Christchurch City Council	Resource Management Act 1991 Christchurch District Plan Private Plan Change 11 Section 32 Evaluation and AEE	11

a) INCLUSION OF THE PROPERTY AT 254 FITZGERALD AVENUE, RICHMOND IN THE EDGE HOUSING OVERLAY SHOWN ON THE DEVELOPMENT PLAN IN APPENDIX 13.14.6.1 OF THE DISTRICT PLAN.
AND

b) INCLUSION OF THE PROPERTY AT 5 HARVEY TERRACE, RICHMOND, IN APPENDIX 13.14.6.2 OF THE SPECIFIC PURPOSE **Ō**T**Ā**KARO AVON RIVER CORRIDOR ZONE, WITH AN ALTERNATIVE ZONING OF RESIDENTIAL MEDIUM DENSITY

Overview

The following report has been prepared by the applicant in support of their request for a plan change to the Christchurch District Plan, which proposes to include the land at 254 Fitzgerald Avenue in the Edge Housing Overlay and 5 Harvey Terrace, Richmond, Christchurch into Appendix 13.14.6.2 of the Specific Purpose Ōtākaro Avon River Corridor (SPOARC) Zone with an alternative zoning of Residential Medium Density. The effect of this change would be to enable the properties to be developed for medium density housing under the proposed provisions.

This report has been prepared in accordance with the requirements of Section 32 (s 32) of the Resource Management Act 1991 (RMA).

The purpose of this change is to enable the application site to be developed for medium density housing. The site is at the edge of the Specific Purpose Ōtākaro Avon River Corridor Zone. It is separated from the river to the west by Fitzgerald Avenue, which is a 4-lane major arterial road, and to the south by Harvey Terrace and a wide strip of open land. The properties adjoin existing properties to the north and east which are zoned and occupied for medium density and low-medium density housing. The properties are privately owned.

The purposes of the river corridor zone are primarily for the redevelopment of earthquake damaged land along the river corridor for recreation access to the river, as well as landscape and ecological enhancement and cultural purposes. The zone also allows for residential use and development of a number of privately owned properties specified in the Appendix, and for small areas of "Edge" and "Trial" housing. Because of their location the application site is not considered to be ideally suitable for the primary purposes of the zone, but very suitable for medium density housing. However, it is appropriate to retain the site in the zone to ensure its development complements the values of the river corridor.

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1 Introduction

1.1 Purpose of this report

1.1.1 The overarching purpose of section 32 (s32) of the Resource Management Act 1991 (RMA) is to ensure that plans are developed using sound evidence and rigorous policy analysis, leading to more robust and enduring provisions.

1.1.2 Section 32 requires that the applicant provides an evaluation of the changes proposed in a request for a Plan Change to the Christchurch District Plan (the Plan). The evaluation must examine whether the proposed objectives are the most appropriate way to achieve the purpose of the RMA, and whether the proposed provisions are the most appropriate way to achieve the objectives of the Plan. The report must consider reasonably practicable options and assess the efficiency and effectiveness of the provisions in achieving the objectives. This will involve identifying and assessing the benefits and costs of the environmental, economic, social and cultural effects anticipated from implementing the provisions. The report must also assess the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions.

1.1.3 The purpose of this report is to fulfil the s32 requirements for proposed Plan Change 11 -. In addition, the report examines any relevant directions from the statutory context including higher order documents and provides an Assessment of Environmental Effects (AEE) in Appendix 1.

2 Resource Management Issues

2.1 Legal obligations and strategic planning documents

2.1.1 Section 73(2) of the RMA and Clause 21, Part 2 of Schedule 1 provide for private requests for changes to a district plan. Clause 22 of Schedule 1 sets out the requirements for what a plan change request must address and contain, including an explanation of the purpose of and reasons for the plan change request, a section 32 evaluation report and an assessment of environmental effects which takes into account the provisions of Schedule 4, clauses 6 and 7.

2.1.2 Sections 74 and 75 of the RMA set out legal obligations when changing a District Plan. Consideration needs to be given to whether the plan change accords with and will assist the Council in carrying out its functions under Section 31 of the RMA to, among other things, achieve integrated management of the effects of the use, development, or protection of land and associated resources. This includes the control of the actual and potential effects of land use or development on the environment in accordance with the provisions of Part 2 while recognising and providing for Section 6 matters, having particular regard to Section 7 matters, and taking into account Section 8 matters.

2.1.3 As required by s74 and s75 of the RMA, a Plan Change must specifically give effect to, not be inconsistent with, take into account, or have regard to the following "higher order" documents / provisions which provide directions for the issues relevant to this plan change.

a. National Policy Statement for Urban Development 2020

i. As set out in the accompanying Assessment of Environmental Effects, Objective 3 of the NPSUD requires the Christchurch City Council to provide sufficient land that is enabled for anticipated residential development. Policy 3 requires that within Central City Zones or walkable distance of them, as this site is, such residential development should be enabled to be constructed to 6 stories.

ii. Policy 4 provides an exception for this, where there exists what are described as qualifying matters. These are explained more specifically in clauses 3.32 and 3.33. In summary qualifying matters include areas that may be unsuitable for such intense development. It is probable that the presence of the Avon River corridor in close proximity, as well as the existence of soft soils suitable for only light weight construction, as discussed in the accompanying geotechnical assessment, could amount to a qualifying matter. In any case the NPS is yet to be implemented by the Christchurch City Council through district plan changes. Overall, it is considered that the NPSUD is encouraging of higher density residential development in this area but not yet in a determinative manner, i.e., one that must be implemented. There is nothing in the NPSUD which deals specifically with the Avon River Corridor Zone, or similar areas.

iii. This proposal would assist in a small way to the provision of additional housing, so is consistent with Objective 3.

iv. It is therefore concluded that little weight needs to be given to the NPSUD for the purposes of this plan change.

b. Canterbury Regional Policy Statement (CRPS)

i. Chapter 6 of the Canterbury Regional Policy Statement deals with earthquake recovery.

ii. Issue 1 of the RPS – Enabling Recovery, Rebuilding and Development is

How to provide certainty to the community and businesses around how Greater Christchurch will accommodate expected population and household relocation and growth, housing needs and economic activity during the recovery period in an efficient and environmentally sustainable manner. This includes providing for a diverse community with a range of incomes, needs and business types.

Issue 2 - Adverse Effects Arising from Development states that

Development can result in adverse effects on the environment, which if not identified and avoided, remedied, or mitigated where appropriate, could result in inappropriate outcomes for the region's natural and physical resources, and reduce Greater Christchurch's resilience and ability to provide for the needs of people and communities.

Objective 6.2.1 is seeking that

Recovery, rebuilding, and development are enabled within Greater Christchurch through a land use and infrastructure framework.

Objective 6.2.2 Urban form and settlement pattern seeks that

The urban form and settlement pattern in Greater Christchurch is managed to provide *sufficient land for rebuilding and recovery needs and set a foundation for future growth, with an urban form that achieves consolidation and intensification of urban areas, and avoids unplanned expansion of urban areas, by, among other matters:*

2. providing higher density living environments including mixed use developments and a greater range of housing types, particularly in and around the Central City,

Objective 6.2.3 seeks

6.2.3 Sustainable Recovery and rebuilding is undertaken in Greater Christchurch that:

1. provides for quality living environments incorporating good urban design;

2. retains identified areas of special amenity and historic heritage value;

3. retains values of importance to Tāngata Whenua;

4. provides a range of densities and uses; and

5. is healthy, environmentally sustainable, functionally efficient, and prosperous

Policy 6.3.1-Development within the Greater Christchurch provides a framework for urban development within the Greater Christchurch Metropolitan area, including a Map showing where substantial new development is to occur.

Overall, it is considered the RPS deals with urban development at a high level, metropolitan scale. The RPS is implemented by the territorial local authorities through their district plans. The Christchurch City Council has been prepared in the light of the RPS and gives effect to it.

It is concluded that this application is broadly consistent with these key provisions of the RPS, but that there is nothing in the RPS which is specific enough to give detailed guidance as the outcome of the application, so little weight needs to be given to it for the purposes of this plan change application. The Christchurch District Plan is the more appropriate vehicle to consider a small-scale local proposal such as this one.

c. The **Ō**t**ā**karo Avon River Corridor Regeneration Plan

This plan was prepared by the Crown and the Christchurch City Council to set out a vision for the use of the land along the Avon River corridor that was severely affected by the Canterbury earthquakes. It identifies a number of subareas within the corridor where specific projects are intended, as well as accesses into and along the corridor. Several sites are identified for Edge Housing and Trial Housing Areas. The application site is not identified as part of any of these subarea or projects, but instead is included in the general Green Spine.

As discussed in the Assessment of Environmental Effects (the AEE) which is attached in Appendix 1, which should be read together with this section 32 Assessment, the application site does not strongly reflect the core values and opportunities the Regeneration Plan seeks to protect and promote. As discussed in the Landscape and Urban Design Report the proposed development will have no more than minor, and in most cases negligible effects on the values and specific proposals promoted by the Regeneration Plan and would provide a more appropriate edge to the river corridor than the present rather irregular boundary in this location. The application is therefore consistent with the Regeneration Plan.

2.1.4 No other management plans or strategies prepared under other Acts are relevant to the resource management issue identified.

2.1.5 As mentioned above, the RMA prescribes certain requirements for how district plans are to align with other instruments. Whether the District Plan objectives and provisions relevant to them do that will be discussed in section 5.1 of the report.

2.2 Problem definition - the issues being addressed

2.2.1 ISSUE 1 - A small block of privately owned vacant land at 254 Fitzgerald Avenue and 5 Harvey Terrace is within the Specific Purpose Ōtākaro Avon River Corridor Zone. The land is not proposed to be developed for the primary purposes of that zone by any public authority. The owner has no interest in carrying out such development and wishes to develop it for housing. This is not currently provided for by the provisions of the zone.

2.2.2 ISSUE 2 – Development under the present zoning provisions would require resource consent applications for non-complying activities at each stage, with significant expense and uncertainty, due to aspects of the relevant objectives and policies which could count against such

applications, as outlined in the accompanying Assessment of Environmental effects. The owners do not wish to undertake this without greater certainty.

2.2.3 The desired outcome would not require a revision of objectives, or policies, and only minor technical adjustments to rules. All that is required is the insertion of the two application sites respectively in the Edge Housing Overlay in Appendix 13.14.6.1, and the table of privately owned properties in in Appendix 13.14.6.2 of the District Plan with an alternative zoning of Residential Medium Density, and the insertion of rules to ensure that access to the proposed new dwellings as a permitted activity is restricted to the Harvey Tce frontage. This will enable the applicant to undertake its proposed developments under the already existing rules, in exactly the same manner as other similar sites that are already listed in the Appendices.

3 Development of the plan change

3.1 Background

3.1.1 The resource management issues set out above have been identified through the assessment of the current district plan relevant to the issues and other documents relating to the Ōtākaro River corridor, such as the Ōtākaro River Regeneration Plan.

3.1.2 The situation has arisen through the applicant's desire to erect a new dwelling on the land at 254 Fitzgerald Avenue next door to its existing 4 unit apartment block dwelling at No 256, and the opportunity to acquire the adjacent land at No 5 Harvey Terrace from the Crown.

3.1.3 The current provisions in the District Plan have arisen because of the Canterbury Earthquakes when large areas of land, including the application sites along the lower reaches of the Avon River and in other parts of Christchurch were badly affected, particularly by liquefaction and lateral slumping towards the river. A large number of buildings were damaged beyond economic repair. The land was declared by the Government to be a "red zone". The affected owners were given an offer of purchase by the Crown, which most but not all accepted, and most but not all of the red zone was cleared. This presented an opportunity for redeveloping the river corridor for the as an environmental, recreational, and cultural asset. When the district plan was reviewed the affected land was given a zoning of Specific Purpose Ōtākaro Avon River Corridor.

3.1.4 The provisions of this zone largely reflect the new primary purposes of this zone, but provision was made for the retention of remaining privately owned houses and limited numbers of new dwellings through the rules, as described in the overview above and in the AEE document in Appendix 1. The application properties were not included in either the Edge Housing Overlay or the table of existing privately owned properties in the zone created by the new zone provisions, because at the time they were not owned by the applicant. However, they are generally very similar to properties nearby which have been identified for those purposes.

3.1.5 The suitability for housing of the application sites has been improved by the construction by the Council of a large retaining wall along the riverbank on the opposite side of Fitzgerald Avenue which has reduced the potential for lateral slumping, as discussed in the attached geotechnical report in Appendix 2.

3.1.6 Technical advice from various experts has been commissioned to assist with assessing the existing environment/issues and the potential effects of the proposal on the environment, as well as the potential options for mitigating the adverse effects. This advice includes the following:

Table 1: Technical Reports informing Plan Change XX

	Title	Author	Description of Report
a.	Geotechnical Assessment		Geotechnical conditions/ land contamination/ remediation requirements/ costs
b.	Visual Amenity		Assessment of visual and other amenity effects on the existing/ neighbouring environment (urban design, setbacks, landscaping, glare etc.)

3.2 Current Christchurch District Plan provisions

3.2.1 The current Plan's Strategic Directions objectives, chapter objectives and provisions relevant to this plan change are set out and discussed in the AEE which is attached as Appendix 1.

3.2.2 The rules provide do not provide for the applicant's proposal as a permitted controlled, restricted discretionary or discretionary activity.

3.3 Description and scope of the changes proposed

3.3.1 The Plan Change does not propose any changes to the objectives and policies of the Plan.

3.3.2 The purpose of the Plan Change proposal is to enable the properties to remain in the Specific Purpose Ōtākaro Avon River Corridor Zone and to be developed for housing under the provisions of the Edge Housing Overlay and the Residential Medium Density (RMD) Zone. The plan change proposes to do this by the insertion of the property at 254 Fitzgerald Avenue in the Edge Housing Overlay and the property at 5 Harvey Terrace in the Table in Appendix 13.14.6.2 with an alternative zoning of Residential Medium Density.

3.4 Community/Stakeholder engagement

3.4.1 No consultation has been undertaken with any parties.

4 Scale and significance evaluation

4.1 The degree of shift in the provisions

4.1.1 The level of detail in the evaluation of the proposal has been determined by the degree of shift of the scale of effects anticipated from the proposal.

4.1.2 The degree of shift in the provisions from the status quo is not significant as the proposal is very localised and the outcomes will only be perceptible in the near vicinity of the sites, for example passers-by who will have a very brief view of the sites, and immediate neighbours who will be more aware of the new dwellings proposed to be constructed. As these will be modern dwellings constructed in accordance with the RMD zone provisions, and as the amount of open space in the vicinity will remain very large, the effects on the amenities of those neighbours are considered to be low.

4.1.3 The degree of shift in the provisions is therefore considered to be very low.

4.1.4 The scale and significance of the likely effects anticipated from the implementation of the proposal has also been evaluated. The initial assessment of the environmental effects anticipated has been verified by the specialist advice obtained. It is considered that the effects of the proposal:

a. Will result in effects that have been considered, implicitly or explicitly, by higher order documents,

b. Are of localised significance and will have localised impact,

c. Will affect a very limited number of individual property owners in the immediate vicinity and have low impact on private properties,

d. Will contribute to the City's recovery,

e. Will have positive effects,

f. Will not impose significant costs on individuals or communities.

5 Evaluation of the proposal

5.1 Statutory evaluation

5.1.1 Refer to section 2.1 above and the Assessment of Environmental Effects (see Appendix 1) for the evaluation of relevant statutory documents.

5.2 Evaluation of the purpose of the plan change

5.2.1 Section 32 requires an evaluation of the extent to which the objectives of the proposal are the most appropriate way to achieve the purpose of the Act (s 32(1)(a))

5.2.2 The existing objectives of the operative Christchurch District Plan are not proposed to be altered or added to by this Plan Change. This report, therefore, evaluates the extent to which the purpose of the Plan Change is the most appropriate way *to* achieve the purpose of the Act.

5.2.3 The evaluation, therefore, examines whether:

a. the purpose of the plan change (s32(6)(b)) is the most appropriate way to achieve the purpose of the Act (s32(1)(a));

b. the provisions in the proposal are the most appropriate way to achieve the purpose of the plan change (refer to section 5.3 below) and

c. the provisions in the proposal implement the unaltered objectives of the District Plan (refer to section 5.3 below). One alternative purpose is also evaluated. [*s75(1)*].

5.2.4 The following table provides an evaluation of the purpose of the proposed Plan Change as well as an alternative purpose of retaining the status quo to establish which is the most appropriate way to achieve the purpose of the Act (s32(1)(a) and s32(6)(b)).

Purpose of the proposal	Summary of Evaluation
Purpose of the Plan Change as proposed The purpose of the Plan Change proposal is to enable the properties to remain in the Specific Purpose Ōtākaro Avon River Corridor Zone and to be developed for Edge Housing medium density	*a. The intent of the Plan Change is to facilitate development of a small site at the fringe of the Avon River corridor, and to increase the supply of housing in Christchurch consistent with Objective 3 of the NPSUD, Objective 6.2.2 of the Regional Policy Statement Objective 13.14.2.1(b) of the Christchurch District Plan.* *b. The implementation of the plan change will provide for a level of amenity that will be appropriate for both the*

housing under the provisions of the Edge Housing Overlay and the Residential Medium Density Zone.	*adjacent medium density residential and the river corridor environments, and* *c. The proposal seeks to address the following resource management issues identified earlier, namely:* *i. Issue 1, the unlikelihood of the sites being developed for the primary purposes of the SPOARC zone in the foreseeable future, and* *ii. Issue 2, the ongoing costs and uncertainty for the owners to be able to develop the sites for residential purposes through applying for resource consents.* *d. The proposed Plan Change would promote the sustainable management purpose of Section 5 of the RMA by:* *i. Enabling development of housing in a locality already allocated for that purpose without adversely affecting the open space and natural values of the river corridor environment.* *ii. Being consistent with the Recovery Strategy, Ōtākaro River Regeneration Plan and Chapter 6 of the CRPS.* *e. Provide for the efficient use of land as a resource* *f. There no disadvantages foreseen from this proposal*
Alternative purpose *Retain status quo with no changes to provisions* *The sites would remain in the SPOARC zone with no recognition of their privately owned status*	*a. The current, unchanged rules do not provide any opportunity for alternative development under the rules. No development for the primary purposes of the zone would be likely to be undertaken by either the owners or the Council and if the owners wished to carry out development, they would need to apply for non-complying activity resource consents. The land potentially could remain an open area of grass for the foreseeable future, and a maintenance liability for the owner.* *Retaining the status quo would (in the context of Part 2 matters):* *b. not be inconsistent with the higher order documents or the objectives of the district plan, but* *c. not provide any positive benefits for the owners, the public or the natural environment…..*
Summary of evaluation: *The plan change purpose is the most consistent with the Plan objectives and higher order directions and will best achieve them. Retaining the status quo would not resolve the issues identified in 2.2*	

5.2.5 The above analysis indicates that the purpose of the Plan Change implements the Plan objectives and higher order directions. These promote an increased supply of medium density housing in Christchurch, the development of the Avon River corridor for environmental, ecological, recreational and cultural purposes but also allow for limited development of housing in selected

areas including on land in the SPOARC zone retained by private owners. By comparison, the alternative purpose of retaining the status quo would not resolve the issues outlined earlier, implement the relevant objectives in full or be fully consistent with the relevant higher order documents, and would not achieve the purpose of the Act.

5.2.6 It is, therefore, considered that the purpose of the Plan Change is the most appropriate way to achieve the purpose of the Act.

5.2.7 In establishing the most appropriate provisions for the proposal to achieve the purpose of the plan change, reasonably practicable options for provisions were identified and evaluated.

5.3 Reasonably practicable options

5.3.1 In considering reasonably practicable options for achieving the objectives of the Plan and any relevant higher order directions, the following options have been identified. Considering the environmental, economic, social and cultural effects, the options identified were assessed in terms of their benefits, and costs. Based on that, the overall efficiency and effectiveness of the alternative options was assessed.

5.3.2 Option 1 – Status quo. The sites would be retained in the SPOARC zone without inclusion in Appendix 13.4.6.2 or the Edge Housing Overlay. Any development for purposes other than the primary purposes of the zone would necessitate successfully obtaining a resource consent or consents. Such consents would be non-complying activities. If development proceeded in stages, this process would need to be repeated for each stage.

5.3.3 Option 2 – The sites would be rezoned as Residential Medium Density. Opportunity would be taken to include the site at 256 Fitzherbert St as RMD.

5.3.4 Option 3 – The sites would be rezoned as Residential Suburban Density Transitional.

5.3.5 Option 4 – Proposed Plan Change. Include the application site at 5 Harvey Tce in Appendix 13.14.6.2 and the site at 254 Fitzgerald Avenue in the Edge Housing Overlay.

5.4 Evaluation of options for provisions

5.4.1 The policies of the proposal must implement the objectives of the District Plan (s75(1)(b)), and the rules are to implement the policies of the District Plan (s75(1)(c)).

5.4.2 In addition, rule *[*is to be examined as to whether it is the most appropriate way for achieving the *purpose [s32(6)(b)]* of the plan change (s32(1)(b)).

5.4.3 Before providing a detailed evaluation of the rules proposed *in* the plan change, the alternative options identified have been considered in terms of their potential costs and benefits and overall appropriateness in achieving the objectives of the Plan and the relevant directions of the higher order documents*]*.

5.4.4 The tables below summarise the assessment of costs and benefits for each option based on their anticipated environmental, economic, social, and cultural effects. The assessments are supported by the information obtained through technical reports, consultation, etc. ….

5.4.5 The overall effectiveness and efficiency of each option has been evaluated, as well as the risks of acting or not acting.

5.4.6 Option 1 - Status quo

Benefits	Appropriateness in achieving the objectives/ higher order document directions
Environmental:	Efficiency:

<table>
<tr><td>The land would remain in open space, and if maintained well it would not detract from the local landscape.</td><td rowspan="10">This option would be unable to achieve the objectives of the higher order documents or the district plan in full.

It would not achieve any positive environmental, recreational or cultural benefits, or any economic activities.

It would not provide for residential activities on the privately owned land, as promoted by policy 13.14.2.1.4 of the District Plan.

It would not provide an appropriate edge to residential land. At best it would see the land retained as a vacant and passive piece of open space.

Therefore, this is not regarded as an efficient option.

Effectiveness

This option would not be effective in achieving any of the desired outcomes for the zone unless the Council acquires the land.</td></tr>
<tr><td>Economic:

Nil</td></tr>
<tr><td>Social:

Nil</td></tr>
<tr><td>Cultural:

Nil</td></tr>
<tr><td>Costs</td></tr>
<tr><td>Environmental:

Nil, unless the land is poorly maintained.</td></tr>
<tr><td>Economic:

Loss of economic return for owners and developers.</td></tr>
<tr><td>Social:

Loss of a small supply of housing</td></tr>
<tr><td>Cultural:

Nil</td></tr>
<tr><td colspan="2">Risk of acting/not acting

The risk of the identified costs and benefits occurring is considered to be high, while noting that some of these costs and benefits are relatively minor.</td></tr>
<tr><td colspan="2">Recommendation: This option is not recommended as it is considered the only benefit would be the retention of a small area of privately-owned land in undeveloped open space, and the cost to the owners and the community would exceed this benefit.</td></tr>
</table>

5.4.7 Option 2 – Rezone subject sites and 256 Fitzgerald Avenue as Residential Medium Density

<table>
<tr><th>Benefits</th><th>Appropriateness in achieving the objectives/ higher order document directions</th></tr>
<tr><td>Environmental:

An appropriate edge would be provided to the river corridor along Fitzgerald Avenue and Harvey Terrace. An increased supply of housing would occur.</td><td rowspan="2">Efficiency:

This option would be highly effective in achieving the objectives and policies of the higher order documents and the district plan.</td></tr>
<tr><td>Economic:

Economic benefits would result from the increased supply of housing to the present</td></tr>
</table>

and future owners and occupiers, and to the construction industry.	Effectiveness: This option would be effective in achieving the objectives of the higher order documents and the district plan.
Social: An increased supply of housing	
Cultural: Nil	
Costs	
Environmental: Loss of opportunity to develop the sites for the primary purposes of the SPOARC zone	
Economic: Nil	
Social: Nil	
Cultural: Nil	
Risk of acting/not acting This option would have similar outcomes to the option applied for, but without the opportunity for enhanced landscaping at the corner of Fitzgerald Avenue and Harvey Terrace to provide a visual transition towards the river corridor.	
Recommendation: This option is not recommended as it is considered that attention should be drawn to the proximity of the river corridor zone when preparing and assessing plans for future development. However, there is a very narrow margin between this option and the option applied for	

5.4.8 Option 3 – Rezone subject sites and 256 Fitzgerald Avenue as Residential Suburban Density Transitional

Benefits	Appropriateness in achieving the objectives/ higher order document directions
Environmental: An appropriate edge would be provided to the river corridor along Fitzgerald Avenue and Harvey Terrace. An increased supply of housing would occur.	Efficiency: This option would be efficient in achieving the objectives and policies of the higher order documents and the district plan, although not to the same extent as the preferred option.
Economic: Economic benefits would result from the increased supply of housing to the present	

and future owners and occupiers, and to the construction industry.	
Social: Increased housing supply	
Cultural: Nil	
Costs	Effectiveness: This option would be moderately effective in achieving the objectives of the higher order documents and the district plan.
Environmental: Loss of opportunity to develop the sites for the primary purposes of the SPOARC zone. This is regarded as a minor cost only as the site is not necessary or completely suitable for the primary outcomes sought by the zone as discussed in the Assessment of Effects	
Economic: Nil	
Social: Nil	
Cultural: Nil	
Risk of acting/not acting This option would have very similar outcomes to the option applied for, with potentially a lesser level of housing development. There would be little risk, as the social and economic benefits outweigh the costs by a significant margin.	
Recommendation: This option is not recommended as it is considered that the benefits would be less than Option 2 or the preferred option.	

5.4.9 Summing up, Option 1 is not considered to be efficient or effective, and Options 2 and 3 are not considered as efficient and effective in achieving the objectives of the Plan and the relevant directions *of* higher order documents as the preferred option.

5.4.10 The detailed evaluation of Option 4, the preferred option, follows.

6 Evaluation of the preferred option for provisions

6.1.1 Option 2 is the proposed plan change, which is to include the application site in Appendix 13.14.6.2 with an alternative zoning of Residential Medium Density.

6.2 Assessment of proposed rules

6.2.1 The proposed amendments to Appendix 13.14.6.2 insert the site at 5 Harvey Terrace property into the Appendix with alternative zoning of residential Medium Density, in order to achieve the

opportunity of medium density residential development and the establishment of a more appropriate edge to the river corridor zone.

6.2.2 The proposed amendments to Appendix 13.14.6.1 insert the site at 254 Fitzgerald Avenue into the Edge Housing Overlay, which will enable a visual transition into the river corridor to the south across Harvey Terrace.

6.2.3 The proposed amendments to Rule 14.4.1.1 P23 and P33, Rule 13.14.4.1.3 1 RD1 and RD2, Rule 13.14.4.2.11 and Rule 13.14.4.11 ensure that access to the proposed new dwellings will be restricted to their Harvey Tce frontage, or be subject to restricted discretionary activity procedures to protect the continuity of the landscape frontage on Fitzgerald Avenue and the safety and efficiency of traffic there.

Benefits
Environmental: An edge would be provided to the Special Purpose Ōtākaro Avon River Corridor Zone which follows road boundaries, Fitzgerald Avenue and Harvey Terrace. This is considered preferable the present irregular boundary as it would be a clean, straight identifiable edge that addresses the predominantly linear form of the zone and overlooks and activates the zone. This would continue the edge as exists already to the east along Harvey Terrace. There would be an exception to this, immediately to the north of number 256 Fitzgerald Avenue where an isolated and vacant site owned by the Christchurch City Council would remain in the SPOARC zone but not within the Appendix. This site would be isolated from the river corridor and may also be suitable for a change in its zoning status as its contribution to the core values of the zone are probably even less than the application sites, but that would need to be promoted by the Council.
Economic: There would be economic benefits for the owners from the proposed residential development, any future owners and occupiers and the construction industry.
Social: Social benefits would arise from the housing development which would provide a small contribution to resolving the housing crisis and enable people to live in an attractive location close to the river corridor and the central city.
Cultural: No cultural benefits are foreseen.

Costs
Environmental: Loss of opportunity to develop the sites for the primary purposes of the SPOARC zone. This is regarded as a negligible cost only as the site is not necessary or completely suitable for the primary outcomes sought by the zone as discussed in the Assessment of Effects and not likely to be developed for those purposes anyway. It is noted also that the Council is likely to have much more significant priorities for regeneration in the zone.
Economic:

Nil
Social: Some potential amenity effects for immediate neighbours in Harvey Tce who will experience residential neighbours rather than open space. These will be mitigated through the application of the RMD rules and will be less than minor, or any developments will be limited notified to them under the rules.
Cultural: Nil

6.2.4 This proposed amendment to the rules will enable this privately owned land to be developed for an appropriate purpose, medium density housing, without adversely affecting the amenities of the river corridor, both as they exist at present and as they will exist in future as the Ōtākaro River Regeneration Plan continues to be implemented. In particular it will provide an appropriate edge to the river corridor which will activate and overlook it, increasing usage and security there. This option will provide the private owners an economic option for the use of their land and increase the likelihood of it not remaining vacant and becoming a maintenance burden. This option is marginally more efficient and effective than Options 2 and 3, because it would maintain the awareness of the river corridor and the need to protect its amenities when undertaking development. It is far more efficient than Option 1, the status quo because it removes the need for non-complying activity applications with their cost and uncertainty and which would be at least inconsistent with several aspects of the district plan objectives and policies.

Consistency with the policies and appropriateness in achieving the objectives
Efficiency: This option will give effect very efficiently to Policy 13.14.2.1.4 - Continuation of Pre-Earthquake Activities which seeks in subclause a) to provide for *residential activities and other existing activities on existing properties in private ownership in the River Corridor.* This option will also be consistent with the higher order documents and with the objectives and policies of the district plan especially with Objective 13.14.2.1 – Regeneration. Part b) of this objective is that the Ōtākaro Avon River Corridor supports opportunities for other uses and activities that are compatible with the priority outcomes including limited residential development on the outer edge of the Zone to improve integration between the edge of existing neighbourhoods and the activities within the Ōtākaro Avon River Corridor. It is therefore an appropriate way to achieve this objective which is directly relevant to the properties subject to the application.
Effectiveness: This option will be effective in addressing the relevant objectives and policies which apply at the edge of the SPOARC zone and to privately owned properties in the zone.
Risk of acting/not acting The risks of acting in the proposed manner are considered to be minimal. The risk of not acting is the land may be left undeveloped, in a vacant state which would be a maintenance burden

on the owners and may not be adequately maintained. Alternatively, there is a risk of placing an unnecessarily difficult consenting regime on the owners.

6.3 The most appropriate option

6.3.1 The option discussed in 6.2 above is the preferred option, because it is more efficient and effective in achieving those objectives and policies of the SPOARC zone which apply specifically to the edges of the zone and to privately owned properties within the zone and would have less than minor adverse effects on activities in the balance of the zone or on immediately adjoining owners and occupiers.

7 Conclusions

7.1.1 The conclusion is the preferred option would be the most efficient, effective and appropriate outcome for the owners of the land and the best means to achieve and give effect to the objectives and policies of the district plan.

APPENDIX 1 - ASSESSMENT OF ENVIRONMENTAL EFFECTS

CHRISTCHURCH DISTRICT PLAN

PROPOSED PLAN CHANGE 11

ASSESSMENT OF ENVIRONMENTAL EFFECTS

Primary Purposes of the district plan

The effects on the environment of the proposal can be identified from the objectives and policies of the Specific Purpose Otakaro Avon River Corridor zone. The intended priority and other outcomes of the zone are well described in the single objective for the zone, as follows.

13.14.2.1 Objective - Regeneration

a) *The regeneration of the Specific Purpose Ōtākaro Avon River Corridor achieves the following priority outcomes:*

   i. *Significant areas of restored natural environment containing a predominance of indigenous planting, wetlands and restored habitat for indigenous fauna, birdlife and indigenous species, improved surface water quality and provision for the practice of mahinga kai;*

   ii. *Flood hazard and stormwater management infrastructure that mitigates natural hazard risks for the Ōtākaro Avon River Corridor and surrounding areas and is integrated with the natural landscape;*

   iii. *Accessibility and connectivity across and along the Ōtākaro Avon River Corridor, and with existing communities; and*

   iv. *A predominance of natural and open spaces, with limited areas of built development concentrated in specific Reaches, residential areas, Activity Area Overlays and Landing Overlays.*

b) *The Ōtākaro Avon River Corridor supports opportunities for other uses and activities that are compatible with the priority outcomes in a. above, including:*

   i. *Increased opportunities for recreation, cultural activities and community-based activities;*

   ii. *A range of visitor attractions and limited small-scale retail activities;*

   iii. *Limited residential development on the outer edge of the Zone to improve integration between the edge of existing neighbourhoods and the activities within the Ōtākaro Avon River Corridor;*

   iv. *Varied learning, experimenting and research opportunities, including testing and demonstrating adaptation to natural hazards and climate change; and*

   v. *Transitional activities and structures where these do not compromise the priority outcomes in a. above.*

c) *The continuation of pre-earthquake activities on privately-owned properties that still exist within the Ōtākaro Avon River Corridor.*

Assessment

The proposal will not contribute to natural regeneration, natural hazard mitigation, accessibility, recreational or cultural purpose in subclause (a) of the objective. However it is considered to be consistent with subclause b) iii, as it would provide an enhanced green frontage to Fitzgerald Avenue and be a relatively small residential development at the outer edge of the zone in a location which would provide a clean and easily identifiable boundary between the green spine and adjacent housing areas. It is fully consistent with subclause c).

Several policies follow this objective.

13.14.2.1.1 Policy - Ōtākaro Avon River Corridor Areas

a. *Recognise that areas within the Ōtākaro Avon River Corridor have different priorities, characteristics and expected levels of built form, by spatially defining different areas within the Ōtākaro Avon River Corridor and managing these areas to:*

i. *Provide for the activities identified as 'Intended Activities' in Table 1 below, and ensure other activities are compatible with the 'Character Outcomes' and 'Intended Activities' in Table 1 below.*

ii. *Avoid other activities that are not compatible with the 'Character Outcomes' or 'Intended Activities' in Table 1 below.*

Provide for limited retail activities which support the 'Intended Activities' within the Zone, while ensuring that they do not undermine the continued viability of nearby commercial centres.

Table 1- Corridor Areas And Overlays of Policy 1 states that the for the Green Spine

> *The Green Spine is to be predominantly natural open space providing for stormwater management, flood protection and significant ecological restoration, with enhanced indigenous habitat and mahinga kai opportunities.*
> *Stormwater management and flood protection activities are to be integrated into a naturalised and ecologically restored environment.*
>
> *The Green Spine will be largely free of built development, providing a continuous area of public open space with trails, paths and footbridges, extending from the central city to the sea.*
>
> *Built development and other activities will be largely limited to and concentrated in the Landing Overlays, Edge Housing Area Overlays, an Activity Area Overlay and Trial Housing Area Overlays (refer below).*

Assessment

The proposal is not completely consistent with this policy or Table 1 as these "largely" limit housing to defined Edge Housing Areas and Trial Housing Areas. However only a very small 18 metre wide frontage on Harvey Tce would be outside the Edge Housing Overlay with the rest of the site within it. Therefore it is considered that the subject sites come within the exception created by the use of the word "largely" in Table 1 of the policy.

The proposal does not follow the existing legal boundaries in all respects. In particular the proposed Edge Housing Area overlaps the boundaries of No 256 Fitzgerald Avenue and No 5 Harvey Tce slightly. This will be corrected by a later subdivision. This slight overlap does not affect the conclusion that the Green Spine will remain largely free of built development and built development will be largely limited to the areas referred in Table 1.

13.14.2.1.2 Policy - Supporting Regeneration Activities

(a) Recognise that the process of regeneration is ongoing and adaptive, and provide for this through:

i. *enabling transitional activities and structures where these do not compromise the priority outcomes in Objective 13.14.2.1a. or the Character outcomes and Intended Activities indicated in Policy 13.14.2.1.1;*

ii. *focusing the management of amenity effects on neighbouring properties and activities, predominantly at adjacent zone boundaries and boundaries of private properties that still exist within the Zone;*

iii. *utilising a global consent process where appropriate for particular categories of large scale and ongoing activities;*

iv. *updating the Development Plan in Appendix 13.14.6.1 to reflect the locations of facilities as they are developed; and*

v. *acknowledging that there will be some loss of indigenous biodiversity associated with the development of Landings and new infrastructure, except within inanga spawning sites which will be protected, and recognising that over time there will be a significant net gain in indigenous biodiversity across the Corridor as a whole.*

Assessment

It is considered that the proposal is consistent with subclauses I and ii of the policy and clauses ii to v are not relevant.

13.14.2.1.3 Policy - Providing for Stormwater Management, Flood Hazard Mitigation and Transport Infrastructure

a) *Provide for stormwater management and flood hazard mitigation and protection works when undertaken by or on behalf of the Council, the Canterbury Regional Council or the Crown, having regard to potential adverse effects;*

b) *Avoid activities that would individually or cumulatively significantly compromise the provision and effective functioning and integrity of identified, existing and proposed stormwater, flood management and transport infrastructure; and*

c) *Provide for indigenous flora, fauna, habitat, mahinga kai and amenity restoration and enhancement in the design of stormwater and flood hazard mitigation and protection works.*

Assessment

The proposed development will be carried out in accord with the requirements of the Residential Medium Density Zone and Edge Housing Overlay and will be fully consistent with this policy. The site is not in a Flood Management Overlay. It is within the liquefaction hazard overlay and the relevant rules in chapter 5 Natural Hazards would apply to any development.

13.14.2.1.4 Policy - Continuation of Pre-Earthquake Activities

a) *Provide for residential activities and other existing activities on existing properties in private ownership in the Ōtākaro Avon River Corridor.*

b) *Manage activities in the Ōtākaro Avon River Corridor to ensure effects on existing privately-owned residential properties within the Zone are generally consistent with those anticipated in the Alternative Zone specified in Appendix 13.14.6.2.*

Assessment

This policy provides for precisely for what is being sought by this plan change application. It is considered that the policy is so specifically applicable that it should prevail over other policies if there is any inconsistency with those.

13.14.2.1.5 Policy - Residential Activities

a) *Provide for limited new clustered, tiny or small footprint housing and temporary and permanent residential activities in identified Trial Housing Areas to enable opportunities for testing and demonstrating adaptation to natural hazards and climate change, where these:*

    i. *are comprehensively designed in one plan for the whole Trial Housing location to:*

        A. *complement and integrate with the surrounding natural and cultural environment, including the intended indigenous natural environment of the Ōtākaro Avon River Corridor;*

        B. *provide safe and social communal spaces; and*

        C. *provide visually attractive buildings and structures.*

    ii. *avoid unacceptable risk to life and property from natural hazards.*

b) *Provide for limited new residential development in identified Edge Housing Area Overlays where these are designed to front on to the Ōtākaro Avon River Corridor and improve integration between the edge of existing neighbourhoods and the activities within the Zone.*

c) *Other than in Trial Housing and Edge Housing Overlays, provide for one new residential unit on a site only where it is ancillary to, and required for, the primary activity on the site.*

Assessment

The proposal is almost entirely consistent with this policy, with the exception of the 18 metre wide frontage of 5 Harvey Tce, which is not consistent with subclause c). As noted above, the proposal is also considered to be consistent with the parent objective.

13.14.2.1.6 Policy – Design

This policy contains design criteria for built form activity in the various sub areas in the river corridor. If the sites are included in the table in Appendix 13.14.6.2 and the Edge Housing Overlay, then they would be developed under the provisions of the RMD zone and the Overlay, including their objectives, policies and rules[1].

*13.14.2.1.7 Policy - Mana Whenua and the **Ōtā**karo Avon River Corridor*

a) *Recognise the Ōtākaro Avon River as a taonga and a cultural landscape for which Te Ngāi Tūāhuriri exercise kaitiakitanga by ensuring values of cultural importance are managed, enhanced and/or protected.*

b) *Manage activities within the Zone to restore the Ōtākaro Avon River Corridor for mahinga kai and to improve water quality, recognising that land use activities can have adverse impacts on water resources.*

c) *Where resource consent is required, require earthworks within the Zone to be undertaken in accordance with cultural best practice, including the adoption of an Accidental Discovery Protocol, the training of contractors in identification of archaeological sites, cultural monitoring, recording and other measures as informed by mana whenua.*

d) *Recognise that sites where evidence of historic Māori occupation is uncovered through earthworks or development activities are wāhi tapu to mana whenua and that the manner in which the earthworks and land development continue should be informed by cultural advice.*

e) *Provide for customary access for the purposes of mahinga kai as part of ecological restoration activities.*

The applicant has approached tangata whenua through Mahaanui Kurataio LtdT and has been advised that the proposal is unlikely to be of concern and does not need to be considered further unless in the unlikely event that the Council decides to refer it to MKT.

Landscape effects

A report by DCM Urban concludes that although the proposal would amount to a considerable change from the present open appearance of the sites, the visual effects of the proposal from a number of viewpoints would be less than minor or indiscernible. The report also concludes that Harvey Tce would provide be an appropriate edge between the river corridor and the adjoining residential development to the north and east of the sites. At present the sites have clean boundaries to Fitzgerald Avenue and Harvey Tce, medium density housing at 256 Fitzgerald Avenue to the north also owned by the applicant, housing to the north-east along

[1] Rule 13.14..4.1.1 P32 and 13.14.1.3 RD3

Heywood Tce which is zoned Residential Medium Density, and multi-unit housing to the east on Harvey Terrace which is zoned Residential Suburban Density Transitional but more closely resembles an RMD typology.

This boundary is therefore irregular, and a development boundary at Harvey Tce would present a distinct and attractive face to the river corridor, especially considering the river itself is approximately 180 metres away to the south and not visible from Harvey Terrace due to a low ridge of land between. There would be an 18 metre wide addition to the existing housing in Harvey Tce. The balance of the site frontage, which wraps around the Harvey Tce/Fitzgerald Avenue corner will be landscaped along its frontage at least t the extent required in the Edge Housing Overlay.

It is assumed that land between the river and Harvey Terrace will be redeveloped for purposes consistent with the primary purposes of the SPOARC zone, including the cycle trail which follows River Rd at the river edge in this location.

Restriction of access to No 254 Fitzgerald Avenue, which is a corner site, to its other frontage on Havey Tce as a permitted activity will assist to preserve the continuity of landscaping treatment along Fitzgerald Avenue and the safety and efficiency of traffic movements on Fitzgerald Avenue.

Other effects

Positive Effects

Housing Supply

This proposed development would have the potential to produce an estimated 6-8 dwelling units in an excellent location if developed to its potential under the RMD zone and the Edge Housing Overlay. This would be a successful contribution to the national and local housing shortage. It would be in accordance with the Objectives and policies of the National Policy Statement on Urban Development 20201 (the NPSUD), particularly Objective 3 which states

> *Regional policy statements and district plans enable more people to live in, and more businesses and community services to be located in, areas of an urban environment in which one or more of the following apply:*
>
> *(a) the area is in or near a centre zone or other area with many employment opportunities*
>
> *(b) the area is well-serviced by existing or planned public transport*
>
> *(c) there is high demand for housing or for business land in the area, relative to other areas within the urban environment.*

The proposal would also accord with Strategic Objectives 3.3.1 and 3.3.4(b) of the Christchurch District Plan which state that

> *3.3.1 Objective - Enabling recovery and facilitating the future enhancement of the district*
>
> *a) The expedited recovery and future enhancement of Christchurch as a dynamic, prosperous and internationally competitive city, in a manner that:*
>
> *i. Meets the community's immediate and longer term needs for housing, economic development, community facilities, infrastructure, transport, and social and cultural wellbeing; and*

ii. Fosters investment certainty; and

iii. Sustains the important qualities and values of the natural environment.

3.3.4 Objective - Housing capacity and choice

a) For the period 2018-2048, a minimum of 55,950 additional dwellings are enabled through a combination of residential intensification, brownfield and greenfield development, made up of:

i. 17,400 dwellings between 2018 and 2028, and

ii. 38,550 dwellings between 2028 and 2048; and

b) There is a range of housing opportunities available to meet the diverse and changing population and housing needs of Christchurch residents, including:

i. a choice in housing types, densities and locations; and

ii. affordable, community and social housing and papakāinga.

Geotechnical Effects

Although buildings on the sites were damaged in the Canterbury Earthquakes and demolished, the stability of the parts of the site closest to the river has been improved by the construction of a substantial retaining wall along the river on the opposite side of Fitzgerald Avenue. A recent geotechnical report by Geotech Consulting Ltd, which is attached as Appendix 1, has concluded that all the land is suitable for medium density housing using lightweight construction and a hybrid TC2/TC3 gravel raft foundation system.

CONCLUSION

1. Potential ecological, amenity and recreational opportunities of the site

a) It is acknowledged that the whole site could be developed for ecological, amenity and recreational purposes. However there would be little such opportunity while the site remains in private ownership. Compared to the bulk of the river corridor it is a small, narrow site. It is separated from the river to the east by the wide heavily trafficked Fitzgerald Avenue and from the river to the south by Harvey terrace and a 200m wide strip of open land, and bordered on its other two sides by medium density housing. It would be most unlikely that a private owner would carry out such activity and it would be much more appropriate for a public entity, such as the Council to do so.

b) Because of the site's small size and lack of close connection to the river, these would be limited opportunities, compared to what could be achieved more comprehensively on the much more spacious land south of Harvey Tce.

c) There would be opportunity for planting along the Fitzgerald Avenue frontage and around the corner into Harvey Terrace to enhance the approach to the Green Spine under the Edge Housing Overlay of the Specific Purpose Zone. This is discussed further below. Because of the existing two-storey flats at No. 256 Fitzgerald Avenue it will not be possible to achieve a planted frontage along the full extent of this block face between Heywood Tce at the northern edge of the Specific Purpose Zone and Harvey Tce.

d) In the case of the rest of the Harvey Terrace frontage, this is considered to be a very small frontage and that ecological, amenity and recreational opportunities could be easily and

more appropriately achieved on the southern, undeveloped side of the road. This would ensure there is minimal loss of continuity of the river corridor and its values in this location.

e) Other more active activities could include for example a children's playground or a picnic area. It is considered that there are ample and more attractive opportunities for such activities elsewhere within the green spine closer to the river. The site is too small for larger recreational or sporting facilities and such activities would not be particularly compatible with the purposes of the green spine in any case.

f) The site does not provide any useful opportunities for walking or cycling access to or along the river corridor that could not be equally well provided by Harvey Terrace and Fitzgerald Avenue. Access to the river corridor upstream to the west is restricted by the heavy traffic on Fitzgerald Avenue. Pedestrian and cyclists should not be encouraged to cross Fitzgerald Avenue along this frontage for reasons of safety. The City to Sea walkway/cycleway being developed by the Council in the vicinity is routed along River Rd much closer to the river.

g) Overall it is considered that the site offers a small but quite limited potential for ecological restoration, cultural and recreational opportunities, or for landscape enhancement/mitigation, and these would not outweigh the benefits of the site for residential development. It is also considered unlikely that such opportunities would be taken up while the site is in private ownership, except for frontage landscaping associated with residential development.

2. The extent to which the plan change will give effect to the Green Spine provisions,

a) With the inclusion of 254 Fitzgerald Avenue in the Edge Housing overlay, and with appropriate frontage planting there, it will be possible to achieve the purposes of the Green Spine along most of this frontage, with the exception of No 5 Harvey Terrace. This is a single, 18m wide residential site, alongside other housing further to the east along this road. This would be a very small reduction in the Green Spine in the area. There would not be any additional gaps created in the Green Spine. The loss of any Green Spine qualities there would be negligible.

3. Why the proposal is more appropriate than the current applicable provisions

a) It is estimated that the proposal would enable the provision of up to 6 medium density housing units in an attractive location close to the City centre. As noted above, the loss of the qualities anticipated in the Green Spine would be insignificant. Therefore the positive effects are considered to outweigh the costs by a significant margin.

APPENDIX 2 – GEOTECHNICAL REPORT

GEOTECH
consulting ltd

Subdivision of
254-256 Fitzgerald Avenue
Richmond
Christchurch

Geotechnical Assessment Report

REFERENCE NUMBER: 5595

DATE: February 2021

PREPARED FOR: Ms R Harwood

PREPARED BY: Geotech Consulting Ltd

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GEOLOGICAL & ENGINEERING SERVICES

Summary

Site & Sub-surface Conditions	Terrain	Near flat site but with Avon River passing 30 m to the west and approximately 4 m below site level.
	Soil profile	A surface layer of historic fill and topsoil up to 0.8 m deep, over interbedded silts and sands to about 5 m depth, over medium dense sands to ≈11 m and very soft silts and clays to ≈14 m. This is underlain by ≈ 9 m thickness of dense sands, then 0.5 m of clayeys silts, capping the Riccarton Gravel aquifer at 23 m deep.
	Soil classification	Class D, deep soil site to NZS1170.5:2004
	Groundwater depth	3 m median depth on east side of site with fall to the river of 0.3 m over the site length.
Seismic Aspects	Earthquake performance	Well tested to > SLS shaking in the September 2010 and February 2011 earthquakes, with moderate to severe liquefaction effects recorded.
	Liquefaction	Significant liquefaction throughout the soil profile at ULS but in isolated layers and typically below 5 m depth at SLS.
	Liquefaction 'index' settlement	SLS: 20 - 40 mm ULS: 80 – 150 mm (for top 10m of soil profile)
	Lateral spread	**Minor to moderate** spread is predicted, based on construction of the CCC palisade wall protecting the Avon River-bank along Fitzgerald Ave, following the Christchurch earthquake.
	Foundation technical category	Red-zone by MBIE classification Hybrid TC2/TC3 (SLS/ULS) by assessment
Natural hazards	Slippage	Low risk, except under liquefaction conditions when lateral spread may be an issue. The Avon River palisade wall has mitigated this risk.
	Subsidence	Liquefaction settlement is expected in major earthquakes. Risk can be minimised by following MBIE Guidance and recommendations of this report.
	Inundation	The site level is well above the Avon River and the site is outside the CCC Flood Management Area. Normal Building Code provisions for floor levels above finished ground will mitigate this risk.
Site Development	Proposal	New two-storey apartment blocks on Lots 2 and 3.
	Suitable foundation	TC2 Enhanced slab foundations are suitable, with shallow ground improvement.
	Bearing capacity	200 kPa ultimate bearing capacity is available in the natural ground. 300 kPa can be assumed for design of foundations on top of reinforced gravel rafts.
	Suitability for subdivision	Suitable for subdivision in terms of RMA section 106 requirements

Subdivision

254-256 Fitzgerald Avenue, Christchurch

Geotechnical Assessment Report

Contents

Appendix

- Site Investigation Plan
- Hand-auger logs, 10 pages
- CPT plots, 2020 investigation, 4 pages
- CPT plots from NZGD, 5 pages
- Borehole log from NZGD. 6 pages
- Liquefaction Analysis, 14 pages
- Extract from MBIE Guidance – method specification for type G1d ground improvement

1 Introduction

1.1 Purpose

This geotechnical report evaluates the ground conditions, assesses the geotechnical hazards and recommends a suitable foundation system for the proposed development of 254-256 Fitzgerald Avenue, Richmond, Christchurch. It is intended to be used in support of foundation design and for building and resource consent applications.

The report includes:

- A summary of investigations and ground conditions on and around the site
- a liquefaction & lateral spread assessment
- a geo-hazard assessment against RMA Section 106
- Site ground improvement and foundation recommendations for new buildings

Any issues of ground contamination have not been considered and are outside our scope of work.

1.2 Site

This 2408 m^2 site is on the corner of Fitzgerald Ave and Harvey Terrace, and has established residential properties on the east and north-east sides. It is 44 m wide on Fitzgerald Ave and 48 m long on Harvey Terrace.

The site appears flat but there is about 0.5 m fall from north to south and the entire site is elevated above Fitzgerald Ave which is in turn elevated above the adjacent Avon River. The Avon River bed is estimated to be 4 m below site level.

This section of Fitzgerald Ave was closed following the February 2011 earthquake because of lateral spreading and slumping of the northbound lanes into the river. A substantial ground improvement project has created a palisade wall along the river-bank and under the edge of the north-bound lanes which allowed the road to be re-opened.

This site has been classified red-zone by MBIE as have all sites to the south of Harvey Terrace, and all sites along Fitzgerald Ave up to Heywood Terrace. Properties one back from the Fitzgerald Ave frontage are classified as Foundation Technical Category TC3.

1.3 Proposed Development

A subdivision is proposed for 254-256 Fitzgerald Ave where a single large site that has previously been occupied by three residential apartment buildings is intended to be subdivided into three titles and developed with two new apartment buildings to complement the one remaining block of four apartments on the site.

The subdivision proposal is still under development, but an early version of the plan shows Lot 1 holding the existing block of four apartments at 256 Fitzgerald Ave, with drive-on access from Harvey Terrace. Lot 2 occupies the south-west corner of the site at 254 Fitzgerald Ave and Lot 3 will be an 18m wide strip on the east side of the property corresponding to the apartments that were previously at No 5 Harvey Terrace.

Building details are not yet known but they are expected to be similar to the existing, that is, two storeyed but typically of lightweight construction.

2 Ground Information

2.1 Regional Geology

GNS Geological Map 3 (Begg, Jones, & Barrell, 2015) shows the site as being located on a fluvial interchannel trough or flat, part of the Yaldhurst member of the Springston Formation with a surface geology typically of alluvial sand and silt and an estimated maximum age of 3,000 years. To the south of Harvey Terrace is a 'recent river plain' with an estimated maximum age of 500 years.

This surface material is underlain with alluvial sands and gravels, transported by the Waimakariri River. Underlying the entire site (as it does for all of Christchurch) is the dense gravel layer known as the Riccarton Gravel. The regional geological model (Begg, Jones, & Barrell, 2015) predicts the Riccarton Gravels to be at 27 m depth and about 18 m thick in this location. The Riccarton gravel is underlain with further layers of silt, sand and gravel for another 500 – 600m before volcanic rock from the Lyttelton volcano is encountered.

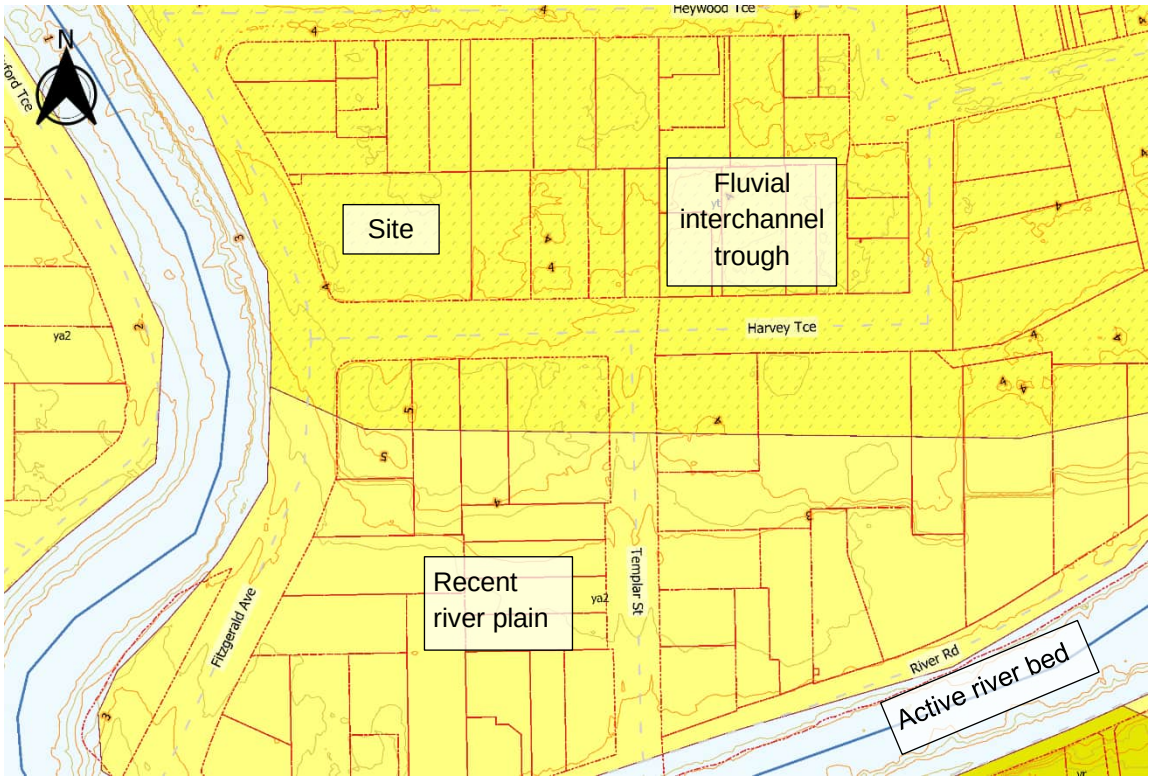

Figure 2-1 Geomorphic map data (ref GNS Geological Map 3)

2.2 Existing geotechnical records

The New Zealand Geotechnical Database (NZGD) holds data close to the site. The most relevant is listed in Table 2-1. The locations of the closest tests are shown on the appended site plan 5595/1.

NZGD Test	Location	Depth of test (m)
CPT_564	12 m west, on Fitzgerald Ave in front of site	23.1
CPT_404	8 m south on Harvey Tce outside No 5	22.9
BH_1740	8 m south on Harvey Tce adjacent to CPT_404	29.2
CPT_46985	25 m north on 20 Heywood Tce	18.1

Table 2-1 NZGD deep soil test information

2.3 Site Investigation

A site investigation was arranged in December 2020 with shallow testing by hand-auger and Scala Penetrometer with four tests around a likely building footprint on Lot 2 and six tests around a likely building footprint on Lot 3.

Deep testing by CPT was also carried out with four tests, two each on Lot 2 and Lot 3. The CPT testing was arranged to form a Tee shape in plan with the existing CPT's forming the extreme ends of the Tee. CPT_564, CPT001, 2 & 3 are aligned perpendicular to the river to test continuity of any liquefiable layers, whilst CPT003 & 4 align with the existing testing to the north and south to form a line parallel to the river under the site on Lot 3.

Test locations are shown on the appended site plan. Test data are also appended.

3 Subsurface Conditions

3.1 General soil profile

The hand auger boreholes show fill and sometimes buried topsoil from 0.4 to 0.8m depth over silts and sands on Lot 2 and sands on Lot 3 to the maximum 2.1m depth tested. HA07 on Lot 3 was unable to get past an obstruction at 0.5m depth.

An interpretation of the CPT tests are plotted together on the following page (Figure 3-1).

A general description of the ground conditions is:

Depth to top surface (m)	Thickness (m)	Description
0	0.4 to 0.8	Historic fill, buried topsoil in places.
0.4 to 0.8	≈ 5 (up to 9m in CPT04)	Interbedded silts and sands – generally loose and soft with some very soft clayey layers
≈ 5	≈ 6	Medium dense sands and silty sands. With some siltier lenses (eg at -4m RL in CPT002)
10 to 12	1.5 to 3	Very soft silts and clayey silts
13 to 15	8 to 10 m	Dense to very dense sands – becoming silty with depth
22.5	0.5	Clayey silts – aquifer capping layer
23	≈ 18	Riccarton gravels aquifer (from Borehole_1740)

Table 3-1 Generalised soil profile

The table and figure indicate substantial variability in ground conditions which is not uncommon in Christchurch alluvial deposits.

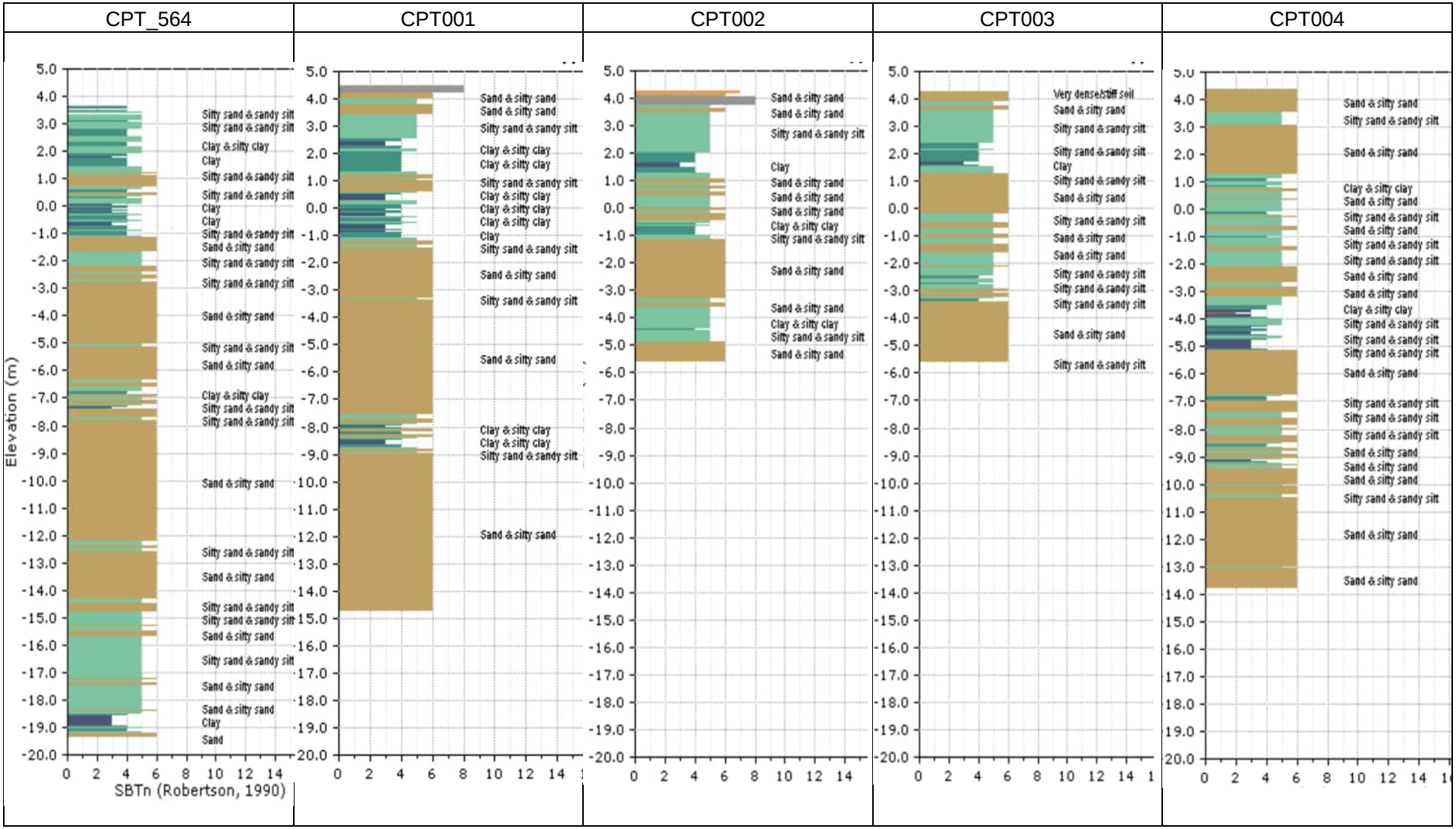

Figure 3-1 Interpretation of soil properties from CPT data

3.2 Groundwater

The Groundwater Surface Elevation studies (GNS Science, 2014) suggests a median groundwater elevation[1] of about 1.2 m on the east side of the site falling toward the river at a grade of 1 in 120 m. The $85\%_{ile}$ water level is 0.2 m higher.

With existing ground levels of 4.2 m this gives water depths of 3 to 3.3 m (accounting for the groundwater gradient across the site).

Groundwater was observed at 3 m and 3.1 m in the recent investigations. This is consistent with the GNS model and with the water level in the river.

A groundwater depth of 3 m has been adopted for the purpose of liquefaction assessment.

4 Seismic Considerations

4.1 Seismic Category

The deep alluvial soils that underlie most of Christchurch makes this a Class D, deep or soft soil site, in terms of the seismic design requirements of NZS 1170.5:2004.

4.2 Seismic Hazard

Design of buildings must consider at least two loading situations – the serviceability limit state (SLS) and the ultimate limit state (ULS). At the SLS level of earthquake shaking a building should perform such that damage is easily repairable and does not affect the function of the structure. At ULS the structure can suffer severe damage but should not collapse.

Following the Canterbury Earthquakes a review of the regional seismic hazard has resulted in peak ground accelerations (PGA) for liquefaction assessment, recommended by MBIE (MBIE, 2012), (MBIE, 2014) for **Class D** sites and Importance Level 2 (IL2), normal occupancy, structures as shown in Table 4-1.

Design Case	PGA	Magnitude	Return period
SLS_A	0.13g	M7.5	25 yr
SLS_B	0.19g	M6	25 yr
ULS	0.35g	M7.5	500 yr

Table 4-1 Seismic design cases for liquefaction assessment

[1] *to NZ Vertical Datum 2016 (or approximately 21 m to Christchurch Drainage Datum)*

4.3 Recent Earthquakes

The site has been subject to repeated shaking in the Canterbury Earthquakes. Estimates of peak ground accelerations (Bradley & Hughes, 2012) show that the site is likely to have experienced shaking exceeding a Serviceability Limit State (SLS) event in each of the four main earthquakes (see Table 4-2).

Earthquake	Mag.	Peak Ground Acceleration, PGA		
		Mean	Equivalent M7.5	$PGA_{10\_7.5}$
4 Sep 2010	7.1	0.21	0.19	**0.13**
22 February 2011	6.2	0.45	0.32	**0.21**
13 June 2011	6.0	0.26	0.18	0.11
23 Dec 2011	5.9	0.23	0.15	0.10

Table 4-2 Estimated PGA for the main Canterbury earthquakes *(green fill indicates 'sufficiently tested')*

The estimated mean PGA for each earthquake has been converted to an equivalent PGA for a magnitude M7.5 earthquake (allowing direct comparison with the M7.5 MBIE design PGA's in ***Table 4-1***), plus the PGA with 90%, probability of being exceeded ($PGA_{10\_7.5}$). The 90% exceedance PGA is the level at which the MBIE guidance accepts a site as being "sufficiently tested".

At this site the September 2010 and February 2011 earthquakes almost certainly (90%) exceeded SLS shaking and are likely to have exceeded SLS in all four main earthquakes. The February 2011 earthquake is likely to have been very close to a ULS event.

4.4 Site Performance

4.4.1 Ground damage records

Ground damage reports from EQC records (EQC, 2013), following the significant earthquake events are as follows:

Event	Ground observation	Aerial photo inspection
September 2010	no records	No observed liquefaction
February 2011	severe lateral spreading ejected material often observed. "moderate" recorded on the road	Moderate-Severe
June 2011	no records (road observations only)	Moderate-Severe (in our experience interpretation for this event often overstates actual liquefaction)
December 2011	no records	Minor observed liquefaction

Table 4-3 EQC records of liquefaction on site

Our own examination of aerial photographs taken after the February 2011 earthquake confirms the "Moderate to Severe" assessment from the aerial photos. Significant ground cracking is visible along Fitzgerald Avenue and this may have influenced the ground-based observation.

4.4.2 Ground Cracking

Ground cracks as recorded by consultants for EQC (EQC, 2012) are shown running along the river side of Fitzgerald Ave and out to the median strip opposite Harvey Terrace (Figure 4-1) Some relatively minor cracks (green are under 10 mm and blue are under 50 mm) are seen along Harvey Terrace adjacent to the site.

Only one crack is recorded on the site itself, an 'unclassified crack crossing the north-east edge of the site. Unclassified cracks are generally minor in nature and the orientation of this crack is not consistent with lateral spread.

Figure 4-1 Ground cracks as recorded for EQC (from NZGD)

4.4.3 Change in ground surface levels

Interpretation of LiDAR surveys (EQC, 2012) suggests a total vertical elevation change of 0.4 m at the site with 0.16 m estimated as movement of the bedrock. The liquefaction induced settlement is thus 0.24 m over all of the main earthquake events.

Settlements (as estimated from LiDAR) were variable across the site with the least settlement seen in the south west corner and the most on the east side where up to 0.5 m is indicated (Figure 4-2). The settlement associated with slope failure along the river edge is seen in pink to the left of this image.

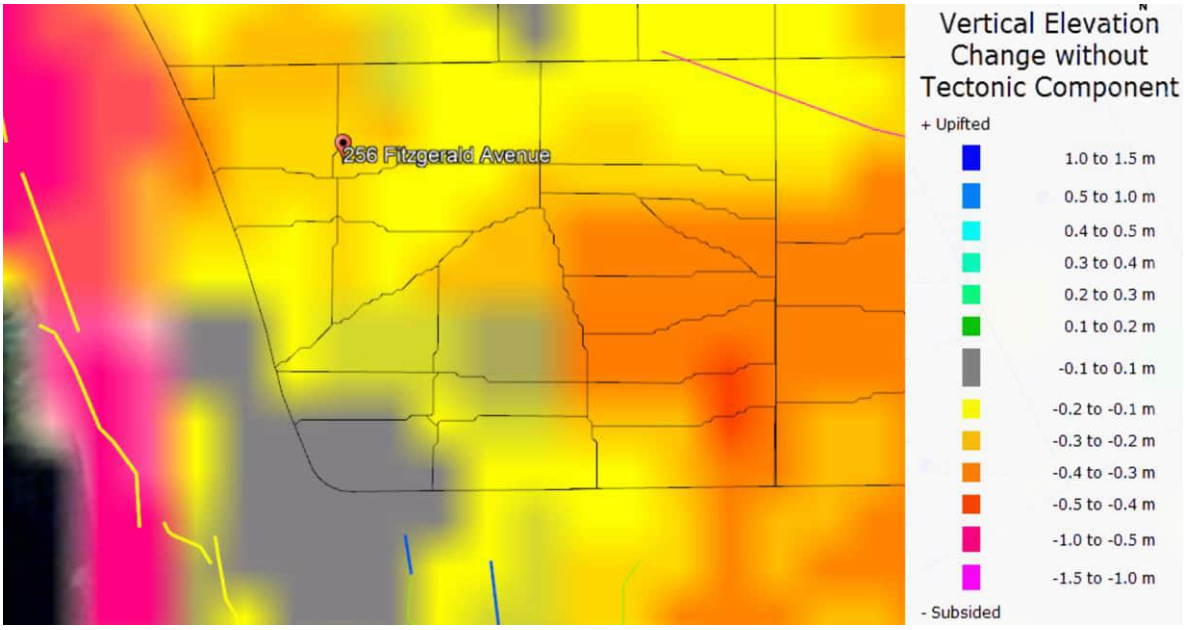

Figure 4-2 Liquefaction settlements - all events

4.4.4 Site performance summary

The site clearly suffered significant liquefaction damage in the Canterbury earthquakes. However, this appears to be mainly in terms of liquefaction ejecta and on-site settlement. There was a known lateral spread and/or slope failure along Fitzgerald Avenue, but this doesn't appear to have had a significant effect on the site itself.

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4.5 Liquefaction potential

4.5.1 Analysis

Analysis of the on-site CPT's has been carried out using the methods recommended by MBIE[2]. The peak ground accelerations used for analysis are as shown in ***Table 4-1*** and, for comparison, the February 2011 event was modelled with peak ground acceleration of 0.45g and Magnitude 6.2.

Standard parameters of 0.15 for Probability of Liquefaction (P_L) and a fines fitting factor C_{FC} = 0.0, this was found to give reasonable agreement with the observed settlements discussed in Section 4.4.3 above.

Detailed liquefaction profiles are shown on the appended output sheets. Cumulative thicknesses of liquefaction and liquefaction induced settlements for the upper 10m and for the full profile, where available, are shown in Table 4-4.

[2] Liquefaction assessment method by Boulanger & Idriss (2014) and settlement method by Zhang (2002)

CPT	Depth (m)	Liquefaction Induced Settlement (mm)				Sum of liquefiable layer thickness (m)			
		ULS M7.5	SLS_A M7.5	SLS_B M6	Feb '11 M6.2	ULS M7.5	SLS_A M7.5	SLS_B M6	Feb '11 M6.2
CPT001	10	80	10	20	70	3.6	0.0	0.5	3.6
CPT002	10	150	30	50	150	6.3	0.8	1.5	6.3
CPT003	10	130	20	30	130	5.8	0	1.1	5.7
CPT004	10	130	20	40	130	5.4	0.2	2.0	5.4
CPT_564	10	70	10	20	70	3.3	0.0	0.5	3.2
CPT_404	10	50	0	10	50	2.4	0	0.5	2.2
CPT_46985	10	100	20	40	100	4.5	0.3	1.6	4.5
Tests deeper than 10m (full profile)									
CPT001	19.3	160	20	30	150	8.3	0.3	1.1	7.7
CPT004	18.3	210	40	70	210	9.7	0.6	2.8	9.4
CPT_564	23.1	100	10	20	90	4.7	0.1	0.5	4.5
CPT_404	22.9	100	10	20	100	5.5	0.2	0.7	5.0
CPT_46985	18.1	170	30	60	170	8	0.7	2.2	7.5

Table 4-4 Cumulative thickness and Liquefaction Induced Settlement

Estimated liquefaction induced settlements on the site are 20 to 40 mm at SLS and 80 to 150 mm at ULS for the upper 10m, increasing to 30-70 mm SLS and 160 to 210 mm ULS for the full soil profile. At the estimated mean level of shaking the February 2011 earthquake would be expected to result in liquefaction induced ground settlement close to a ULS event.

The settlement analysis method is empirical and approximate only, with perhaps a ±50% margin to the numbers given. It also applies to a 'free field'[3] situation and additional large settlements may occur associated with sand ejection, lateral spread and movement under foundation loads.

4.5.2 Lateral Spread

Lateral spread and lateral stretch are the most damaging aspect of liquefaction, in Christchurch lateral spreading was mostly seen along the banks of the Avon River and was worse downstream of Barbadoes Street. Conditions that allow for lateral spread include:

- a sudden change in ground elevation, referred to as a free-face, such as a river bank,
- a significant thickness of liquefiable soils and
- continuity of liquefiable layers away from the free face to under the site in question

The standard methods for estimating lateral spread can give widely varying answers (between methods) and are known for poor accuracy. In many cases the extent of lateral spreading may be constrained by geology and will not occur as estimated by models that are usually limited by the amount of geological data available.

For this site we can see that there are liquefiable layers of reasonable thickness that appear to be near continuous between the site and the river, although the two CPT's closer to the river have more

[3] 'free field' is level open ground away from any influence of foundation loads or slopes.

broken layers in the critical depths (between 3 and 8 m). We also know from observation that in a significant earthquake such as February 11 there was no significant ground cracking recorded on the site and that since then there has been a major repair of the river-bank along Fitzgerald Ave with deep ground improvement by stone columns that have the specific intention of disrupting the continuity of the liquefiable layers and holding back the ground behind the palisade wall.

We have not been able to obtain information on the design standard for this retaining wall from Council, but we assume it will be not less than a 1 in 100 year event and is more likely to be a 1 in 500 year.

Taking account of the presence of this wall and the reasonable performance during the February 2011 earthquake we assess the residual lateral spread and lateral stretch risk as **minor** or TC2 equivalent at SLS and **Minor to Moderate** (less than 200 mm) at ULS.

4.6 Liquefaction Summary

The site has been 'sufficiently tested' at SLS and the February 2011 earthquake is likely to have produced liquefaction approaching that of a ULS event. Accordingly, the observations of performance during the Canterbury Earthquakes can be relied upon to predict future performance.

The MBIE 'index' limits for liquefaction induced settlements in TC2 areas, are 50mm at SLS and 100mm at ULS over the upper 10m. At 20 - 40 mm SLS and 80-150 mm ULS the site fits into a hybrid category of TC2/TC3.

Lateral stretch risk is assessed as **minor** at SLS and **minor to moderate** at ULS, based on records of site performance in the Canterbury Earthquakes and the expectation of improved performance due to the stone column palisade wall built along Fitzgerald Ave in front of the site.

5 Geotechnical Hazards

5.1 Section 106 Assessment

Section 106 of the RMA identifies a range of hazards that may provide justification for a consent authority to refuse subdivision consent. Section 106 also requires consideration of those same hazards following any likely development.

An assessment of the site against those hazards is provided in Table 5-1. The property is assessed as being either free of particular hazards, or, the hazard can be satisfactorily mitigated, such that there is no reason from a geotechnical perspective that the subdivision cannot proceed.

Hazard	Current assessment	Post development assessment
Erosion	The site is close to the Avon River but is separated from the main channel by Fitzgerald Ave. As a major city thoroughfare we anticipate that Council will ensure that the river bank does not erode in this location	No change in risk.
Falling debris	The site is flat with no source area for falling debris.	No change
Subsidence	There is a liquefaction risk at the site which is likely to result in some subsidence in a future earthquake.	Building in accordance with the recommendations of MBIE for liquefaction prone sites will mitigate this risk.
Slippage	There is a risk of lateral spread associated with liquefaction and proximity to the Avon River, in a ULS earthquake	Development does not change this risk but building in accordance with the recommendations of MBIE for liquefaction prone sites will protect life in the event that some slippage takes place.
Inundation	The site is not in the CCC Flood Management Area	No change in risk

Table 5-1 Assessment against RMA S.106

The only significant risks that affect the site are both associated with liquefaction. This has been discussed in Section 4 above.

6 Foundations

6.1 Shallow Bearing Capacity

The shallow soils testing shows uncontrolled fill at the ground surface over most of the site, with buried topsoil encountered in two of the ten holes. The depth of fill and topsoil is from 500 to 800 mm below current ground level. For shallow foundation systems this fill and any underlying topsoil must first be removed to expose natural silts and sands.

Scala penetrometer testing shows a Geotechnical Ultimate Bearing Capacity (GUBC) of 200 kPa in the natural subsoils. HA1 shows thin loose layer from 1.35 to 1.5 m. This layer has an indicative Ultimate bearing capacity of 150 kPa and is sufficiently deep that it should not affect bearing capacity for shallow foundations.

6.2 Foundation Recommendations

The relevant parameters for selecting a foundation system are:

Technical Category	TC2/TC3 hybrid
GUBC	≈200 kPa from 800 mm deep
SLS liquefaction settlement	20 to 50 mm, Lot 2 30 to 40 mm, Lot 3
ULS liquefaction settlement	80 to 150 mm, Lot 2 130 mm, Lot 3
ULS lateral spread	Assessed as **minor to moderate**
Proposed construction	Two storey apartment buildings, still to be designed, but assumed to be light timber framed structures with light roofing and medium weight cladding, on concrete foundations.

There is sufficient distinction between Lot 2 and Lot 3 to recommend different foundation systems for the structures on each. The CPT's on Lot 2 show greater differential settlement at both SLS and ULS (30 mm and 70 mm), and proximity to the river is expected to mean more significant lateral spread effects if the design capacity of the riverside palisade wall is exceeded. There is also the soft layer identified in HA01 at 1.35m depth.

6.2.1 Lot 2 – shallow ground improvement

For Lot 2, shallow ground improvement is recommended in the form of a 1.2m thick reinforced crushed gravel raft with two layers of geogrid reinforcement (Tensar Triax 160, or similar approved) (Type G1d Section 15.3.10.1b, MBIE Guide).

A method statement for construction of the gravel raft is contained in Appendix C4 of the guidance (extract appended to this report). At a depth of 1.2 m below the foundations the surface fills will be removed and the soft layer in HA01 will be improved by compaction of the base of the excavation.

6.2.2 Lot 3 - shallow ground improvement

Shallow ground improvement for Lot 3 can be as described for hybrid TC2/3 sites in Clause 15.4.6 of the MBIE Guidance, but with an additional layer of geogrid. This system includes:

- Excavate to 600 mm below foundation level (minimum 800 below ground) and to 1m outside the footprint.
- Thoroughly compact the base of the excavation.
- Place geotextile (Bidim A19 or similar) and Geogrid (Triax TX160 or equivalent) in the bottom of the excavation. Wrap the geotextile up the sides of the excavation.
- Place and compact a layer of AP40 on top of the geogrid and then a second geogrid layer.
- Place and compact layers of AP65 gravel back into the excavation up to foundation level

6.2.3 Further recommendations for shallow ground improvement

The following recommendations are common to both Lots:

- Follow all manufacturers instructions for lapping of geotextile and geogrid
- Geogrid should be laid in strips, full length across the excavation, in an east-west direction, toward the river.
- Place and compact layers of imported gravel (200 mm loose thickness) back into the excavation up to foundation level
- All layers of hardfill should receive the same compactive effort, that is, the same number of passes with the same heavy compactor (eg vibrating plate compactor of 350 kg or greater).
- ND testing should be arranged by the contractor for the second layer placed and every second layer after that as well as the finished surface
- A target of 92% of maximum dry density as determined by vibrating hammer test (NZS 4402:1988 Test 4.1.3) is to be achieved,

Following completion of the gravel rafts the sites can be considered equivalent of a TC2 site.

6.2.4 Enhanced foundations slabs

For each building construct an enhanced foundation slab on top of the hardfill raft. Option 2 or Option 4, as described in Clause 5.3.1 of the MBIE Guidance are considered suitable.

Structural design of the raft must consider standard 'loss of support' criteria as recommended by MBIE of 2 m at slab edges and 4 m in the interior.

Foundations can be designed for an ultimate bearing capacity of 300 kPa on top of the gravel raft. A capacity reduction factor of 0.5 should be applied to the GUBC to derive the design bearing strength of 150 kPa for comparison with ULS load cases.

The CPT's on Lot 3 show consistent settlements at ULS (130 mm in the upper 10m) but the adjacent CPT on Harvey Terrace is only predicting 50 mm in the upper 10 m. This suggests the possibility of dishing in the foundation slab of a long apartment block. We recommend this effect be assessed during structural design and consideration be given to a structural separation between a north and south apartment block on Lot 3.

7 Construction Monitoring

Construction monitoring inspections are recommended for:

a) the base of the excavation, to confirm subgrade suitability.
b) placement of geotextile and geogrid.
c) placement and compaction of gravel hardfill early in placement.
d) further inspections of hardfill during placement and again on completion.

8 Conclusions

Liquefaction assessment indicates that a hybrid TC2/TC3 classification is appropriate for the site, based on:

a) Reasonable performance during the Canterbury Earthquakes where the site was 'well tested' at SLS.
b) Subsequent construction of a major palisade wall along the Avon River bank, involving interruption of the critical liquifiable layers by deep ground improvement.
c) Analysis of on-site CPT's.

For Lot 2 our foundation recommendation is to treat as for a TC3 site with a type G1d gravel raft and an enhanced concrete slab foundation. This is because of greater differential settlement calculated across Lot 2 and because of proximity to the Avon River with some uncertainty over the design standard used for the Fitzgerald Avenue palisade wall.

For Lot 3 a hybrid TC2/TC3 foundation system, comprising a geogrid reinforced gravel raft to 600 mm below foundation level, with two layers of geogrid, and a TC2 Enhanced foundation slab system (waffle slab or equivalent) is recommended.

A subgrade bearing capacity of 200 kPa is expected and foundations can be designed for 300 kPa (Ultimate Bearing) on top of the gravel raft.

Given that the residual liquefaction risk can be addressed by shallow ground improvement as described above we conclude that there is no geotechnical reason to prevent the subdivision of the land and construction of new apartment blocks.

Our recommendations are based on assumptions about the form of construction of the apartment blocks given that no details are available. As the design proceeds we recommend that a suitably qualified geotechnical engineer be engaged to confirm that the proposed buildings and foundations are consistent with this geotechnical assessment.

9 Limitations

The subsurface conditions and the interpretations reported are those identified at the locations of the investigations at the time of the investigation and are subject to the limitations of the investigation methods. The borelogs are an engineering/geological interpretation of the subsurface conditions dependent on the method and frequency of sampling and testing. The boreholes represent only a very small sample of the total subsurface soils. The interpretation of the information and its application must take into account the spacing of the boreholes, the frequency of sampling and testing and the possibility of undetected variations in soils.

While care has been taken with the report as it relates to interpretation of subsurface conditions, and recommendations or suggestions for design and construction, Geotech Consulting Ltd cannot anticipate or assume responsibility for unexpected variations in ground conditions.

This report has been prepared for the purpose as outlined in the introduction and the information and interpretation may not be relevant for other purposes. Geotech Consulting Ltd can review the report and the sufficiency of the investigation and appropriateness of the recommendations for other purposes as needed.

This report has been prepared solely for the benefit of Ms R Harwood, and the Christchurch City Council. No liability is accepted by this Company or any employee or sub-consultant of this company with respect to its use by any other person. This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval or to fulfil a legal requirement.

10 References

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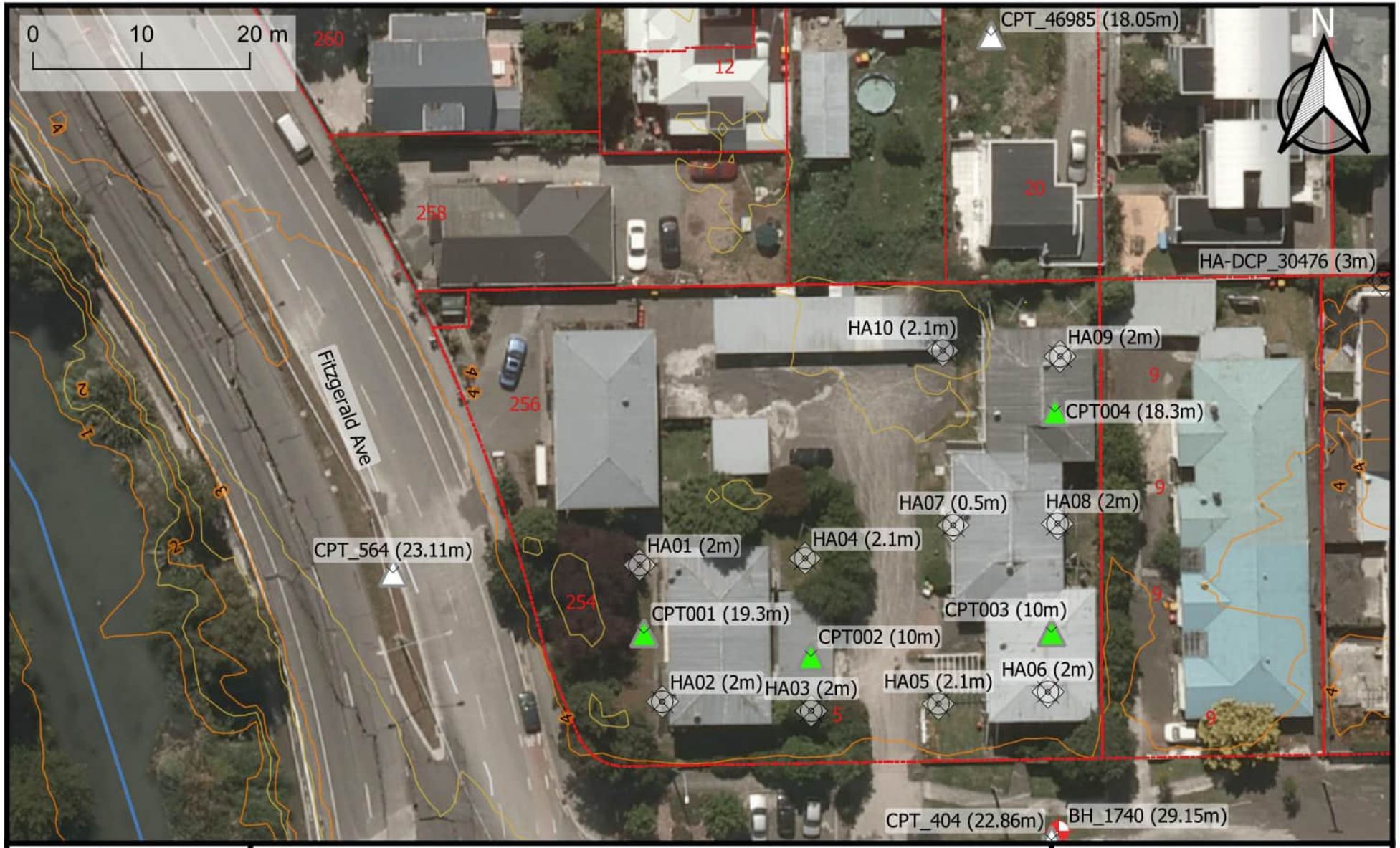
Appendix

- Site Investigation Plan
- Hand-auger logs, 10 pages
- CPT plots, 2020 investigation, 4 pages
- CPT plots from NZGD, 5 pages
- Borehole log from NZGD. 6 pages
- Liquefaction Analysis, 14 pages
- Extract from MBIE Guidance – method specification for type G1d ground improvement

Basemap: Aerial photo, Christchurch Post Earthquake 0.1m Urban Aerial Photos (24/02/2011); Contours to NZVD2016 from, Christchurch and Ashley River 1m DEM (2018); both accessed at data.linz.govt.nz



GEOTECH consulting ltd

256 FITZGERALD AVE

SITE INVESTIGATION PLAN

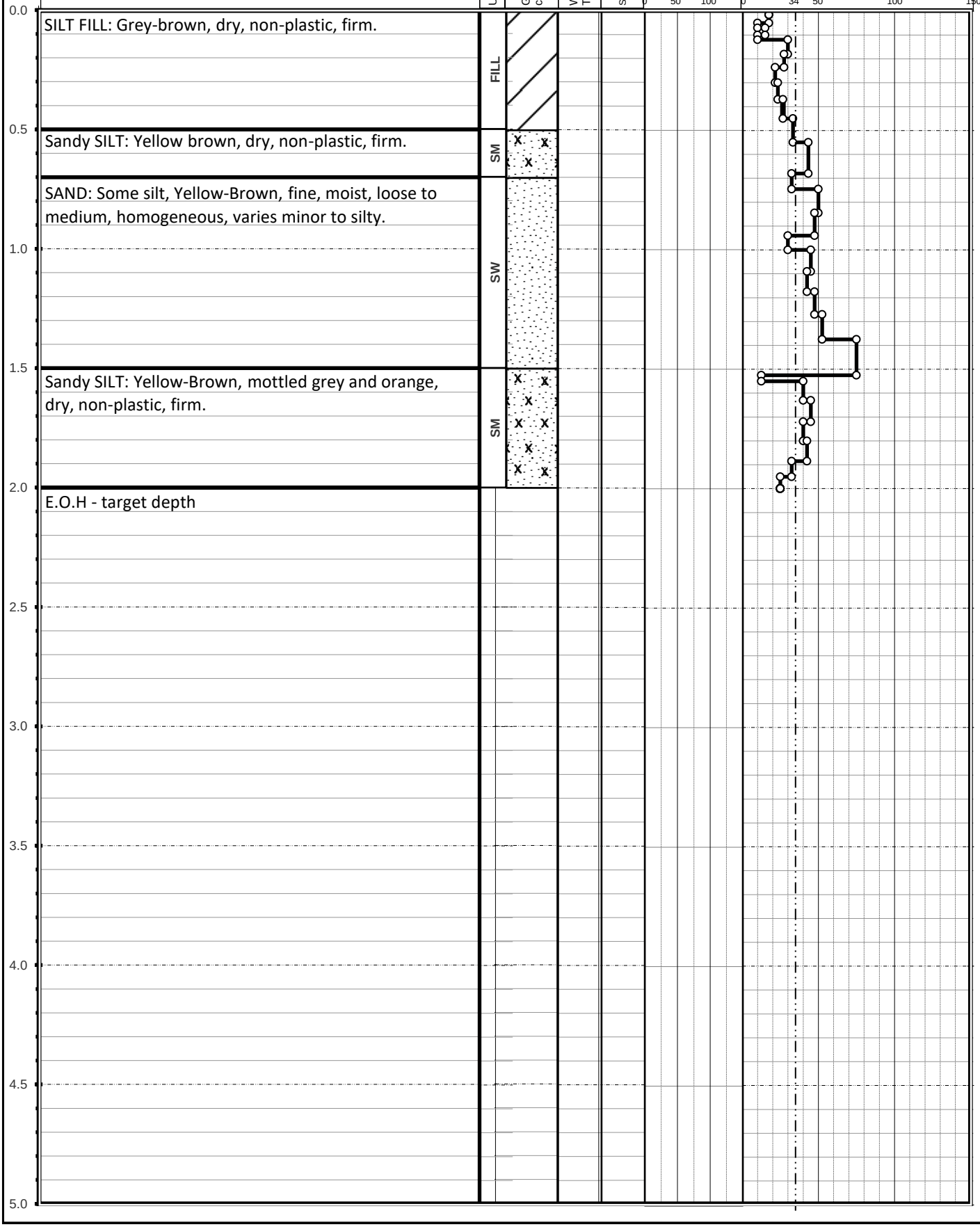
SCALE (A4):	1:500
DRAWN BY:	AJH
DATE DRAWN:	11/12/2020
CHECKED BY:	AJH
FIGURE NO.	**5595/1**

BORE HOLE LOG

GEOTECH

Hole No:	HA01		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, firm.	FILL					
Sandy SILT: Yellow brown, dry, non-plastic, firm.	SM					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium, homogeneous, varies minor to silty.	SW					
Sandy SILT: Yellow-Brown, mottled grey and orange, dry, non-plastic, firm.	SM					
E.O.H - target depth						

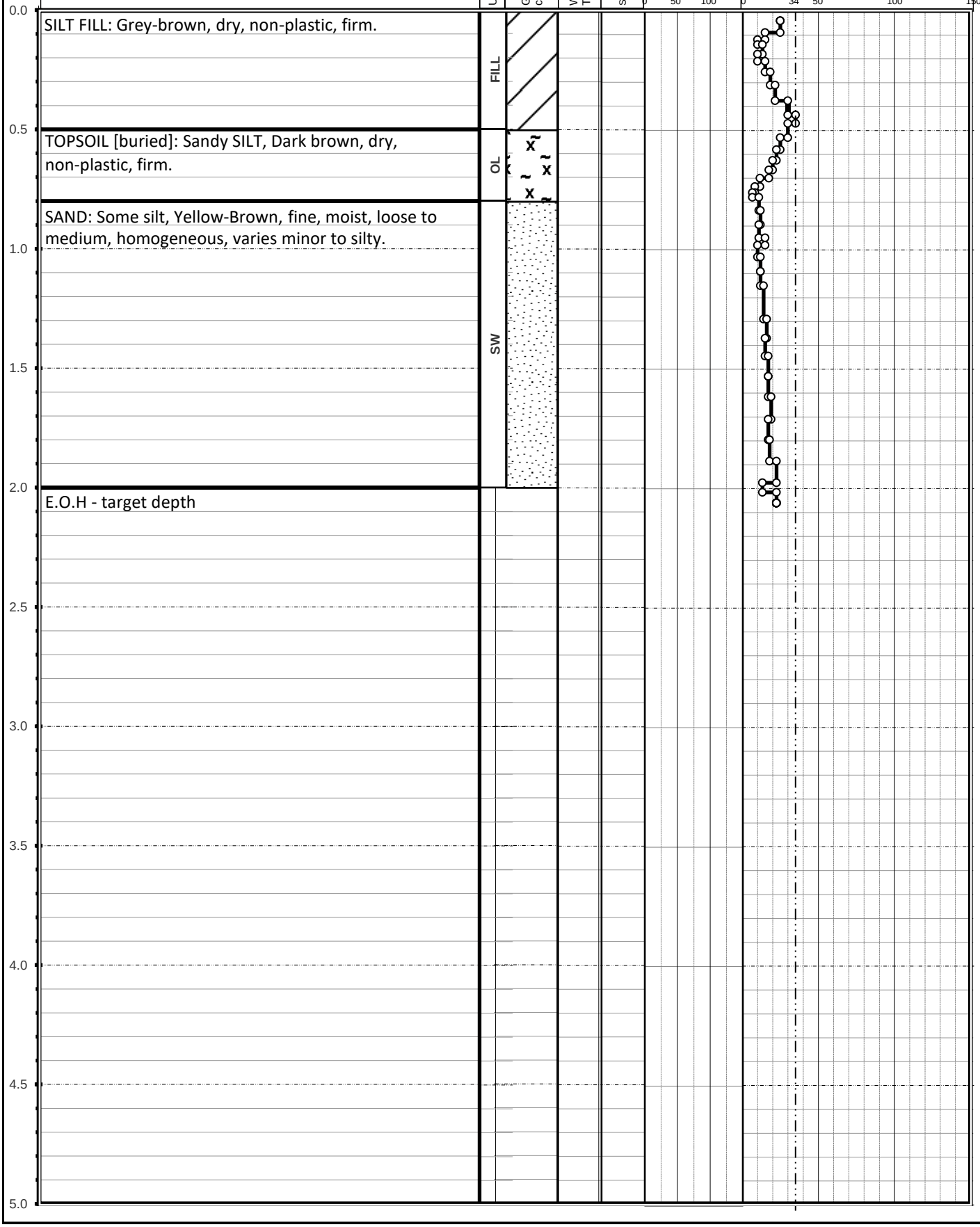


BORE HOLE LOG

GEOTECH

Hole No:	HA02		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, firm.	FILL					
TOPSOIL [buried]: Sandy SILT, Dark brown, dry, non-plastic, firm.	OL					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium, homogeneous, varies minor to silty.	SW					
E.O.H - target depth						



BORE HOLE LOG

GEOTECH

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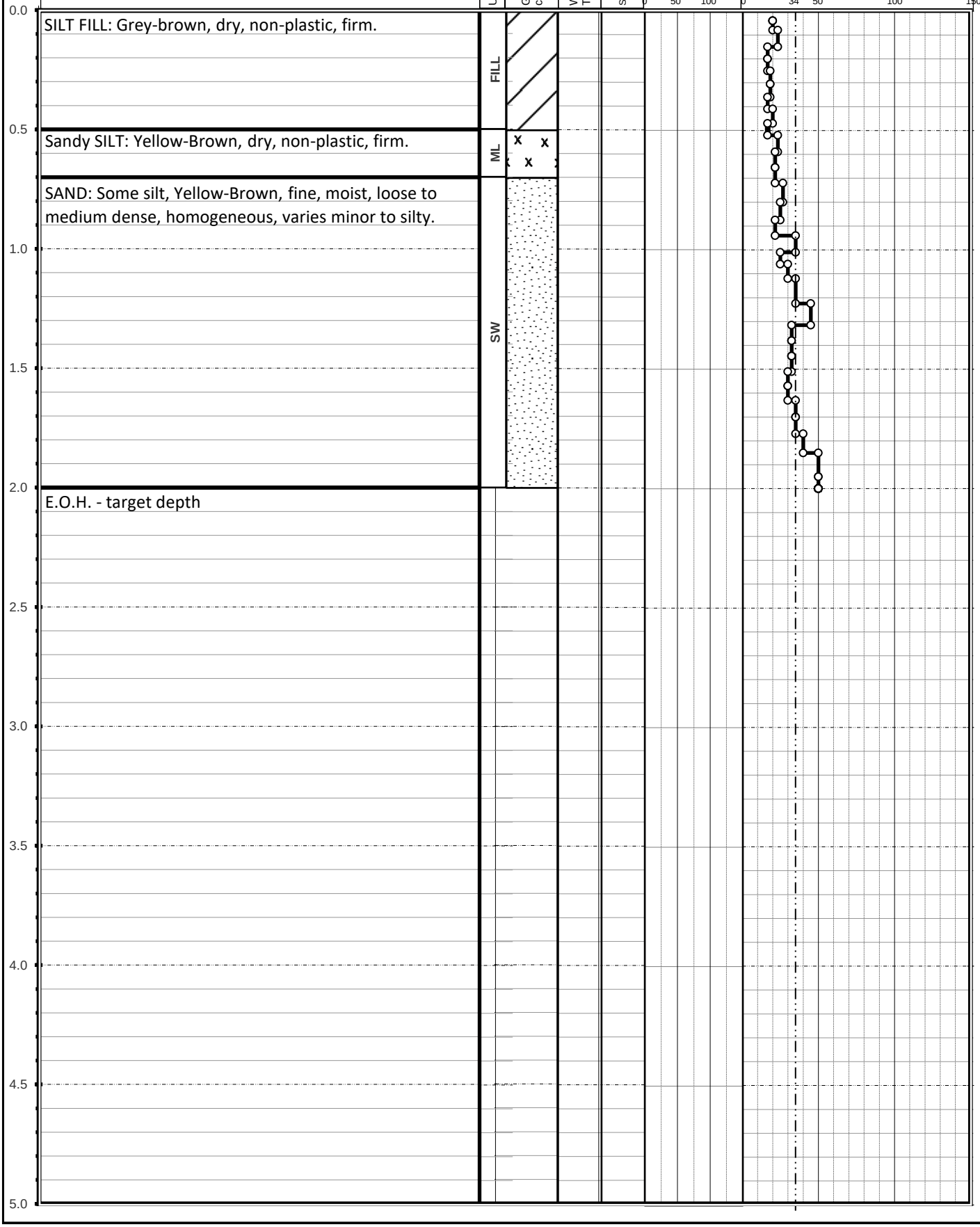
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, firm.	FILL					
Sandy SILT: Yellow-Brown, dry, non-plastic, firm.	ML					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium dense, homogeneous, varies minor to silty.	SW					
E.O.H. - target depth						

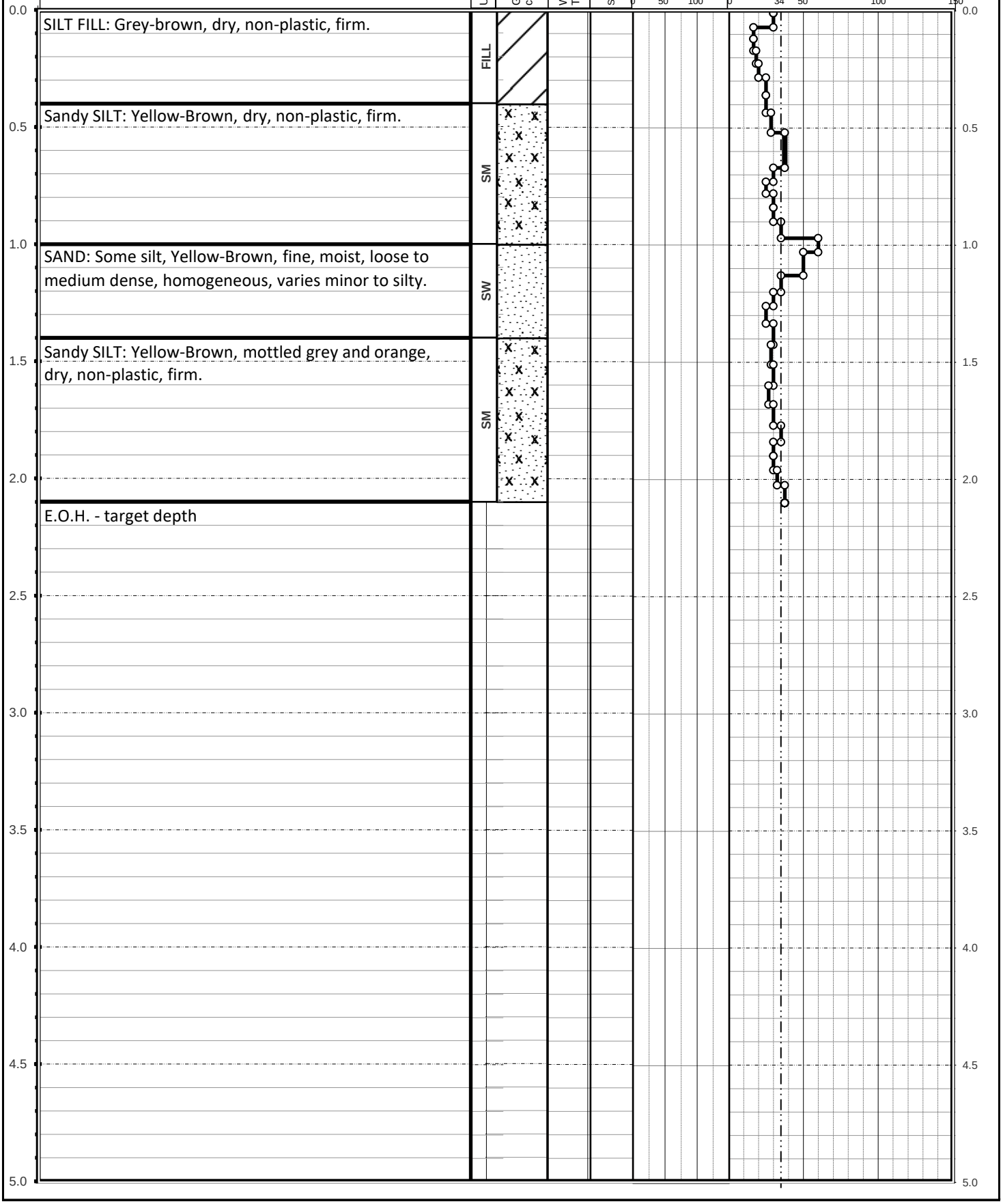


BORE HOLE LOG

GEOTECH

				Hole No:	HA04
				Job No:	5595
				Logged by:	WH/RBW
Project:	256 Fitzgerald Ave, Christchurch			Date drilled:	2/12/2020
Client:	R Harwood			Checked by:	RBW
Hole location:	Refer to Site Plan.			Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L:	Max depth:	2.10
Notes:					

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, firm.	FILL					
Sandy SILT: Yellow-Brown, dry, non-plastic, firm.	SM					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium dense, homogeneous, varies minor to silty.	SW					
Sandy SILT: Yellow-Brown, mottled grey and orange, dry, non-plastic, firm.	SM					
E.O.H. - target depth						

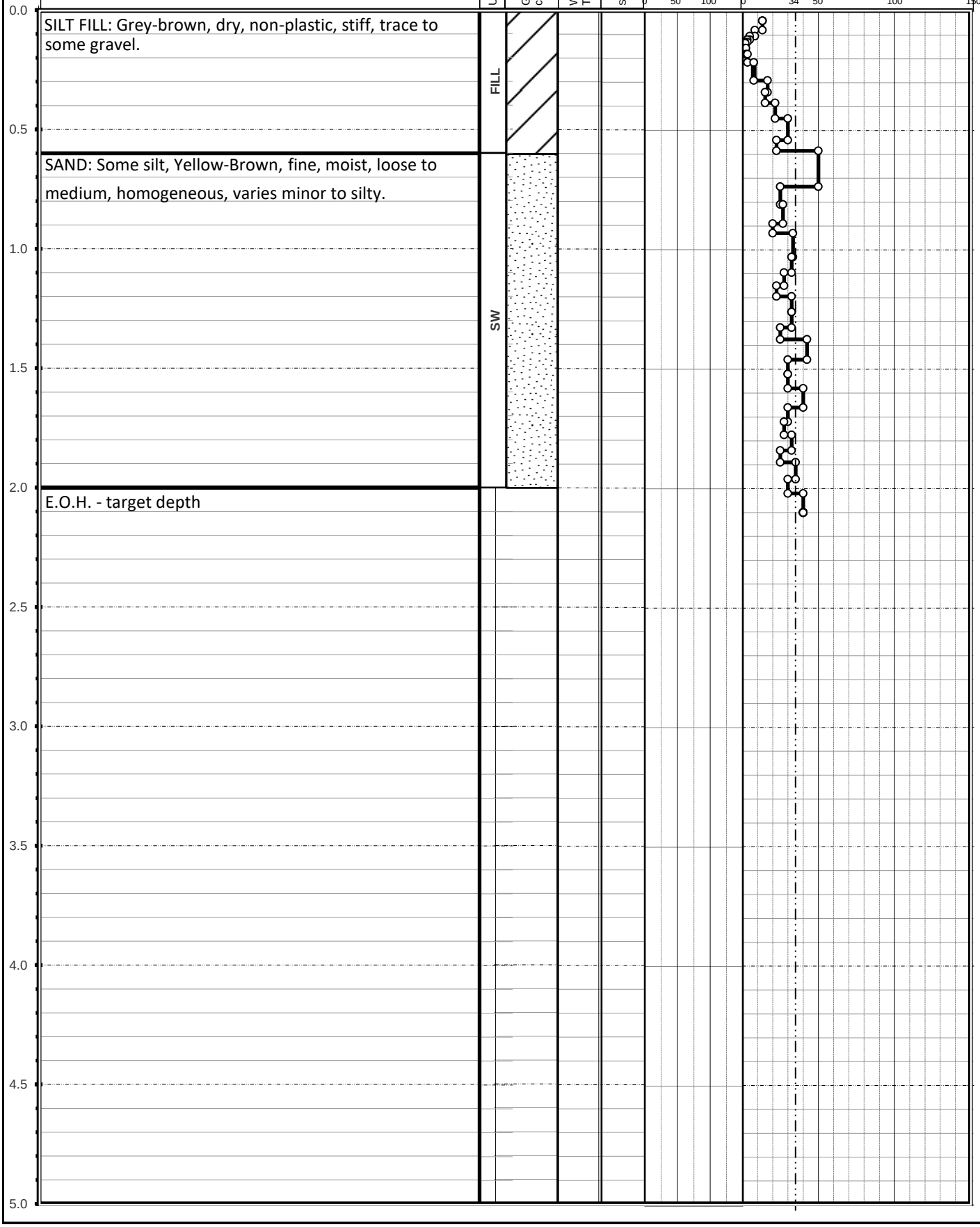


BORE HOLE LOG

GEOTECH

Hole No:	HA05		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, stiff, trace to some gravel.	FILL					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium, homogeneous, varies minor to silty.	SW					
E.O.H. - target depth						

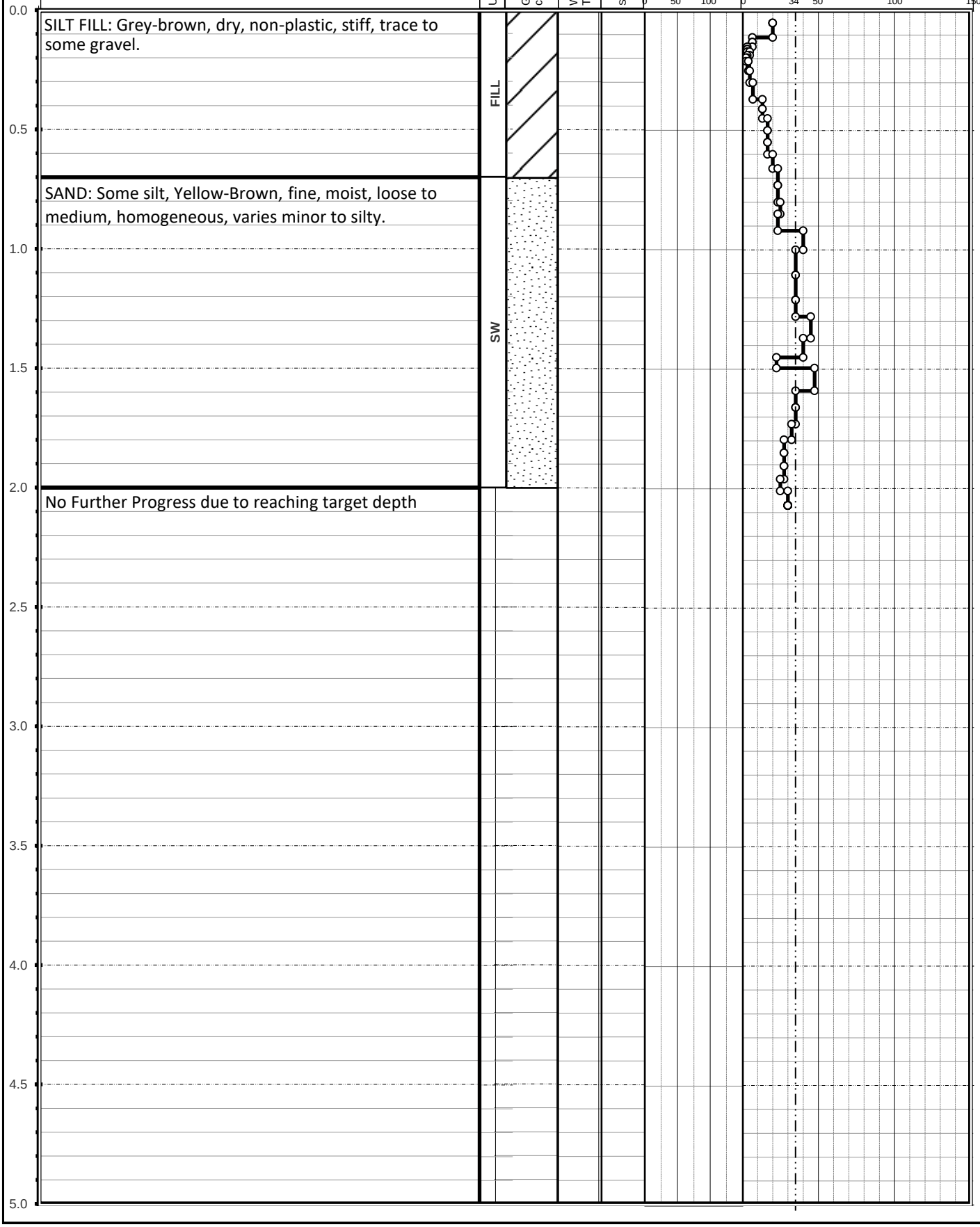


BORE HOLE LOG

GEOTECH

Hole No:	HA06		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, stiff, trace to some gravel.	FILL					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium, homogeneous, varies minor to silty.	SW					
No Further Progress due to reaching target depth						



BORE HOLE LOG

GEOTECH

				Hole No:	HA07
				Job No:	5595
				Logged by:	WH/RBW
Project:	256 Fitzgerald Ave, Christchurch			Date drilled:	2/12/2020
Client:	R Harwood			Checked by:	RBW
Hole location:	Refer to Site Plan.			Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L:	Max depth:	0.50

Notes: Hand cleared to 400mm then resumed scala penetrometer. Refusal on large concrete at 0.5m

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, stiff, some gravel.	FILL					
No Further Progress due to refusal on large concrete.						

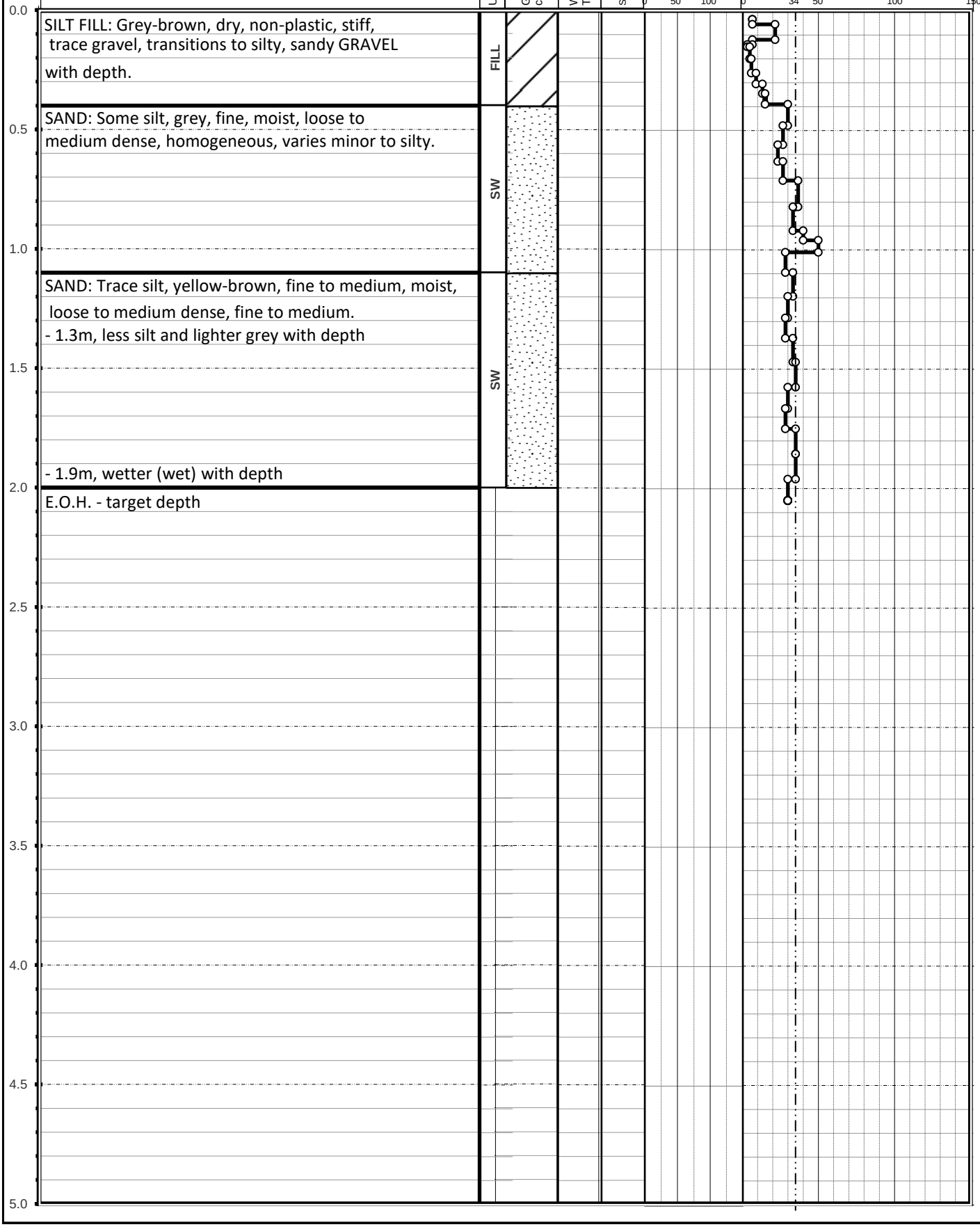
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

BORE HOLE LOG

GEOTECH

Hole No:	HA08		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-plastic, stiff, trace gravel, transitions to silty, sandy GRAVEL with depth.	FILL					
SAND: Some silt, grey, fine, moist, loose to medium dense, homogeneous, varies minor to silty.	SW					
SAND: Trace silt, yellow-brown, fine to medium, moist, loose to medium dense, fine to medium. - 1.3m, less silt and lighter grey with depth - 1.9m, wetter (wet) with depth	SW					
E.O.H. - target depth						

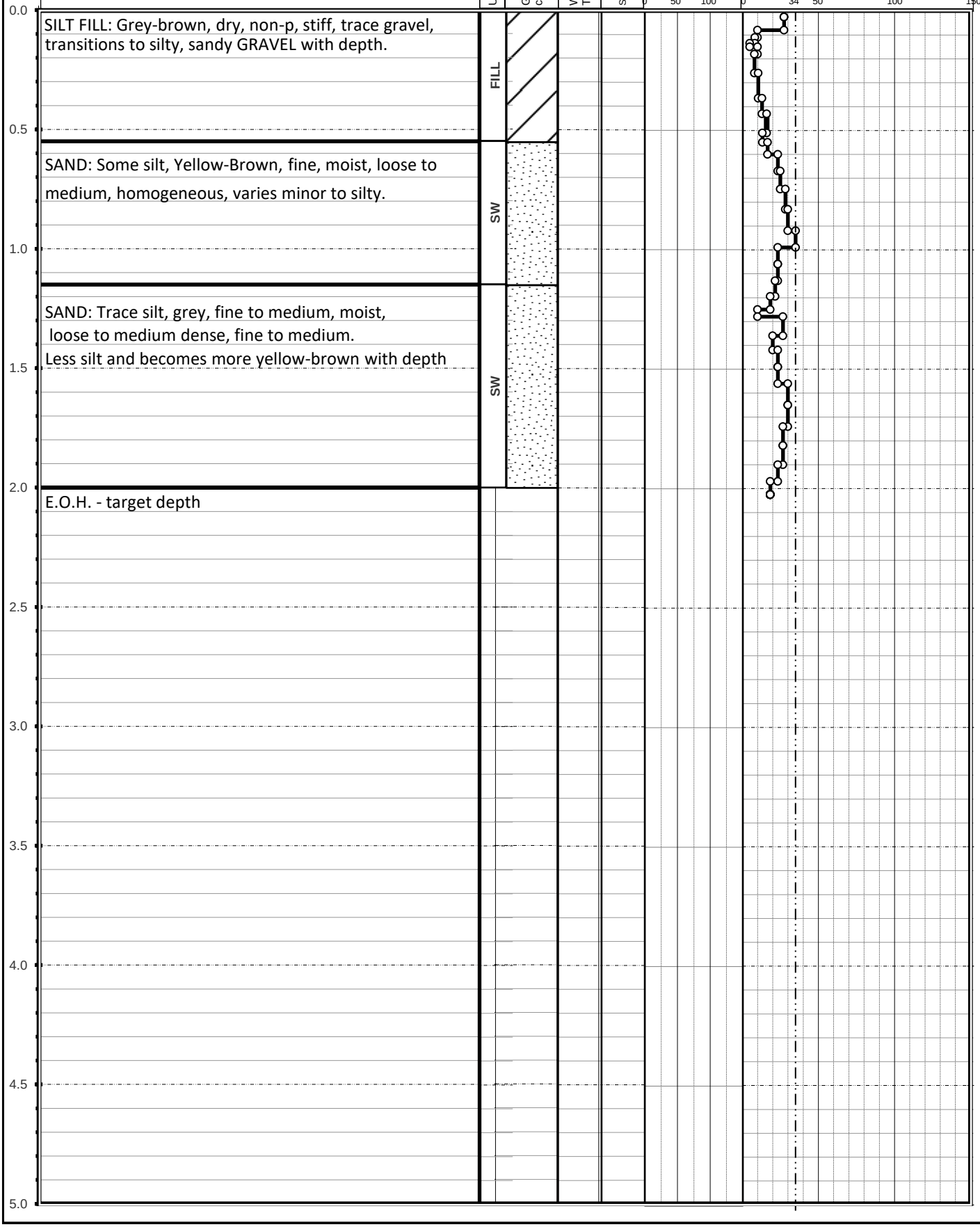


BORE HOLE LOG

GEOTECH

Hole No:	HA09		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00
Notes:			

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-p, stiff, trace gravel, transitions to silty, sandy GRAVEL with depth.	FILL					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium, homogeneous, varies minor to silty.	SW					
SAND: Trace silt, grey, fine to medium, moist, loose to medium dense, fine to medium. Less silt and becomes more yellow-brown with depth	SW					
E.O.H. - target depth						



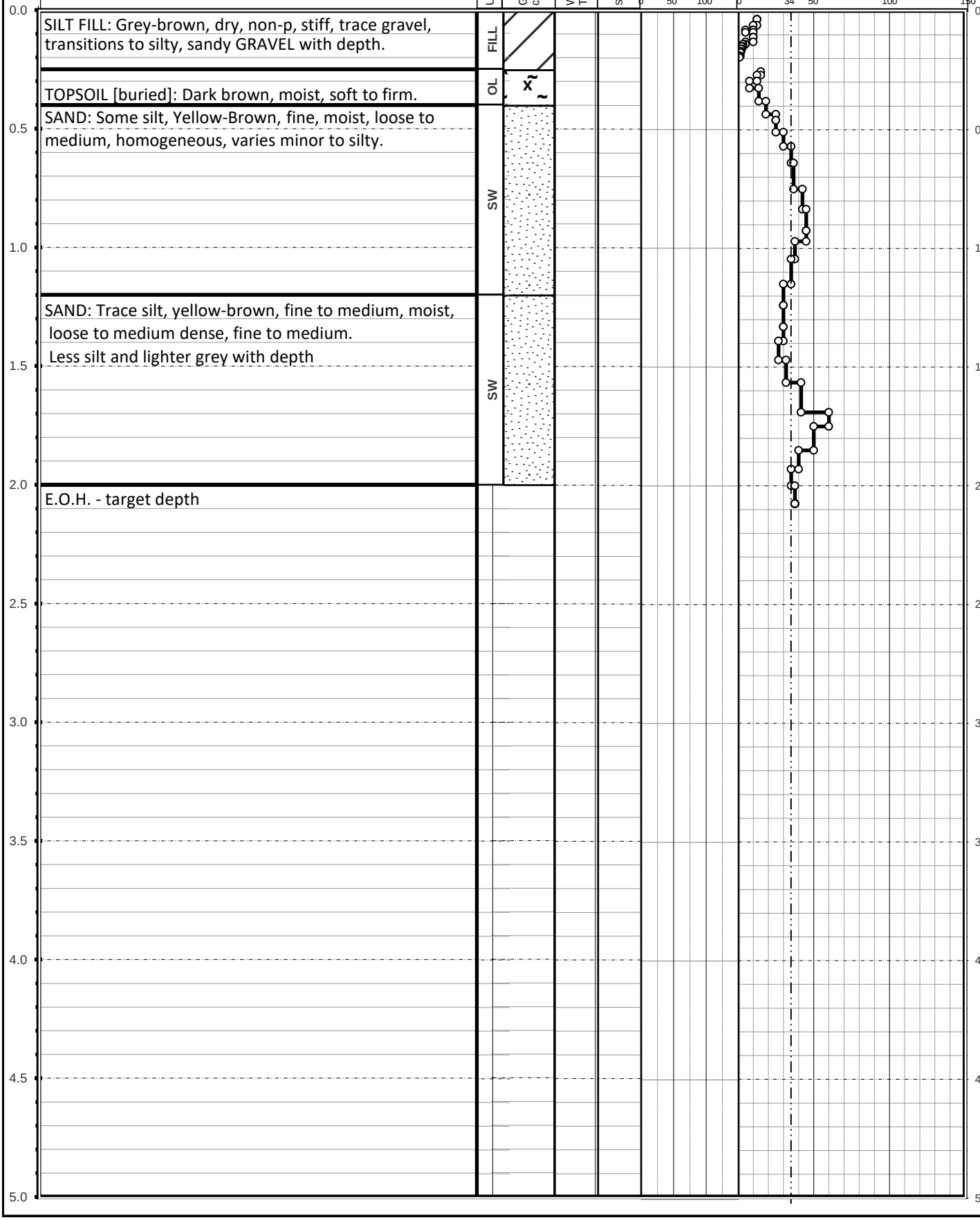
BORE HOLE LOG

GEOTECH

Hole No:	HA10		
Job No:	5595		
Logged by:	WH/RBW		
Project:	256 Fitzgerald Ave, Christchurch	Date drilled:	2/12/2020
Client:	R Harwood	Checked by:	RBW
Hole location:	Refer to Site Plan.	Date checked:	7/12/2020
Driller: WH	Contractor:	Equipment: SC+HA	R.L: / Max depth: 2.00

Notes: Location hand cleared to 0.25m, then scala penetrometer recommenced after refusal in surface fill.

STRATA DESCRIPTION	USCS	Graphic Log	Water Table	Samples	S.P.T N uncorrected (0 50 100)	SCALA PENETROMETER (mm/blow) (0 34 50 100 150)
SILT FILL: Grey-brown, dry, non-p, stiff, trace gravel, transitions to silty, sandy GRAVEL with depth.	FILL					
TOPSOIL [buried]: Dark brown, moist, soft to firm.	OL					
SAND: Some silt, Yellow-Brown, fine, moist, loose to medium, homogeneous, varies minor to silty.	SW					
SAND: Trace silt, yellow-brown, fine to medium, moist, loose to medium dense, fine to medium. Less silt and lighter grey with depth	SW					
E.O.H. - target depth						



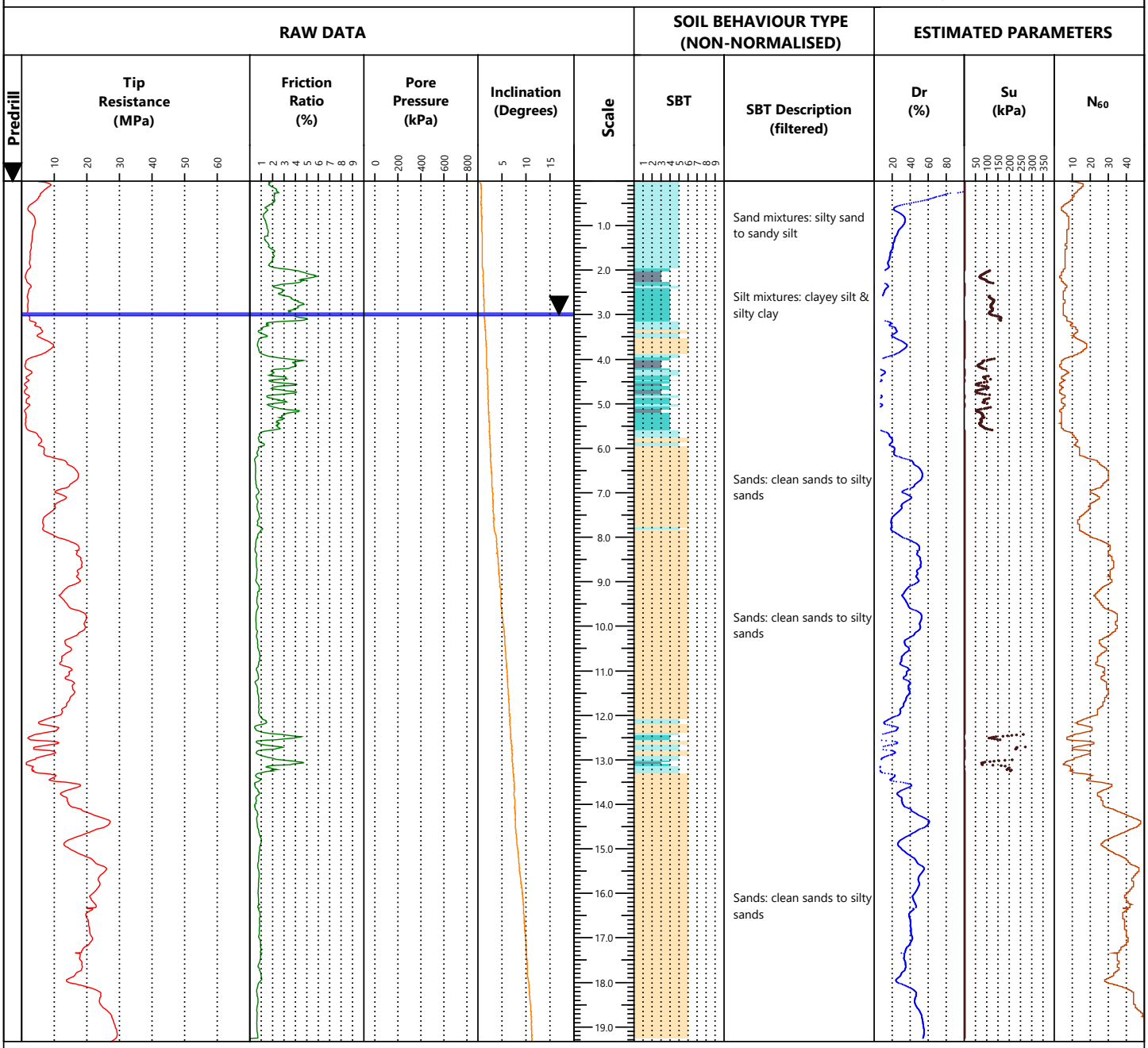
McMILLAN Drilling

Client: Geotech Consulting Ltd	**Bore No.:** CPT001
Project: 256 Fitzgerald Avenue, Christchurch	**Job No.:** 19425

Site Location: 256 Fitzgerald Avenue, Christchurch **Date:** 2/12/2020

Grid Reference: 1571833.44m E, 5180877.93m N (NZTM) - Map or aerial photograph **Rig Operator:** R. Wyllie

Elevation: 0.00m **Datum:** Ground **Equipment:** 14t truck mounted rig



EOH: 19.33m

Cone Type: I-CFXY-10 - Compression
Cone Reference: 110542
Cone Area Ratio: -
Standards: ISO 22476-1:2012

Predrill: -
Water Level: 3m
Collapse: 3.2m

Zero load outputs (MPa)	Before test	After test
Tip Resistance	-0.1482	-0.1442
Local Friction	0.0291	0.0291
Pore Pressure	-	-

Termination

Target Depth: ☐

Effective Refusal

Tip: ☐
Gauge: ☑
Inclinometer: ☐

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

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

Notes & Limitations

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

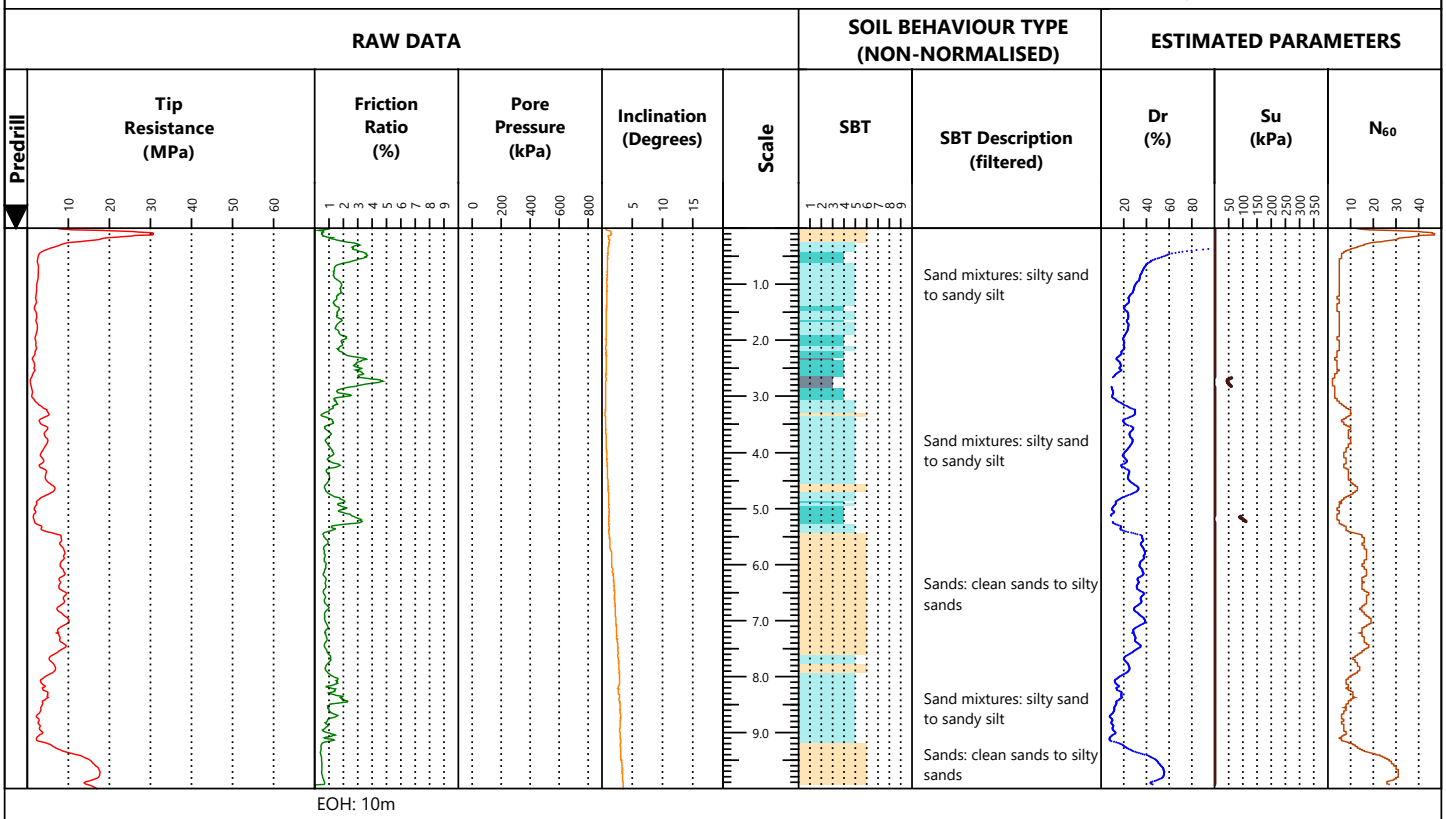
Remarks

McMILLAN Drilling	Client: Geotech Consulting Ltd	Bore No.: CPT002
	Project: 256 Fitzgerald Avenue, Christchurch	Job No.: 19425

Site Location: 256 Fitzgerald Avenue, Christchurch **Date:** 2/12/2020

Grid Reference: 1571851.88m E, 5180876.9m N (NZTM) - Map or aerial photograph **Rig Operator:** R. Wyllie

Elevation: 0.00m **Datum:** Ground **Equipment:** 14t truck mounted rig



Cone Type: I-CFXY-10 - Compression
Cone Reference: 110542
Cone Area Ratio: -
Standards: ISO 22476-1:2012

Predrill: -
Water Level: -
Collapse: 2.7m

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

Zero load outputs (MPa)	Before test	After test
Tip Resistance	-0.1747	-0.1427
Local Friction	0.0293	0.0288
Pore Pressure	-	-

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

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

Notes & Limitations

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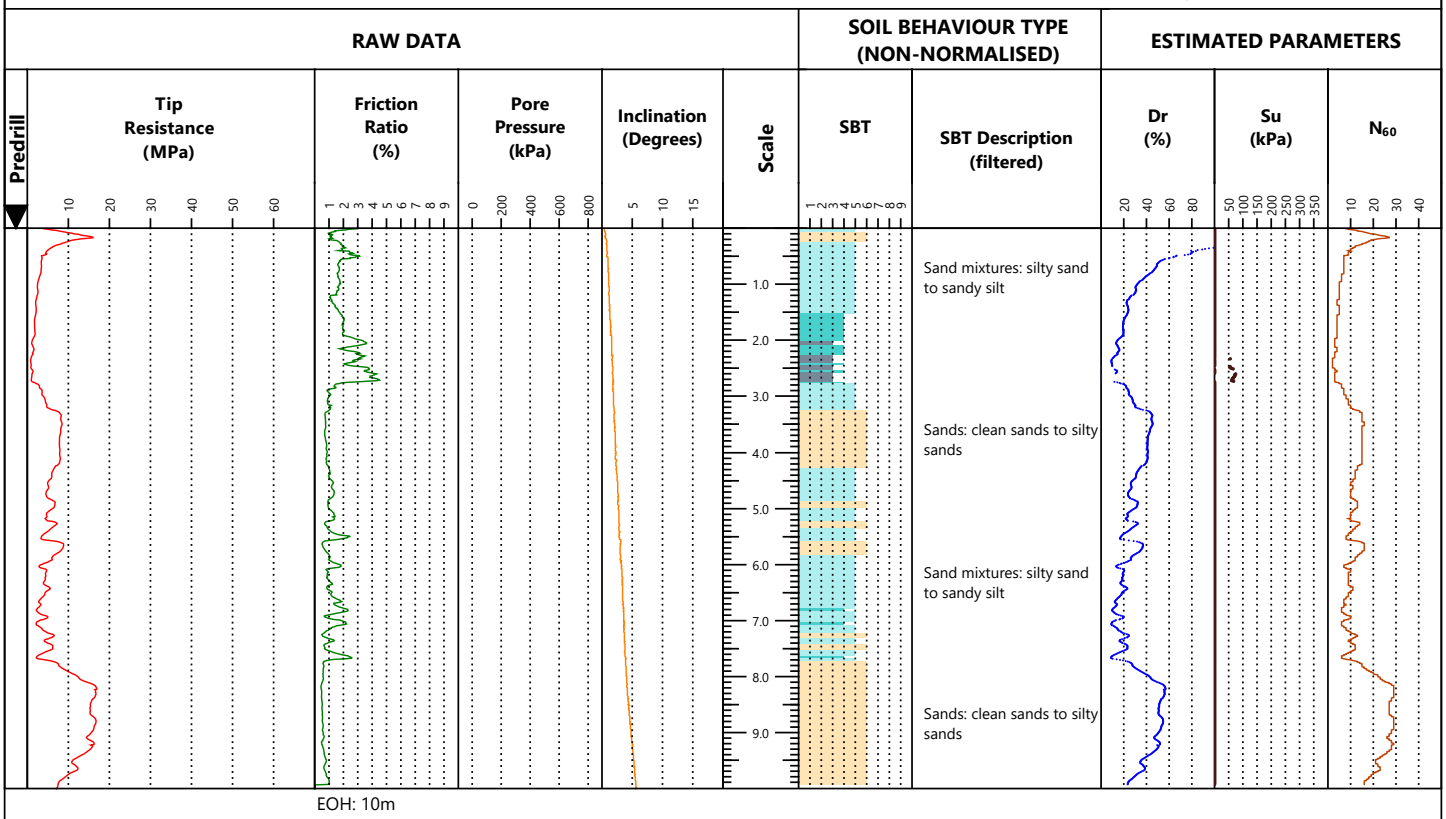
Remarks

McMILLAN Drilling	Client: Geotech Consulting Ltd	Bore No.: CPT003
	Project: 256 Fitzgerald Avenue, Christchurch	Job No.: 19425

Site Location: 256 Fitzgerald Avenue, Christchurch **Date:** 2/12/2020

Grid Reference: 1571873.18m E, 5180876.89m N (NZTM) - Map or aerial photograph **Rig Operator:** R. Wyllie

Elevation: 0.00m **Datum:** Ground **Equipment:** 14t truck mounted rig



Cone Type: I-CFXY-10 - Compression
Cone Reference: 110542
Cone Area Ratio: -
Standards: ISO 22476-1:2012

Predrill: -
Water Level: -
Collapse: 2.2m

Termination
Target Depth: ☑
Effective Refusal
Tip: ☐
Gauge: ☐
Inclinometer: ☐

Zero load outputs (MPa)	Before test	After test
Tip Resistance	-0.1551	-0.1357
Local Friction	0.0292	0.029
Pore Pressure	-	-

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

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

Notes & Limitations

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Remarks

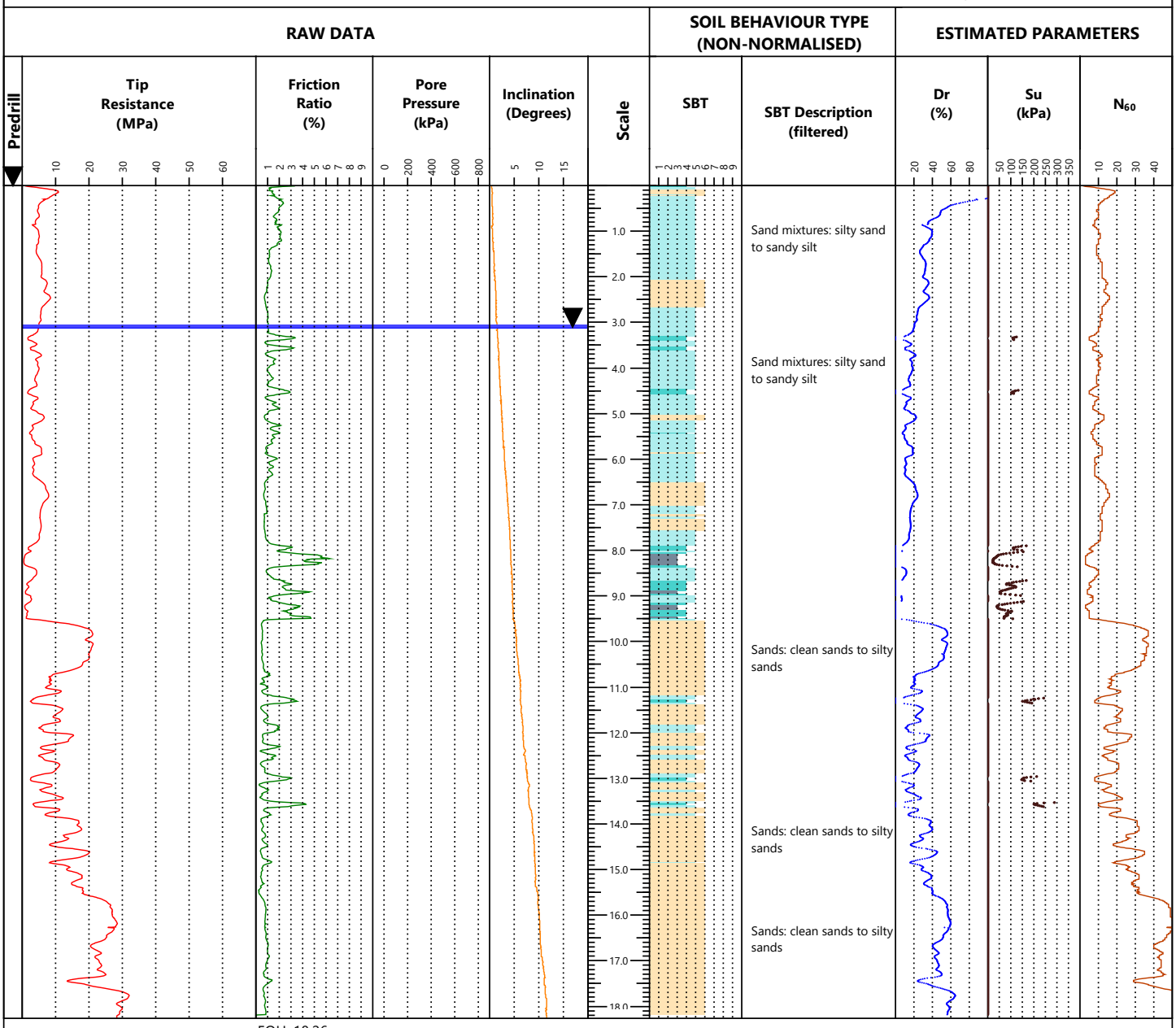
McMILLAN Drilling

Client: Geotech Consulting Ltd	**Bore No.:** CPT004
Project: 256 Fitzgerald Avenue, Christchurch	**Job No.:** 19425

Site Location: 256 Fitzgerald Avenue, Christchurch **Date:** 2/12/2020

Grid Reference: 1571873.4m E, 5180900.92m N (NZTM) - Map or aerial photograph **Rig Operator:** R. Wyllie

Elevation: 0.00m **Datum:** Ground **Equipment:** 14t truck mounted rig



EOH: 18.26m

Cone Type: I-CFXY-10 - Compression
Cone Reference: 110542
Cone Area Ratio: -
Standards: ISO 22476-1:2012

Predrill: -
Water Level: 3.1m
Collapse: 3.3m

Termination
Target Depth: ☐

Effective Refusal
Tip: ☐
Gauge: ☑
Inclinometer: ☐

Zero load outputs (MPa)	Before test	After test
Tip Resistance	-0.1968	-0.1469
Local Friction	0.0306	0.0287
Pore Pressure	-	-

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

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

Notes & Limitations

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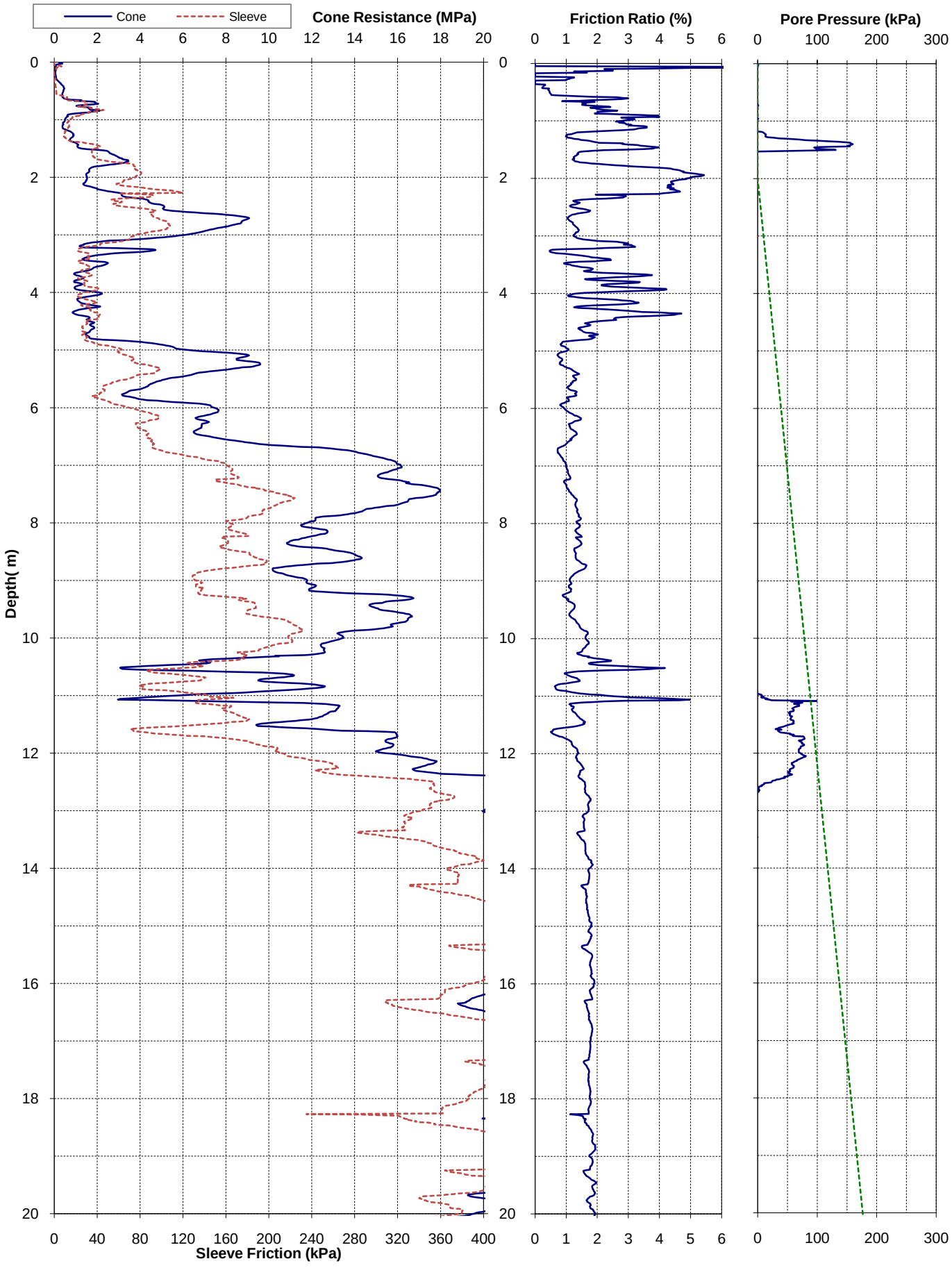
Remarks

Project:	Christchurch 2011 Earthquake - EQC Ground Investigations			Page: 1 of 2	CPT-RCH-54
Test Date:	26-May-2011	Location:	Richmond	Operator:	Perry
Pre-Drill:	1.2m	Assumed GWL:	2mBGL	Located By:	Survey GPS
Position:	2481814mE	5742497.6mN	4.16mRL	Coord. System:	NZMG & MSL
Other Tests:				Comments:	



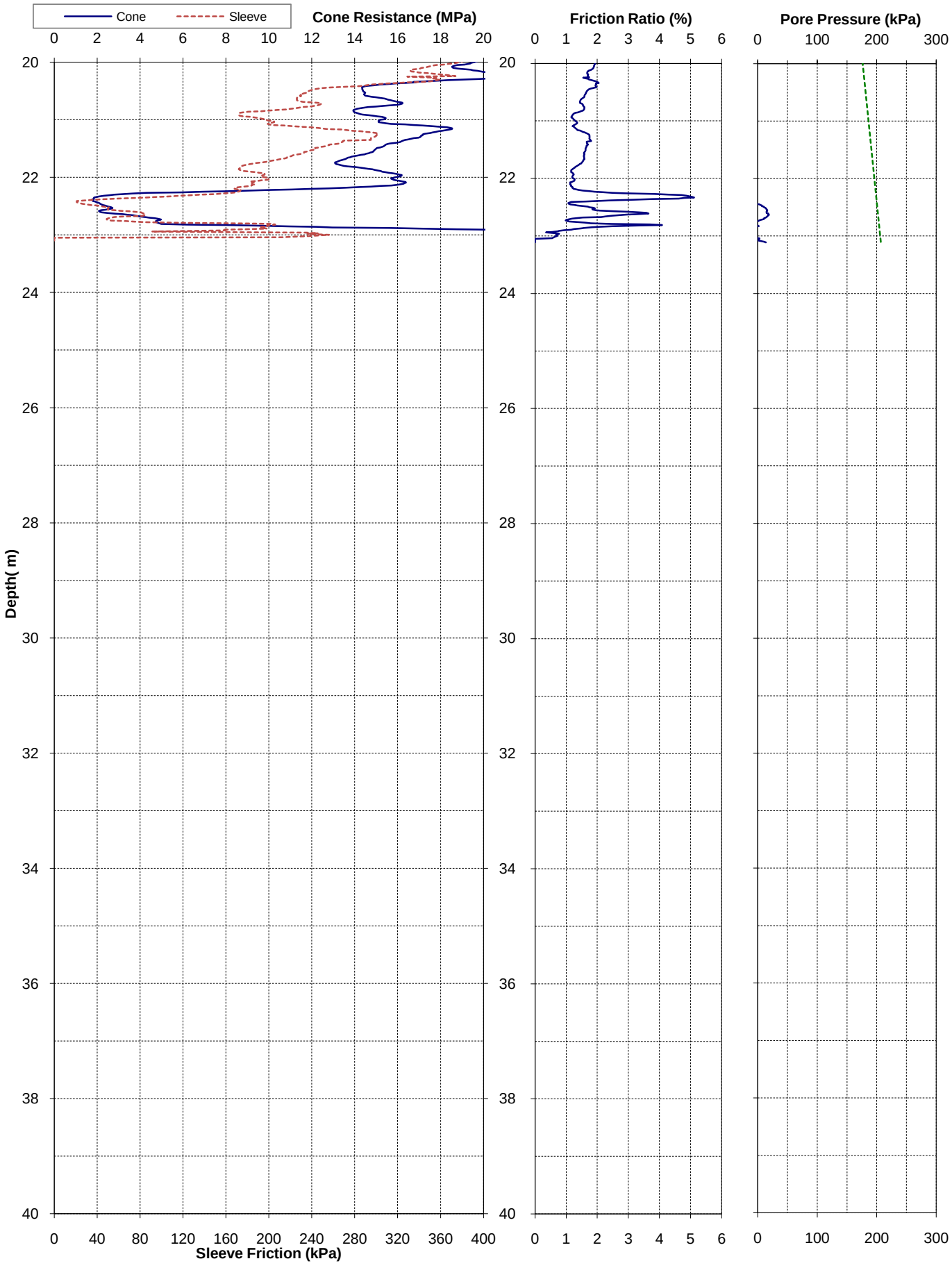
T+T Ref: 51731.001

Printed: 21/09/2011 12:17 p.m.

Template: CPT Graph Template v0.41.xls

NZGD ID: CPT_564

Project:	Christchurch 2011 Earthquake - EQC Ground Investigations			Page: 2 of 2	CPT-RCH-54
Test Date:	26-May-2011	Location:	Richmond	Operator:	Perry
Pre-Drill:	1.2m	Assumed GWL:	2mBGL	Located By:	Survey GPS
Position:	2481814mE	5742497.6mN	4.16mRL	Coord. System:	NZMG & MSL
Other Tests:				Comments:	



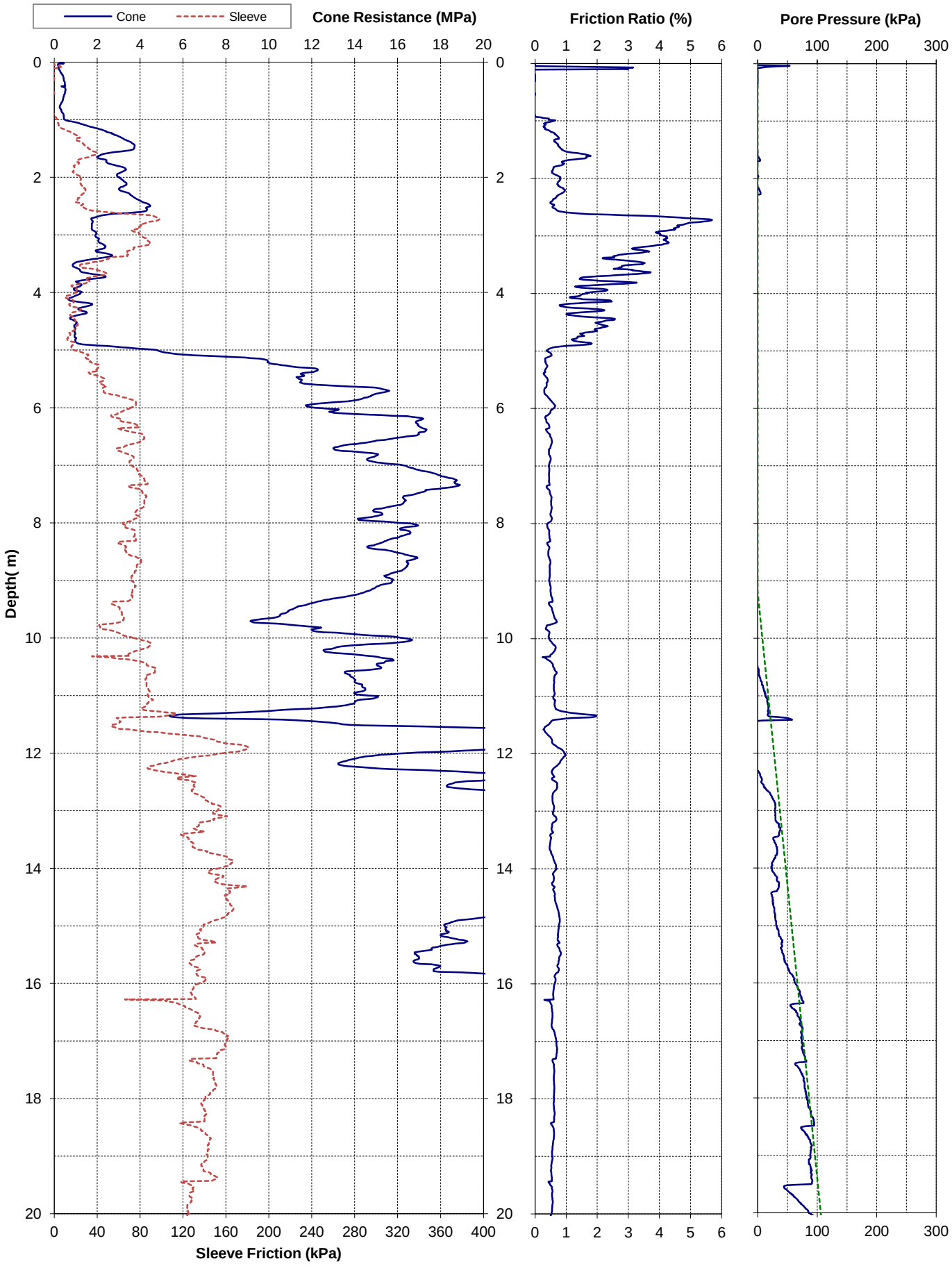
T+T Ref: 51731.001

Printed: 21/09/2011 12:17 p.m.

Template: CPT Graph Template v0.41.xls

NZGD ID: CPT_564

Project:	Christchurch 2011 Earthquake - CCC Ground Investigations			Page: 1 of 2	CPT-CBD-27
Test Date:	30-May-2011	Location:	Central City	Operator:	Perry
Pre-Drill:	1.5m	Assumed GWL:	9.2mBGL	Located By:	Survey GPS
Position:	2481874.8mE	5742472.9mN	4.189mRL	Coord. System:	NZMG & MSL
Other Tests:				Comments:	



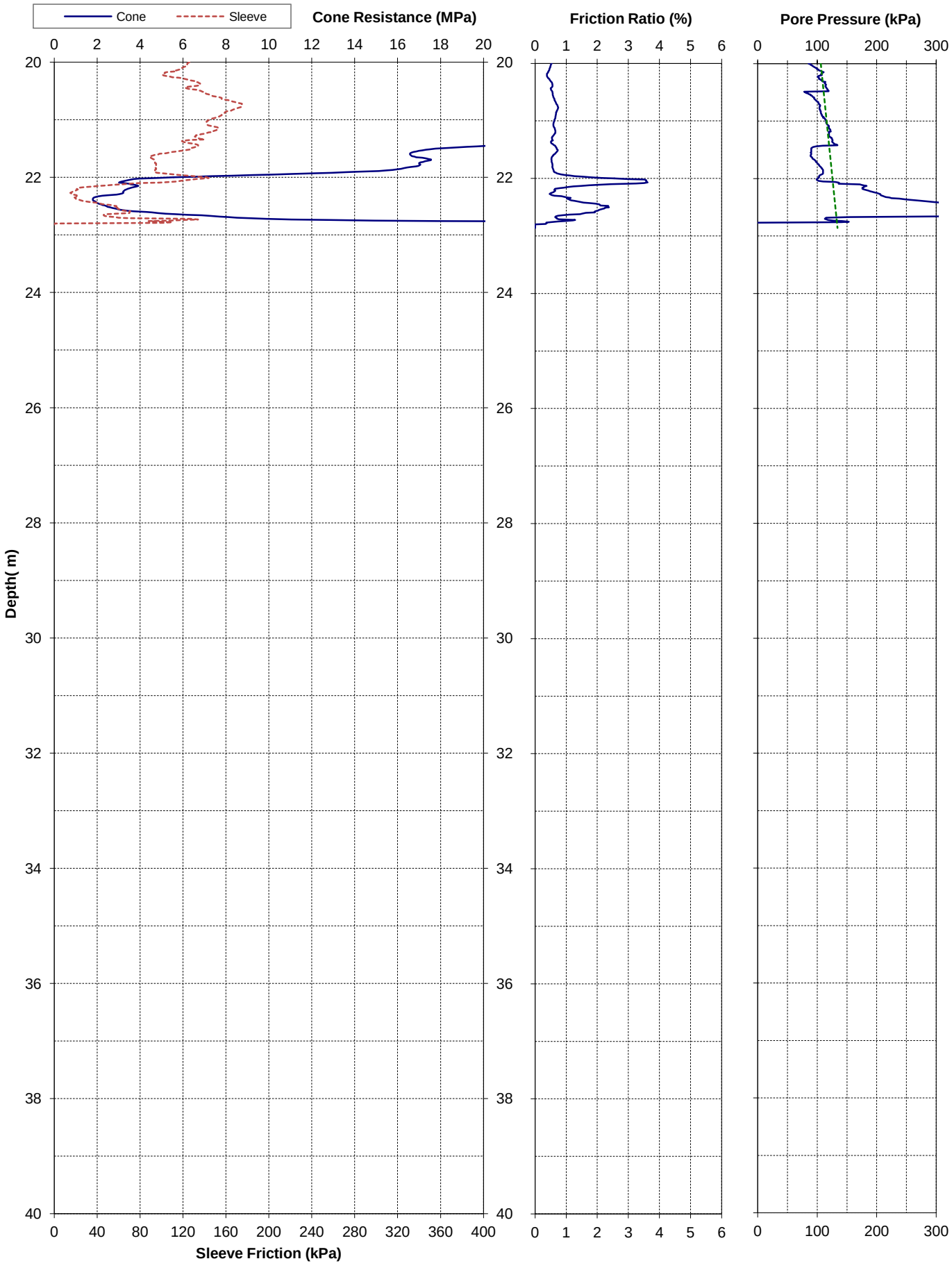
T+T Ref: 52000.3400

Printed: 4/11/2011 11:49 a.m.

Template: CPT Graph Template v0.41.xls

NZGD ID: CPT_404

Project:	Christchurch 2011 Earthquake - CCC Ground Investigations			Page: 2 of 2	CPT-CBD-27
Test Date:	30-May-2011	Location:	Central City	Operator:	Perry
Pre-Drill:	1.5m	Assumed GWL:	9.2mBGL	Located By:	Survey GPS
Position:	2481874.8mE	5742472.9mN	4.189mRL	Coord. System:	NZMG & MSL
Other Tests:				Comments:	



T+T Ref: 52000.3400

Printed: 4/11/2011 11:49 a.m.

Template: CPT Graph Template v0.41.xls

NZGD ID: CPT_404

McMILLAN Drilling GROUP

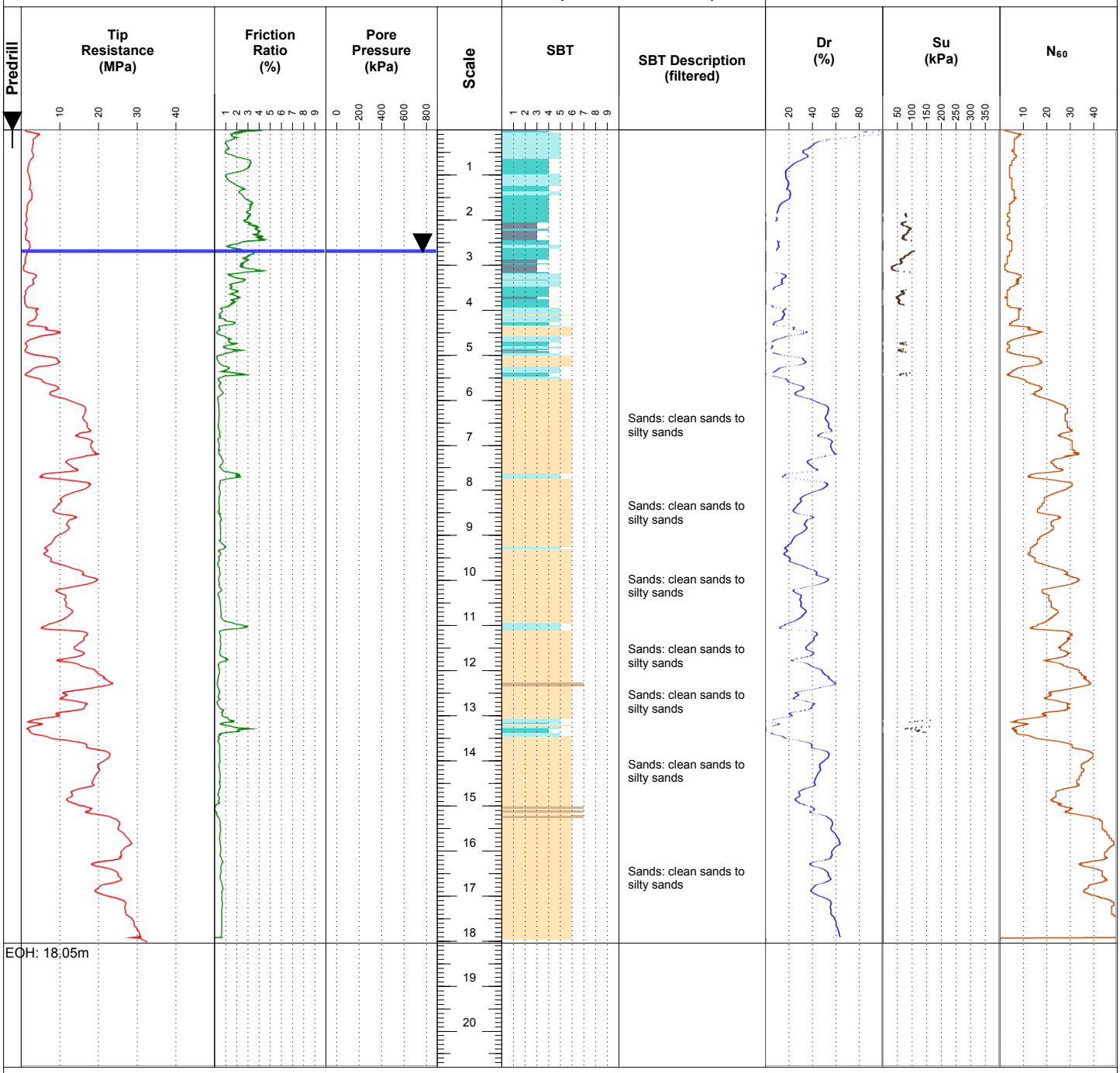
CONE PENETRATION TEST

Job: 13302
CPT No.: CPT002

Name: 20 Heywood Terrace, Christchurch
Client: Geotech Consulting Ltd
Location: 20 Heywood Terrace, Christchurch

Grid: NZTM
Datum:
Termination: -

North (m): 5180935.17
East (m): 1571868.35
Elevation (m): -
Hole Depth (m): 18.05



Operator: S. Cardona
Cone Reference: 110542T
Cone Area Ratio: 0.75
Cone Type: -

Date: 03/03/2014
Predrill: 0.00
Water Level: 2.70
Collapse:

Tip Resistance (MPa) Initial: -5.0007 **Final:** -5.0874
Local Friction (MPa) Initial: 0.0192 **Final:** 0.02
Pore Pressure (KPa) Initial: - **Final:** -

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

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

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

Notes & Limitations

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Remarks
Effective Refusal

Hole Depth (m): 18.05

Sheet 1 of 1

Generated with Core-GS by Geroc

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: CBD 07
Hole Location: Harvey Tce

SHEET 1 OF 6

PROJECT: CHRISTCHURCH CITY 2011 REMEDIATION | LOCATION: CENTRAL CITY | JOB No: 52000.3400

CO-ORDINATES 5742473 mN, 2481875.25 mE
R.L. 4.21 m
DATUM NZMG

DRILL TYPE: Rotary
DRILL METHOD: OB/Triple Tube
DRILL FLUID: Mud

HOLE STARTED: 11/7/11
HOLE FINISHED: 12/7/11
DRILLED BY: Pro-Drill
LOGGED BY: RKH/CP CHECKED: BMcD

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	DEPTH (m)	R.L. (m)	SAMPLES	TESTS	CASING	METHOD	CORE RECOVERY (%)	WATER	FLUID LOSS	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
HAND DIG FILL. (Potholed for services check and backfilled.)	0.5	4.0				PRE-DUG	0										Fill: Borehole drilled through pre-dug and backfilled pothole.
YALDHURST MEMBER OF THE SPRINGSTON FORMATION (ALLUVIAL)	1.5	3.5		1/1/0/1/0/1 N=2		SPT					ML	S	S				Sandy SILT, brown. Soft, wet, non plastic. Sand is fine. 1.6m to 1.95m no recovery
	2.0	3.0	B	✱FC		OB	100										
	2.5	2.5									SP	W	L				Silty, fine SAND, grey. Loose, wet.
	3.0	2.0		2/1/2/2/2/2 N=8		SPT											
	3.5	1.5															3.45m to 3.85m no recovery
	4.0	1.0	B	✱FC		OB	62										
	4.5	0.5									SP	M	L				Fine SAND with some silt, grey. Loose, moist.
	5	0.0		0/0/2/1/2/2 N=7		SPT											
		-0.5															

T+T DATATEMPLATE.GDT eek

BORELOG 650494.000.BOREHOLE LOGS A.GPJ 5/10/11

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: CBD 07
Hole Location: Harvey Tce

PROJECT: CHRISTCHURCH CITY 2011 REMEDIATION | LOCATION: CENTRAL CITY | JOB No: 52000.3400

CO-ORDINATES 5742473 mN, 2481875.25 mE | DRILL TYPE: Rotary | HOLE STARTED: 11/7/11

DRILL METHOD: OB/Triple Tube | HOLE FINISHED: 12/7/11

R.L. 4.21 m | DRILLED BY: Pro-Drill

DATUM NZMG | DRILL FLUID: Mud | LOGGED BY: RKH/CP | CHECKED: BMcD

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	DEPTH (m)	R.L. (m)	SAMPLES	TESTS	CASING	METHOD	CORE RECOVERY (%)	WATER	FLUID LOSS	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
YALDHURST MEMBER OF THE SPRINGSTON FORMATION (ALLUVIAL)	5.5	-1.0	B	✱FC		OB	100				SP	M	L				Fine SAND with some silt, grey. Loose, moist.
	6.0	-1.5				SPT							MD				- becoming medium dense
	6.5	-2.0		1/1/2/2/5/6 N=15													
	7.0	-2.5				OB	62										6.45m to 6.85m no recovery
	7.5	-3.0	B	✱FC													
	8.0	-3.5		1/1/2/2/2/4 N=10		SPT											
	8.5	-4.0				OB	100										- SAND becoming fine to medium
	9.0	-4.5															- with extremely closely spaced laminated silt beds
CHRISTCHURCH FORMATION (MARINE & ESTUARINE)	9.5	-5.0		1/1/2/2/5/6 N=15		SPT					SP	M	MD				Fine SAND with some silt, grey. Medium dense, moist.
	10	-5.5															9.45m to 9.9m no recovery

T+T DATATEMPLATE.GDT eek

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: CBD 07
Hole Location: Harvey Tce

SHEET 3 OF 6

PROJECT: CHRISTCHURCH CITY 2011 REMEDIATION | LOCATION: CENTRAL CITY | JOB No: 52000.3400

CO-ORDINATES 5742473 mN, 2481875.25 mE
R.L. 4.21 m
DATUM NZMG

DRILL TYPE: Rotary
DRILL METHOD: OB/Triple Tube
DRILL FLUID: Mud

HOLE STARTED: 11/7/11
HOLE FINISHED: 12/7/11
DRILLED BY: Pro-Drill
LOGGED BY: RKH/CP CHECKED: BMcD

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	DEPTH (m)	R.L. (m)	CORE RECOVERY (%)	METHOD	TESTS	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SOIL DESCRIPTION / ROCK DESCRIPTION
CHRISTCHURCH FORMATION (MARINE & ESTUARINE)	10.5	-6.0	55	HQTT			SW	W	MD	Fine to medium SAND with trace silt, grey. Medium dense, wet.
										- 10.5m to 10.75m some shells
	11.0	-6.5					ML	W	S	SILT with some sand, blue grey. Soft, wet, low plasticity.
	11.5	-7.0		SPT	1/1/2/2/3/4 N=11		SW	W	MD	Fine to medium SAND with some silt interbedded, grey. Medium dense, wet.
			76	HQTT						11.45m to 11.7m no recovery
	12.5	-8.0		SPT	3/1/3/5/9/7 N=24					12.75m to 13.25m no recovery
	13.5	-9.0	71	HQTT						- extremely closely spaced thinly laminated silt bed
	14.0	-9.5		SPT	3/4/4/4/5/9 N=22		SW	W	MD	Silty, fine to medium SAND, grey. Medium dense, wet. Silt is interbedded.
	14.5	-10.0								14.35m to 14.75m no recovery
	15	-10.5	71	HQTT						- contains some shells

SHEAR STRENGTH (kPa): 10, 25, 50, 100, 200
COMPRESSIVE STRENGTH (MPa): 1, 5, 20, 50, 100, 250
DEFECT SPACING (mm): 50, 250, 1000, 2000

SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour.
ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.

T+T DATATEMPLATE.GDT eek

BORELOG 650494.000.BOREHOLE LOGS A.GPJ 5/10/11

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: CBD 07
Hole Location: Harvey Tce

PROJECT: CHRISTCHURCH CITY 2011 REMEDIATION | LOCATION: CENTRAL CITY | JOB No: 52000.3400

CO-ORDINATES 5742473 mN, 2481875.25 mE | DRILL TYPE: Rotary | HOLE STARTED: 11/7/11

DRILL METHOD: OB/Triple Tube | HOLE FINISHED: 12/7/11

R.L. 4.21 m | DRILLED BY: Pro-Drill

DATUM NZMG | DRILL FLUID: Mud | LOGGED BY: RKH/CP | CHECKED: BMcD

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
CHRISTCHURCH FORMATION (MARINE & ESTUARINE)								-11.0	15.5		SW	W	MD				Silty, fine to medium SAND, grey. Medium dense, wet. Silt is interbedded.
				SPT		2/3/3/5/7/9 N=24		-11.5									15.7m to 15.95m no recovery
			100	HQTT		✱FC	B	-12.0	16.0		SW	W	MD				Fine to medium SAND with trace silt, grey. Medium dense, wet.
								-12.5	16.5								
				SPT		5/3/6/7/9/9 N=31		-13.0	17.0				D				- becoming dense
			95	HQTT		✱FC	B	-13.5	17.5								17.4m to 17.5m no recovery
								-14.0	18.0								
				SPT		4/8/14/ 14/17/15 for 15mm N>50		-14.5	18.5				VD				- becoming very dense
			90	HQTT				-15.0	19.0								
								-15.5	19.5								19.4m to 19.55m no recovery
									20								

NZGD ID: BH_1740

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: CBD 07
Hole Location: Harvey Tce

PROJECT: CHRISTCHURCH CITY 2011 REMEDIATION | LOCATION: CENTRAL CITY | JOB No: 52000.3400

CO-ORDINATES 5742473 mN, 2481875.25 mE | DRILL TYPE: Rotary | HOLE STARTED: 11/7/11

DRILL METHOD: OB/Triple Tube | HOLE FINISHED: 12/7/11

R.L. 4.21 m | DRILLED BY: Pro-Drill

DATUM NZMG | DRILL FLUID: Mud | LOGGED BY: RKH/CP | CHECKED: BMcD

GEOLOGICAL								ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
CHRISTCHURCH FORMATION (MARINE & ESTUARINE)			97	HQTT				-16.0 / 20.5		SW	W	MD				Fine to medium SAND with trace silt, grey. Medium dense, wet.
								-16.5								20.4m to 20.45m no recovery
								21.0 / -17.0								
				SPT		4/9/12/12/16/10 for 35 mm N>50		21.5 / -17.5								
			100	HQTT				22.0 / -18.0								
								22.5		ML	M	F				SILT with some sand, bluish grey. Firm, moist, low plasticity. Sand is fine.
				SPT		1/9/16/26/8 for 25mm N>50		23.0 / -19.0		GW	W	VD				Sandy, fine to coarse GRAVEL, grey. Very dense, wet. Gravel is subangular to subrounded. Sand is medium to coarse. 23.15m to 23.45m no recovery
RICCARTON GRAVELS			43	HQTT				23.5 / -19.5		GW	D	VD				Fine to coarse GRAVEL, grey. Very dense, dry. Gravel is subangular to subrounded. 23.9m to 24.5m no recovery
								24.0 / -20.0								
				SPT		4/4/5/5/6/7 N=23		24.5 / -20.5		SW	W	MD				Gravelly, medium to coarse SAND, yellowish brown. Medium dense, wet. Gravel is fine to coarse, subangular to subrounded. 24.85m to 24.95m no recovery
								25								

T+T DATATEMPLATE.GDT eek

NZGD ID: BH_1740

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: CBD 07
Hole Location: Harvey Tce

PROJECT: CHRISTCHURCH CITY 2011 REMEDIATION		LOCATION: CENTRAL CITY	JOB No: 52000.3400
CO-ORDINATES	5742473 mN 2481875.25 mE	DRILL TYPE: Rotary	HOLE STARTED: 11/7/11
		DRILL METHOD: OB/Triple Tube	HOLE FINISHED: 12/7/11
R.L.	4.21 m		DRILLED BY: Pro-Drill
DATUM	NZMG	DRILL FLUID: Mud	LOGGED BY: RKH/CP CHECKED: BMcD

GEOLOGICAL													ENGINEERING DESCRIPTION						
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (mm) 50 250 1000 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.	
RICCARTON GRAVELS			19	HQTT				-21.0	25.5		GW	D	VD				Fine to coarse GRAVEL, grey. Very dense, dry. Gravel is subangular to subrounded. 25.15m to 26.0m no recovery	25.5
				SPT		25/25 for 95mm N>50		-21.5	26.0									26.0
								-22.0	26.5								26.1m to 26.45m no recovery - becoming very dense	26.5
			19	HQTT				-22.5	27.0								26.65m to 27.5m no recovery	27.0
								-23.0	27.5		GW	W	VD				Sandy, fine to coarse GRAVEL, grey. Very dense, wet. Gravel is subangular to subrounded. Sand is medium to coarse. 27.55m to 27.95m no recovery	27.5
				SPT		6/8/11/ 14/26 for 75mm N>50		-23.5	28.0		GW	D	VD				Fine to coarse GRAVEL, grey. Very dense, dry. Gravel is subangular to subrounded. 28.2m to 29.0m no recovery Note: fines only recovered in SPT	28.0
			24	HQTT				-24.0	28.5									28.5
								-24.5	29.0		GW	W	VD				Sandy, fine to coarse GRAVEL, grey. Very dense, wet. Gravel is subangular to subrounded. Sand is medium to coarse. 29.05m to 29.15m no recovery	29.0
				SPT		20/30 for 75mm N>50		-25.0	29.5								**End of borehole at 29.15mbgl.** Open standpipe piezometer installed. Please see attached diagram in Appendix F.	29.5
								-25.5	30									

NZGD ID: BH_1740

GEOTECH

Liquefaction Potential Analysis

CPT001

GEOTECH CONSULTING LTD

Project: **256 Fitzgerald Avenue** Client: **R Harwood**

Job No: **5595** Date: 11/12/2020

Analysis: AJH

Checked: AJH

ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	155	20	31	149
Total liquefiable thickness (m):	8.31	0.33	1.1	7.70
Settlement in top 10m (mm):	75	8	16	74
Liquefiable thickness in top 10m (m):	3.62	0.00	0.47	3.56
Average MSF =	1.000	1.000	1.372	1.314
LSN ('mm')	14	1	3	14
LDI (m)	1.59	0.09	0.21	1.55
For free face of 4 m, LDI =	0.77	0.02	0.09	0.78

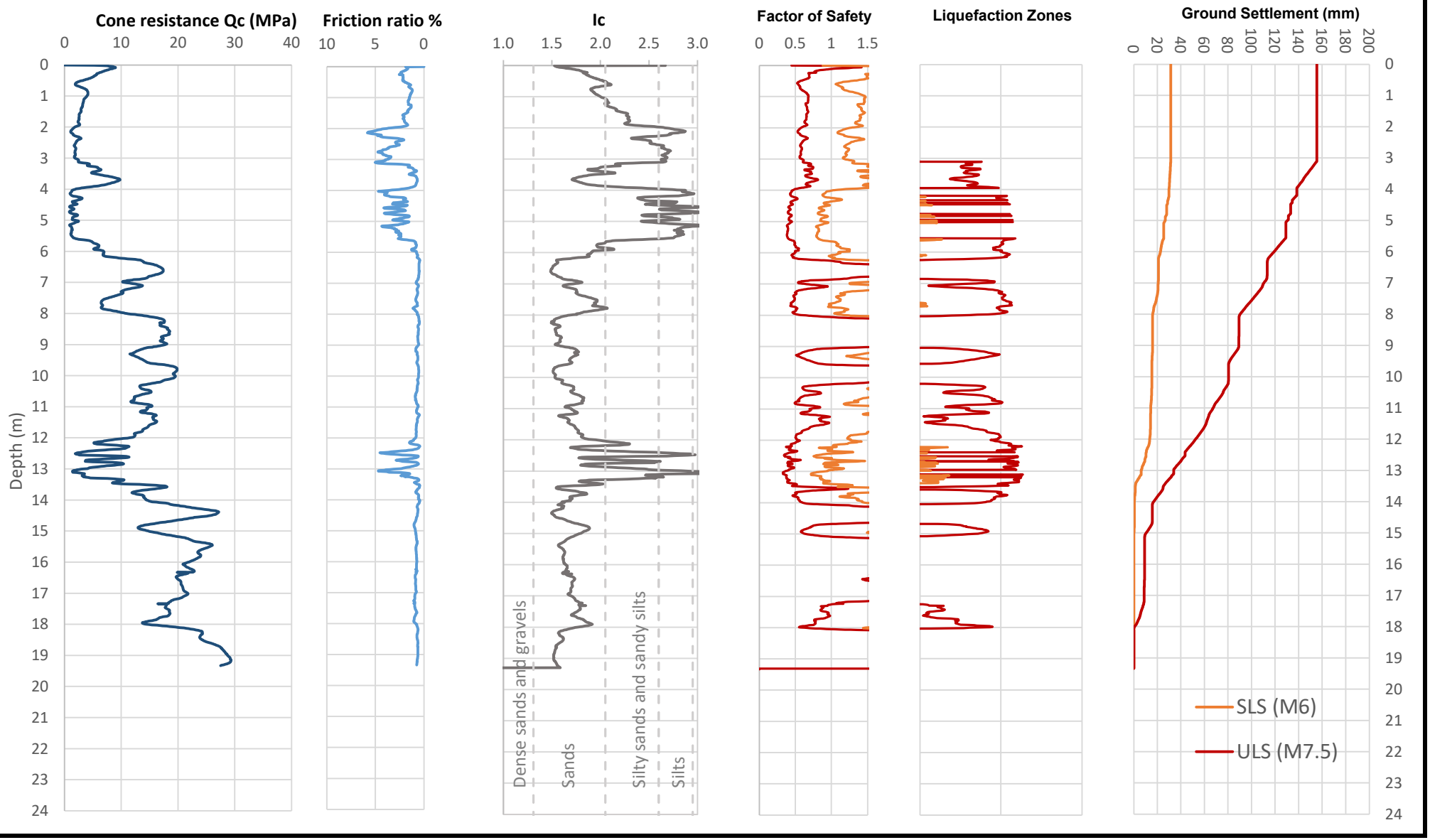
GEOTECH

Liquefaction Potential Analysis

CPT001

Project: **256 Fitzgerald Avenue**
Job No: **5595**
Client: **R Harwood**
Date: 11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002



GEOTECH

Liquefaction Potential Analysis — CPT002

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	12/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	147	27	53	147
Total liquefiable thickness (m):	6.33	0.75	1.5	6.29
Settlement in top 10m (mm):	147	27	53	147
Liquefiable thickness in top 10m (m):	6.33	0.75	1.46	6.29
Average MSF =	1.000	1.000	1.723	1.611
LSN ('mm')	26	4	8	26
LDI (m)	1.97	0.16	0.55	1.96
For free face of 4 m, LDI =	1.40	0.04	0.14	1.40

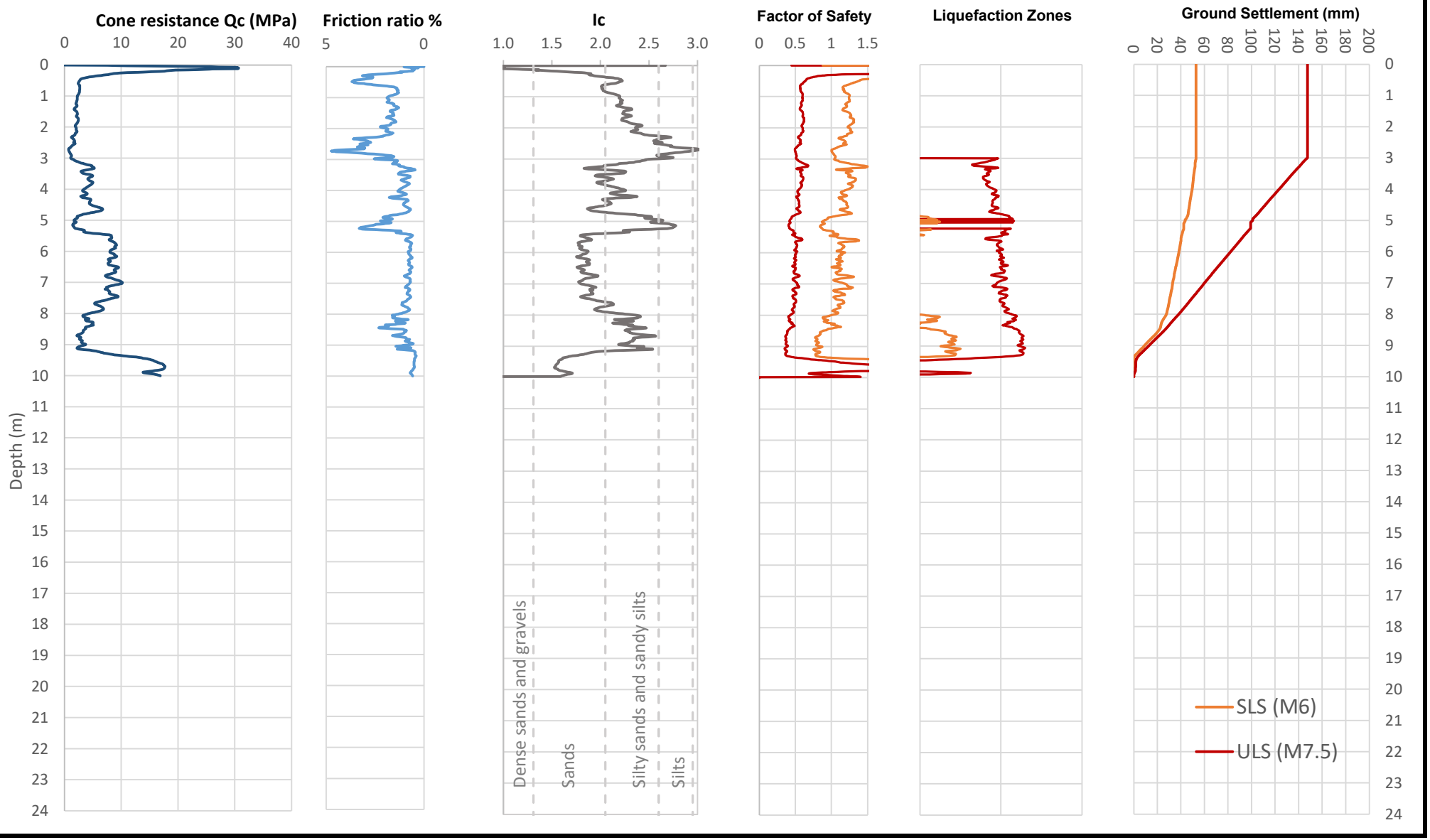
GEOTECH

Liquefaction Potential Analysis

CPT002

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	12/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002



GEOTECH

Liquefaction Potential Analysis — CPT003

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	12/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	128	16	32	127
Total liquefiable thickness (m):	5.79	0.00	1.1	5.73
Settlement in top 10m (mm):	128	16	32	127
Liquefiable thickness in top 10m (m):	5.79	0.00	1.14	5.73
Average MSF =	1.000	1.000	1.352	1.297
LSN ('mm')	23	3	5	23
LDI (m)	1.54	0.06	0.22	1.53
For free face of 4 m, LDI =	1.38	0.05	0.21	1.38

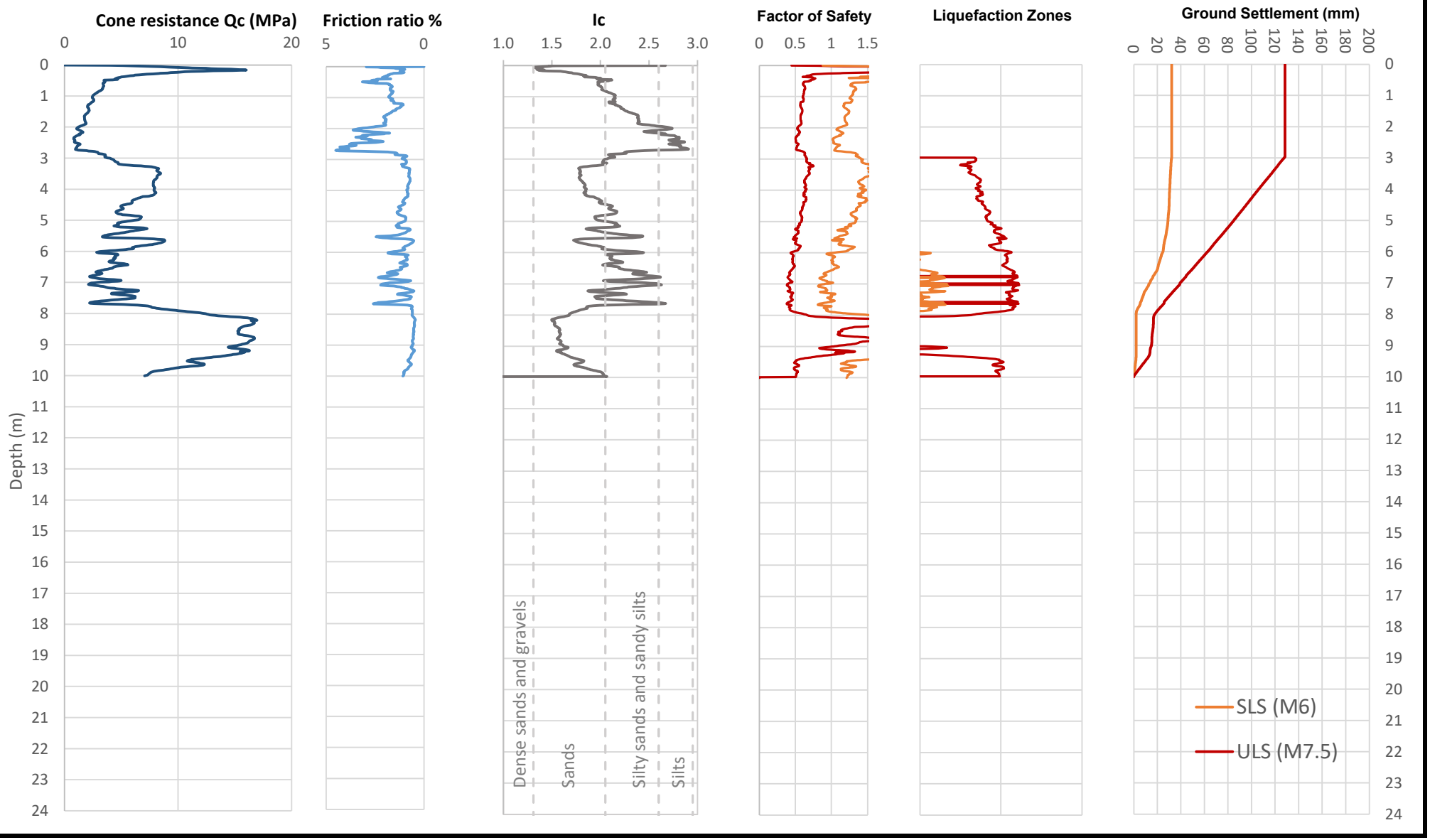
GEOTECH

Liquefaction Potential Analysis

CPT003

Project: **256 Fitzgerald Avenue**
Job No: **5595**
Client: **R Harwood**
Date: 12/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002



GEOTECH

Liquefaction Potential Analysis — CPT004

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	214	39	68	211
Total liquefiable thickness (m):	9.72	0.62	2.8	9.44
Settlement in top 10m (mm):	126	20	44	126
Liquefiable thickness in top 10m (m):	5.39	0.23	2.04	5.38
Average MSF =	1.000	1.000	1.174	1.147
LSN ('mm')	23	3	7	23
LDI (m)	2.63	0.20	0.50	2.61
For free face of 4 m, LDI =	1.47	0.05	0.16	1.47

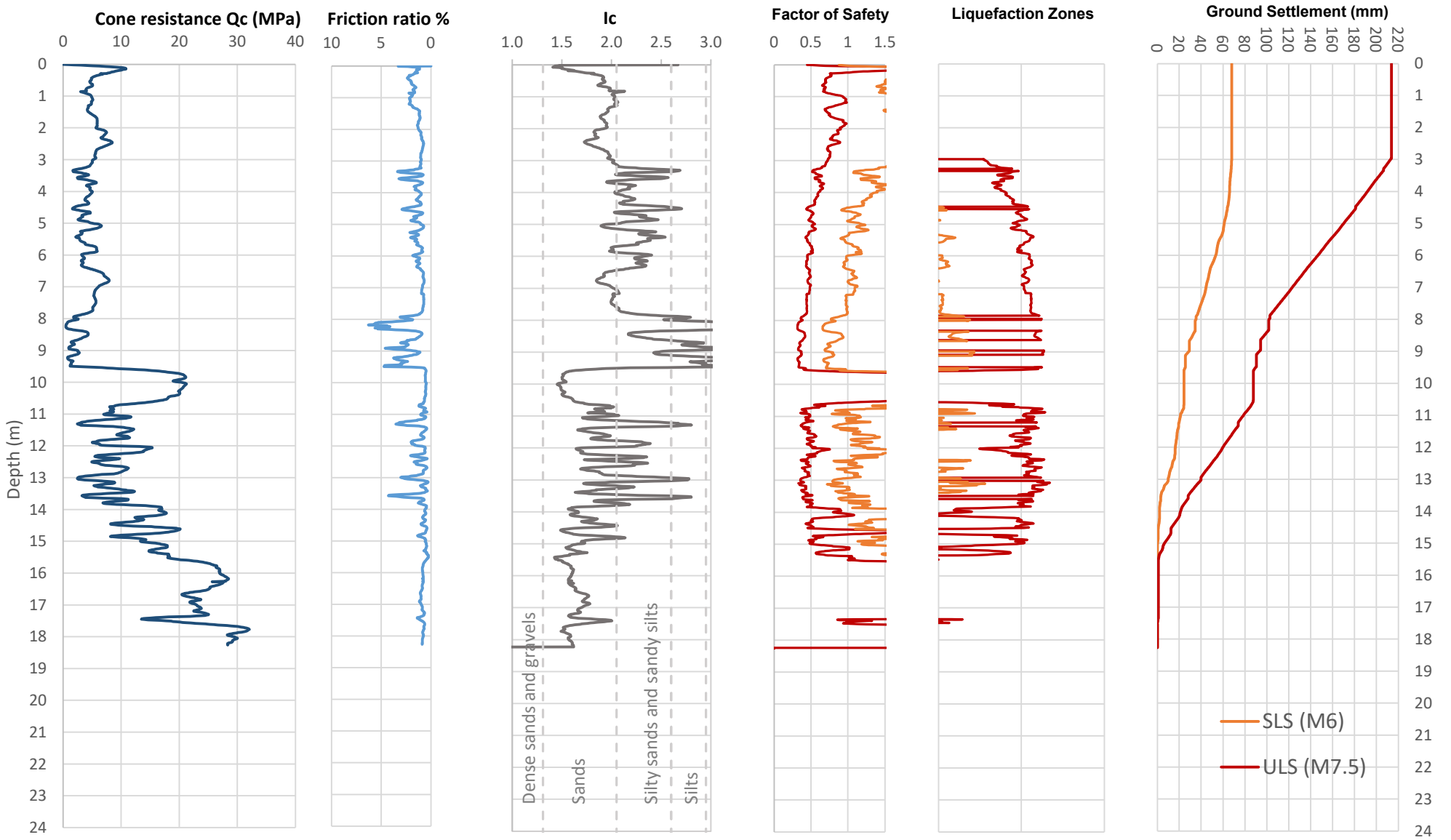
GEOTECH

Liquefaction Potential Analysis

CPT004

Project: **256 Fitzgerald Avenue**
Job No: **5595**
Client: **R Harwood**
Date: 11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002



GEOTECH

Liquefaction Potential Analysis

CPT_564

Project: **256 Fitzgerald Avenue** Client: **R Harwood**
Job No: **5595** Date: 11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	101	9	19	94
Total liquefiable thickness (m):	4.73	0.06	0.5	4.47
Settlement in top 10m (mm):	73	6	16	70
Liquefiable thickness in top 10m (m):	3.28	0.00	0.49	3.20
Average MSF =	1.000	1.000	1.060	1.050
LSN ('mm')	14	1	4	14
LDI (m)	1.10	0.03	0.18	1.06
For free face of 4 m, LDI =	0.80	0.02	0.16	0.80

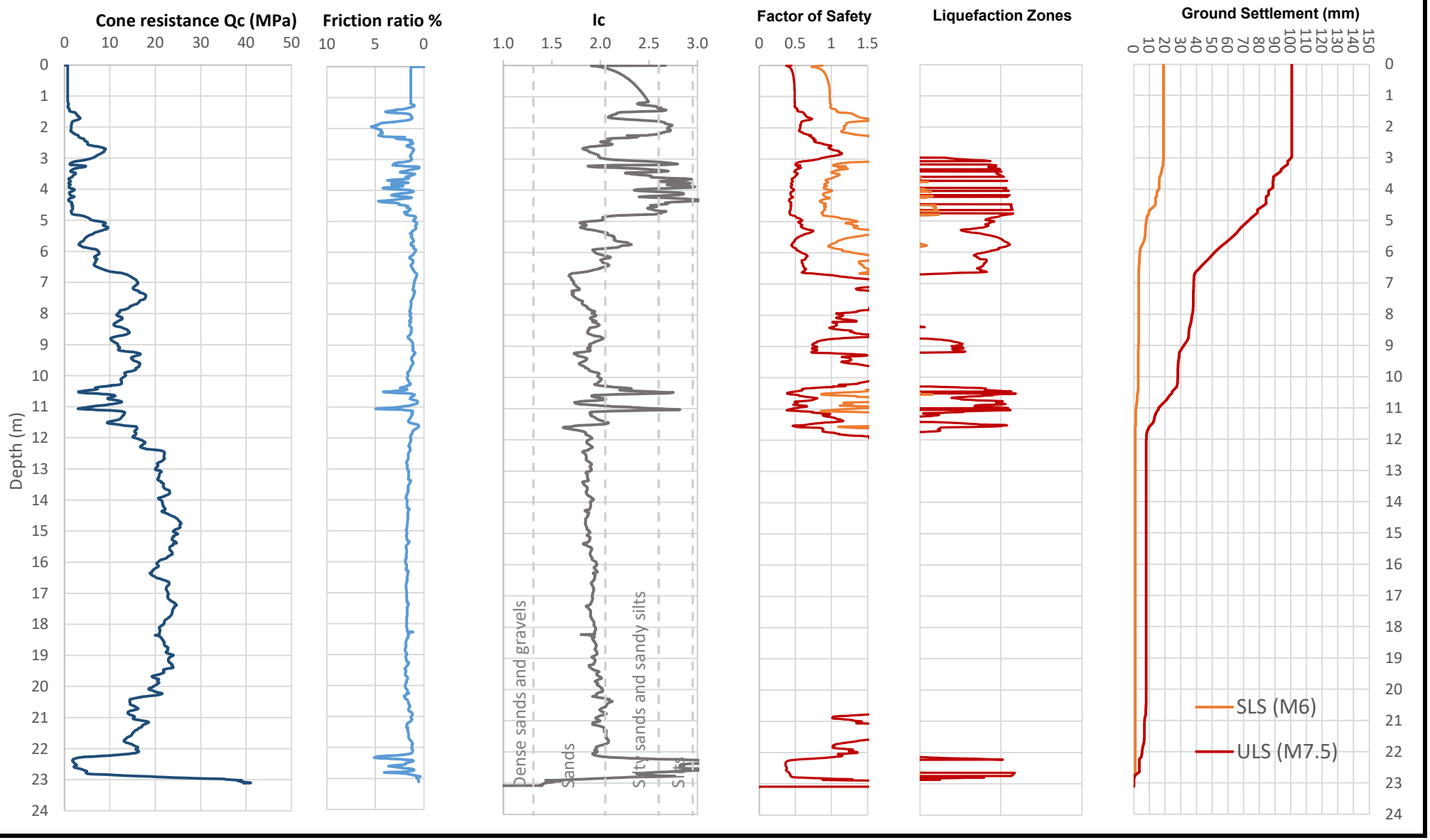
GEOTECH

Liquefaction Potential Analysis

CPT_564

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002



GEOTECH

Liquefaction Potential Analysis

CPT_404

Project: **256 Fitzgerald Avenue** Client: **R Harwood**
Job No: **5595** Date: 11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	103	13	21	96
Total liquefiable thickness (m):	5.50	0.19	0.7	4.98
Settlement in top 10m (mm):	49	5	13	46
Liquefiable thickness in top 10m (m):	2.41	0.00	0.48	2.20
Average MSF =	1.000	1.000	1.080	1.067
LSN ('mm')	8	1	3	8
LDI (m)	1.03	0.11	0.25	0.99
For free face of 4 m, LDI =	0.37	0.01	0.15	0.36

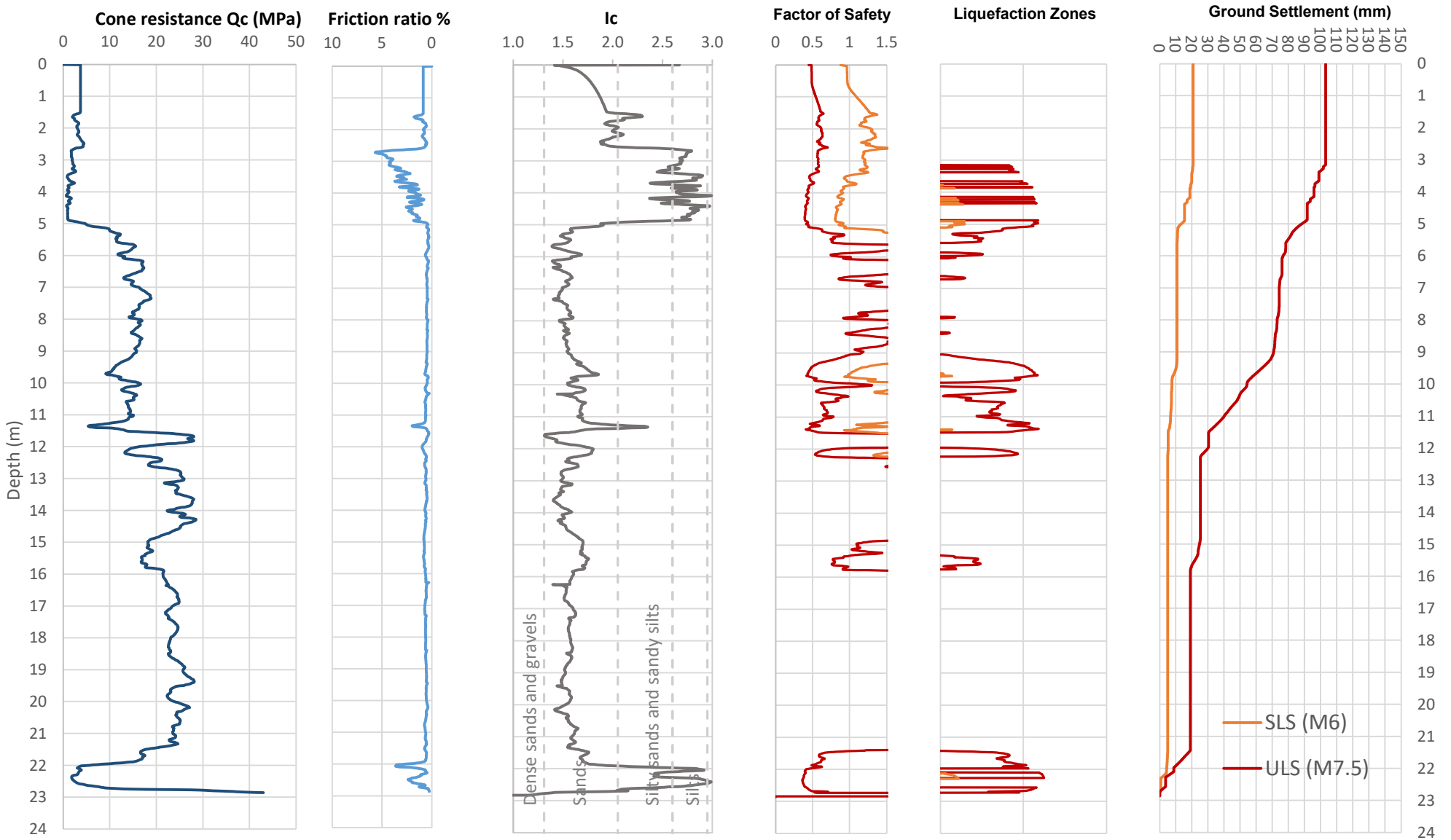
GEOTECH

Liquefaction Potential Analysis

CPT_404

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	11/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002



GEOTECH

Liquefaction Potential Analysis

CPT_46985

Project: **256 Fitzgerald Avenue** Client: **R Harwood**
Job No: **5595** Date: 12/12/2020

GEOTECH CONSULTING LTD
Analysis: AJH
Checked: AJH
ref: Boulanger & Idriss 2014, Zhang 2002

Input Parameters

Groundwater depth =	3	m
Soil density γ =	17	kN/m^3
Fines fitting parameter C_{fc} =	0	
Probability of Liquefaction =	0.15	(0.15 is standard deterministic model)
sigma(lnR) =	0.2	

Seismic Load Cases	**Case 1 ULS at M7.5**	**Case 2 SLS at M7.5**	**Case 3 SLS at M6**	**Case 4 22 Feb 2011**
Peak Ground Acceleration (PGA) =	0.35	0.13	0.19	0.45
Magnitude M =	7.50	7.50	6.00	6.20
representative M =	6.80	7.50	6.00	6.20
Summary Results				
Overall settlement (Zhang) (mm):	169	33	61	165
Total liquefiable thickness (m):	7.96	0.69	2.2	7.53
Settlement in top 10m (mm):	104	19	42	103
Liquefiable thickness in top 10m (m):	4.53	0.33	1.61	4.48
Average MSF =	1.000	1.000	1.068	1.057
LSN ('mm')	18	3	7	18
LDI (m)	2.07	0.26	0.70	2.04
For free face of 4 m, LDI =	0.89	0.02	0.27	0.89

GEOTECH

Liquefaction Potential Analysis

CPT_46985

Project:	**256 Fitzgerald Avenue**	Client:	**R Harwood**
Job No:	**5595**	Date:	12/12/2020

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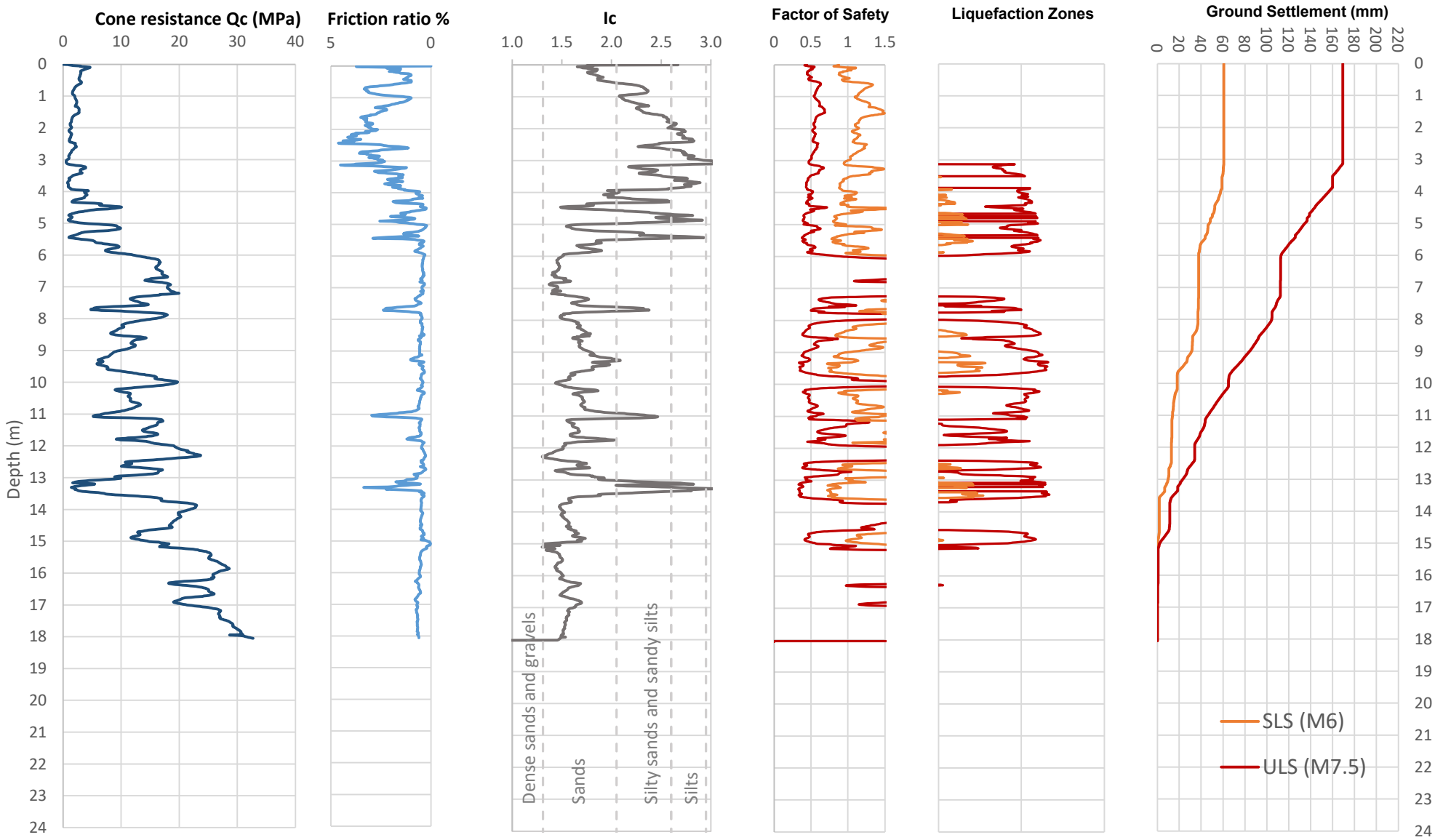

Densified Crust Method Statement (reinforced crushed gravel raft) (Type G1d)

This method is generally suitable for most sites where the water table is at least 1.0m below ground level.

The crushed gravel raft is to be a minimum of 1.2m deep (below the underside of foundation elements) over the entire house footprint, and extend a minimum of 1.0m beyond the perimeter foundation line. The raft is to be constructed of crushed gravels comprising TNZ M/4 40mm or equivalent (eg crushed AP40 with at least 70% stone having 2 or more broken faces. Outside reinforced grid zones, crushed AP65 can be used).

Two layers of geogrid are incorporated into the raft to add resilience and improve the ability of the crust to resist differential settlement and (in the case of lateral stretch) fracturing/ pulling apart. In areas of 'major' lateral stretch as defined within these guidelines, a third layer of geogrid is incorporated.

It may be necessary to batter the sides of the excavation, and provide a drainage sump to remove ground water for the duration of the excavation, filling and compaction work. This method may have limited application where the groundwater level is high and a 'dry' and stable excavation cannot be practically formed.

A resource consent for dewatering may be required, particularly if the site is potentially contaminated. The potential effects on settlement of neighbouring properties needs to be assessed when designing the dewatering system.

Step	Type G1d – Typical Activity Sequence for Densified Crust (reinforced crushed gravel raft)
1d.1	Set out perimeter of foundation treatment area and locate marker pegs clear of all workings. Remove all topsoil and other unsuitable materials.
1d.2	During excavation any organic material is to be removed from site and reported to the Design Engineer.
1d.3	Any physical obstructions encountered during excavation shall be reported to the Design Engineer for further direction.
1d.4	Excavation in strips or sections may be necessary due to site constraints such as adjacent properties or the physical shape of the house. In this case additional care is required at the vertical edge joins by cutting into the previous compacted zone at 2h:1v to ensure compaction integrity is attained across the joins.
1d.5	Commence excavation to 1.2m (below the underside of foundation elements) and if water is present, construct dewatering sump adjacent to work area. Install pump in the sump and pipe to sediment control.
1d.6	Level and compact the base of the excavation. Static compaction is likely to be required in wet or saturated subgrade to avoid fluidizing and/or heaving the ground.
1d.7	The base of the excavation should be stable (not yielding) prior to backfilling. In the event that soft areas are present in the base layer and the target compaction is not achieved, the soft materials should be removed and replaced with suitable material placed and compacted as described in step 1a.9. The base can also be stabilised by placing a layer of compacted rock or crushed concrete (dia. ≤ 150mm) over the soft area to create a 'working platform'. A nonwoven geotextile fabric separation layer comprising Bidim A19 or equivalent should be placed both under and over the 'platform' to prevent potential migration of soil into voids within the rock/concrete. Alternatively, cement can to be added and mixed into the first 200mm of the subgrade layer to stabilise it. The amount of cement required to stabilise moist (not saturated) soil will be in the order of 8% by weight. The mixed layer should be compacted to the extent practicable and allowed to harden prior to placing any additional fill.
1d.8	Place the first 200mm layer (loose thickness) of crushed gravel and compact as described in step 1a.9, then install two layers of geogrid (refer the preferred performance characteristics above – refer to section C4.1 for further information) separated by a 200mm thick layer of compacted fill. The grid should extend neatly to the sides of the excavation, and be lapped at joints as specified by the manufacturer. **Prior to placing fill on top of the geogrid, it is important that the grid is sufficiently tensioned to remove any wrinkles, bulges, etc**. Note that three layers of geogrid, each separated by 200mm of compacted crushed gravel, are required in areas of 'major' lateral stretch as defined in this document.

1d.9	Backfill the excavation by placing crushed gravel fill in horizontal loose layers not exceeding 200mm in thickness, moisture conditioned as necessary, and compacting to achieve a minimum of: • 95% standard or 92% of vibrating hammer compaction (NZS 4402:1988 – Test 4.1.1 or Test 4.1.3); or • 82% of the solid density of the fill material – (well-graded sandy gravel only, refer to section 4.1). Target density by this method is 2180 kg/m^3 Perform compaction testing at 600mm vertical intervals within the fill at a minimum frequency of 1 test for each 50m^2 of treatment area or a minimum of 3 tests per layer.
1d.10	Remove dewatering pump and sump once clear of the water table. Backfill and compact as for the foundation treatment work area.
1d.11	Provide the Design Engineer with complete records of: 1) the material used to construct the raft; 2) results of laboratory MDD/moisture content or solid density tests of backfill materials; 3) results of field compaction testing of backfill; and 4) an 'as-built' plan. Documentation of other relevant details (ie stabilisation of the excavation subgrade with cement or rock) should also be provided. Field compaction test results should include depth below ground level, and horizontal locations relative to a fix point such as a corner of the excavation, and the depth below the top of the raft.

APPENDIX 3 – LANDSCAPE AND URBAN DESIGN REPORT

256 FITZGERALD AVE MULTI UNIT DEVELOPMENT

HAYWOOD / MOUNTFORT

Urban Design and Visual Impact Assessment

Project No. 2021_063 | B

4 May 2021

256 FITZGERALD AVE – MULTI UNIT DEVELOPMENT

Project no: 2021_063
Document title: Urban Design and Visual Impact Assessment

Revision: B
Revision Date: 4 May 2021
Client name: Haywood / Mountfort

Author: Dave Compton-Moen
File name: 2021_063 Haywood_256 Fitzgerald Ave_UDVIA_B

DOCUMENT HISTORY AND STATUS

REVISION	DATE	DESCRIPTION	BY	REVIEW	APPROVED
A	1/04/2021	UDVIA Report for Comment	DCM		
B	4/05/2021	Client review update	DCM		
	6/06/2021	Client review update	DCM		

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1. INTRODUCTION AND PROPOSAL

The following report is an Urban Design and Visual Impact Assessment for a proposal to include the land at 5-8/254 Fitzgerald Avenue and 9-20/5 Harvey Terrace within the table in Appendix 13.14.6.2 of the Christchurch district plan. This land is within the Specific Purpose (Ōtākaro-Avon River Corridor) Zone. This will enable the redevelopment of this former residential land for residential purposes.

Prior to the Canterbury earthquakes in 2010/11, the site contained several blocks of flats (a total of 20 including the current 4 units) and a carport building with development extending out to Harvey Terrace.

The property is located in the Specific Purpose (Ōtākaro-Avon River Corridor) Zone of the Christchurch District Plan where it is highlighted in the Ōtākaro-Avon River Development Plan as being part of the Green Spine along with the block immediately to the south of Harvey Terrace.

2. M E T H O D O L O G Y

The urban design and visual impact assessment consider the likely effects of the proposal in a holistic sense.There are three components to the assessment:

1. Identification of the receiving environment and a description of the existing urban and landscape character.
2. The urban design and landscape assessment is an assessment of the proposal against the policies, objectives, and rules of the relevant District Plan regarding building style, land use activity, setbacks and active frontages, height, shading and signage (if relevant);
3. The visual impact assessment is primarily concerned with the effects of the proposal on visual amenity and people, evaluated against the character and quality of the existing visual catchment.

2.1 URBAN DESCRIPTION

To describe the character of the receiving urban environment a site visit is undertaken noting the character of existing buildings, their height, setbacks from street frontages and where there are any active frontages. The style and character of individual buildings are noted and grouped where possible, with particular emphasis placed on buildings with any heritage value. An analysis is also undertaken. of the open space network, movement connections and the quality of the receiving streetscape A combination of desktop and site analysis is used to determine the overall character of an urban area and what its ‘Sensitivity to Change’ may be. For example, an urban area which exhibits a high level of cohesion and uniformity may have a higher sensitivity to a proposal than an area which is more irregular and mixed.

2.2 URBAN DESIGN ASSESSMENT

The urban design assessment component reviews the proposal against the policies, objectives and rules of the District Plan which relate to Signage matters. When assessing the proposal, the

receiving environment is considered and whether the proposal will have an adverse effect on the existing urban character and amenity of a place, which is described above.

2.3 VISUAL ASSESSMENT METHODOLOGY

In response to section 7(c) of the RMA, an evaluation is undertaken to define and describe visual amenity values. As with aesthetic values, with which amenity values share considerable overlap, this evaluation was professionally based using current and accepted good practice rather than community-consultation methods. Amenity values are defined in the Act as *"those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes."* The visual assessment looks at the sensitivity of receptors to changes in their visual amenity through the analysis of selected representative viewpoints and wider visibility analysis. It identifies the potentialsources for visual effects resulting from the project and describes the existing character of the area in terms of openness, prominence, compatibility of the project with the existing visual context, viewing distances and the potential for obstruction of views.

The visual assessment involves the following procedures:

- Identification of key viewpoints: A selection of key viewpoints are identified and verified for selection during the site visit. The viewpoints are considered representative of the various viewing audiences within the receiving catchment, being taken from public locations where views of the proposal were possible, some of which would be very similar to views from nearby residential properties/apartments.The identification of the visual catchment is prepared as a desktop study in the first instance using.

  Council GIS for aerials and contours. This information is then ground-truthed on site to determine thekey viewpoints and potential audience. Depending on the complexity of the project a 'viewshed' may be prepared which highlights the 'Theoretical Zone of Visual Influence' (TZVI) from where a proposal will theoretically be visible from.

- Assessment of the degree of sensitivity of receptors to changes in visual amenity resulting from the proposal: Factors affecting the sensitivity of receptors for evaluation of visual effects include the valueand quality of existing views, the type of receiver, duration or frequency of view, distance from the proposal and the degree of visibility. For example, those who view the change from their homes may be considered to be highly sensitive. The attractiveness or otherwise of the outlook from their home will have a significant effect on their perception of the quality and acceptability of their home environment and their general quality of life.

- Those who view the change from their workplace are considered to be only moderately sensitive as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies depends on whether the workplace is industrial, retail or commercial. Those who view the change whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. For example, walkers in open country on a long-distance tramp are considered to be highly sensitive to change while other walkers may not be so focused on the surrounding landscape. Those who view the change whilst travelling on a public thoroughfare will also display varying

sensitivity depending on the speed and direction of travel and whether the view is continuous or occasionally glimpsed.

- Identification of potential mitigation measures: These may take the form of revisions/refinements to the engineering and architectural design to minimise potential effects, and/or the implementation of landscape design measures (e.g., screen tree planting, colour design of hard landscape features etc.) to alleviate adverse urban design or visual effects and generate potentially beneficial long-term effects.
- Prediction and identification of the pre-mitigation and residual effects after the implementation of themitigation measures.

2.4 EFFECTS ANALYSIS METHODOLOGY

Analysis of the existing urban and visual environment is focused upon understanding the functioning of how an environment is likely to respond to external change (the proposal). The assessment considers the resilience of the existing character, values or views and determines their capacity to absorb change, or sensitivity to change.The proposal is assessed in its 'unmitigated' form and then following proposed mitigation to determine the likelyresidual effects. The analysis identifies opportunities, risks, threats, costs, and benefits arising from the potential change.

Assessing the magnitude of change (from the proposal) is based on the NZILA Best Practice Guide –Landscape Assessment and Sustainable Management (02.11.10) with a seven-point scale, being:

EXTREME / VERY HIGH / HIGH / MODERATE / LOW / VERY LOW / NEGLIGIBLE

In determining the extent of adverse effects, taking into account the sensitivity (low, medium, high) of the visualreceptor, combined with the Magnitude of Change proposed, the level of effects is along a continuum to ensurethat each effect has been considered consistently and in turn cumulatively. This continuum may include the following effects (based on the descriptions provided on the Quality Planning website (ref: http://www.qualityplanning.org.nz/index.php/node/837 - Determining the Extent of Adverse Effects):

- **Indiscernible Effects** No effects at all or are too small to register.
- **Less than Minor Adverse Effects** Adverse effects that are discernible day-to-day effects, but toosmall to adversely affect other persons.
- **Minor Adverse Effects** Adverse effects that are noticeable but will not cause any significant adverseimpacts.
- **More than Minor Adverse Effects** Adverse effects that are noticeable that may cause an adverseimpact but could be potentially mitigated or remedied.
- **Significant Adverse Effects that could be remedied or mitigated** an effect that is noticeable and will have a serious adverse impact on the environment but could potentially be mitigated or remedied.
- **Unacceptable Adverse Effects** Extensive adverse effects that cannot be

avoided, remedied, ormitigated.

Identification of potential mitigation or offsetting measures: These may take the form of revisions/refinements to the engineering and architectural design to minimise potential effects, and/or the implementation of landscape design measures (e.g., screen tree planting, colour design of hard landscape features etc.) to alleviate adverse urban design or visual effects and/or generate potentially beneficial long-term effects. The following table assists with providing consistency between NZILA and RMA terms to determine where effects lie.

NZILA Rating	Extreme	Very High	High	Moderate			Low	Very Low	Negligible
				Moderate-High	Moderate	Moderate-Low			
RMA Effects Equivalent	Unacceptable	Significant		More than Minor		Minor	Less than Minor		Indiscernible

The NZILA rating of 'Moderate' has been divided into 3-levels as a 'Moderate' magnitude of change to always result in either 'More than Minor' or 'Minor' effects but may be one or the other depending on site conditions, context, sensitivity or receiving character and its degree of change.

Prediction and assessment identification of the residual adverse effects after the implementation of the mitigation measures. Residual effects are considered to be five years after the implementation of the proposedmitigation measures, allowing for planting to get established but not to a mature level.

3. ASSESSMENT OF EFFECTS

3.1 EXISTING URBAN CHARACTER

For this proposal the receiving environment is considered to be an 800m wide catchment as shown on figure 4 in the attached figures. This is due to the relatively flat character of the receiving environment and the relatively minor nature of the proposal. The site is on the edge of existing urban development consisting of a mix of low and medium density housing in close proximity to the city centre. The style and type of housing in the area varies greatly but could be described as transitioning from 'low density with infill development' to 'medium density'. Multi-unit developments are common, often running at right angles to the street due to the long, deep nature of the lots which were designed as ¼ acre allotments (approximately 50 deep x 20m wide). Buildings are predominately 1 or 2 storeys although there is the occasional 3 storey building.

The entire area was residential prior to the establishment of the 'Red-zone' following the Canterbury Earthquakes in 2010/11. The earthquakes caused widespread damage in the area with housing removed along a wide corridor starting at the Avon Loop and extending east towards Bexley and New Brighton. In the immediate area housing was removed between the river and Harvey Terrace as well as a small portion north of Harvey up to Heywood Terrace. The proposal is located within this portion fronting onto both Fitzgerald Ave and Harvey Terrace. Housing

remains on the southern side of the Ōtākaro-Avon River immediately adjacent to Avonside Drive. On the northern side of the river, River Road has now been reduced to a cycle/walkway, forming part of the City to Sea Path. The pathway crosses the river at the Kilmore Street intersection before following an old section of Oxford Terrace, on the opposite side of the river from the proposal site.

The proposal site itself is separated from the Ōtākaro-Avon by Fitzgerald Ave to the west. Fitzgerald Avenue is a 30m wide road corridor with 2 traffic lanes and on-street cycle lanes travelling in each direction. Footpaths are present on both side of the road with a raised central median approximately 2m wide in the centre. The footpath on the west side of the street is a boardwalk, partially grade separated from the roadway. At Kilmore Street the river bends sharply to the east running perpendicular to Fitzgerald Ave, being approximately 200m from the site to the south. In this space there are two remaining houses, being 238 Fitzgerald Ave, which is a single-storey residential dwelling being used as a second-hand car sales yard and 20 Templar Road – Bill Sutton's house, which is being used as 'an artist in residence' house. Multi-unit housing exists immediately to the east of the proposal site, extending up to Stanmore Road almost 400m away. The site is bordered by residential development on the eastern and part of the northern boundary with the boundary fenced. A 1.8m high close board timber fence runs along this edge. The two storey 4unit block at the front of the site is existing, surrounded by a mix of typical residential landscape plantings. Overall, the receiving environment is considered to have a medium level of sensitivity to change due to the proximity of residential development and the Otakaro- Avon River corridor. The quality and amenity of the environment is reduced though by the presence of Fitzgerald Avenue and the large number of vehicle movements that pass through the corridor.

3.2 URBAN DESIGN ASSESSMENT

3.2.1 SPECIFIC PURPOSE (OTAKARO-AVON RIVER CORRIDOR) ZONE

Located in a Specific Purpose (Otakaro-Avon River Corridor) Zone of the Christchurch District Plan and labeled as Green Spine in Appendix 13.14.6.1, the proposal has been assessed against the objectives, policies and rules of this chapter in regard to urban design matters:

As described in Clause 13.14.1 this chapter relates to the area of land that falls within the Ōtākaro Avon River Corridor Regeneration Plan. These are predominantly areas of land that run alongside the Ōtākaro Avon River which were 'red zoned' as a result of the Canterbury Earthquakes in 2010 and 2011 and which were previously part of the Specific Purpose (Flat Land Recovery) Zone, with some adjoining public open spaces. The Specific Purpose (Ōtākaro Avon River Corridor) Zone provides for a range of activities and outcomes that have been identified in the Ōtākaro Avon River Corridor Regeneration Plan. The objectives, policies, rules, standards and assessment criteria in this chapter seek to manage activities in the Zone through identifying sub-areas in the Development Plan in Appendix 13.14.6.1 (copied in the supporting figures).

13.14.2.1 Objective - Regeneration

a. The regeneration of the Ōtākaro Avon River Corridor achieves the following priority outcomes:

- ***i. Significant areas of restored natural environment containing a predominance of indigenous planting, wetlands and restored habitat for indigenous fauna, birdlife and indigenous species, improved surface water quality and provision for the practice of mahinga kai;***
- ***ii. Flood hazard and stormwater management infrastructure that mitigates natural hazard risks for the Ōtākaro Avon River Corridor and surrounding areas and is integrated with the natural landscape;***
- ***iii. Accessibility and connectivity across and along the Ōtākaro Avon River Corridor, and with existing communities; and***
- ***iv. A predominance of natural and open spaces, with limited areas of built development concentrated in specificReaches, residential areas, Activity Area Overlays and Landing Overlays.***

b. The Ōtākaro Avon River Corridor supports opportunities for other uses and activities that are compatible with the priority outcomes in a. above, including:

- ***i. Increased opportunities for recreation, cultural activities and community-based activities;***
- ***ii. A range of visitor attractions and limited small-scale retail activities;***
- ***iii. Limited residential development on the outer edge of the Zone to improve integration between the edge of existing neighbourhoods and the activities within the Ōtākaro Avon River Corridor;***
- ***iv. Varied learning, experimenting and research opportunities, including testing and demonstrating adaptation to natural hazards and climate change; and***
- ***v. Transitional activities and structures where these do not compromise the priority outcomes in a. above.***

c. The continuation of pre-earthquake activities on privately-owned properties that still exist within the Ōtākaro Avon RiverCorridor.

Response

The proposal is located on the edge of the corridor and would improve integration between the edge of existing neighbourhoods and the activities within the Otakaro Avon River corridor. The section of land between Harvey and Heywood Terraces, zoned as Specific Purpose, is a relatively small parcel of land, separated from the rest of the corridor by Harvey Terrace and Fitzgerald Avenue. Fitzgerald Ave is a 40m wide road corridor creating a significant break between the proposal site and the river while to the south the river is 180m away. The proposal area is perceived separate, both visually and physically, from the river but with the ability for the site to form a strong built edge to the open space across Harvey Terrace to the south.

13.14.2.1.1 Policy - Ōtākaro Avon River Corridor Areas

a. Recognise that areas within the Ōtākaro Avon River Corridor have different priorities, characteristics and expected levels of built form, by spatially defining different areas within the Ōtākaro Avon River Corridor and managing these areas to:

- ***i. Provide for the activities identified as 'Intended Activities' in Table 1 below, and ensure other activities arecompatible with the 'Character Outcomes' and 'Intended Activities' in Table 1 below.***

ii. ***Avoid other activities that are not compatible with the 'Character Outcomes' or 'Intended Activities' in Table 1 below.***

13.14.2.1.2 Policy - Supporting Regeneration Activities

a. Recognise that the process of regeneration is ongoing and adaptive, and provide for this through:

i. ***enabling transitional activities and structures where these do not compromise the priority outcomes in Objective 13.14.2.1a. or the Character outcomes and Intended Activities indicated in Policy 13.14.2.1.1;***

ii. ***focusing the management of amenity effects on neighbouring properties and activities,***

iii. ***predominantly at adjacent zone boundaries and boundaries of private properties that still exist within the Zone;***

iv. ***utilising a global consent process where appropriate for particular categories of large scale and ongoing activities;***

v. ***updating the Development Plan in Appendix 13.14.6.1 to reflect the locations of facilities as they are developed;and***

vi. ***acknowledging that there will be some loss of indigenous biodiversity associated with the development of Landings and new infrastructure, except within inanga spawning sites which will be protected, and recognising that over time there will be a significant net gain in indigenous biodiversity across the Corridor as a whole.***

Response

The proposal is located in the "green spine' which allows for some residential development in Table 1 (not copied). The implementation of the proposal will not have an effect on the ability to implement Regeneration activities shown on the Development Plan, Appendix 13.14.6.1. It will not have an adverse effect on the amenity of neighbouring properties, albeit there will be a change, the effects are considered to be less than minor or indiscernible. The proposal is consistent with residential development which occurred on the site prior to the earthquakes and is of a scale and type which is consistent with current types of residential development in the immediate area.

13.14.2.1.3 Policy - Continuation of Pre-Earthquake Activities

a. Provide for residential activities and other existing activities on existing properties in private ownership in the Ōtākaro AvonRiver Corridor.

b. Manage activities in the Ōtākaro Avon River Corridor to ensure effects on existing privately-owned residential propertieswithin the Zone are generally consistent with those anticipated in the Alternative Zone specified in Appendix 13.14.6.2.

Response

Prior to the earthquakes there were 20 residential units on the site. As it is a privately-owned site, providing dwellings on the site would be consistent with subclause a of this policy. Providing additional dwellings on the site would not prevent the implementation of the purpose of the zone or any of the activities proposed to improve the amenity of the corridor.

13.14.2.1.4 **Policy - Residential Activities**

a. Provide for limited new clustered, tiny or small footprint housing and temporary and permanent residential activities in identified Trial Housing Areas to enable opportunities for testing and demonstrating adaptation to natural hazards and

climate change, where these:

i. are comprehensively designed in one plan for the whole Trial Housing location to:

A. complement and integrate with the surrounding natural and cultural environment, including the intended indigenous natural environment of the Ōtākaro Avon River Corridor;

B. provide safe and social communal spaces; and

C. provide visually attractive buildings and structures.

ii. avoid unacceptable risk to life and property from natural hazards.

b. Provide for limited new residential development in identified Edge Housing Area Overlays where these are designed to front on to the Ōtākaro Avon River Corridor and improve integration between the edge of existing neighbourhoods and theactivities within the Zone.

c. Other than in Trial Housing and Edge Housing Overlays, provide for one new residential unit on a site only where it isancillary to, and required for, the primary activity on the site.

Response

While the site is not in an identified Edge Housing Area Overlay, the site and adjoining properties between Harvey and Heywood Terraces would lend themselves to this purpose. This is due to the relatively small scale of the area between Harvey and Heywood Terraces and the ability to redevelop these sites without affecting the amenity of adjoining properties. The area's development into residential would improve the integration between the edge of existing neighbourhoods and the activities within the zone. The current zone boundary is mid-block and defined by a close board timber fence.

13.14.2.5 Policy - Design

a. Provide for built development where it is of a design, scale and character that is consistent and integrated with the intended character of the area within which it is located, and which:

i. incorporates ecological enhancement planting to provide a high level of onsite amenity and mitigate effects onadjacent activities, and support an improved natural environment with increased native habitat and improved surface water quality;

ii. complements the surrounding natural and cultural environment, including the intended indigenous natural environment of the Ōtākaro Avon River Corridor;

iii. incorporates onsite treatment of stormwater and/or integrates with wider stormwater management systems where practicable;

iv. achieves a high quality, visually attractive development when viewed from the street and other public spaces;

v. provides accessible, safe, and efficient movement options for pedestrians, cyclists, and vehicles;

i. maintains and enhances the natural character, indigenous biodiversity, health and life supporting capacity ofwater bodies and their margins;

ii. ***is designed to deter crime and encourage a sense of safety, reflecting the principles of CPTED;***

iii. ***manages the interface with adjacent residential and open space-zoned areas;***

iv. ***promotes active engagement with any adjacent streets or public spaces, and contributes to the vibrancy and attractiveness of those spaces;***

v. ***provides an adequate firefighting water supply; and***

vi. ***is designed and located so that it does not obstruct existing or potential customary access to areas of ecological enhancement planting.***

Response

While the level of detail outlined above has not been developed yet, it is possible for several of the above criteria to be included in any future building and landscape design.

3.2.2 Residential Zone

If the proposal site were to be rezoned Residential, the following Objectives and Policies of the Residential zone are considered appropriate to assess:

14.2.1 Objective - Housing supply

a. An increased supply of housing that will:

i. enable a wide range of housing types, sizes, and densities, in a manner consistent with Objectives 3.3.4(a) and 3.3.7;

ii. meet the diverse needs of the community in the immediate recovery period and longer term, including social housing options; and

iii. assist in improving housing affordability.

14.2.1.1 ***Policy - Housing distribution and density***

a. Provide for the following distribution of different areas for residential development, in accordance with the residential zones identified and characterised in Table 14.2.1.1a, in a manner that ensures:

iii. medium density residential development in and near identified commercial centres in existing urban areas where there is ready access to a wide range of facilities, services, public transport, parks and open spaces, that achieves an average net density of at least 30 households per hectare for intensification development;

Response

The proposal site is close to a wide range of facilities and services, public transport and open spaces (Avon-Otakaro River). There are two bus stops (28191 and 36046) for the Halswell/Queenspark (7) bus route in close proximity to the site providing links into the city and further afield. The Stanmore Road shops (containing several takeaway outlets, a petrol station and Dan's Fresh Produce) are within a 500m radius of the site or a 10m walk. Towards the city centre, Little Poms and Pomeroys are within 300m of the site. Being on the each of the Central City, the site is appropriate for higher density development.

3.3 VISUAL EFFECTS

3.3.1 VISUAL CATCHMENT AND AMENITY

The following table outlines the potential visual effects likely to be experienced by Visually Sensitive Receivers inthe receiving environment. To assist with determining effects, a series of public viewpoints were visited, considered representative of views that may be experienced from surrounding businesses, residences, and public spaces (including footpaths). These were as follows:

- VP1 – View southeast from 358 Cambridge Terrace
- VP2 – View northeast from 250 Fitzgerald Avenue
- VP3 – View north from 6 Harvey Terrace
- VP4 – View south from 272 Fitzgerald Avenue
- VP5 – View southeast from 11 Heywood Terrace

3.3.2 TABLE OF VISUAL EFFECTS

The following table outlines the potential visual effects each Visually Sensitive Receptor might receive:

Table 1: Assessment of Effects on Visually Sensitive Receptors

Viewpoint	**Visually Sensitive Receptors** (VSR)	**Distance from Proposal** (m)	**Type of View** (open, partial, screened)	**Description of existing view**	**Sensitivity of VSR**	**Magnitude of Change**	**Effects**	**Description of Effects**
1. View southeast from 358 Cambridge Terrace	Residents on Cambridge Terrace and Fitzgerald Ave	150m	Open	Existing views to the south are possible of the existing building, the road corridor and associated infrastructure. Existing trees on adjacent sites and within the road corridor are visible along with the Port Hills in the distance.	High	Negligible	Indiscernible	The existing building is already visible with any site improvements including fencing unlikely to be discernible. The building is viewed in the context of the existing urban environment and is not viewed as part of the Ōtākaro-Avon River corridor from this perspective.
	Travellers using Fitzgerald Ave				Low			
2. View northeast from 250 Fitzgerald Ave	Travellers using Fitzgerald Ave	110m	Partial/Open	From the middle of the road, the existing dwelling is partially visible behind well-established vegetation. The Ōtākaro-Avon River corridor is visible on the left of the image, separated from the proposal site by Fitzgerald Ave. The old residential lots (now part of the river park) are visible on the right of the image.	Low	Negligible	Indiscernible	While the proposal is visible, any proposed changes are considered to be negligible with no discernible effects on visual amenity. The river corridor is visible in the view, but Fitzgerald Ave creates a clear demarcation visually between the river and residential development.
3. View north from 6 Harvey Terrace	Users of the future Ōtākaro – Avon River Park	20m	Open	Open views are possible of the site and the existing dwelling. The rear of the site is visible from the street due to the openness of the adjacent dwellings. The boundary fences and adjoining residential dwellings are also visible from this location. The river is visible to the left of the photo, at the end of Harvey Terrace, across Fitzgerald Avenue.	Medium	Very Low	Less than Minor	The proposed new dwellings will be visible from this view but will be viewed in context with the existing dwelling on site and existing residential dwellings on adjoining properties. The proposal will be viewed as an extension of this type of development.
4. View south from 272 Fitzgerald Ave	Pedestrians using Fitzgerald Ave	25m	Open	Open views of the site and existing dwellings are visible from this viewpoint. Existing plantings and close board timber fences highlight old and current boundaries. The river corridor is visible to the right of the photo, across Fitzgerald Avenue	Medium	Negligible	Indiscernible	Only partial views of the proposal will be visible from this location with most views screened by existing vegetation or the existing residential block on site.
5. View southeast from 11 Heywood Terrace	Residents on Heywood Terrace	60m	Partial	Partial views of the site and existing dwellings are visible from this viewpoint. Existing plantings and close board timber fences highlight old and current boundaries. The river corridor is visible to the right of the photo, across Fitzgerald Avenue	High	Negligible	Indiscernible	The proposal will not be visible from this location as it is 'tucked' behind existing residential development on the adjoining site and the existing building on site.

3.3.3 SUMMARY OF VISUAL EFFECTS

In terms of visual effects, the proposal is considered to have less than minor effects when viewed from Harvey Terrace but Indiscernible from all other viewpoints.

Occupants of the residential dwellings will not notice any discernible change from the proposal given the character and quality of existing views.

For pedestrians and vehicles travelling west along Fitzgerald Avenue, any changes to views are anticipated to be partial and intermittent while travelling with any effects anticipated to be Indiscernible.

4. MITIGATION MEASURES

The following mitigation measures are suggested to either avoid, remedy, or mitigate any potential effects on visual amenity:

MM1 LANDSCAPE CONCEPT PLAN

It is recommended that a landscape plan be developed for the site, prior to development commencing, showing:

- Ground floor building(s) outline
- Ground surface materials such as paving, including type, location and parking areas.
- Location and width of kerbs.
- Fencing type (materials), height, location and a drawn elevation, any gates or access to the site.
- Plant/tree schedule, including species, quantity and height or grade at time of planting and at maturity.
- The location, species and height of existing planting to be retained.
- The location of new planting, and the area available for planting (including the total landscape area as a site coverage percentage, where zoning requires this).
- Identification of any protected trees or other landscape features.
- Ground contours where appropriate.
- Practical and accessible location of bins, service areas, garages, sheds, washing lines and the location of external features such as heat pumps and satellite dishes.

MM2 SUGGESTED ZONE CHANGE

The site should adopt the Residential Medium Density (RMD) zoning to be consistent with land adjacent to the site.

5. CONCLUSIONS

In summary, I consider that the proposed development is an appropriate activity for the site with Fitzgerald Ave creating a significant barrier between the site and the Otakaro-Avon River corridor. While the site benefits from amenity afforded to it from the waterway and the Otakaro Loop Reach, the site is not considered to be part of the corridor from an urban design or a landscape perspective but is, along with the remainder of the vacant land between Heywood and Harvey Terraces being more suited to residential, in particular medium density, development.

The current ‘mid-block’ zoning change results in an ‘awkward’ edge where most of the adjoining residential developments have turned their back on the open space and the built edge to Fitzgerald Ave is somewhat diluted. The sides of buildings, service areas and close board fencing typify the edge treatment to the space, as opposed to being a high amenity built interface. It is recommended that the underlying zoning is modified to RMD to reflect the block form and current severance from the Otakaro-Avon River corridor.

The proposal will not affect any of the infrastructure proposed as part of the Otakaro-Avon River corridor.

In terms of visual amenity, the proposal will have less than minor to indiscernible effects on the receiving environment.

APPENDIX ONE - URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

MULTI-UNIT DEVELOPMENT PROPOSAL - 256 FITZGERALD AVENUE

FOR MOUNTFORT PLANNING / HARWOOD

9 JUNE 2021
Project no. 2021_063
REVISION B

dcm URBAN

256 FITZGERALD AVENUE MULTI-UNIT DEVELOPMENT PROPOSAL

Project no: 2021_063
Document title: URBAN DESIGN AND VISUAL IMPACT ASSESSMENT
Revision: B
Date: 9 JUNE 2021
Client name: Mountfort Planning / Harwood

Author: David Compton-Moen |Sophie Beaumont

File name: 2021_063 Mountfort 256 Fitzgerald Ave_B

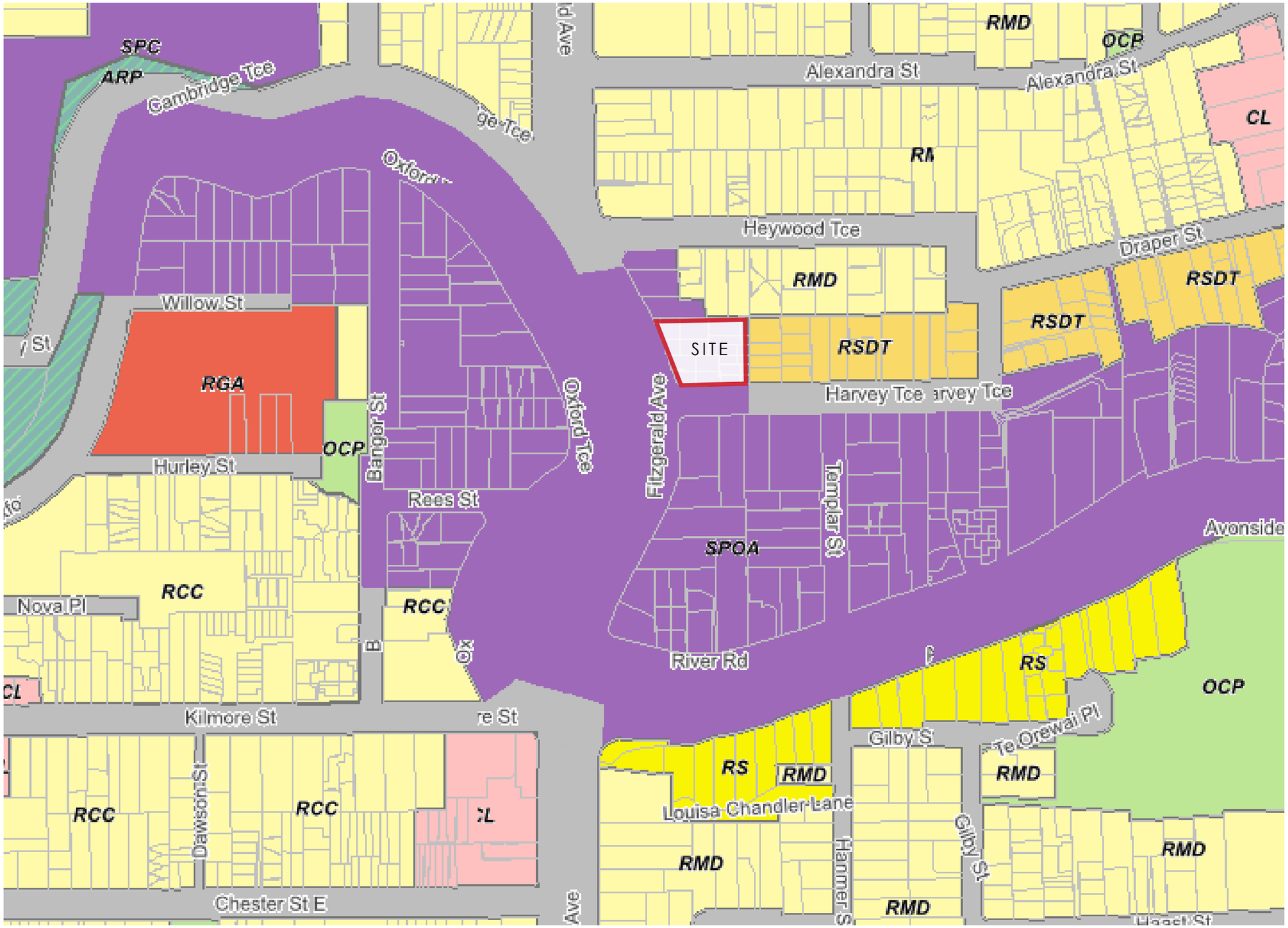
DOCUMENT HISTORY AND STATUS

REVISION	DATE	DESCRIPTION	BY	REVIEW	APPROVED
A	1/04/2021	UDVIA Report	SB	DCM	DM
B	9/06/2021	UPDATE	DCM	DCM	

DCM URBAN DESIGN LIMITED

Level 3, 329 Durham Street North
Christchurch 8013

CONTENTS



Zone

- ARP Avon River Precinct (Te Papa Ōtākaro) Zone
- CCMU Commercial Central City Mixed Use Zone
- CC Commercial Core Zone
- CL Commercial Local Zone
- OCP Open Space Community Parks Zone
- OWM Open Space Water and Margins Zone
- RCC Residential Central City Zone
- RGA Residential Guest Accommodation Zone
- RMD Residential Medium Density Zone
- RS Residential Suburban Zone
- RSDT Residential Suburban Density Transition Zone
- SPC Specific Purpose (Cemetery) Zone
- SPOA Specific Purpose (Otakaro Avon River Corridor) Zone
- SPS Specific Purpose (School) Zone
- Transport Zone

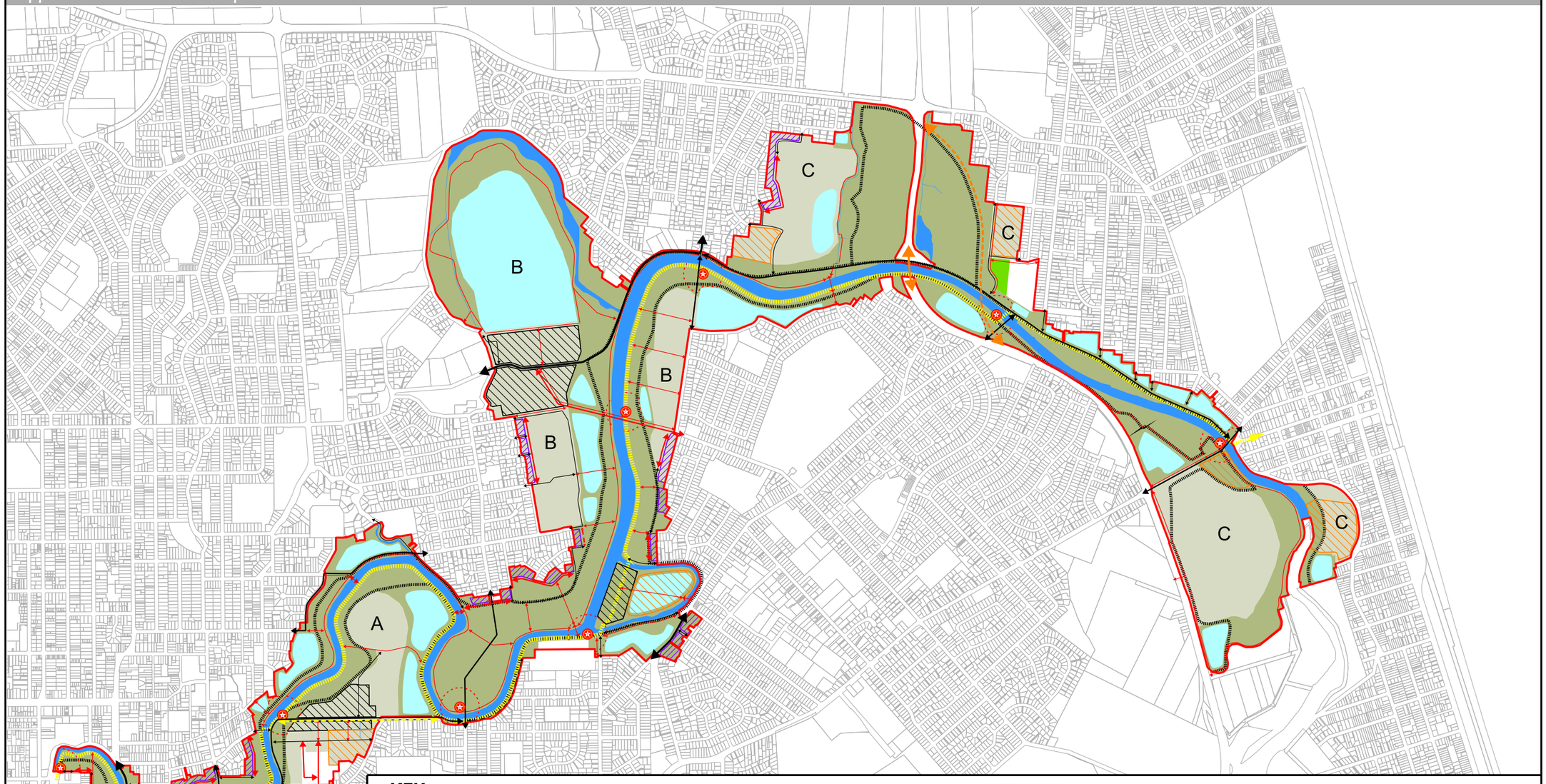
Designations and Heritage Orders

Designation

- Designation

A. DISTRICT PLAN MAP SHOWING PROPOSED LOCATION

Map / image source: Christchurch City Council - District Plan



KEY

- Development Plan boundary
- Open Space Community Park Zone
- Water bodies
- Stormwater Management Areas *
- Green Spine
- A — Otakaro Loop Reach
- B — Horseshoe Lake Reach
- C — Eastern Reaches
- No change to zoning
- City to Sea Path * * * *
- Proposed new roads
- Indicative pedestrian / cycle linkages
- Cycle commuter linkage
- New pedestrian / cycle / vehicle bridges
- State Highway 74
- Proposed Road linkage * * *
- Existing minor arterial
- Existing collector road
- Existing local roads * *
- Stopbank * * * *

OVERLAYS

- Activity Area
- Trial Housing Area
- Edge Housing Area
- Landing
- * Indicative size and shape
- * * These are the minimum number of local roads that are required to be retained. Others may also be retained.
- * * * To be investigated.
- * * * * Indicative alignments.

NORTH

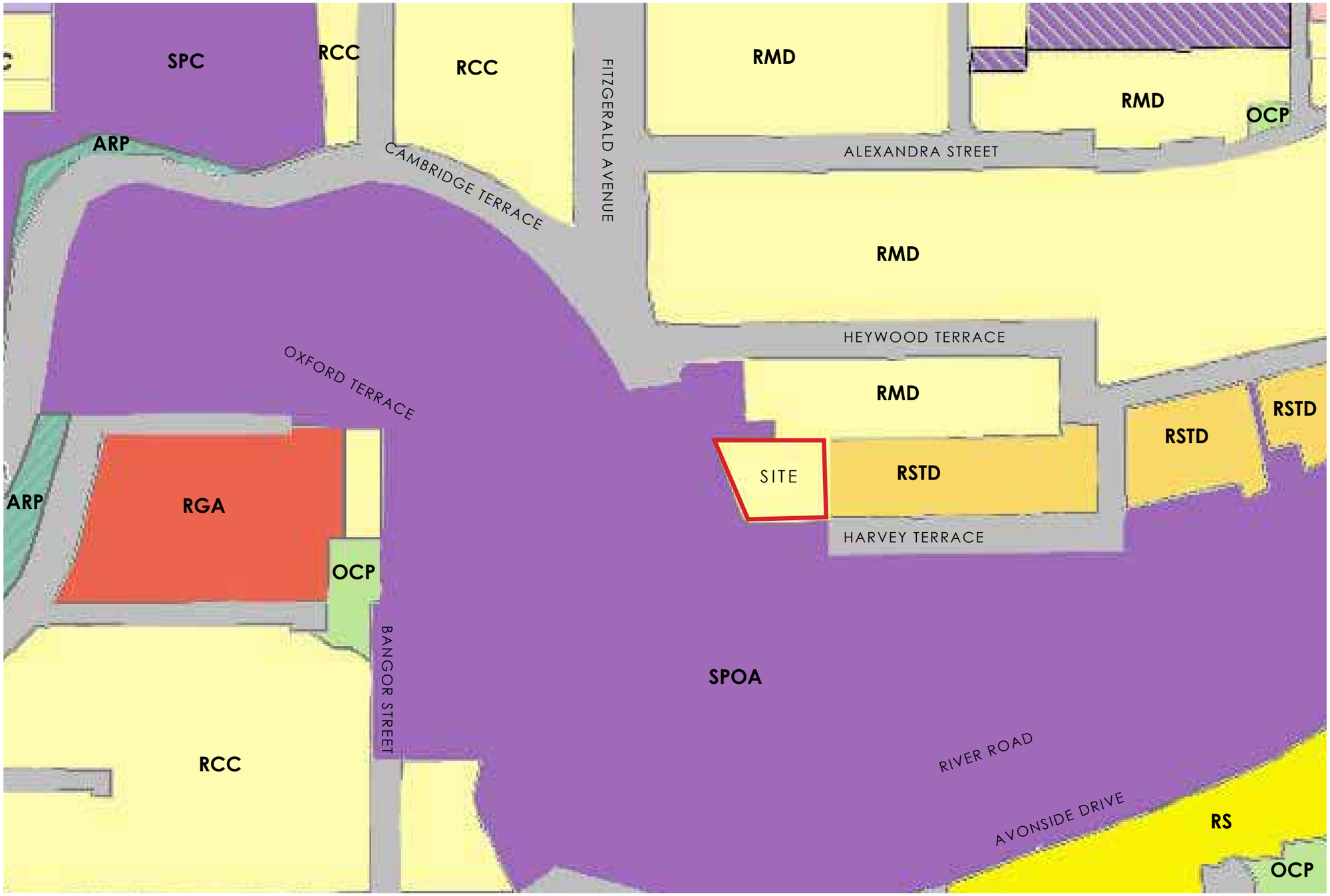
200 100 0 200 400 600 800

SCALE (m) A3 at 1:20,000

Technical Services and Design
Christchurch City Council

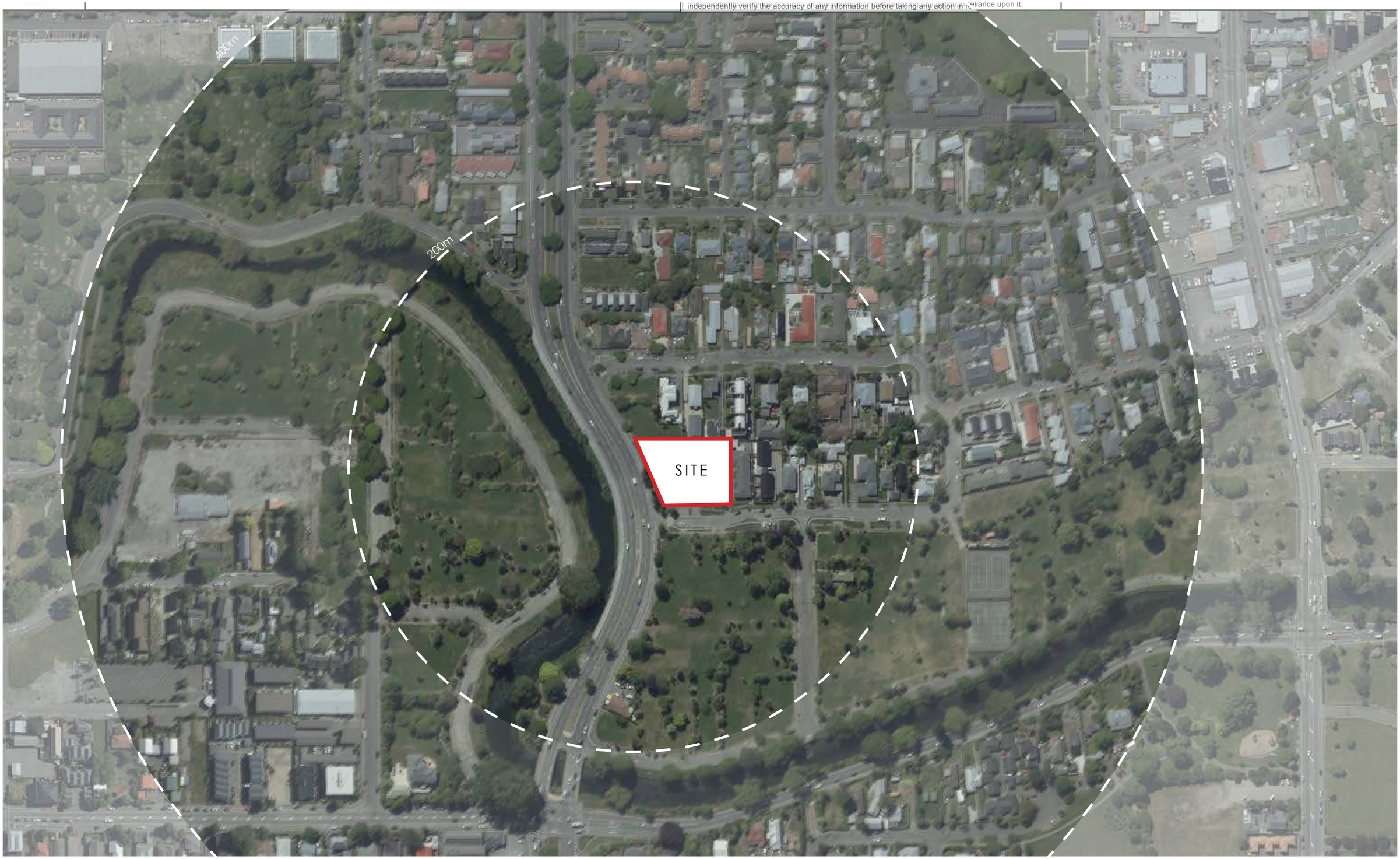
Map: pp105201.dgn
Date: 9/09/2019

Appendix 13.14.6.1
Ōtākaro Avon River Corridor Development Plan



A. DISTRICT PLAN MAP SHOWING SUGGESTED ZONING

Map / image source: Christchurch City Council - District Plan



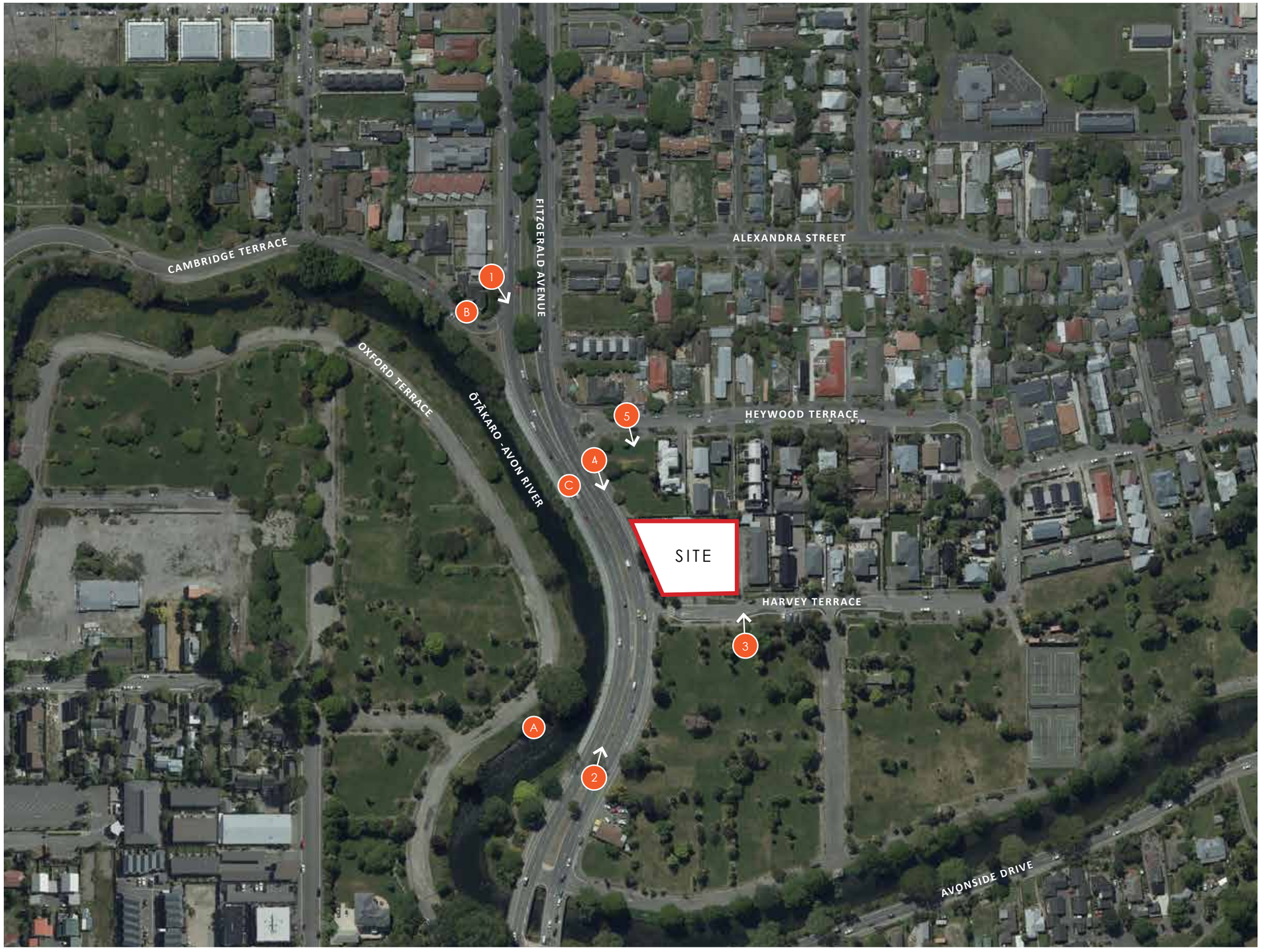
A. AERIAL PHOTO SHOWING THE PROPOSAL SITE

Map / image source: Canterbury Maps

0 25 50 75 100m
1:2500

LEGEND
VIEWPOINT LOCATIONS

1. VP1 - VIEW South East from 358 Cambridge Terrace
2. VP2 - VIEW North East from 250 Fitzgerald Avenue
3. VP3 - VIEW North from 6 Harvey Terrace
4. VP4 - VIEW South from 272 Fitzgerald Avenue
5. VP5 - VIEW South East from 11 Heywood Terrace



Map / image source: Auckland Council GeoMaps

URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

CONTEXT - VIEWPOINT LOCATIONS

MULTI UNIT DEVELOPMENT - 256 FITZGERALD AVENUE, CHRISTCHURCH

0 25 50 75 100m
1:2500

A The Ōtākaro - Avon River flows through the centre of the city, providing the city with a strong blue network and high level of amenity. A shared pedestrian path follows the river which provides a high amenity connection to and from the city (City to Sea path).

B Existing medium density housing located on the corner of Cambridge Terrace and Fitzgerald Avenue. The development has distinctive architectural style and large windows looking over the road to the Avon River. Medium density and infill housing are common in the receiving environment.

C The SPOA Zone surrounds the Ōtākaro-Avon River and is defined by sporadic, mature planting, remnant of old residential lots. This area has been cleared of all infrastructure following the Christchurch Earthquake, leaving only vegetation to delineate the previous property boundaries where residential dwellings were once located

D Fitzgerald Avenue is the main north - south connection along the eastern boundary of the city centre, carrying large volumes of traffic in both directions with a dual carriageway, on-road cycle paths and footpaths on both sides.. The road forms a significant barrier or corridor between the Ōtākaro-Avon River and the proposal site.

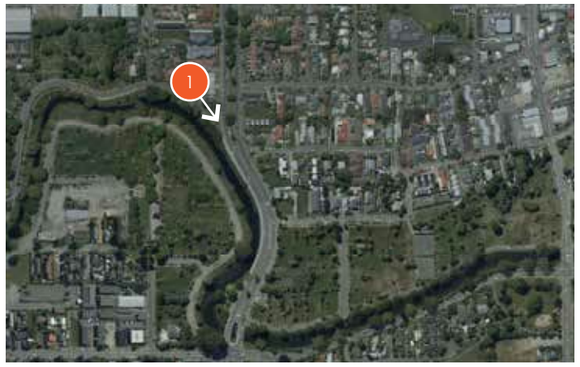


IMAGE LOCATION

PROPOSAL LOCATION

A. EXISTING VIEW

URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

1 VP1 - VIEW SOUTH EAST FROM 385 CAMBRIDGE TERRACE

MULTI UNIT DEVELOPMENT - 256 FITZGERALD AVENUE, CHRISTCHURCH

Image captured on Sony ILCE-6000
Focal length of 50mm
Date: 16 March 2021 at 10:59am
Height of 1.7 metres
43°47'68.15"S 172°65'97.90"E

IMAGE LOCATION

PROPOSAL LOCATION

A. EXISTING VIEW

URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

2 VP2 - VIEW NORTH EAST FROM 250 FITZGERALD AVENUE

MULTI UNIT DEVELOPMENT - 256 FITZGERALD AVENUE, CHRISTCHURCH

Image captured on Sony ILCE-6000
Focal length of 50mm
Date: 16 March 2021 at 10:51am
Height of 1.7 metres
43°47'64.15"S 172°65'97.36"E

IMAGE LOCATION

PROPOSAL LOCATION

A. EXISTING VIEW

URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

3 VP3 - VIEW NORTH FROM 6 HARVEY TERRACE

MULTI UNIT DEVELOPMENT - 256 FITZGERALD AVENUE, CHRISTCHURCH

Image captured on Sony ILCE-6000
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Height of 1.7 metres
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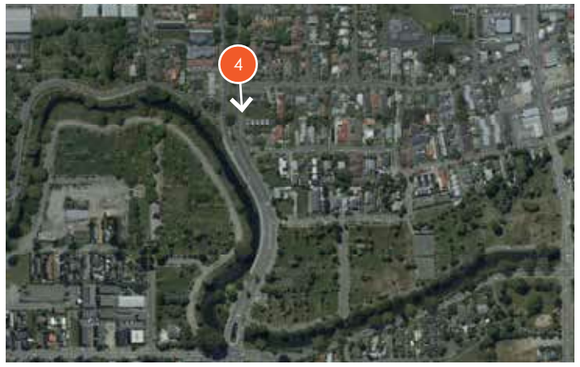

IMAGE LOCATION

PROPOSAL LOCATION

A. EXISTING VIEW

URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

4 VP4 - VIEW SOUTH FROM 272 FITZGERALD AVENUE

MULTI UNIT DEVELOPMENT - 256 FITZGERALD AVENUE, CHRISTCHURCH

Image captured on Sony ILCE-6000
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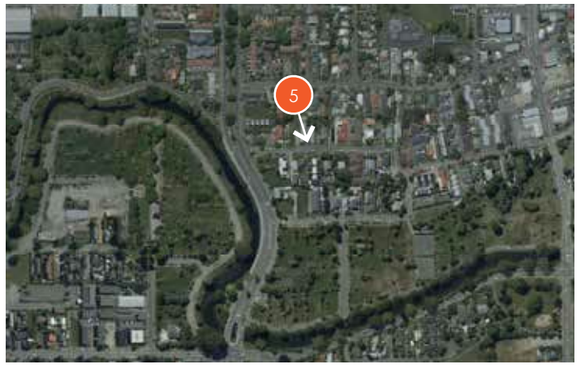

IMAGE LOCATION

PROPOSAL LOCATION

A. EXISTING VIEW

URBAN DESIGN AND VISUAL IMPACT ASSESSMENT

5 VP5 - VIEW SOUTH EAST FROM 11 HEYWOOD TERRACE

MULTI UNIT DEVELOPMENT - 256 FITZGERALD AVENUE, CHRISTCHURCH

Image captured on Sony ILCE-6000
Focal length of 50mm
Date: 16 March 2021 at 10:36am
Height of 1.7 metres
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