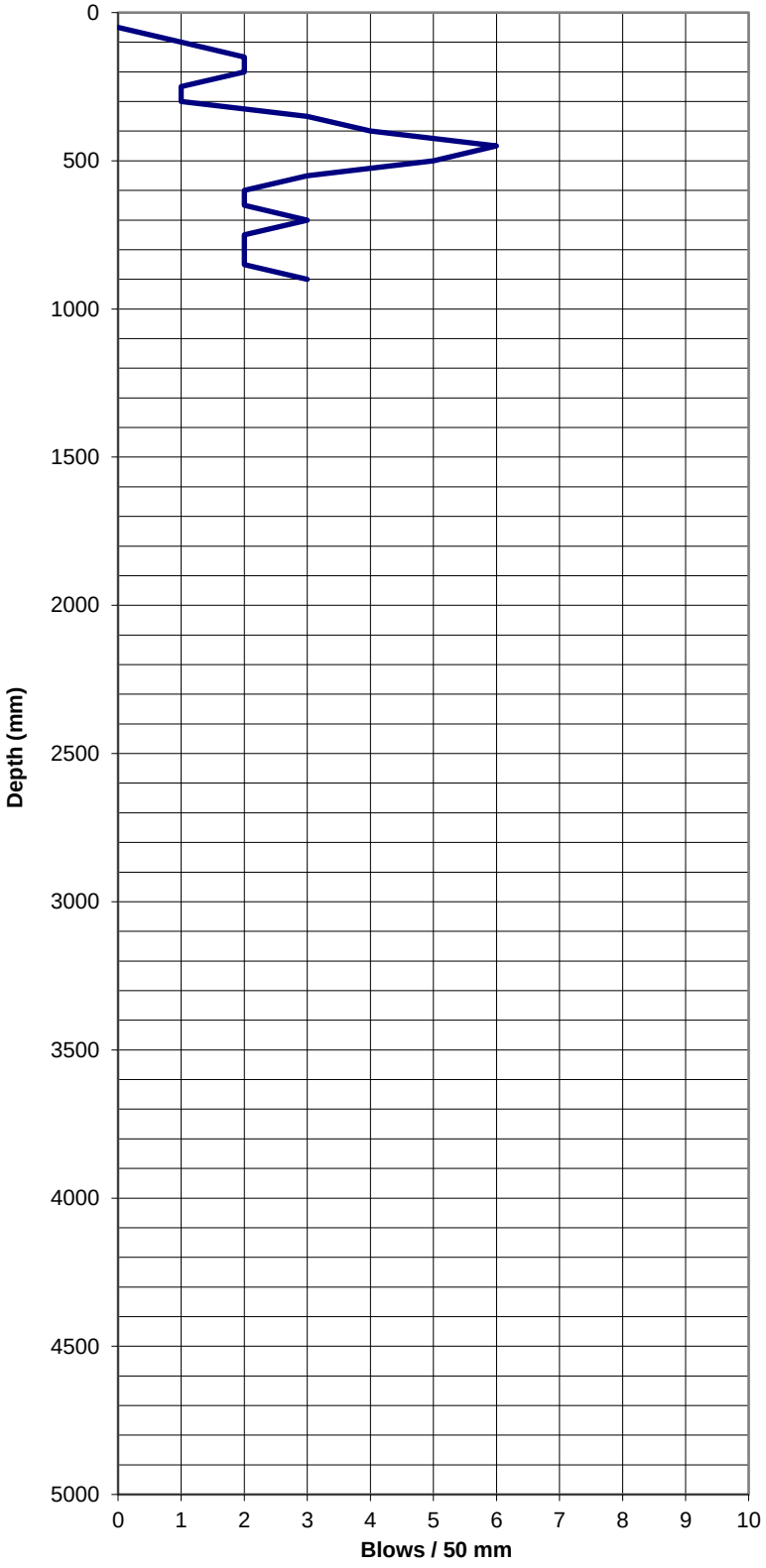
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	J
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	
100	1	2600	
150	2	2650	
200	2	2700	
250	1	2750	
300	1	2800	
350	3	2850	
400	4	2900	
450	6	2950	
500	5	3000	
550	3	3050	
600	2	3100	
650	2	3150	
700	3	3200	
750	2	3250	
800	2	3300	
850	2	3350	
900	3	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



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SCALA PENETROMETER LOG

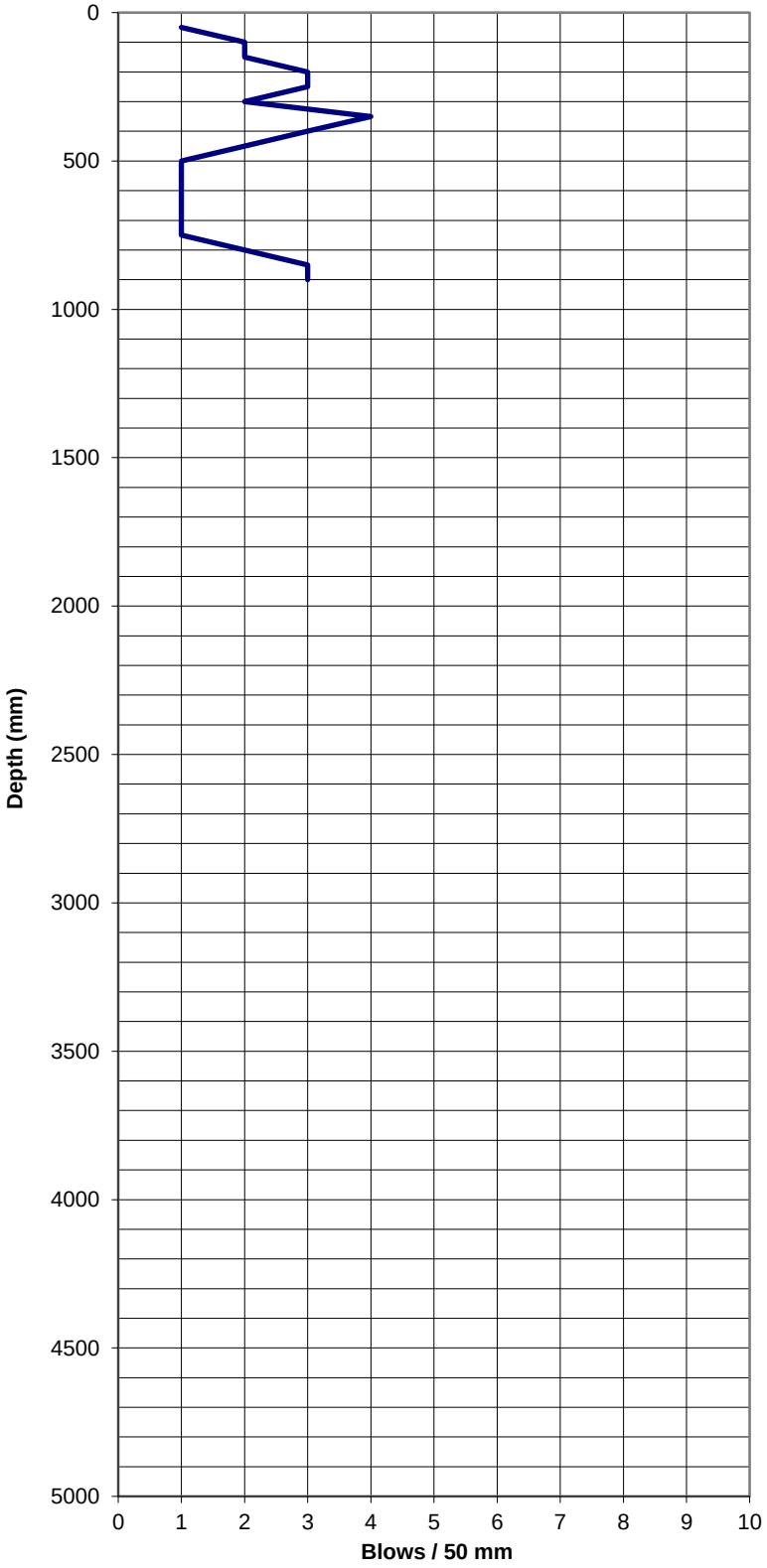
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *HokowhituLagoon, Palmerson North*
Date: *29/10/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_10_29
Test No:	K
Sheet	1 of 1

mm Driven	No. of Blows
50	1
100	2
150	2
200	3
250	3
300	2
350	4
400	3
450	2
500	1
550	1
600	1
650	1
700	1
750	1
800	2
850	3
900	3
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



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SCALA PENETROMETER LOG

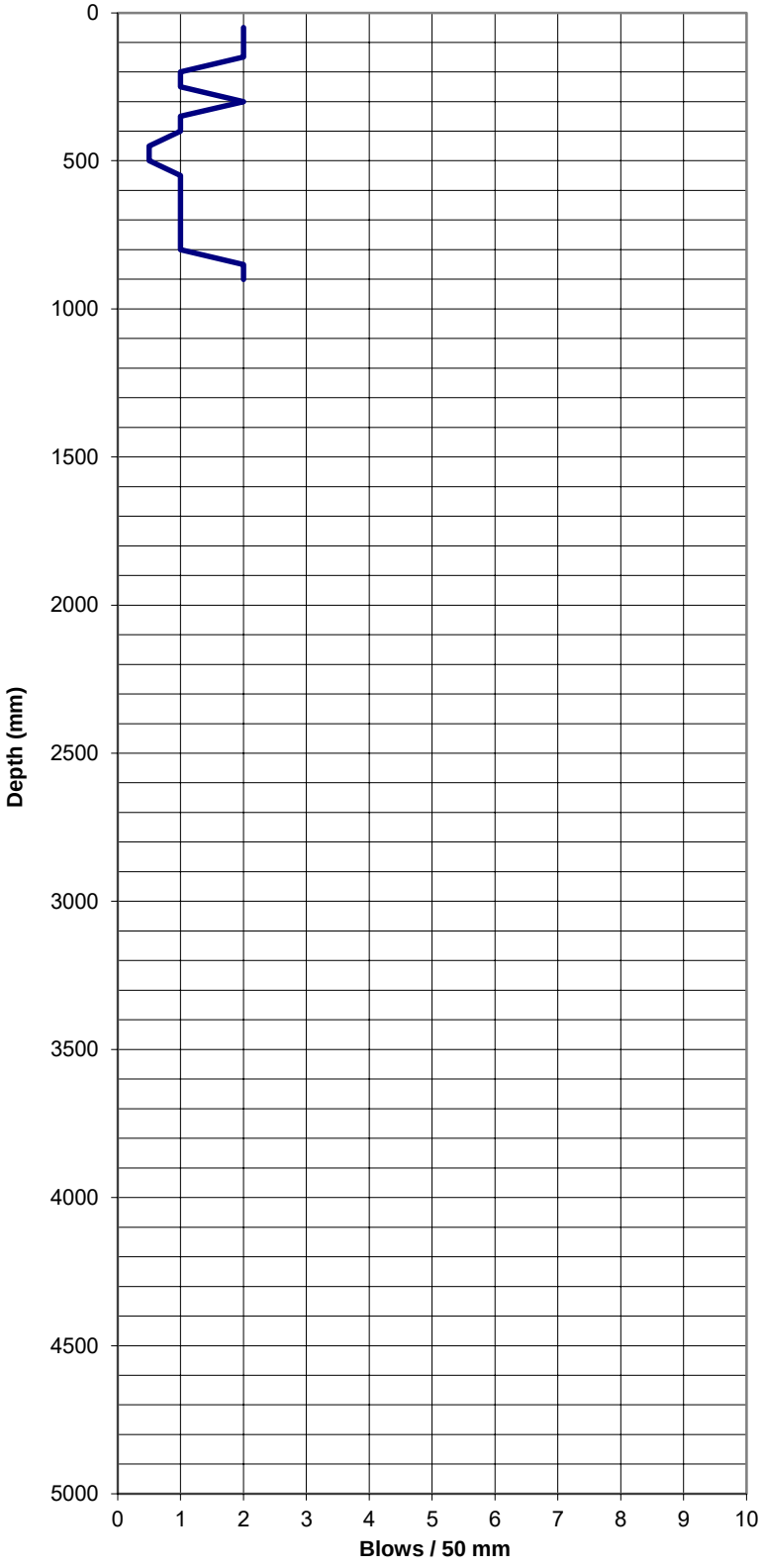
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L : -350
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_11_15
Test No:	A
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	2	2550	
100	2	2600	
150	2	2650	
200	1	2700	
250	1	2750	
300	2	2800	
350	1	2850	
400	1	2900	
450	0.5	2950	
500	0.5	3000	
550	1	3050	
600	1	3100	
650	1	3150	
700	1	3200	
750	1	3250	
800	1	3300	
850	2	3350	
900	2	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design



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

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SCALA PENETROMETER LOG

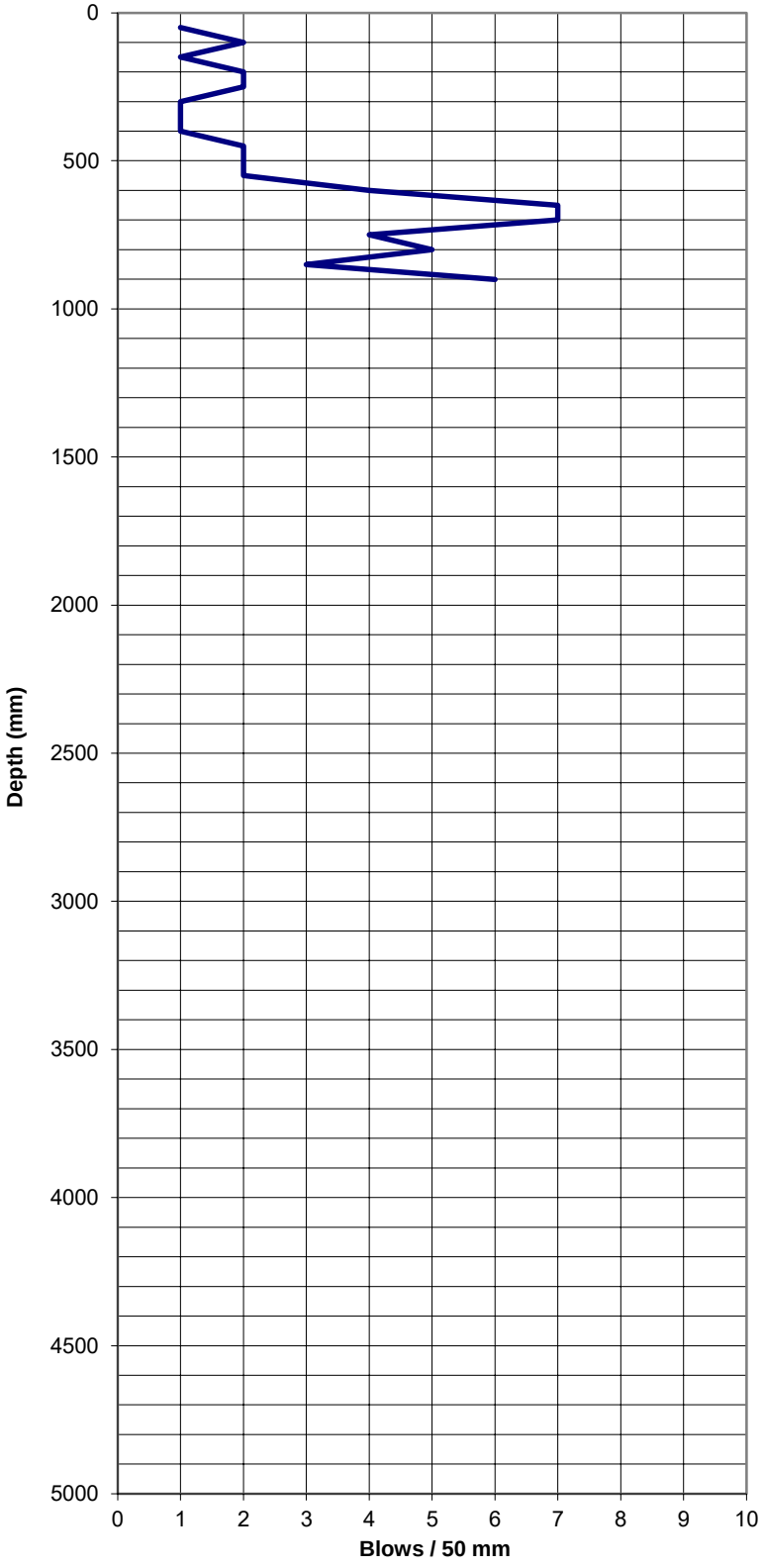
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L : -350
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC_2019_11_15*
Test No:	B
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*1*	2650	
200	*2*	2700	
250	*2*	2750	
300	*1*	2800	
350	*1*	2850	
400	*1*	2900	
450	*2*	2950	
500	*2*	3000	
550	*2*	3050	
600	*4*	3100	
650	*7*	3150	
700	*7*	3200	
750	*4*	3250	
800	*5*	3300	
850	*3*	3350	
900	*6*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design



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

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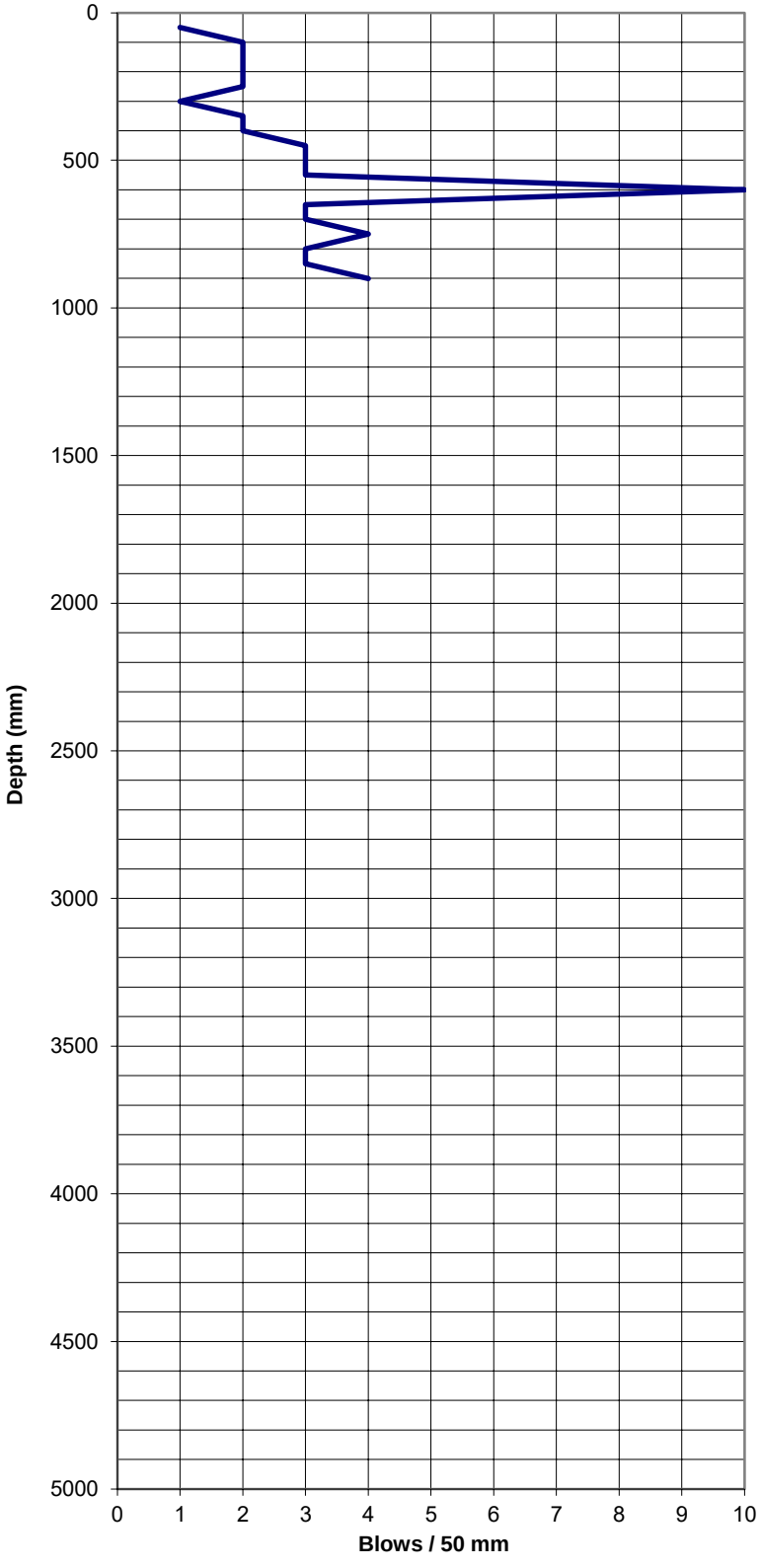
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L : -350
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC_2019_11_15*
Test No:	C
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*2*	2650	
200	*2*	2700	
250	*2*	2750	
300	*1*	2800	
350	*2*	2850	
400	*2*	2900	
450	*3*	2950	
500	*3*	3000	
550	*3*	3050	
600	*10*	3100	
650	*3*	3150	
700	*3*	3200	
750	*4*	3250	
800	*3*	3300	
850	*3*	3350	
900	*4*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design

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

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SCALA PENETROMETER LOG

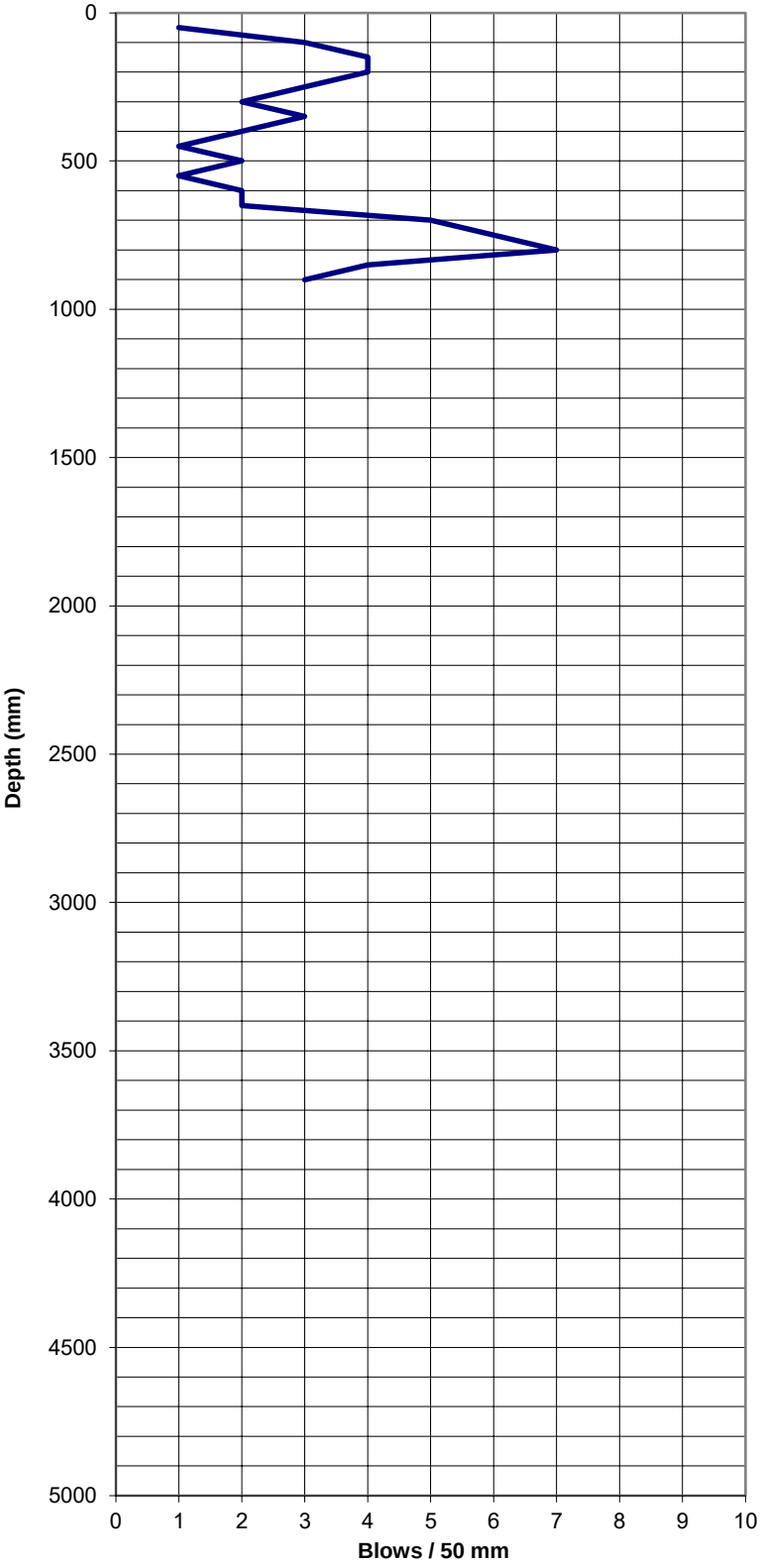
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L : -350
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC_2019_11_15*
Test No:	D
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*3*	2600	
150	*4*	2650	
200	*4*	2700	
250	*3*	2750	
300	*2*	2800	
350	*3*	2850	
400	*2*	2900	
450	*1*	2950	
500	*2*	3000	
550	*1*	3050	
600	*2*	3100	
650	*2*	3150	
700	*5*	3200	
750	*6*	3250	
800	*7*	3300	
850	*4*	3350	
900	*3*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design



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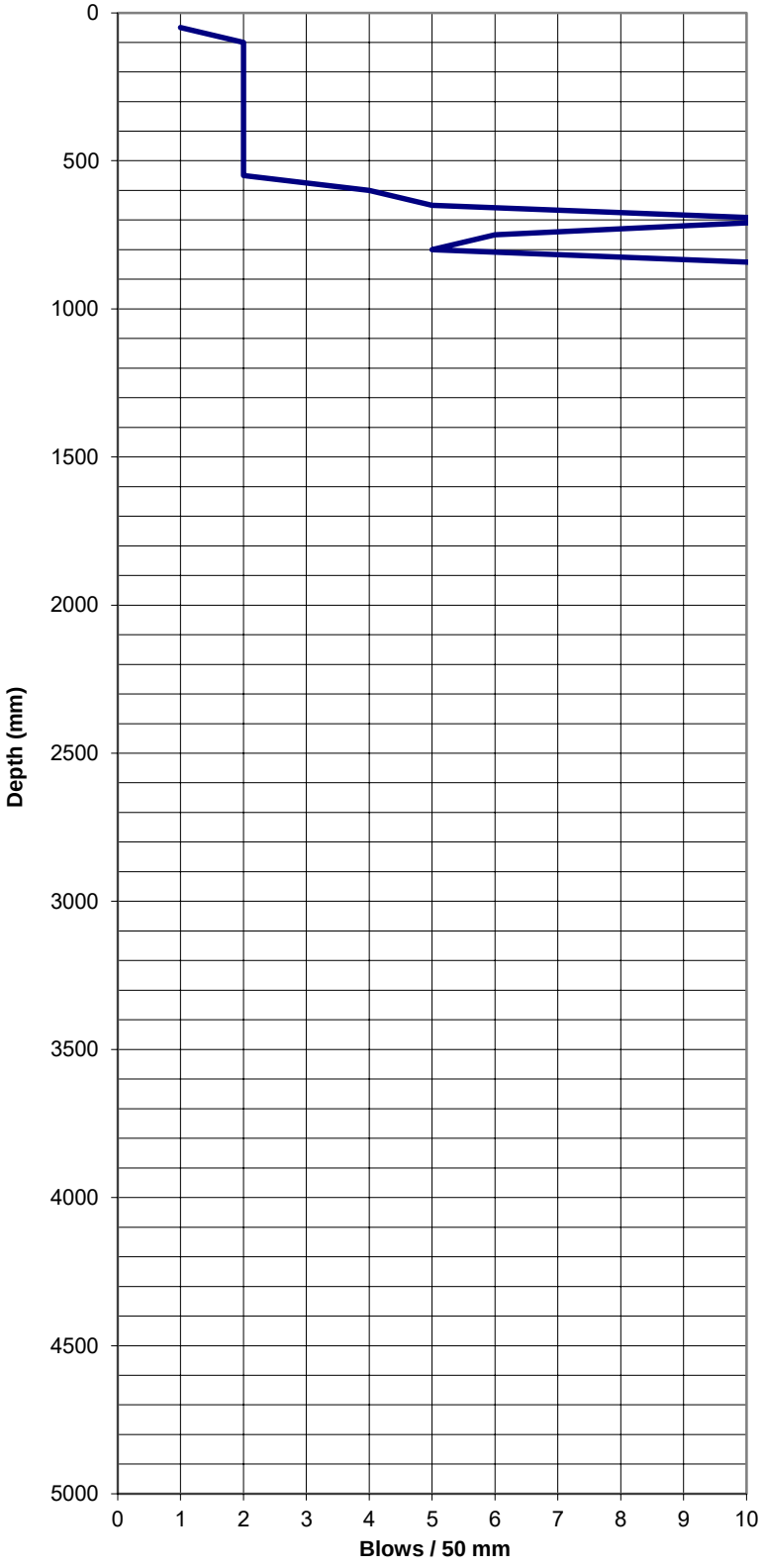
SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L : -350	**Test Series:**	***SC_2019_11_15***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**E**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *15/11/2019*	Checked by:		

mm Driven	No. of Blows
50	*1*
100	*2*
150	*2*
200	*2*
250	*2*
300	*2*
350	*2*
400	*2*
450	*2*
500	*2*
550	*2*
600	*4*
650	*5*
700	*11*
750	*6*
800	*5*
850	*11*
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design

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

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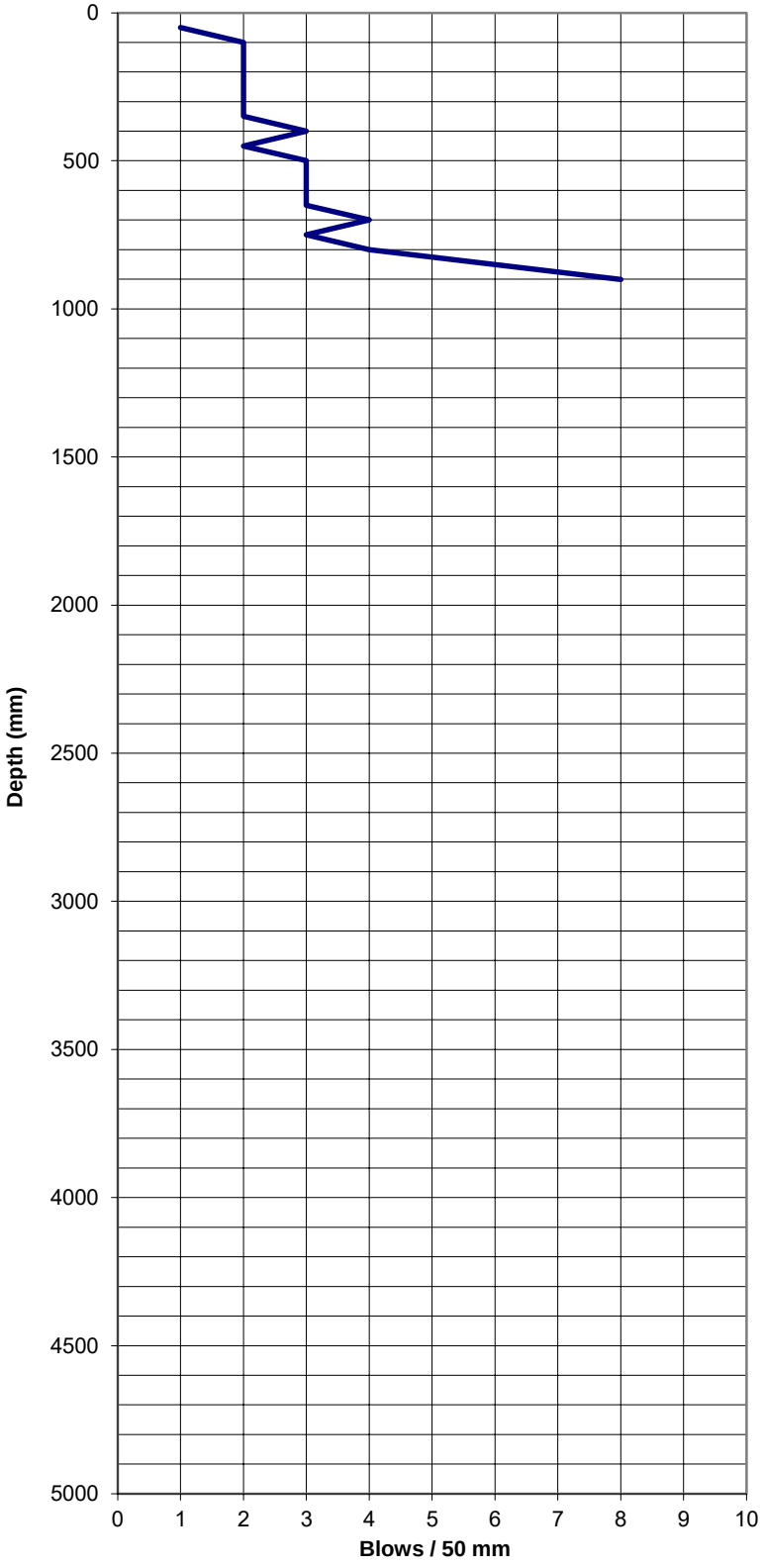
SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L :	**Test Series:**	***SC_2019_11_15***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**F**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *15/11/2019*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*2*	2650	
200	*2*	2700	
250	*2*	2750	
300	*2*	2800	
350	*2*	2850	
400	*3*	2900	
450	*2*	2950	
500	*3*	3000	
550	*3*	3050	
600	*3*	3100	
650	*3*	3150	
700	*4*	3200	
750	*3*	3250	
800	*4*	3300	
850	*6*	3350	
900	*8*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design



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

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SCALA PENETROMETER LOG

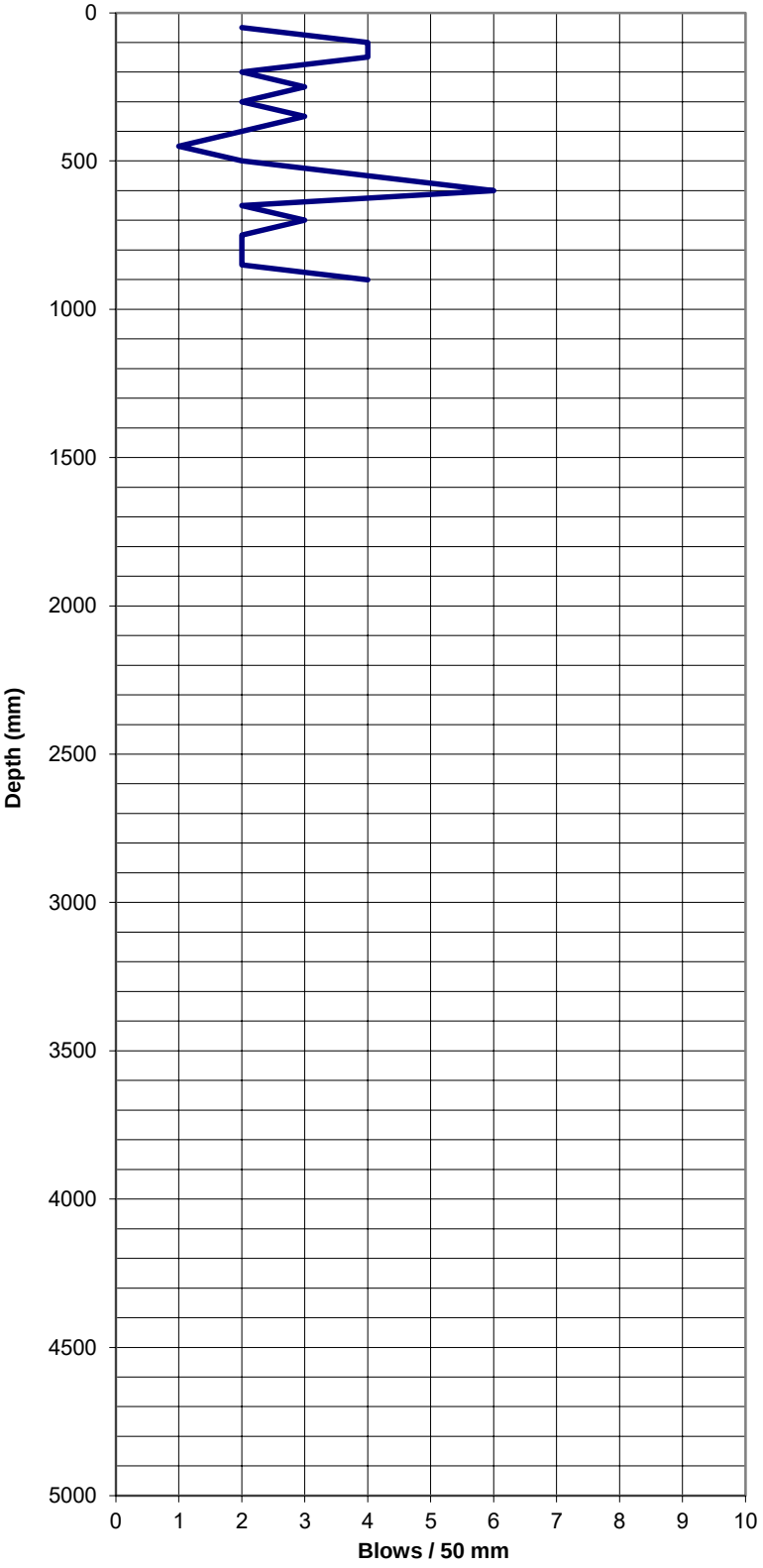
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC_2019_11_15*
Test No:	G
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*4*	2600	
150	*4*	2650	
200	*2*	2700	
250	*3*	2750	
300	*2*	2800	
350	*3*	2850	
400	*2*	2900	
450	*1*	2950	
500	*2*	3000	
550	*4*	3050	
600	*6*	3100	
650	*2*	3150	
700	*3*	3200	
750	*2*	3250	
800	*2*	3300	
850	*2*	3350	
900	*4*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: RL's are rough estimates only in relation to design RL.



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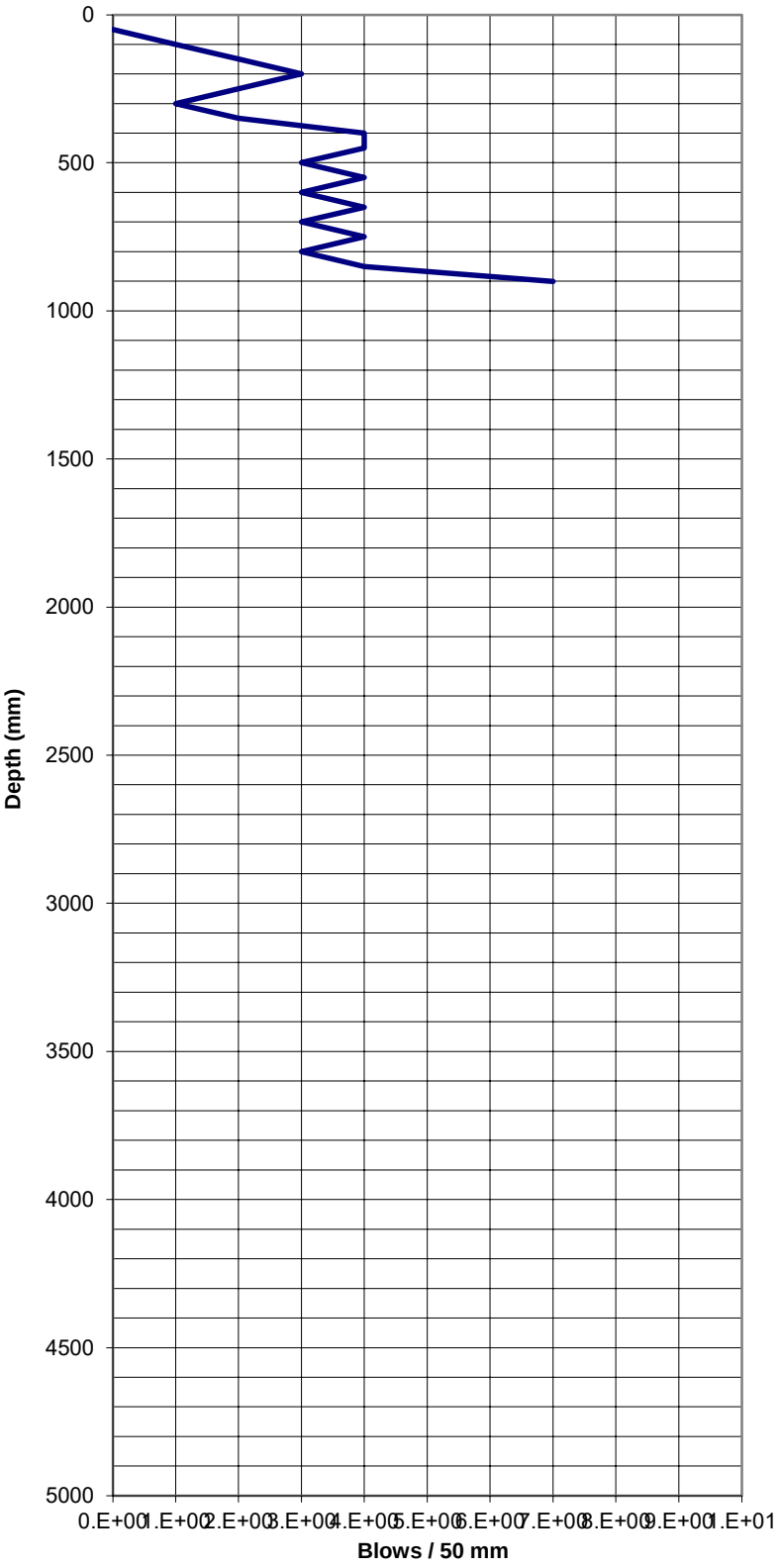
SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L :	**Test Series:**	***SC_2019_11_15***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**H**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *15/11/2019*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*0.E+00*	2550	
100	*1*	2600	
150	*2*	2650	
200	*3*	2700	
250	*2*	2750	
300	*1*	2800	
350	*2*	2850	
400	*4*	2900	
450	*4*	2950	
500	*3*	3000	
550	*4*	3050	
600	*3*	3100	
650	*4*	3150	
700	*3*	3200	
750	*4*	3250	
800	*3*	3300	
850	*4*	3350	
900	*7*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL.

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

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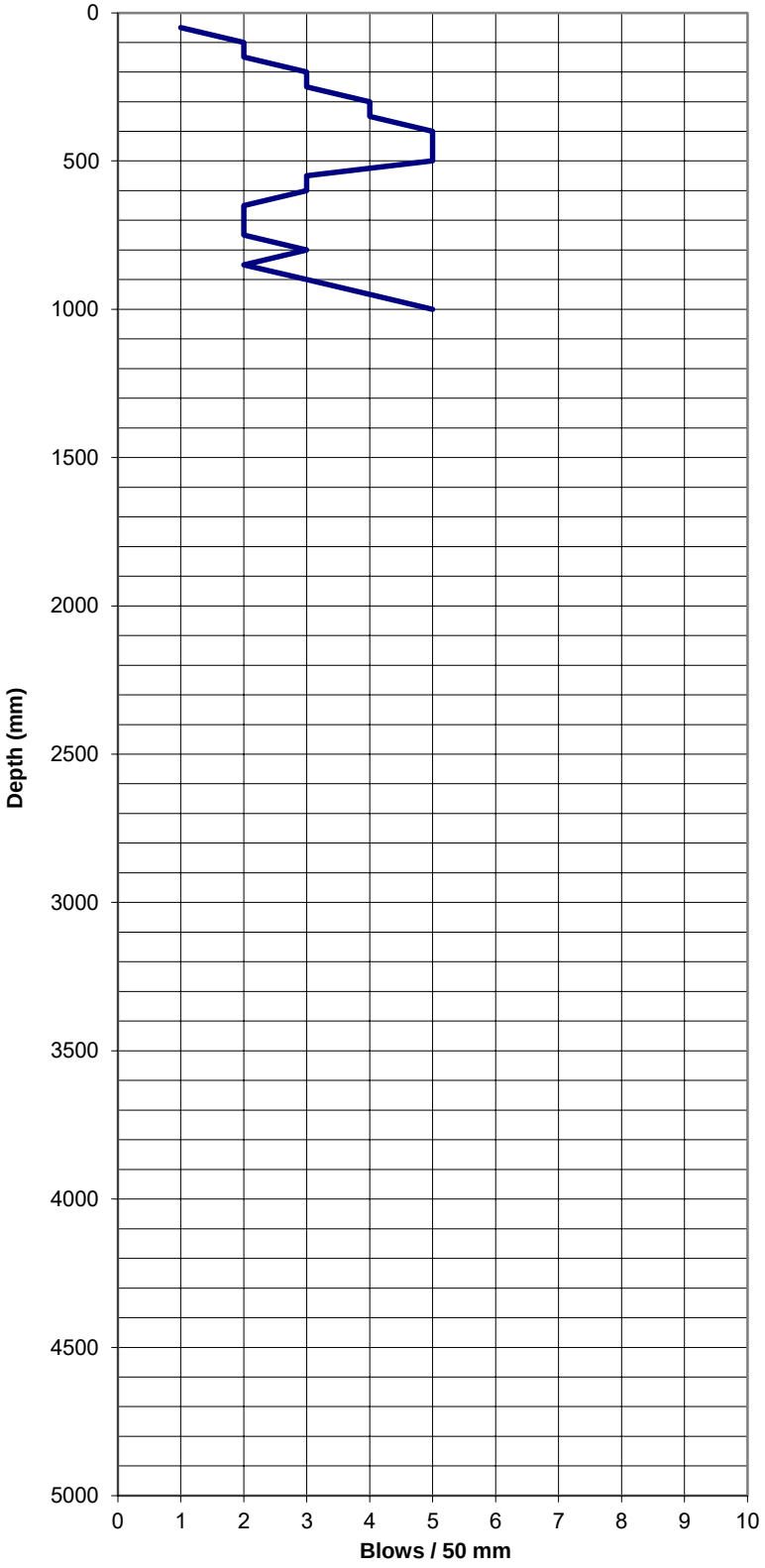
SCALA PENETROMETER LOG

Job No:	*1004625.003*	m R.L :	below
Project:	*Centennial Park Stage 1*	Operated by:	*EJWL*
Location:	*Hokowhitu Lagoon, Palmerson North*	Logged by:	*EJWL*
Date:	*15/11/2019*	Checked by:	

Test Series:	***SC_2019_11_15***
Test No:	**I**
Sheet	***1*** **of** ***1***

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*2*	2650	
200	*3*	2700	
250	*3*	2750	
300	*4*	2800	
350	*4*	2850	
400	*5*	2900	
450	*5*	2950	
500	*5*	3000	
550	*3*	3050	
600	*3*	3100	
650	*2*	3150	
700	*2*	3200	
750	*2*	3250	
800	*3*	3300	
850	*2*	3350	
900	*3*	3400	
950	*4*	3450	
1000	*5*	3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: RL unknown, below design RL



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

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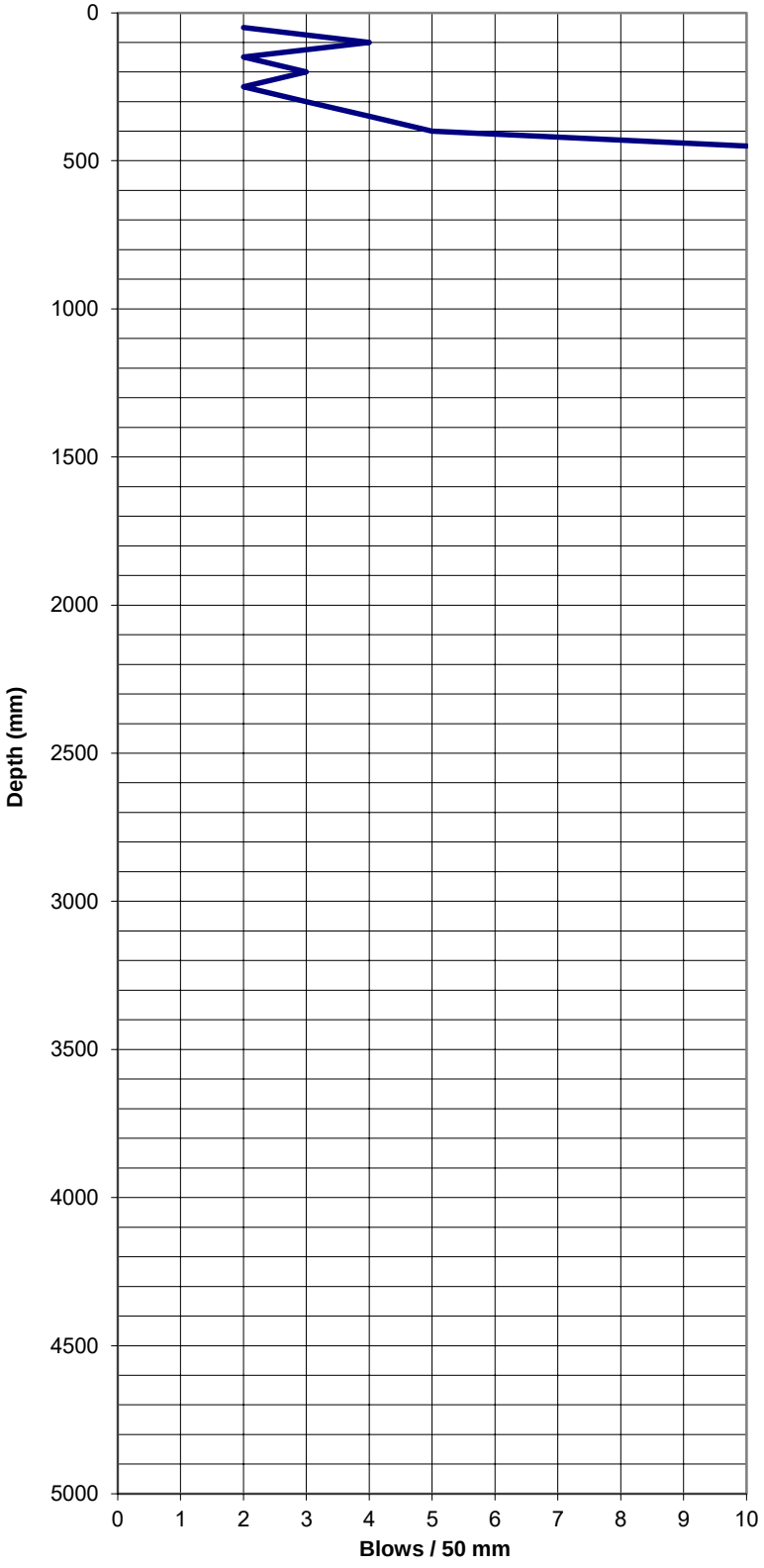
SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L :	**Test Series:**	***SC_2019_11_15***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**J**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *15/11/2019*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*4*	2600	
150	*2*	2650	
200	*3*	2700	
250	*2*	2750	
300	*3*	2800	
350	*4*	2850	
400	*5*	2900	
450	*10*	2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: RL's are rough estimates only in relation to design RL.



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

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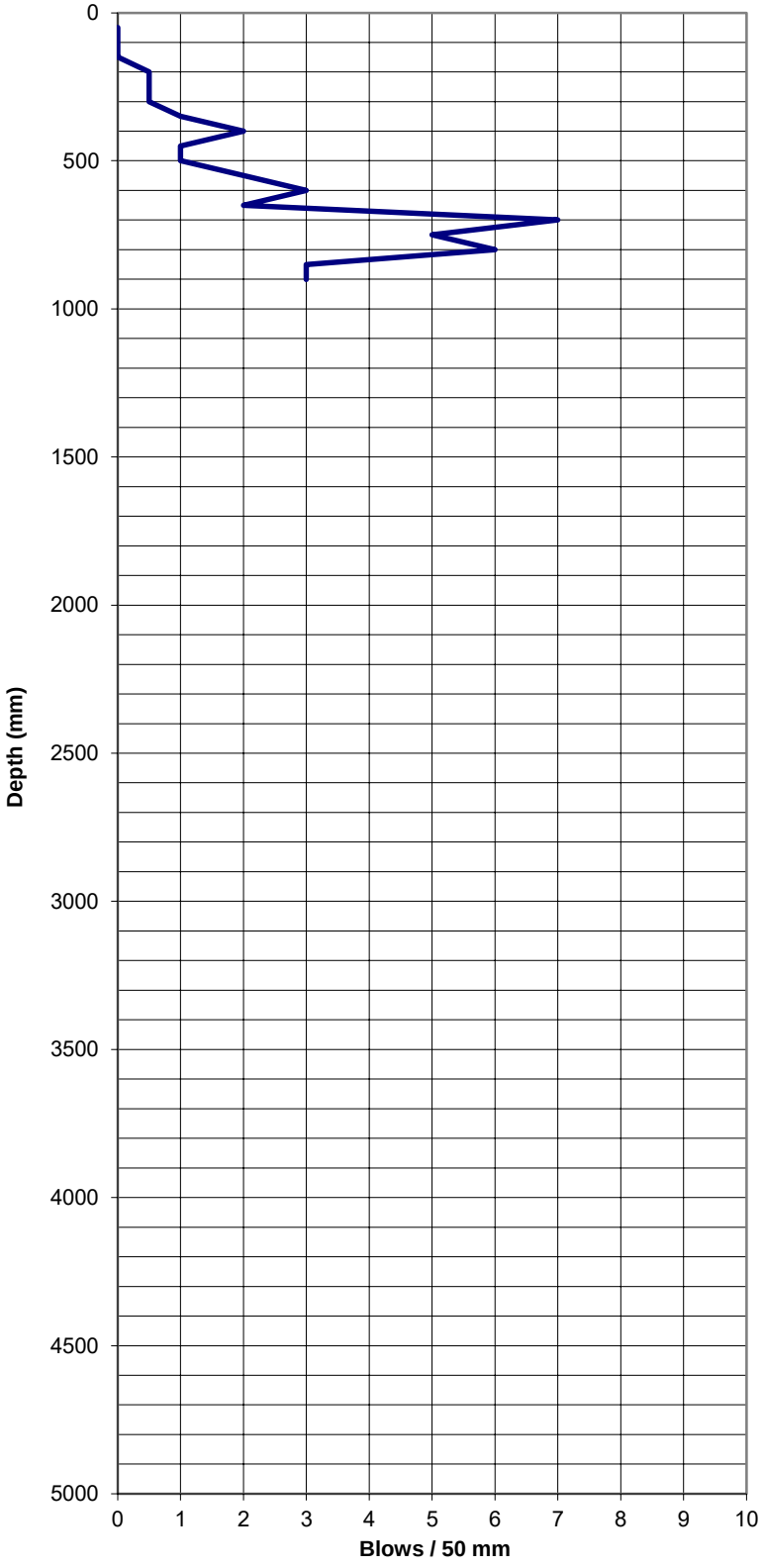
SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L :	**Test Series:**	***SC_2019_11_15***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**K**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *15/11/2019*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*0*	2550	
100	*0*	2600	
150	*0*	2650	
200	*0.5*	2700	
250	*0.5*	2750	
300	*0.5*	2800	
350	*1*	2850	
400	*2*	2900	
450	*1*	2950	
500	*1*	3000	
550	*2*	3050	
600	*3*	3100	
650	*2*	3150	
700	*7*	3200	
750	*5*	3250	
800	*6*	3300	
850	*3*	3350	
900	*3*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL.

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

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SCALA PENETROMETER LOG

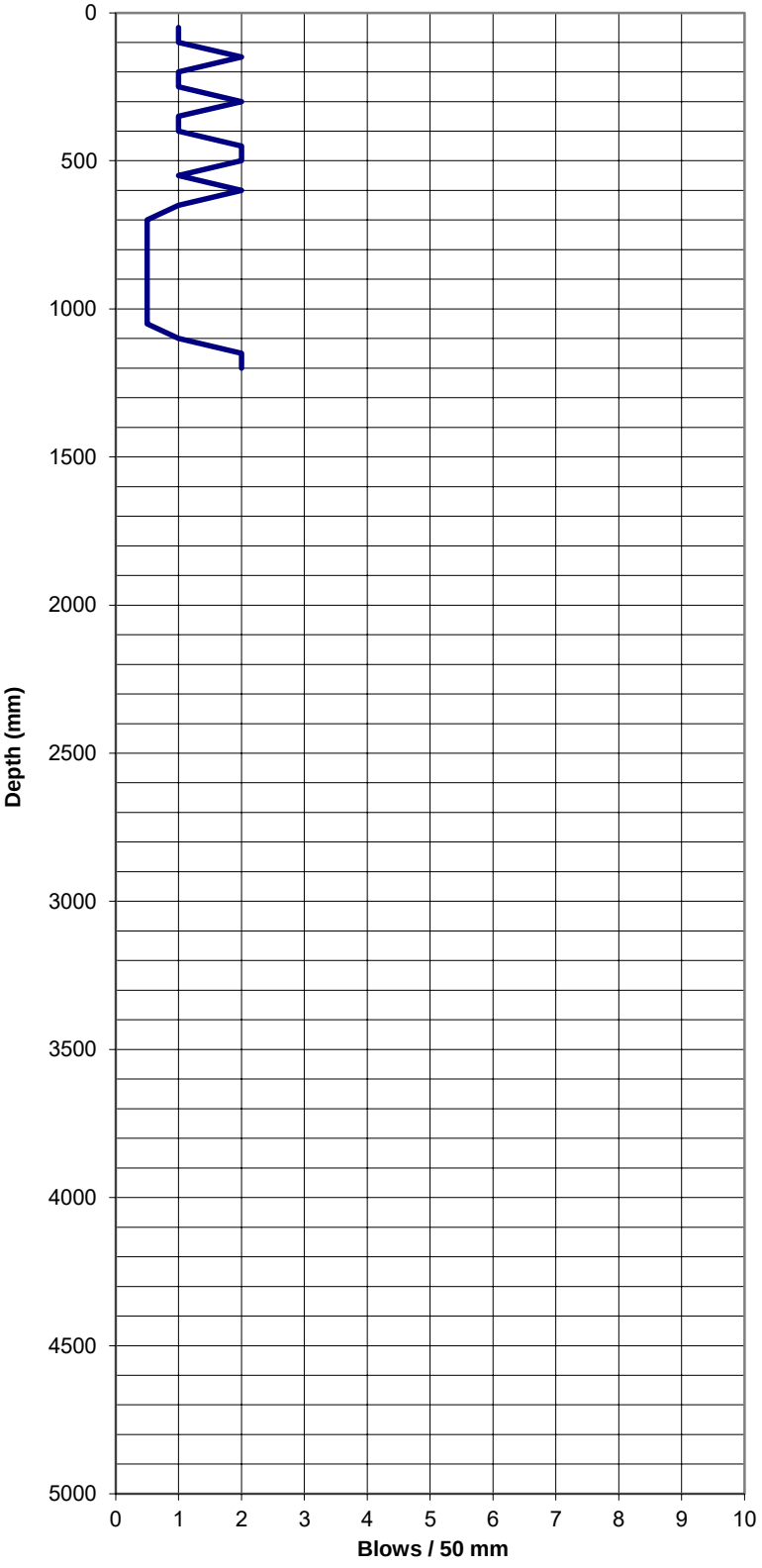
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_11_15
Test No:	L
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	1	2550	
100	1	2600	
150	2	2650	
200	1	2700	
250	1	2750	
300	2	2800	
350	1	2850	
400	1	2900	
450	2	2950	
500	2	3000	
550	1	3050	
600	2	3100	
650	1	3150	
700	0.5	3200	
750	0.5	3250	
800	0.5	3300	
850	0.5	3350	
900	0.5	3400	
950	0.5	3450	
1000	0.5	3500	
1050	0.5	3550	
1100	1	3600	
1150	2	3650	
1200	2	3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: RL's are rough estimates only in relation to design RL.



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

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SCALA PENETROMETER LOG

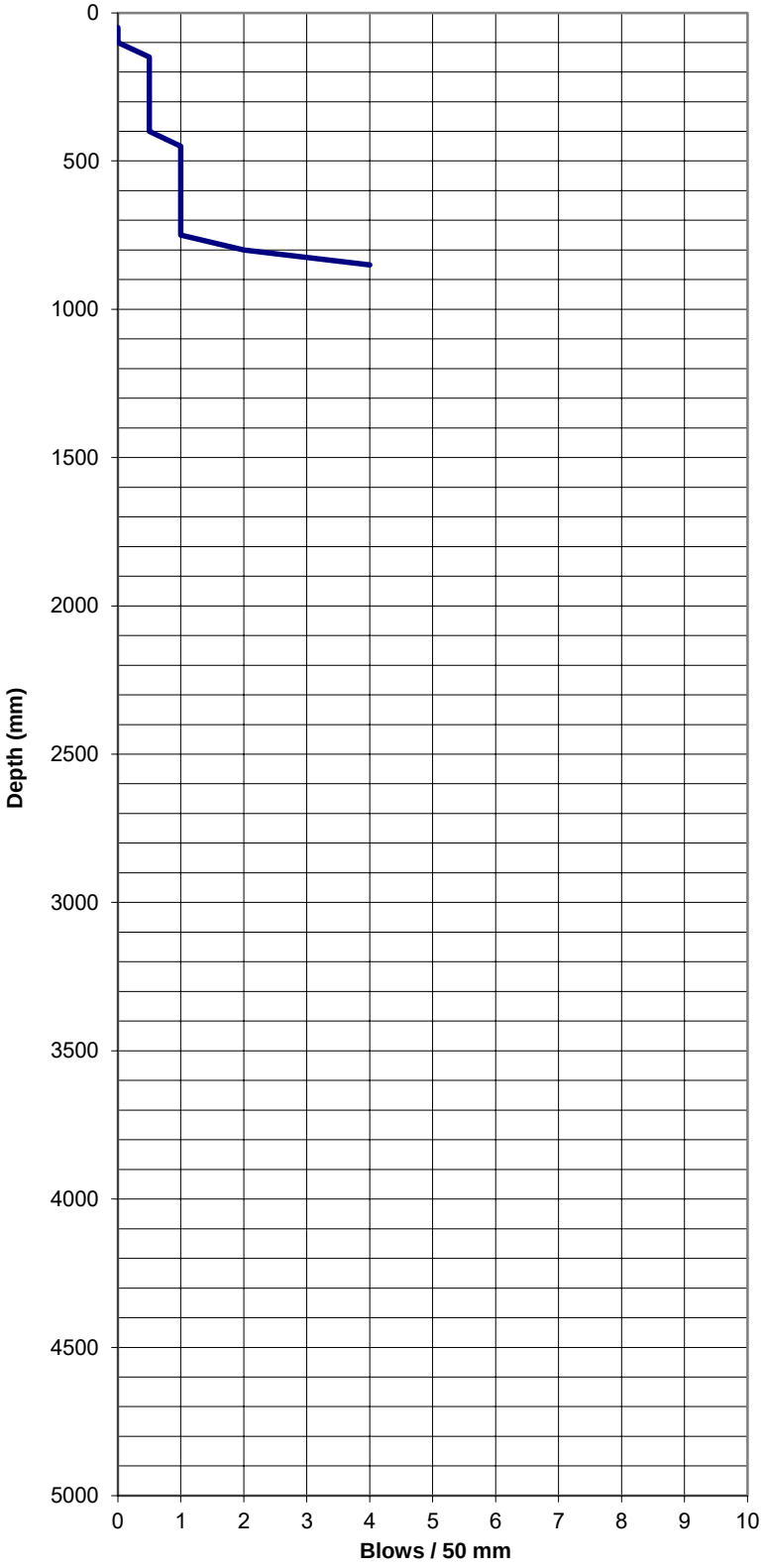
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_11_15
Test No:	M
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	0	2550	
100	0	2600	
150	0.5	2650	
200	0.5	2700	
250	0.5	2750	
300	0.5	2800	
350	0.5	2850	
400	0.5	2900	
450	1	2950	
500	1	3000	
550	1	3050	
600	1	3100	
650	1	3150	
700	1	3200	
750	1	3250	
800	2	3300	
850	4	3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: RL's are rough estimates only.



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

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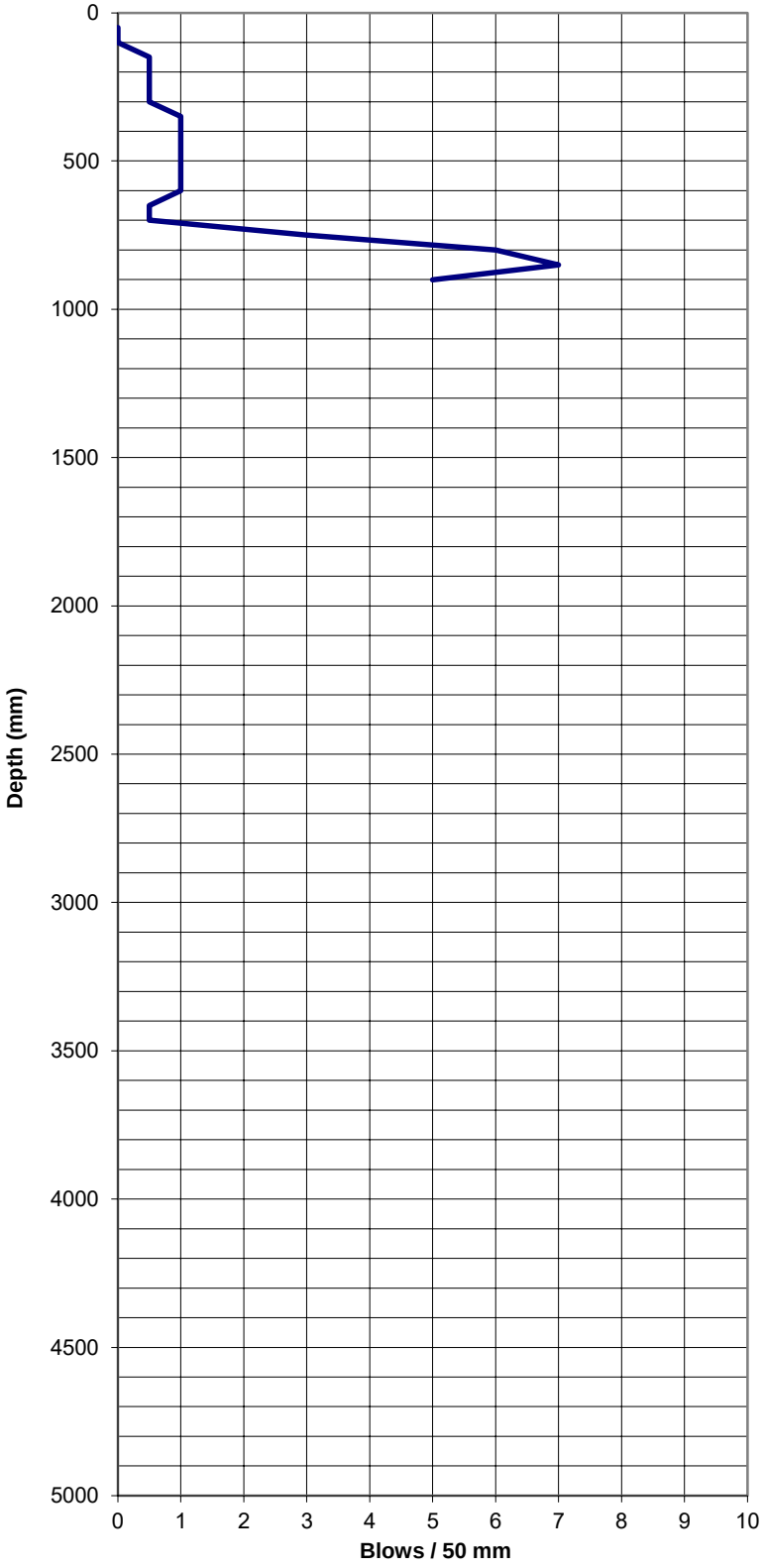
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC_2019_11_15*
Test No:	N
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*0*	2550	
100	*0*	2600	
150	*0.5*	2650	
200	*0.5*	2700	
250	*0.5*	2750	
300	*0.5*	2800	
350	*1*	2850	
400	*1*	2900	
450	*1*	2950	
500	*1*	3000	
550	*1*	3050	
600	*1*	3100	
650	*0.5*	3150	
700	*0.5*	3200	
750	*3*	3250	
800	*6*	3300	
850	*7*	3350	
900	*5*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only.

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

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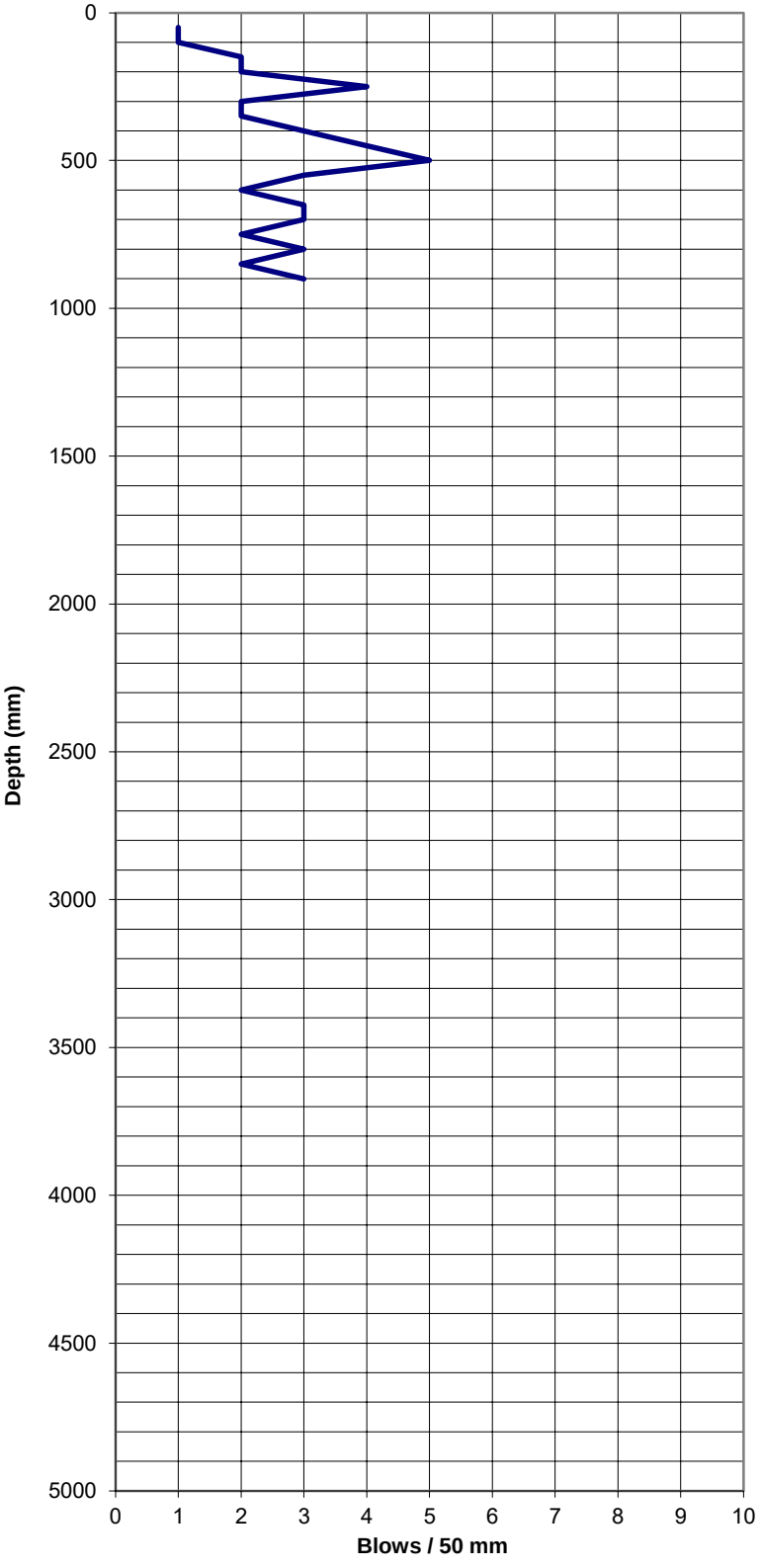
SCALA PENETROMETER LOG

Job No:	*1004625.003*	m R.L :	
Project:	*Centennial Park Stage 1*	Operated by:	*EJWL*
Location:	*Hokowhitu Lagoon, Palmerson North*	Logged by:	*EJWL*
Date:	*15/11/2019*	Checked by:	

Test Series:	***SC_2019_11_15***
Test No:	**O**
Sheet	***1*** **of** ***1***

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*1*	2600	
150	*2*	2650	
200	*2*	2700	
250	*4*	2750	
300	*2*	2800	
350	*2*	2850	
400	*3*	2900	
450	*4*	2950	
500	*5*	3000	
550	*3*	3050	
600	*2*	3100	
650	*3*	3150	
700	*3*	3200	
750	*2*	3250	
800	*3*	3300	
850	*2*	3350	
900	*3*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL

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

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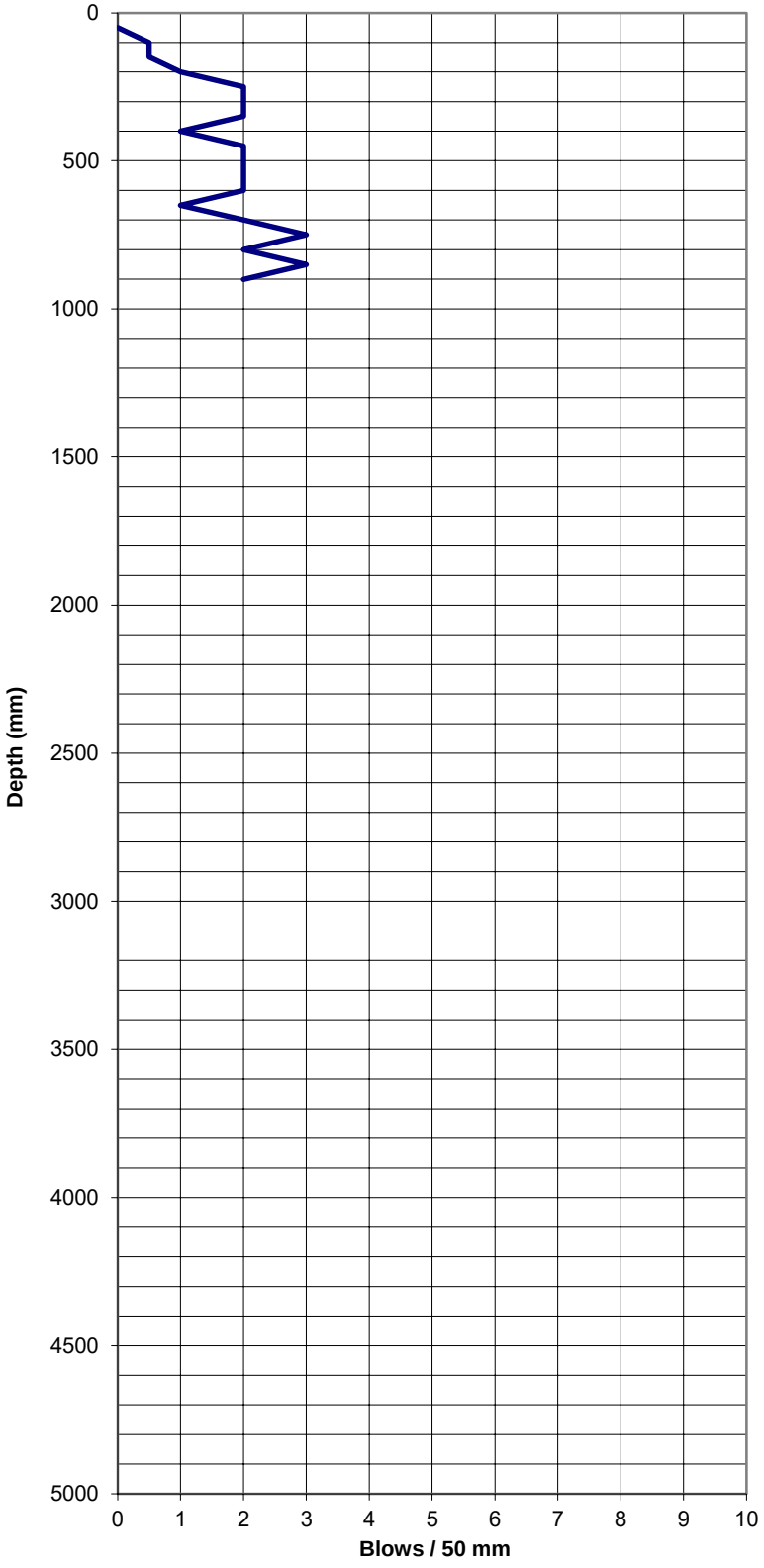
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_11_15
Test No:	P
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	0	2550	
100	0.5	2600	
150	0.5	2650	
200	1	2700	
250	2	2750	
300	2	2800	
350	2	2850	
400	1	2900	
450	2	2950	
500	2	3000	
550	2	3050	
600	2	3100	
650	1	3150	
700	2	3200	
750	3	3250	
800	2	3300	
850	3	3350	
900	2	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL.

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

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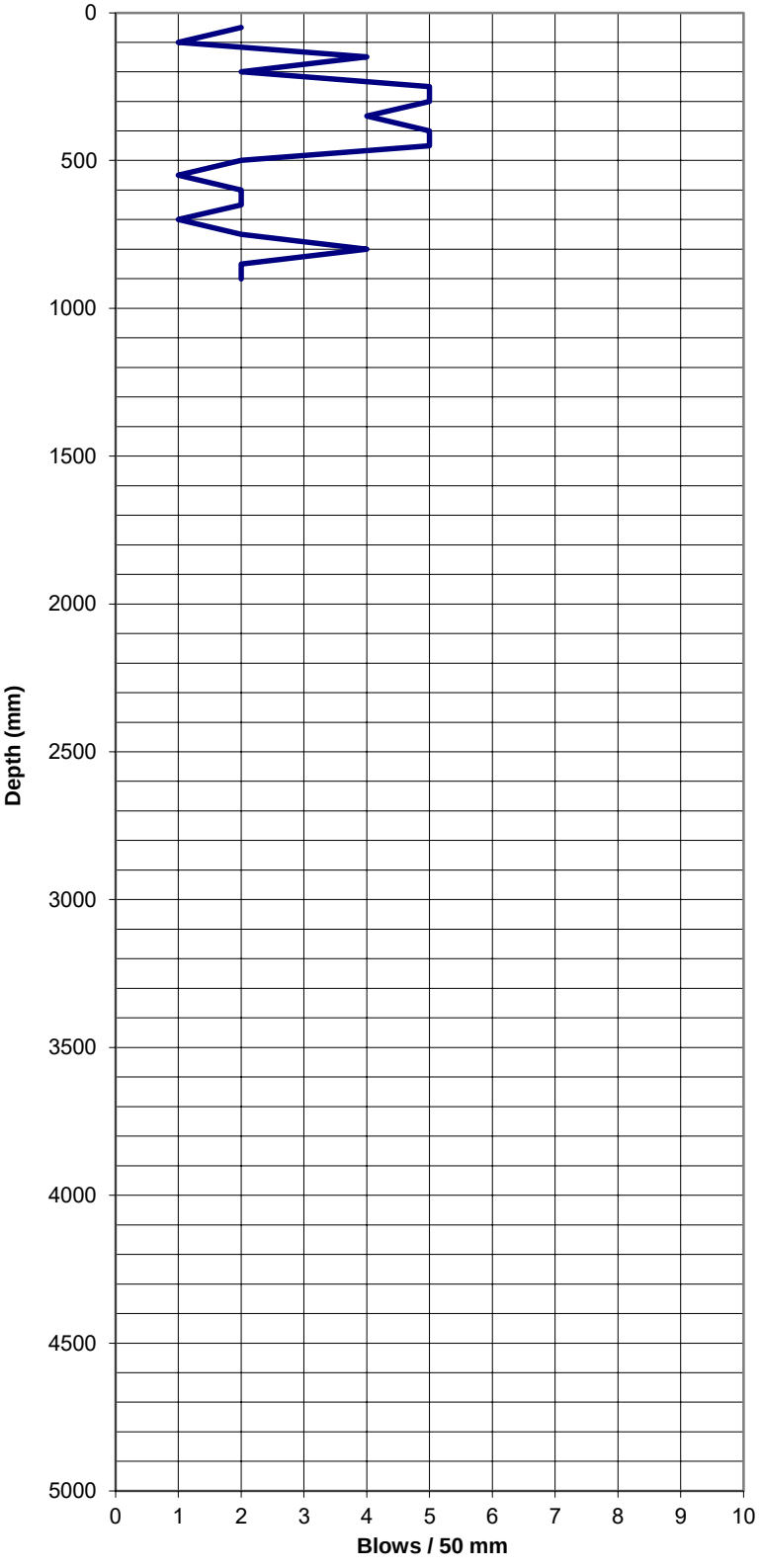
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *15/11/2019*

m R.L :
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	SC_2019_11_15
Test No:	Q
Sheet	1 of 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	2	2550	
100	1	2600	
150	4	2650	
200	2	2700	
250	5	2750	
300	5	2800	
350	4	2850	
400	5	2900	
450	5	2950	
500	2	3000	
550	1	3050	
600	2	3100	
650	2	3150	
700	1	3200	
750	2	3250	
800	4	3300	
850	2	3350	
900	2	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL.

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

Tonkin+Taylor

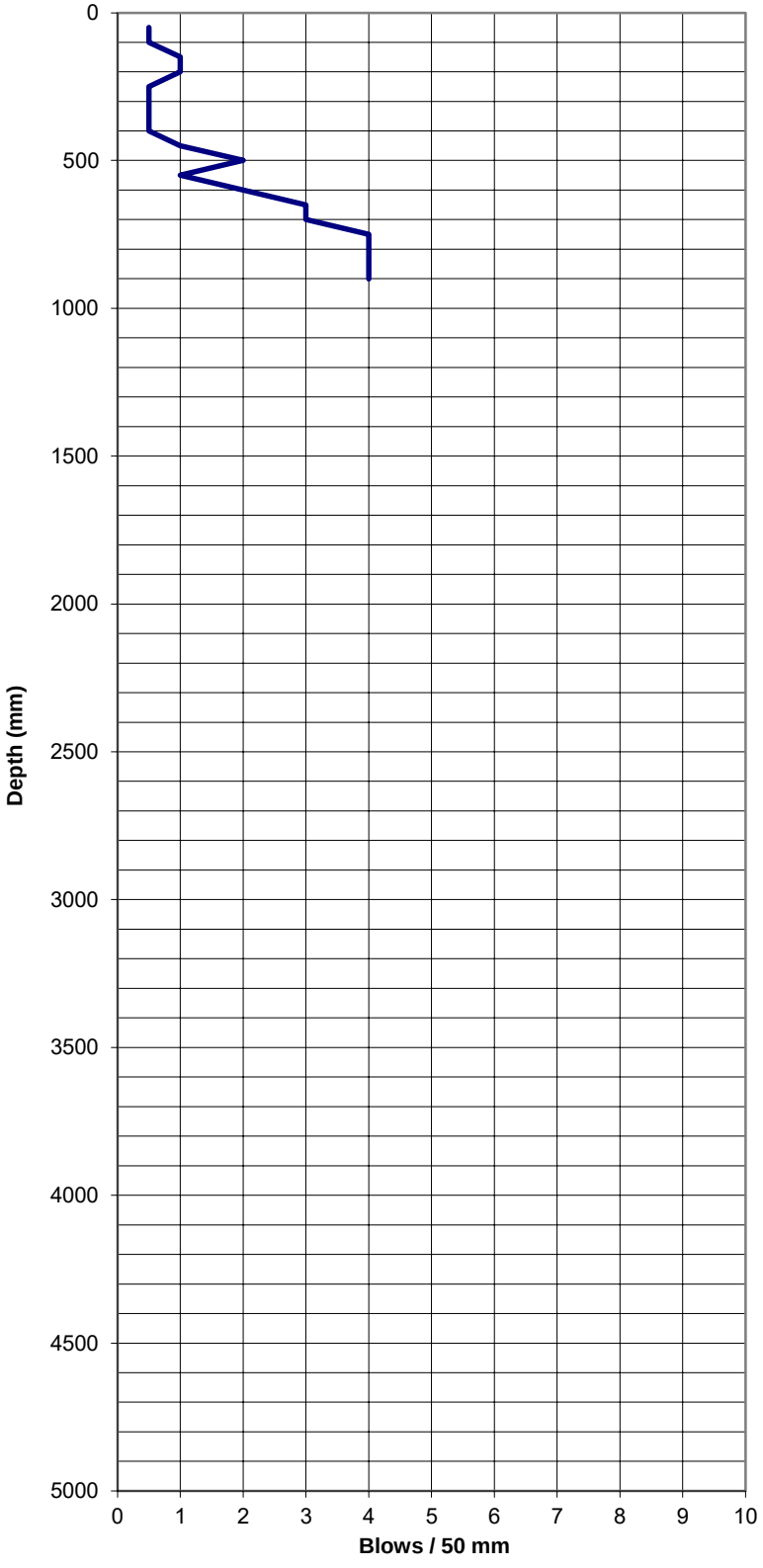
TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No:	*1004625.003*	m R.L :	-0.8
Project:	*Centennial Park Stage 1*	Operated by:	*EJWL*
Location:	*Hokowhitu Lagoon, Palmerson North*	Logged by:	*EJWL*
Date:	*15/11/2019*	Checked by:	

Test Series:	***SC_2019_11_15***
Test No:	**R**
Sheet	***1*** **of** ***1***

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*0.5*	2550	
100	*0.5*	2600	
150	*1*	2650	
200	*1*	2700	
250	*0.5*	2750	
300	*0.5*	2800	
350	*0.5*	2850	
400	*0.5*	2900	
450	*1*	2950	
500	*2*	3000	
550	*1*	3050	
600	*2*	3100	
650	*3*	3150	
700	*3*	3200	
750	*4*	3250	
800	*4*	3300	
850	*4*	3350	
900	*4*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL.

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

Tonkin+Taylor

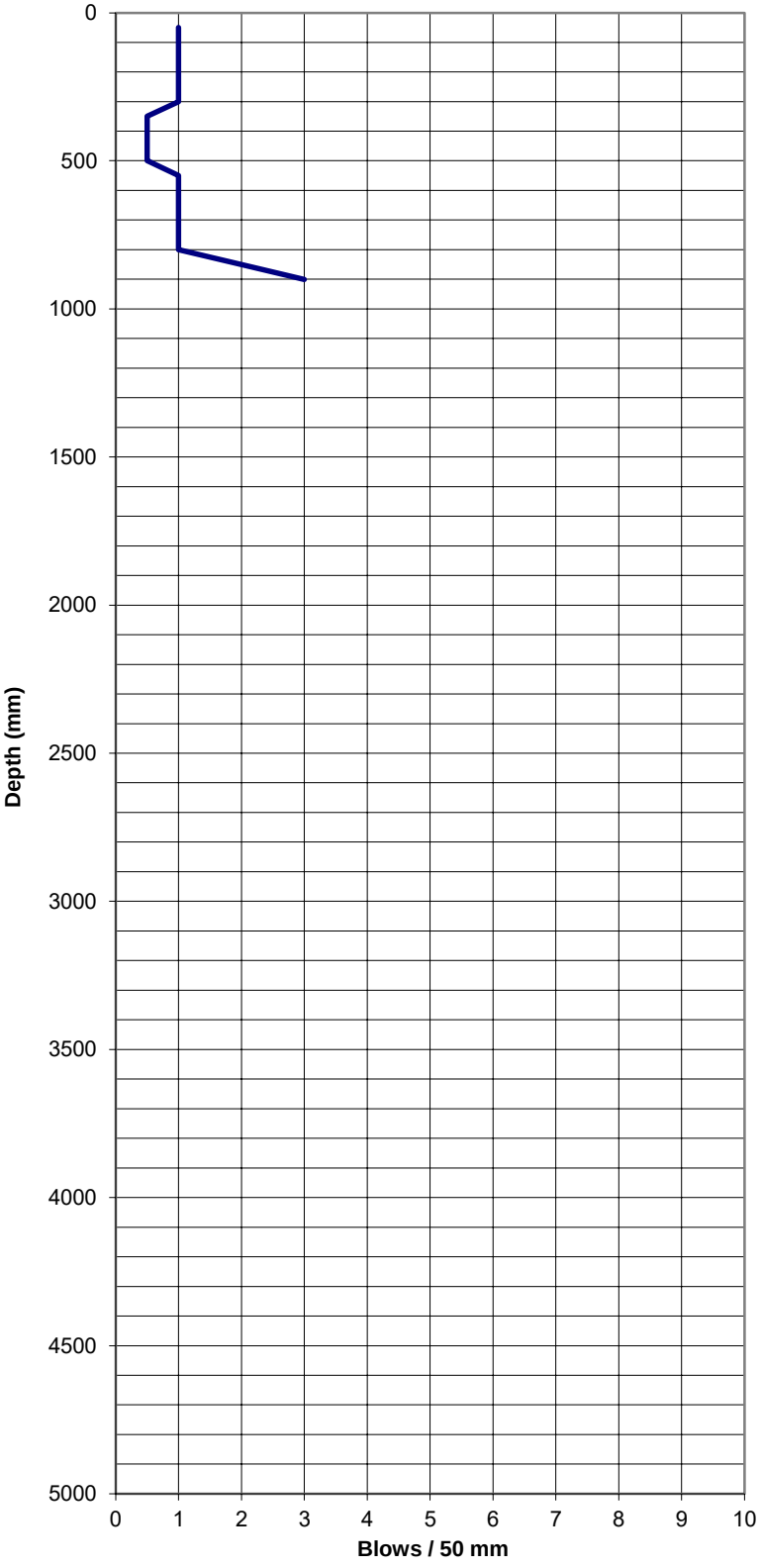
TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No:	*1004625.003*	m R.L :	-0.8
Project:	*Centennial Park Stage 1*	Operated by:	*EJWL*
Location:	*Hokowhitu Lagoon, Palmerson North*	Logged by:	*EJWL*
Date:	*15/11/2019*	Checked by:	

Test Series:	***SC_2019_11_15***
Test No:	**S**
Sheet	***1*** **of** ***1***

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*1*	2600	
150	*1*	2650	
200	*1*	2700	
250	*1*	2750	
300	*1*	2800	
350	*0.5*	2850	
400	*0.5*	2900	
450	*0.5*	2950	
500	*0.5*	3000	
550	*1*	3050	
600	*1*	3100	
650	*1*	3150	
700	*1*	3200	
750	*1*	3250	
800	*1*	3300	
850	*2*	3350	
900	*3*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: RL's are rough estimates only in relation to design RL.

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

Tonkin+Taylor

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SCALA PENETROMETER LOG

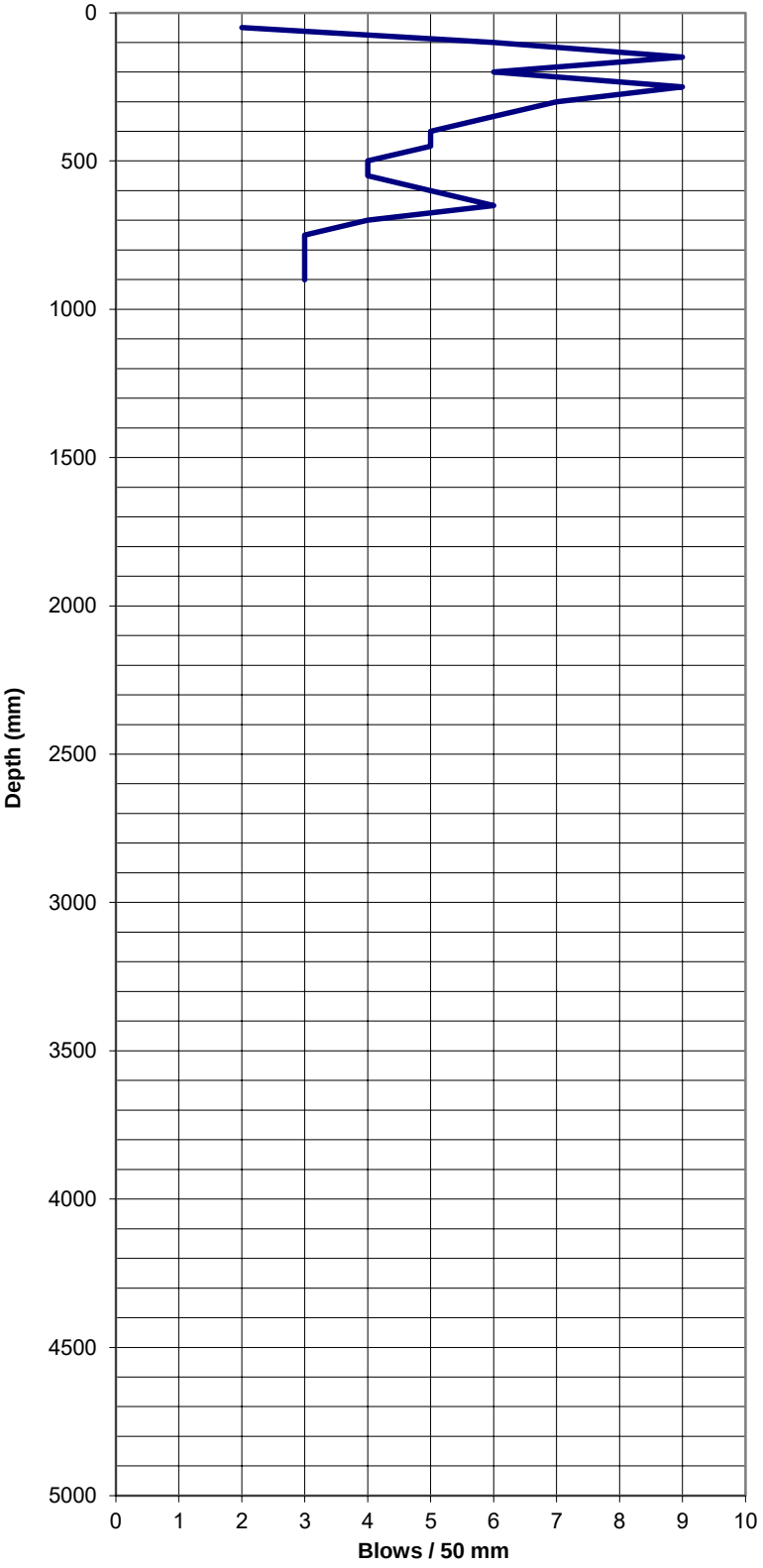
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	A
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*6*	2600	
150	*9*	2650	
200	*6*	2700	
250	*9*	2750	
300	*7*	2800	
350	*6*	2850	
400	*5*	2900	
450	*5*	2950	
500	*4*	3000	
550	*4*	3050	
600	*5*	3100	
650	*6*	3150	
700	*4*	3200	
750	*3*	3250	
800	*3*	3300	
850	*3*	3350	
900	*3*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

Tonkin+Taylor

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SCALA PENETROMETER LOG

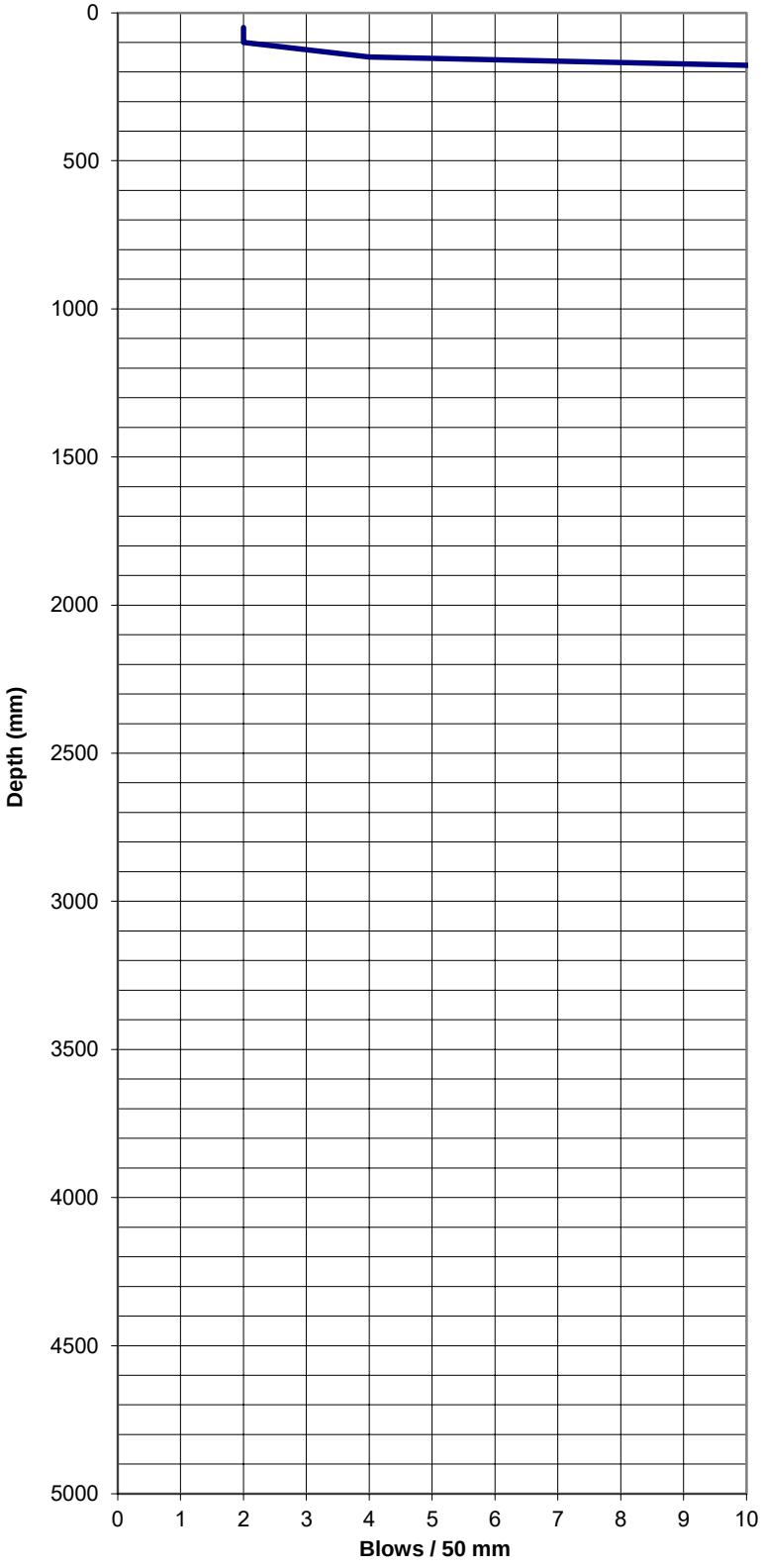
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	B
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*2*
150	*4*
200	*15*
250	
300	
350	
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design ±100mm. Results given deepest of 3 attempts

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

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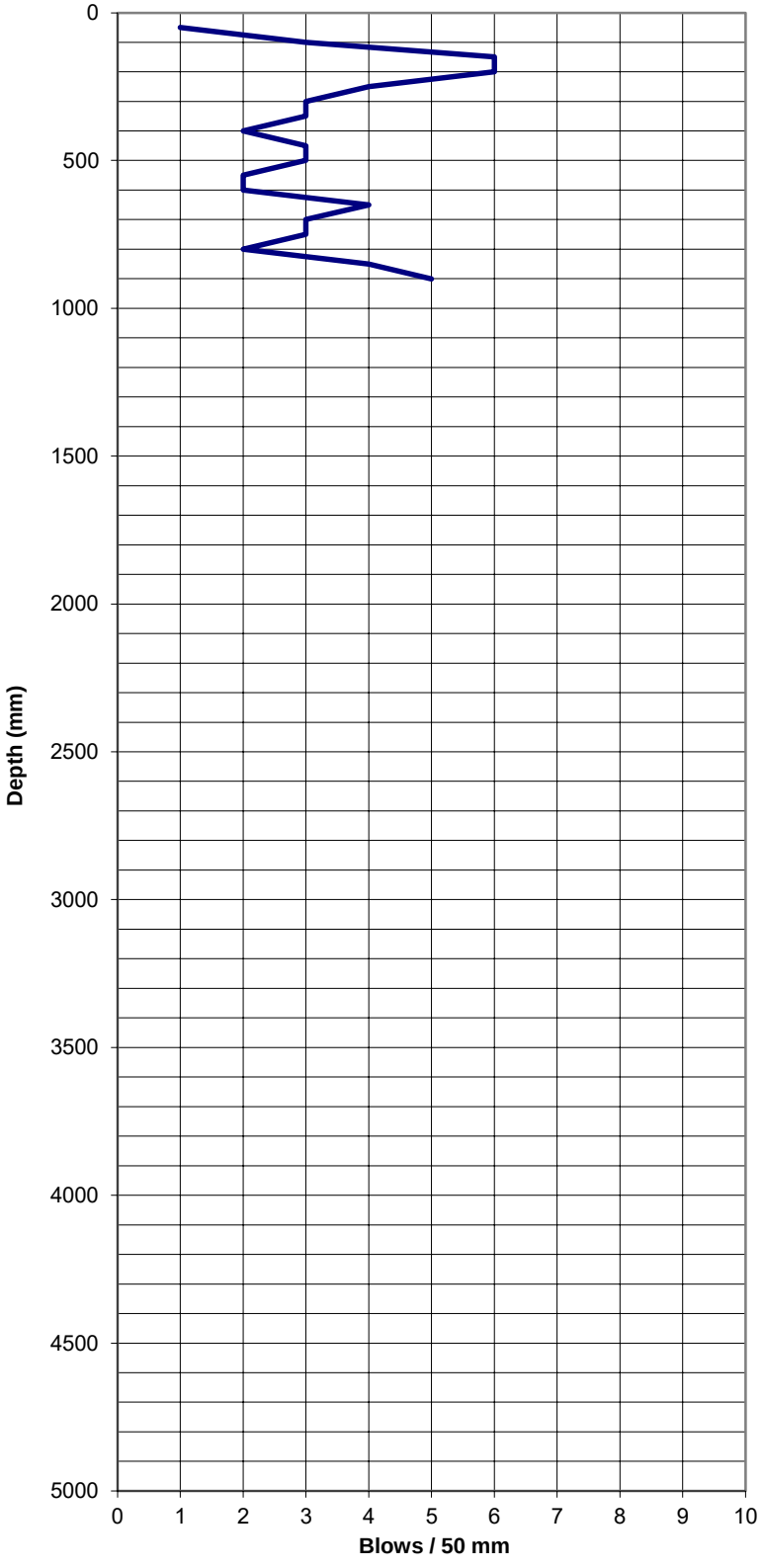
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	C
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*3*	2600	
150	*6*	2650	
200	*6*	2700	
250	*4*	2750	
300	*3*	2800	
350	*3*	2850	
400	*2*	2900	
450	*3*	2950	
500	*3*	3000	
550	*2*	3050	
600	*2*	3100	
650	*4*	3150	
700	*3*	3200	
750	*3*	3250	
800	*2*	3300	
850	*4*	3350	
900	*5*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**

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

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SCALA PENETROMETER LOG

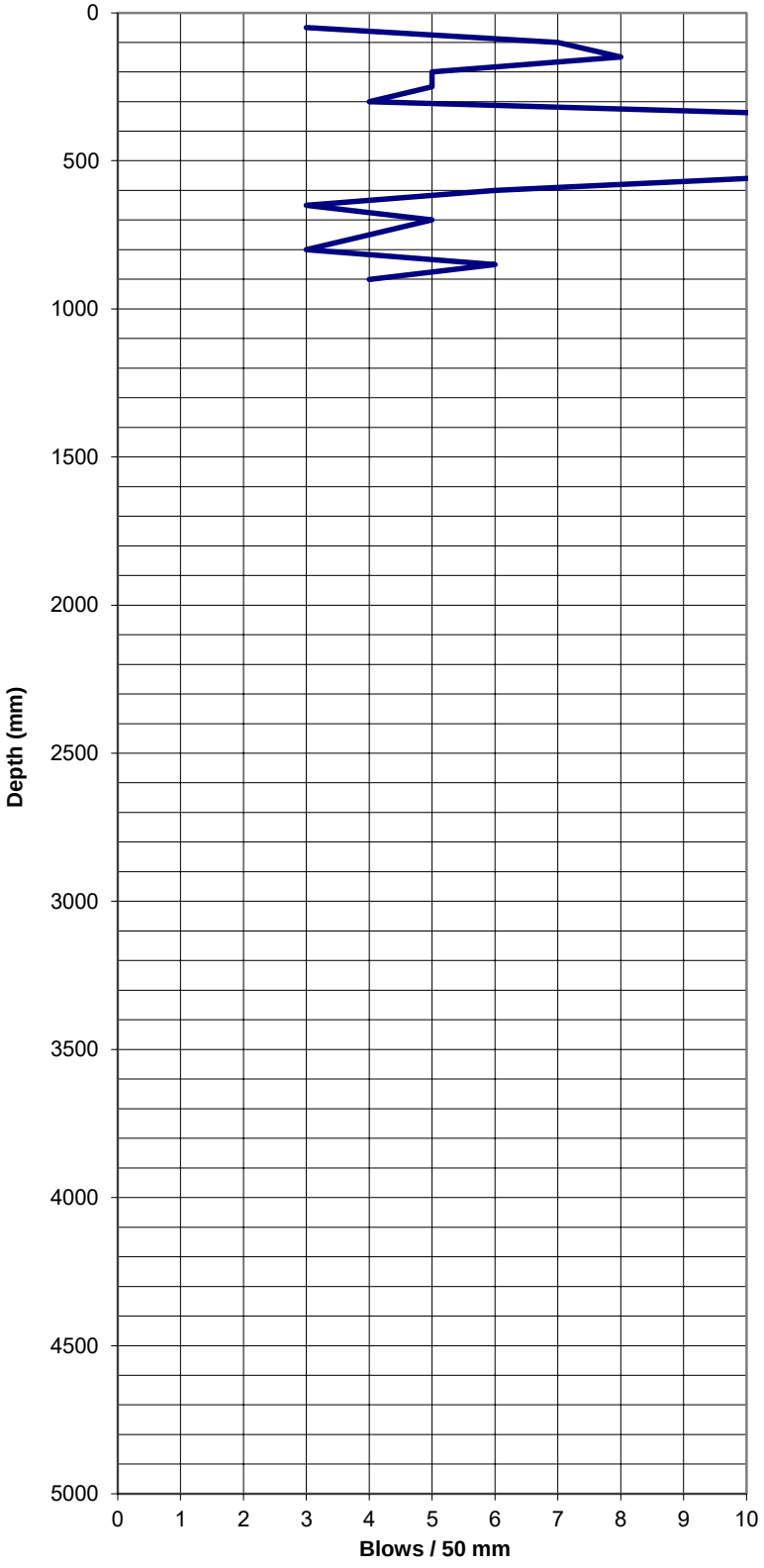
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	A
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*3*	2550	
100	*7*	2600	
150	*8*	2650	
200	*5*	2700	
250	*5*	2750	
300	*4*	2800	
350	*12*	2850	
400	*14*	2900	
450	*12*	2950	
500	*11*	3000	
550	*11*	3050	
600	*6*	3100	
650	*3*	3150	
700	*5*	3200	
750	*4*	3250	
800	*3*	3300	
850	*6*	3350	
900	*4*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

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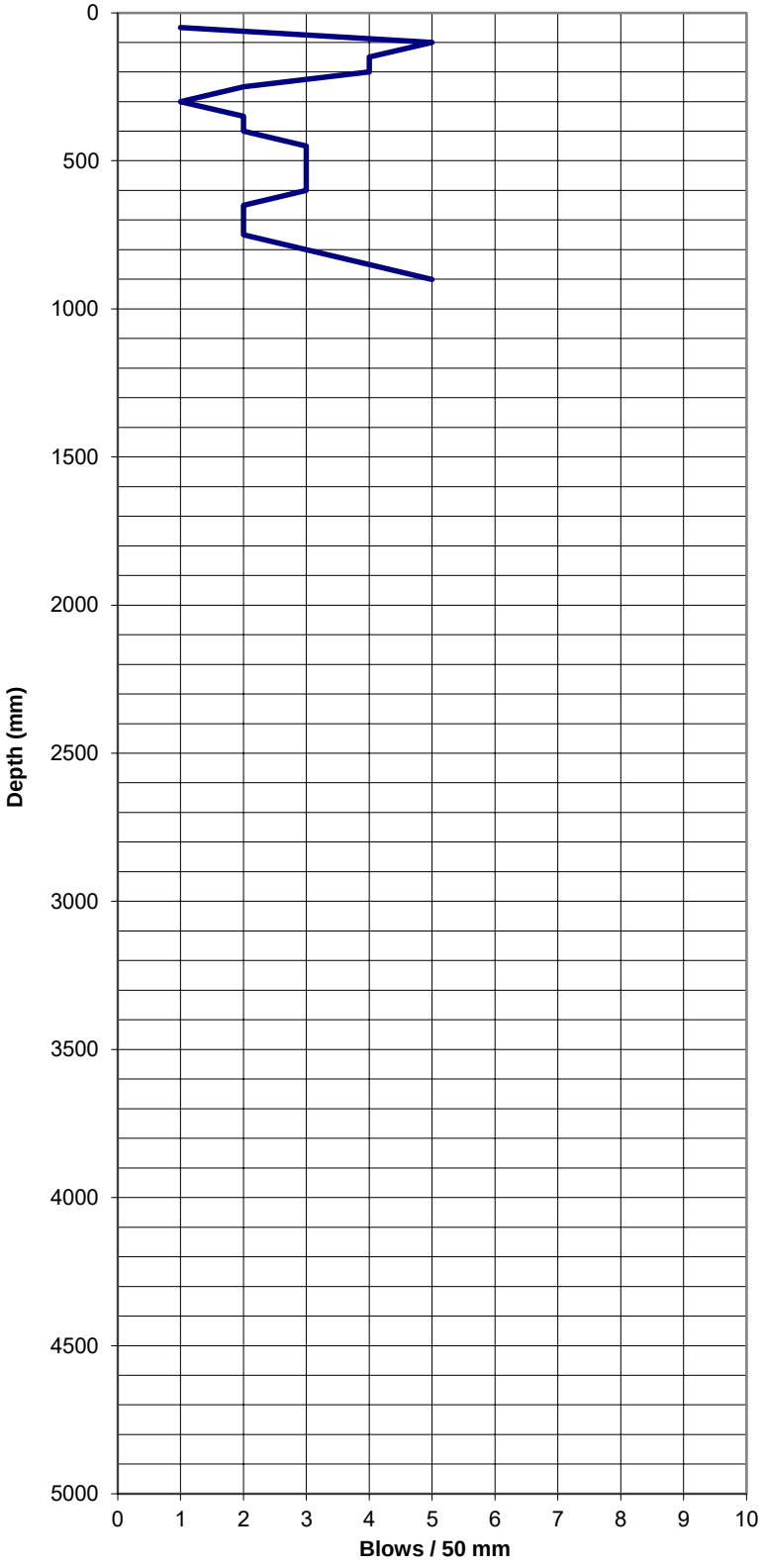
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	A
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*5*	2600	
150	*4*	2650	
200	*4*	2700	
250	*2*	2750	
300	*1*	2800	
350	*2*	2850	
400	*2*	2900	
450	*3*	2950	
500	*3*	3000	
550	*3*	3050	
600	*3*	3100	
650	*2*	3150	
700	*2*	3200	
750	*2*	3250	
800	*3*	3300	
850	*4*	3350	
900	*5*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**

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

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SCALA PENETROMETER LOG

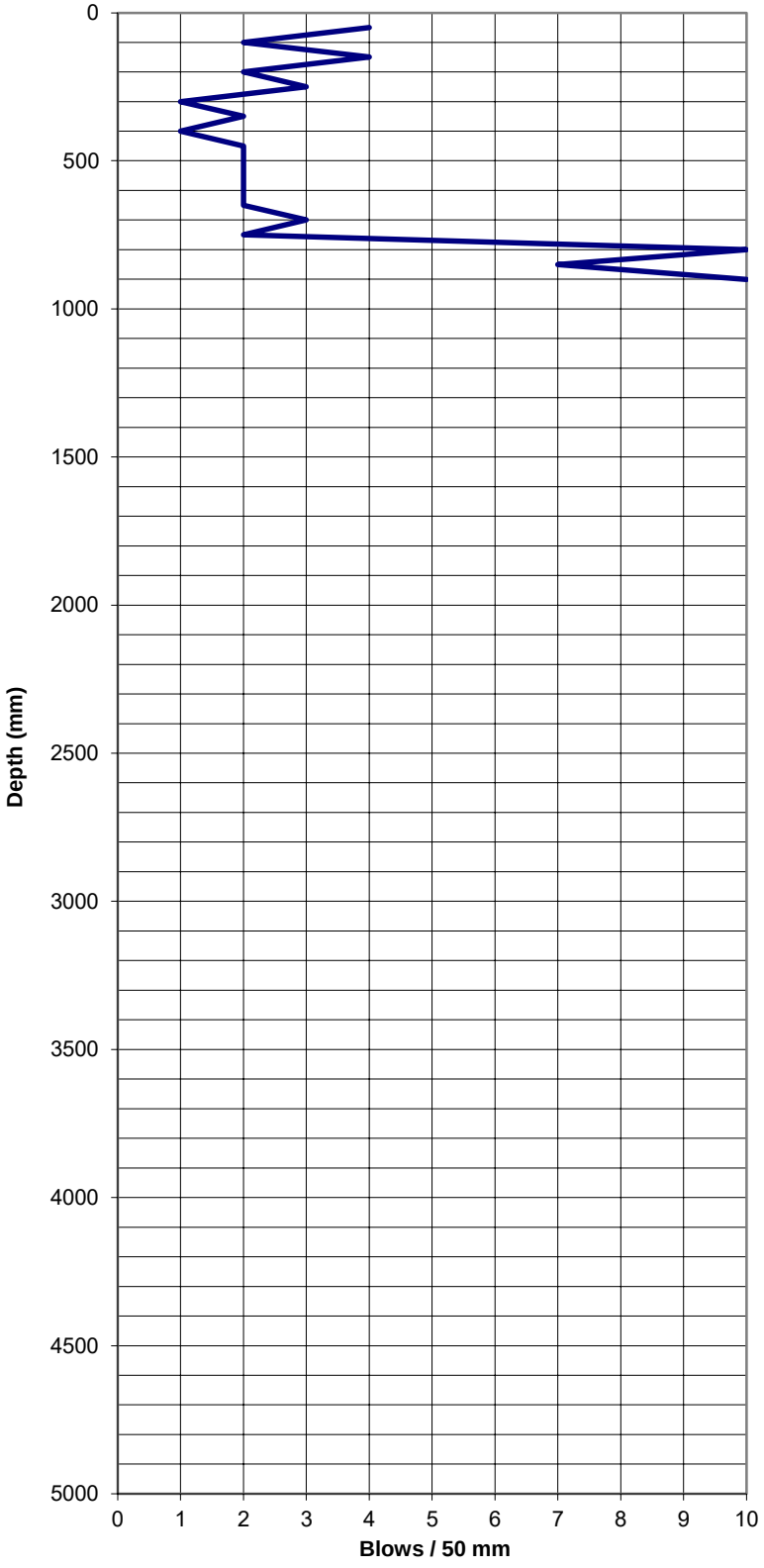
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	F
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*4*	2550	
100	*2*	2600	
150	*4*	2650	
200	*2*	2700	
250	*3*	2750	
300	*1*	2800	
350	*2*	2850	
400	*1*	2900	
450	*2*	2950	
500	*2*	3000	
550	*2*	3050	
600	*2*	3100	
650	*2*	3150	
700	*3*	3200	
750	*2*	3250	
800	*10*	3300	
850	*7*	3350	
900	*10*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

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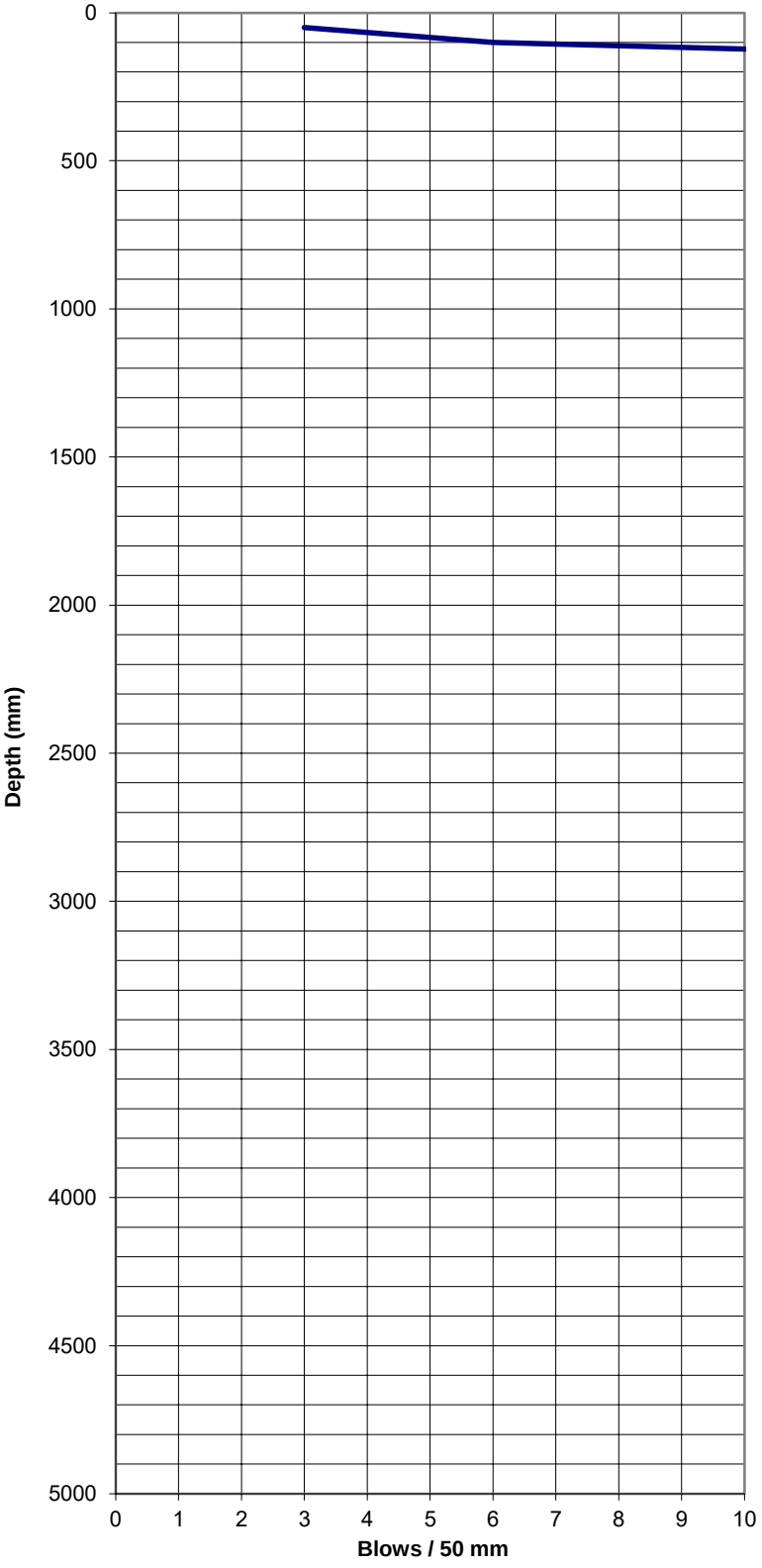
SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L : 0	**Test Series:**	***SC.2020.01.13***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**G**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *13/01/2020*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*3*	2550	
100	*6*	2600	
150	*15*	2650	
200		2700	
250		2750	
300		2800	
350		2850	
400		2900	
450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm. Results deepest of 3**



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

Tonkin+Taylor

TONKIN & TAYLOR

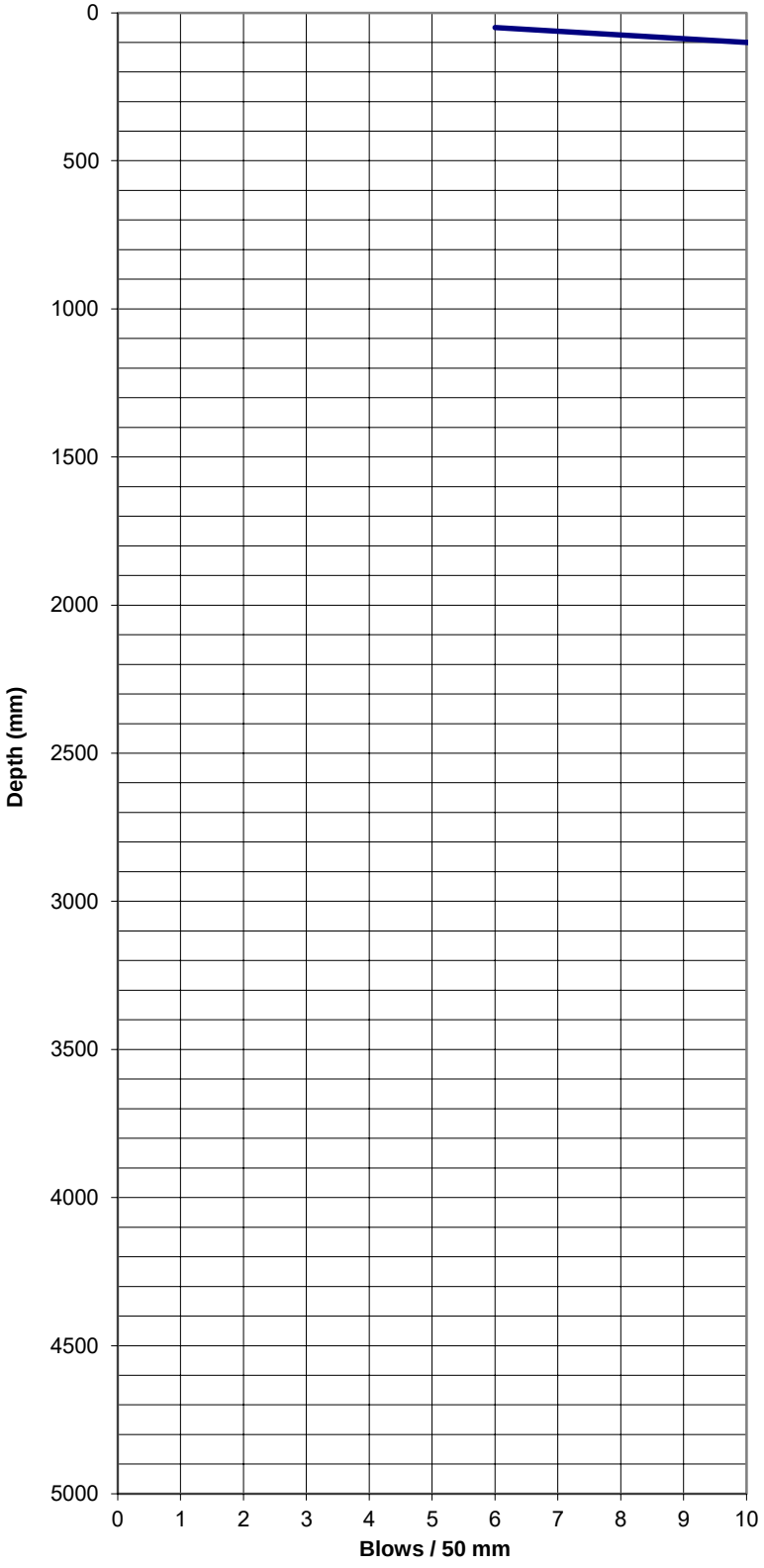
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	H
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*6*	2550	
100	*10*	2600	
150	*18*	2650	
200	*22*	2700	
250		2750	
300		2800	
350		2850	
400		2900	
450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm. Results deepest of 3 SC**

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

Tonkin+Taylor

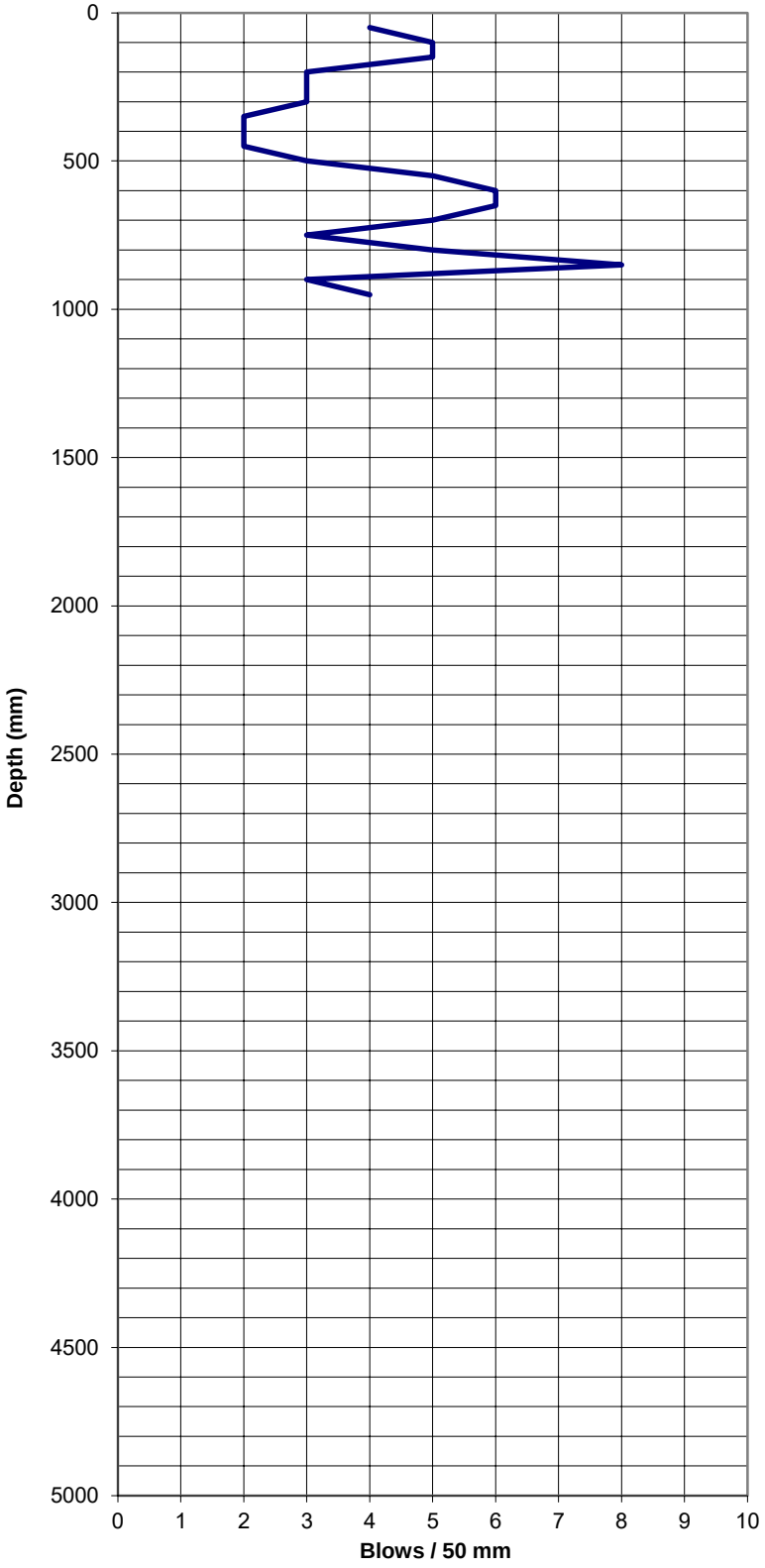
TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L : 0	**Test Series:**	***SC.2020.01.13***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**I**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *13/01/2020*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*4*	2550	
100	*5*	2600	
150	*5*	2650	
200	*3*	2700	
250	*3*	2750	
300	*3*	2800	
350	*2*	2850	
400	*2*	2900	
450	*2*	2950	
500	*3*	3000	
550	*5*	3050	
600	*6*	3100	
650	*6*	3150	
700	*5*	3200	
750	*3*	3250	
800	*5*	3300	
850	*8*	3350	
900	*3*	3400	
950	*4*	3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

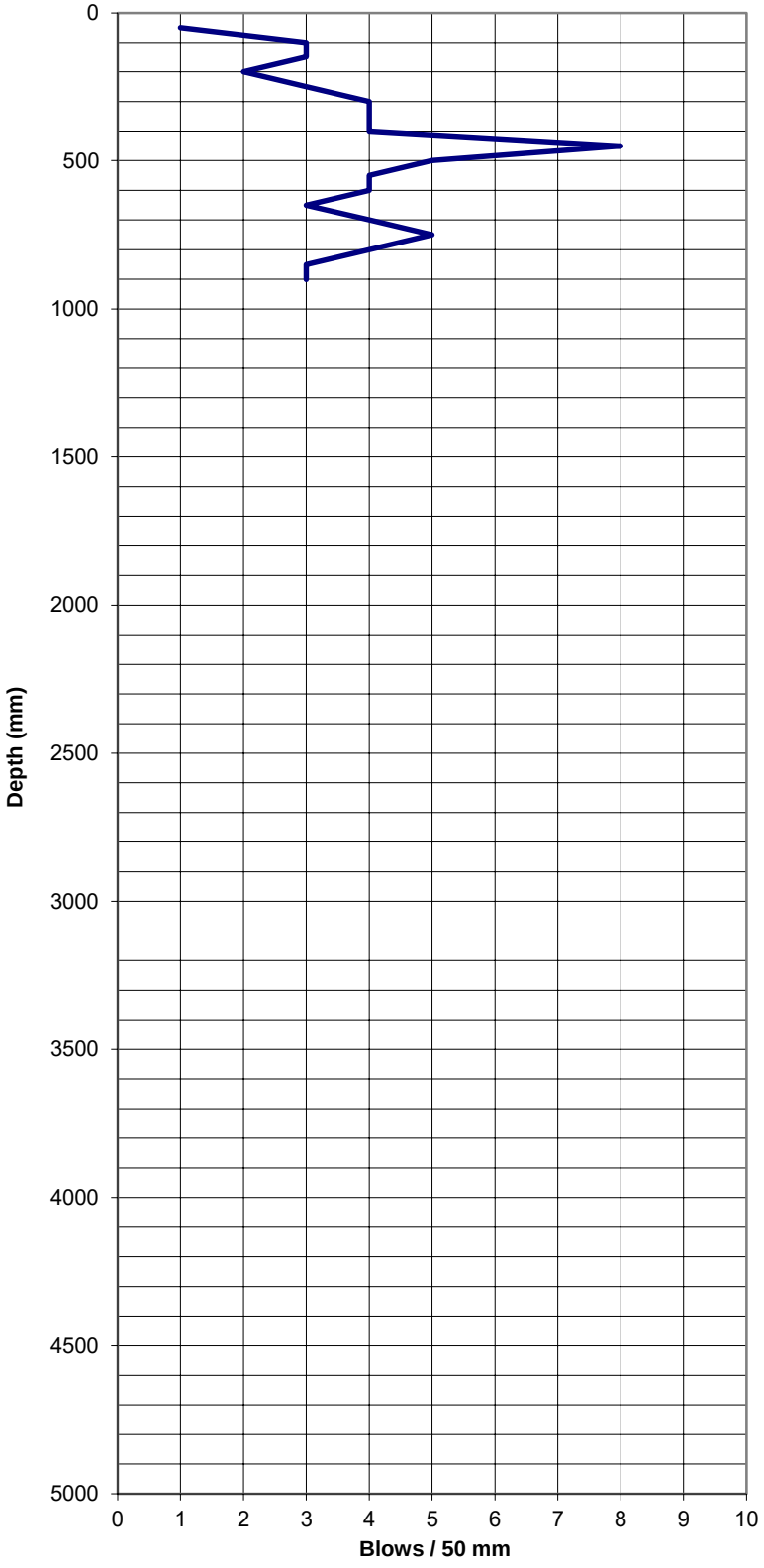
Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *1004625.003*	m R.L : 0	**Test Series:**	***SC.2020.01.13***
Project: *Centennial Park Stage 1*	Operated by: *EJWL*	**Test No:**	**J**
Location: *Hokowhitu Lagoon, Palmerson North*	Logged by: *EJWL*	**Sheet**	***1*** **of** ***1***
Date: *13/01/2020*	Checked by:		

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*3*	2600	
150	*3*	2650	
200	*2*	2700	
250	*3*	2750	
300	*4*	2800	
350	*4*	2850	
400	*4*	2900	
450	*8*	2950	
500	*5*	3000	
550	*4*	3050	
600	*4*	3100	
650	*3*	3150	
700	*4*	3200	
750	*5*	3250	
800	*4*	3300	
850	*3*	3350	
900	*3*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design ±100mm.

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

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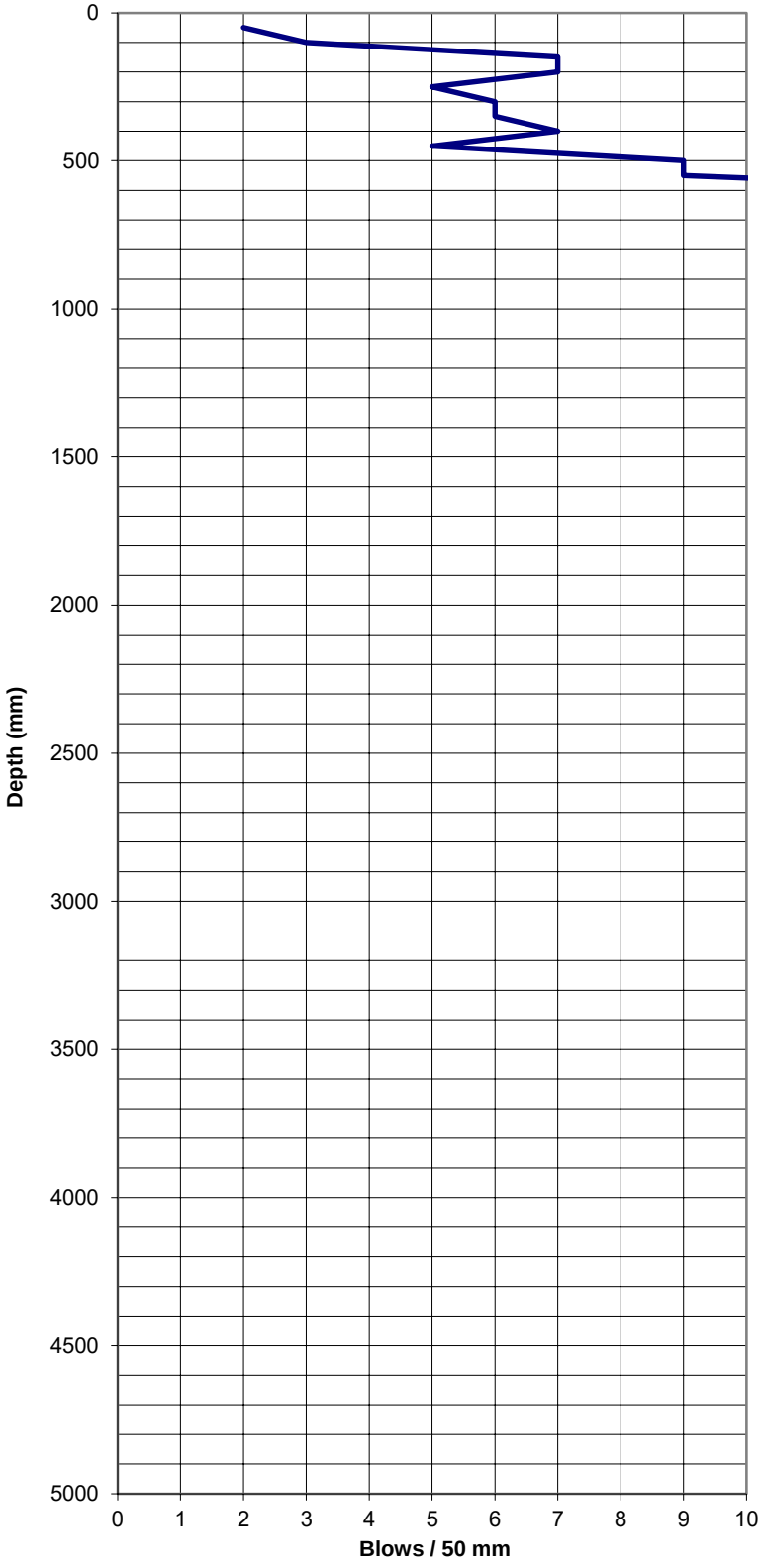
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	K
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*3*	2600	
150	*7*	2650	
200	*7*	2700	
250	*5*	2750	
300	*6*	2800	
350	*6*	2850	
400	*7*	2900	
450	*5*	2950	
500	*9*	3000	
550	*9*	3050	
600	*15*	3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**

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

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SCALA PENETROMETER LOG

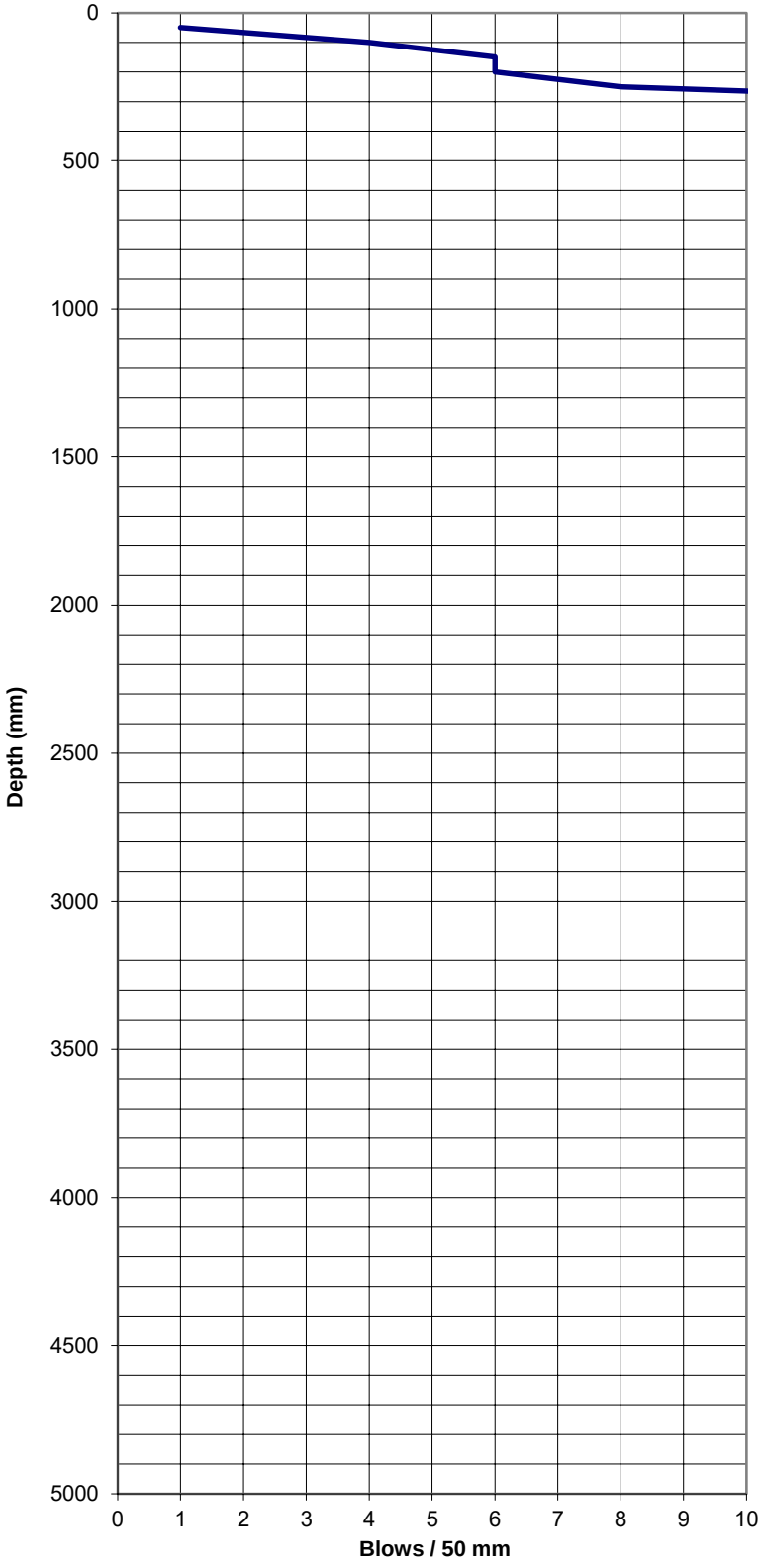
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	L
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*4*
150	*6*
200	*6*
250	*8*
300	*15*
350	
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**

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

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SCALA PENETROMETER LOG

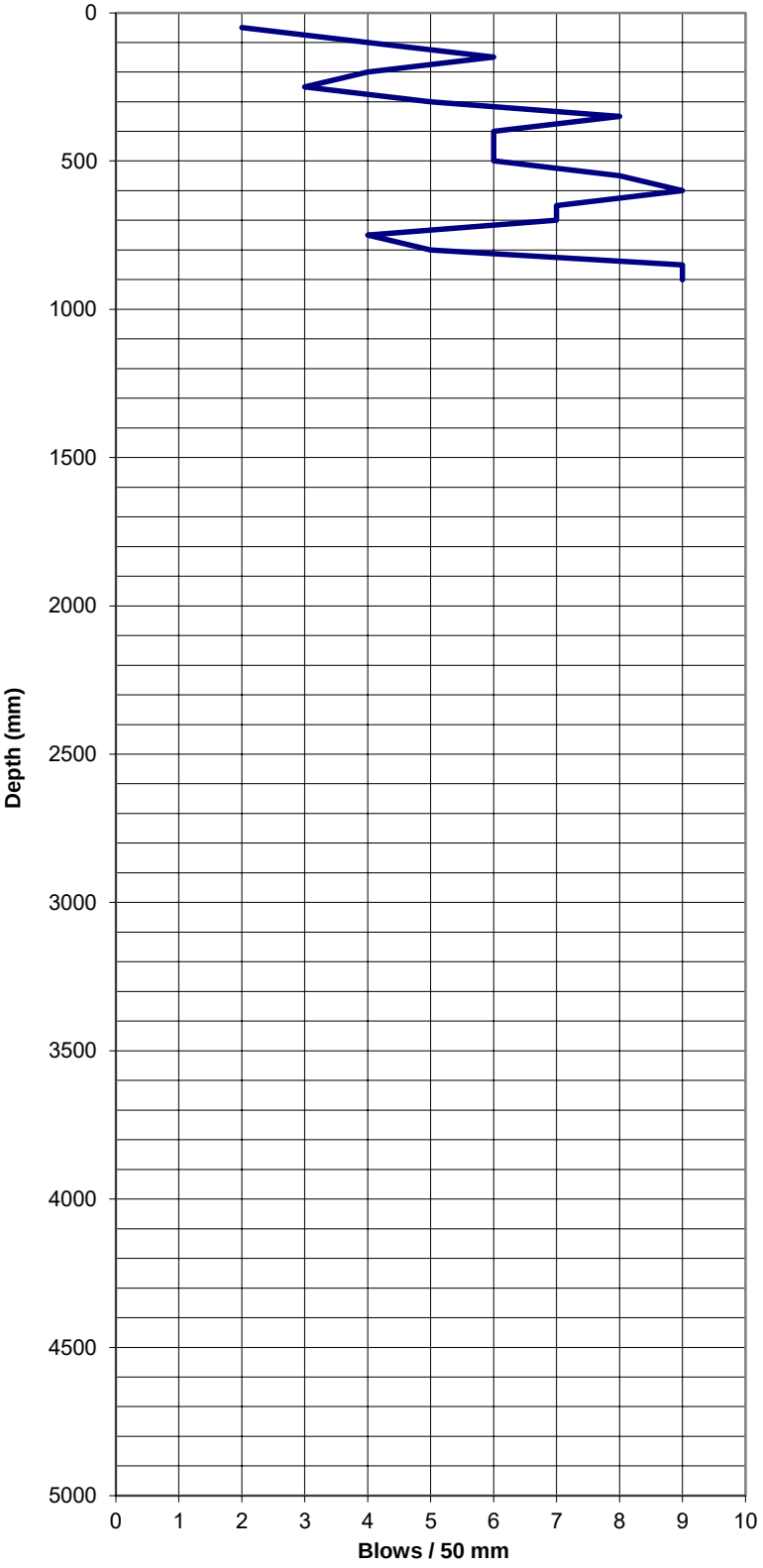
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	M
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*4*	2600	
150	*6*	2650	
200	*4*	2700	
250	*3*	2750	
300	*5*	2800	
350	*8*	2850	
400	*6*	2900	
450	*6*	2950	
500	*6*	3000	
550	*8*	3050	
600	*9*	3100	
650	*7*	3150	
700	*7*	3200	
750	*4*	3250	
800	*5*	3300	
850	*9*	3350	
900	*9*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

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SCALA PENETROMETER LOG

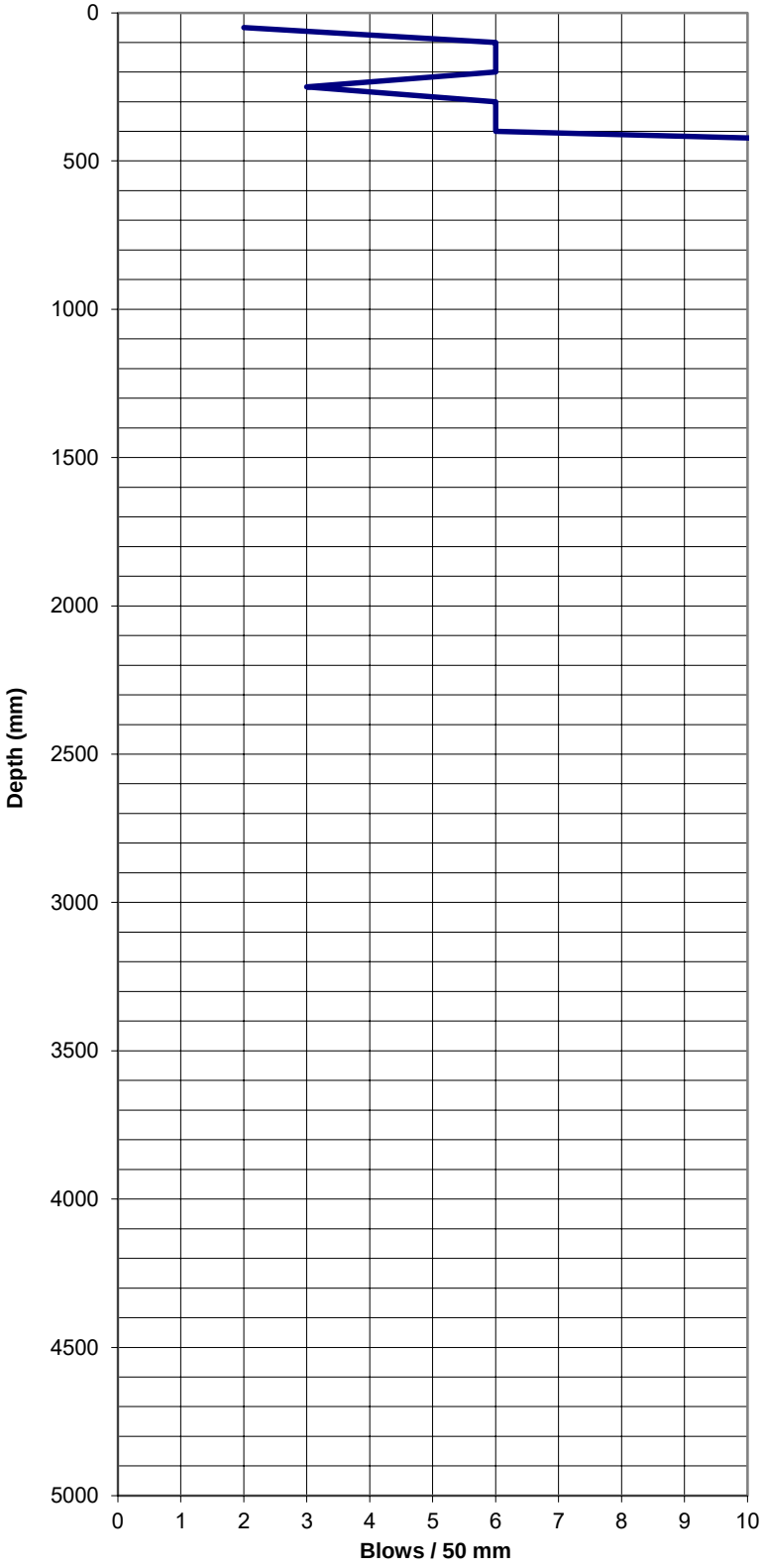
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	***SC.2020.01.13***
Test No:	**N**
Sheet	***1*** **of** ***1***

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*6*	2600	
150	*6*	2650	
200	*6*	2700	
250	*3*	2750	
300	*6*	2800	
350	*6*	2850	
400	*6*	2900	
450	*15*	2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

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SCALA PENETROMETER LOG

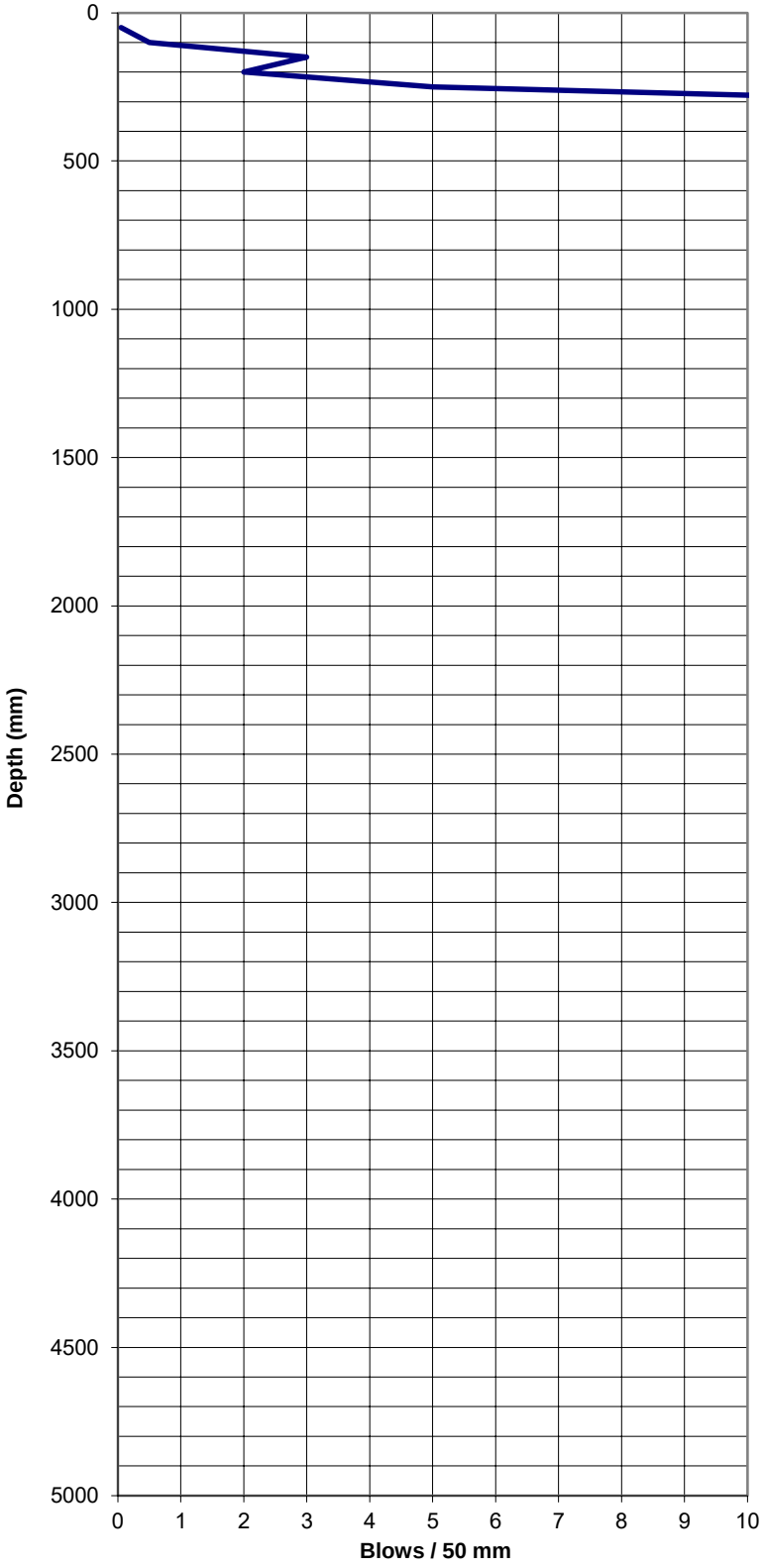
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *13/01/2020*

m R.L : 0
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.01.13*
Test No:	O
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*0.05*	2550	
100	*0.5*	2600	
150	*3*	2650	
200	*2*	2700	
250	*5*	2750	
300	*14*	2800	
350	*14*	2850	
400	*12*	2900	
450	*15*	2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	

Test Notes: mRL given by Hoults Ltd in relation to finished design **±100mm**



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

Tonkin+Taylor

TONKIN & TAYLOR

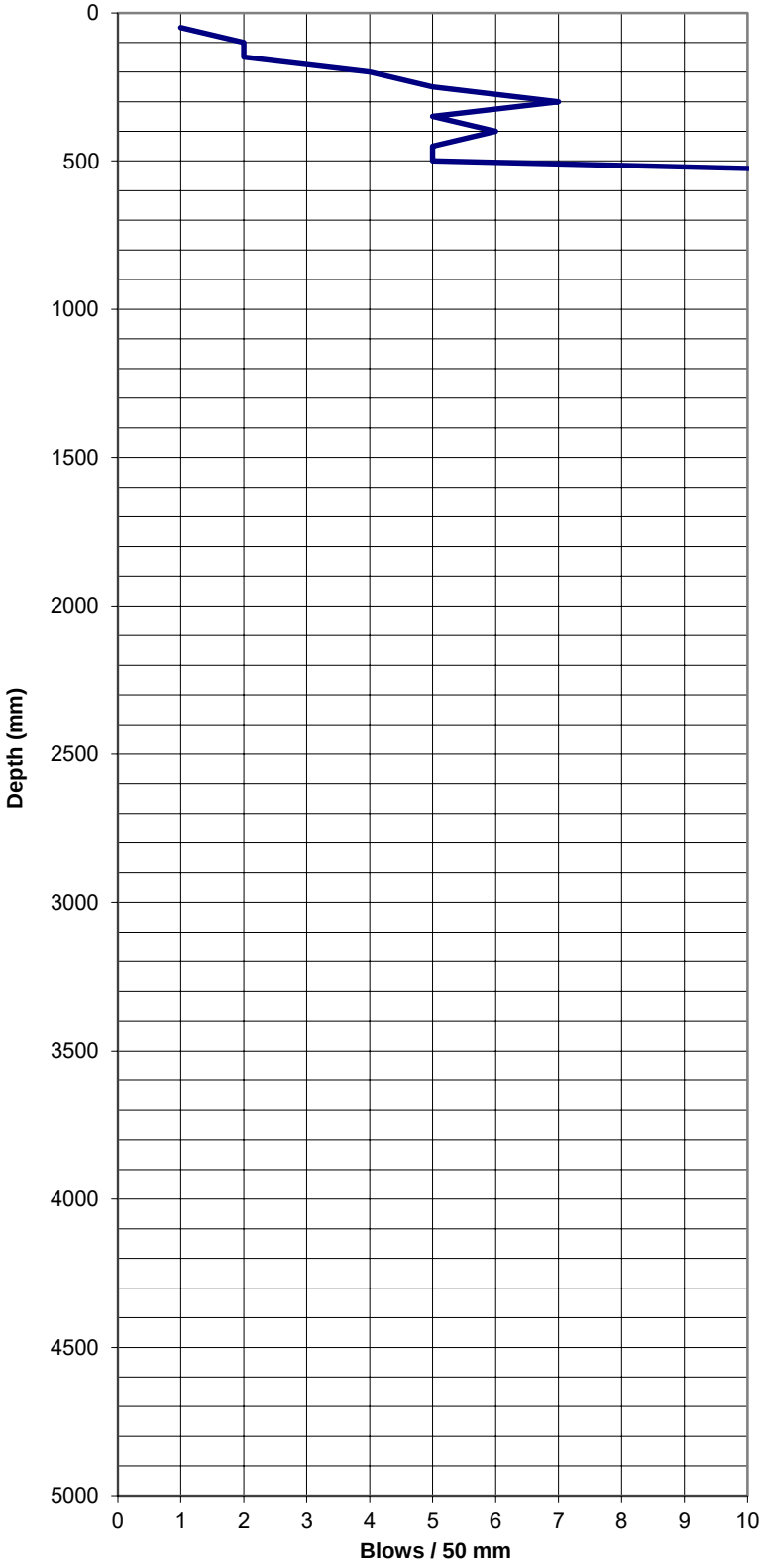
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	A
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*2*	2650	
200	*4*	2700	
250	*5*	2750	
300	*7*	2800	
350	*5*	2850	
400	*6*	2900	
450	*5*	2950	
500	*5*	3000	
550	*15*	3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

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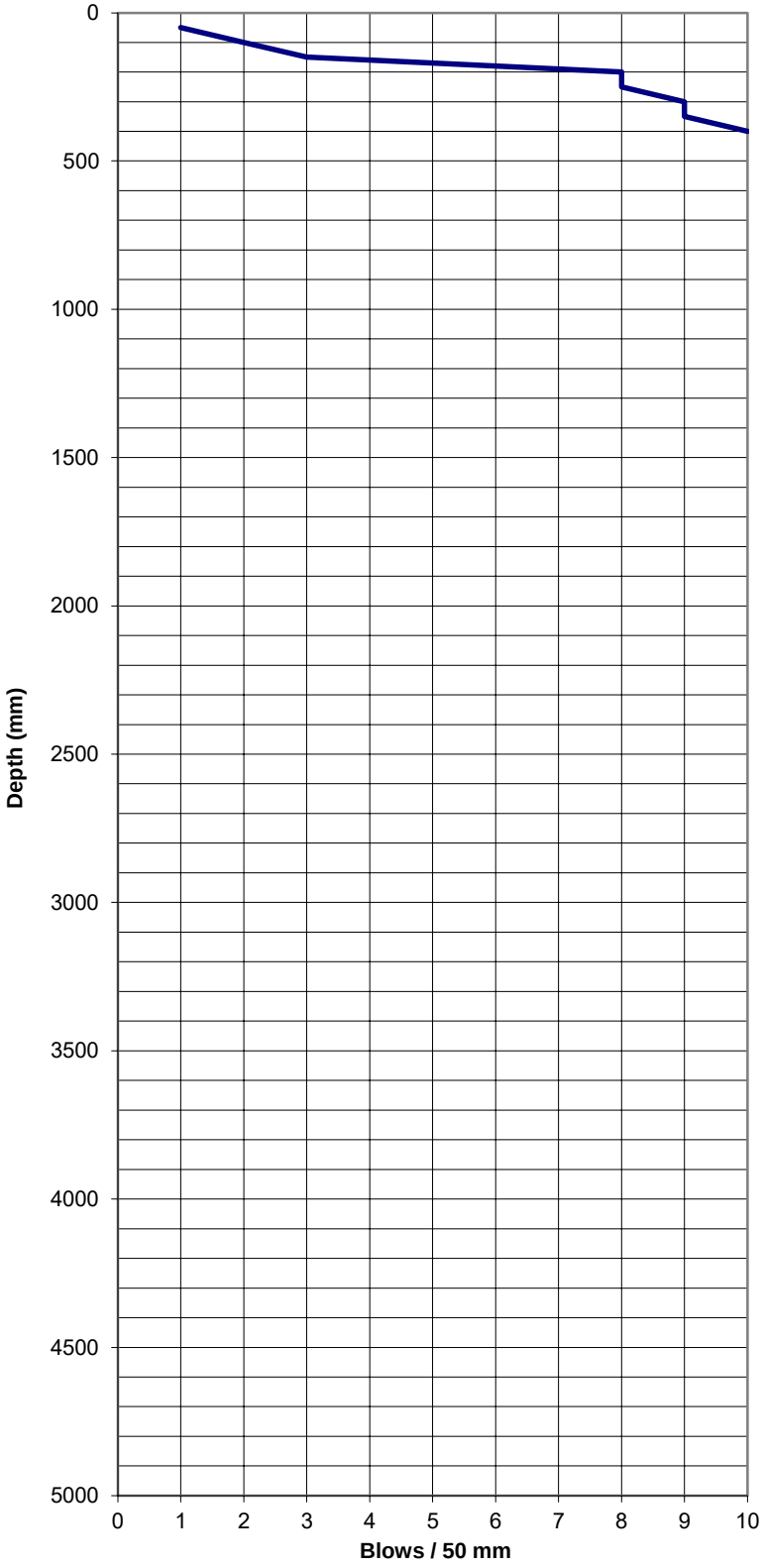
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	B
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*3*	2650	
200	*8*	2700	
250	*8*	2750	
300	*9*	2800	
350	*9*	2850	
400	*10*	2900	
450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

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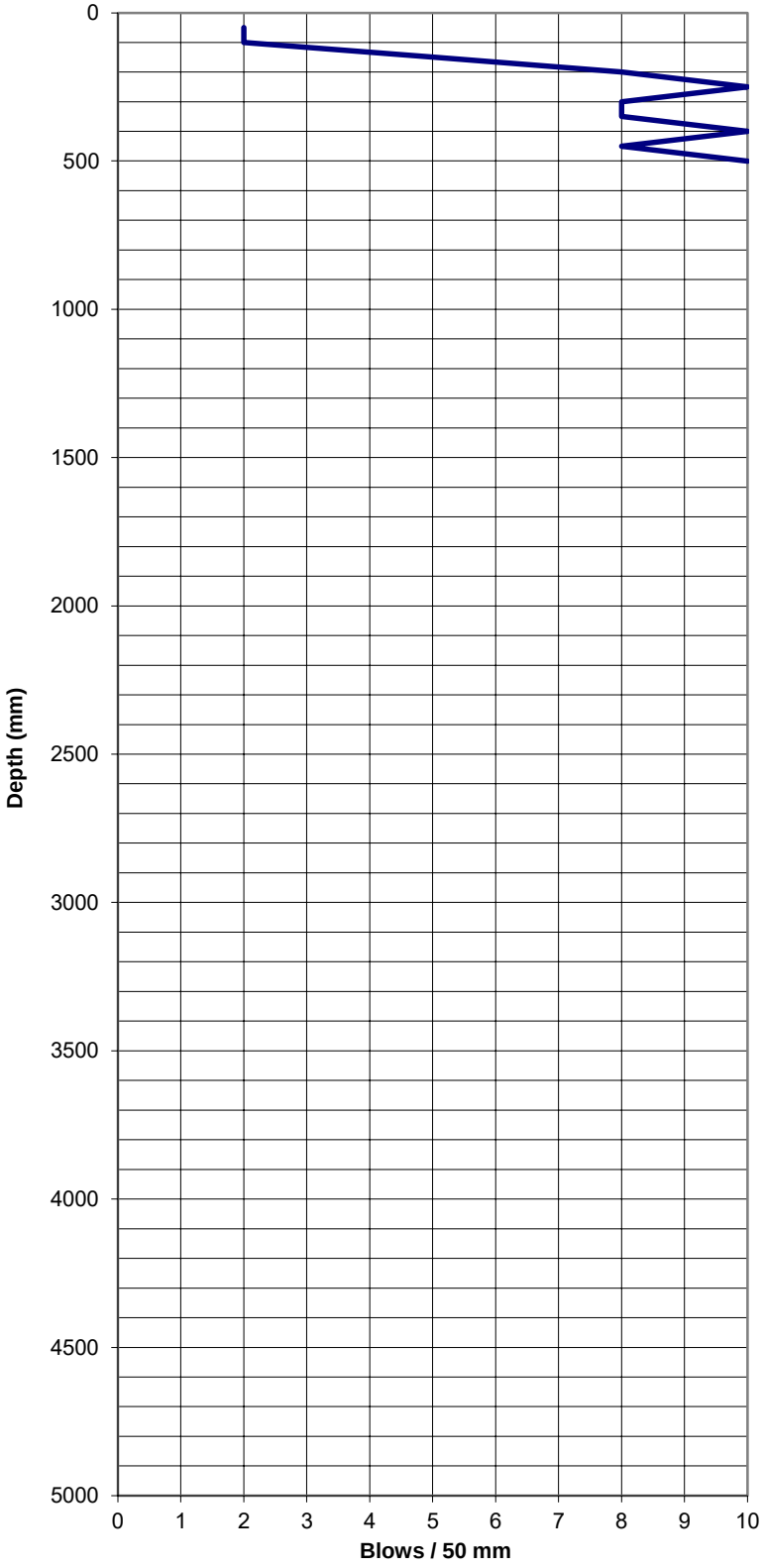
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	C
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*2*	2600	
150	*5*	2650	
200	*8*	2700	
250	*10*	2750	
300	*8*	2800	
350	*8*	2850	
400	*10*	2900	
450	*8*	2950	
500	*10*	3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

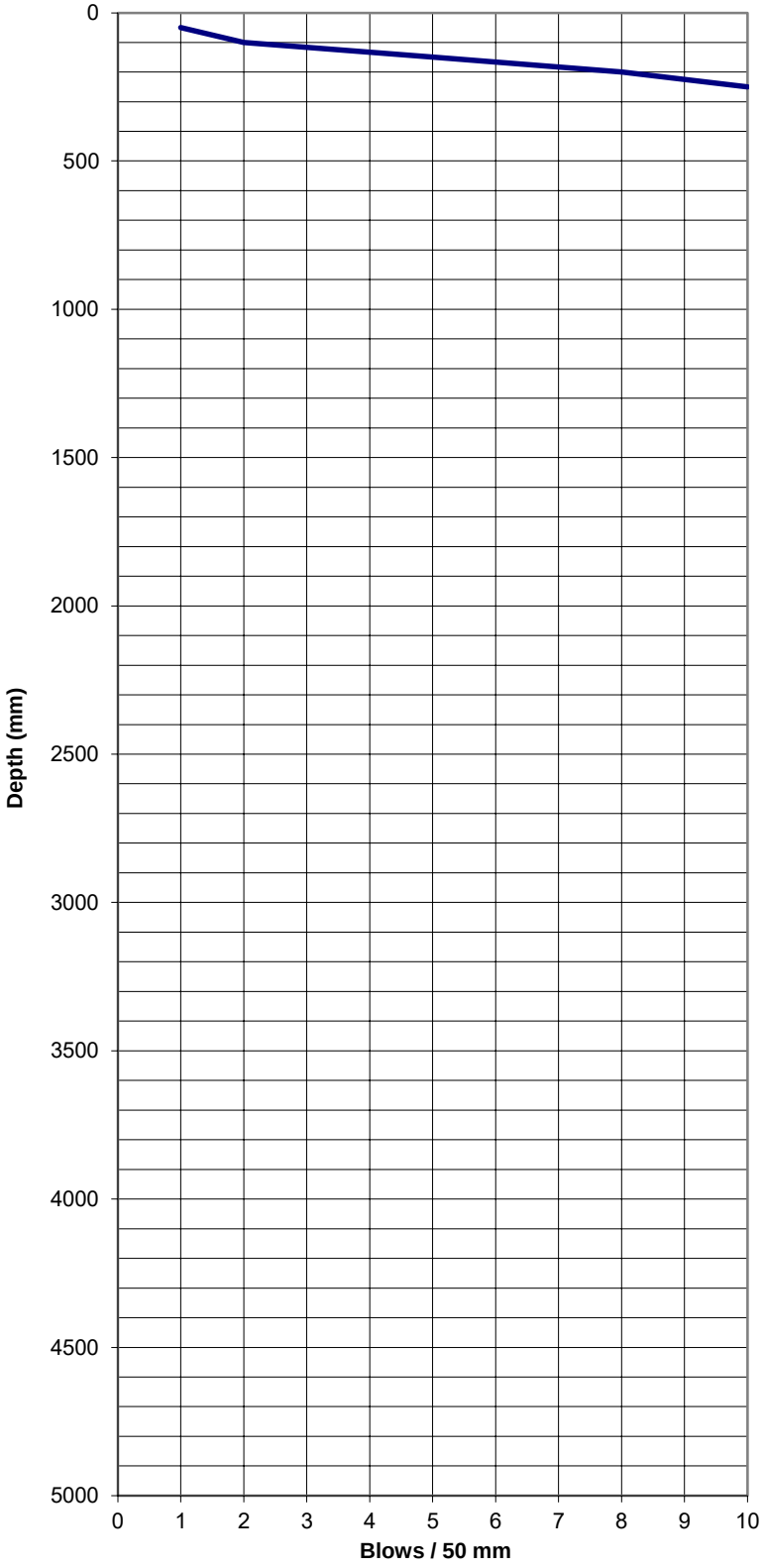
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	A
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*2*
150	*5*
200	*8*
250	*10*
300	
350	
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

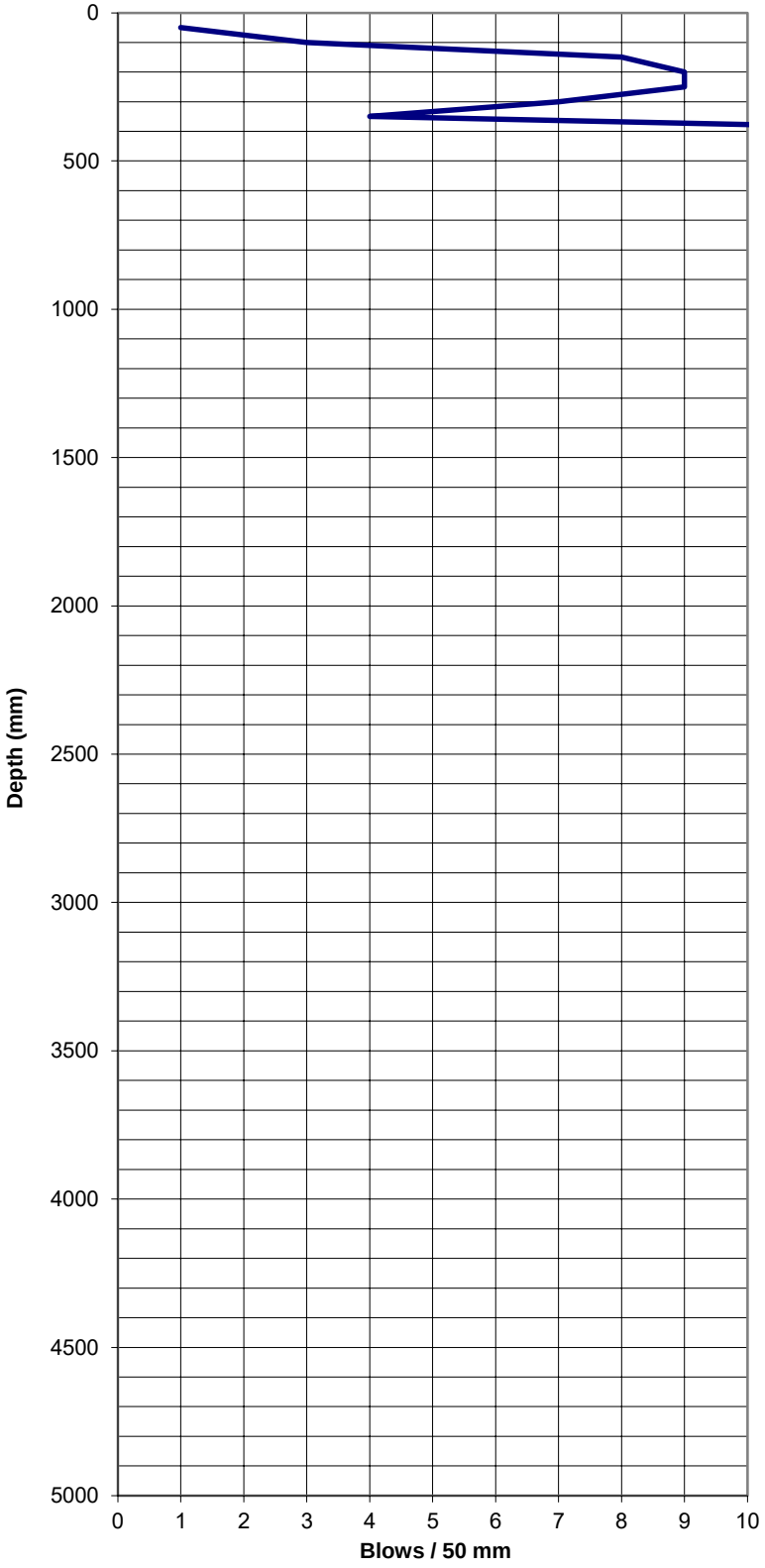
Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	A
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*1*
100	*3*
150	*8*
200	*9*
250	*9*
300	*7*
350	*4*
400	*15*
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

TONKIN & TAYLOR

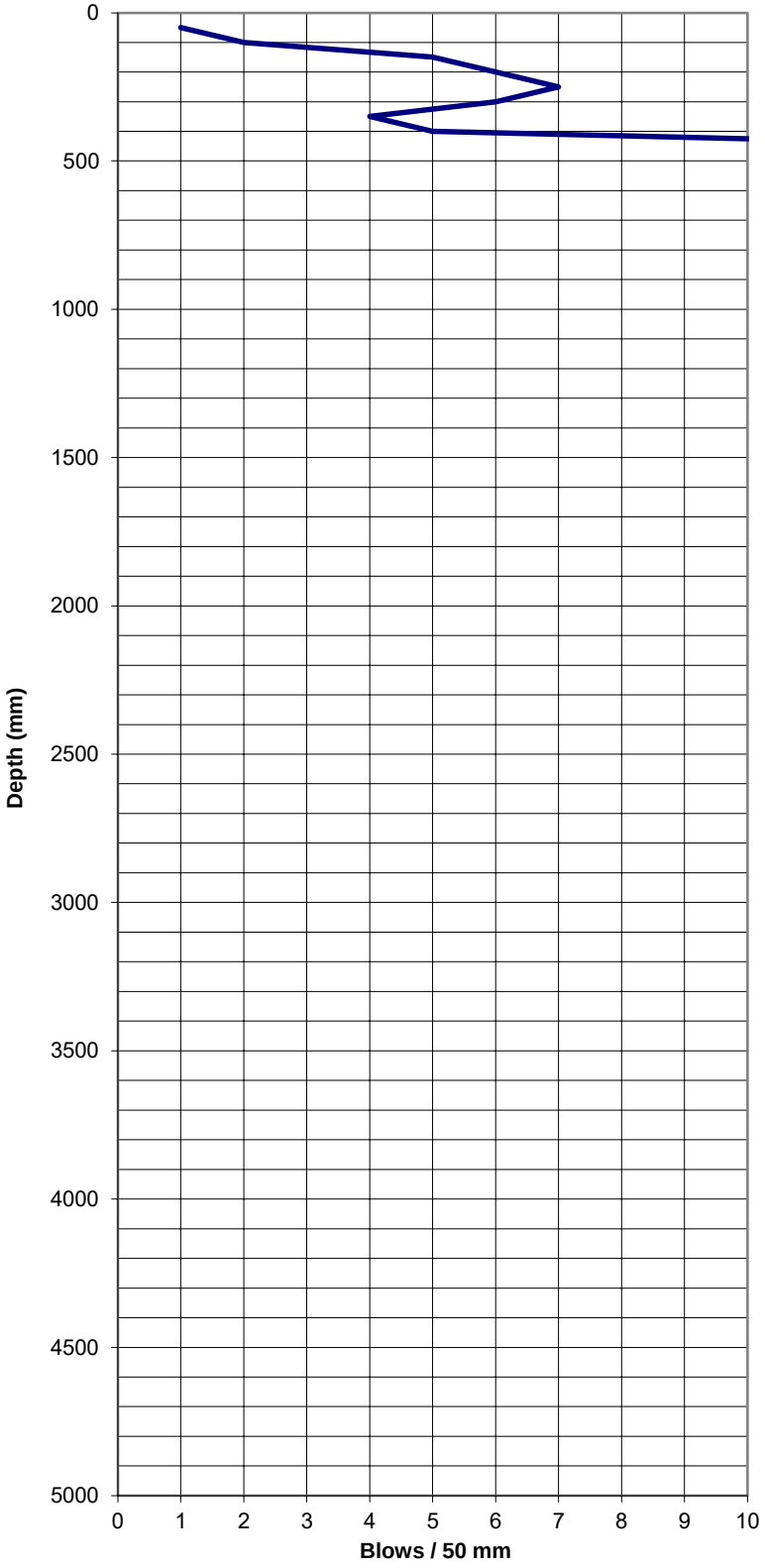
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	F
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*5*	2650	
200	*6*	2700	
250	*7*	2750	
300	*6*	2800	
350	*4*	2850	
400	*5*	2900	
450	*15*	2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

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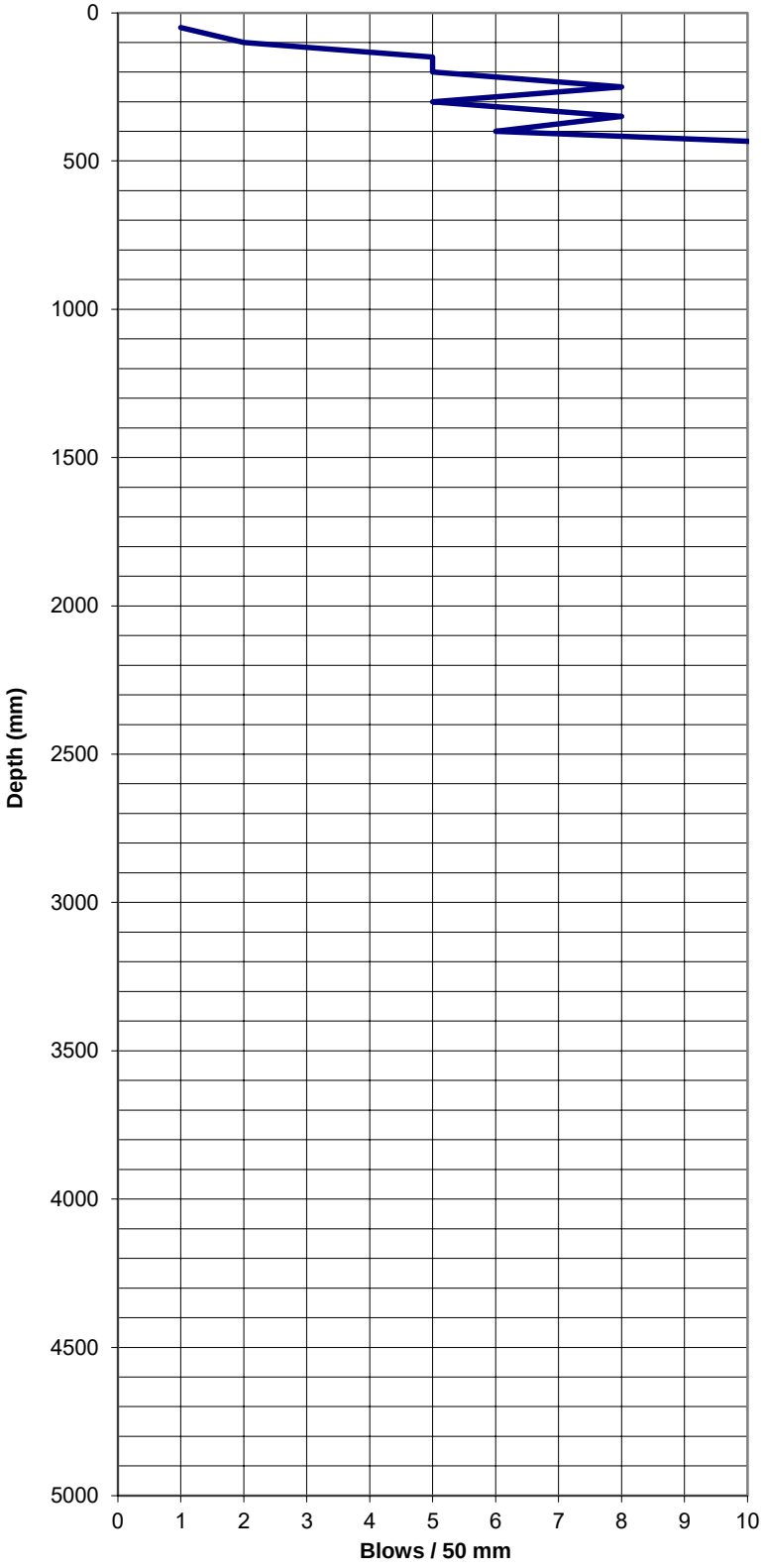
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	G
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*5*	2650	
200	*5*	2700	
250	*8*	2750	
300	*5*	2800	
350	*8*	2850	
400	*6*	2900	
450	*12*	2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

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SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	H
Sheet	*1* of *1*

mm Driven	No. of Blows
50	*2*
100	*4*
150	*4*
200	*5*
250	*6*
300	*8*
350	*7*
400	*8*
450	*7*
500	*7*
550	*5*
600	*6*
650	*7*
700	*12*
750	*15*
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
2050	
2100	
2150	
2200	
2250	
2300	
2350	
2400	
2450	
2500	

mm Driven	No. of Blows
2550	
2600	
2650	
2700	
2750	
2800	
2850	
2900	
2950	
3000	
3050	
3100	
3150	
3200	
3250	
3300	
3350	
3400	
3450	
3500	
3550	
3600	
3650	
3700	
3750	
3800	
3850	
3900	
3950	
4000	
4050	
4100	
4150	
4200	
4250	
4300	
4350	
4400	
4450	
4500	
4550	
4600	
4650	
4700	
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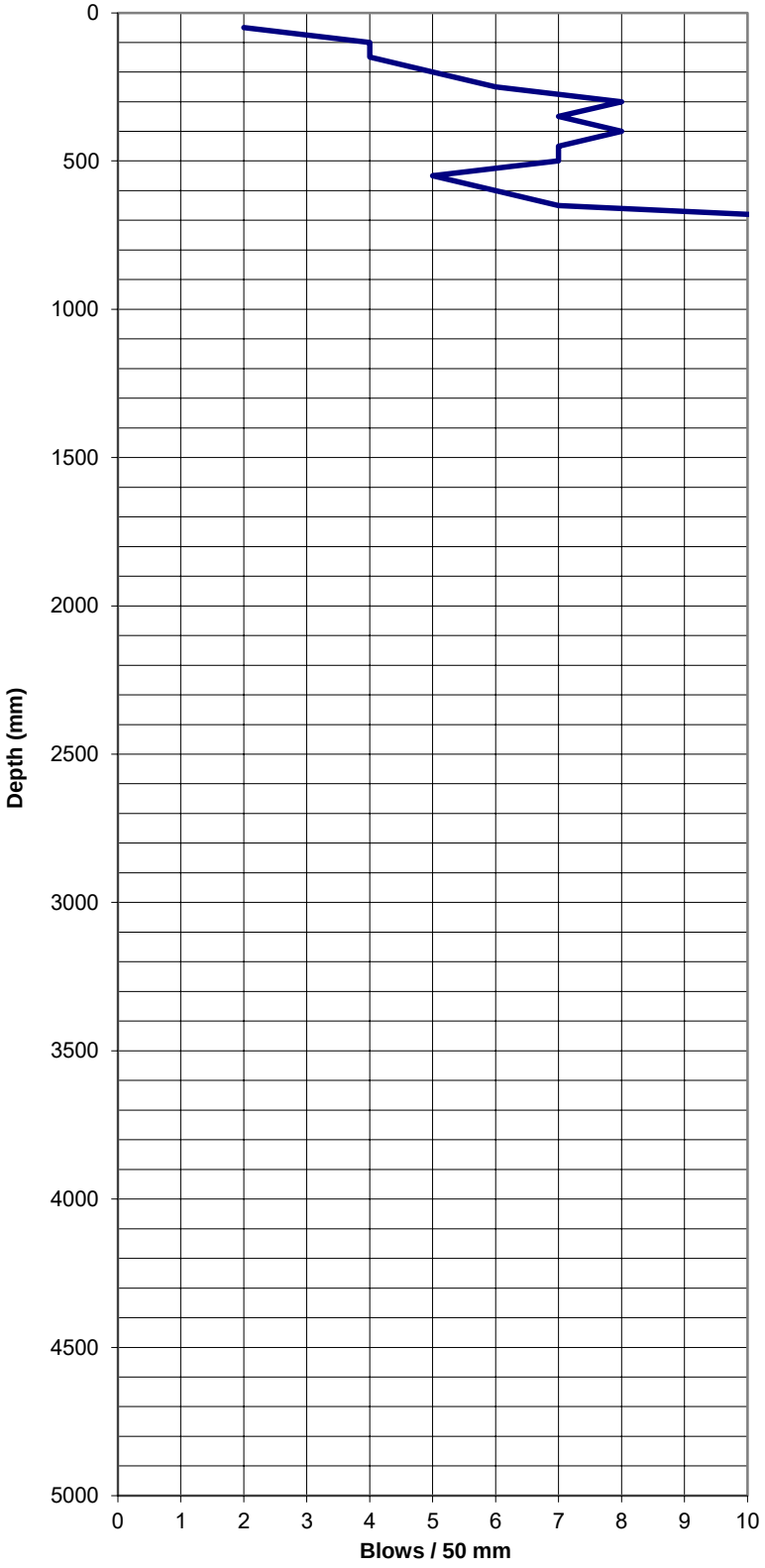
4800	
4850	
4900	
4950	
5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

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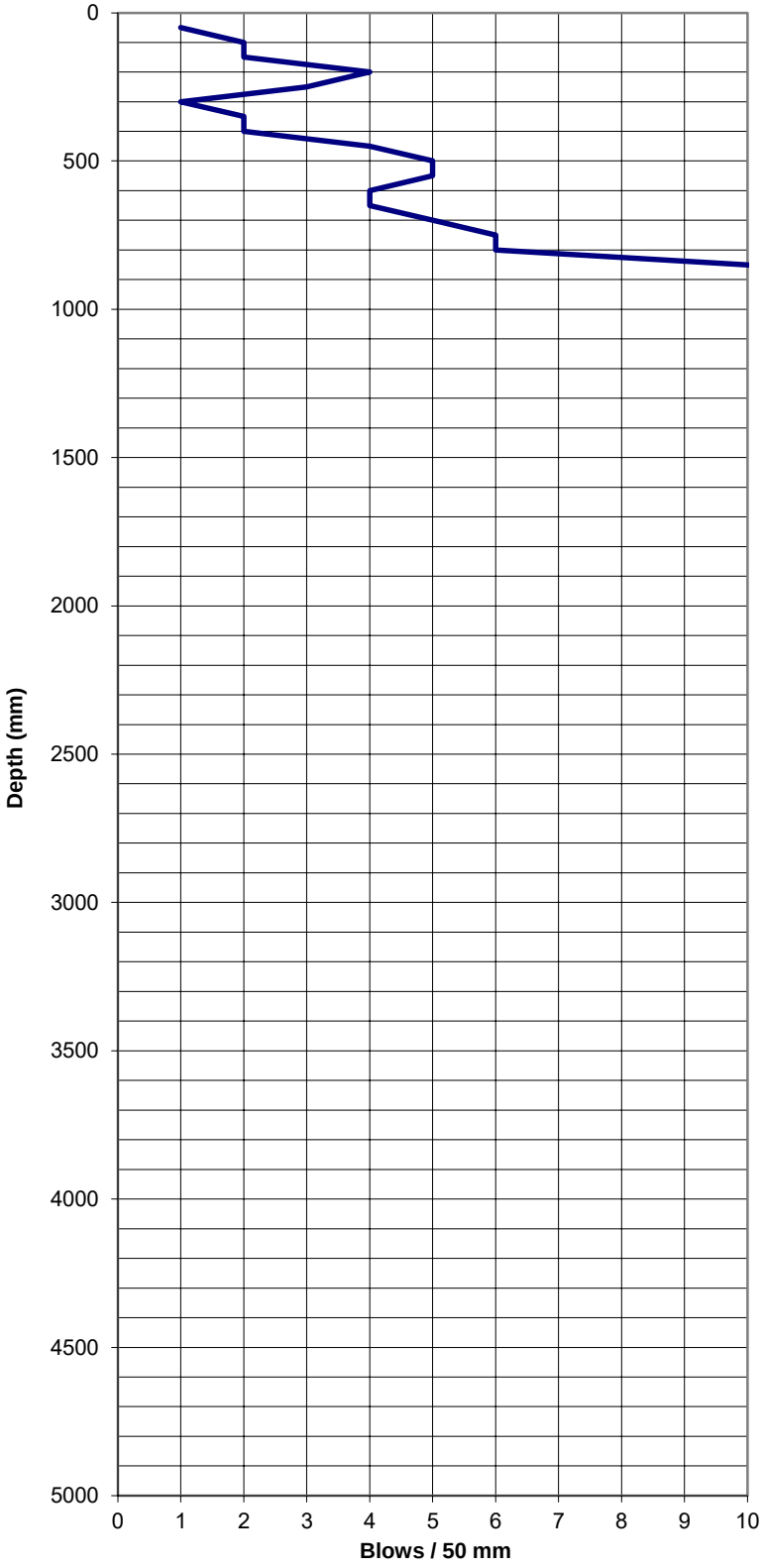
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	I
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*1*	2550	
100	*2*	2600	
150	*2*	2650	
200	*4*	2700	
250	*3*	2750	
300	*1*	2800	
350	*2*	2850	
400	*2*	2900	
450	*4*	2950	
500	*5*	3000	
550	*5*	3050	
600	*4*	3100	
650	*4*	3150	
700	*5*	3200	
750	*6*	3250	
800	*6*	3300	
850	*10*	3350	
900	*12*	3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

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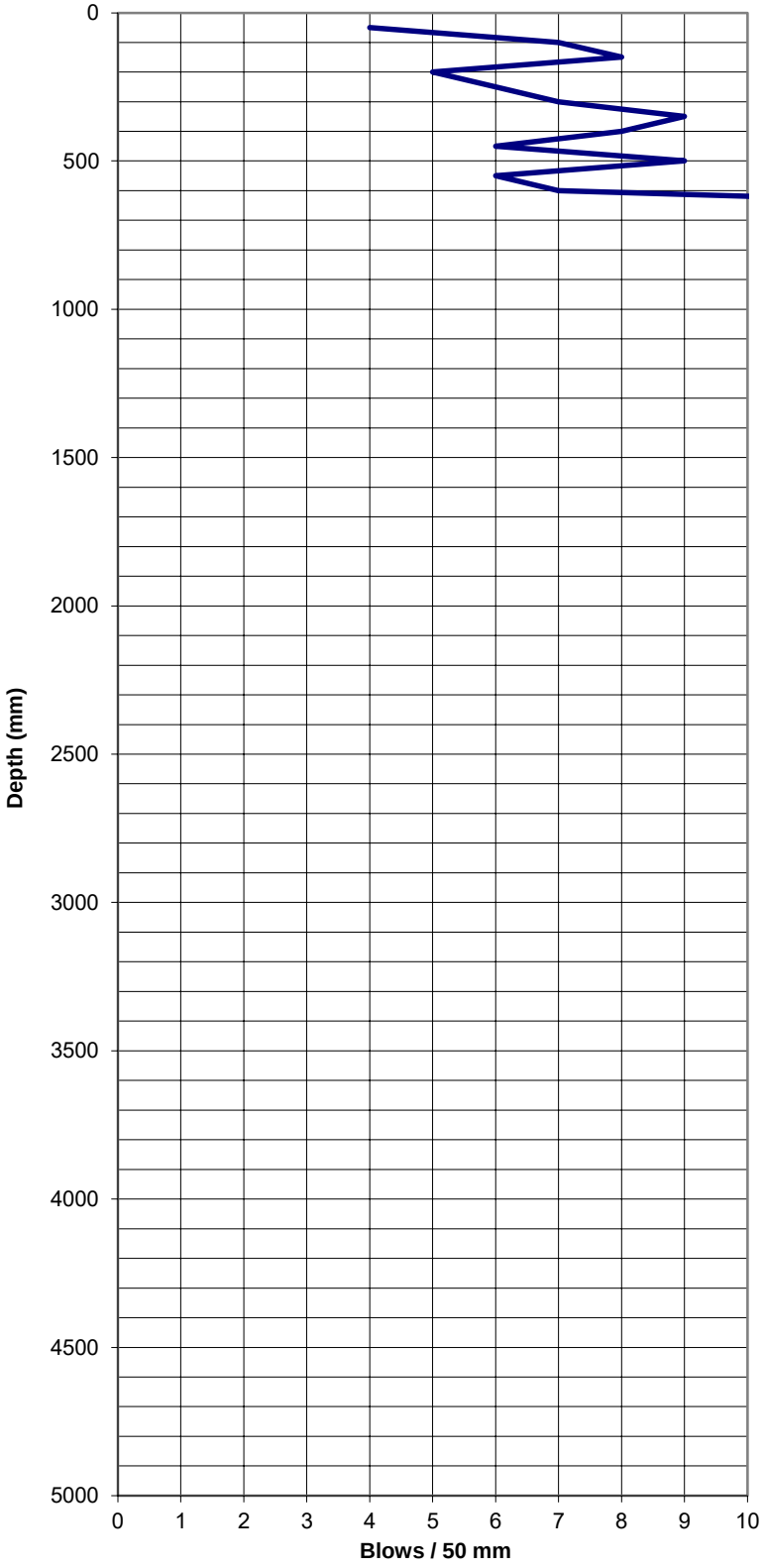
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	J
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*4*	2550	
100	*7*	2600	
150	*8*	2650	
200	*5*	2700	
250	*6*	2750	
300	*7*	2800	
350	*9*	2850	
400	*8*	2900	
450	*6*	2950	
500	*9*	3000	
550	*6*	3050	
600	*7*	3100	
650	*15*	3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

TONKIN & TAYLOR

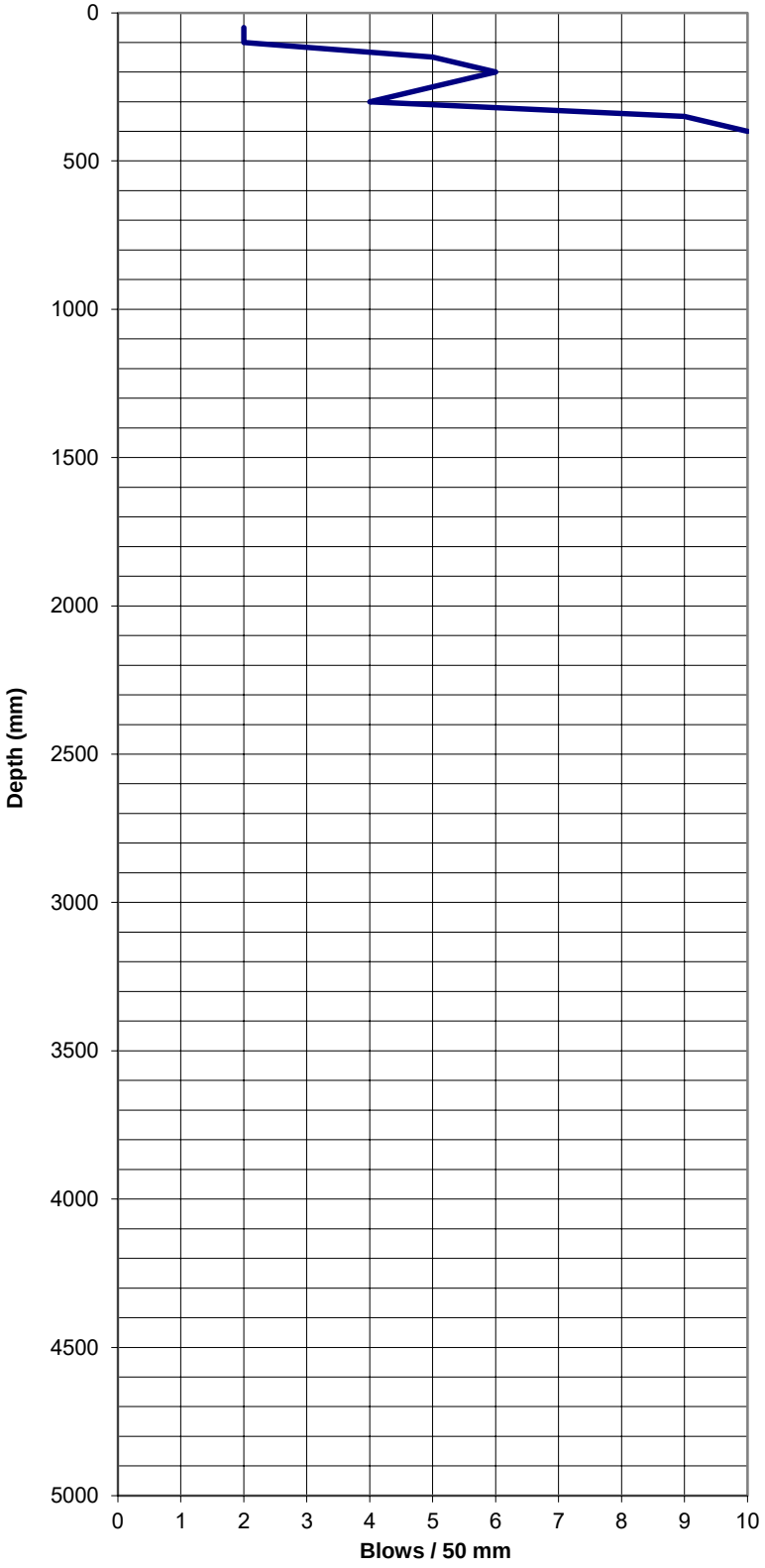
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	K
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*2*	2550	
100	*2*	2600	
150	*5*	2650	
200	*6*	2700	
250	*5*	2750	
300	*4*	2800	
350	*9*	2850	
400	*10*	2900	
450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

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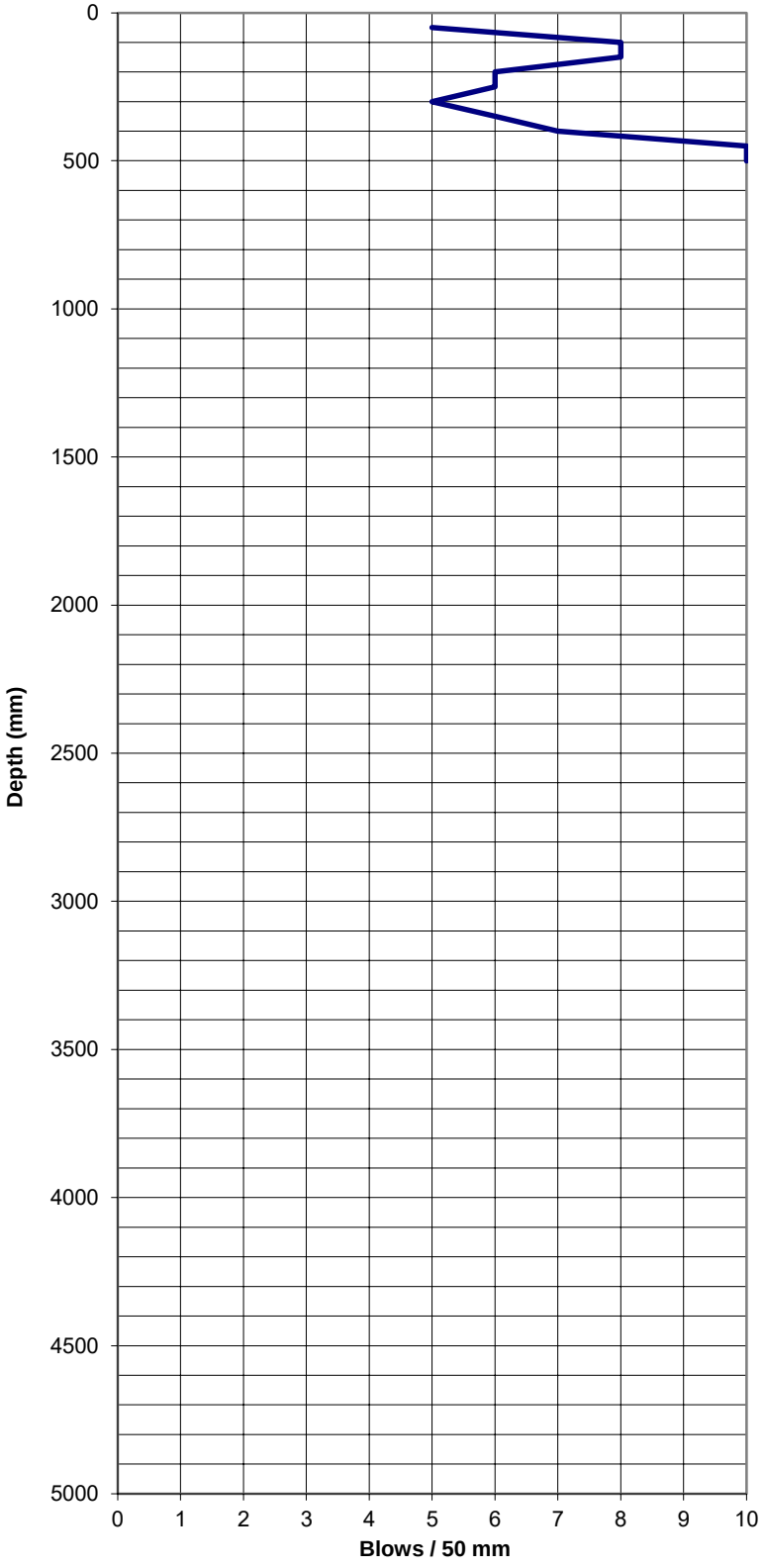
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	L
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*5*	2550	
100	*8*	2600	
150	*8*	2650	
200	*6*	2700	
250	*6*	2750	
300	*5*	2800	
350	*6*	2850	
400	*7*	2900	
450	*10*	2950	
500	*10*	3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

TONKIN & TAYLOR

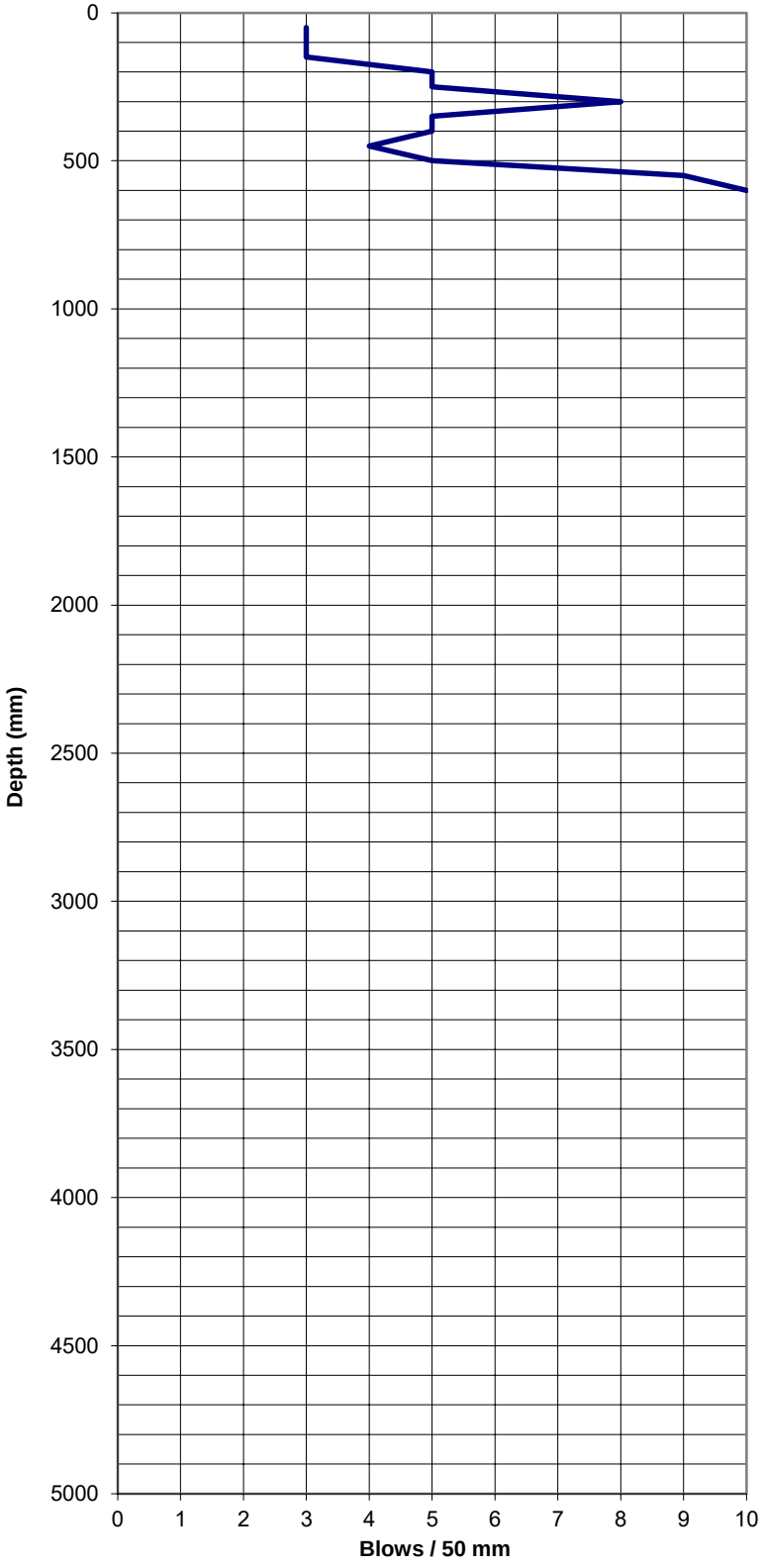
SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *25/02/2020*

m R.L : -0.1
Operated by: *EJWL*
Logged by: *EJWL*
Checked by:

Test Series:	*SC.2020.02.25*
Test No:	M
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50	*3*	2550	
100	*3*	2600	
150	*3*	2650	
200	*5*	2700	
250	*5*	2750	
300	*8*	2800	
350	*5*	2850	
400	*5*	2900	
450	*4*	2950	
500	*5*	3000	
550	*9*	3050	
600	*10*	3100	
650		3150	
700		3200	
750		3250	
800		3300	
850		3350	
900		3400	
950		3450	
1000		3500	
1050		3550	
1100		3600	
1150		3650	
1200		3700	
1250		3750	
1300		3800	
1350		3850	
1400		3900	
1450		3950	
1500		4000	
1550		4050	
1600		4100	
1650		4150	
1700		4200	
1750		4250	
1800		4300	
1850		4350	
1900		4400	
1950		4450	
2000		4500	
2050		4550	
2100		4600	
2150		4650	
2200		4700	
2250		4750	
2300		4800	
2350		4850	
2400		4900	
2450		4950	
2500		5000	



Test Notes: mRL given by Hoults Ltd in relation to finished design -100mm; results deepest of 3 attempts

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

Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *10/06/2020*

m R.L :
Operated by: *JJXW*
Logged by: *JJXW*
Checked by:

Test Series:	*SC.2020.06.10*
Test No:	SC1
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
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100	*1*	2600	
150	*1*	2650	
200	*5*	2700	
250	*7*	2750	
300	*7*	2800	
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450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
800		3300	
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2150		4650	
2200		4700	
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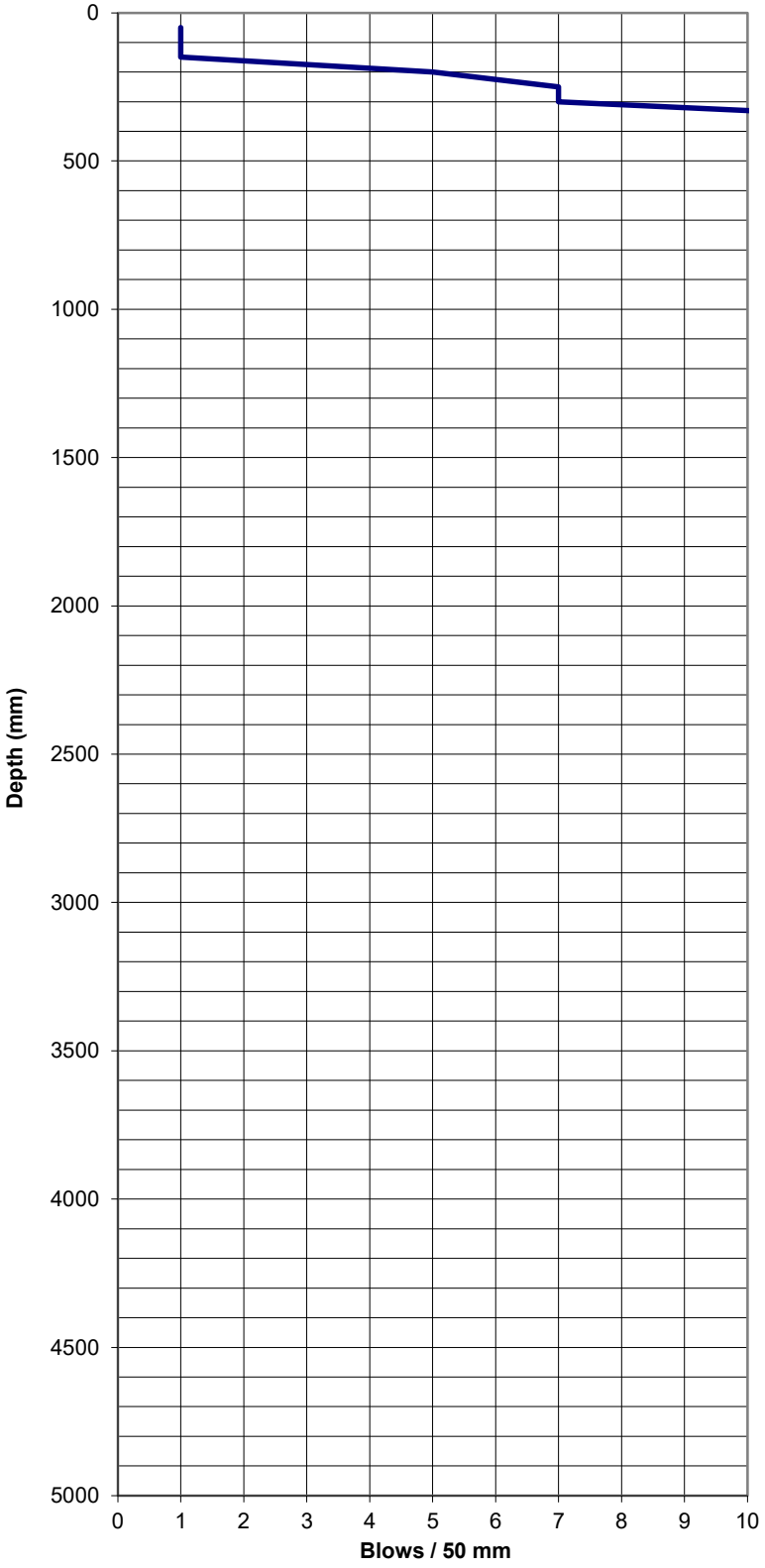
Test Notes: results deepest of 3 attempts



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

Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *10/06/2020*

m R.L :
Operated by: *JJXW*
Logged by: *JJXW*
Checked by:

Test Series:	*SC.2020.06.10*
Test No:	SC2
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
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100	*1*	2600	
150	*3*	2650	
200	*4*	2700	
250	*6*	2750	
300	*11*	2800	
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450		2950	
500		3000	
550		3050	
600		3100	
650		3150	
700		3200	
750		3250	
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850		3350	
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2150		4650	
2200		4700	
2250		4750	
2300		4800	
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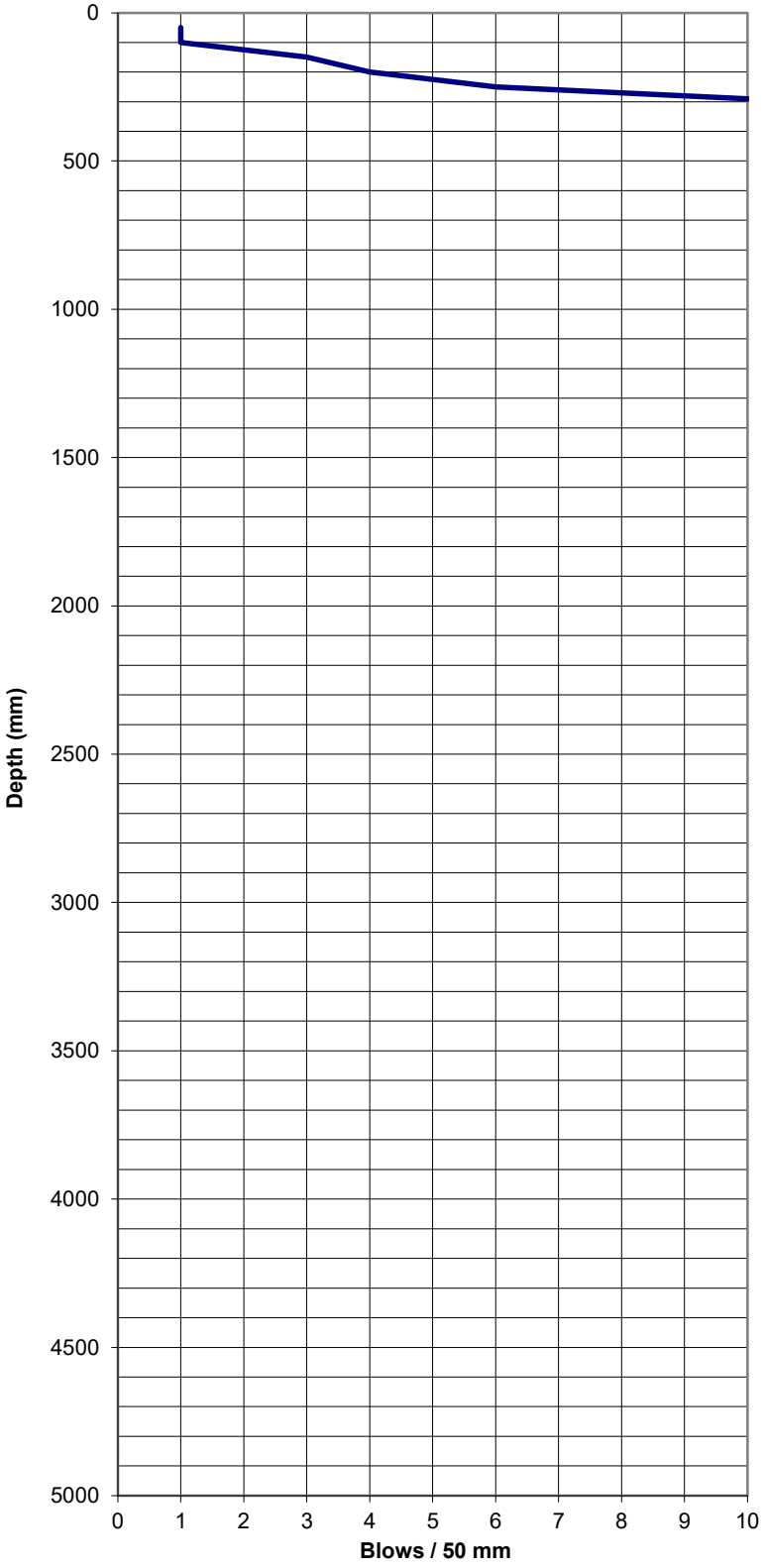
2400		4900	
2450		4950	
2500		5000	

Test Notes: results deepest of 3 attempts



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

Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *10/06/2020*

m R.L :
Operated by: *JJXW*
Logged by: *JJXW*
Checked by:

Test Series:	*SC.2020.06.10*
Test No:	SC3
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
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100	*2*	2600	
150	*12*	2650	
200	*9*	2700	
250	*11*	2750	
300	*23*	2800	
350		2850	
400		2900	
450		2950	
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2150		4650	
2200		4700	
2250		4750	
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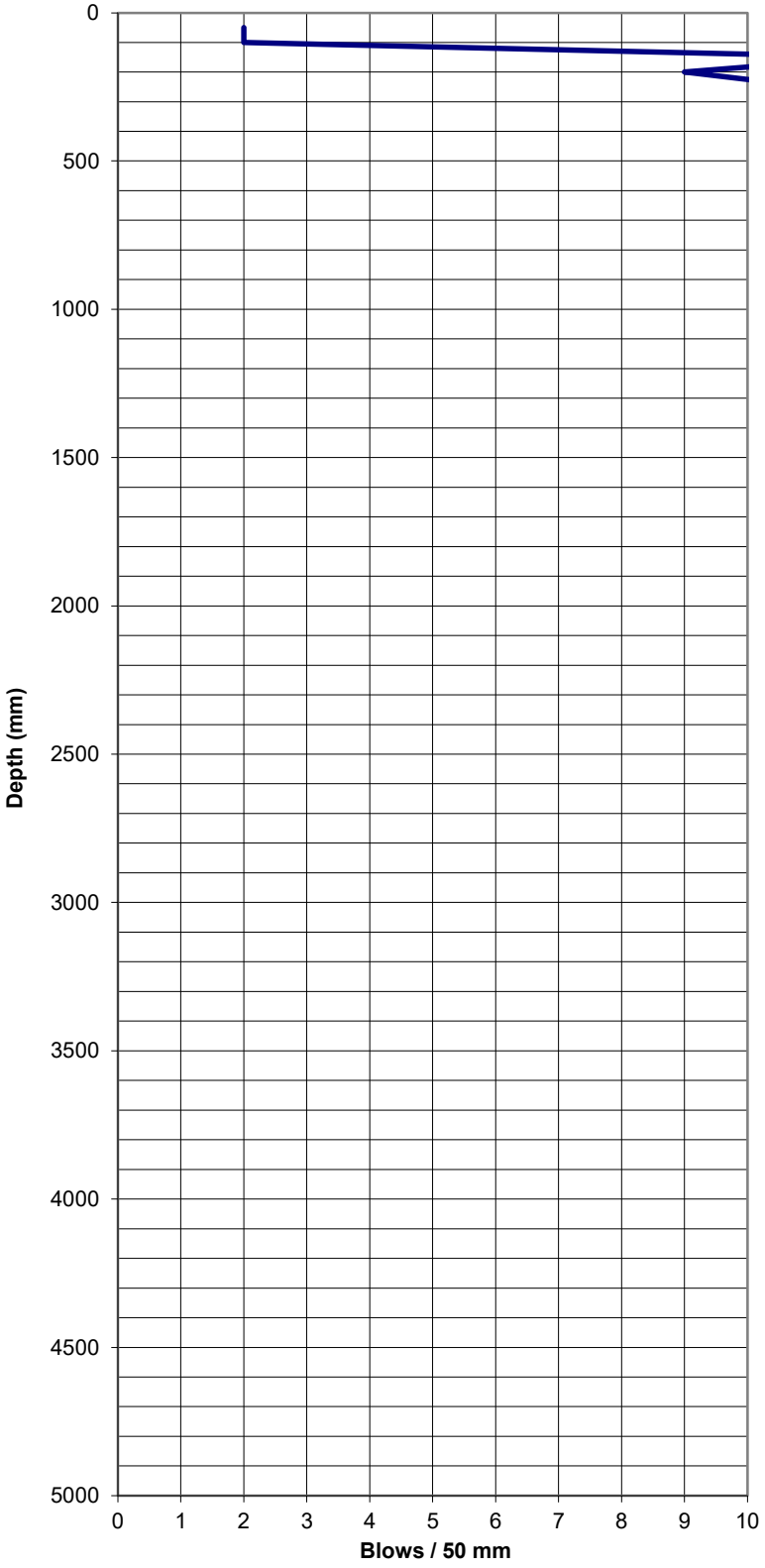
2400		4900	
2450		4950	
2500		5000	

Test Notes: results deepest of 3 attempts



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

Tonkin+Taylor

TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *1004625.003*
Project: *Centennial Park Stage 1*
Location: *Hokowhitu Lagoon, Palmerson North*
Date: *10/06/2020*

m R.L :
Operated by: *JJXW*
Logged by: *JJXW*
Checked by:

Test Series:	*SC.2020.06.10*
Test No:	SC4
Sheet	*1* of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
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200	*8*	2700	
250	*9*	2750	
300	*8*	2800	
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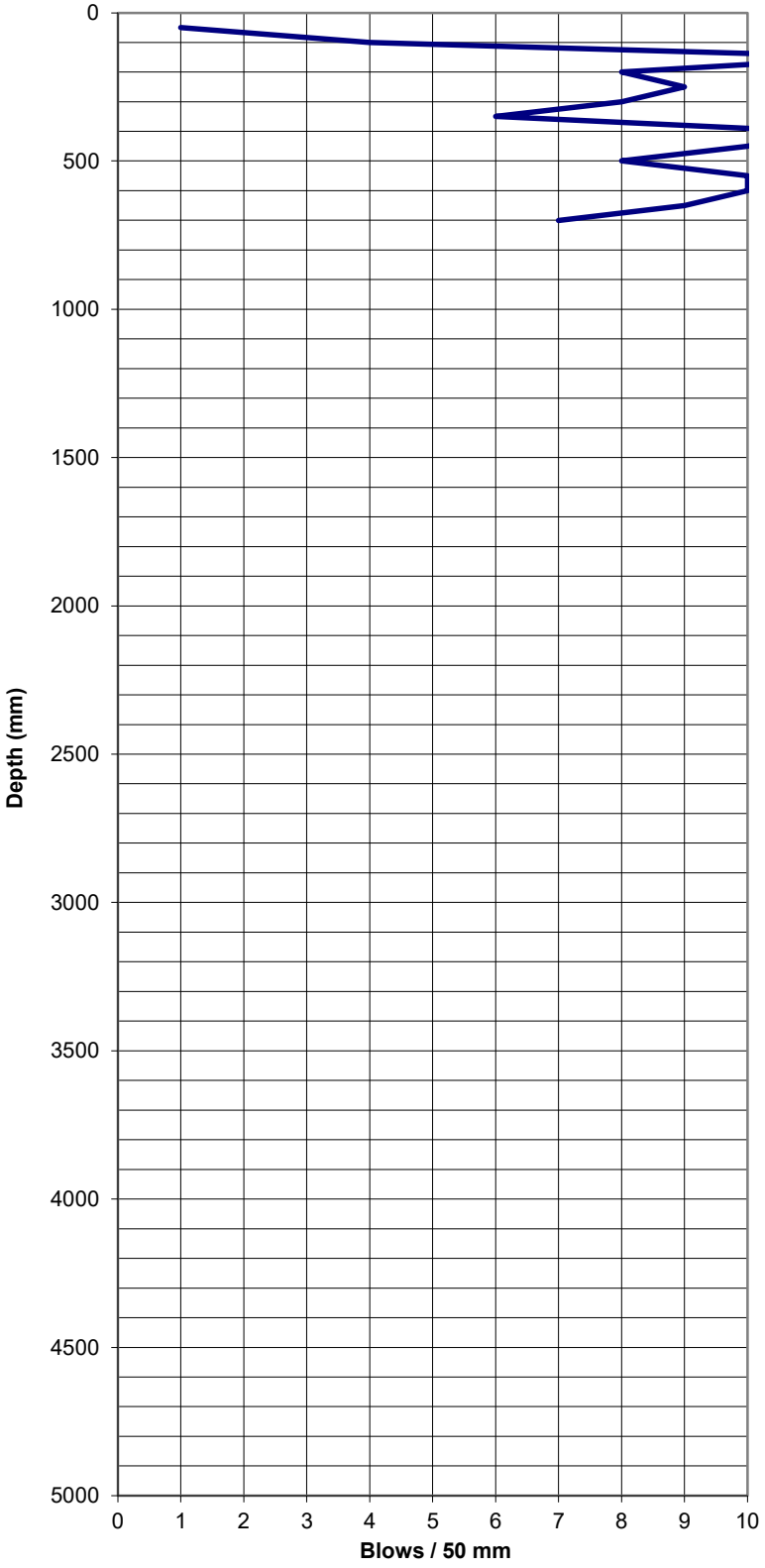
Test Notes: results deepest of 3 attempts



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

Appendix E: Minimum lot requirements

This Appendix was originally part of the report "Centennial Park, Palmerston North - Geotechnical Investigation and Liquefaction Assessment", prepared by Tonkin & Taylor Ltd for Wallace Development Company Ltd, January 2019, T+T Ref: 1004625.001.v2. The full report should be referred to for full details of the geotechnical recommendations for the Centennial Park site.

Tables E1 and E4 below have been modified from the previous January 2019 version to reflect additional information regarding development requirements provided in Section 3.2 of the July 2020 completion report, and to limit detail to the scope of certification of this completion report. Modifications from the previous version are shown in blue text.

The process required for design of residential dwellings in the Centennial Park development will depend on the liquefaction vulnerability and lateral spread hazard present on each lot, as summarised in Table E1 below.

For residential lots assessed as having ***Medium*** or ***High*** liquefaction vulnerability or as ***susceptible to lateral spreading***, enhanced foundations and/or ground improvement are likely to be required to meet minimum Building Code requirements. Examples of potentially suitable foundation options are summarised in Table E2 and E3 below. Further detail regarding these foundation options is provided in Section 5 of this report [(4)] and the MBIE residential construction guidance for Canterbury [(5)].

The assessed liquefaction vulnerability and lateral spreading susceptibility for each of the proposed lots in the Centennial Park development is summarised in Table E4, along with the minimum foundation option likely to meet Building Code requirements.

The minimum foundation requirements outlined in Table E4 for the individual lots should be discussed with a Licensed Building Practitioner (including engineering input as outlined in Table E1) to determine foundation design and/or ground improvement appropriate for that site. Specialised geotechnical engineering input is likely to be required for land assigned a liquefaction vulnerability category of ***High*** or identified as ***susceptible to lateral spreading***.

The assessment in Table E4 does not remove any requirement of a site specific assessment necessary for the detailed design of individual lots (refer Table E1). Additional shallow ground investigation and testing (e.g. hand augers and Scala penetrometer testing) will be required within the location of the proposed dwelling to confirm the foundation design and/or ground improvement appropriate for that site.

The existing area-wide site investigation layout has been designed with the intention to provide sufficient deep ground investigation information to support foundation design for Building Consent without the need for additional site-specific deep investigations in most cases. Any need for additional site-specific deep investigations would be a matter of judgement for the ***Geotechnical Engineer***, and would likely only be required in special circumstances (e.g. to suit the particular requirements of the preferred ground improvement and/or foundation option).

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(4) "Centennial Park, Palmerston North - Geotechnical Investigation and Liquefaction Assessment", report prepared by Tonkin & Taylor Ltd for Wallace Development Company Ltd, January 2019, T+T Ref: 1004625.001.v2

(5) "Repairing and rebuilding houses affected by the Canterbury earthquakes", Part A and C, Ministry of Business, Innovation and Employment, 3rd Edition, Published on 1 December 2012, Updated on 29 May 2018. https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/repairing-and-rebuilding-houses-affected-by-the-canterbury-earthquakes/

Table E1: Process required for design of residential dwellings

Location	Process required for design of residential dwellings
Stage 1-East (Blue area in Figure 1.1)	There are two options for the design process, as detailed in Section 3.2.2 of this report: ***Option 1: If a TC2-type enhanced foundation option is adopted*** Refer to Table E2 for definition of "enhanced foundation". We encourage enhanced slab foundations for increased resilience as they can provide a substantial improvement in foundation performance for only a small increase in construction cost (which may be similar to the cost otherwise required for specialist site-specific geotechnical input). Design to be undertaken by a Licensed Building Practitioner (LBP), with input from a ***CPEng. Engineer*** *(specialist geotechnical input not required)*. Specific engineering design required, making allowance for the geotechnical design parameters detailed in Section 3.2.2.1 of this report. The ***CPEng. Engineer*** may judge it appropriate to adopt one of the standard "off the shelf" foundation details presented in the MBIE residential construction guidance for Canterbury. Alternatively the ***CPEng. Engineer*** may choose to develop a bespoke design which meets the performance requirements detailed in Section 5.4 and 5.7 of the MBIE guidance, taking into account the geotechnical inputs provided in items (d) to (j) of Section 3.2.2.1. ***Option 2: If a TC2-type enhanced foundation option is not adopted*** Alternatively, there is an option to undertake completely independent specific engineering design to design a bespoke foundation/building solution. If this option is adopted it should incorporate the appropriate level of involvement of structural and geotechnical engineers to demonstrate that the proposed building meets the performance requirements of the Building Code. Design to be undertaken by a Licensed Building Practitioner (LBP), with input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer***. It is possible that site-specific geotechnical assessment by a ***Geotechnical Engineer*** (including additional deep ground investigations) might determine that "good ground" [(6)] can be assumed for a specific building footprint location. In this case the ***CPEng. Engineer*** might determine that it is possible to proceed with an NZS3604 building without the need for further specific engineering design.
Stage 1-West (Yellow area in Figure 1.1)	Design to be undertaken by a Licensed Building Practitioner (LBP), with input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer***. Specific engineering design required, however the ***CPEng. Engineer*** may judge it appropriate to adopt one of the standard "off the shelf" foundation details presented in the MBIE residential construction guidance for Canterbury. Alternatively, the ***CPEng. Engineer*** may choose to develop a bespoke design which takes into account the site-specific geotechnical input provided by the ***Geotechnical Engineer*** and meets the performance requirements detailed in Section 15 of the MBIE guidance and/or the Building Code.

[(6)] The Building Code has recently been updated to exclude liquefaction-prone ground from the definition of "good ground". For details refer to https://www.building.govt.nz/building-code-compliance/annual-building-code-updates/november-2019-building-code-update/

Table E2: Enhanced foundation options

Foundation option	Description
Option 1: Enhanced slab	Enhanced reinforced concrete slab on grade foundation. Four example options are presented in Section 5.3.1 of the MBIE residential construction guidance for Canterbury. Alternatively the ***CPEng. Engineer*** may choose to develop a bespoke design which meets the performance requirements detailed in Section 5.4 and 5.7 of the MBIE guidance and/or the Building Code. Can also be combined with a shallow geogrid-reinforced gravel raft for increased performance (this is termed a hybrid TC2/TC3 foundation in the MBIE Canterbury guidance).
Option 2: Deep piles	Piles founding on dense (non-liquefiable) ground at depth. Various example options are presented in Section 15.2 of the MBIE residential construction guidance for Canterbury.
Option 3: Surface structures	Lightweight and flexible relevel-able platforms with shallow foundations, designed to tolerate differential ground settlement and lateral stretch with the intention of being readily-repairable following and SLS-level earthquake event. Various example options are presented in Section 15.4 of the MBIE residential construction guidance for Canterbury, with the most relevant options for these areas being Type 1 or Type 2A surface structures. Alternatively the ***CPEng. Engineer*** may choose to develop a bespoke design which takes into account the site-specific geotechnical input and meets the performance requirements detailed in Section 15 of the MBIE guidance and/or the Building Code. The guidance outlines various recommendations for the building superstructure, which will be particularly relevant for land assigned a liquefaction vulnerability category of ***High***.

Table E3: Ground improvement options

Ground improvement option	Description
Option A: Reinforcement	Formation of a grid of individual columns with a 1.5–2.5 m grid spacing using either timber or concrete piles or stone columns. Depending on the location of the proposed dwelling, reinforcement (piles or stone columns) may be constructed within the upper 4m, bearing into the gravel layer (Layer 2).
Option B: Densified crust	Excavation of liquefiable soils and replacement with dense/stabilised soil. Depending on the location of the proposed dwelling a reinforced gravel raft may be constructed to approximately 1.2m depth, consisting of compacted crushed gravel with geo-grid reinforcement (Option G1d in the MBIE Canterbury guidance). Alternatively, in some cases it may be preferable to excavate to approximately 2.0m depth (or to the top of the gravel layer) and recompact the excavated material, with geo-grid reinforcement (Option G1a in the MBIE Canterbury guidance).

Table E4: Minimum foundation requirements for each lot in Stage 1

This table details the minimum foundation option covered by the ground preparation certification provided in this completion report.

As an alternative to relying on this certification, completely independent specific engineering design could be undertaken to design a bespoke foundation/building solution. This should incorporate site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

Lot numbers are as shown on GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020, provided in Appendix A.

	Hazards				
	Liquefaction Vulnerability			Lateral	
Lot #	Low	Medium	High	Spread	Minimum foundation option covered by the ground preparation certification provided in this completion report
1	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
2	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
3	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
4	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
5	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
6	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
7	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
8	X	X		X	Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
9	X	X		X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation.
10		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.
11		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.
12		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.
13		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.
14		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.
15		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.

Table E4 (continued)

Lot #	Hazards				Minimum foundation option covered by the ground preparation certification provided in this completion report
	Liquefaction Vulnerability			Lateral Spread	
	Low	Medium	High		
16		X	X	X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation plus shallow ground improvement beneath dwelling footprint.
Lots 17 and 18 have been deleted from the planned development					
19		X		X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation.
20		X		X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation.
21		X		X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation.
22	X	X		X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation.
23	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
24	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
25	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
26	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
27	X				Enhanced foundation (MBIE TC2 Option 4 slab, or bespoke design which meets performance requirements in Section 5.4 and 5.7 of MBIE guidance).
28	X	X		X	Requires site-specific geotechnical assessment and specific engineering design. Likely to require an enhanced foundation.

Appendix F: Statement of Suitability of Earth Fill for Residential Development (NZS 4431:1989)

APPENDIX A

STATEMENT OF SUITABILITY OF EARTH FILL
FOR RESIDENTIAL DEVELOPMENT

To Palmerston North City Council (name and address
32 The Square, Palmerston North 4410 of Local Authority)
New Zealand

STATEMENT OF SUITABILITY OF EARTH FILL
FOR RESIDENTIAL DEVELOPMENT

Subdivision Centennial Park Development - Stage 1 Lots 1 to 16, 19 to 28

Owner/Developer Wallace Development Company Limited

Location Hokowhitu, Palmerston North

The earth fills shown on the attached plan No. 51-37652-C003 to C008 have been placed in compliance with the terms of NZS 4431.

While work was in progress I retained as my inspecting engineer the engineer named below who is registered in terms of the Engineers Registration Act 1924.

Hugh Edward Cherrill, Tonkin & Taylor Ltd.,
Level 4, 2 Hunter Street, Wellington, 6011
Address

During the work, the inspecting engineer and his staff made periodic visits of inspection to the site as detailed in his report No 1004625.003 which is attached. Details of the soil testing carried out to check the quality of the fill by the inspecting engineer and his testing agency are also included in this report.

The attached ~~plan No.~~ report Centennial Park, Geotechnical liquefaction assessment report T+T Ref: 1004625.001 shows Lot Nos.
Lots 1-16 and 19-28

to be affected by filling and the extent of the fill.

In the opinion of the inspecting engineer the following special limitations should be observed:

Refer T+T Report Centennial Park Earthworks Geotechnical Completion Report, Stage 1 Lots 1 to 16,19 to 28, V6 Aug 2020, for requirements for building on individual sites.

This certification, that the earth fills have been placed in compliance with the terms of NZS 4431 does not remove the necessity for the normal inspection and design of foundations as would be made in natural ground.

V Thompson (signature)
Palmerston North Office Manager (position)
11 August 2020 (date)

on behalf of
Wallace Development Company Limited
Level 1, 227 Broadway Avenue
Palmerston North 4410 (name of Owner/Developer)

SCHEDULE 2A

STATEMENT OF PROFESSIONAL OPINION ON SUITABILITY OF LAND FOR BUILDING CONSTRUCTION

Development Centennial Park Development - Stage 1 Lots 1 to 16, 19 to 28

Developer Wallace Development Company Limited

Location Hokowhitu, Palmerston North

I Hugh Edward Cherrill of Tonkin & Taylor Ltd.
(Full name) *(Name and address of firm)*

Hereby confirm that:

1. I am a geo-professional as defined in clause 1.2.2 of NZS 4404:2010 and was retained by the developer as the geo-professional on the above development.

2. The extent of my preliminary investigations are described in my Report(s) number Centennial Park, Geotechnical liquefaction assessment report, T+T Ref: 1004625.001 dated January 2019, and the conclusions and recommendations of that/those document(s) have been re-evaluated in the preparation of this report. The extent of my inspections during construction, and the results of all tests and/or re-evaluations carried out are as described in my geotechnical completion report dated v7 August 2020

3. In my professional opinion, not to be construed as a guarantee, I consider that (delete as appropriate):

   (a) The earth fills shown on the attached Plan No. 51-37652-C003 to C008 have been placed in compliance with the requirements of the Palmerston North City Council and ~~my~~ provided specification.

   (b) The completed works take into account land slope and foundation stability considerations, subject to the appended foundation recommendations and earthworks restrictions, (which should be read in conjunction with the appended final site contour plan).

   (c) Subject to 3(a) and 3(b) of this Schedule, the original ground not affected by filling is suitable for the erection of buildings ~~designed according to NZS 3604 provided that:~~

   (i) Subject to the requirements for individual sites set out

   (ii) in, Appendix E in T+T Completion Report v7 dated August 2020 for requirements for building on individual sites

   (d) Subject to 3(a) and 3(b) of this Schedule, the filled ground is suitable for the erection of buildings ~~designed according to NZS 3604 provided that:~~

   (i) Subject to the requirements for individual sites set out

   (ii) in Appendix E in T+T Completion Report v7 dated August 2020 requirements for building on individual sites

   (e) ~~The original ground not affected by filling and the filled ground are not subject to erosion, subsidence, or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991 provided that:~~

   (i) For details of ground hazards Refer Centennial Park, Geotechnical

   (ii) liquefaction assessment report, T+T Ref: 1004625.001, January 2019

NOTE – These subclauses may be deleted or added to as appropriate, to include such considerations as expansive soils where excluded from NZS 3604, and site seismic characteristics as covered in clause 3.1.3 of NZS 1170.5.

4. This professional opinion is furnished to the TA and the developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.

5. This certificate shall be read in conjunction with my geotechnical report referred to in clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

Signed .....

Date 13th August 2020

Geotechnical Engineer
BSc (Hons), PhD, MICE, CEng,
CEnv, CMEngNZ, IntPE(NZ)

(Name, title, and professional qualifications)

Appendix G: Geotechnical considerations for specific engineering design

- **Stage 1-East**
- **Stage 1-West**

Job No: 1004625.003
10 August 2020

Wallace Development Company Ltd.
227 Broadway Avenue
Palmerston North 4410

Centennial Park, Palmerston North
Stage 1-East: Geotechnical considerations for specific engineering design

1 Background

Subdivision development earthworks have been completed for Stage 1 of Centennial Park. As detailed in Section 3.2.2.1 of the ***Earthworks Completion Report***, the ground preparation for Stage 1-East (the area shaded blue in Figure 1.1 below) has been certified suitable for residential development subject to specific engineering design of a TC2-type enhanced foundation and building superstructure in accordance with NZ3604. Alternatively, other foundation or superstructure options may be possible subject to site-specific geotechnical assessment and specific engineering design as described in Section **Error! Reference source not found.** of the ***Earthworks Completion Report***.

This letter provides information about the general geotechnical conditions on the site, which should be taken into account as part of specific engineering design for buildings on each lot, and the associated Building Consent and Code Compliance certification.

This letter should be provided to purchasers of all lots in Stage 1-East, and passed on to the designers of all buildings on these lots.

Figure 1.1: Layout of Centennial Park Stage 1 subdivision. Two portions of Stage 1 have been defined for the purposes of this letter: Stage 1-West shaded yellow, and Stage 1-East shaded blue. Subdivision layout is as per the GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020.

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2 Engineering input required for design of individual buildings

Specific engineering design will be required for all buildings in Stage 1-East. Each individual building will require site-specific input from a ***CPEng. Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

Input from a ***Geotechnical Engineer*** is not expected to be required if a TC2-type enhanced foundation is adopted and the building superstructure (from the from the ground floor plate up) is in accordance with NZS3604. If alternative foundation or superstructure options are adopted then input from a ***Geotechnical Engineer*** will likely be required.

In this letter, the term "***CPEng. Engineer***" refers to a Chartered Professional Engineer engaged by (or on behalf of) an individual lot owner, responsible for undertaking specific engineering design of a particular building on a particular site. This will typically include specification of foundation and superstructure details for Building Consent, and accompanying Producer Statements PS1 (Design) and PS4 (Construction Review). This engineer will typically have primary competence in structural or general civil engineering design, with no specific competence in geotechnical engineering. This engineer is responsible for recognising any matters which are outside their expertise (e.g. specialist geotechnical assessment) and seeking any specialist input needed.

In this letter, the term "***Geotechnical Engineer***" refers to a Chartered Professional Engineer with competence in geotechnical engineering engaged by (or on behalf of) an individual lot owner. This engineer is responsible for providing specialist geotechnical input to help inform the ***CPEng. Engineer*** undertaking building design.

3 Previous area-wide geotechnical reports

The following area-wide geotechnical reports should be read in conjunction with this letter:

Earthworks Completion Report: *T+T (2020), Centennial Park, Earthworks Geotechnical Completion Report, Stage 1, Lots 1 to 16 and 19 to 28, Wallace Development Company Ltd., 10 August 2020, Ref. 1004625.003.v07*

Liquefaction Assessment Report: *T+T (2019), Centennial Park, Palmerston North, Geotechnical Investigation and Liquefaction Assessment, Wallace Development Company Ltd., January 2019, Ref.1004625.001.v2*

4 Ground investigations

The existing area-wide ground investigations are summarised in the ***Liquefaction Assessment Report***, and the raw digital data is available on the NZ Geotechnical Database. This is expected to provide sufficient deep ground investigation information to support foundation design for Building Consent without the need for additional site-specific deep investigations in most cases. Additional site-specific deep investigations would likely only be required in special circumstances (e.g. to suit the particular requirements of the preferred foundation option if a TC2-type enhanced foundation is not adopted) and would be a matter of judgement for the ***Geotechnical Engineer***.

It is likely that site-specific shallow ground testing (e.g. hand augers and Scala penetrometer testing) and observation of the exposed founding material during construction will be required (as judged appropriate by the ***CPEng. Engineer***). The purpose of this is to confirm that ground conditions encountered beneath the specific building footprint are consistent with the assumptions on which the building design was based, or to determine any additional undercut, compaction or support required.

We emphasise that there is an important difference between geotechnical engineering advice (also described as geotechnical input or geotechnical assessment) and geotechnical site investigations. Where geotechnical input is needed, any requirements for further site investigations will depend on the ***Geotechnical Engineer's*** assessment of the existing area-wide deep ground investigations (CPT

and boreholes), and how any uncertainty in ground conditions could impact on the specific building proposed. The ***Geotechnical Engineer*** might undertake additional deep site investigations (e.g. CPT testing or boreholes to confirm whether or not the liquefiable layer is present at the specific site), or they might decide further deep investigations are not required and only undertake shallow investigations to confirm the near-surface bearing conditions.

5 Specific building development requirements for each lot

5.1 Geotechnical context

For Stage 1-East, the ***Liquefaction Assessment Report*** concluded that the liquefaction vulnerability was likely to be Low, with potential lateral spreading susceptibility at the western margin.

This assessment was sufficiently conclusive to support the subdivision consent application, however residual uncertainty remained regarding the presence of a thin liquefiable soil layer between approximately 2m and 3m below ground and potential effects from lateral spreading of adjacent land towards the Hokowhitu Lagoon. Also, as discussed in Section 2.3 of the ***Earthworks Completion Report***, all fill in Stage 1 was specified as "General Bulk Fill" (although the compaction test results in Appendix C of that report suggest that much of the fill has actually achieved the criteria for "General Structural Fill").

These uncertainties mean there is not yet sufficient site-specific certainty to allow "good ground" to be assumed for Building Consent purposes. Therefore design of the building for each lot will require site-specific input from a ***CPEng. Engineer*** (and in some cases a ***Geotechnical Engineer***) to demonstrate that the proposed building meets the performance requirements of the Building Code.

5.2 Minimum foundation requirements

Appendix E of the ***Earthworks Completion Report*** details the minimum foundation option covered by the ground preparation certification provided (a TC2-type enhanced foundation, with the building superstructure in accordance with NZS3604).

As an alternative to relying on this certification, completely independent specific engineering design could be undertaken to design a bespoke foundation/building solution. This should incorporate site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

In either case, foundation and building performance expectations should be confirmed between the client and the design team to understand the risk associated with the site-specific ground conditions and specific building details.

5.3 Process for design of residential dwellings

An example process for foundation design for each individual building is provided below. It is expected that in most cases this process would enable the ***CPEng. Engineer*** to complete the design without the need for site-specific geotechnical assessment. Other approaches could also be suitable, provided they demonstrate compliance with the Building Code.

1. Lateral spreading and liquefaction vulnerability for the specific lot is assumed to be Low to Medium. This may overestimate the vulnerability for some lots.

2. Rather than undertaking more detailed site-specific geotechnical assessment to determine whether the actual liquefaction and lateral spreading vulnerability at the site is Very Low (in which case an NZS3604 foundation might be sufficient), adopt a more robust TC2-type foundation option (with the building superstructure in accordance with NZS3604) [(1)]. The additional cost of a TC2-type enhanced foundation may be similar to the cost of the detailed geotechnical assessment. However, investing in the foundation provides greater certainty of outcome and a range of performance benefits such as lower bearing capacity requirements, greater tolerance of static and shrink-swell ground settlements, improved thermal insulation and increased flooding freeboard.

3. Assume geotechnical inputs into foundation and building design as listed in Section 3.2.2.1 of the ***Earthworks Completion Report***.

4. Based on this geotechnical input, the ***CPEng. Engineer*** would specify the foundation details required, and demonstrate that the performance requirements of the Building Code are satisfied. This information should be included in the Building Consent application in the form of a "Design Features Report", supported by a Producer Statement PS1 (Design).

   For Stage 1-East there are various potential outcomes, for example:

   (a) The ***CPEng. Engineer*** might choose to adopt the standardised TC2 Option 4 slab foundation concept outlined in the MBIE Canterbury Guidance, if appropriate. Refer to Section 5.3 of the guidance for TC2 Option 4 slab details and Section 5.7 for service connections. This constitutes specific engineering design. However, in most cases the primary focus of this design will be selecting an appropriate option from the standard foundation concepts and detailing to suit the specific building and site.

   The TC2 Option 4 slab has a lower bearing capacity requirement than "good ground", requiring a capacity of only 200kPa (or less if foundations are redimensioned as per Section 3.4.1 and 5.4 of the guidance).

   MBIE have already determined how much ground displacement these standard options can accommodate, so to confirm that the foundation meets the relevant Building Code performance requirements the ***CPEng. Engineer*** simply has to choose an option which is rated for the bearing capacity, liquefaction settlement and lateral spread magnitudes provided by the ***Geotechnical Engineer***.

   (b) The ***CPEng. Engineer*** might choose to create their own bespoke design rather than adopting a TC2 Option 4 slab foundation. They might do this if they can design a foundation that is cheaper/easier to construct, or if it offers some other kind of performance advantage given the particular site conditions and building details, while still being suitable for the geotechnical parameters provided in Section 3.2.2.1 of the ***Earthworks Completion Report***. This requires more detailed specific engineering design to demonstrate "from first principles" that the foundation meets the performance requirements detailed in Section 5.4 and 5.7 of the MBIE guidance and/or the Building Code.

[(1)] For an example process including detailed site-specific geotechnical assessment which might allow these building restrictions to be relaxed (e.g. less robust foundations or non-NZS3604 superstructure), refer to T+T letter "Stage 1-West: Geotechnical considerations for specific engineering design", 10 August 2020, ref. 1004625.003.

5. Site-specific shallow ground testing and observation of the exposed founding material must be undertaken during construction, to confirm that ground conditions encountered beneath building footprints are consistent with the geotechnical inputs assumed for design. This can be carried out by a soils technician or other suitably trained and supervised person, under the guidance of the ***CPEng. Engineer***.

   The following minimum requirements apply to confirm the assumed geotechnical parameters provided in Section 3.2.2.1 of the ***Earthworks Completion Report***:

   i. Visual observation of the exposed founding material does not reveal unsuitable material (e.g. organic topsoil, peat, expansive clays, soft/loose or saturated material, rubbish or buried objects).

   ii. The investigation to confirm determine the suitability and bearing capacity of the soil shall follow the procedure as generally outlined in NZS 3604:2011, except as modified below.

   iii. The depth of testing shall be 2m below the underside of the foundation or to refusal if deemed satisfactory by the ***CPEng. Engineer***.

   iv. As recommended in Section 3.4.1 of the MBIE Canterbury Guidance, Scala blows per 100 mm shall be minimum 2 blows (i.e. 50 mm per blow) for ground deemed to have 200 kPa geotechnical ultimate bearing capacity.

   If ground conditions encountered on site are not consistent with the assumptions on which our recommendations are based then additional undercut, compaction or support may be required, as determined by the ***CPEng. Engineer*** (who may judge it necessary to seek input from a ***Geotechnical Engineer)***.

   Construction observations should be documented in a "Construction Observation Report", which confirms that conditions encountered were as assumed for design; or details any additional ground preparation works undertaken or amendments to design assumptions required. This report will provide part of the supporting information relied upon by the ***CPEng. Engineer*** to issue a Producer Statement PS4 (Construction Review) to confirm that the building works have been completed in accordance with the Building Consent and Building Code.

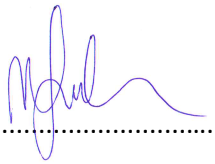
6 Applicability

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

We understand and agree that our report will be used by Palmerston North City Council in undertaking its regulatory functions in connection with the Centennial Park Stage 1 subdivision. We also understand and agree that our report will be provided to designers engaged by individual lot owners for the purpose of providing information about general conditions on the site, on the basis that any use or reliance on this report is at that party's sole risk. The responsibility for specific engineering design and construction review of foundations for individual buildings remains with the designers.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
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Christopher Sandoval	Mike Jacka
Geotechnical Engineer	Project Director

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Tonkin+Taylor

Job No: 1004625.003
10 August 2020

Wallace Development Company Ltd.
227 Broadway Avenue
Palmerston North 4410

Centennial Park, Palmerston North
Stage 1-West: Geotechnical considerations for specific engineering design

1 Background

Subdivision development earthworks have been completed for Stage 1 of Centennial Park. As detailed in the ***Earthworks Completion Report***, the ground preparation for Stage 1-West (the area shaded yellow in Figure 1.1 below) has been certified suitable for residential development subject to site-specific geotechnical assessment and specific engineering design.

This letter provides information about the general geotechnical conditions on the site, which should be taken into account as part of specific engineering design for buildings on each lot, and the associated Building Consent and Code Compliance certification.

This letter should be provided to purchasers of all lots in Stage 1-West, and passed on to the designers of all buildings on these lots.

Figure 1.1: Layout of Centennial Park Stage 1 subdivision. Two portions of Stage 1 have been defined for the purposes of this letter: Stage 1-West shaded yellow, and Stage 1-East shaded blue. Subdivision layout is as per the GHD Drawings 51-37652 Sheets -C003 to -C008 dated 26 June 2020.

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2 Engineering input required for design of individual buildings

Specific engineering design will be required for all buildings in Stage 1-West. Each individual building will require site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

In this letter, the term "***CPEng. Engineer***" refers to a Chartered Professional Engineer engaged by (or on behalf of) an individual lot owner, responsible for undertaking specific engineering design of a particular building on a particular site. This will typically include specification of foundation and superstructure details for Building Consent, and accompanying Producer Statements PS1 (Design) and PS4 (Construction Review). This engineer will typically have primary competence in structural or general civil engineering design, with no specific competence in geotechnical engineering. This engineer is responsible for recognising any matters which are outside their expertise (e.g. specialist geotechnical assessment) and seeking any specialist input needed.

In this letter, the term "***Geotechnical Engineer***" refers to a Chartered Professional Engineer with competence in geotechnical engineering engaged by (or on behalf of) an individual lot owner. This engineer is responsible for providing specialist geotechnical input to help inform the ***CPEng. Engineer*** undertaking building design.

3 Previous area-wide geotechnical reports

The following area-wide geotechnical reports should be read in conjunction with this letter:

Earthworks Completion Report: *T+T (2020), Centennial Park, Earthworks Geotechnical Completion Report, Stage 1, Lots 1 to 16 and 19 to 28, Wallace Development Company Ltd., 10 August 2020, Ref. 1004625.003.v07*

Liquefaction Assessment Report: *T+T (2019), Centennial Park, Palmerston North, Geotechnical Investigation and Liquefaction Assessment, Wallace Development Company Ltd., January 2019, Ref.1004625.001.v2*

4 Ground investigations

The existing area-wide ground investigations are summarised in the ***Liquefaction Assessment Report***, and the raw digital data is available on the NZ Geotechnical Database. This is expected to provide sufficient deep ground investigation information to support foundation design for Building Consent without the need for additional site-specific deep investigations in most cases. Any need for additional site-specific deep investigations would be a matter of judgement for the ***Geotechnical Engineer***, and would likely only be required in special circumstances (e.g. to suit the particular requirements of the preferred ground improvement and/or foundation option).

It is likely that site-specific shallow ground testing (e.g. hand augers and Scala penetrometer testing) and observation of the exposed founding material during construction will be required (as judged appropriate by the ***Geotechnical Engineer***). The purpose of this is to confirm that ground conditions encountered beneath the specific building footprint are consistent with the assumptions on which the building design was based, or to determine any additional undercut, compaction or support required.

We emphasise that there is an important difference between geotechnical engineering advice (also described as geotechnical input or geotechnical assessment) and geotechnical site investigations. Any requirements for further site investigations will depend on the ***Geotechnical Engineer's*** assessment of the existing area-wide deep ground investigations (CPT and boreholes), and how any uncertainty in ground conditions could impact on the specific building proposed. The ***Geotechnical Engineer*** might undertake additional deep site investigations (e.g. CPT testing or boreholes to confirm whether or not the liquefiable layer is present at the specific site), or they might decide further deep investigations are not required and only undertake shallow investigations to confirm the near-surface bearing conditions.

5 Specific building development requirements for each lot

5.1 Geotechnical context

For Stage 1-West, the ***Liquefaction Assessment Report*** identified the potential for Medium or High liquefaction vulnerability and lateral spreading susceptibility.

There is no "one size fits all" foundation option in this situation, as the best option will depend on the site-specific ground conditions and details of the particular building. Therefore design of the building for each lot will require site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

5.2 Minimum foundation requirements

Appendix E of the ***Earthworks Completion Report*** details the minimum foundation option covered by the ground preparation certification provided.

As an alternative to relying on this certification, completely independent specific engineering design could be undertaken to design a bespoke foundation/building solution. This should incorporate site-specific input from a ***CPEng. Engineer*** and a ***Geotechnical Engineer*** to demonstrate that the proposed building meets the performance requirements of the Building Code.

In either case, foundation and building performance expectations should be confirmed between the client and the design team to understand the risk associated with the site-specific ground conditions and specific building details.

5.3 Process for design of residential dwellings

An example process for geotechnical input and foundation design for each individual building is provided below (other approaches could also be suitable, provided they demonstrate compliance with the Building Code).

1. ***Geotechnical Engineer*** engaged by the homeowner confirms the lateral spreading and liquefaction vulnerability for the specific lot, taking into account the specific details of the proposed building and any site-specific investigations they might undertake:
    (a) As a minimum (required for all homes built anywhere in NZ) this would include shallow soil testing (e.g. Scala penetrometer and hand auger) directly beneath the proposed building footprint to confirm ground bearing capacity is sufficient and there are no unsuitable soils.
    (b) In some special cases (e.g. very heavy or complex buildings, or at the boundary between medium and high liquefaction vulnerability) the ***Geotechnical Engineer*** might also consider that deep investigations are required (e.g. CPT). But any need for deep investigations is expected to be rare as the previous area-wide investigations will generally inform the assumptions about deep ground conditions adopted for building consent design.

2. There are various potential outcomes from this site-specific geotechnical assessment:
    (a) In many cases the ***Geotechnical Engineer*** is likely to confirm that the previous area-wide lateral spreading and liquefaction vulnerability assessment (from the January 2019 report) is correct for the specific site.
    (b) In some cases the ***Geotechnical Engineer*** might determine that the hazard on the specific site is lower than indicated in the previous area-wide report, so less robust foundations could be considered.

(c) In rare cases the ***Geotechnical Engineer*** might determine that the hazard on the specific site is higher, so more robust foundations should be considered.

(d) In some cases rather than undertaking more detailed geotechnical assessment to precisely determine the site-specific hazard (e.g. Medium vs. High vulnerability), the ***Geotechnical Engineer*** might recommend adopting a more robust foundation. The cost of a robust foundation or geotechnical assessment may be similar, but investing in the foundation can provide greater certainty of outcome and a range of performance benefits.

3. Based on the site-specific assessment, the ***Geotechnical Engineer*** would provide guidance to the ***CPEng. Engineer*** about the ground conditions they need to design the foundation and building for on that specific lot. This should be provided in a "Site-Specific Geotechnical Assessment Report", including:

   (a) The load bearing capacity of the ground.

   (b) The magnitude of liquefaction-related settlement and lateral spreading displacement that needs to be accommodated in the structural design of the foundation.

   (c) Ground deformations that should be allowed for when detailing service connections.

   (d) Advice on foundation options (e.g. suitable types of enhanced foundation or ground improvement).

4. Based on this geotechnical input, the ***CPEng. Engineer*** would specify the foundation details required, and demonstrate that the performance requirements of the Building Code are satisfied. This information should be included in the Building Consent application in the form of a "Design Features Report", supported by a Producer Statement PS1 (Design).

   For Stage 1-West there are various potential outcomes, for example:

   (a) The ***CPEng. Engineer*** might choose to adopt one of the standardised TC2 or TC3 foundation concepts outlined in the MBIE Canterbury Guidance, if appropriate. Refer to Section 5.3 of the guidance for TC2 foundations, Section 15 for TC3 foundations, and Section 5.7 for service connections. This constitutes specific engineering design. However, in most cases the primary focus of this design will be selecting an appropriate option from the standard foundation concepts and detailing to suit the specific building and site.

   TC2 foundations are typically suitable to accommodate Medium liquefaction vulnerability, with TC3 foundations or ground improvement typically suitable to accommodate High liquefaction vulnerability and/or lateral spreading. Many of these foundation options have lower bearing capacity requirements than "good ground", requiring a capacity of only 200kPa (or less if foundations are redimensioned as per Section 3.4.1 and 5.4 of the guidance).

   MBIE have already determined how much ground displacement these standard options can accommodate, so to confirm that the foundation meets the relevant Building Code performance requirements the ***CPEng. Engineer*** simply has to choose an option which is rated for the bearing capacity, liquefaction settlement and lateral spread magnitudes provided by the ***Geotechnical Engineer***.

   (b) The ***CPEng. Engineer*** might choose to create their own bespoke design rather than adopting one of the standard TC2 or TC3 options. They might do this if they can design a foundation that is cheaper/easier to construct, or if it offers some other kind of performance advantage given the particular site conditions and building details, while still being suitable for the parameters provided by the ***Geotechnical Engineer***. This requires more detailed specific engineering design to demonstrate "from first principles" that the foundation meets the performance requirements of the Building Code. The MBIE guidance

provides guidance for specific engineering design in Section 5.4 for TC2 (similar to Medium liquefaction vulnerability), Section 15 for TC3 (similar to High liquefaction vulnerability or lateral spreading areas) and Section 5.7 for service connections.

5. It is likely that observation of the exposed founding material during construction will be required, potentially including testing such as Scala penetrometer or hand held shear vane. The purpose of this is to confirm that ground conditions encountered beneath the specific building footprint are consistent with the assumptions on which the building design was based, or to determine any additional undercut, compaction or support required. The scope of observation required, and the appropriate field personnel and supervision, should be as specified by the ***Geotechnical Engineer***.

   Construction observations should be documented in a "Construction Observation Report", which confirms that conditions encountered were as assumed for design; or details any additional ground preparation works undertaken or amendments to design assumptions required. This report will provide part of the supporting information relied upon by the ***CPEng. Engineer*** to issue a Producer Statement PS4 (Construction Review) to confirm that the building works have been completed in accordance with the Building Consent and Building Code.

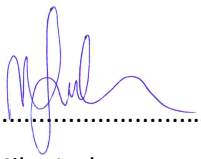
6 Applicability

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

We understand and agree that our report will be used by Palmerston North City Council in undertaking its regulatory functions in connection with the Centennial Park Stage 1 subdivision. We also understand and agree that our report will be provided to designers engaged by individual lot owners for the purpose of providing information about general conditions on the site, on the basis that any use or reliance on this report is at that party's sole risk. The responsibility for specific engineering design and construction review of foundations for individual buildings remains with the designers.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
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Christopher Sandoval	Mike Jacka
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